Appendix I

Drainage Report

Kimley»Horn

Cannon

Drainage (LID) Report

14005 Live Oak
Irwindale, CA

Prepared for

Rexford Industrial - 14005 Live Oak, LLC, a Delaware Limited Liability Company
333 City Boulevard West, Suite 705
Orange, CA 92868

Prepared by

Cannon Corporation
Samuel J. Jacoby, PE, QSD
11900 w. Olympic Blvd, Suite 530
Los Angeles, CA 90064

REGISTERED PROFESSIONAL ENGINEER
SAMUEL J. JACOBY
C74309
EXP. 6/30/25
CIVIL
STATE OF CALIFORNIA

March 19, 2024

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2. PROJECT BACKGROUND

Project Owner

Owner:	Rexford Industrial - 14005 Live Oak, LLC, a Delaware Limited Liability Company
Site Address:	14005 Live Oak
City/State:	Irwindale, CA
Total Site Area:	214,315.2 s.f. (4.92 acres)
Hillside Area:	No
APN:	8535-001-033

3. INTRODUCTION

Project Owner

Owner:	Rexford Industrial - 14005 Live Oak, LLC, a Delaware Limited Liability Company
Site Address:	14005 Live Oak
City/State:	Irwindale, CA
Total Site Area:	5.13 acres (4.86 acres net)
Hillside Area:	No
APN:	8535-001-033

Project Background

The site is 5.13 acres. The project is located at 14005 Live Oak, Irwindale, California. The property is bounded by Live Oak to the south, Stewart to the west, and Rivergrade to the north. To the South, North and west are existing light industrial buildings. To the east is currently vacant with a planning-approved transfer station planned for the site (by others). The site is currently occupied by a 2-story commercial building and surface parking.

The proposed development is a new verify 105,350 s.f. building with surface parking. This project is a Designated Project under the terms of the LID Standards Manual. The project is a redevelopment project which will result in the replacement of more than 5,000 s.f. of impervious surface on a site that was previously developed as a commercial/parking site.

Purpose and Scope

This report is to document the proposed site discharge of the 10- 25- and 50-year site discharges.

4. **LOW IMPACT DEVELOPMENT (LID) FEASIBILITY SCREENING**
Structural or Treatment Control Best Management Practices (BMPs) are required for this project under the County of Los Angeles LID program. The impacts thereof are not a subject of this report and are instead discussed in the Preliminary LID. Infiltration is feasible and incorporated into the LID management

5. **METHODOLOGY**
This report uses the HydroCalc Program developed by the LACDPW to produce the peak stormwater runoff flow rates and volumes. The HydroCalc results are summarized below:

6. **PROPOSED IMPROVEMENTS**
The project will provide for onsite drains, catch basins, and the LID-required infiltration BMP. The first flush will be directed to the BMP. Additional flows directed to the BMP will be detain by the BMP's internal "Level Pool" once the first flush is captured, will experience attenuation, and will be discharged to the City's storm drain (currently stubbed to site for existing drainage) located at the northwest corner of Live Oak and Stewart. As Builts and allowable release has been requested.

Table 6-1 HydroCalc Inputs

Project Name	14005 Live Oak, Irwindale
Subarea ID	Entire Site
Area (ac)	5.13
Flow Path Length (ft)	658
Flow Path Slope (vft/hft)	0.0141
85^{th} Percentile Rainfall Depth (in)	1.1
Percent Impervious	1.0
Soil Type	8
Design Storm Frequency	85^{th} Percentile Storm
Fire Factor	0
50-year Rainfall Depth	**1.1**

Table 6-2 HydroCalc Outputs

	cfs	cfs/ac
10-Year Clear Runoff (cfs)	10.16	1.98
25-Year Clear Runoff (cfs)	13.2	2.57
50-Year Clear Runoff (cfs)	16.01	3.12

7. CONCLUSIONS

Since the site is currently developed with similar discharge rates, and considering the LID-required BMP elements, the project will comply with City's requirements to maintain the project's runoff to the public main.

8. REFERENCES

Los Angeles County Department of Public Works, *LACDPW Hydrology/Sedimentation Manual and Appendices* (LACDPW 1991, 1992, 1993, 2002, 2006).

Los Angels County Department of Public Works, The LACDPW TCv1.0 Manual (TC_calc_cepth.xls, December 1991, June 2002)

9. List of Attachments

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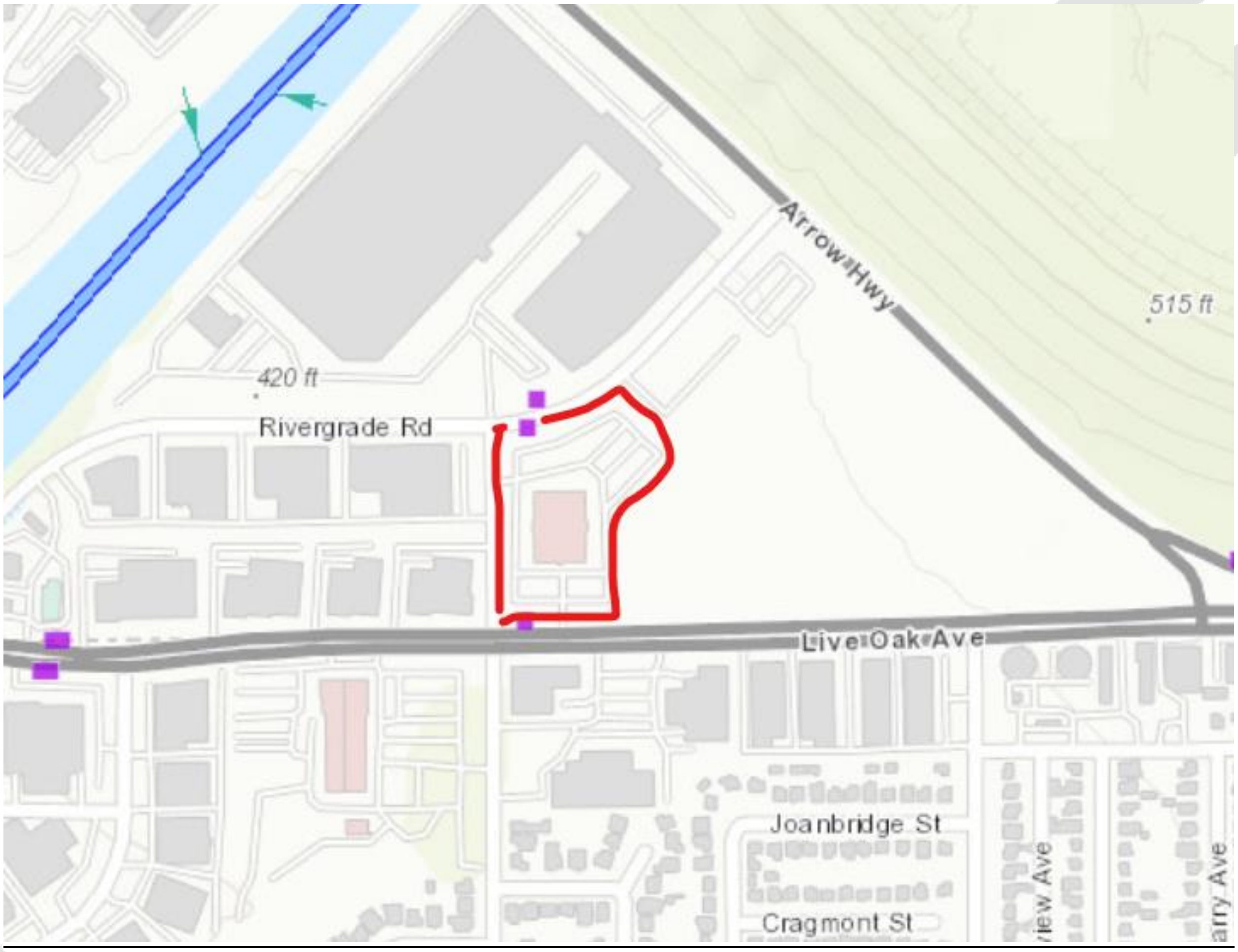
ATTACHMENT 7. PROJECT DESIGN PLANS

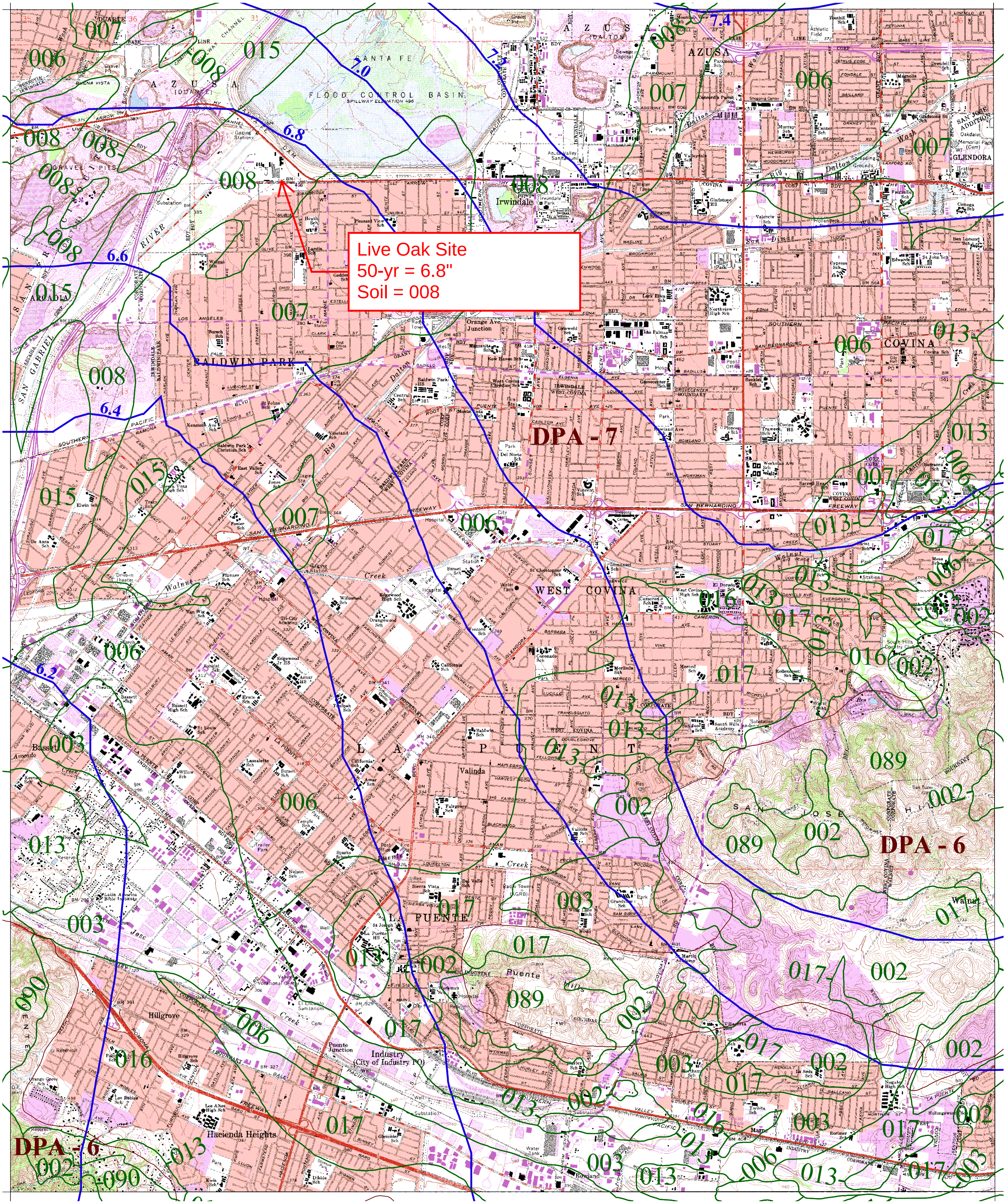
Attachment 1. EXISTING SITE MAP

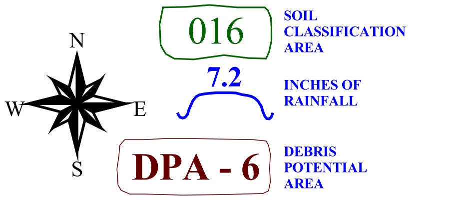
Attachment 2. EXISTING STORM DRAINS AND INLETS



(Source: LA County DPW)

Attachment 3. **SOIL TYPE**





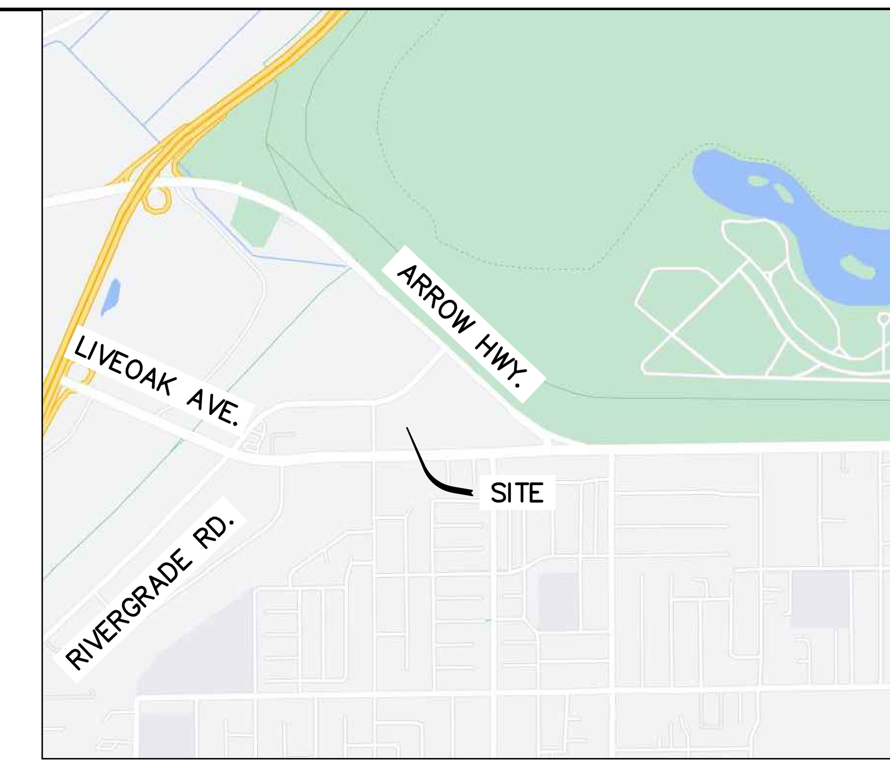
25-YEAR 24-HOUR ISOHYET REDUCTION FACTOR: 0.878
10-YEAR 24-HOUR ISOHYET REDUCTION FACTOR: 0.714

BALDWIN PARK
50-YEAR 24-HOUR ISOHYET

1-H1.21

LOS ANGELES COUNTY PUBLIC WORKS Public Service That Works

Attachment 4. PROJECT EXHIBITS



LEGEND

EX. DRAINAGE PATH

EXISTING CONTOURS

Know what's below. Call before you dig.

REV. NO	DATE	REVISED	DESTROY ALL PRINTS BEARING EARLIER DATE	REV. BY	CKD. BY	APRD BY

Cannon
16842 Von Karman Avenue, Suite 150
Irvine, CA 92606
P 909.753.8111 F 909.753.0775

DRAWN BY CP	DATE -----
CHECKED BY SJ	SCALE AS SHOWN
	CA JOB NO. 220334

REXFORD
14005 LIVE OAK
EXISTING HYDROLOGY
IRWINDALE, CA

SHEET
HX1

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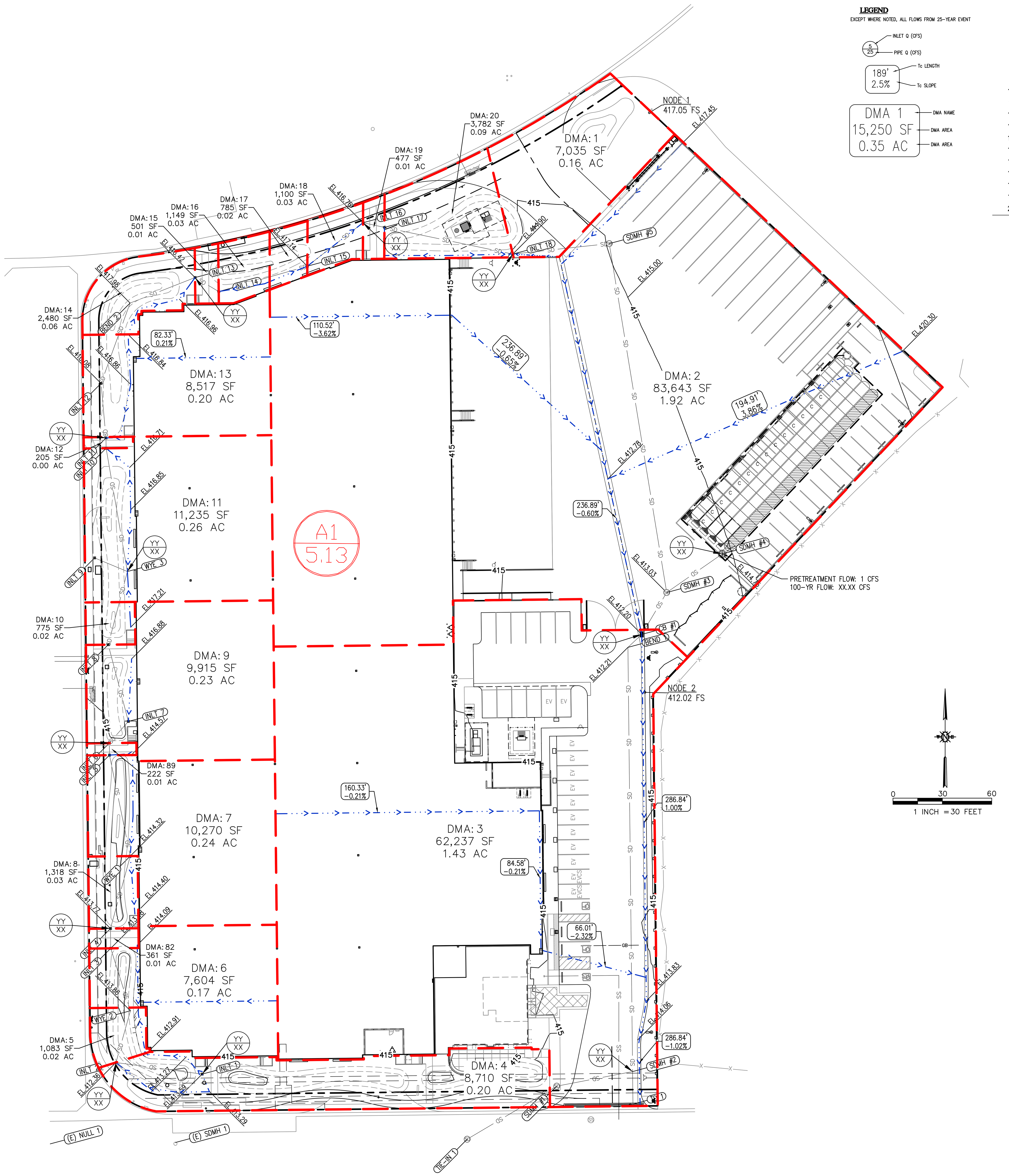


LEGEND

EXCEPT WHERE NOTED, ALL FLOWS FROM 25-YEAR EVENT

INLET Q (CFS)

PIPE Q (CFS)

189'
2.5%

Tc LENGTH

Tc SLOPE

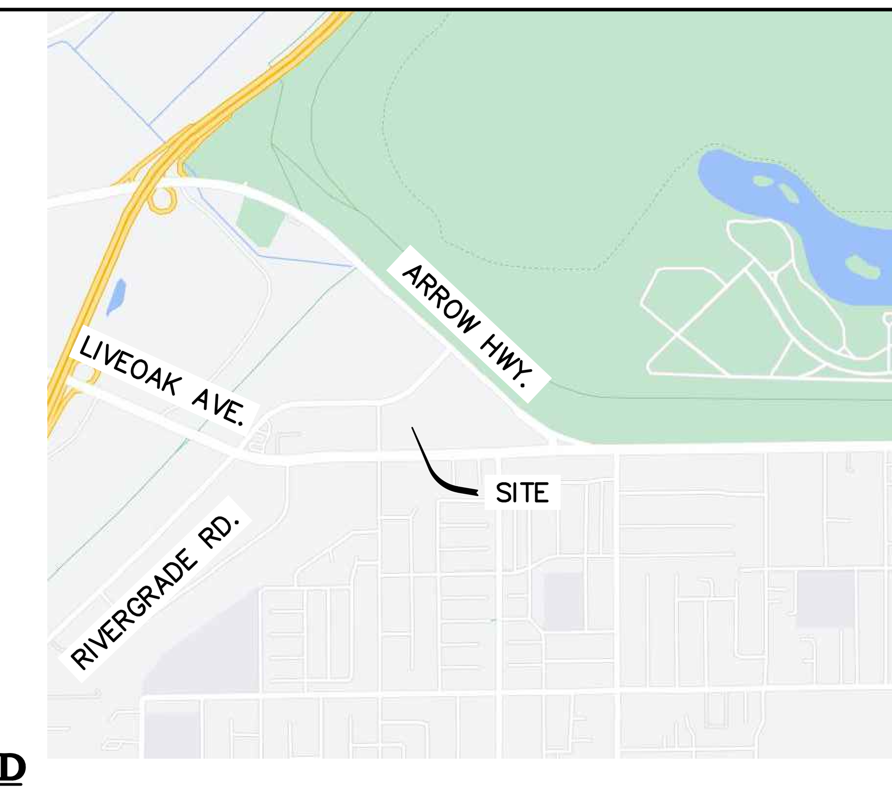
DMA 1
15,250 SF
0.35 AC

DMA NAME

DMA AREA

DMA AREA

	INLET	0100 CFS	TC* CFS	TC MIN	AREA AC	L FT	SLOPE %
1	INLET 1				0.20		
2	INLET 2				0.02		
3	INLET 3				0.17		
4	INLET 4				0.01		
5	INLET 5				4.20		
6	INLET 6				5.20		
7	INLET 7				6.20		
8	INLET 8				7.20		
9	INLET 9				8.20		
10	INLET 10				9.20		
11	INLET 11				10.20		
12	INLET 12				11.20		
13	INLET 13				12.20		
14	INLET 14				13.20		
15	INLET 15				14.20		
16	INLET 16				15.20		
17	INLET 17				16.20		
18	INLET 18				17.20		
19	CB 1				18.20		
20	TD 1				19.20		



LEGEND

A1
4.77

AREA DESIGNATION

AREA (IN ACRES)

PROPERTY LINE

DRAINAGE AREA BOUNDARY

PR . DRAINAGE PATH

PROPOSED CONTOURS

LEGEND

EXCEPT WHERE NOTED, ALL FLOWS FROM 25-YEAR EVENT

INLET Q (CFS)

PIPE Q (CFS)

189'
2.5%

Tc LENGTH

Tc SLOPE

DMA 1
15,250 SF
0.35 AC

DMA NAME

DMA AREA

DMA AREA

PROJECT SITE =	4.76 ACRES
INFILTRATION RATE (NRCS) = 0.69 IN/HR.	
TEST1=1.94, TEST2=0.82, SAFETY FACTOR=2	
INFILTRATION IS FEASIBLE	
PROPOSED CONDITIONS PERVIOUS AREA =	10%
IMPERVIOUS AREA =	90%
SOIL TYPE=	A
1HR, 2YR RAINFALL	0.521 IN
DCV (SITE)	20,771 CF
DRAWDOWN	48 HR
MIN SURF AREA	7,526 SF
DESIGN STORAGE DEPTH	2.76 FT

WATER MAIN — W

FIRE WATER LINE — FW

SANITARY SEWER LINE — 4"S

STORM DRAIN LINE — SD

FORCE MAIN LINE — SD-FM

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

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REVISED

REV. NO | DATE

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Irvine, CA 92606
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DATE -----
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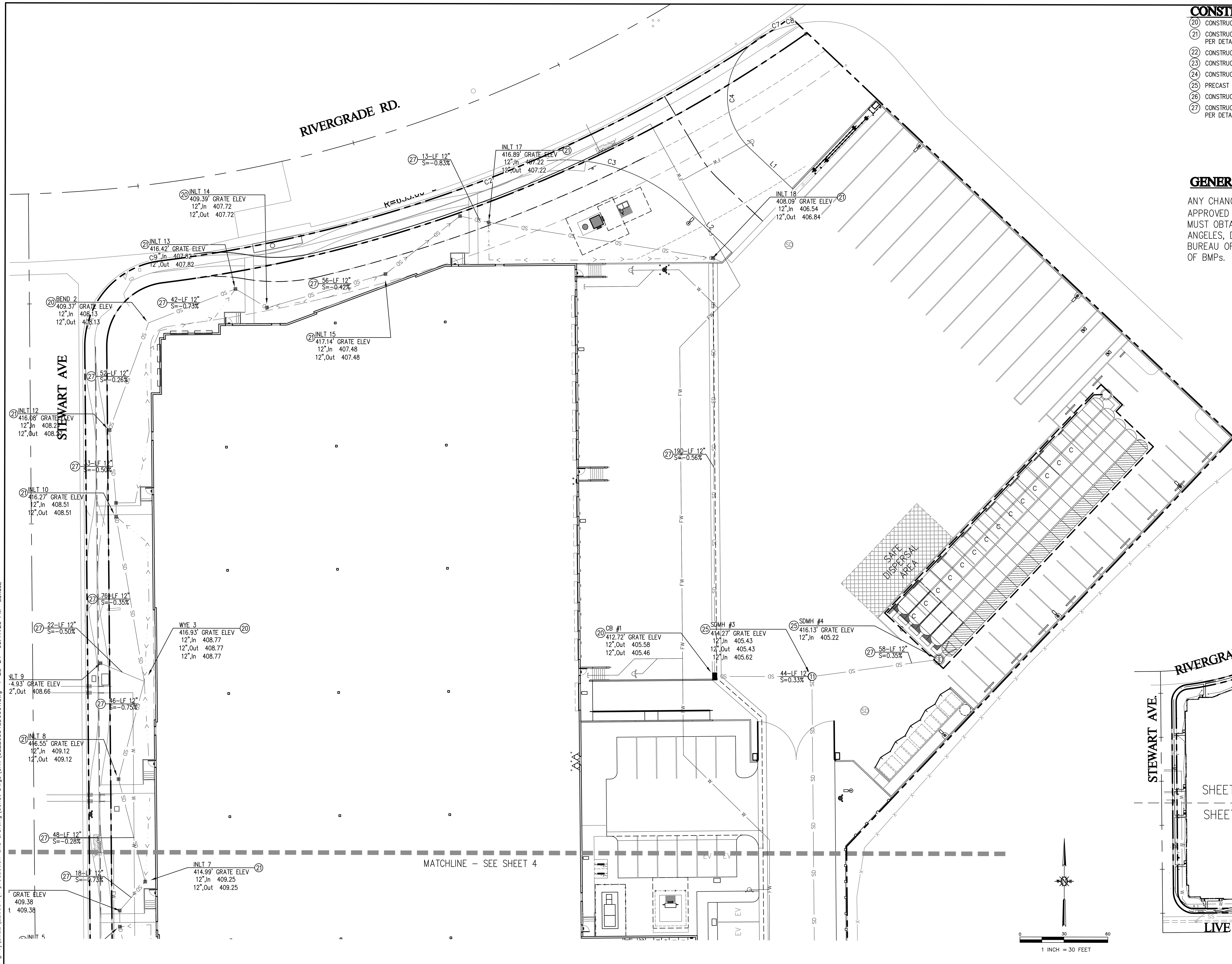
SCALE AS SHOWN
CA JOB NO. 220334

REXFORD
14005 LIVE OAK
PROPOSED HYDROLOGY
IRWINDALE, CA

SHEET
HX2

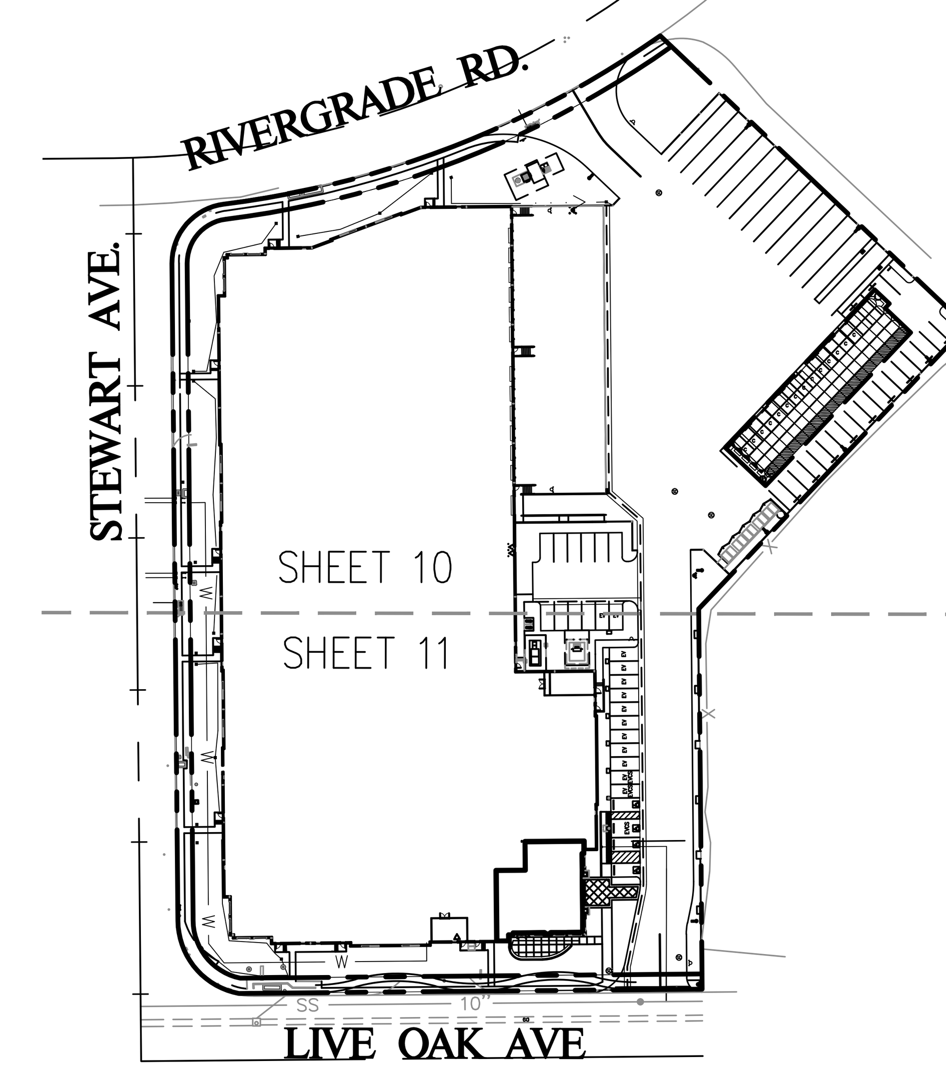


CONSTRUCTION NOTES

(20) CONSTRUCT PREMANUFACTURED BEND/JUNCTION, SIZE AS NOTED.
(21) CONSTRUCT ALLEY DRAIN INLET PER SPPWC 300-4. OR EQUAL STENCIL PER DETAILS 2 SHEET 16
(22) CONSTRUCT 18"X18" INLET PER NDS 1212
(23) CONSTRUCT CHANNEL GRATE PER NDS XX
(24) CONSTRUCT PRECAST INLET PER NDS 1213
(25) PRECAST STORM DRAIN MANHOLE PER SPPWC 304-4
(26) CONSTRUCT HDPE STORM DRAIN. SIZE, SLOPE AS NOTED.
(27) CONSTRUCT NDS MC-3500 STORMTECH CHAMBER DETENTION SYSTEM PER DETAILS, SHEET XX.

GENERAL NOTES

ANY CHANGES (TYPE, SIZE, LOCATION) TO APPROVED BEST MANAGEMENT PRACTICES (BMPs) MUST OBTAIN WRITTEN APPROVAL FROM LOS ANGELES, DEPARTMENT OF PUBLIC WORKS, BUREAU OF SANITATION, PRIOR TO CONSTRUCTION OF BMPs.



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REGISTERED PROFESSIONAL ENGINEER
SAMUEL J. JACOBY
C74309
EXP. 6/30/25
CIVIL
STATE OF CALIFORNIA

REXFORD INDUSTRIAL
14005 LIVE OAK REDEVELOPMENT
STORM DRAIN PLAN
14005 LIVE OAK AVE
IRWINDALE, CALIFORNIA

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OF 21

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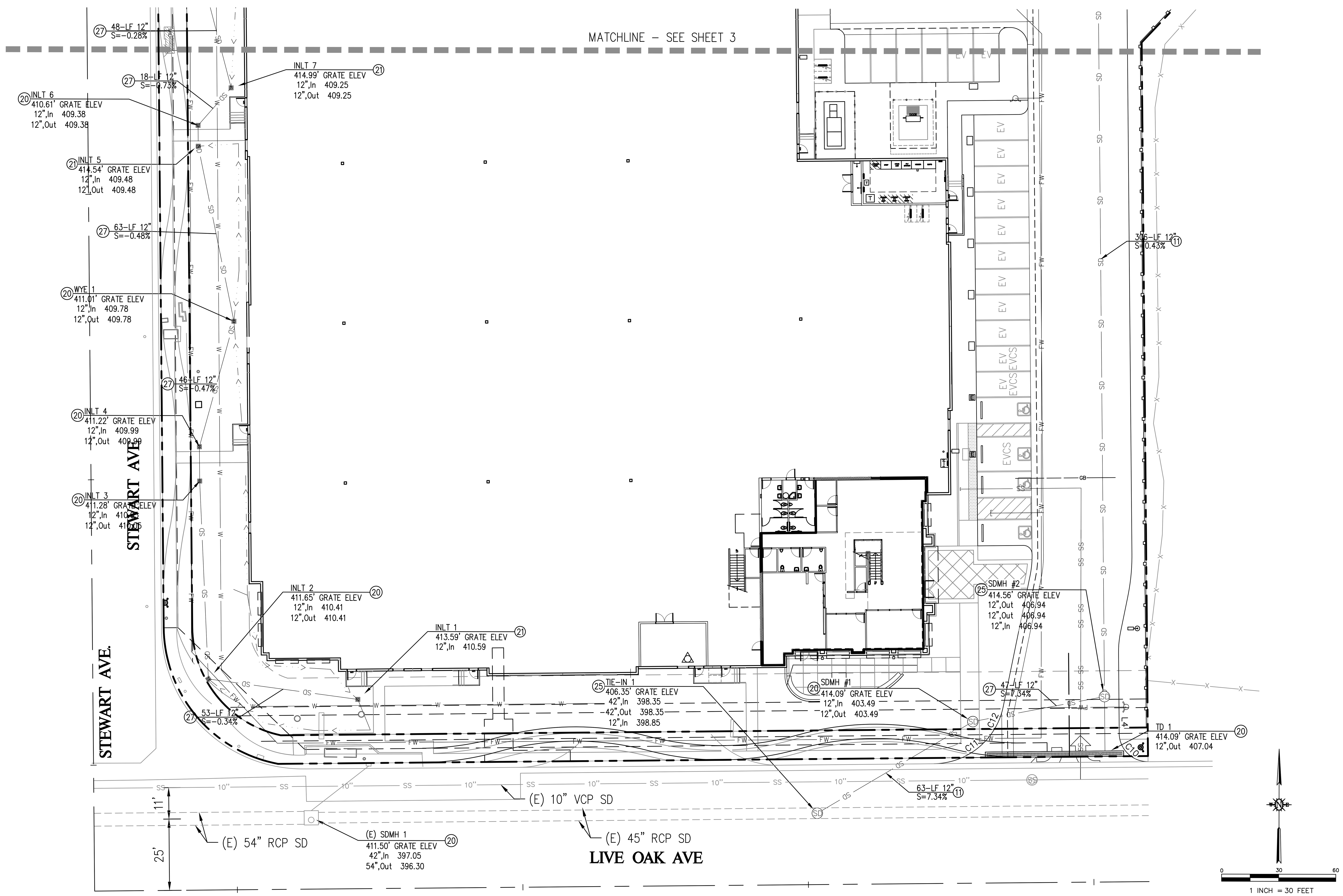

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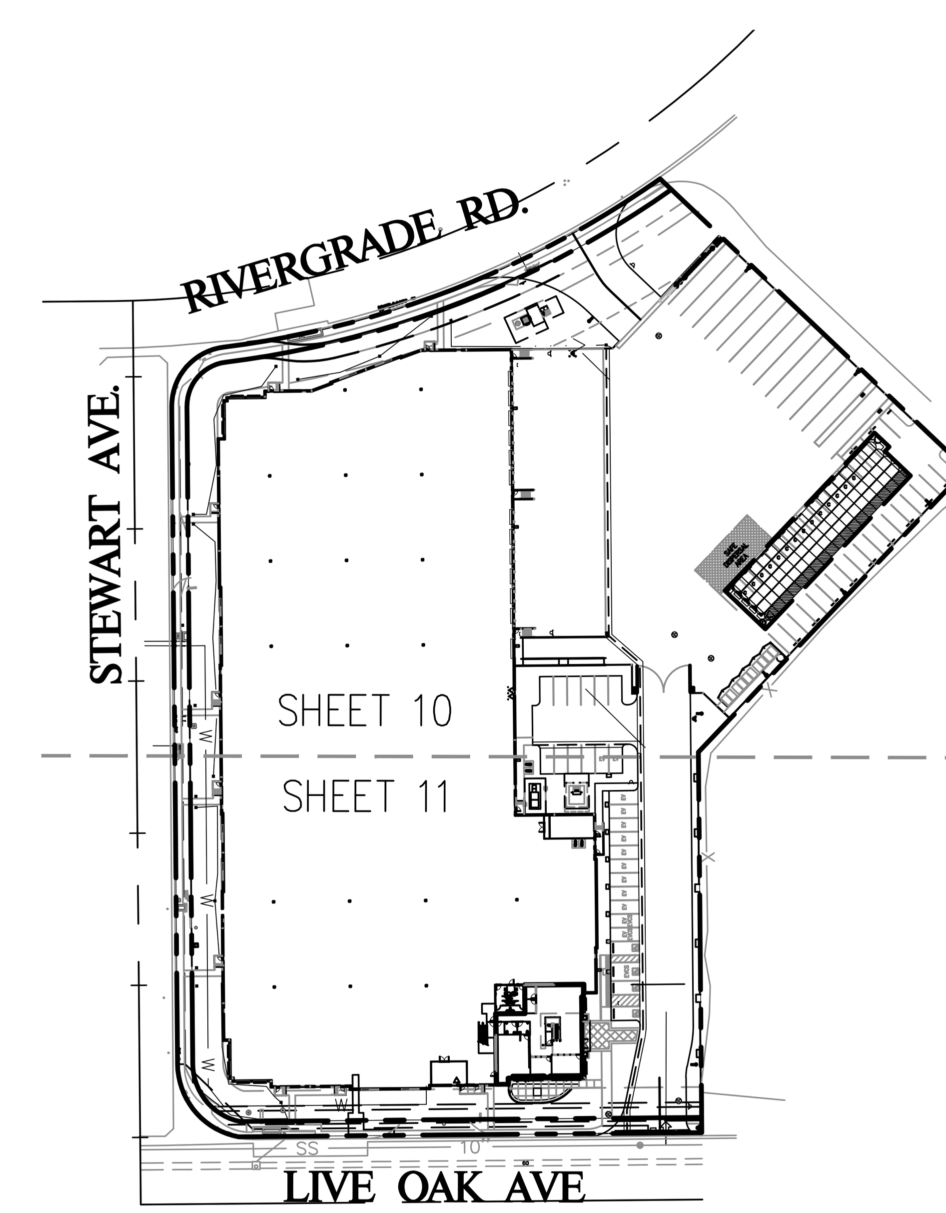

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REGISTERED PROFESSIONAL ENGINEER SAMUEL J. JACOBY C74309 EXP. 6/30/25 CIVIL STATE OF CALIFORNIA

REXFORD INDUSTRIAL
14005 LIVE OAK REDEVELOPMENT
STORM DRAIN PLAN
14005 LIVE OAK AVE
IRWINDALE, CALIFORNIA

SHEET 11 OF 21

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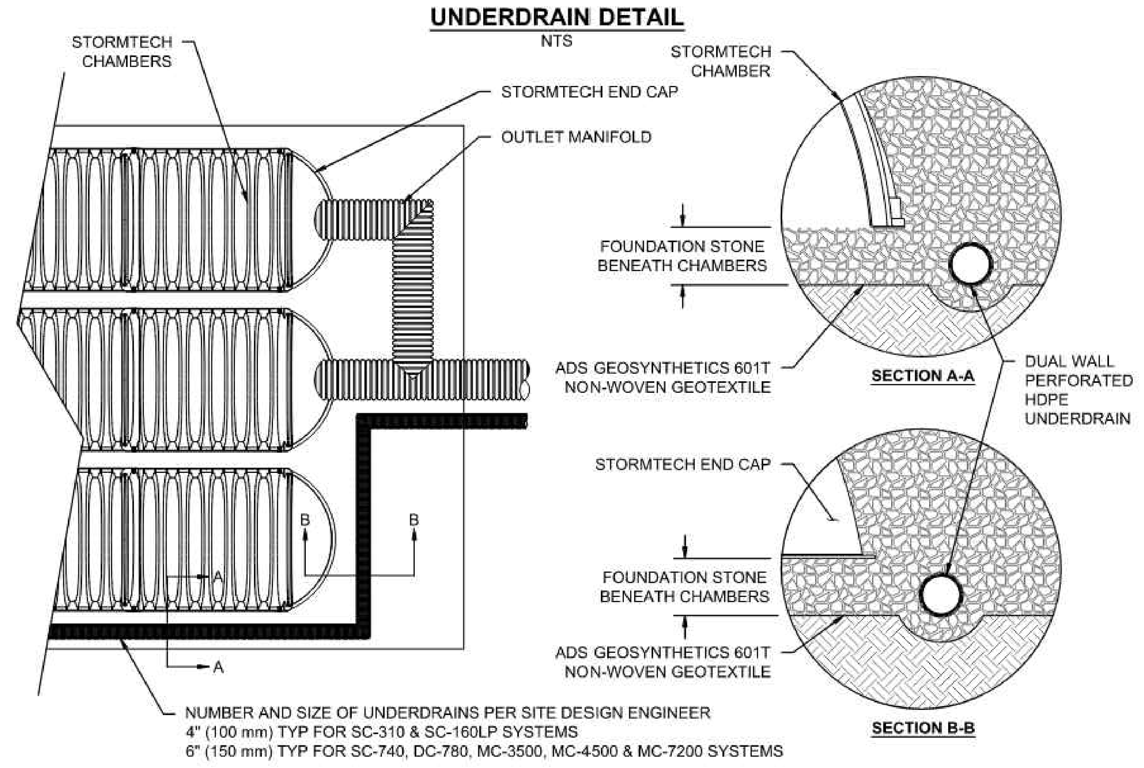
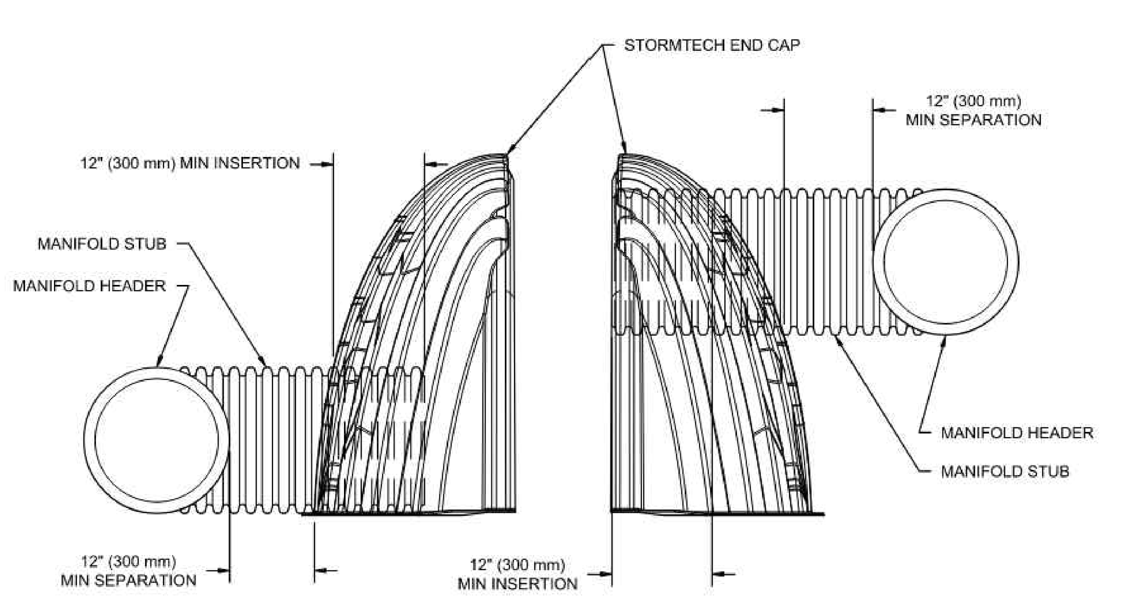
UNDERDRAIN DETAIL
NTS



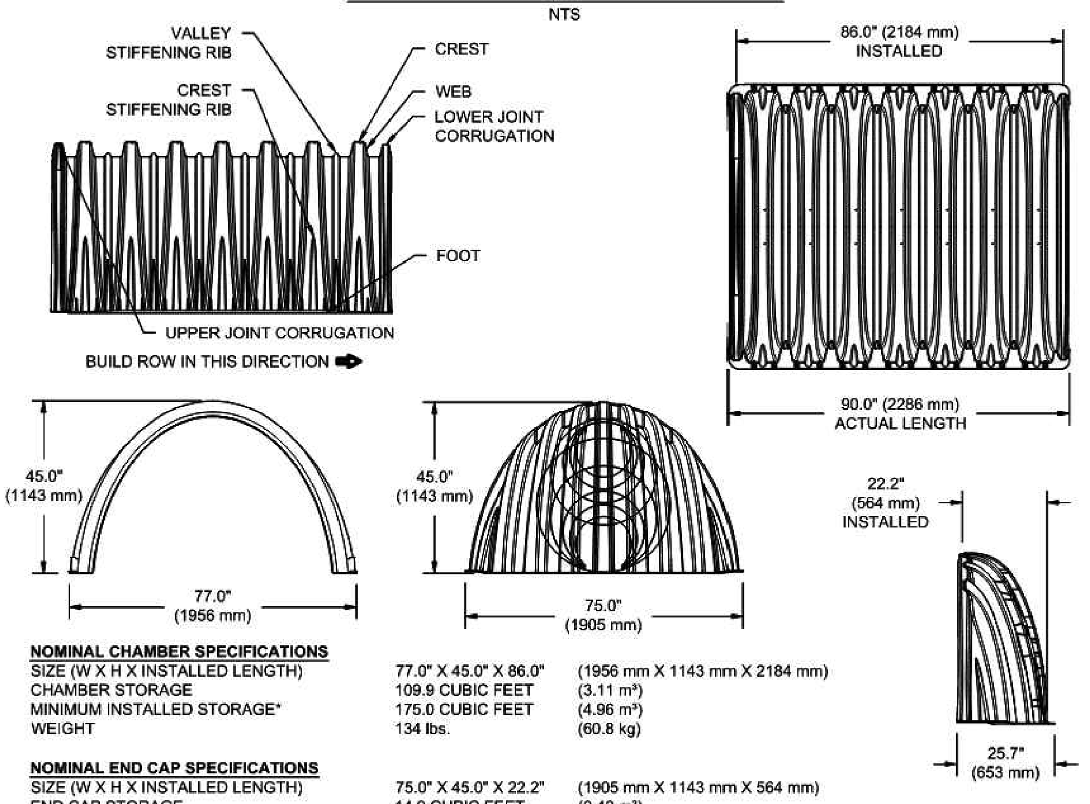
NUMBER AND SIZE OF UNDERDRAINS PER SITE DESIGN ENGINEER
4" (100 mm) TYP FOR SC-310 & SC-160LP SYSTEMS
6" (150 mm) TYP FOR SC-740, DC-780, MC-3500, MC-4500 & MC-7200 SYSTEMS

MC-SERIES END CAP INSERTION DETAIL
NTS



NOTE: MANIFOLD STUB MUST BE LAID HORIZONTAL FOR A PROPER FIT IN END CAP OPENING.

MC-3500 TECHNICAL SPECIFICATION
NTS



NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	77.0" X 45.0" X 86.0"	(1956 mm X 1143 mm X 2184 mm)
CHAMBER STORAGE	109.9 CUBIC FEET	($3.11\ m^3$)
MINIMUM INSTALLED STORAGE*	175.0 CUBIC FEET	($4.96\ m^3$)
WEIGHT	134 lbs.	(60.8 kg)

NOMINAL END CAP SPECIFICATIONS

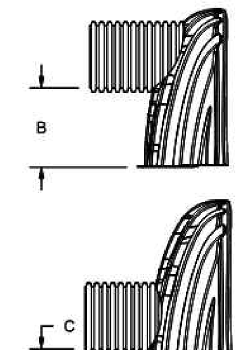
SIZE (W X H X INSTALLED LENGTH)	75.0" X 45.0" X 22.2"	(1905 mm X 1143 mm X 564 mm)
END CAP STORAGE	14.9 CUBIC FEET	($0.42\ m^3$)
MINIMUM INSTALLED STORAGE*	45.1 CUBIC FEET	($1.28\ m^3$)
WEIGHT	49 lbs.	(22.2 kg)

*ASSUMES 12" (305 mm) STONE ABOVE, 9" (229 mm) STONE FOUNDATION, 6" SPACING BETWEEN CHAMBERS, 6" (152 mm) STONE PERIMETER IN FRONT OF END CAPS AND 40% STONE POROSITY

STUBS AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
STUBS AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"
END CAPS WITH A WELDED CROWN PLATE END WITH "C"
END CAPS WITH A PREFABRICATED WELDED STUB END WITH "W"

PART #	STUB	B	C
MC3500IEPP06T	6" (150 mm)	33.21" (844 mm)	---
MC3500IEPP06B		---	0.66" (17 mm)
MC3500IEPP08T	8" (200 mm)	31.16" (791 mm)	---
MC3500IEPP08B		---	0.81" (21 mm)
MC3500IEPP10T	10" (250 mm)	29.04" (738 mm)	---
MC3500IEPP10B		---	0.93" (24 mm)
MC3500IEPP12T	12" (300 mm)	26.36" (670 mm)	---
MC3500IEPP12B		---	1.35" (34 mm)
MC3500IEPP15T	15" (375 mm)	23.39" (594 mm)	---
MC3500IEPP15B		---	1.50" (38 mm)
MC3500IEPP18TC	18" (450 mm)	20.03" (509 mm)	---
MC3500IEPP18TW			
MC3500IEPP18BC		---	1.77" (45 mm)
MC3500IEPP18BW			
MC3500IEPP24TC	24" (600 mm)	14.48" (368 mm)	---
MC3500IEPP24TW			
MC3500IEPP24BC		---	2.06" (52 mm)
MC3500IEPP24BW			
MC3500IEPP30BC	30" (750 mm)	---	2.75" (70 mm)

NOTE: ALL DIMENSIONS ARE NOMINAL



CUSTOM PRECORED INVERTS ARE AVAILABLE UPON REQUEST. INVENTORIED MANIFOLDS INCLUDE 12-24" (300-600 mm) SIZE ON SIZE AND 15-48" (375-1200 mm) ECCENTRIC MANIFOLDS. CUSTOM INVERT LOCATIONS ON THE MC-3500 END CAP CUT IN THE FIELD ARE NOT RECOMMENDED FOR PIPE SIZES GREATER THAN 10" (250 mm). THE INVERT LOCATION IN COLUMN 'B' ARE THE HIGHEST POSSIBLE FOR THE PIPE SIZE.

ADS 4640 TRUEMAN BLVD HILLIARD, OH 43026 1-800-733-7473

StormTech® Chamber System
888-892-2694 | WWW.STORMTECH.COM

220334 IRWINDALE, CA
DATE: DRAWN: SJ
PROJECT #: CHECKED: N/A

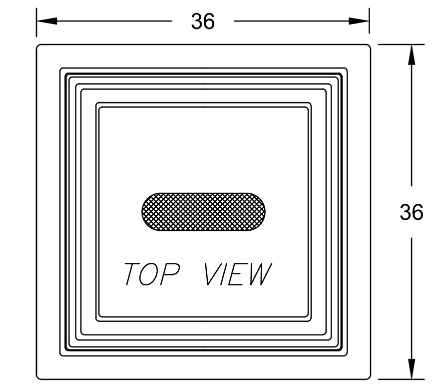
DATE | DRW | CHK | DESCRIPTION

SHEET 5 OF 5

STORM DRAIN DETENTION SYSTEM 1
NTS

EXCLUSIVE CALIFORNIA DISTRIBUTOR:
BIO CLEAN ENVIRONMENTAL SERVICE
P.O. BOX 869, OCEANSIDE, CA. 92049
TEL. 760-433-7640 FAX:760-433-3176
Email: info@biocleanenvironmental.net

SUNTREE TECHNOLOGIES 798 CLEARLAKE RD. SUITE #2 COCOA FL. 32922 TEL. 321-637-7552 FAX 321-637-7554		PROJECT:	
GRATE INLET SKIMMER BOX FOR FLORIDA DOT INLET STRUCTURES.		REVISIONS:	DATE:
DATE:	SCALE:SF = 15	REVISIONS:	DATE:
DRAFTER: N.R.B.	UNITS =INCHES	REVISIONS:	DATE:



FLOW SCHEMATIC

Flow Specifications

Description of filter opening	Percent Open (Based on Screen Dimensions)	Total Square Inches per Unit	Square Inches of Total Unobstructed Openings	Flow Rate (Cubic Feet per Second)
Skimmer protected By-Pass	100%	381.5	381.5	13.4 cfs
Coarse Screen 3/4" x 1-3/4" stainless steel flattened expanded	62%	231.0	143.2	6.2 cfs
Medium Screen 10x10 mesh stainless steel	56%	231.0	129.3	6.4 cfs
Fine screen 14 x 18 mesh stainless steel	68%	283.5	192.8	10.8
MAXIMUM THROAT FLOW RATE Total: 18.8 cfs		SCREEN TREATED FLOW RATE Total: 23.4 cfs		
FLOW RATES BASED ON UNOBSTRUCTED SCREEN OPENINGS				

BOX MANUFACTURED FROM
MARINE GRADE FIBERGLASS & GEL
COATED FOR UV PROTECTION

5 YEAR MANUFACTURERS WARRANTY

PATENTED

ALL FILTER SCREENS ARE STAINLESS STEEL

SUNTREE QUALITY PRODUCTS ARE BUILT FOR EASY CLEANING AND ARE DESIGNED TO BE PERMANENT INFRASTRUCTURE AND SHOULD LAST FOR DECADES.

NOTE:

ALL DRAIN INLETS THAT DISCHARGE INTO AN EXISTING OR PROPOSED STORM DRAIN MUST BE LABELED TO DISCOURAGE ILLEGAL DUMPING OF POLLUTANTS WITH THE STENCIL ABOVE IN A VISIBLE AREA. 2 COATS MINIMUM.

STORM INLET STENCIL 2
NTS

REV. NO	DATE	REVISED	REV. BY	CKD. BY	APRD BY

DESTROY ALL PRINTS BEARING EARLIER DATE

Cannon
16842 Von Karman Avenue, Suite 150
Irvine, CA 92606
P 909.753.8111 F 909.753.0775

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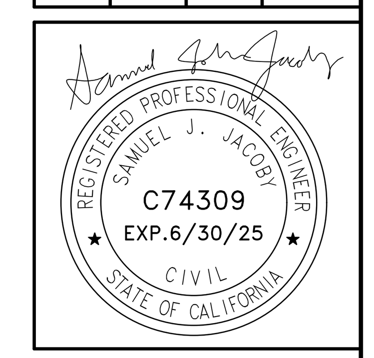
CHECKED BY LE
DATE 9/15/23
SCALE AS SHOWN
CA JOB NO. 220334



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14005 LIVE OAK REDEVELOPMENT
LID DETAIL
14005 LIVE OAK AVE
IRWINDALE, CALIFORNIA

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16
OF 21

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PROJECT INFORMATION

ENGINEERED PRODUCT MANAGER	
ADS SALES REP	
PROJECT NO.	

ADS Advanced Drainage Systems, Inc.

ADS SiteAssist FOR STORMTECH INSTALLATION INSTRUCTIONS VISIT OUR APP

220334

IRWINDALE, CA

MC-3500 STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH MC-3500.
2. CHAMBERS SHALL BE ARCH-SHAPED AND SHALL BE MANUFACTURED FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE COPOLYMERS.
3. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 45x76 DESIGNATION SS.
4. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORTS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
5. THE STRUCTURAL DESIGN OF THE CHAMBERS, THE STRUCTURAL BACKFILL, AND THE INSTALLATION REQUIREMENTS SHALL ENSURE THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET FOR: 1) LONG-DURATION DEAD LOADS AND 2) SHORT-DURATION LIVE LOADS, BASED ON THE AASHTO DESIGN TRUCK WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.
6. CHAMBERS SHALL BE DESIGNED, TESTED AND ALLOWABLE LOAD CONFIGURATIONS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS". LOAD CONFIGURATIONS SHALL INCLUDE: 1) INSTANTANEOUS (<1 MIN) AASHTO DESIGN TRUCK LIVE LOAD ON MINIMUM COVER 2) MAXIMUM PERMANENT (75-YR) COVER LOAD AND 3) ALLOWABLE COVER WITH PARKED (1-WEEK) AASHTO DESIGN TRUCK.
7. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT SHALL BE GREATER THAN OR EQUAL TO 450 LBS/FT/%. THE ASC IS DEFINED IN SECTION 6.2.8 OF ASTM F2418. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.
8. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. UPON REQUEST BY THE SITE DESIGN ENGINEER OR OWNER, THE CHAMBER MANUFACTURER SHALL SUBMIT A STRUCTURAL EVALUATION FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE AS FOLLOWS:
   - THE STRUCTURAL EVALUATION SHALL BE SEALED BY A REGISTERED PROFESSIONAL ENGINEER.
   - THE STRUCTURAL EVALUATION SHALL DEMONSTRATE THAT THE SAFETY FACTORS ARE GREATER THAN OR EQUAL TO 1.95 FOR DEAD LOAD AND 1.75 FOR LIVE LOAD, THE MINIMUM REQUIRED BY ASTM F2787 AND BY SECTIONS 3 AND 12.12 OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR THERMOPLASTIC PIPE.
   - THE TEST DERIVED CREEP MODULUS AS SPECIFIED IN ASTM F2418 SHALL BE USED FOR PERMANENT DEAD LOAD DESIGN EXCEPT THAT IT SHALL BE THE 75-YEAR MODULUS USED FOR DESIGN.
9. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF MC-3500 CHAMBER SYSTEM

1. STORMTECH MC-3500 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH MC-3500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. CHAMBERS ARE NOT TO BE BACKFILLED WITH A DOZER OR AN EXCAVATOR SITUATED OVER THE CHAMBERS. STORMTECH RECOMMENDS 3 BACKFILL METHODS:
   - STONESHOOTER LOCATED OFF THE CHAMBER BED.
   - BACKFILL AS ROWS ARE BUILT USING AN EXCAVATOR ON THE FOUNDATION STONE OR SUBGRADE.
   - BACKFILL FROM OUTSIDE THE EXCAVATION USING A LONG BOOM HOE OR EXCAVATOR.
4. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
5. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
6. MAINTAIN MINIMUM - 6" (150 mm) SPACING BETWEEN THE CHAMBER ROWS.
7. INLET AND OUTLET MANIFOLDS MUST BE INSERTED A MINIMUM OF 12" (300 mm) INTO CHAMBER END CAPS.
8. EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE MEETING THE AASHTO M43 DESIGNATION OF #3 OR #4.
9. STONE MUST BE PLACED ON THE TOP CENTER OF THE CHAMBER TO ANCHOR THE CHAMBERS IN PLACE AND PRESERVE ROW SPACING.
10. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES WITH CHAMBER FOUNDATION MATERIALS BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
11. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUBSURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

NOTES FOR CONSTRUCTION EQUIPMENT

1. STORMTECH MC-3500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
2. THE USE OF EQUIPMENT OVER MC-3500 CHAMBERS IS LIMITED:
   - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
   - NO RUBBER TIRED LOADER, DUMP TRUCK, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
   - WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. FULL 36" (900 mm) OF STABILIZED COVER MATERIALS OVER THE CHAMBERS IS REQUIRED FOR DUMP TRUCK TRAVEL OR DUMPING.

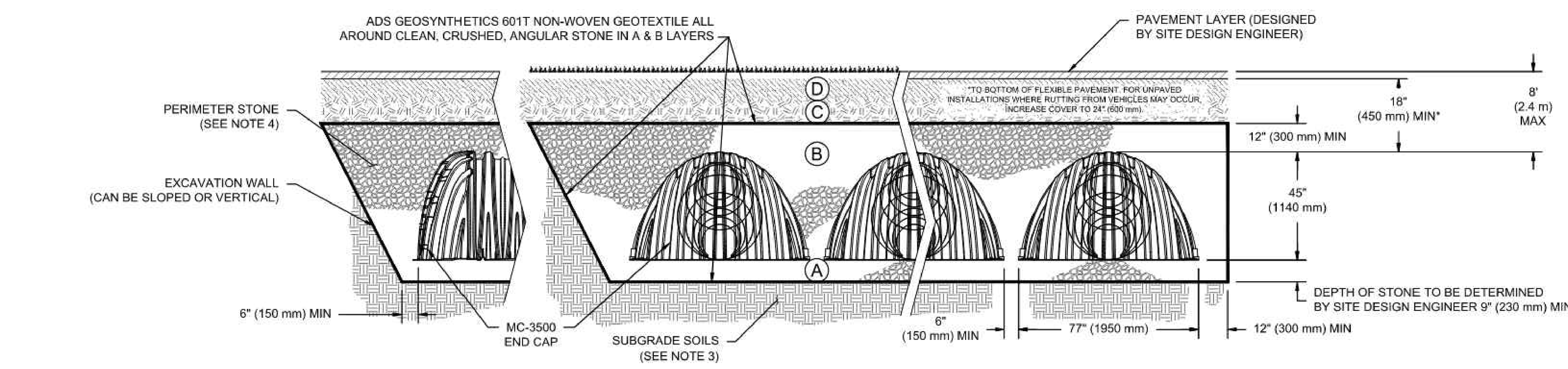
USE OF A DOZER TO PUSH EMBEDMENT STONE BETWEEN THE ROWS OF CHAMBERS MAY CAUSE DAMAGE TO CHAMBERS AND IS NOT AN ACCEPTABLE BACKFILL METHOD. ANY CHAMBERS DAMAGED BY USING THE "DUMP AND PUSH" METHOD ARE NOT COVERED UNDER THE STORMTECH STANDARD WARRANTY.

CONTACT STORMTECH AT 1-888-892-2694 WITH ANY QUESTIONS ON INSTALLATION REQUIREMENTS OR WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT.

ACCEPTABLE FILL MATERIALS: STORMTECH MC-3500 CHAMBER SYSTEMS

	MATERIAL LOCATION	DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 24" (600 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145[1] A-1, A-2-4, A-3 OR AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 24" (600 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 12" (300 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS.
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 4	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 4	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE.[2,3]

PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 9" (230 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.
4. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.



NOTES:

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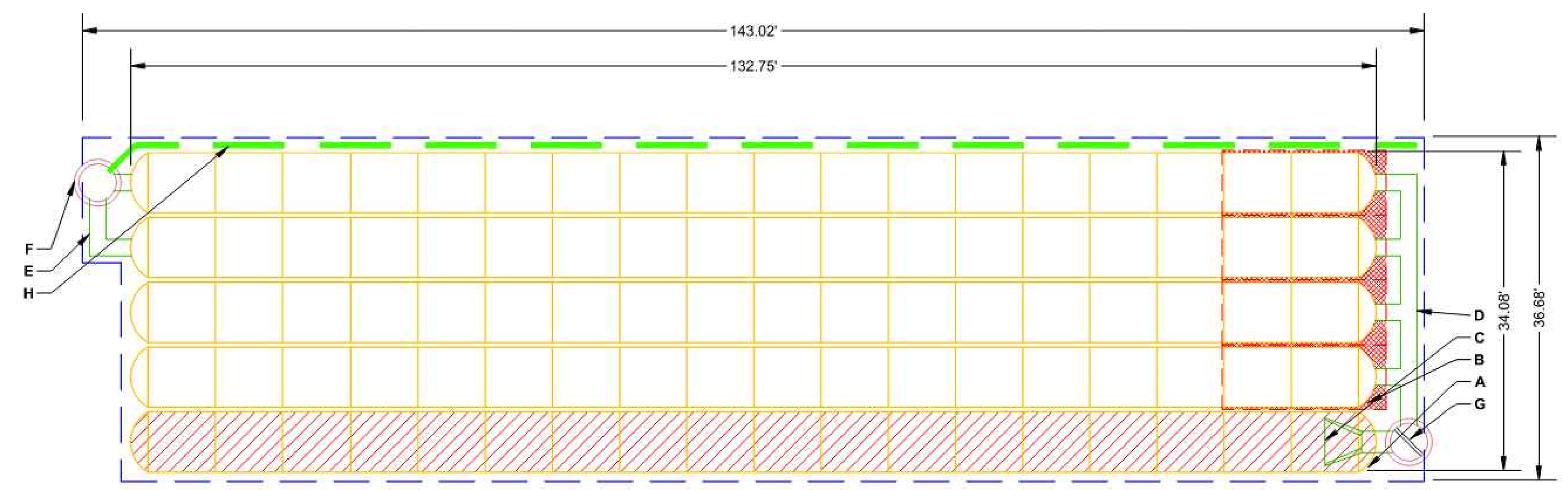
2. MC-3500 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT SHALL BE GREATER THAN OR EQUAL TO 450 LBS/FT/%. THE ASC IS DEFINED IN SECTION 6.2.8 OF ASTM F2418. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

PROPOSED LAYOUT		CONCEPTUAL ELEVATIONS	
90	STORMTECH MC-3500 CHAMBERS	MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):	12.50
10	STORMTECH MC-3500 END CAPS	MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):	6.50
12	STONE ABOVE (in)	MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):	6.00
9	STONE BELOW (in)	MINIMUM ALLOWABLE GRADE (TOP OF RIGID CONCRETE PAVEMENT):	6.00
40	STONE VOID	MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):	6.00
17357	INSTALLED SYSTEM VOLUME (CF) (PERIMETER STONE INCLUDED) (COVER STONE INCLUDED) (BASE STONE INCLUDED)	TOP OF STONE:	5.50
		TOP OF MC-3500 CHAMBER:	4.50
		24" ISOLATOR ROW PLUS INVERT:	0.92
		18" x 18" BOTTOM MANIFOLD INVERT:	0.90
5150	SYSTEM AREA (SF)	18" x 18" BOTTOM MANIFOLD INVERT:	0.90
359.4	SYSTEM PERIMETER (ft)	18" BOTTOM CONNECTION INVERT:	0.90
		BOTTOM OF MC-3500 CHAMBER:	0.75
		UNDERDRAIN INVERT:	0.00
		BOTTOM OF STONE:	0.00

*INVERT ABOVE BASE OF CHAMBER

PART TYPE	ITEM ON LAYOUT	DESCRIPTION	INVERT*	MAX FLOW
PREFABRICATED END CAP	A	24" BOTTOM CORED END CAP, PART#: MC3500IEPP24BC / TYP OF ALL 24" BOTTOM CONNECTIONS AND ISOLATOR PLUS ROWS	2.06"	
PREFABRICATED END CAP	B	18" BOTTOM CORED END CAP, PART#: MC3500IEPP18BC / TYP OF ALL 18" BOTTOM CONNECTIONS	1.77"	
FLAMP	C	INSTALL FLAMP ON 24" ACCESS PIPE / PART#: MC350024RAMP		
MANIFOLD	D	18" x 18" BOTTOM MANIFOLD, ADS N-12	1.77"	
MANIFOLD	E	18" x 18" BOTTOM MANIFOLD, ADS N-12	1.77"	
CONCRETE STRUCTURE	F	OCS (DESIGN BY ENGINEER / PROVIDED BY OTHERS)		8.0 CFS OUT
CONCRETE STRUCTURE W/WEIR	G	(DESIGN BY ENGINEER / PROVIDED BY OTHERS)		20.9 CFS IN
UNDERDRAIN	H	6" ADS N-12 DUAL WALL PERFORATED HDPE UNDERDRAIN		

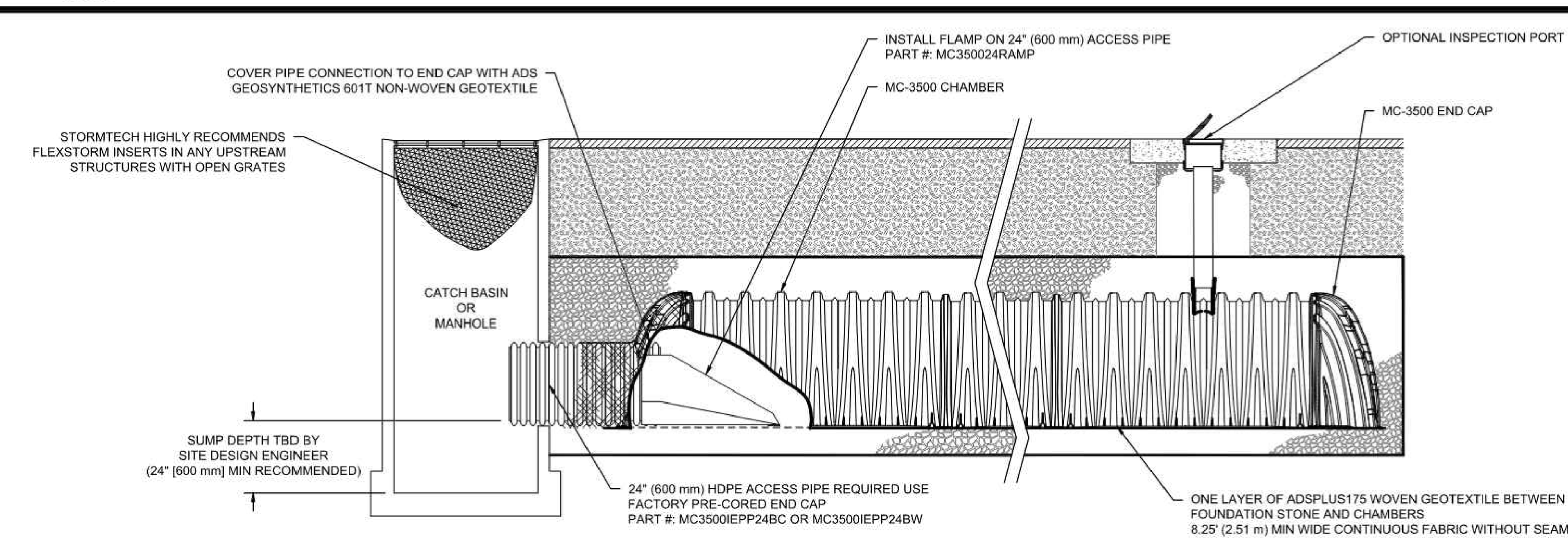


ISOLATOR ROW PLUS (SEE DETAIL)

PLACE MINIMUM 17.50' OF ADSPLUS175 WOVEN GEOTEXTILE OVER BEDDING STONE AND UNDERNEATH CHAMBER FEET FOR SCOUR PROTECTION AT ALL CHAMBER INLET ROWS

BED LIMITS

NOTES
- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECH NOTE #6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- **NOT FOR CONSTRUCTION:** THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.



MC-3500 ISOLATOR ROW PLUS DETAIL
NTS

INSPECTION & MAINTENANCE

STEP 1) INSPECT ISOLATOR ROW PLUS FOR SEDIMENT
- A. INSPECTION PORTS (IF PRESENT)
  - A.1. REMOVE/OPEN LID ON NYLOPLAST INLINE DRAIN
  - A.2. REMOVE AND CLEAN FLEXSTORM FILTER IF INSTALLED
  - A.3. USING A FLASHLIGHT AND STADIA ROD, MEASURE DEPTH OF SEDIMENT AND RECORD ON MAINTENANCE LOG
  - A.4. LOWER A CAMERA INTO ISOLATOR ROW PLUS FOR VISUAL INSPECTION OF SEDIMENT LEVELS (OPTIONAL)
  - A.5. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.
- B. ALL ISOLATOR PLUS ROWS
  - B.1. REMOVE COVER FROM STRUCTURE AT UPSTREAM END OF ISOLATOR ROW PLUS
  - B.2. USING A FLASHLIGHT, INSPECT DOWN THE ISOLATOR ROW PLUS THROUGH OUTLET PIPE
    - i) MIRRORS ON POLES OR CAMERAS MAY BE USED TO AVOID A CONFINED SPACE ENTRY
    - ii) FOLLOW OSHA REGULATIONS FOR CONFINED SPACE ENTRY IF ENTERING MANHOLE
  - B.3. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.

STEP 2) CLEAN OUT ISOLATOR ROW PLUS USING THE JETVAC PROCESS
- A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45" (1.1 m) OR MORE IS PREFERRED
- B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN
- C. VACUUM STRUCTURE SUMP AS REQUIRED

STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS.

STEP 4) INSPECT AND CLEAN BASINS AND MANHOLES UPSTREAM OF THE STORMTECH SYSTEM.

NOTES

1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS.
2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.

220334 IRWINDALE, CA | DRAWN: SJ | CHECKED: N/A | DATE | PROJECT # | DESCRIPTION | DATE | DRW | CHK

ADS 4640 TRUEMAN BLVD HILLIARD, OH 43026 1-800-733-7473 | StormTech® Chamber System 888-892-2694 | WWW.STORMTECH.COM

SHEET 2 OF 5 | SHEET 3 OF 5 | SHEET 4 OF 5

REV. NO	DATE	REVISED	DESTROY ALL PRINTS BEARING EARLIER DATE	REV. BY	CKD./APRD. BY

Cannon
16842 Von Kaman Avenue, Suite 150
Irvine, CA 92606
P 909.753.8111 F 909.753.0775

DRAWN BY DT | CHECKED BY LE | DATE 9/15/23 | SCALE AS SHOWN | CA JOB NO. 220334

REGISTERED PROFESSIONAL ENGINEER SAMUEL J. JACOBY C74309 EXP.6/30/25 CIVIL STATE OF CALIFORNIA

REXFORD INDUSTRIAL
14005 LIVE OAK REDEVELOPMENT
LID DETAIL
14005 LIVE OAK AVE
IRWINDALE, CALIFORNIA

F:\proj\2022\220334\4 production and drafting\Const Dwgs\Civil\CE220334LID0001.dwg 1-25-24 05:18:55 PM LukasE

Attachment 5. HYDROCALC STORM VOLUME CALCULATIONS

Peak Flow Hydrologic Analysis

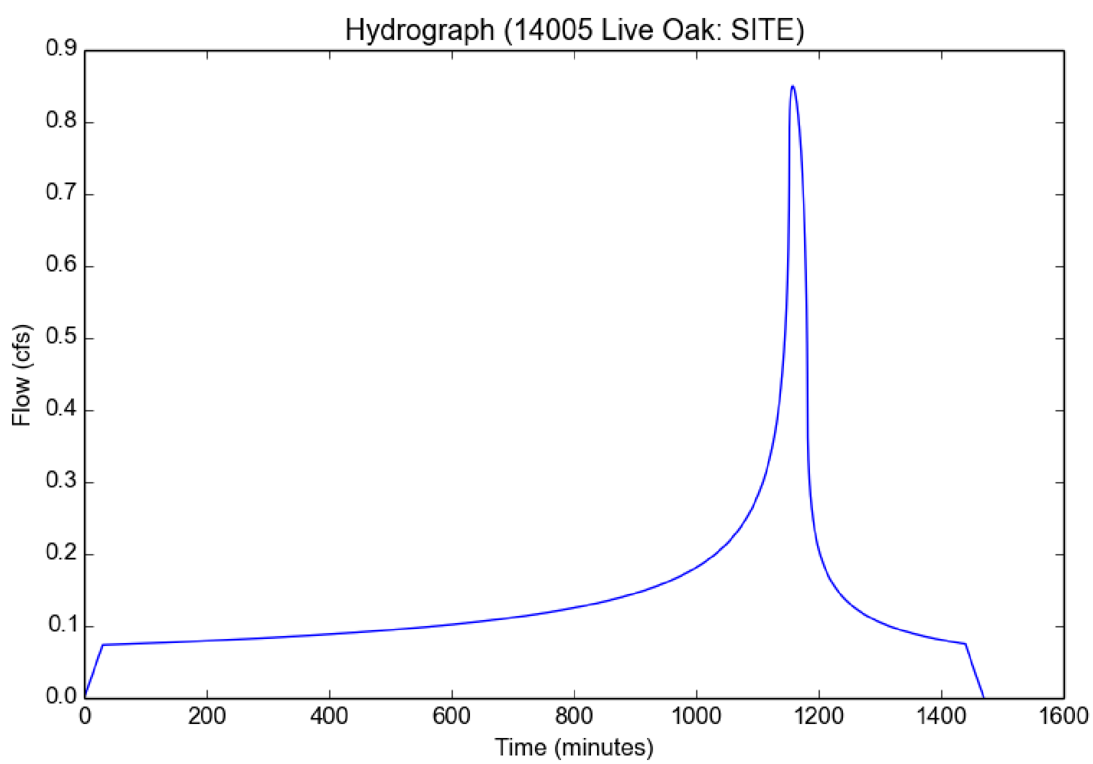
File location: F:/proj/2022/220334/3 Project Design/Civil/Design Calcs/drainage/04 Calcs/14005 Live Oak Report.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	14005 Live Oak
Subarea ID	SITE
Area (ac)	5.13
Flow Path Length (ft)	658.0
Flow Path Slope (vft/hft)	0.0141
50-yr Rainfall Depth (in)	1.1
Percent Impervious	0.9
Soil Type	8
Design Storm Frequency	10-yr
Fire Factor	0
LID	False

Output Results

Modeled (10-yr) Rainfall Depth (in)	0.7854
Peak Intensity (in/hr)	0.2019
Undeveloped Runoff Coefficient (Cu)	0.1063
Developed Runoff Coefficient (Cd)	0.8206
Time of Concentration (min)	30.0
Clear Peak Flow Rate (cfs)	0.8498
Burned Peak Flow Rate (cfs)	0.8498
24-Hr Clear Runoff Volume (ac-ft)	0.2731
24-Hr Clear Runoff Volume (cu-ft)	11894.214



Peak Flow Hydrologic Analysis

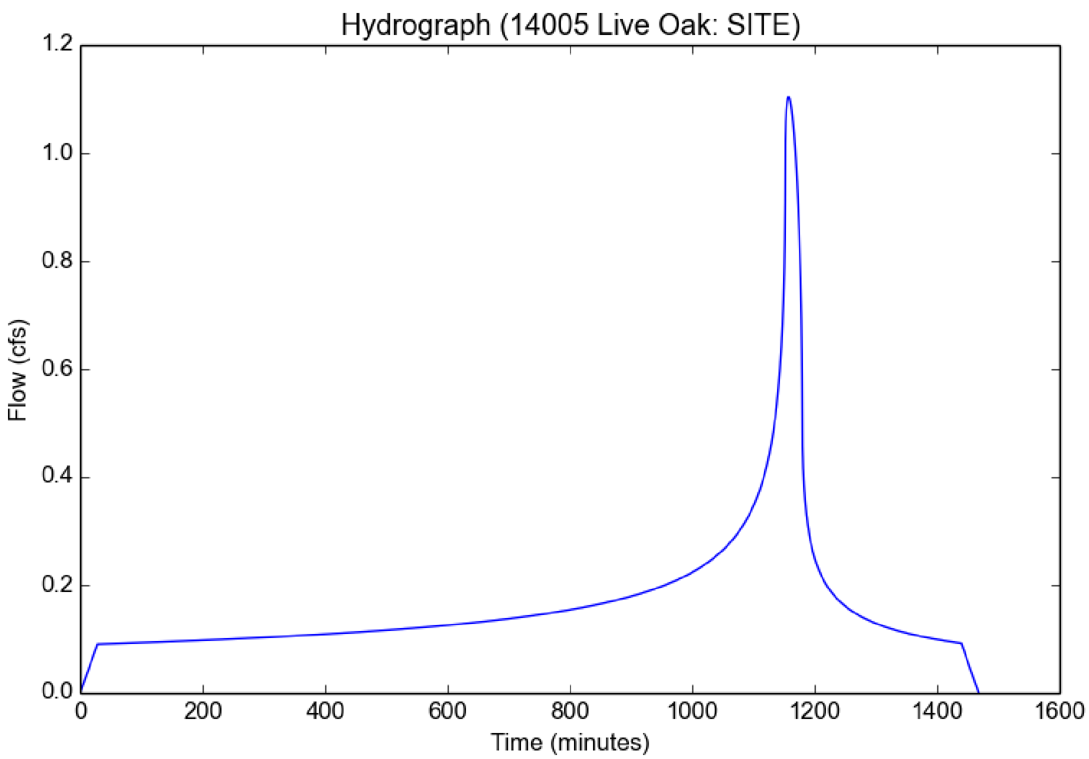
File location: F:/proj/2022/220334/3 Project Design/Civil/Design Calcs/drainage/04 Calcs/14005 Live Oak Report.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	14005 Live Oak
Subarea ID	SITE
Area (ac)	5.13
Flow Path Length (ft)	658.0
Flow Path Slope (vft/hft)	0.0141
50-yr Rainfall Depth (in)	1.1
Percent Impervious	0.9
Soil Type	8
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	0.9658
Peak Intensity (in/hr)	0.2564
Undeveloped Runoff Coefficient (Cu)	0.2895
Developed Runoff Coefficient (Cd)	0.8389
Time of Concentration (min)	28.0
Clear Peak Flow Rate (cfs)	1.1036
Burned Peak Flow Rate (cfs)	1.1036
24-Hr Clear Runoff Volume (ac-ft)	0.3363
24-Hr Clear Runoff Volume (cu-ft)	14650.5061



Peak Flow Hydrologic Analysis

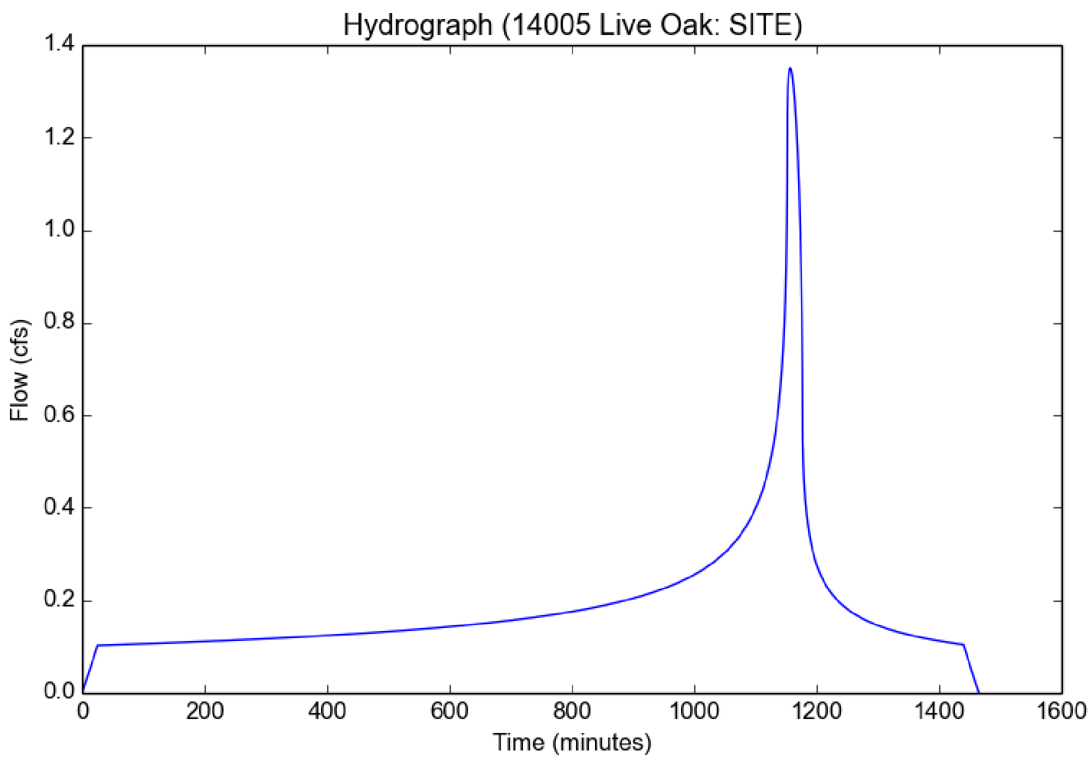
File location: F:/proj/2022/220334/3 Project Design/Civil/Design Calcs/drainage/04 Calcs/14005 Live Oak Report.pdf
Version: HydroCalc 1.0.3

Input Parameters

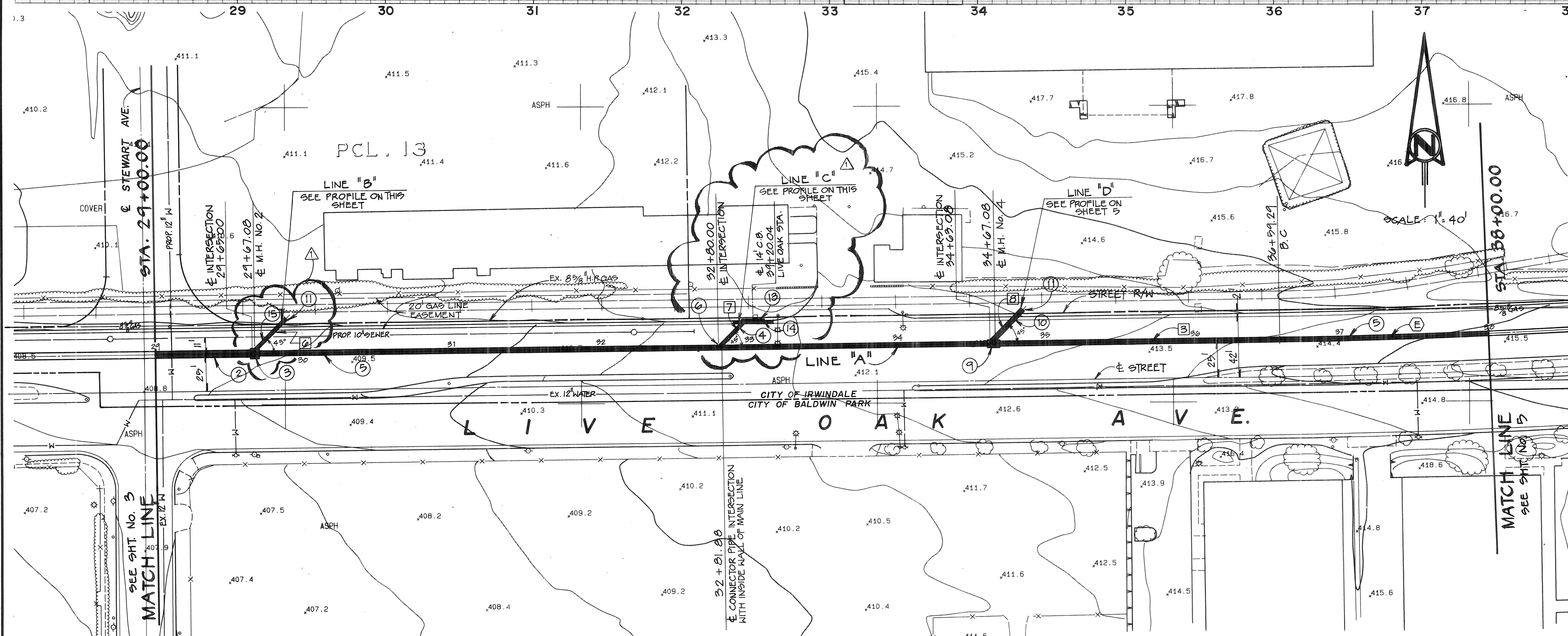
Project Name	14005 Live Oak
Subarea ID	SITE
Area (ac)	5.13
Flow Path Length (ft)	658.0
Flow Path Slope (vft/hft)	0.0141
50-yr Rainfall Depth (in)	1.1
Percent Impervious	0.9
Soil Type	8
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	1.1
Peak Intensity (in/hr)	0.308
Undeveloped Runoff Coefficient (Cu)	0.4438
Developed Runoff Coefficient (Cd)	0.8544
Time of Concentration (min)	25.0
Clear Peak Flow Rate (cfs)	1.3501
Burned Peak Flow Rate (cfs)	1.3501
24-Hr Clear Runoff Volume (ac-ft)	0.3838
24-Hr Clear Runoff Volume (cu-ft)	16717.0533



Attachment 6. Storm Drain As-builts



CONSTRUCTION NOTES

(2) CONSTRUCT 54"RCP (1800-D).

(3) CONSTRUCT MANHOLE NO. 2 PER L.A.C.F.C.D. STANDARD DRAWING NO. 2-D184.

(4) CONSTRUCT 24" RCP (1250-D).

(5) CONSTRUCT 45" RCP (1800-D).

(6) CONSTRUCT JUNCTION STRUCTURE NO. 2 PER L.A.C.F.C.D. STANDARD DRAWING NO. 2-D112. (C = 3')

(14) CONSTRUCT LOCAL DEPRESSION NO. 3 PER L.A.C.F.C.D. STANDARD DRAWING NO. 2-D248.

(13) CONSTRUCT CATCH BASIN NO. 4 (W = 14') PER L.A.C.F.C.D. STANDARD DRAWING NO. 2-D101. (V = 6.4')

(9) CONSTRUCT MANHOLE NO. 4 PER L.A.C.F.C.D. STANDARD DRAWING NO. 2-D113.

(10) CONSTRUCT 36" RCP (1250-D).

(11) PLUG END OF PIPE WITH BRICK AND MORTAR.

△1 (15) CONSTRUCT 21" RCP (1250-D)

REGISTERED PROFESSIONAL ENGINEER
ART R. RICO
28203
EXP. 3/31/94
CIVIL
STATE OF CALIFORNIA

℄ S.D. COURSE DATA		
	LENGTH	BEARING
3	1300.38'	N 89°22'40"E
6	33.94'	N 44°22'40"E
7	21.75'	N 44°22'40"E
8	33.94'	N 44°22'40"E

℄ STORM DRAIN CURVE DATA				
⬡	Δ	R	L	T
E	2°18'47"	4,975.00'	200.88'	100.45'

REVISIONS				
REVISION	DATE	INITIALS	DESCRIPTION	APPV'D
△1	4/30/91	JKP	CHANGE CATCH BASIN TYPE ON LATERAL "C". LOWER LATERAL "B", CHANGE PIPE SIZE.	C. A.

PREPARED IN THE OFFICE OF:
WILLIAMSON & SCHMID
CONSULTING CIVIL ENGINEERS AND LAND SURVEYORS
15101 Red Hill Avenue • Tustin, California 92680 • 714/259-7900

ART R. RICO — R.C.E. 28203 — DATE 4/15/91

DRAWN BY: SKH
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DEPARTMENT OF PUBLIC WORKS

STORM DRAIN IMPROVEMENT PLANS FOR

LIVE OAK AVENUE

STA. 29 + 00.00 TO STA. 38 + 00.00

CITY OF IRWINDALE

SHEET 4 OF 6

JOB No. 89140.29

Appendix J

Low Impact Development Report

Cannon

Low Impact Development (LID) Report

14005 Live Oak
Irwindale, CA

Prepared for

Rexford Industrial - 14005 Live Oak, LLC, a Delaware Limited Liability Company
333 City Boulevard West, Suite 705
Orange, CA 92868

Prepared by

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March 19, 2024

REGISTERED PROFESSIONAL ENGINEER
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STATE OF CALIFORNIA

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2. PROJECT BACKGROUND

Project Owner

Owner:	Rexford Industrial - 14005 Live Oak, LLC, a Delaware Limited Liability Company
Site Address:	14005 Live Oak
City/State:	Irwindale, CA
Total Site Area:	214,315.2 s.f. (4.92 acres)
Hillside Area:	No
APN:	8535-001-033

1. INTRODUCTION

Project Background

The site is 5.13acres (4.86 acres gross). The project is located at 14005 Live Oak Avenue, Irwindale, California. The property is bounded by Live Oak Avenue to the south, Stewart Avenue to the west, and Rivergrade Road to the north. To the east on Live Oak Avenue is vacant land, to the east on Rivergrade Road is surface parking. The site is currently occupied by a commercial building (bank) and surface parking.

The proposed development is a new 100,380 s.f. building with surface parking. This project is a Designated Project under the terms of the LID Standards Manual. The project is a redevelopment project which will result in the replacement of more than 5,000 s.f. of impervious surface on a site that was previously developed as a commercial/parking site. Because more than 50 percent of the impervious surface of the previously developed site is proposed to be altered, the entire development site must meet the requirements of the LID Standards Manual.

All Designated Projects must retain 100 percent of the Storm Water Quality Design volume (SWQDv) on-site through infiltration, evapotranspiration, stormwater runoff harvest and use, or a combination thereof.

Purpose and Scope

This report is to document the City of Irwindale and County of Los Angeles Los Impact Development (LID) Best Management Practices will be met.

2. LOW IMPACT DEVELOPMENT (LID) Feasibility Screening

Structural or Treatment Control Best Management Practices (BMPs) are required for this project under the County of Los Angeles LID program. The LID requirements, approved by the Regional Water Quality Control Board, call for the treatment of the Stormwater Quality Design Volume (SWQDv). The design storm, from with the SWQDv is calculated, is defined as the greater of:

- The 0.75-inch, 24—hour rain event: or
- The 85th percentile, 24-hour rain event as determined from the Los Angeles County 85th percentile precipitation isoheytal map.

The 85th percentile rainfall depth in this area is 1.1 in., therefore the design storm is 1.1 in.

BMP selection was analyzed per section 4 of the County of Los Angeles Low Impact Development Best Management Practices Handbook (LID Manual).

Infiltration
Infiltration systems were analyzed for the site.

2a. High Groundwater
While the historically shallowest groundwater, per the California Geological Survey is approximately 100+' BGS. Groundwater does not appear to be an active constraint.

2b. Percolation Test Infiltration Rate
Field Percolation Testing was conducted by the geotechnical engineer at the southwestern and southeastern portions of the site (LP-1 & LP-2) using a high-flow constant head percolation test at depths of approximately 5 to 10 feet bgs. The measured (unfactored) infiltration rates for the two tests conducted were 1.91 in. per hour (LP-1) and 5.94 in. per hour (LP-2) which are well above below the minimum feasibility criteria of 0.3 in. per hour. The average rate of 3.93 in/hr was used in the analysis. The design rate of 1.97 is used, using a safety factor of 2.

Infiltration is considered feasible.

2d. Site
The Site is not located within an Alquist-Priolo Earthquake Fault Zone and is also not located within an earthquake-induced landslide hazard zone nor within a liquefaction hazard zone. However, it is located within an area of minimal flood hazard but also located within a flood inundation zone associated with the San Gabriel Dam and Morris Dam.

3. Methodology

This report uses the HydroCalc Program developed by the LACDPW to produce the peak stormwater runoff flow rates and volumes. The HydroCalc results are summarized below:

Table 3-1 Hydrocalc Inputs for LID analysis

Project Name	14005 Live Oak, Irwindale
Subarea ID	Entire Site
Area (ac)	5.13
Flow Path Length (ft)	658
Flow Path Slope (vft/hft)	0.0141
85^{th} Percentile Rainfall Depth (in)	1.1
Percent Impervious	0.90 (assumed, for concept)
Soil Type	8
Design Storm Frequency	85^{th} Percentile Storm
Fire Factor	0
Modeled (85^{th} percentile storm) Rainfall Depth (in)	**1.1**

Table 3-2 Hydrocalc Output for LID analysis

85th Percentile (cfs, cf)	1.42 cfs / 18,283 cf
10-Year Clear Runoff (cfs)	0.85 cfs
25-Year Clear Runoff (cfs)	1.10 cfs
1=50-Year Clear Runoff (cfs)	1.35 cfs

4. LID STRUCTURAL BMPS

The project proposes to infiltrate the SWQDv utilizing subsurface infiltration. Water will be collected in trench drains and inlets equipped with inlet filters to reduce sediment and trash loading of the BMP. The BMP is also equipped with a pre-treatment chamber. The pre-treatment chamber is 66 in. tall and the design rate infiltration is 1.97 in/hr since we are using a factor of safety of 2. Therefore, the drain time is 33.5 hours which is less than 72 hours resulting in the LID design to conform to requirements.

5. CONCLUSION

LID BMPs have been designed to treat the peak mitigation flow rate produced by a 1.1 in, 24-hour rainfall event. Infiltration BMPs were selected as the appropriate treatment system. The 18,084.41 cu-ft infiltration system has been sized to treat the required mitigation volume (18,283 cu-ft)

6. LIMITATIONS

This report was prepared to comply with the guidelines establish by the County of Los Angeles. Evaluation of the appropriateness of these guidelines and the accuracy of County data are beyond the scope of this work.

Usage of this report is limited to address the purpose and scope previously defined. Cannon shall not be responsible for any unauthorized application of this report and the contents herein.

The opinions represented in this report have been derived in accordance with current standards of civil engineering practice. No other warranty is expressed or implied.

7. REFERENCES

Los Angeles County Department of Public Works, *LACDPW Hydrology/Sedimentation Manual and Appendices* (LACDPW 1991, 1992, 1993, 2002, 2006).

Los Angels County Department of Public Works, The LACDPW TCv1.0 Manual (TC_calc_cepth.xls, December 1991, June 2002)

Los Angeles Regional Water Quality Control Board, *Standard Urban Storm Water Mitigation Plan for Los Angeles County and Cities in Los Angeles County*, (March 2000)

Los Angeles County Department of Public Works, *Development Planning for Storm Water Management, A Manual for the Standard Urban Stormwater Mitigation Plan, Appendix A, Volume and Flow Rate Calculations*, issued May 2000 (LACDPW, 2000)

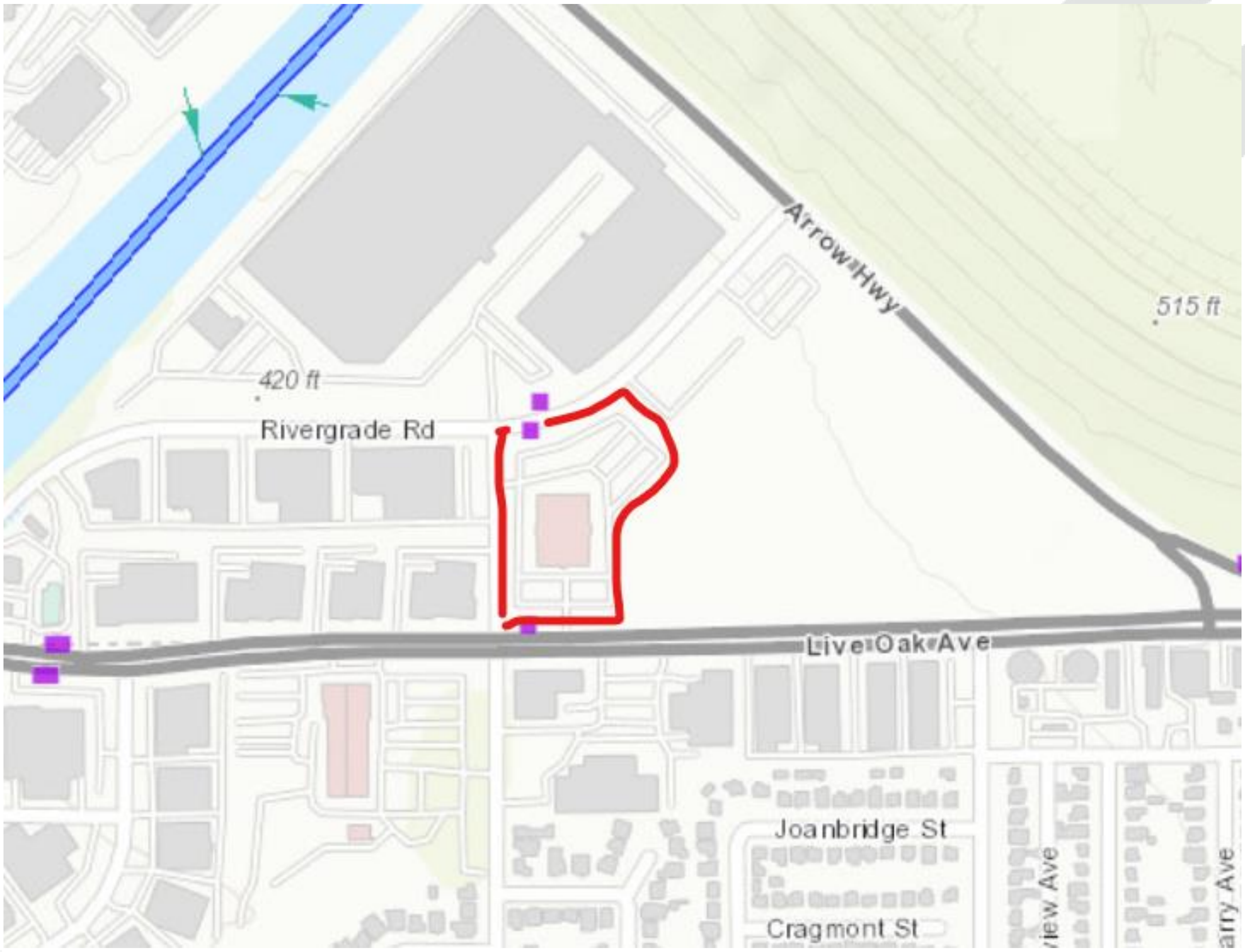
California Stormwater Quality Association, Stormwater Best Management Practice Handbook New Development and Redevelopment (January 2003).

8. List of Attachments

ATTACHMENT 1. EXISTING SITE MAP
ATTACHMENT 2. EXISTING STORM DRAINS AND INLETS
ATTACHMENT 3. SOIL TYPE
ATTACHMENT 4. DTSC MAP
ATTACHMENT 5. 85 PERCENTILE STORM RAINFALL
ATTACHMENT 6. HYDROCALC STORM VOLUME CALCULATIONS
ATTACHMENT 7. ROUTINE STRUCTURAL BMPS
ATTACHMENT 8. OPERATIONS AND MAINTENANCE PLAN
ATTACHMENT 9. BMP / FACT SHEET
ATTACHMENT 10. PROJECT EXHIBITS

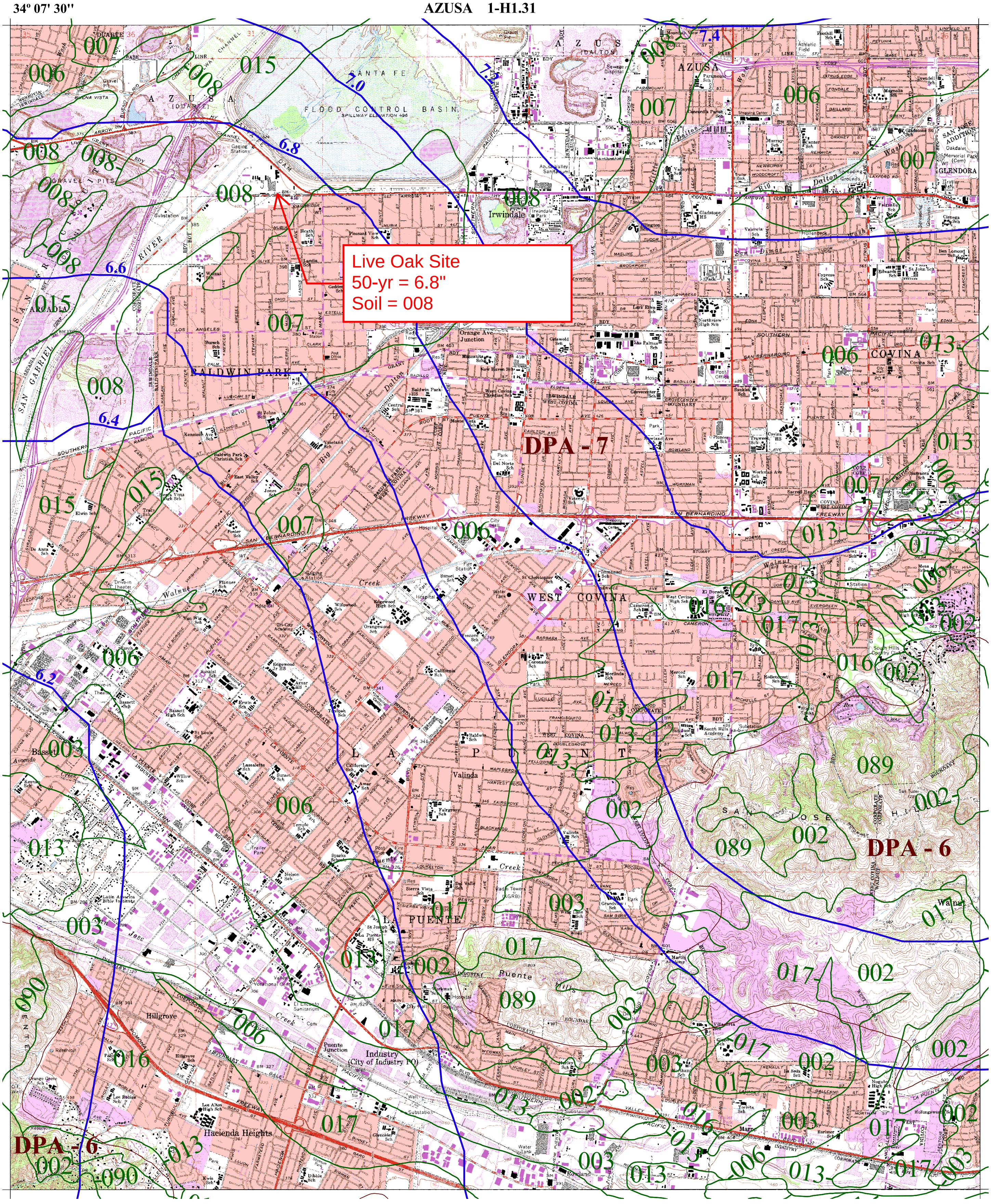
Attachment 1. EXISTING SITE MAP

Attachment 2. EXISTING STORM DRAINS AND INLETS



(Source: LA County DPW)

Attachment 3. Soil Type



1 0 1 2 Miles

016 SOIL CLASSIFICATION AREA

7.2 INCHES OF RAINFALL

DPA - 6 DEBRIS POTENTIAL AREA

25-YEAR 24-HOUR ISOHYET REDUCTION FACTOR: 0.878
10-YEAR 24-HOUR ISOHYET REDUCTION FACTOR: 0.714

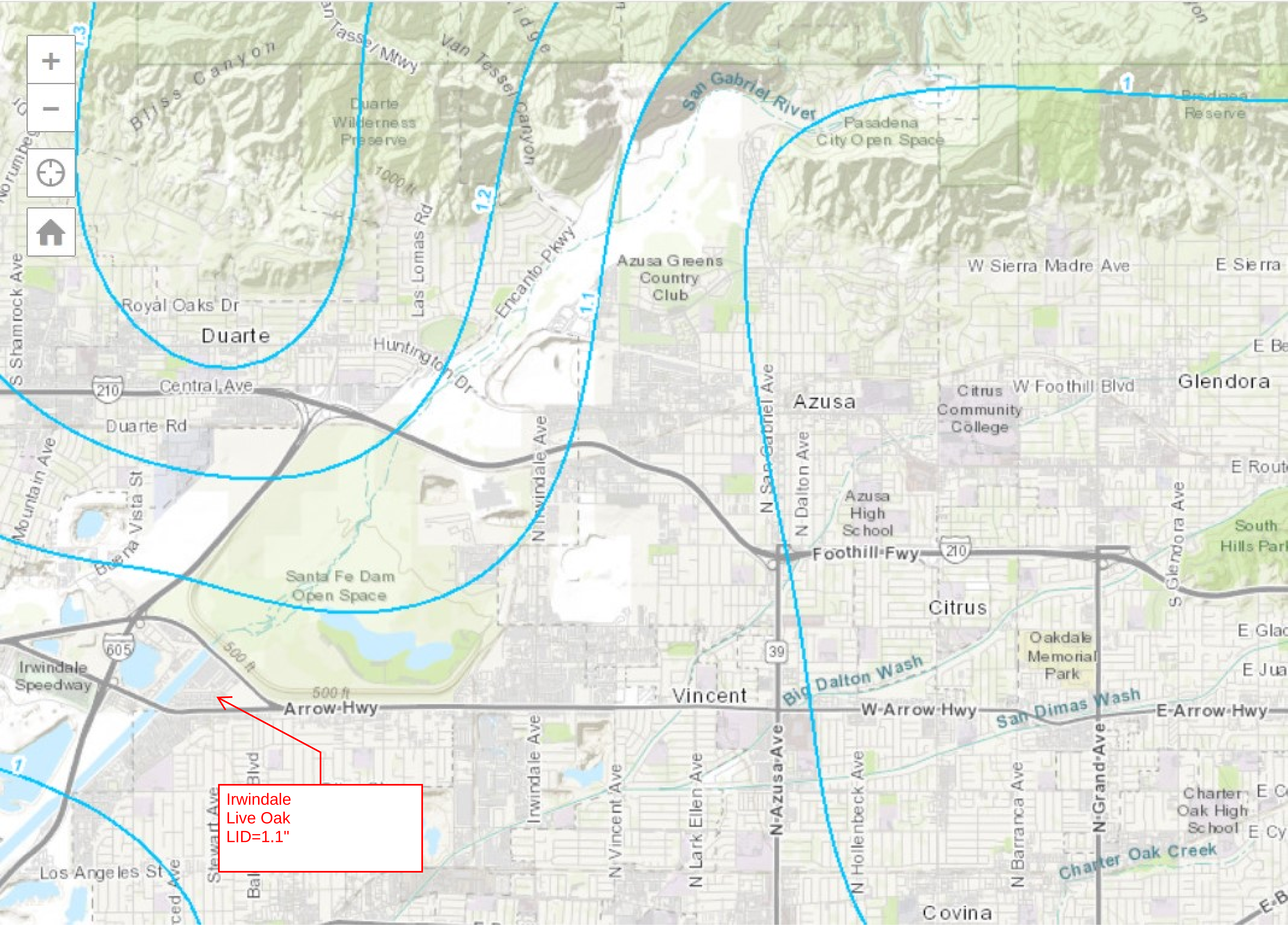
BALDWIN PARK
50-YEAR 24-HOUR ISOHYET

1-H1.21

LOS ANGELES COUNTY PUBLIC WORKS Public Service That Works

Attachment 4. 85 Percentile Storm Rainfall

LA County Hydrology Map



Attachment 5. HYDROCALC STORM VOLUME CALCULATIONS

Peak Flow Hydrologic Analysis

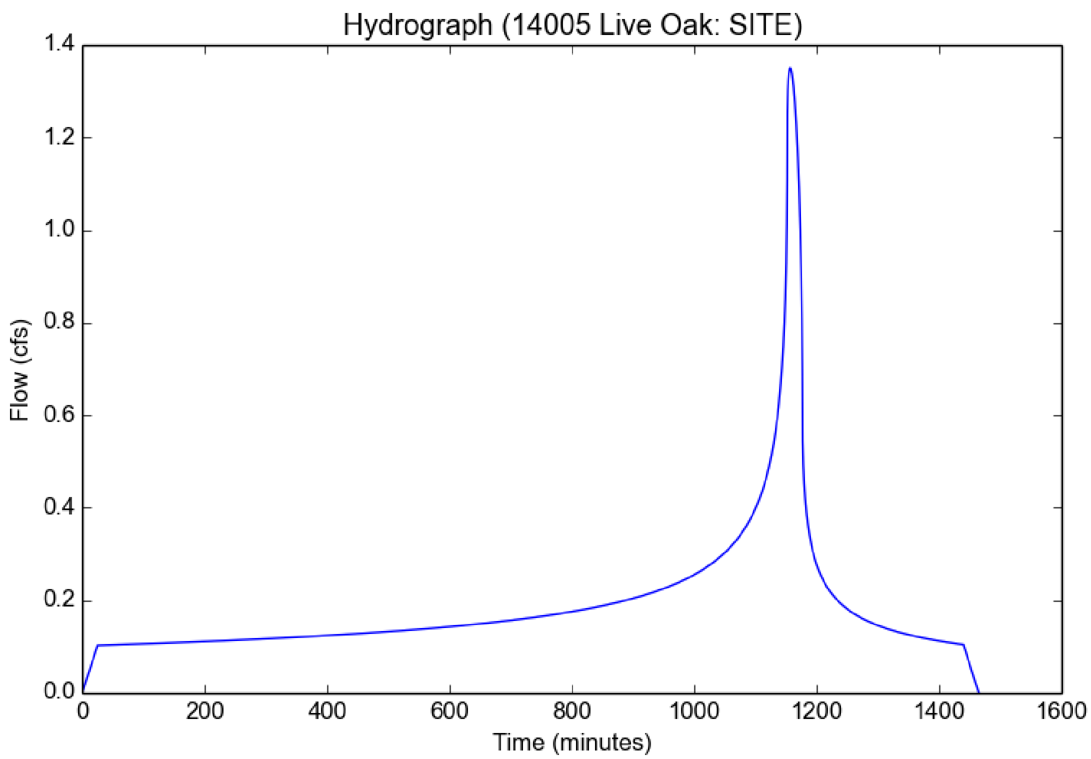
File location: F:/proj/2022/220334/3 Project Design/Civil/Design Calcs/drainage/04 Calcs/14005 Live Oak Report.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	14005 Live Oak
Subarea ID	SITE
Area (ac)	5.13
Flow Path Length (ft)	658.0
Flow Path Slope (vft/hft)	0.0141
85th Percentile Rainfall Depth (in)	1.1
Percent Impervious	0.9
Soil Type	8
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.1
Peak Intensity (in/hr)	0.308
Undeveloped Runoff Coefficient (Cu)	0.4438
Developed Runoff Coefficient (Cd)	0.8544
Time of Concentration (min)	25.0
Clear Peak Flow Rate (cfs)	1.3501
Burned Peak Flow Rate (cfs)	1.3501
24-Hr Clear Runoff Volume (ac-ft)	0.3838
24-Hr Clear Runoff Volume (cu-ft)	16717.0533



Peak Flow Hydrologic Analysis

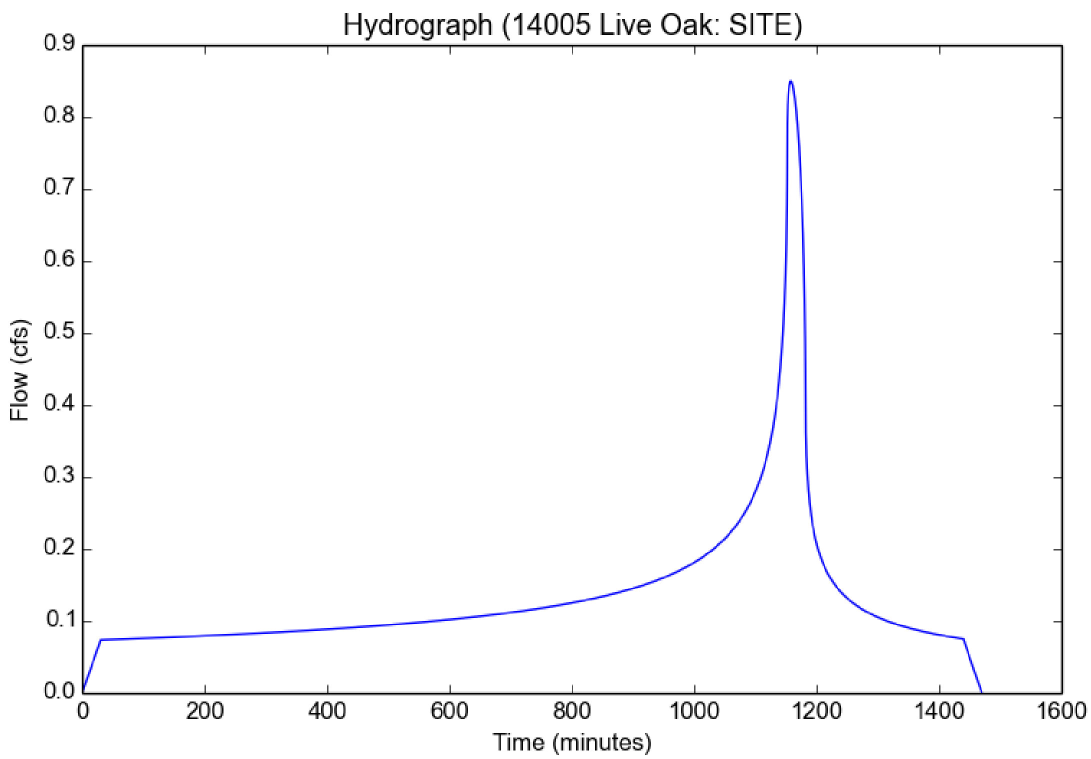
File location: F:/proj/2022/220334/3 Project Design/Civil/Design Calcs/drainage/04 Calcs/14005 Live Oak Report.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	14005 Live Oak
Subarea ID	SITE
Area (ac)	5.13
Flow Path Length (ft)	658.0
Flow Path Slope (vft/hft)	0.0141
50-yr Rainfall Depth (in)	1.1
Percent Impervious	0.9
Soil Type	8
Design Storm Frequency	10-yr
Fire Factor	0
LID	False

Output Results

Modeled (10-yr) Rainfall Depth (in)	0.7854
Peak Intensity (in/hr)	0.2019
Undeveloped Runoff Coefficient (Cu)	0.1063
Developed Runoff Coefficient (Cd)	0.8206
Time of Concentration (min)	30.0
Clear Peak Flow Rate (cfs)	0.8498
Burned Peak Flow Rate (cfs)	0.8498
24-Hr Clear Runoff Volume (ac-ft)	0.2731
24-Hr Clear Runoff Volume (cu-ft)	11894.214



Peak Flow Hydrologic Analysis

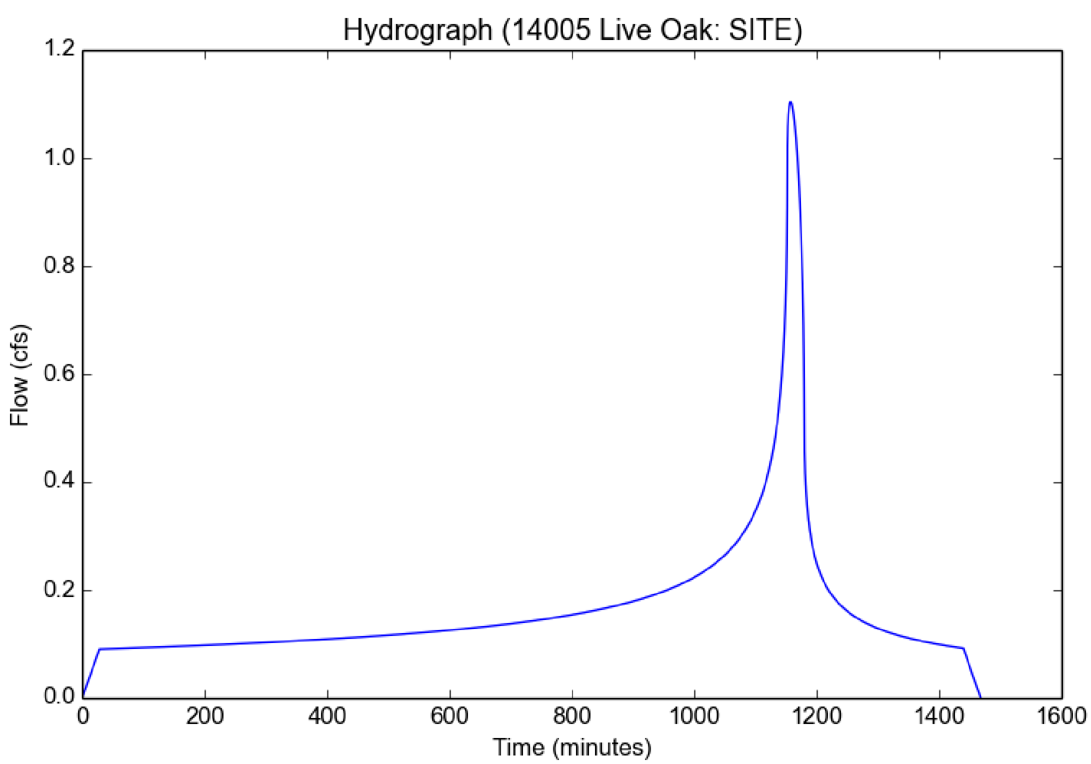
File location: F:/proj/2022/220334/3 Project Design/Civil/Design Calcs/drainage/04 Calcs/14005 Live Oak Report.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	14005 Live Oak
Subarea ID	SITE
Area (ac)	5.13
Flow Path Length (ft)	658.0
Flow Path Slope (vft/hft)	0.0141
50-yr Rainfall Depth (in)	1.1
Percent Impervious	0.9
Soil Type	8
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	0.9658
Peak Intensity (in/hr)	0.2564
Undeveloped Runoff Coefficient (Cu)	0.2895
Developed Runoff Coefficient (Cd)	0.8389
Time of Concentration (min)	28.0
Clear Peak Flow Rate (cfs)	1.1036
Burned Peak Flow Rate (cfs)	1.1036
24-Hr Clear Runoff Volume (ac-ft)	0.3363
24-Hr Clear Runoff Volume (cu-ft)	14650.5061



Peak Flow Hydrologic Analysis

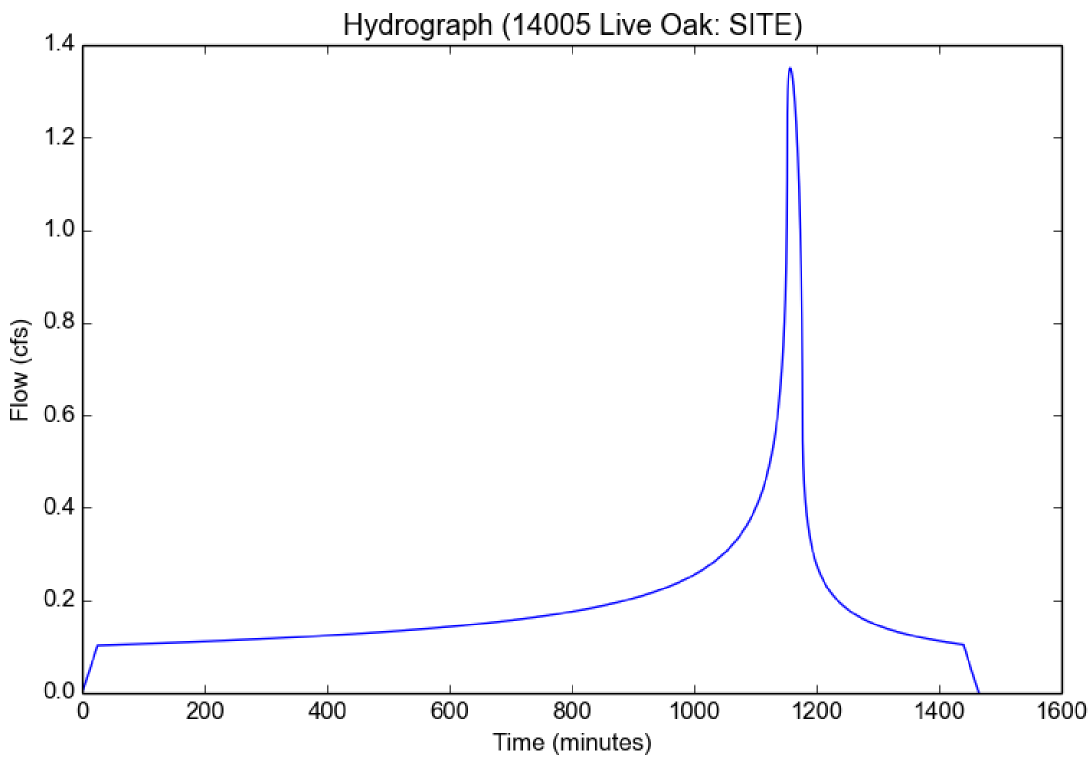
File location: F:/proj/2022/220334/3 Project Design/Civil/Design Calcs/drainage/04 Calcs/14005 Live Oak Report.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	14005 Live Oak
Subarea ID	SITE
Area (ac)	5.13
Flow Path Length (ft)	658.0
Flow Path Slope (vft/hft)	0.0141
50-yr Rainfall Depth (in)	1.1
Percent Impervious	0.9
Soil Type	8
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	1.1
Peak Intensity (in/hr)	0.308
Undeveloped Runoff Coefficient (Cu)	0.4438
Developed Runoff Coefficient (Cd)	0.8544
Time of Concentration (min)	25.0
Clear Peak Flow Rate (cfs)	1.3501
Burned Peak Flow Rate (cfs)	1.3501
24-Hr Clear Runoff Volume (ac-ft)	0.3838
24-Hr Clear Runoff Volume (cu-ft)	16717.0533



Attachment 6. NON-STRUCTURAL BMPS

Table 3. Routine Non-Structural BMPS

Identifier	Name	Included	Not Applicable	If Not Applicable, State Reason
N1	Education for Property Owners, Tenants and Occupants	X		
N2	Activity Restrictions	X		
N3	Common Area Landscape Management	X		
N4	BMP Maintenance	X		
N5	Title 22 CCR Compliance (How Development will comply)	X		
N6	Local Industrial Permit Compliance	X		
N7	Spill Contingency Plan	X		
N8	Underground Storage Tank Compliance		X	No underground storage tanks at site
N9	Hazardous Materials Disclosure Compliance	X		
N10	Uniform Fire Code Implementation	X		
N11	Common Area Litter Control	X		
N12	Employee Training	X		
N13	Housekeeping of Loading Dock	X		
N14	Common Area Catch Basin Inspection	X		
N15	Street Sweeping Private Streets and Parking Lots	X		
N16	Commercial Vehicle Washing		X	No vehicle washing activities will be performed onsite.

<u>N1 Education for Property Owners, Tenants and Occupants Homeowner or Tenant Education</u>

Rexford Industrial - 14005 Live Oak, LLC shall conduct orientation during the first four weeks of occupancy and as on-going. An awareness program will be established to inform all the employees of the impacts of dumping oil, antifreeze, paints, solvents, or other potentially harmful chemicals into storm drain; the proper use (e.g., application methods, frequencies and precautions) and management of fertilizers, pesticides and herbicides in landscaping maintenance practices; the impacts of littering and improper water disposal. Non-structural BMPs implemented are listed and included in Table 5-1 above. Reference BMPs/Fact Sheets include:

- SC10-Non-Stormwater Discharges
- SC11-Spill Prevention Control and Cleanup
- SC30-Outdoor loading/Unloading
- SC34-Waste Handling & Disposal

- SC41-Building & Grounds Maintenance
- SC43-Parking/Storage Area Maintenance

BMP Maintenance Responsibility/Frequency Matrix in Section 7.

N2 Activity Restrictions and Employee Training
Rexford Industrial - 14005 Live Oak, LLC shall conduct daily management of business activities. Rexford Industrial - 14005 Live Oak, LLC will conduct orientation during the first four weeks of startup and as on-going. Each business activity is restricted under the City of Los Angeles guidance, Conditions, Covenants and Restrictions (CC&Rs), and Conditions of Approval.

N3 Common Area Landscape Management
Rexford Industrial - 14005 Live Oak, LLC, through its site and landscape maintenance contractors, will be responsible for inspection and maintenance activities in landscape areas. Debris and other water pollutants will be controlled, contained and disposed of in a proper manner by the maintenance contractors hired by Rexford Industrial - 14005 Live Oak, LLC Reference BMPs/Fact Sheets include:

- SC41-Building & Grounds Maintenance
  BMP Maintenance Responsibility/Frequency Matrix in Section 7

N4 BMP Maintenance
In addition to the community awareness program Rexford Industrial - 14005 Live Oak, LLC, through its site and landscape maintenance contractors will be responsible for inspection and maintenance activities in landscape areas. Debris and other water pollutants will be controlled, contained and disposed of in a proper manner by the maintenance contractors hired by Rexford Industrial - 14005 Live Oak, LLC. The site maintenance manager will maintain and inspect non-structural and structural BMPs on the site at least once a month. Each BMP shall be inspected and maintained. Reference BMPs/Fact Sheets include:

- SC-44 Drainage System Maintenance
  BMP Maintenance Responsibility/Frequency Matrix in Section 7

N5 Title 22 CCR Compliance
Rexford Industrial - 14005 Live Oak, LLC, and future tenants shall comply with Title 22 of the California Code of Regulations and relevant Sections of the California Health and Safety Code regarding hazardous waste management, as enforced by County Environmental Health on behalf of the State. Hazardous materials will be handled and disposed of inside the proposed building by individual tenants. The disposed hazardous materials will be delivered off-site. Reference BMPs/Fact Sheets include:

- SC10-Non-Stormwater Discharge
- SC11-Spill prevention, Control, Cleanup
- SC34-Waste Handling and Disposal
- BMP Maintenance Responsibility/Frequency Matrix in Section 7

N6 Local Industrial Permit Compliance
Rexford Industrial - 14005 Live Oak, LLC shall comply with the permit pertaining to the discharge of commercial waste to public properties if there is any discharge to be made.

N7 Spill Contingency Plan
Rexford Industrial - 14005 Live Oak, LLC shall be responsible for creating and complying with the Spill Contingency Plan in accordance with all State and Local authorities.

N9 Hazardous Materials Disclosure Compliance
Rexford Industrial - 14005 Live Oak, LLC shall compile and disclose a list of all hazardous materials to be stored on site with the appropriate State and Local authorities.

N10 Uniform Fire Code Implementation
Rexford Industrial - 14005 Live Oak, LLC shall be responsible to comply with the local Fire Code enforced by fire protection agency.

N11 Common Area Litter Control
Rexford Industrial - 14005 Live Oak, LLC, through site maintenance contractor shall implement litter control procedures and management in the parking lot areas in order to prevent and reduce pollution of storm water runoff on a weekly basis. Waste containers located outside shall be provided with spill prevention features and emptied on a regular basis, but as a minimum on a weekly basis. Reference BMPs/Fact Sheets include:

- SC41-Building & Ground Maintenance
- SC43-Parking/Storage Area Maintenance

BMP Maintenance Responsibility/Frequency Matrix in Section 7

N12 Employee Training
Rexford Industrial - 14005 Live Oak, LLC shall conduct an employee training program and shall inform and train employees engaged in maintenance activities regarding the impacts of dumping oil, antifreeze, paints, solvents or other potentially harmful chemicals into storm sewer; the proper use (e.g., application methods, frequencies and precautions) and management of fertilizers, pesticides and herbicides in landscaping maintenance practice; the impacts of littering an improper water disposal. Employee training program shall be conducted on an ongoing basis and during the first month of startup period. This LID Plan shall be a reference to be used for the program and an annual review of the provisions of the LID Plan shall be done by each employee.

The proposed Project site is currently owned by Rexford Industrial - 14005 Live Oak, LLC. If there are any changes of ownership on the site, a new owner shall be responsible once the ownership is transferred. Further guidance and information can be referred to BMPs in Section VIII and the BMP Maintenance Responsibility/Frequency Matrix in Section 7.

N13 Housekeep of Loading Docks
Rexford Industrial Realty, Inc shall maintain the loading dock through its contractor per separate plans and permits. Rexford Industrial Realty, Inc shall maintain good housekeeping practices in the loading dock environment and keep the dock areas clean and free of debris. Loading areas shall be checked periodically to ensure containment of accumulated water and prevention of storm water run-on.

N14 Common Area Catch Basin Inspection

Rexford Industrial - 14005 Live Oak, LLC, through its site maintenance contractor shall provide catch basin inspection and maintenance prior to the start of the rainy season around October 15 of every year to minimize water pollution during the "first flush" storm. Reference BMPs/Fact Sheets include:

- SC44-Drainage System Maintenance
  BMP Maintenance Responsibility/Frequency Matrix in Section 7

N15 Street Sweeping Private Streets and Parking Lots

Rexford Industrial - 14005 Live Oak, LLC, through its site maintenance contractor shall provide vacuum sweeping of parking lots prior to the start of the rainy season around October 15 of every year to minimize water pollution during the "first flush" storm. Reference BMPs/Fact Sheets include:

- SC34-Waste Handling and Disposal
- SC43-Parking/Storage Area Maintenance
- BMP Maintenance Responsibility/Frequency Matrix in Section 7

N16 Commercial Vehicle Washing

This type of BMP is not applicable to the type of used proposed. No vehicle washing activities will be performed onsite.

Attachment 7. ROUTINE STRUCTURAL BMPS

Table 4. Routine Structural BMPs

	Name	Included	Not applicable	If not applicable, State brief reason
S1	Provide storm drain system stenciling and signage	X		
S2	Design and construct outdoor material storage areas to reduce pollution introduction			No materials will be stored outdoor.
S3	Design and construct trash and waste storage areas to reduce pollution introduction	X		
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control	X		
S5	Set finish grade of landscape areas 1 to 2 inches below top of curb	X		
S6	Protect slopes and channels and provide energy dissipation		X	No slopes or channels are proposed.
S7	Dock areas	X		
S8	Maintenance bays		X	Not Proposed/No Activities
S9	Vehicle wash areas		X	Not Proposed/No Activities
S10	Outdoor processing areas		X	Not Proposed/No Activities
S11	Equipment wash areas		X	Not Proposed/No Activities
S12	Fueling areas		X	Not Proposed/No Activities
S13	Hillside landscaping		X	Not Proposed/No Activities
S14	Wash water control for food		X	Not Proposed/No Activities
S15	Community car wash racks		x	Not Proposed/No Activities

S1 Provide storm drain system stenciling and signage

Rexford Industrial - 14005 Live Oak, LLC shall provide storm drain system stenciling and signage at the appropriate locations. Repair of storm drain system stenciling, and signage shall be performed regularly and at least three times a year or as many times as necessary during the storm seasons.

Stenciling catch basins by the owner will inform the public about non-point source pollution, highlighting the direct link between such basins and sensitive Los Angeles County receiving waters and draws public attention to the fate of materials that are dumped into the storm drain system. The stencil will carry the message “NO DUMPING-DRAINS TO OCEAN”. Reference BMPs/Fact Sheets include:

SD13-Storm Drain Signage
SC44-Drainage System Maintenance
BMP Maintenance Responsibility/Frequency Matrix in Section 7.

S2 Design and construct outdoor material storage areas to reduce pollution introduction
This is not applicable to this project. There are no outdoor material storage areas in the proposed condition.

S3 Design and Construct Trash and Waste Storage Areas to Reduce Pollution Introduction
Rexford Industrial - 14005 Live Oak, LLC shall provide trash and waste storage areas through its contractors. See Architectural Plans and Improvement Plans for details.

Rexford Industrial - 14005 Live Oak, LLC, through its site maintenance contractor shall maintain daily. Trash dumpster shall be picked up at least once a week. Loose trash shall be picked up daily and shall be placed in containers periodically. The trash storage areas shall be inspected and maintained daily by the maintenance contractor in order to prevent overflowing dumpster and open lids. The trash container area shall contain trash bins with covers and trash area shall be roofed over in order to prevent rain from entering the bin to reduce water pollution. The bins will be provided with self-closing features and will be inspected on a regular basis as needed for the amount of trash generated. The design of the trash container area will include features such that drainage from adjoining roofs and pavements shall be diverted around the trash container areas. All trash container areas will be surrounded by walls and gates to prevent offsite transport of trash. All employees will be instructed to make sure that covers are kept closed and only opened at the time the trash is deposited. Trash and waste storage areas will be constructed to reduce pollution. It will be located outside the building and trash enclosure will be installed. Reference BMPs/Fact Sheets include:

SD32-Trash Storage Areas
BMP Maintenance Responsibility/Frequency Matrix in Section VI

S4 Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control
Rexford Industrial - 14005 Live Oak, LLC through site maintenance contractor shall be responsible to inspect irrigation equipment such as water sensors, irrigation heads and timing on a monthly basis. Rexford Industrial - 14005 Live Oak, LLC shall propose landscape and irrigation system that reduces excess irrigation runoff and promote surface filtration and complies with the County of Los Angeles. For this project, water meters will be installed at appropriate locations. Rexford Industrial - 14005 Live Oak, LLC shall instruct the landscape architect to select plant materials that will minimize the need for fertilizer and pesticides. Limited use of herbicides will be used at the initial installation to deal with existing and latent weeds. Plant materials will be encouraged to spread quickly so as to minimize the future need for herbicide. Hand weeding will take place as plants mature. Herbicides used will be the type that decomposes rapidly. Rexford Industrial - 14005 Live Oak, LLC shall encourage the use of native and drought tolerant plants which adapt to local soil conditions and are resistant to pests where appropriate. Watering practices will be implemented to minimize fungus and mildew potential. The use of gypsum will be encouraged to improve oil drainage and further minimize the need for fertilizers. Reference BMPs/Fact Sheets include:

- SD10-Site Design & Landscape Planning
- SD12-Efficient Irrigation
- SD20-Pervious Pavements
- SD31-Maintenance Bays & Docks

<u>S5 Set finish grade of landscape areas 1 to 2 inches below top of curb</u>
Rexford Industrial - 14005 Live Oak, LLC through site maintenance contractor shall be responsible to maintain all landscape areas minimum of 1 inch below top of curb or sidewalk for increased retention/infiltration of stormwater and irrigation water.

<u>S6 Protect slopes and channels and provide energy dissipation</u>
Not applicable to this project. No slopes or channels are proposed for this project. Please see Improvement Plans for details.

Incorporate requirements applicable to individual priority project categories:

<u>S7 Dock areas</u>
See N13 – Housekeeping of Loading Docks above.

<u>S8 Maintenance bays</u>
Not applicable to this project. There aren't any proposed maintenance bays.

<u>S9 Vehicle wash areas</u>
Not applicable to this project. No vehicle wash activities will be performed onsite.

<u>S10 Outdoor processing areas</u>
Not applicable. No washing, steam cleaning, vehicle or equipment maintenance and repair, or material processing activities will be conducted onsite.

<u>S11 Equipment wash area</u>
Not applicable. No activities of equipment washing will be performed onsite.

<u>S12 Fueling area</u>
Not applicable. No fueling activities will be performed onsite.

<u>S14 Hillside landscaping</u>

Not applicable. No nearby hillside is found in the vicinity of the project site.

<u>S14 Wash water control for food preparation areas</u>
Not applicable. No food preparation area is proposed onsite.

<u>S15 Community car wash racks</u>

No car wash activities will be conducted on-site. Therefore, it is not applicable.

Attachment 8. **OPERATIONS AND MAINTENANCE PLAN**

O&M Plan / Inspection & Maintenance Responsibilities for BMPs
RESPONSIBLE PARTIES FOR BMP MAINTENANCE FOR POST CONSTRUCTION

Rexford Industrial - 14005 Live Oak, LLC is the owner of the property and its successors and assigns, is responsible for LID Plan implementation per BMPs and other necessary inspection and maintenance requirements indicated, but are not limited to, in this LID Plan. Rexford Industrial - 14005 Live Oak, LLC may hire construction managers, general contractors, subcontractors and property managers on behalf of Rexford Industrial - 14005 Live Oak, LLC to implement, monitor, inspect, and maintain the BMPs indicated in this LID Plan in order to ensure compliance.

Responsible Personnel:

Rexford Industrial - 14005 Live Oak, LLC
333 City Boulevard West, Suite 705
Orange, CA 92868

Ultimately, Rexford Industrial - 14005 Live Oak, LLC shall be enforcing recorded CC&R's and shall be responsible for the BMP program for the project including the dissemination and conformance of the awareness program and the enforcement of activity restrictions.

General
Responsible Personnel:
Rexford Industrial - 14005 Live Oak, LLC
333 City Boulevard West, Suite 705
Orange, CA 92868

Training employees about BMPs affecting their job:
Rexford Industrial - 14005 Live Oak, LLC
333 City Boulevard West, Suite 705
Orange, CA 92868

SITE INSPECTIONS
Quarterly Post-Construction Inspection
Storm drains on the site shall be inspected to check the obstruction of sediments.

Pre-Storm Inspection

Inspection shall be conducted before the storm season which is from October through April. Biofiltration Planters shall be inspected to assure the clearance for proper function.

Post-Storm Inspection

Inspection shall be conducted on biofiltration planter for clearance. Any detected ponded water around the site shall be examined to determine the cause and to mitigate. Inspection shall be conduct on surface erosion, periodically.

REPORTING
Inspection Records

Rexford Industrial - 14005 Live Oak, LLC shall prepare and provide inspection reports from scheduled maintenance and mitigations that were conducted on-site. Inspection reports shall contain information, but not limited to, the inspector information, date of inspection, observed and actions in details. The inspection reports shall be recorded and kept as on-going by Rexford Industrial - 14005 Live Oak, LLC. The reports and records shall be available for inspection upon request by the City Engineer, Regional Water Quality Control Board, or the designated City Representative.

Maintenance Requirements

Maintenance shall be performed accordance with BMPs in Sections 4, 5, 6 and manufacturer's recommendations. Maintenance shall be conducted at least once before and during, and after the storm season.

Revision to the LID Plan

Rexford Industrial - 14005 Live Oak, LLC shall revise LID Plan accordance with the changes to the project due to any substantial modifications on the site. In addition, LID Plan shall be revised if any potential increase in pollutant discharge from the site is found and indicated BMPs are ineffective. Rexford Industrial - 14005 Live Oak, LLC shall secure the services of the firm that prepared the original LID Plan and have a qualified person to prepare the revisions on the LID Plan Any modification on the LID Plan shall require the approval by the local government that has jurisdiction over the project site.

If the ownership is transferred to new owner, the current owner shall assure to submit to the local government that has jurisdiction over the project site the LID Plan notice of transfer of responsibility document and successor individual shall implement LID Plan.

Table 5. BMP Maintenance Schedule

Best Management Practices (BMPs)	Inspection Frequency	Maintenance/Repair Program
SC10 Non-Storm Water Discharges	Continuous and Annual	Responsible Party: Rexford Industrial - 14005 Live Oak, LLC Orientation shall be given to new owners, employees, and tenants.
SC11 Spill Prevention, Control and Cleanup	Daily	Responsible Party: Rexford Industrial - 14005 Live Oak, LLC Conduct employee training and awareness program and implement of spill prevention plan.
SC34 Waste Handling & Disposal	Daily	Responsible Party: Rexford Industrial - 14005 Live Oak, LLC Orientation shall be given to new owners, employees, and tenants.
SC41 Building & Grounds Maintenance	Prevent soil from being washed onto pavement and keep landscape areas well maintained inspect pavement at least twice per year. Inspect outlets annually. Vacuum/Pressure wash clogged surfaces.	Responsible Party: Rexford Industrial - 14005 Live Oak, LLC Orientation shall be given to new owners, employees, and tenants.
SC43 Parking/Storage Area Maintenance	Weekly	Responsible Party: Rexford Industrial - 14005 Live Oak, LLC Orientation shall be given to new owners, employees, and tenants.
SD13 Storm Drain System Signs	At least three times per year.	Responsible Party: Rexford Industrial - 14005 Live Oak, LLC Orientation shall be given to new owners, employees, and tenants.
SD32 Trash Storage Areas	Weekly.	Responsible Party: Rexford Industrial - 14005 Live Oak, LLC Orientation shall be given to new owners, employees, and tenants

Attachment 9. BMP / Fact Sheet

Description

Promote efficient and safe housekeeping practices (storage, use, and cleanup) when handling potentially harmful materials such as fertilizers, pesticides, cleaning solutions, paint products, automotive products, and swimming pool chemicals. Related information is provided in BMP fact sheets SC-11 Spill Prevention, Control & Cleanup and SC-34 Waste Handling & Disposal.

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	☑
Oil and Grease	☑
Organics	☑
Oxygen Demanding	☑

Approach

Pollution Prevention

- Purchase only the amount of material that will be needed for foreseeable use. In most cases this will result in cost savings in both purchasing and disposal. See SC-61 Safer Alternative Products for additional information.

- Be aware of new products that may do the same job with less environmental risk and for less or the equivalent cost. Total cost must be used here; this includes purchase price, transportation costs, storage costs, use related costs, clean up costs and disposal costs.

Suggested Protocols

General

- Keep work sites clean and orderly. Remove debris in a timely fashion. Sweep the area.

- Dispose of wash water, sweepings, and sediments, properly.

- Recycle or dispose of fluids properly.

- Establish a daily checklist of office, yard and plant areas to confirm cleanliness and adherence to proper storage and security. Specific employees should be assigned specific inspection responsibilities and given the authority to remedy any problems found.

- Post waste disposal charts in appropriate locations detailing for each waste its hazardous nature (poison, corrosive, flammable), prohibitions on its disposal (dumpster, drain, sewer) and the recommended disposal method (recycle, sewer, burn, storage, landfill).

- Summarize the chosen BMPs applicable to your operation and post them in appropriate conspicuous places.

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- Require a signed checklist from every user of any hazardous material detailing amount taken, amount used, amount returned and disposal of spent material.
- Do a before audit of your site to establish baseline conditions and regular subsequent audits to note any changes and whether conditions are improving or deteriorating.
- Keep records of water, air and solid waste quantities and quality tests and their disposition.
- Maintain a mass balance of incoming, outgoing and on hand materials so you know when there are unknown losses that need to be tracked down and accounted for.
- Use and reward employee suggestions related to BMPs, hazards, pollution reduction, work place safety, cost reduction, alternative materials and procedures, recycling and disposal.
- Have, and review regularly, a contingency plan for spills, leaks, weather extremes etc. Make sure all employees know about it and what their role is so that it comes into force automatically.

Training

- Train all employees, management, office, yard, manufacturing, field and clerical in BMPs and pollution prevention and make them accountable.
- Train municipal employees who handle potentially harmful materials in good housekeeping practices.
- Train personnel who use pesticides in the proper use of the pesticides. The California Department of Pesticide Regulation license pesticide dealers, certify pesticide applicators and conduct onsite inspections.
- Train employees and contractors in proper techniques for spill containment and cleanup. The employee should have the tools and knowledge to immediately begin cleaning up a spill if one should occur.

Spill Response and Prevention

- Refer to SC-11, Spill Prevention, Control & Cleanup.
- Keep your Spill Prevention Control and Countermeasure (SPCC) plant up-to-date, and implement accordingly.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

Other Considerations

- There are no major limitations to this best management practice.
- There are no regulatory requirements to this BMP. Existing regulations already require municipalities to properly store, use, and dispose of hazardous materials

Requirements

Costs

- Minimal cost associated with this BMP. Implementation of good housekeeping practices may result in cost savings as these procedures may reduce the need for more costly BMPs.

Maintenance

- Ongoing maintenance required to keep a clean site. Level of effort is a function of site size and type of activities.

Supplemental Information

Further Detail of the BMP

- The California Integrated Waste Management Board's Recycling Hotline, 1-800-553-2962, provides information on household hazardous waste collection programs and facilities.

Examples

There are a number of communities with effective programs. The most pro-active include Santa Clara County and the City of Palo Alto, the City and County of San Francisco, and the Municipality of Metropolitan Seattle (Metro).

References and Resources

British Columbia Lake Stewardship Society. Best Management Practices to Protect Water Quality from Non-Point Source Pollution. March 2000.
http://www.nalms.org/bclss/bmphome.html#bmp

King County Stormwater Pollution Control Manual - http://dnr.metrokc.gov/wlr/dss/spcm.htm

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities, Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July, 1998, Revised by California Coastal Commission, February 2002.

Orange County Stormwater Program
http://www.ocwatersheds.com/stormwater/swp_introduction.asp

San Mateo STOPPP - (http://stoppp.tripod.com/bmp.html)

Objectives

- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	
Bacteria	
Oil and Grease	
Organics	
Oxygen Demanding	☑

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Description

Landscape maintenance activities include vegetation removal; herbicide and insecticide application; fertilizer application; watering; and other gardening and lawn care practices. Vegetation control typically involves a combination of chemical (herbicide) application and mechanical methods. All of these maintenance practices have the potential to contribute pollutants to the storm drain system. The major objectives of this BMP are to minimize the discharge of pesticides, herbicides and fertilizers to the storm drain system and receiving waters; prevent the disposal of landscape waste into the storm drain system by collecting and properly disposing of clippings and cuttings, and educating employees and the public.

Approach

Pollution Prevention

- Implement an integrated pest management (IPM) program. IPM is a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools.

- Choose low water using flowers, trees, shrubs, and groundcover.

- Consider alternative landscaping techniques such as naturescaping and xeriscaping.

- Conduct appropriate maintenance (i.e. properly timed fertilizing, weeding, pest control, and pruning) to help preserve the landscapes water efficiency.

- Consider grass cycling (grass cycling is the natural recycling of grass by leaving the clippings on the lawn when mowing. Grass clippings decompose quickly and release valuable nutrients back into the lawn).

Suggested Protocols

Mowing, Trimming, and Weeding

- Whenever possible use mechanical methods of vegetation removal (e.g mowing with tractor-type or push mowers, hand cutting with gas or electric powered weed trimmers) rather than applying herbicides. Use hand weeding where practical.

- Avoid loosening the soil when conducting mechanical or manual weed control, this could lead to erosion. Use mulch or other erosion control measures when soils are exposed.

- Performing mowing at optimal times. Mowing should not be performed if significant rain events are predicted.

- Mulching mowers may be recommended for certain flat areas. Other techniques may be employed to minimize mowing such as selective vegetative planting using low maintenance grasses and shrubs.

- Collect lawn and garden clippings, pruning waste, tree trimmings, and weeds. Chip if necessary, and compost or dispose of at a landfill (see waste management section of this fact sheet).

- Place temporarily stockpiled material away from watercourses, and berm or cover stockpiles to prevent material releases to storm drains.

Planting

- Determine existing native vegetation features (location, species, size, function, importance) and consider the feasibility of protecting them. Consider elements such as their effect on drainage and erosion, hardiness, maintenance requirements, and possible conflicts between preserving vegetation and the resulting maintenance needs.

- Retain and/or plant selected native vegetation whose features are determined to be beneficial, where feasible. Native vegetation usually requires less maintenance (e.g., irrigation, fertilizer) than planting new vegetation.

- Consider using low water use groundcovers when planting or replanting.

Waste Management

- Compost leaves, sticks, or other collected vegetation or dispose of at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.

- Place temporarily stockpiled material away from watercourses and storm drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.

- Reduce the use of high nitrogen fertilizers that produce excess growth requiring more frequent mowing or trimming.

- Avoid landscape wastes in and around storm drain inlets by either using bagging equipment or by manually picking up the material.

Irrigation

- Where practical, use automatic timers to minimize runoff.
- Use popup sprinkler heads in areas with a lot of activity or where there is a chance the pipes may be broken. Consider the use of mechanisms that reduce water flow to sprinkler heads if broken.
- Ensure that there is no runoff from the landscaped area(s) if re-claimed water is used for irrigation.
- If bailing of muddy water is required (e.g. when repairing a water line leak), do not put it in the storm drain; pour over landscaped areas.
- Irrigate slowly or pulse irrigate to prevent runoff and then only irrigate as much as is needed.
- Apply water at rates that do not exceed the infiltration rate of the soil.

Fertilizer and Pesticide Management

- Utilize a comprehensive management system that incorporates integrated pest management (IPM) techniques. There are many methods and types of IPM, including the following:
  - Mulching can be used to prevent weeds where turf is absent, fencing installed to keep rodents out, and netting used to keep birds and insects away from leaves and fruit.
  - Visible insects can be removed by hand (with gloves or tweezers) and placed in soapy water or vegetable oil. Alternatively, insects can be sprayed off the plant with water or in some cases vacuumed off of larger plants.
  - Store-bought traps, such as species-specific, pheromone-based traps or colored sticky cards, can be used.
  - Slugs can be trapped in small cups filled with beer that are set in the ground so the slugs can get in easily.
  - In cases where microscopic parasites, such as bacteria and fungi, are causing damage to plants, the affected plant material can be removed and disposed of (pruning equipment should be disinfected with bleach to prevent spreading the disease organism).
  - Small mammals and birds can be excluded using fences, netting, tree trunk guards.
  - Beneficial organisms, such as bats, birds, green lacewings, ladybugs, praying mantis, ground beetles, parasitic nematodes, trichogramma wasps, seed head weevils, and spiders that prey on detrimental pest species can be promoted.
- Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.

- Use pesticides only if there is an actual pest problem (not on a regular preventative schedule).

- Do not use pesticides if rain is expected. Apply pesticides only when wind speeds are low (less than 5 mph).

- Do not mix or prepare pesticides for application near storm drains.

- Prepare the minimum amount of pesticide needed for the job and use the lowest rate that will effectively control the pest.

- Employ techniques to minimize off-target application (e.g. spray drift) of pesticides, including consideration of alternative application techniques.

- Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.

- Calibrate fertilizer and pesticide application equipment to avoid excessive application.

- Periodically test soils for determining proper fertilizer use.

- Sweep pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.

- Purchase only the amount of pesticide that you can reasonably use in a given time period (month or year depending on the product).

- Triple rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.

- Dispose of empty pesticide containers according to the instructions on the container label.

Inspection

- Inspect irrigation system periodically to ensure that the right amount of water is being applied and that excessive runoff is not occurring. Minimize excess watering, and repair leaks in the irrigation system as soon as they are observed.

- Inspect pesticide/fertilizer equipment and transportation vehicles daily.

Training

- Educate and train employees on use of pesticides and in pesticide application techniques to prevent pollution. Pesticide application must be under the supervision of a California qualified pesticide applicator.

- Train/encourage municipal maintenance crews to use IPM techniques for managing public green areas.

- Annually train employees within departments responsible for pesticide application on the appropriate portions of the agency's IPM Policy, SOPs, and BMPs, and the latest IPM techniques.

- Employees who are not authorized and trained to apply pesticides should be periodically (at least annually) informed that they cannot use over-the-counter pesticides in or around the workplace.

- Use a training log or similar method to document training.

Spill Response and Prevention

- Refer to SC-11, Spill Prevention, Control & Cleanup

- Have spill cleanup materials readily available and in a know in location

- Cleanup spills immediately and use dry methods if possible.

- Properly dispose of spill cleanup material.

Other Considerations

- The Federal Pesticide, Fungicide, and Rodenticide Act and California Title 3, Division 6, Pesticides and Pest Control Operations place strict controls over pesticide application and handling and specify training, annual refresher, and testing requirements. The regulations generally cover: a list of approved pesticides and selected uses, updated regularly; general application information; equipment use and maintenance procedures; and record keeping. The California Department of Pesticide Regulations and the County Agricultural Commission coordinate and maintain the licensing and certification programs. All public agency employees who apply pesticides and herbicides in "agricultural use" areas such as parks, golf courses, rights-of-way and recreation areas should be properly certified in accordance with state regulations. Contracts for landscape maintenance should include similar requirements.

- All employees who handle pesticides should be familiar with the most recent material safety data sheet (MSDS) files.

- Municipalities do not have the authority to regulate the use of pesticides by school districts, however the California Healthy Schools Act of 2000 (AB 2260) has imposed requirements on California school districts regarding pesticide use in schools. Posting of notification prior to the application of pesticides is now required, and IPM is stated as the preferred approach to pest management in schools.

Requirements

Costs

Additional training of municipal employees will be required to address IPM techniques and BMPs. IPM methods will likely increase labor cost for pest control which may be offset by lower chemical costs.

Maintenance

Not applicable

Supplemental Information

Further Detail of the BMP

Waste Management

Composting is one of the better disposal alternatives if locally available. Most municipalities either have or are planning yard waste composting facilities as a means of reducing the amount of waste going to the landfill. Lawn clippings from municipal maintenance programs as well as private sources would probably be compatible with most composting facilities

Contractors and Other Pesticide Users

Municipal agencies should develop and implement a process to ensure that any contractor employed to conduct pest control and pesticide application on municipal property engages in pest control methods consistent with the IPM Policy adopted by the agency. Specifically, municipalities should require contractors to follow the agency's IPM policy, SOPs, and BMPs; provide evidence to the agency of having received training on current IPM techniques when feasible; provide documentation of pesticide use on agency property to the agency in a timely manner.

References and Resources

King County Stormwater Pollution Control Manual. Best Management Practices for Businesses. 1995. King County Surface Water Management. July. On-line: http://dnr.metrokc.gov/wlr/dss/spcm.htm

Los Angeles County Stormwater Quality Model Programs. Public Agency Activities http://ladpw.org/wmd/npdes/model_links.cfm

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July. 1998.

Orange County Stormwater Program http://www.ocwatersheds.com/StormWater/swp_introduction.asp

Santa Clara Valley Urban Runoff Pollution Prevention Program. 1997 Urban Runoff Management Plan. September 1997, updated October 2000.

United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Landscaping and Lawn Care. Office of Water. Office of Wastewater Management. On-line: http://www.epa.gov/npdes/menuofbmps/poll_8.htm

Photo Credit: Geoff Brosseau

Objectives

- Contain
- Educate
- Reduce/Minimize

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	☑
Oil and Grease	☑
Organics	☑
Oxygen Demanding	☑

Description

As a consequence of its function, the stormwater conveyance system collects and transports urban runoff that may contain certain pollutants. Maintaining catch basins, stormwater inlets, and other stormwater conveyance structures on a regular basis will remove pollutants, prevent clogging of the downstream conveyance system, restore catch basins' sediment trapping capacity, and ensure the system functions properly hydraulically to avoid flooding.

Approach

Suggested Protocols

Catch Basins/Inlet Structures

- Municipal staff should regularly inspect facilities to ensure the following:
  - Immediate repair of any deterioration threatening structural integrity.
  - Cleaning before the sump is 40% full. Catch basins should be cleaned as frequently as needed to meet this standard.
  - Stenciling of catch basins and inlets (see SC-75 Waste Handling and Disposal).
- Clean catch basins, storm drain inlets, and other conveyance structures in high pollutant load areas just before the wet season to remove sediments and debris accumulated during the summer.

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- Conduct inspections more frequently during the wet season for problem areas where sediment or trash accumulates more often. Clean and repair as needed.
- Keep accurate logs of the number of catch basins cleaned.
- Record the amount of waste collected.
- Store wastes collected from cleaning activities of the drainage system in appropriate containers or temporary storage sites in a manner that prevents discharge to the storm drain.
- Dewater the wastes with outflow into the sanitary sewer if permitted. Water should be treated with an appropriate filtering device prior to discharge to the sanitary sewer. If discharge to the sanitary sewer is not allowed, water should be pumped or vacuumed to a tank and properly disposed of. Do not dewater near a storm drain or stream.
- Except for small communities with relatively few catch basins that may be cleaned manually, most municipalities will require mechanical cleaners such as eductors, vacuums, or bucket loaders.

Storm Drain Conveyance System

- Locate reaches of storm drain with deposit problems and develop a flushing schedule that keeps the pipe clear of excessive buildup.
- Collect flushed effluent and pump to the sanitary sewer for treatment.

Pump Stations

- Clean all storm drain pump stations prior to the wet season to remove silt and trash.
- Do not allow discharge from cleaning a storm drain pump station or other facility to reach the storm drain system.
- Conduct quarterly routine maintenance at each pump station.
- Inspect, clean, and repair as necessary all outlet structures prior to the wet season.
- Sample collected sediments to determine if landfill disposal is possible, or illegal discharges in the watershed are occurring.

Open Channel

- Consider modification of storm channel characteristics to improve channel hydraulics, to increase pollutant removals, and to enhance channel/creek aesthetic and habitat value.
- Conduct channel modification/improvement in accordance with existing laws. Any person, government agency, or public utility proposing an activity that will change the natural (emphasis added) state of any river, stream, or lake in California, must enter into a steam or Lake Alteration Agreement with the Department of Fish and Game. The developer-applicant should also contact local governments (city, county, special districts), other state agencies

(SWRCB, RWQCB, Department of Forestry, Department of Water Resources), and Federal Corps of Engineers and USFWS

Illicit Connections and Discharges

- During routine maintenance of conveyance system and drainage structures field staff should look for evidence of illegal discharges or illicit connections:
  - Is there evidence of spills such as paints, discoloring, etc.
  - Are there any odors associated with the drainage system
  - Record locations of apparent illegal discharges/illicit connections
  - Track flows back to potential dischargers and conduct aboveground inspections. This can be done through visual inspection of up gradient manholes or alternate techniques including zinc chloride smoke testing, fluorometric dye testing, physical inspection testing, or television camera inspection.
  - Once the origin of flow is established, require illicit discharger to eliminate the discharge.
- Stencil storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as “Dump No Waste Drains to Stream” stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.
- Refer to fact sheet SC-10 Non-Stormwater Discharges.

Illegal Dumping

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- Establish a system for tracking incidents. The system should be designed to identify the following:
  - Illegal dumping hot spots
  - Types and quantities (in some cases) of wastes
  - Patterns in time of occurrence (time of day/night, month, or year)
  - Mode of dumping (abandoned containers, “midnight dumping” from moving vehicles, direct dumping of materials, accidents/spills)
  - Responsible parties
- Post “No Dumping” signs in problem areas with a phone number for reporting dumping and disposal. Signs should also indicate fines and penalties for illegal dumping.
- Refer to fact sheet SC-10 Non-Stormwater Discharges.

- The State Department of Fish and Game has a hotline for reporting violations called Cal TIP (1-800-952-5400). The phone number may be used to report any violation of a Fish and Game code (illegal dumping, poaching, etc.).
- The California Department of Toxic Substances Control's Waste Alert Hotline, 1-800-69TOXIC, can be used to report hazardous waste violations.

Training

- Train crews in proper maintenance activities, including record keeping and disposal.
- Only properly trained individuals are allowed to handle hazardous materials/wastes.
- Train municipal employees from all departments (public works, utilities, street cleaning, parks and recreation, industrial waste inspection, hazardous waste inspection, sewer maintenance) to recognize and report illegal dumping.
- Train municipal employees and educate businesses, contractors, and the general public in proper and consistent methods for disposal.
- Train municipal staff regarding non-stormwater discharges (See SC-10 Non-Stormwater Discharges).

Spill Response and Prevention

- Refer to SC-11, Prevention, Control & Cleanup
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

Other Considerations

- Cleanup activities may create a slight disturbance for local aquatic species. Access to items and material on private property may be limited. Trade-offs may exist between channel hydraulics and water quality/riparian habitat. If storm channels or basins are recognized as wetlands, many activities, including maintenance, may be subject to regulation and permitting.
- Storm drain flushing is most effective in small diameter pipes (36-inch diameter pipe or less, depending on water supply and sediment collection capacity). Other considerations associated with storm drain flushing may include the availability of a water source, finding a downstream area to collect sediments, liquid/sediment disposal, and disposal of flushed effluent to sanitary sewer may be prohibited in some areas.
- Regulations may include adoption of substantial penalties for illegal dumping and disposal.
- Municipal codes should include sections prohibiting the discharge of soil, debris, refuse, hazardous wastes, and other pollutants into the storm drain system.
- Private property access rights may be needed to track illegal discharges up gradient.

- Requirements of municipal ordinance authority for suspected source verification testing for illicit connections necessary for guaranteed rights of entry.

Requirements

Costs

- An aggressive catch basin cleaning program could require a significant capital and O&M budget. A careful study of cleaning effectiveness should be undertaken before increased cleaning is implemented. Catch basin cleaning costs are less expensive if vacuum street sweepers are available; cleaning catch basins manually can cost approximately twice as much as cleaning the basins with a vacuum attached to a sweeper.

- Methods used for illicit connection detection (smoke testing, dye testing, visual inspection, and flow monitoring) can be costly and time-consuming. Site-specific factors, such as the level of impervious area, the density and ages of buildings, and type of land use will determine the level of investigation necessary. Encouraging reporting of illicit discharges by employees can offset costs by saving expense on inspectors and directing resources more efficiently. Some programs have used funds available from "environmental fees" or special assessment districts to fund their illicit connection elimination programs.

Maintenance

- Two-person teams may be required to clean catch basins with vactor trucks.

- Identifying illicit discharges requires teams of at least two people (volunteers can be used), plus administrative personnel, depending on the complexity of the storm sewer system.

- Arrangements must be made for proper disposal of collected wastes.

- Requires technical staff to detect and investigate illegal dumping violations, and to coordinate public education.

Supplemental Information

Further Detail of the BMP

Storm Drain flushing

Sanitary sewer flushing is a common maintenance activity used to improve pipe hydraulics and to remove pollutants in sanitary sewer systems. The same principles that make sanitary sewer flushing effective can be used to flush storm drains. Flushing may be designed to hydraulically convey accumulated material to strategic locations, such as to an open channel, to another point where flushing will be initiated, or over to the sanitary sewer and on to the treatment facilities, thus preventing re-suspension and overflow of a portion of the solids during storm events. Flushing prevents "plug flow" discharges of concentrated pollutant loadings and sediments. The deposits can hinder the designed conveyance capacity of the storm drain system and potentially cause backwater conditions in severe cases of clogging.

Storm drain flushing usually takes place along segments of pipe with grades that are too flat to maintain adequate velocity to keep particles in suspension. An upstream manhole is selected to place an inflatable device that temporarily plugs the pipe. Further upstream, water is pumped into the line to create a flushing wave. When the upstream reach of pipe is sufficiently full to cause a flushing wave, the inflated device is rapidly deflated with the assistance of a vacuum pump, releasing the backed up water and resulting in the cleaning of the storm drain segment.

To further reduce the impacts of stormwater pollution, a second inflatable device, placed well downstream, may be used to re-collect the water after the force of the flushing wave has dissipated. A pump may then be used to transfer the water and accumulated material to the sanitary sewer for treatment. In some cases, an interceptor structure may be more practical or required to re-collect the flushed waters.

It has been found that cleansing efficiency of periodic flush waves is dependent upon flush volume, flush discharge rate, sewer slope, sewer length, sewer flow rate, sewer diameter, and population density. As a rule of thumb, the length of line to be flushed should not exceed 700 feet. At this maximum recommended length, the percent removal efficiency ranges between 65-75 percent for organics and 55-65 percent for dry weather grit/inorganic material. The percent removal efficiency drops rapidly beyond that. Water is commonly supplied by a water truck, but fire hydrants can also supply water. To make the best use of water, it is recommended that reclaimed water be used or that fire hydrant line flushing coincide with storm drain flushing.

Flow Management

Flow management has been one of the principal motivations for designing urban stream corridors in the past. Such needs may or may not be compatible with the stormwater quality goals in the stream corridor.

Downstream flood peaks can be suppressed by reducing through flow velocity. This can be accomplished by reducing gradient with grade control structures or increasing roughness with boulders, dense vegetation, or complex banks forms. Reducing velocity correspondingly increases flood height, so all such measures have a natural association with floodplain open space. Flood elevations laterally adjacent to the stream can be lowered by increasing through flow velocity.

However, increasing velocity increases flooding downstream and inherently conflicts with channel stability and human safety. Where topography permits, another way to lower flood elevation is to lower the level of the floodway with drop structures into a large but subtly excavated bowl where flood flows we allowed to spread out.

Stream Corridor Planning

Urban streams receive and convey stormwater flows from developed or developing watersheds. Planning of stream corridors thus interacts with urban stormwater management programs. If local programs are intended to control or protect downstream environments by managing flows delivered to the channels, then it is logical that such programs should be supplemented by management of the materials, forms, and uses of the downstream riparian corridor. Any proposal for steam alteration or management should be investigated for its potential flow and stability effects on upstream, downstream, and laterally adjacent areas. The timing and rate of flow from various tributaries can combine in complex ways to alter flood hazards. Each section of channel is unique, influenced by its own distribution of roughness elements, management activities, and stream responses.

Flexibility to adapt to stream features and behaviors as they evolve must be included in stream reclamation planning. The amenity and ecology of streams may be enhanced through the landscape design options of 1) corridor reservation, 2) bank treatment, 3) geomorphic restoration, and 4) grade control.

Corridor reservation - Reserving stream corridors and valleys to accommodate natural stream meandering, aggradation, degradation, and over bank flows allows streams to find their own form and generate less ongoing erosion. In California, open stream corridors in recent urban developments have produced recreational open space, irrigation of streamside plantings, and the aesthetic amenity of flowing water.

Bank treatment - The use of armoring, vegetative cover, and flow deflection may be used to influence a channel's form, stability, and biotic habitat. To prevent bank erosion, armoring can be done with rigid construction materials, such as concrete, masonry, wood planks and logs, riprap, and gabions. Concrete linings have been criticized because of their lack of provision of biotic habitat. In contrast, riprap and gabions make relatively porous and flexible linings. Boulders, placed in the bed reduce velocity and erosive power.

Riparian vegetation can stabilize the banks of streams that are at or near a condition of equilibrium. Binding networks of roots increase bank shear strength. During flood flows, resilient vegetation is forced into erosion-inhibiting mats. The roughness of vegetation leads to lower velocity, further reducing erosive effects. Structural flow deflection can protect banks from erosion or alter fish habitat. By concentrating flow, a deflector causes a pool to be scoured in the bed.

Geomorphic restoration – Restoration refers to alteration of disturbed streams so their form and behavior emulate those of undisturbed streams. Natural meanders are retained, with grading to gentle slopes on the inside of curves to allow point bars and riffle-pool sequences to develop. Trees are retained to provide scenic quality, biotic productivity, and roots for bank stabilization, supplemented by plantings where necessary.

A restorative approach can be successful where the stream is already approaching equilibrium. However, if upstream urbanization continues new flow regimes will be generated that could disrupt the equilibrium of the treated system.

Grade Control - A grade control structure is a level shelf of a permanent material, such as stone, masonry, or concrete, over which stream water flows. A grade control structure is called a sill, weir, or drop structure, depending on the relation of its invert elevation to upstream and downstream channels.

A sill is installed at the preexisting channel bed elevation to prevent upstream migration of nick points. It establishes a firm base level below which the upstream channel can not erode.

A weir or check dam is installed with invert above the preexisting bed elevation. A weir raises the local base level of the stream and causes aggradation upstream. The gradient, velocity, and erosive potential of the stream channel are reduced. A drop structure lowers the downstream invert below its preexisting elevation, reducing downstream gradient and velocity. Weirs and drop structure control erosion by dissipating energy and reducing slope velocity.

When carefully applied, grade control structures can be highly versatile in establishing human and environmental benefits in stabilized channels. To be successful, application of grade control structures should be guided by analysis of the stream system both upstream and downstream from the area to he reclaimed.

Examples

The California Department of Water Resources began the Urban Stream Restoration Program in 1985. The program provides grant funds to municipalities and community groups to implement stream restoration projects. The projects reduce damages from streambank aid watershed instability arid floods while restoring streams' aesthetic, recreational, and fish and wildlife values.

In Buena Vista Park, upper floodway slopes are gentle and grassed to achieve continuity of usable park land across the channel of small boulders at the base of the slopes.

The San Diego River is a large, vegetative lined channel, which was planted in a variety of species to support riparian wildlife while stabilizing the steep banks of the floodway.

References and Resources

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Storm Drain Signage SD-13

Design Objectives

Maximize Infiltration

Provide Retention

Slow Runoff

Minimize Impervious Land Coverage

☑ Prohibit Dumping of Improper Materials

Contain Pollutants

Collect and Convey

Description

Waste materials dumped into storm drain inlets can have severe impacts on receiving and ground waters. Posting notices regarding discharge prohibitions at storm drain inlets can prevent waste dumping. Storm drain signs and stencils are highly visible source controls that are typically placed directly adjacent to storm drain inlets.

Approach

The stencil or affixed sign contains a brief statement that prohibits dumping of improper materials into the urban runoff conveyance system. Storm drain messages have become a popular method of alerting the public about the effects of and the prohibitions against waste disposal.

Suitable Applications

Stencils and signs alert the public to the destination of pollutants discharged to the storm drain. Signs are appropriate in residential, commercial, and industrial areas, as well as any other area where contributions or dumping to storm drains is likely.

Design Considerations

Storm drain message markers or placards are recommended at all storm drain inlets within the boundary of a development project. The marker should be placed in clear sight facing toward anyone approaching the inlet from either side. All storm drain inlet locations should be identified on the development site map.

Designing New Installations

The following methods should be considered for inclusion in the project design and show on project plans:

- Provide stenciling or labeling of all storm drain inlets and catch basins, constructed or modified, within the project area with prohibitive language. Examples include "NO DUMPING

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– DRAINS TO OCEAN" and/or other graphical icons to discourage illegal dumping.

- Post signs with prohibitive language and/or graphical icons, which prohibit illegal dumping at public access points along channels and creeks within the project area.

Note - Some local agencies have approved specific signage and/or storm drain message placards for use. Consult local agency stormwater staff to determine specific requirements for placard types and methods of application.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. If the project meets the definition of "redevelopment", then the requirements stated under " designing new installations" above should be included in all project design plans.

Additional Information

Maintenance Considerations

- Legibility of markers and signs should be maintained. If required by the agency with jurisdiction over the project, the owner/operator or homeowner's association should enter into a maintenance agreement with the agency or record a deed restriction upon the property title to maintain the legibility of placards or signs.

Placement

- Signage on top of curbs tends to weather and fade.

- Signage on face of curbs tends to be worn by contact with vehicle tires and sweeper brooms.

Supplemental Information

Examples

- Most MS4 programs have storm drain signage programs. Some MS4 programs will provide stencils, or arrange for volunteers to stencil storm drains as part of their outreach program.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Maintenance Concerns, Objectives, and Goals

- Clogged Soil or Outlet Structures
- Invasive Species
- Vegetation/Landscape Maintenance
- Erosion
- Channelization of Flow
- Aesthetics

General Description

The bioretention best management practice (BMP) functions as a soil and plant-based filtration device that removes pollutants through a variety of physical, biological, and chemical treatment processes. These facilities normally consist of a grass buffer strip, sand bed, ponding area, organic layer or mulch layer, planting soil, and plants. The runoff's velocity is reduced by passing over or through a sand bed and is subsequently distributed evenly along a ponding area. Exfiltration of the stored water in the bioretention area planting soil into the underlying soils occurs over a period of days.

Inspection/Maintenance Considerations

Bioretention requires frequent landscaping maintenance, including measures to ensure that the area is functioning properly, as well as maintenance of the landscaping on the practice. In many cases, bioretention areas initially require intense maintenance, but less maintenance is needed over time. In many cases, maintenance tasks can be completed by a landscaping contractor, who may already be hired at the site. In cold climates the soil may freeze, preventing runoff from infiltrating into the planting soil.

Targeted Constituents

✓	Sediment	■
✓	Nutrients	▲
✓	Trash	■
✓	Metals	■
✓	Bacteria	■
✓	Oil and Grease	■
✓	Organics	■

Legend *(Removal Effectiveness)*

● Low ■ High

▲ Medium

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Inspection Activities	Suggested Frequency
■ Inspect soil and repair eroded areas.	Monthly
■ Inspect for erosion or damage to vegetation, preferably at the end of the wet season to schedule summer maintenance and before major fall runoff to be sure the strips are ready for winter. However, additional inspection after periods of heavy runoff is desirable.	Semi-annual inspection
■ Inspect to ensure grass is well established. If not, either prepare soil and reseed or replace with alternative species. Install erosion control blanket. ■ Check for debris and litter, and areas of sediment accumulation. ■ Inspect health of trees and shrubs.	
Maintenance Activities	**Suggested Frequency**
■ Water plants daily for 2 weeks.	At project completion
■ Remove litter and debris.	Monthly
■ Remove sediment. ■ Remulch void areas. ■ Treat diseased trees and shrubs. ■ Mow turf areas. ■ Repair erosion at inflow points. ■ Repair outflow structures. ■ Unclog underdrain. ■ Regulate soil pH regulation.	As needed
■ Remove and replace dead and diseased vegetation.	Semi-annual
■ Add mulch. ■ Replace tree stakes and wires.	Annual
■ Mulch should be replaced every 2 to 3 years or when bare spots appear. Remulch prior to the wet season.	Every 2-3 years, or as needed

Additional Information

Landscaping is critical to the function and aesthetic value of bioretention areas. It is preferable to plant the area with native vegetation, or plants that provide habitat value, where possible. Another important design feature is to select species that can withstand the hydrologic regime they will experience. At the bottom of the bioretention facility, plants that tolerate both wet and dry conditions are preferable. At the edges, which will remain primarily dry, upland species will be the most resilient. It is best to select a combination of trees, shrubs, and herbaceous materials.

References

Metropolitan Council, Urban Small Sites Best Management Practices Manual. Available at: http://www.metrocouncil.org/environment/Watershed/BMP/manual.htm

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July, 1998, revised February, 2002.

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Maintenance Concerns, Objectives, and Goals

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- Invasive Species
- Vegetation/Landscape Maintenance
- Erosion
- Channelization of Flow
- Aesthetics

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✓	Bacteria	■
✓	Oil and Grease	■
✓	Organics	■

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Inspection Activities	Suggested Frequency
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■ Inspect for erosion or damage to vegetation, preferably at the end of the wet season to schedule summer maintenance and before major fall runoff to be sure the strips are ready for winter. However, additional inspection after periods of heavy runoff is desirable. ■ Inspect to ensure grass is well established. If not, either prepare soil and reseed or replace with alternative species. Install erosion control blanket. ■ Check for debris and litter, and areas of sediment accumulation. ■ Inspect health of trees and shrubs.	Semi-annual inspection
Maintenance Activities	**Suggested Frequency**
■ Water plants daily for 2 weeks.	At project completion
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Ventura Countywide Stormwater Quality Management Program, Technical Guidance Manual for Stormwater Quality Control Measures. July, 2002.

Design Considerations

- ■ Aesthetics
- ■ Hydraulic Head

Description

Stormwater media filters are usually two-chambered including a pretreatment settling basin and a filter bed filled with sand or other absorptive filtering media. As stormwater flows into the first chamber, large particles settle out, and then finer particles and other pollutants are removed as stormwater flows through the filtering media in the second chamber. There are a number of design variations including the Austin sand filter, Delaware sand filter, and multi-chambered treatment train (MCTT).

Targeted Constituents

☑	Sediment	■
☑	Nutrients	●
☑	Trash	■
☑	Metals	■
☑	Bacteria	▲
☑	Oil and Grease	■
☑	Organics	■

Legend *(Removal Effectiveness)*

● Low ■ High

▲ Medium

California Experience

Caltrans constructed and monitored five Austin sand filters, two MCTTs, and one Delaware design in southern California. Pollutant removal was very similar for each of the designs; however operational and maintenance aspects were quite different. The Delaware filter and MCTT maintain permanent pools and consequently mosquito management was a critical issue, while the Austin style which is designed to empty completely between storms was less affected. Removal of the top few inches of sand was required at 3 of the Austin filters and the Delaware filter during the third year of operation; consequently, sizing of the filter bed is a critical design factor for establishing maintenance frequency.

Advantages

- ■ Relatively high pollutant removal, especially for sediment and associated pollutants.
- ■ Widespread application with sufficient capture volume can provide significant control of channel erosion and enlargement caused by changes to flow frequency relationships resulting from the increase of impervious cover in a watershed.

Limitations

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- More expensive to construct than many other BMPs.
- May require more maintenance that some other BMPs depending upon the sizing of the filter bed.
- Generally require more hydraulic head to operate properly (minimum 4 feet).
- High solids loads will cause the filter to clog.
- Work best for relatively small, impervious watersheds.
- Filters in residential areas can present aesthetic and safety problems if constructed with vertical concrete walls.
- Certain designs (e.g., MCTT and Delaware filter) maintain permanent sources of standing water where mosquito and midge breeding is likely to occur.

Design and Sizing Guidelines

- Capture volume determined by local requirements or sized to treat 85% of the annual runoff volume.
- Filter bed sized to discharge the capture volume over a period of 48 hours.
- Filter bed 18 inches thick above underdrain system.
- Include energy dissipation in the inlet design to reduce resuspension of accumulated sediment.
- A maintenance ramp should be included in the design to facilitate access to the sedimentation and filter basins for maintenance activities (particularly for the Austin design).
- Designs that utilize covered sedimentation and filtration basins should be accessible to vector control personnel via access doors to facilitate vector surveillance and controlling the basins if needed.

Construction/Inspection Considerations

- Tributary area should be completely stabilized before media is installed to prevent premature clogging.

Performance

The pollutant removal performance of media filters and other stormwater BMPs is generally characterized by the percent reduction in the influent load. This method implies a relationship between influent and effluent concentrations. For instance, it would be expected that a device that is reported to achieve a 75% reduction would have an effluent concentration equal to 25% of the influent concentrations. Recent work in California (Caltrans, 2002) on various sand filter designs indicates that this model for characterizing performance is inadequate. Figure 4 presents a graph relating influent and effluent TSS concentrations for the Austin full sedimentation design.

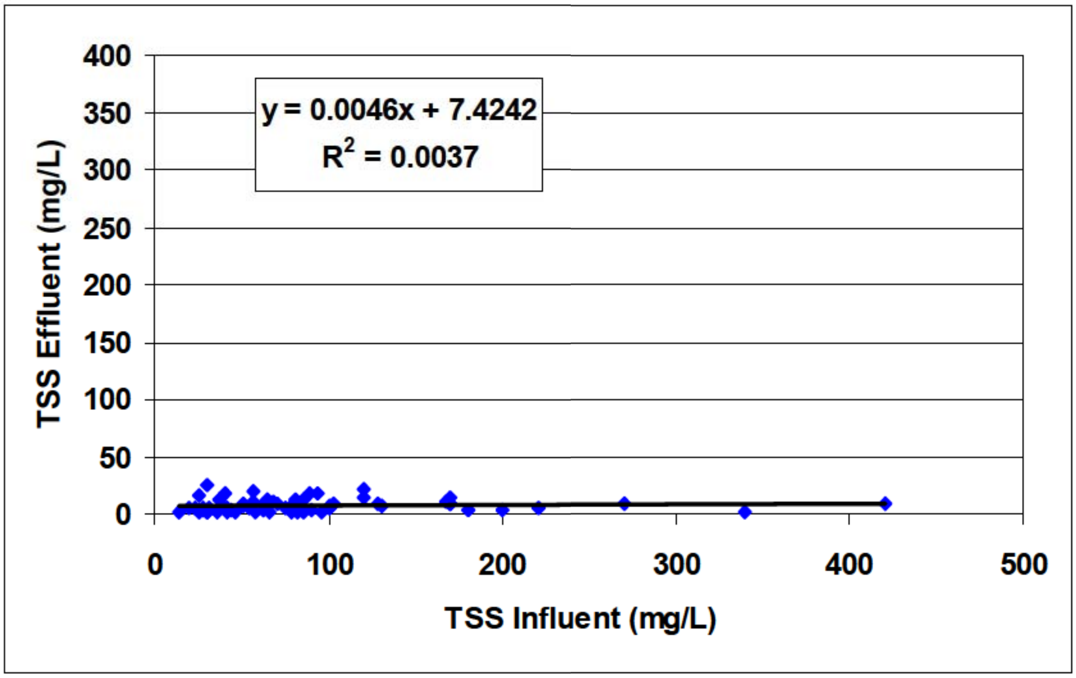

Figure 4
Comparison of Influent and Effluent Concentrations for TSS

It is clearly evident that the effluent concentration is relative constant and independent of influent concentration. Consequently, the performance is more accurately characterized by the effluent concentration, which is about 7.5 mg/L. Constant effluent concentrations also are observed for all other particle related constituents such as particulate metals (total - dissolved) and particulate phosphorus.

The small uncertainty in the estimate of the mean effluent concentration highlights the very consistent effluent quality for TSS produced by sand filters. In addition, it demonstrates that a calculated percent reduction for TSS and other constituents with similar behavior for Austin sand filters is a secondary characteristic of the device and depends primarily on the specific influent concentrations observed. The distinction between a constant effluent quality and a percent reduction is extremely important to recognize if the results are to be used to estimate effluent quality from sand filters installed at other sites with different influent concentrations or for estimating compliance with water quality standards for storms with high concentrations of particulate constituents.

If the conventionally derived removal efficiency (90%) were used to estimate the TSS concentrations in the treated runoff from storms with high influent concentrations, the estimated effluent concentration would be too high. For instance, the storm with the highest observed influent concentration (420 mg/L) would be expected to have a concentration in the treated runoff of 42 mg/L, rather than the 10 mg/L that was measured. In fact, the TSS effluent concentrations for all events with influent concentrations greater than 200 mg/L were 10 mg/L or less.

The stable effluent concentration of a sand filter under very different influent TSS concentrations implies something about the properties of the influent particle size distribution. If one assumes that only the smallest size fraction can pass through the filter, then the similarity in effluent concentrations suggests that there is little difference in the total mass of the smallest sized particles even when the total TSS concentration varies greatly. Further, the difference in TSS concentration must then be caused by changes in the relative amount of the larger size fractions. Further research is necessary to determine the range of particle size that is effectively removed in the filter and the portion of the size fraction of suspended solids that it represents in urban stormwater.

Sand filters are effective stormwater management practices for pollutant removal. Conventional removal rates for all sand filters and organic filters are presented in Table 1. With the exception of nitrates, which are always exported from filtering systems because of the conversion of ammonia and organic nitrogen to nitrate, they perform relatively well at removing pollutants.

Table 1 Sand filter removal efficiencies (percent)

	Sand Filter (Glick et al, 1998)	Compost Filter System		Multi-Chamber Treatment Train		
		Stewart, 1992	Leif, 1999	Pitt et al., 1997	Pitt, 1996	Greb et al., 1998
TSS	89	95	85	85	83	98
TP	59	41	4	80	-	84
TN	17	-	-	-	-	-
Nitrate	-76	-34	-95	-	14	-
Metals	72-86	61-88	44-75	65-90	91-100	83-89
Bacteria	65	-	-	-	-	-

From the few studies available, it is difficult to determine if organic filters necessarily have higher removal efficiencies than sand filters. The MCTT may have high pollutant removal for some constituents, although an evaluation of these devices by the California Department of Transportation indicated no significant difference for most conventional pollutants.

In addition to the relatively high pollutant removal in media filters, these devices, when sized to capture the channel forming storm volume, are highly effective at attenuating peak flow rates and reducing channel erosion.

Siting Criteria

In general, sand filters are preferred over infiltration practices, such as infiltration trenches, when contamination of groundwater with conventional pollutants is of concern. This usually occurs in areas where underlying soils alone cannot treat runoff adequately - or ground water tables are high. In most cases, sand filters can be constructed with impermeable basin or chamber bottoms, which help to collect, treat, and release runoff to a storm drainage system or directly to surface water with no contact between contaminated runoff and groundwater. In regions where evaporation exceeds rainfall and a wet pond would be unlikely to maintain the required permanent pool, a sand filtration system can be used.

The selection of a sand filter design depends largely on the drainage area's characteristics. For example, the Washington, D.C. and Delaware sand filter systems are well suited for highly impervious areas where land available for structural controls is limited, since both are installed underground. They have been used to treat runoff from parking lots, driveways, loading docks, service stations, garages, airport runways/taxiways, and storage yards. The Austin sand filtration system is more suited for large drainage areas that have both impervious and pervious surfaces. This system is located at grade and is used to treat runoff from any urban land use.

It is challenging to use most sand filters in very flat terrain because they require a significant amount of hydraulic head (about 4 feet), to allow flow through the system. One exception is the perimeter sand filter, which can be applied with as little as 2 feet of head.

Sand filters are best applied on relatively small sites (up to 25 acres for surface sand filters and closer to 2 acres for perimeter or underground filters). Filters have been used on larger drainage areas, of up to 100 acres, but these systems can clog when they treat larger drainage areas unless adequate measures are provided to prevent clogging, such as a larger sedimentation chamber or more intensive regular maintenance.

When sand filters are designed as a stand-alone practice, they can be used on almost any soil because they can be designed so that stormwater never infiltrates into the soil or interacts with the ground water. Alternatively, sand filters can be designed as pretreatment for an infiltration practice, where soils do play a role.

Additional Design Guidelines

Pretreatment is a critical component of any stormwater management practice. In sand filters, pretreatment is achieved in the sedimentation chamber that precedes the filter bed. In this chamber, the coarsest particles settle out and thus do not reach the filter bed. Pretreatment reduces the maintenance burden of sand filters by reducing the potential for these sediments to clog the filter. When pretreatment is not provided designers should increase the size of the filter area to reduce the clogging potential. In sand filters, designers should select a medium sand as the filtering medium. A fine aggregate (ASTM C-33) that is intended for use in concrete is commonly specified.

Many guidelines recommend sizing the filter bed using Darcy's Law, which relates the velocity of fluids to the hydraulic head and the coefficient of permeability of a medium. The resulting equation, as derived by the city of Austin, Texas, (1996), is

$$Af = WQV\ d/[k\ t\ (h+d)]$$

Where:

Af = area of the filter bed (ft^2);

d = depth of the filter bed (ft; usually about 1.5 feet, depending on the design);

k = coefficient of permeability of the filtering medium (ft/day);

t = time for the water quality volume to filter through the system (days; usually assumed to be 1.67 days); and

h = average water height above the sand bed (ft; assumed to be one-half of the maximum head).

Typical values for k, as assembled by CWP (1996), are shown in Table 2.

Table 2 Coefficient of permeability values for stormwater filtering practices (CWP, 1996)

Filter Medium	Coefficient of Permeability (ft/day)
Sand	3.5
Peat/Sand	2.75
Compost	8.7

The permeability of sand shown in Table 2 is extremely conservative, but is widely used since it is incorporated in the design guidelines of the City of Austin. When the sand is initially installed, the permeability is so high (over 100 ft/d) that generally only a portion of the filter area is required to infiltrate the entire volume, especially in a "full sedimentation" Austin design where the capture volume is released to the filter basin over 24 hours.

The preceding methodology results in a filter bed area that is oversized when new and the entire water quality volume is filtered in less than a day with no significant height of water on top of the sand bed. Consequently, the following simple rule of thumb is adequate for sizing the filter area. If the filter is preceded by a sedimentation basin that releases the water quality volume (WQV) to the filter over 24 hours, then

$$Af = WQV/18$$

If no pretreatment is provided then the filter area is calculated more conservatively as:

$$Af = WQV/10$$

Typically, filtering practices are designed as "off-line" systems, meaning that during larger storms all runoff greater than the water quality volume is bypassed untreated using a flow splitter, which is a structure that directs larger flows to the storm drain system or to a stabilized channel. One exception is the perimeter filter; in this design, all flows enter the system, but larger flows overflow to an outlet chamber and are not treated by the practice.

The Austin design variations are preferred where there is sufficient space, because they lack a permanent pool, which eliminates vector concerns. Design details of this variation are summarized below.

Summary of Design Recommendations

(1) Capture Volume - The facility should be sized to capture the required water quality volume, preferably in a separate pretreatment sedimentation basin.

(2) Basin Geometry – The water depth in the sedimentation basin when full should be at least 2 feet and no greater than 10 feet. A fixed vertical sediment depth marker should be installed in the sedimentation basin to indicate when 20% of the basin volume has been lost because of sediment accumulation. When a pretreatment sedimentation basin is provided the minimum average surface area for the sand filter (Af) is calculated from the following equation:

$$Af = WQV/18$$

If no pretreatment is provided then the filter area is calculated as:

$$Af = WQV/10$$

(3) Sand and Gravel Configuration - The sand filter is constructed with 18 inches of sand overlying 6 inches of gravel. The sand and gravel media are separated by permeable geotextile fabric and the gravel layer is situated on geotextile fabric. Four-inch perforated PVC pipe is used to drain captured flows from the gravel layer. A minimum of 2 inches of gravel must cover the top surface of the PVC pipe. Figure 5 presents a schematic representation of a standard sand bed profile.

(4) Sand Properties – The sand grain size distribution should be comparable to that of "washed concrete sand," as specified for fine aggregate in ASTM C-33.

(5) Underdrain Pipe Configuration – In an Austin filter, the underdrain piping should consist of a main collector pipe and two or more lateral branch pipes, each with a minimum diameter of 4 inches. The pipes should have a minimum slope of 1% (1/8 inch per foot) and the laterals should be spaced at intervals of no more than 10 feet. There should be no fewer than two lateral branch pipes. Each individual underdrain pipe should have a cleanout access location. All piping is to be Schedule 40 PVC. The maximum spacing between rows of perforations should not exceed 6 inches.

(6) Flow Splitter - The inflow structure to the sedimentation chamber should incorporate a flow-splitting device capable of isolating the capture volume and bypassing the 25-year peak flow around the facility with the sedimentation/filtration pond full.

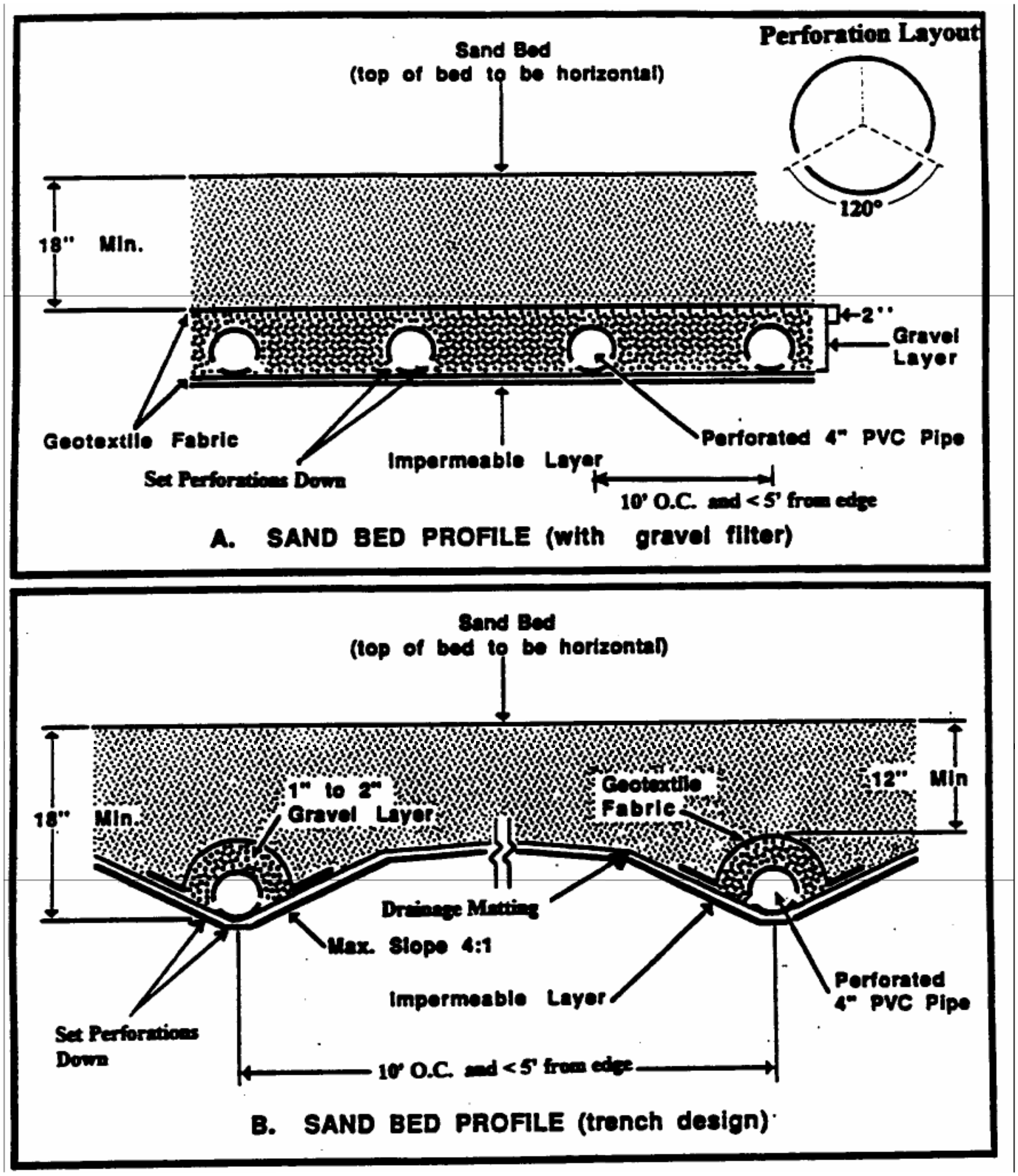

Figure 5
Schematic of Sand Bed Profile

(7) Basin Inlet – Energy dissipation is required at the sedimentation basin inlet so that flows entering the basin should be distributed uniformly and at low velocity in order to prevent resuspension and encourage quiescent conditions necessary for deposition of solids.

(8) Sedimentation Pond Outlet Structure - The outflow structure from the sedimentation chamber should be (1) an earthen berm; (2) a concrete wall; or (3) a rock gabion. Gabion outflow structures should extend across the full width of the facility such that no short-circuiting of flows can occur. The gabion rock should be 4 inches in diameter. The

receiving end of the sand filter should be protected (splash pad, riprap, etc.) such that erosion of the sand media does not occur. When a riser pipe is used to connect the sedimentation and filtration basins (example in Figure 6), a valve should be included to isolate the sedimentation basin in case of a hazardous material spill in the watershed. The control for the valve must be accessible at all times, including when the basin is full. The riser pipe should have a minimum diameter of 6 inches with four 1-inch perforations per row. The vertical spacing between rows should be 4 inches (on centers).

(9) Sand Filter Discharge – If a gabion structure is used to separate the sedimentation and filtration basins, a valve must installed so that discharge from the BMP can be stopped in case runoff from a spill of hazardous material enters the sand filter. The control for the valve must be accessible at all times, including when the basin is full.

Maintenance

Even though sand filters are generally thought of as one of the higher maintenance BMPs, in a recent California study an average of only about 49 hours a year were required for field activities. This was less maintenance than was required by extended detention basins serving comparable sized catchments. Most maintenance consists of routine removal of trash and debris, especially in Austin sand filters where the outlet riser from the sedimentation basin can become clogged.

Most data (i.e. Clark, 2001) indicate that hydraulic failure from clogging of the sand media occurs before pollutant breakthrough. Typically, only the very top of the sand becomes clogged while the rest remains in relative pristine condition as shown in Figure 7. The rate of clogging has been related to the TSS loading on the filter bed (Urbonas, 1999); however, the data are quite variable. Empirical observation of sites treating urban and highway runoff indicates that clogging of the filter occurs after 2 – 10 years of service. Presumably, this is related to differences in the type and amount of sediment in the catchment areas of the various installations. Once clogging occurs the top 2 – 3 inches of filter media is removed, which restores much, but not all, of the lost permeability. This removal of the surface layer can occur several times before the entire filter bed must be replaced. The cost of the removal of the surface layer is not prohibitive, generally ranging between $2,000 (EPA Fact Sheet) and $4,000 (Caltrans, 2002) depending on the size of the filter.

Media filters can become a nuisance due to mosquito and midge breeding in certain designs or if not regularly maintained. "Wet" designs (e.g., MCTT and Delaware filter) are more conducive to vectors than others (e.g., Austin filters) because they maintain permanent sources of standing water where breeding is likely to occur. Caltrans successfully excluded mosquitoes and midges from accessing the permanent water in the sedimentation basin of MCTT installations through use of a tight-fitting aluminum cover to seal vectors out. However, typical wet designs may require routine inspections and treatments by local mosquito and vector control agencies to suppress mosquito production. Vector habitats may also be created in "dry" designs when media filters clog, and/or when features such as level spreaders that hold water over 72 hours are included in the installation. Dry designs such as Austin filters should dewater completely (recommended 72 hour residence time or less) to prevent creating mosquito and other vector habitats. Maintenance efforts to prevent vector breeding in dry designs will need to focus on basic housekeeping practices such as removal of debris accumulations and vegetation management (in filter media) to prevent clogs and/or pools of standing water.

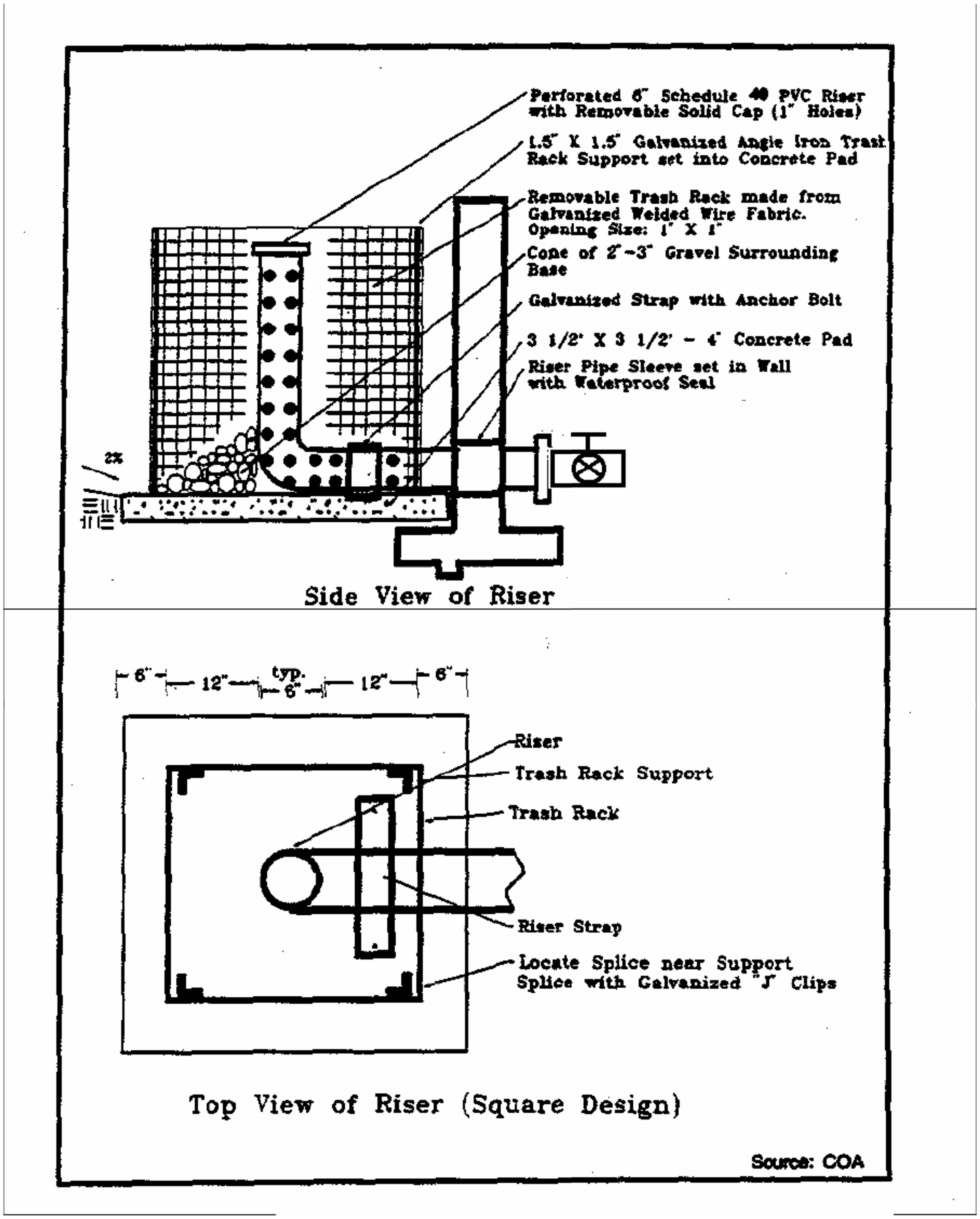

Figure 6
Detail of Sedimentation Riser Pipe

Figure 7
Formation of Clogging Crust on Filter Bed

Recommended maintenance activities and frequencies include:

- Inspections semi-annually for standing water, sediment, trash and debris, and to identify potential problems.
- Remove accumulated trash and debris in the sedimentation basin, from the riser pipe, and the filter bed during routine inspections.
- Inspect the facility once during the wet season after a large rain event to determine whether the facility is draining completely within 72 hr.
- Remove top 50 mm (2 in.) of sand and dispose of sediment if facility drain time exceeds 72 hr. Restore media depth to 450 mm (18 in.) when overall media depth drops to 300 mm (12 in.).
- Remove accumulated sediment in the sedimentation basin every 10 yr or when the sediment occupies 10 percent of the basin volume, whichever is less.

Cost

Construction Cost

There are few consistent published data on the cost of sand filters, largely because, with the exception of Austin, Texas, Alexandria, Virginia, and Washington, D.C., they have not been widely used. Furthermore, filters have such varied designs that it is difficult to assign a cost to filters in general. A study by Brown and Schueler (1997) was unable to find a statistically valid relationship between the volume of water treated in a filter and the cost of the practice. The EPA filter fact sheet indicates a cost for an Austin sand filter at $18,500 (1997 dollars) for a 0.4 hectare- (1 acre-)

drainage area. However, the same design implemented at a 1.1 ha site by the California Department of Transportation, cost $240,000. Consequently, there is a tremendous uncertainty about what the average construction cost might be.

It is important to note that, although underground and perimeter sand filters can be more expensive than surface sand filters, they consume no surface space, making them a relatively cost-effective practice in ultra-urban areas where land is at a premium.

Given the number of facilities installed in the areas that promote their use it should be possible to develop fairly accurate construction cost numbers through a more comprehensive survey of municipalities and developers that have implemented these filters.

Maintenance Cost

Annual costs for maintaining sand filter systems average about 5 percent of the initial construction cost (Schueler, 1992). Media is replaced as needed, with the frequency correlated with the solids loading on the filter bed. Currently the sand is being replaced in the D.C. filter systems about every 2 years, while an Austin design might last 3-10 years depending on the watershed characteristics. The cost to replace the gravel layer, filter fabric and top portion of the sand for D.C. sand filters is approximately $1,700 (1997 dollars).

Caltrans estimated future maintenance costs for the Austin design, assuming a device sized to treat runoff from approximately 4 acres. These estimates are presented in Table 3 and assume a fully burdened hourly rate of $44 for labor. This estimate is somewhat uncertain, since complete replacement of the filter bed was not required during the period that maintenance costs were recorded.

Table 3 Expected Annual Maintenance Costs for an Austin Sand Filter

Activity	Labor Hours	Equipment and Materials ($)	Cost
Inspections	4	0	176
Maintenance	36	125	1,706
Vector Control	0	0	0
Administration	3	0	132
Direct Costs	-	888	888
Total	43	$1,013	**$2,902**

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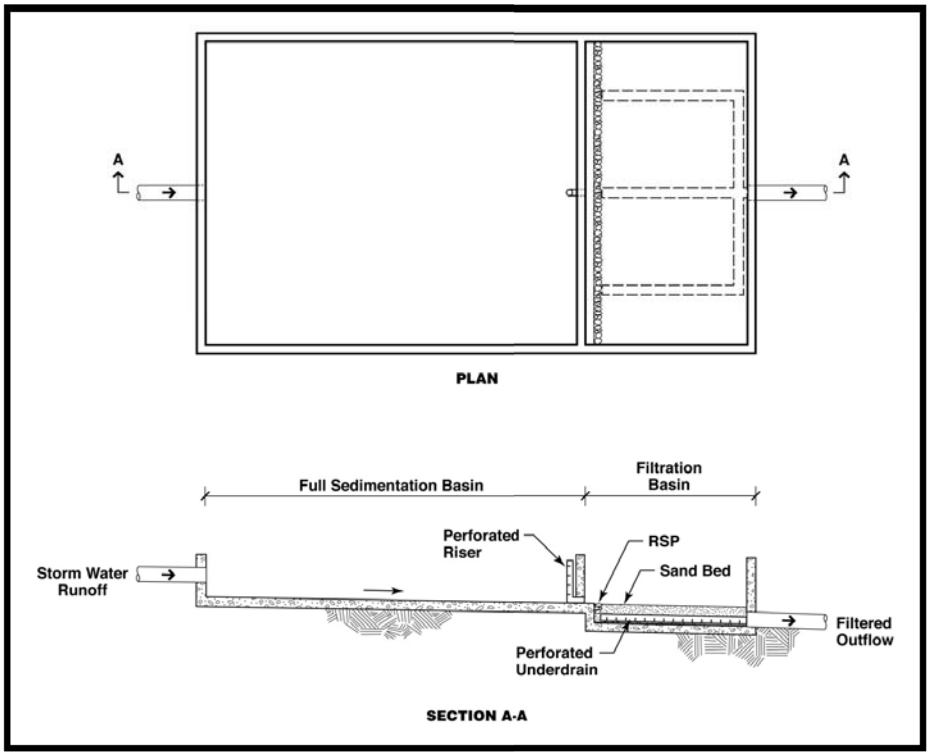
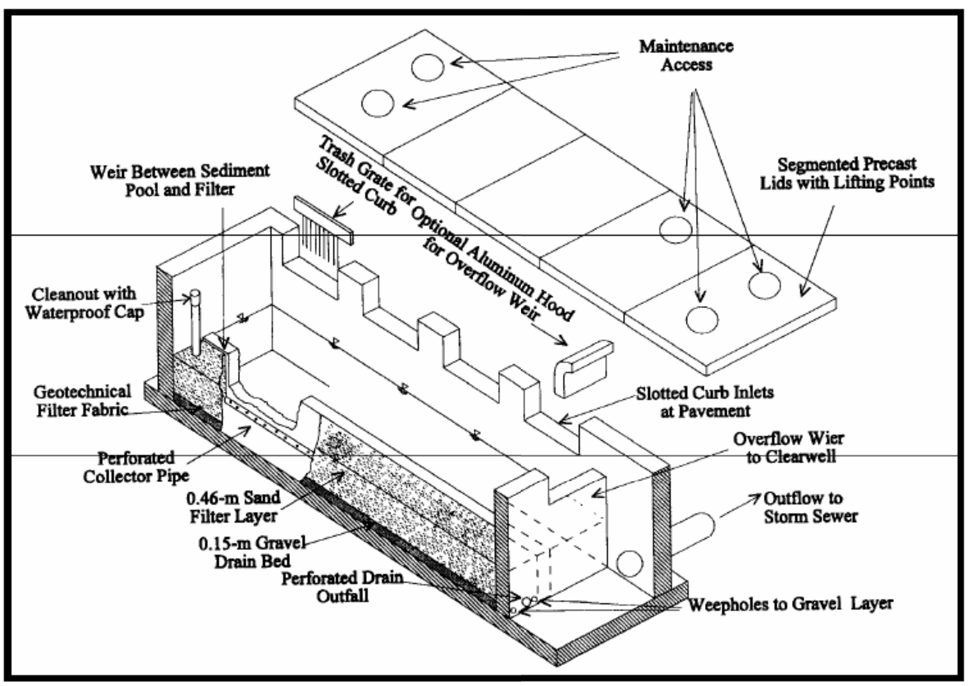
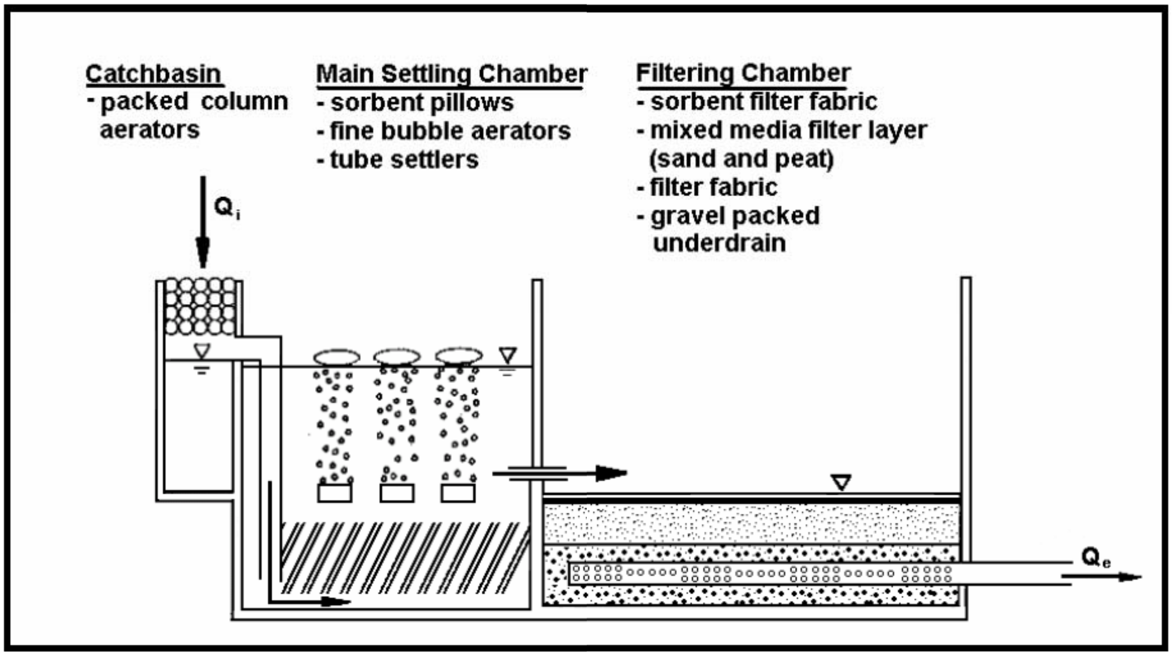


Schematic of the "Full Sedimentation" Austin Sand Filter



Schematic of a Delaware Sand Filter (Young et al., 1996)



Schematic of a MCTT (Robertson et al., 1995)

General Description

A multiple treatment system uses two or more BMPs in series. Some examples of multiple systems include: settling basin combined with a sand filter; settling basin or biofilter combined with an infiltration basin or trench; extended detention zone on a wet pond.

Inspection/Maintenance Considerations

Each of the separate treatment processes will require maintenance as described in the previous fact sheets. For example, multiple system comprises of a biofilter combined with an infiltration basin would require the inspection and maintenance considerations outlined on the fact sheet for each process.

Inspection Activities	Suggested Frequency
■ Refer to individual treatment control factsheets	As needed
Maintenance Activities	**Suggested Frequency**
■ Refer to individual treatment control factsheets	As needed

Maintenance Concerns, Objectives, and Goals

May include some of the following:

- Accumulation of Metals
- Aesthetics
- Channelization of Flow
- Clogged Outlet Structures
- Endangered Species Habitat Creation
- Erosion
- Groundwater Contamination
- Hazardous Waste
- Hydraulic and Removal Efficiency
- Invasive/exotic Plant Species
- Mechanical Malfunction
- Pollutant Breakthrough
- Re-suspension of settled material
- Sediment and Trash Removal
- Sedimentation
- Vector/Pest Control
- Vegetation harvesting
- Vegetation/Landscape Maintenance

Targeted Constituents

✓	Sediment	■
✓	Nutrients	●
✓	Trash	■
✓	Metals	■
✓	Bacteria	▲
✓	Oil and Grease	■
✓	Organics	■

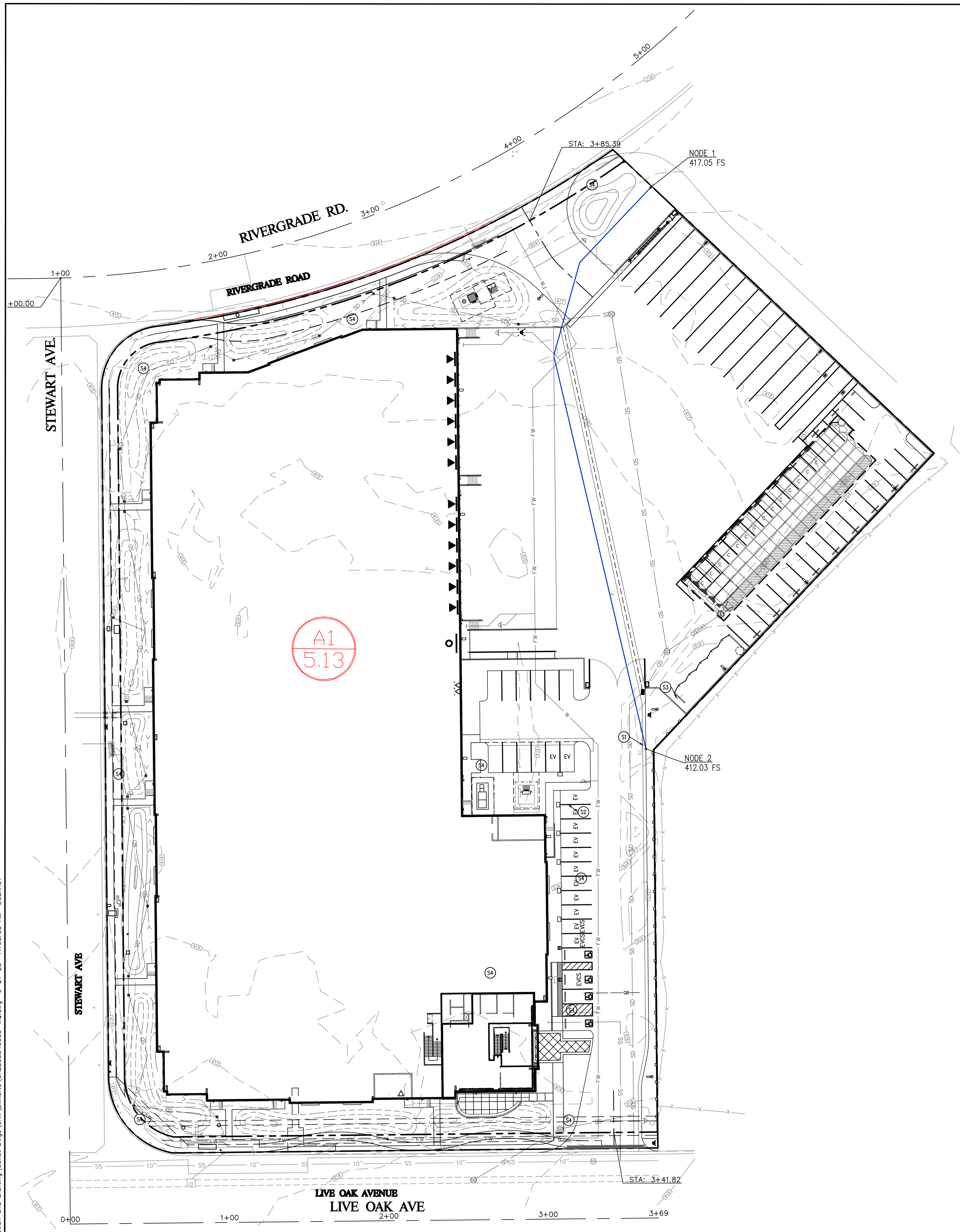
Legend *(Removal Effectiveness)*

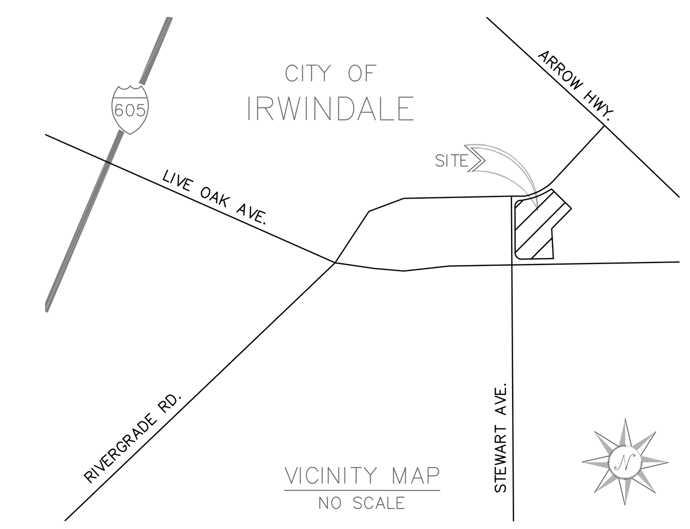
● Low ■ High

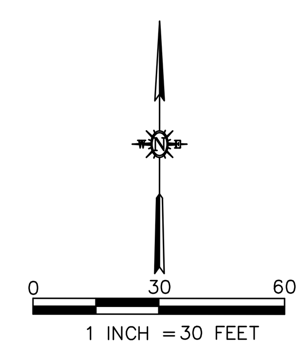
▲ Medium

CASQA California Stormwater Quality Association

Attachment 10. PROJECT EXHIBITS







LEGEND

PROJECT SITE =	5.13 ACRES
INFILTRATION RATE (NRCS) = 1.97 IN/HR.	
TEST1=1.91, TEST2=5.94, SAFETY FACTOR=2	
INFILTRATION IS FEASIBLE	
PROPOSED CONDITIONS PERVIOUS AREA =	10% ASSUMED
IMPERVIOUS AREA =	90%
SOIL TYPE=	8
LID RAINFALL	1.1"
DCV (SITE)	16,720 CF (HYDROCALC) 17,357 CF PROVIDED
DRAWDOWN	60 HR
MIN SURF AREA	3155 SF (CALC) 5150 SF PROVIDED
DESIGN STORAGE DEPTH	66 FT

PROPERTY LINE

DRAINAGE AREA BOUNDARY

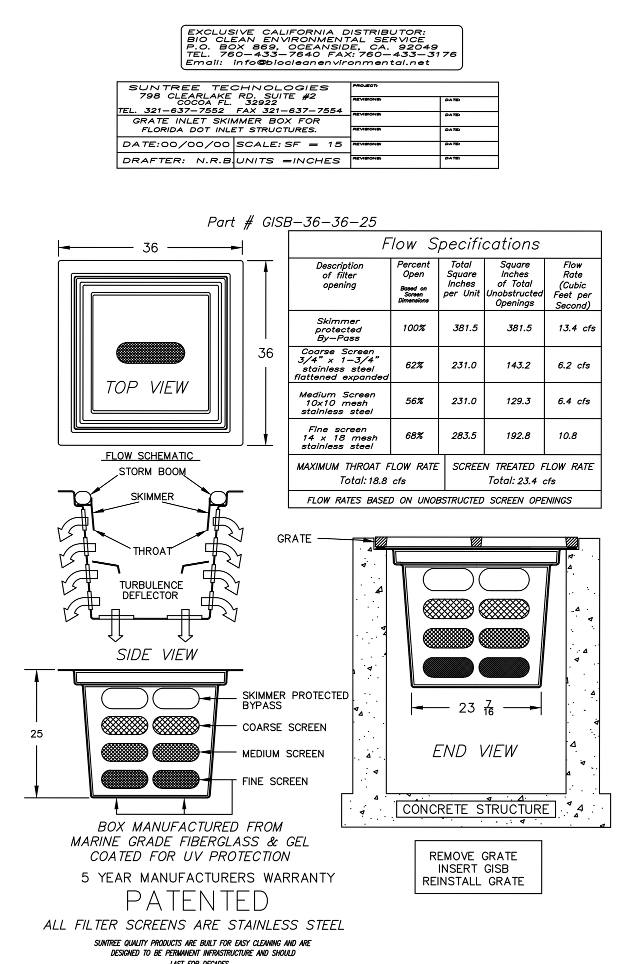
PR . DRAINAGE PATH

PROPOSED CONTOURS — 1016

(S1) STORM DRAIN SYSTEM FILTER & STENCILING
(S2) MC3500 STORM DETENTION SYSTEM
(S3) TRASH AND WASTE STORAGE
(S4) EFFICIENT IRRIGATION

WATER MAIN — W
FIRE WATER LINE — FW
SANITARY SEWER LINE — 4"S
STORM DRAIN LINE — SD
FORCE MAIN LINE

PAVEMENT



INLET FILTER (1) NTS

NOTE:

ALL DRAIN INLETS THAT DISCHARGE INTO AN EXISTING OR PROPOSED STORM DRAIN MUST BE LABELED TO DISCOURAGE ILLEGAL DUMPING OF POLLUTANTS WITH THE STENCIL ABOVE IN A VISIBLE AREA. 2 COATS MINIMIMUM

STORM INLET STENCIL (2) NTS

REV. NO	DATE	REVISED	DESTROY ALL PRINTS BEARING EARLIER DATE	REV. BY	CKD. BY	APRD BY

Cannon
16842 VON KARMAN AVENUE, SUITE 150
IRVINE, CALIFORNIA 92606
949 - 753 - 8111 || CANNONCORP.US

DRAWN BY CP	DATE 6/21/2023
CHECKED BY SJJ	SCALE AS SHOWN
	CANNON JOB NO. 220334

REXFORD
14005 LIVE OAK
WATER QUALITY EXHIBIT

IRWINDALE, CA

SHEET
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PROJECT INFORMATION

ENGINEERED PRODUCT MANAGER	
ADS SALES REP	
PROJECT NO.	

ADS Advanced Drainage Systems, Inc.

ADS SiteAssist FOR STORMTECH INSTALLATION INSTRUCTIONS VISIT OUR APP

220334
IRWINDALE, CA

MC-3500 STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH MC-3500.
2. CHAMBERS SHALL BE ARCH-SHAPED AND SHALL BE MANUFACTURED FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE COPOLYMERS.
3. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 45x76 DESIGNATION SS.
4. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORTS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
5. THE STRUCTURAL DESIGN OF THE CHAMBERS, THE STRUCTURAL BACKFILL, AND THE INSTALLATION REQUIREMENTS SHALL ENSURE THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET FOR: 1) LONG-DURATION DEAD LOADS AND 2) SHORT-DURATION LIVE LOADS, BASED ON THE AASHTO DESIGN TRUCK WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.
6. CHAMBERS SHALL BE DESIGNED, TESTED AND ALLOWABLE LOAD CONFIGURATIONS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS". LOAD CONFIGURATIONS SHALL INCLUDE: 1) INSTANTANEOUS (<1 MIN) AASHTO DESIGN TRUCK LIVE LOAD ON MINIMUM COVER 2) MAXIMUM PERMANENT (75-YR) COVER LOAD AND 3) ALLOWABLE COVER WITH PARKED (1-WEEK) AASHTO DESIGN TRUCK.
7. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT SHALL BE GREATER THAN OR EQUAL TO 450 LBS/FT/%. THE ASC IS DEFINED IN SECTION 6.2.8 OF ASTM F2418. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.
8. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. UPON REQUEST BY THE SITE DESIGN ENGINEER OR OWNER, THE CHAMBER MANUFACTURER SHALL SUBMIT A STRUCTURAL EVALUATION FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE AS FOLLOWS:
   - THE STRUCTURAL EVALUATION SHALL BE SEALED BY A REGISTERED PROFESSIONAL ENGINEER.
   - THE STRUCTURAL EVALUATION SHALL DEMONSTRATE THAT THE SAFETY FACTORS ARE GREATER THAN OR EQUAL TO 1.95 FOR DEAD LOAD AND 1.75 FOR LIVE LOAD, THE MINIMUM REQUIRED BY ASTM F2787 AND BY SECTIONS 3 AND 12.12 OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR THERMOPLASTIC PIPE.
   - THE TEST DERIVED CREEP MODULUS AS SPECIFIED IN ASTM F2418 SHALL BE USED FOR PERMANENT DEAD LOAD DESIGN EXCEPT THAT IT SHALL BE THE 75-YEAR MODULUS USED FOR DESIGN.
9. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF MC-3500 CHAMBER SYSTEM

1. STORMTECH MC-3500 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH MC-3500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. CHAMBERS ARE NOT TO BE BACKFILLED WITH A DOZER OR AN EXCAVATOR SITUATED OVER THE CHAMBERS. STORMTECH RECOMMENDS 3 BACKFILL METHODS:
   - STONESHOOTER LOCATED OFF THE CHAMBER BED.
   - BACKFILL AS ROWS ARE BUILT USING AN EXCAVATOR ON THE FOUNDATION STONE OR SUBGRADE.
   - BACKFILL FROM OUTSIDE THE EXCAVATION USING A LONG BOOM HOE OR EXCAVATOR.
4. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
5. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
6. MAINTAIN MINIMUM - 6" (150 mm) SPACING BETWEEN THE CHAMBER ROWS.
7. INLET AND OUTLET MANIFOLDS MUST BE INSERTED A MINIMUM OF 12" (300 mm) INTO CHAMBER END CAPS.
8. EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE MEETING THE AASHTO M43 DESIGNATION OF #3 OR #4.
9. STONE MUST BE PLACED ON THE TOP CENTER OF THE CHAMBER TO ANCHOR THE CHAMBERS IN PLACE AND PRESERVE ROW SPACING.
10. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES WITH CHAMBER FOUNDATION MATERIALS BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
11. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUBSURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

NOTES FOR CONSTRUCTION EQUIPMENT

1. STORMTECH MC-3500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
2. THE USE OF EQUIPMENT OVER MC-3500 CHAMBERS IS LIMITED:
   - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
   - NO RUBBER TIRED LOADER, DUMP TRUCK, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
   - WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. FULL 36" (900 mm) OF STABILIZED COVER MATERIALS OVER THE CHAMBERS IS REQUIRED FOR DUMP TRUCK TRAVEL OR DUMPING.

USE OF A DOZER TO PUSH EMBEDMENT STONE BETWEEN THE ROWS OF CHAMBERS MAY CAUSE DAMAGE TO CHAMBERS AND IS NOT AN ACCEPTABLE BACKFILL METHOD. ANY CHAMBERS DAMAGED BY USING THE "DUMP AND PUSH" METHOD ARE NOT COVERED UNDER THE STORMTECH STANDARD WARRANTY.

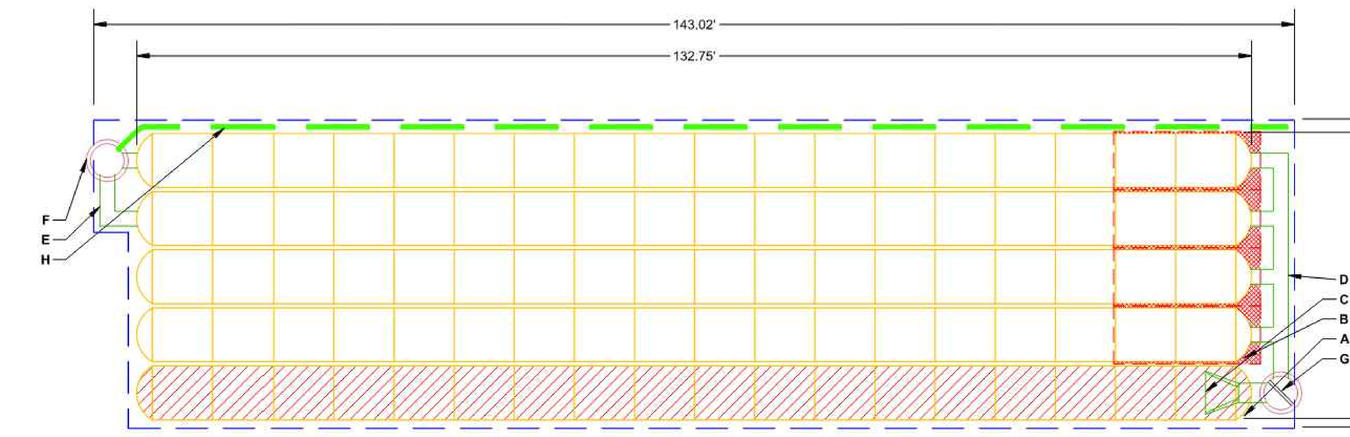
CONTACT STORMTECH AT 1-888-892-2694 WITH ANY QUESTIONS ON INSTALLATION REQUIREMENTS OR WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT.

PROPOSED LAYOUT	
90	STORMTECH MC-3500 CHAMBERS
10	STORMTECH MC-3500 END CAPS
12	STONE ABOVE (in)
9	STONE BELOW (in)
40	STONE VOID
17357	INSTALLED SYSTEM VOLUME (CF) (PERIMETER STONE INCLUDED) (COVER STONE INCLUDED) (BASE STONE INCLUDED)
5150	SYSTEM AREA (SF)
359.4	SYSTEM PERIMETER (ft)

CONCEPTUAL ELEVATIONS	
MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):	12.50
MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):	6.50
MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):	6.00
MINIMUM ALLOWABLE GRADE (TOP OF RIGID CONCRETE PAVEMENT):	6.00
MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):	6.00
TOP OF STONE:	5.50
TOP OF MC-3500 CHAMBER:	4.50
24" ISOLATOR ROW PLUS INVERT:	0.92
18" x 18" BOTTOM MANIFOLD INVERT:	0.90
18" x 18" BOTTOM MANIFOLD INVERT:	0.90
18" BOTTOM CONNECTION INVERT:	0.90
BOTTOM OF MC-3500 CHAMBER:	0.75
UNDERDRAIN INVERT:	0.00
BOTTOM OF STONE:	0.00

*INVERT ABOVE BASE OF CHAMBER

PART TYPE	ITEM ON LAYOUT	DESCRIPTION	INVERT*	MAX FLOW
PREFABRICATED END CAP	A	24" BOTTOM CORED END CAP, PART#: MC3500IEPP24BC / TYP OF ALL 24" BOTTOM CONNECTIONS AND ISOLATOR PLUS ROWS	2.06"	
PREFABRICATED END CAP	B	18" BOTTOM CORED END CAP, PART#: MC3500IEPP18BC / TYP OF ALL 18" BOTTOM CONNECTIONS	1.77"	
FLAMP	C	INSTALL FLAMP ON 24" ACCESS PIPE / PART#: MC350024RAMP		
MANIFOLD	D	18" x 18" BOTTOM MANIFOLD, ADS N-12	1.77"	
MANIFOLD	E	18" x 18" BOTTOM MANIFOLD, ADS N-12	1.77"	
CONCRETE STRUCTURE	F	OCS (DESIGN BY ENGINEER / PROVIDED BY OTHERS)		8.0 CFS OUT
CONCRETE STRUCTURE W/WEIR	G	(DESIGN BY ENGINEER / PROVIDED BY OTHERS)		20.9 CFS IN
UNDERDRAIN	H	6" ADS N-12 DUAL WALL PERFORATED HDPE UNDERDRAIN		



ISOLATOR ROW PLUS (SEE DETAIL)

PLACE MINIMUM 17.50' OF ADSPLUS175 WOVEN GEOTEXTILE OVER BEDDING STONE AND UNDERNEATH CHAMBER FEET FOR SCOUR PROTECTION AT ALL CHAMBER INLET ROWS

BED LIMITS

NOTES
- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECH NOTE #6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- **NOT FOR CONSTRUCTION:** THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.

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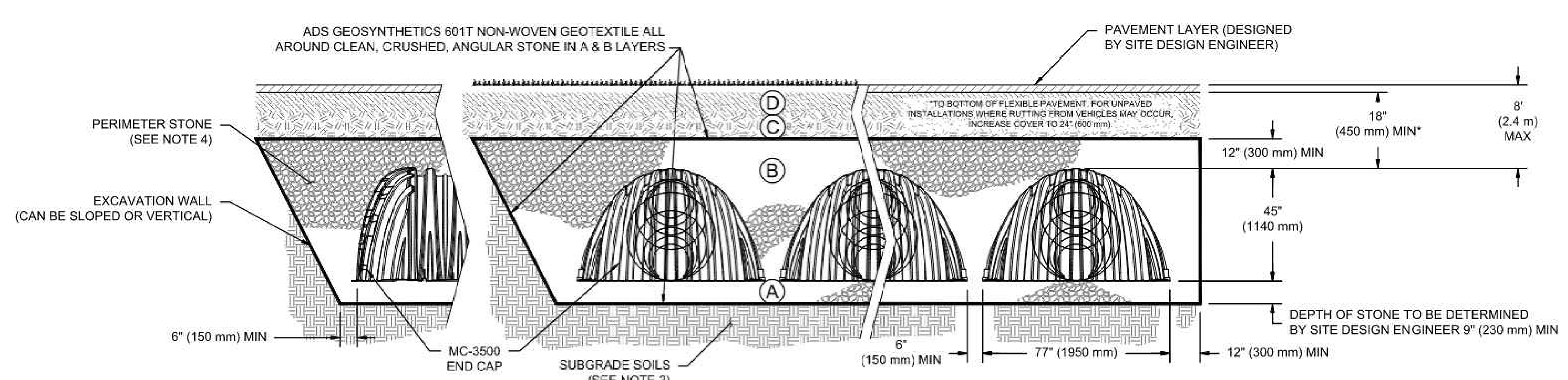
SHEET 2 OF 5

ACCEPTABLE FILL MATERIALS: STORMTECH MC-3500 CHAMBER SYSTEMS

	MATERIAL LOCATION	DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 24" (600 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145[1] A-1, A-2-4, A-3 OR AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 24" (600 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 12" (300 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS.
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 4	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 4	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE.[2,3]

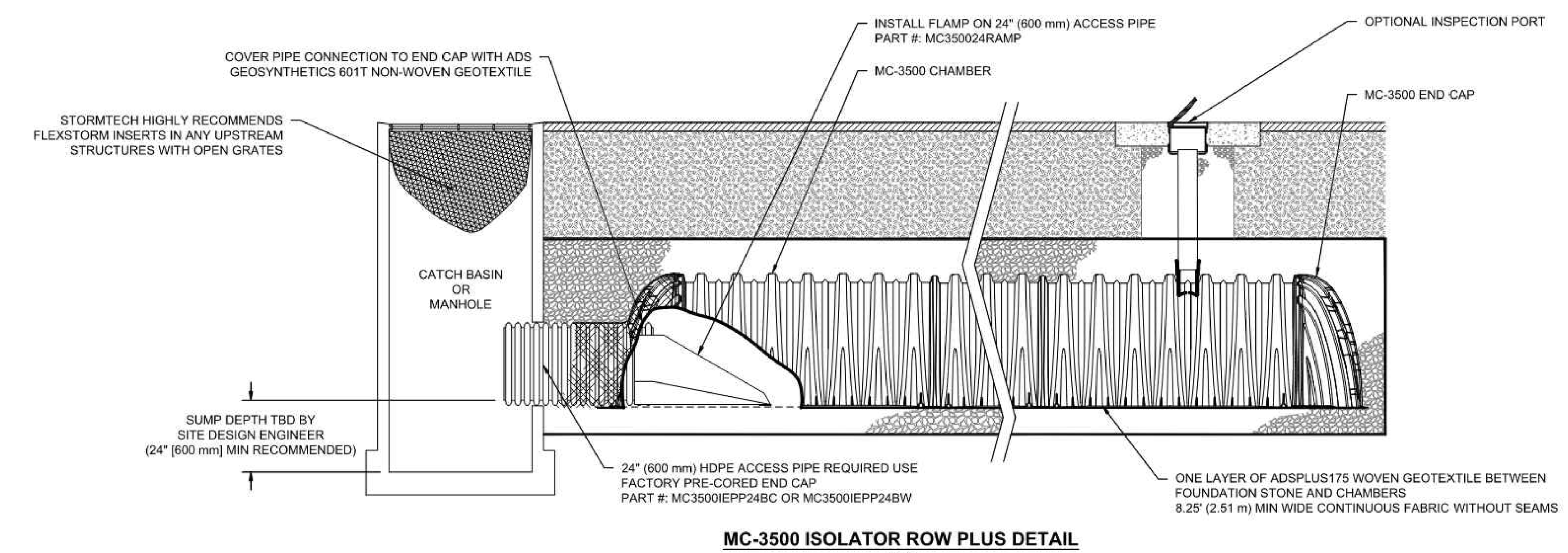
PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 9" (230 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.
4. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.



NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 45x76 DESIGNATION SS.
2. MC-3500 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT SHALL BE GREATER THAN OR EQUAL TO 450 LBS/FT/%. THE ASC IS DEFINED IN SECTION 6.2.8 OF ASTM F2418. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

SHEET 3 OF 5



MC-3500 ISOLATOR ROW PLUS DETAIL
NTS

INSPECTION & MAINTENANCE

STEP 1) INSPECT ISOLATOR ROW PLUS FOR SEDIMENT
- A. INSPECTION PORTS (IF PRESENT)
  - A.1. REMOVE/OPEN LID ON NYLOPLAST INLINE DRAIN
  - A.2. REMOVE AND CLEAN FLEXSTORM FILTER IF INSTALLED
  - A.3. USING A FLASHLIGHT AND STADIA ROD, MEASURE DEPTH OF SEDIMENT AND RECORD ON MAINTENANCE LOG
  - A.4. LOWER A CAMERA INTO ISOLATOR ROW PLUS FOR VISUAL INSPECTION OF SEDIMENT LEVELS (OPTIONAL)
  - A.5. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.
- B. ALL ISOLATOR PLUS ROWS
  - B.1. REMOVE COVER FROM STRUCTURE AT UPSTREAM END OF ISOLATOR ROW PLUS
  - B.2. USING A FLASHLIGHT, INSPECT DOWN THE ISOLATOR ROW PLUS THROUGH OUTLET PIPE
    - i) MIRRORS ON POLES OR CAMERAS MAY BE USED TO AVOID A CONFINED SPACE ENTRY
    - ii) FOLLOW OSHA REGULATIONS FOR CONFINED SPACE ENTRY IF ENTERING MANHOLE
  - B.3. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.

STEP 2) CLEAN OUT ISOLATOR ROW PLUS USING THE JETVAC PROCESS
- A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45" (1.1 m) OR MORE IS PREFERRED
- B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN
- C. VACUUM STRUCTURE SUMP AS REQUIRED

STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS.

STEP 4) INSPECT AND CLEAN BASINS AND MANHOLES UPSTREAM OF THE STORMTECH SYSTEM.

NOTES

1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS.
2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.

SHEET 4 OF 5

REV. NO	DATE	REVISED	DESTROY ALL PRINTS BEARING EARLIER DATE	REV. BY	CKD. BY	APRD. BY

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SHEET WQ2

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Appendix K

Acoustical Assessment

Acoustical Assessment
14005 Live Oak Avenue Project
City of Irwindale, California

Prepared by:

Kimley-Horn and Associates, Inc.
660 South Figueroa Street, Suite 2050
Los Angeles, California 90017
Contact: Noemi Wyss

September 2024

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APPENDIX

Appendix A: Noise Data

LIST OF ABBREVIATED TERMS

APN	Assessor's Parcel Number
ADT	Average daily traffic
dBA	A-weighted sound level
CEQA	California Environmental Quality Act
CNEL	Community equivalent noise level
EV	Electric Vehicle
L_{dn}	Day-night noise level
dB	Decibel
L_{eq}	Equivalent noise level
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
HVAC	Heating ventilation and air conditioning
Hz	Hertz
in/sec	Inches per second
L_{max}	Maximum noise level
µPa	Micropascals
L_{min}	Minimum noise level
PPV	Peak particle velocity
RMS	Root mean square
VdB	Vibration velocity level

1 INTRODUCTION

This report documents the results of an Acoustical Assessment completed for the 14005 Project ("Project" or "proposed Project"). The purpose of this Acoustical Assessment is to evaluate the potential construction and operational noise and vibration levels associated with the Project and determine the level of impact the Project would have on the environment.

1.1 Project Location

The Project site is located in the eastern portion of the City of Irwindale (City or Irwindale) in the County of Los Angeles (County). The City is approximately 20 miles east of downtown Los Angeles and is neighbored by the cities of West Covina, Baldwin Park, Azusa, Duarte, El Monte, Monrovia, and the unincorporated areas of Los Angeles County; see **Exhibit 1: Regional Vicinity Map**. The Project site is located at 14005 Live Oak Avenue at the northeastern corner of the Live Oak Avenue/Stewart Avenue intersection and is bound by vacant land currently undergoing grading to the east, Live Oak Avenue and the City of Baldwin Park to the south, Stewart Avenue to the west, and Rivergrade Road to the north (see **Exhibit 2: Local Vicinity Map**). The Project site is comprised of 5.13 gross acres (4.86 net acres, Assessor's Parcel Number 8535-001-033), with 0.27 acres designated as street dedication.

Regional access to the Project site is provided via the Interstate 605 freeway (I-605) located approximately 0.6-mile to the west. The Interstate 210 (I-210), Interstate 10 (I-10), and State Route 39 (SR-39) freeways also provide regional access to the Project site and are approximately 1.8 miles north, 2.5 miles south, and 3.4 miles east of the Project site, respectively. Local access to the Project site is provided via Live Oak Avenue to the east and Rivergrade Road to the north.

1.2 Project Description

The Project proposes to demolish the existing 56,000-square foot industrial office building and construct a one-story concrete tilt-up warehouse building with a mezzanine totaling 102,424 square feet with associated employee parking, truck docks, and landscaping. The proposed building would include 6,000 square feet of office space in the southeastern portion of the building (3,000 square feet each on the ground floor and mezzanine), and 96,400 square feet of warehouse space on the ground floor; refer to **Exhibit 3: Site Plan**. The Project would have a floor area ratio (FAR) of 0.48. An outdoor employee break area would be located immediately south of the proposed building adjacent to the office space. The Project would be designed to comply with Leadership in Energy and Environmental Design (LEED) Gold standards. The Project would also include security measures such as security lighting, a surveillance camera system, and 24/7 security personnel. As the proposed building is a speculative warehouse with no known tenant, this analysis assumes that the new building would be 100 percent warehousing and would not include any manufacturing, cold storage, or refrigerated space. The Project proposes one electric pump for fire protection services and one emergency diesel generator was modeled for the site.[1]

[1] The emergency generator fuel type is diesel (175-300 HP), assumed for a maximum maintenance and testing of one hour a day or 50 hours per year. The proposed generator has 238 horsepower with a load factor of 0.73.

Access and Parking

The proposed building would have a main entrance/storefront on the southeastern side of the building that would lead into the office space. Eight (8) smaller entrances with stairs and handrails would be on the northern, western, and southern sides of the building, and five (5) would be on the eastern side to provide access to the truck yard and parking lots.

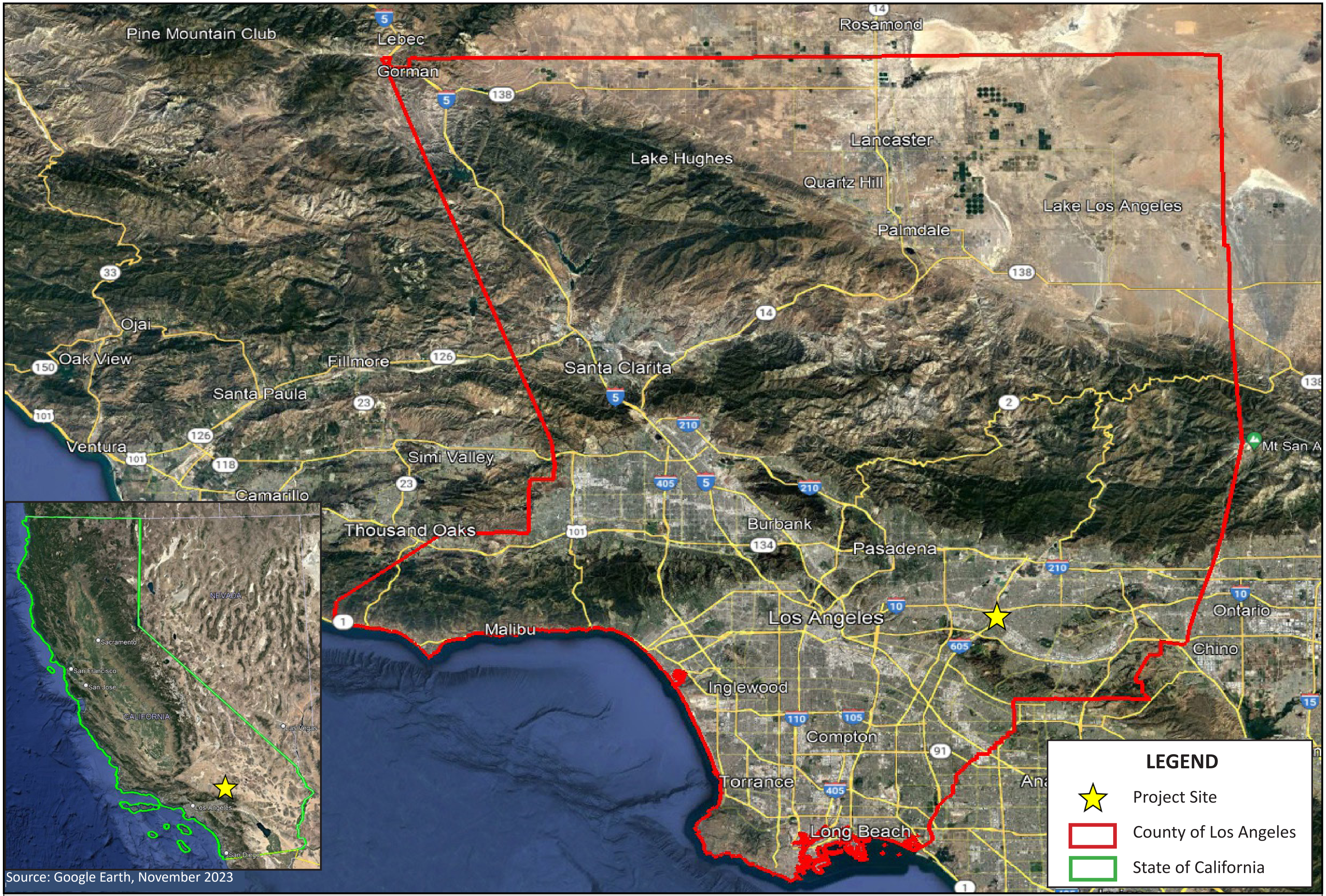
Vehicular access to the Project site would be provided via two (2) new 40-foot driveways: one (1) each off Rivergrade Road and Live Oak Avenue. The northern driveway off Rivergrade Road would provide full ingress and egress for trucking and automobiles for employees only. The southern driveway off Live Oak Avenue would provide ingress and egress only for employee/visitor vehicles and would allow right-in/right-out access only. Both driveways would connect to an internal drive aisle, which is divided by a manual tube steel swing gate on the central eastern portion of the Project site. The gate would restrict access into the truck yard and parking areas on the northeastern portion of the Project site to employees only. The internal drive aisle would also operate as a fire access lane and provide an unobstructed width of 28 feet. The Project would remove and reconstruct the existing Project site driveways in accordance with applicable engineering standards of the City of Irwindale Public Works Department.

The Project proposes to provide sixty-five (65) parking spaces throughout the parking lots, which would include fifteen (15) compact spaces on the northeastern portion of the Project site; and four (4) handicapped accessible spaces, twelve (12) electric vehicle (EV) spaces, and seven (7) EV charging station stalls on the central and southeastern portions. The Project would also provide twelve (12) dock positions and thirteen (13) trailer stalls along the northeastern Project site boundary and across from the proposed truck yard. Additionally, the Project would provide four (4) long-term and four (4) short-term bicycle spaces adjacent to the central and southeastern parking lots. The dock doors would be used for truck loading and unloading in the truck yard adjacent to the northeastern portion of the proposed building.

Pedestrian access would be provided via a new meandering concrete sidewalk along the street frontages on Rivergrade Road, Stewart Avenue, and Live Oak Avenue. The existing public sidewalk abutting the Project site would be demolished and replaced with a new sidewalk including curbs, gutters, and landscaping improvements as needed to facilitate Project site access along the Project’s frontage, consistent with the City’s standards. The Project would also include a 10-foot street easement dedication (totaling 0.27 acres) along Rivergrade Road, Stewart Avenue, and Live Oak Avenue. Additionally, internal walkways leading to the various entrances of the proposed building would be provided onsite and would connect to the new public sidewalk.

Construction Activities

Construction is anticipated to occur over a duration of approximately 13 months, commencing as early as September 2025. There would be approximately 12,345 tons of demolition and no anticipated import or export of soil.



Source: Google Earth, November 2023

Exhibit 1: REGIONAL VICINITY MAP

14005 Live Oak Avenue Project

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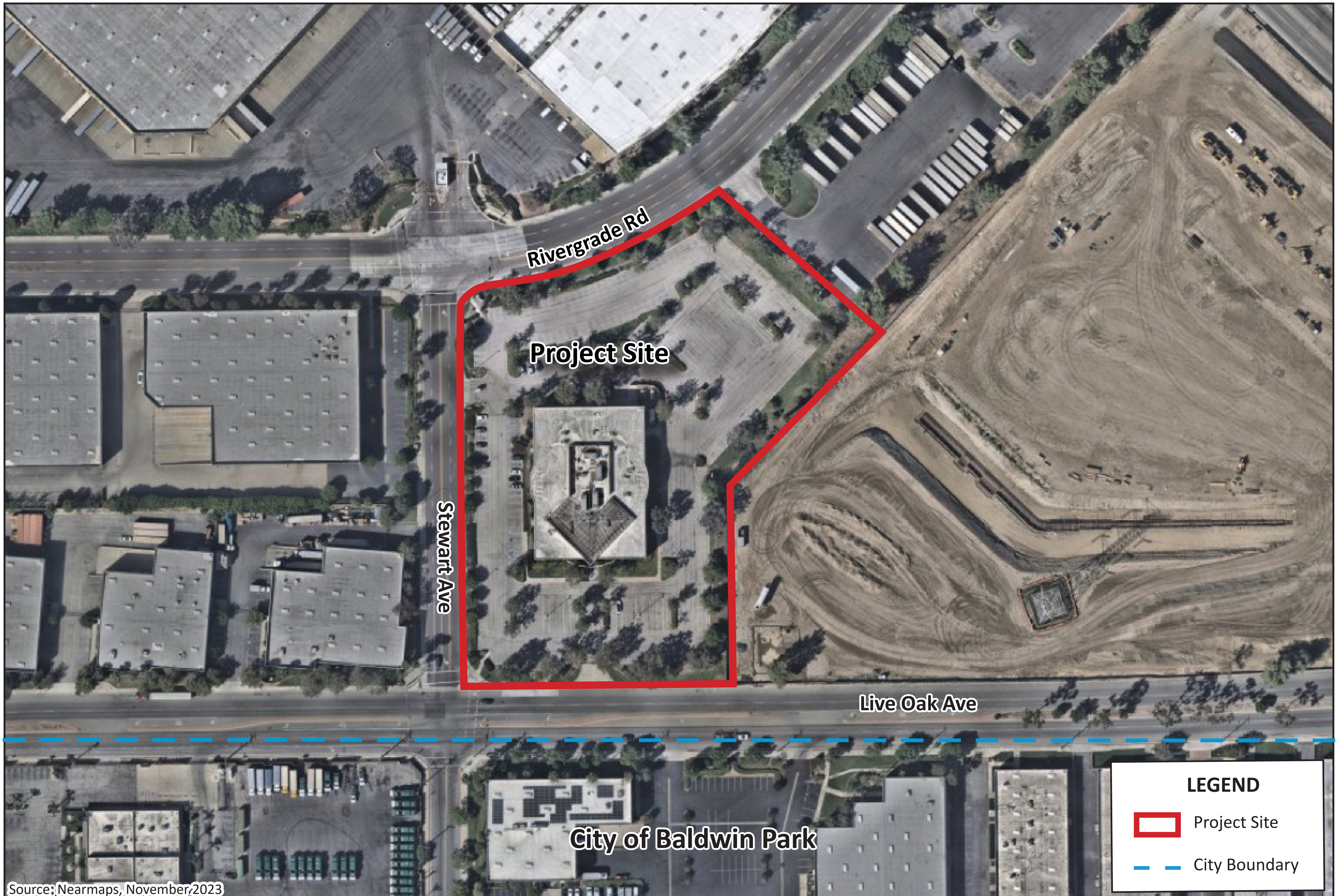

Exhibit 2: LOCAL VICINITY MAP

14005 Live Oak Avenue Project

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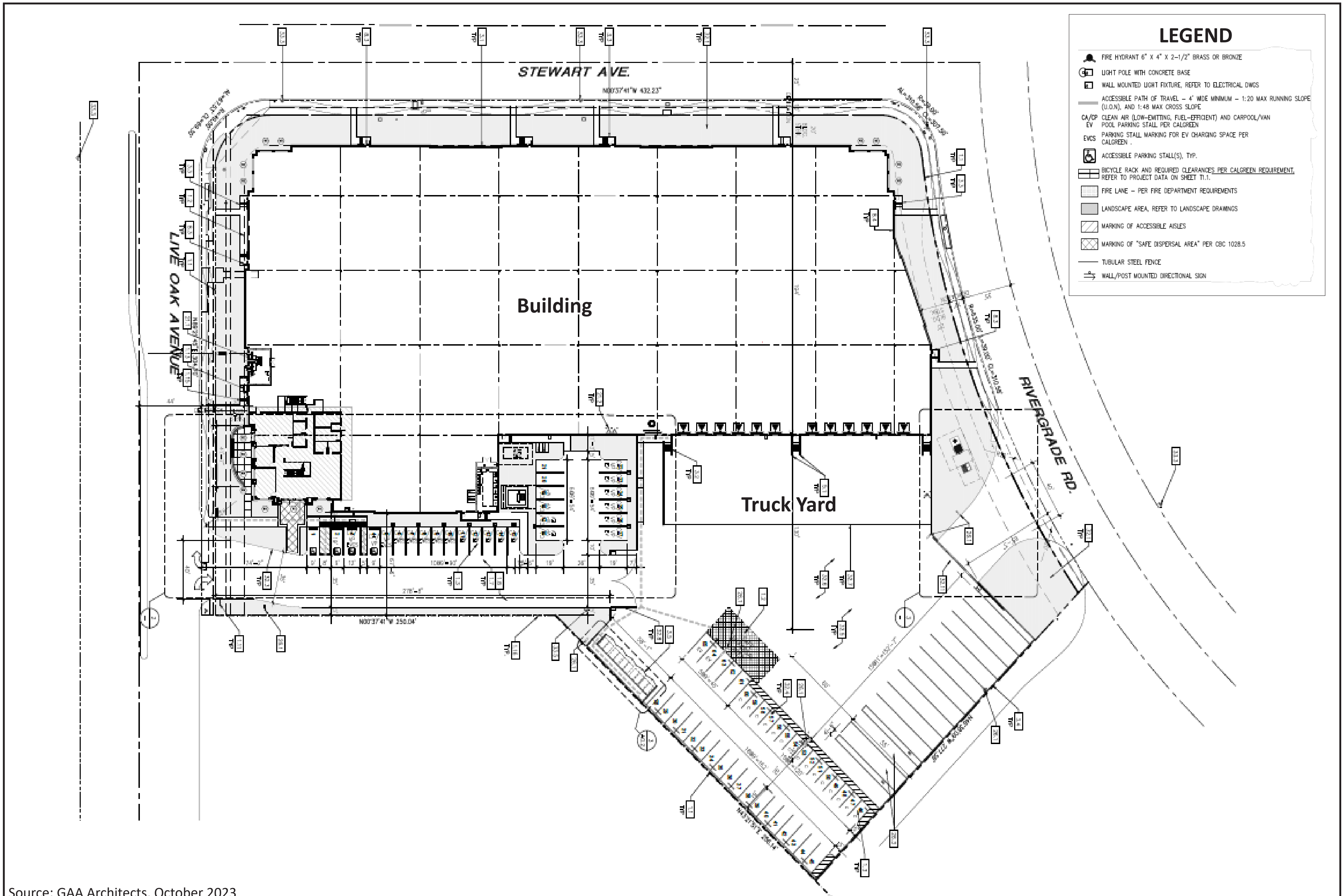

Source: GAA Architects, October 2023

Exhibit 3: SITE PLAN

14005 Live Oak Avenue Project

NOT TO SCALE

Kimley»Horn

2 ACOUSTIC FUNDAMENTALS

2.1 Sound and Environmental Noise

Acoustics is the science of sound. Sound can be described as the mechanical energy of a vibrating object transmitted by pressure waves through a medium (e.g., air) to human (or animal) ear. If the pressure variations occur frequently enough (at least 20 times per second), they can be heard and are called sound. The number of pressure variations per second is called the frequency of sound and is expressed as cycles per second, or hertz (Hz).

Noise is defined as loud, unexpected, or annoying sound. The fundamental model consists of a noise source, a receptor, and the propagation path between the two. The loudness of the noise source, obstructions, or atmospheric factors affecting the propagation path, determine the perceived sound level and noise characteristics at the receptor. Acoustics deal primarily with the propagation and control of sound. A typical noise environment consists of ambient noise that is the sum of many distant and indistinguishable noise sources. Superimposed on this ambient noise is the sound from individual local sources. These sources can vary from an occasional aircraft or train passing by to continuous noise from traffic on a major highway. Perceptions of sound and noise are highly subjective from person to person.

Measuring sound directly in terms of pressure would require a large range of numbers. To avoid this, the decibel (dB) scale was devised. The dB scale uses the hearing threshold of 20 micro-pascals (μPa) as a point of reference, defined as 0 dB. Other sound pressures are then compared to this reference pressure, and the logarithm is taken to keep the numbers in a practical range. The dB scale allows a million-fold increase in pressure to be expressed as 120 dB, and changes in levels correspond closely to human perception of relative loudness. **Table 1: Typical Noise Levels** provides typical noise levels.

Table 1: Typical Noise Levels

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	– 110 –	Rock Band
Jet fly-over at 1,000 feet		
	– 100 –	
Gas lawnmower at 3 feet		
	– 90 –	
Diesel truck at 50 feet at 50 miles per hour		Food blender at 3 feet
	– 80 –	Garbage disposal at 3 feet
Noisy urban area, daytime		
Gas lawnmower, 100 feet	**– 70 –**	Vacuum cleaner at 10 feet
Commercial area		Normal Speech at 3 feet
Heavy traffic at 300 feet	**– 60 –**	
		Large business office
Quiet urban daytime	**– 50 –**	Dishwasher in next room
Quiet urban nighttime	**– 40 –**	Theater, large conference room (background)
Quiet suburban nighttime		
	– 30 –	Library
Quiet rural nighttime		Bedroom at night, concert hall (background)
	– 20 –	
		Broadcast/recording studio
	– 10 –	
Lowest threshold of human hearing	**– 0 –**	Lowest threshold of human hearing

Source: California Department of Transportation, *Technical Noise Supplement to the Traffic Noise Analysis Protocol*, September 2013.

Noise Descriptors

The dB scale alone does not adequately characterize how humans perceive noise. The dominant frequencies of a sound have a substantial effect on the human response to that sound. Several rating scales have been developed to analyze the adverse effect of community noise on people. Because environmental noise fluctuates over time, these scales consider that the effect of noise on people is largely dependent on the total acoustical energy content of the noise, as well as the time of day when the noise occurs. The equivalent noise level (L_{eq}) represents the equivalent continuous sound pressure level over the measurement period, while the day-night noise level (L_{dn}) and Community Equivalent Noise Level (CNEL) are measures of sound energy during a 24-hour period, with dB weighted sound levels from 7:00 p.m. to 7:00 a.m. Most commonly, environmental sounds are described in terms of L_{eq} that has the same acoustical energy as the summation of all the time-varying events. Each is applicable to this analysis and defined in **Table 2: Definitions of Acoustical Terms**.

Table 2: Definitions of Acoustical Terms

Term	Definitions
Decibel (dB)	A unit describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for air is 20.
Sound Pressure Level	Sound pressure is the sound force per unit area, usually expressed in µPa (or 20 micronewtons per square meter), where 1 pascal is the pressure resulting from a force of 1 newton exerted over an area of 1 square meter. The sound pressure level is expressed in dB as 20 times the logarithm to the base 10 of the ratio between the pressures exerted by the sound to a reference sound pressure (e.g. 20 µPa). Sound pressure level is the quantity that is directly measured by a sound level meter.
Frequency (Hz)	The number of complete pressure fluctuations per second above and below atmospheric pressure. Normal human hearing is between 20 Hz and 20,000 Hz. Infrasonic sound are below 20 Hz and ultrasonic sounds are above 20,000 Hz.
A-Weighted Sound Level (dBA)	The sound pressure level in dB as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise.
Equivalent Noise Level (L_{eq})	The average acoustic energy content of noise for a stated period of time. Thus, the L_{eq} of a time-varying noise and that of a steady noise are the same if they deliver the same acoustic energy to the ear during exposure. For evaluating community impacts, this rating scale does not vary, regardless of whether the noise occurs during the day or the night.
Maximum Noise Level (L_{max}) Minimum Noise Level (L_{min})	The maximum and minimum dBA during the measurement period.
Exceeded Noise Levels (L_{01}, L_{10}, L_{50}, L_{90})	The dBA values that are exceeded 1%, 10%, 50%, and 90% of the time during the measurement period.
Day-Night Noise Level (L_{dn})	A 24-hour average L_{eq} with a 10-dBA weighting added to noise during the hours of 10:00 p.m. to 7:00 a.m. to account for noise sensitivity at nighttime. The logarithmic effect of these additions is that a 60 dBA 24-hour L_{eq} would result in a measurement of 66.4 dBA L_{dn}.
Community Noise Equivalent Level (CNEL)	A 24-hour average L_{eq} with a 5-dBA weighting during the hours of 7:00 a.m. to 10:00 a.m. and a 10-dBA weighting added to noise during the hours of 10:00 p.m. to 7:00 a.m. to account for noise sensitivity in the evening and nighttime, respectively. The logarithmic effect of these additions is that a 60 dBA 24-hour L_{eq} would result in a measurement of 66.7 dBA CNEL.
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Intrusive	That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends on its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level.

The A-weighted decibel (dBA) sound level scale gives greater weight to the frequencies of sound to which the human ear is most sensitive. Because sound levels can vary markedly over a short period of time, a method for describing either the average character of the sound or the statistical behavior of the variations must be utilized. Most commonly, environmental sounds are described in terms of an average level that has the same acoustical energy as the summation of all the time-varying events.

The scientific instrument used to measure noise is the sound level meter. Sound level meters can accurately measure environmental noise levels to within about plus or minus 1 dBA. Various computer models are used to predict environmental noise levels from sources, such as roadways and airports. The accuracy of the predicted models depends on the distance between the receptor and the noise source.

A-Weighted Decibels

The perceived loudness of sounds is dependent on many factors, including sound pressure level and frequency content. However, within the usual range of environmental noise levels, perception of loudness is relatively predictable and can be approximated by dBA values. There is a strong correlation between dBA and the way the human ear perceives sound. For this reason, the dBA has become the standard tool of environmental noise assessment. All noise levels reported in this document are in terms of dBA, but are expressed as dB, unless otherwise noted.

Addition of Decibels

The dB scale is logarithmic, not linear, and therefore sound levels cannot be added or subtracted through ordinary arithmetic. Two sound levels 10 dB apart differ in acoustic energy by a factor of 10. When the standard logarithmic dB is A-weighted, an increase of 10 dBA is generally perceived as a doubling in loudness. For example, a 70-dBA sound is half as loud as an 80-dBA sound and twice as loud as a 60-dBA sound.[2] When two identical sources are each producing sound of the same loudness, the resulting sound level at a given distance would be 3 dBA higher than one source under the same conditions.[3] Under the dB scale, three sources of equal loudness together would produce an increase of approximately 5 dBA.

Sound Propagation and Attenuation

Sound spreads (propagates) uniformly outward in a spherical pattern, and the sound level decreases (attenuates) at a rate of approximately 6 dB for each doubling of distance from a stationary or point source. Sound from a line source, such as a highway, propagates outward in a cylindrical pattern. Sound levels attenuate at a rate of approximately 3 dB for each doubling of distance from a line source, such as a roadway, depending on ground surface characteristics.[4] No excess attenuation is assumed for hard surfaces like a parking lot or a body of water. Soft surfaces, such as soft dirt or grass, can absorb sound, so an excess ground-attenuation value of 1.5 dB per doubling of distance is normally assumed.

Noise levels may also be reduced by intervening structures; generally, a single row of buildings between the receptor and the noise source reduces the noise level by about 5 dBA, while a solid wall or berm reduces noise levels by 5 to 10 dBA.[5] The way older homes in California were constructed generally

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2 FHWA, *Noise Fundamentals,* 2017. Available at: https://www.fhwa.dot.gov/environMent/noise/regulations_and_guidance/polguide/polguide02.cfm
3 Ibid.
4 California Department of Transportation, *Technical Noise Supplement to the Traffic Noise Analysis Protocol*, Page 2-29, September 2013.
5 James P. Cowan, *Handbook of Environmental Acoustics,* 1994.

provides a reduction of exterior-to-interior noise levels of about 20 to 25 dBA with closed windows. The exterior-to-interior reduction of newer residential units is generally 30 dBA or more.

Human Response to Noise

The human response to environmental noise is subjective and varies considerably from individual to individual. Noise in the community has often been cited as a health problem, not in terms of actual physiological damage, such as hearing impairment, but in terms of inhibiting general well-being and contributing to undue stress and annoyance. The health effects of noise in the community arise from interference with human activities, including sleep, speech, recreation, and tasks that demand concentration or coordination. Hearing loss can occur at the highest noise intensity levels.

Noise environments and consequences of human activities are usually well represented by median noise levels during the day or night or over a 24-hour period. Environmental noise levels are generally considered low when the CNEL is below 60 dBA, moderate in the 60 to 70 dBA range, and high above 70 dBA. Examples of low daytime levels are isolated, natural settings with noise levels as low as 20 dBA and quiet, suburban, residential streets with noise levels around 40 dBA.[6] Noise levels above 45 dBA at night can disrupt sleep. Examples of moderate-level noise environments are urban residential or semi-commercial areas (typically 55 to 60 dBA) and commercial locations (typically 60 dBA). People may consider louder environments adverse, but most will accept the higher levels associated with noisier urban residential or residential-commercial areas (60 to 75 dBA) or dense urban or industrial areas (65 to 80 dBA). Regarding increases in dBA, the following relationships should be noted[7]:

- Except in carefully controlled laboratory experiments, a 1-dBA change cannot be perceived by humans.
- Outside of the laboratory, a 3-dBA change is considered a just-perceivable difference.
- A minimum 5-dBA change is required before any noticeable change in community response would be expected. A 5-dBA increase is typically considered substantial.
- A 10-dBA change is subjectively heard as an approximate doubling in loudness and would almost certainly cause an adverse change in community response.

Effects of Noise on People

Hearing Loss. While physical damage to the ear from an intense noise impulse is rare, a degradation of auditory acuity can occur even within a community noise environment. Hearing loss occurs mainly due to chronic exposure to excessive noise but may be due to a single event such as an explosion. Natural hearing loss associated with aging may also be accelerated from chronic exposure to loud noise. The Occupational Safety and Health Administration has a noise exposure standard that is set at the noise threshold where hearing loss may occur from long-term exposures. The maximum allowable level is 90 dBA averaged over 8 hours. If the noise is above 90 dBA, the allowable exposure time is correspondingly shorter.

Annoyance. Attitude surveys are used for measuring the annoyance felt in a community for noises intruding into homes or affecting outdoor activity areas. In these surveys, it was determined that causes

6 Compiled from James P. Cowan, *Handbook of Environmental Acoustics,* 1994 and Cyril M. Harris, Handbook of Noise Control, 1979.
7 Compiled from California Department of Transportation, *Technical Noise Supplement to the Traffic Noise Analysis Protocol*, September 2013, and FHWA, *Noise Fundamentals,* 2017.

for annoyance include interference with speech, radio and television, house vibrations, and interference with sleep and rest. The L_{dn} as a measure of noise has been found to provide a valid correlation of noise level and the percentage of people annoyed. People have been asked to judge the annoyance caused by aircraft noise and ground transportation noise. There continues to be disagreement about the relative annoyance of these different sources. A noise level of about 55 dBA L_{dn} is the threshold at which a substantial percentage of people begin to report annoyance[8].

2.2 Ground-Borne Vibration

Sources of ground-borne vibrations include natural phenomena (earthquakes, volcanic eruptions, sea waves, landslides, etc.) or man-made causes (explosions, machinery, traffic, trains, construction equipment, etc.). Vibration sources may be continuous (e.g., factory machinery) or transient (e.g., explosions or heavy equipment use during construction). Ground vibration consists of rapidly fluctuating motions or waves with an average motion of zero. Several different methods are typically used to quantify vibration amplitude. One is vibration decibels (VdB) (the vibration velocity level in decibel scale). Other methods are the peak particle velocity (PPV) and the root mean square (RMS) velocity. The PPV is defined as the maximum instantaneous positive or negative peak of the vibration wave. The RMS velocity is defined as the average of the squared amplitude of the signal. The PPV and RMS vibration velocity amplitudes are used to evaluate human response to vibration.

Table 3: Human Reaction and Damage to Buildings for Continuous or Frequent Intermittent Vibrations, displays the reactions of people and the effects on buildings produced by continuous vibration levels. The annoyance levels shown in **Table 3** should be interpreted with care since vibration may be found to be annoying at much lower levels than those listed, depending on the level of activity or the sensitivity of the individual. To sensitive individuals, vibrations approaching the threshold of perception can be annoying. Low-level vibrations frequently cause irritating secondary vibration, such as a slight rattling of windows, doors, or stacked dishes. The rattling sound can give rise to exaggerated vibration complaints, even though there is very little risk of actual structural damage. In high noise environments, which are more prevalent where ground-borne vibration approaches perceptible levels, this rattling phenomenon may also be produced by loud airborne environmental noise causing induced vibration in exterior doors and windows.

Ground vibration can be a concern in instances where buildings shake, and substantial rumblings occur. However, it is unusual for vibration from typical urban sources such as buses and heavy trucks to be perceptible. Common sources for ground-borne vibration are planes, trains, and construction activities such as earth-moving which requires the use of heavy-duty earth moving equipment. For the purposes of this analysis, a PPV descriptor with units of inches per second (in/sec) is used to evaluate construction-generated vibration for building damage and human complaints.

8 Federal Interagency Committee on Noise, *Federal Agency Review of Selected Airport Noise Analysis Issues*, August 1992.

Table 3: Human Reaction and Damage to Buildings for Continuous or Frequent Intermittent Vibrations

Maximum PPV (in/sec)	Vibration Annoyance Potential Criteria	Vibration Damage Potential Threshold Criteria	FTA Vibration Damage Criteria
0.008	--	Extremely fragile historic buildings, ruins, ancient monuments	--
0.01	Barely Perceptible	--	--
0.04	Distinctly Perceptible	--	--
0.1	Strongly Perceptible	Fragile buildings	--
0.12	--	--	Buildings extremely susceptible to vibration damage
0.2	--	--	Non-engineered timber and masonry buildings
0.25	--	Historic and some old buildings	--
0.3	--	Older residential structures	Engineered concrete and masonry (no plaster)
0.4	Severe	--	--
0.5	--	New residential structures, Modern industrial/commercial buildings	Reinforced-concrete, steel or timber (no plaster)

PPV = peak particle velocity; in/sec = inches per second; FTA = Federal Transit Administration

Source: California Department of Transportation, Transportation and Construction Vibration Guidance Manual, 2020 and Federal Transit administration, Transit Noise and Vibration Assessment Manual, 2018.

3 REGULATORY SETTING

To limit population exposure to physically or psychologically damaging as well as intrusive noise levels, the Federal government, the State of California, various county governments, and most municipalities in the State have established standards and ordinances to control noise.

3.1 Federal

Federal Transit Administration Noise and Vibration Guidance

The Federal Transit Administration (FTA) has published the Transit Noise and Vibration Impact Assessment Manual (FTA Transit Noise and Vibration Manual) to provide guidance on procedures for assessing impacts at different stages of transit project development. The report covers both construction and operational noise impacts and describes a range of measures for controlling excessive noise and vibration. In general, the primary concern regarding vibration relates to potential damage from construction. The guidance document establishes criteria for evaluating the potential for damage for various structural categories from vibration.

3.2 State of California

California Government Code

California Government Code Section 65302(f) mandates that the legislative body of each county and city adopt a noise element as part of its comprehensive general plan. The local noise element must recognize the land use compatibility guidelines established by the State Department of Health Services. The guidelines rank noise land use compatibility in terms of "normally acceptable", "conditionally acceptable", "normally unacceptable", and "clearly unacceptable" noise levels for various land use types. Single-family homes are "normally acceptable" in exterior noise environments up to 60 CNEL and "conditionally acceptable" up to 70 CNEL. Multiple-family residential uses are "normally acceptable" up to 65 CNEL and "conditionally acceptable" up to 70 CNEL. Schools, libraries, and churches are "normally acceptable" up to 70 CNEL, as are office buildings and business, commercial, and professional uses.

Title 24 – Building Code

The State's noise insulation standards are codified in the California Code of Regulations, Title 24: Part 1, Building Standards Administrative Code, and Part 2, California Building Code. These noise standards are applied to new construction in California for interior noise compatibility from exterior noise sources. The regulations specify that acoustical studies must be prepared when noise-sensitive structures, such as residential buildings, schools, or hospitals, are located near major transportation noise sources, and where such noise sources create an exterior noise level of 65 dBA CNEL or higher. Acoustical studies that accompany building plans must demonstrate that the structure has been designed to limit interior noise in habitable rooms to acceptable noise levels. For new multi-family residential buildings, the acceptable interior noise limit for new construction is 45 dBA CNEL.

3.3 Local

City of Irwindale General Plan

The Irwindale General Plan identifies policies in the Safety Element Policy. The Safety Element policies seek to reduce community noise exposure to excessive noise levels through the establishment of noise level standards for a variety of land uses.

The City's General Plan acknowledges the State Office of Noise Control *Guidelines for the Preparation and Content of Noise Elements of General Plans,* which is a guide for compatibility of noise-sensitive land uses in areas subject to noise levels of 55 to 80 dB CNEL or L_{dn}. Residential uses are normally unacceptable in areas exceeding 70 dB CNEL; and conditionally acceptable between 55-70 dB CNEL for low-density single-family dwelling units, duplexes, and mobile homes, and between 60-70 dB CNEL for multiple-family units. Schools, libraries, hospitals, and nursing homes are treated as noise-sensitive land uses, requiring acoustical studies within areas exceeding 60 dB CNEL. Commercial/professional office buildings and industrial land uses are normally unacceptable in areas exceeding 75 dB CNEL, and are conditionally acceptable within 67 to 78 dB CNEL (for commercial and professional offices only). The City's General Plan does not specifically acknowledge the State's noise guidelines for playgrounds and neighborhood parks. These land uses are normally unacceptable in areas exceeding 70 dBA CNEL, and are unacceptable in areas exceeding 75 dBA CNEL.

Public Safety Element

Policy 4: The City of Irwindale will strive to reduce the community's exposure to noise from on-going manufacturing activities.

Policy 5: The City of Irwindale will work towards reducing noise exposure in the City by considering noise and land use compatibility in land use planning.

Policy 6: The City of Irwindale will continue to investigate strategies that will be effective in reducing the community's exposure to harmful noise levels.

City of Irwindale Municipal Code

Irwindale Municipal Code (IMC) Chapter 9.28 Noise Regulation Section 9.28.030 regulates noise levels. **Table 4: Ambient Base Noise Levels** displays ambient noise levels for residential, commercial, and industrial zones. The section also states any noise at a level which exceeds the ambient base level as set forth in **Table 4** below, whichever is greater, by more than 10 dB measured at any boundary line of the property from which the noise emanates shall constitute sufficient proof of a violation.

Table 4: Ambient Base Noise Levels

Zone	7 a.m. to 10 p.m.	10 p.m. to 7 a.m.
Residential	50 dBA	45 dBA
Commercial	55 dBA	50 dBA
Industrial	70 dBA	60 dBA

Source: Irwindale Municipal Code, Chapter 9.28.030

IMC Section 9.28.040, Noise Level violation designated. IMC Section 9.28.040 declares the following relevant act to be unlawful:

- It is unlawful for any person to willfully make or continue, or cause to be made or continued any noise at a level which exceeds by more than five dB the ambient or the ambient base level as set forth in Section 9.28.030, whichever is greater, when measured at any boundary line of the property from which the noise emanates.

IMC Section 9.28.110, Construction of building and projects – Time specified. IMC Section 9.28.110 declares the following times of construction and act to be unlawful:

- It is unlawful for any person within a residential zone, or within a radius of five hundred feet therefrom, to operate equipment or perform any outside construction or repair work on buildings, structures, or projects or to operate any pile driver, steam shovel, pneumatic hammer, derrick, steam, or electric hoist to other construction type device on a development requiring a city permit, in such a manner that noise is produced which would constitute a violation of Section 9.28.040, unless beforehand authorization therefore has been dully obtained from the building inspector. Such activity is unlawful without a permit during all hours on Sunday. No permit shall be required to perform emergency work as defined in subsection E of 9.28.020.
- Construction authorized by subsection A of this section shall be limited to 7:00 a.m. to 7:00 p.m.

City of Baldwin Park General Plan

As discussed in *Section 4.3* below, the proposed Project is located approximately 445 feet northwest of residences within the City of Baldwin Park. As such, the pertinent noise standards and regulations for the City of Baldwin Park are provided below and discussed further *Section 6* below. The Noise Element of the Baldwin Park 2020 General Plan contains land use compatibility guidelines which are summarized in **Table 5: Baldwin Park Interior and Exterior Noise Standards**.

Table 5: Baldwin Park Interior and Exterior Noise Standards

Land Use	Interior[1]	Exterior[2]
Residential – Single family, multifamily, duplex, mobile home	45 dBA CNEL	65 dBA CNEL
Residential – Transient lodging, hotels, motels, nursing homes, hospitals	45 dBA CNEL	65 dBA CNEL
Private Offices, churches, libraries, board rooms, conference rooms, theaters, auditoriums, concert halls, meeting halls, etc.	45 dBA L_{eq} (12 hours)	-
Schools	45 dBA L_{eq} (12 hours)	67 dBA L_{eq}
General office, reception, clerical, etc.	50 dBA L_{eq} (12 hours)	-
Bank, lobby, retail store, restaurant, typing pool, etc.	55 dBA L_{eq} (12 hours)	-
Manufacturing, kitchen, warehousing, etc.	65 dBA L_{eq} (12 hours)	-
Parks, playgrounds	-	65 dBA CNEL
Golf Courses, outdoor spectator sports, amusement parks	-	70 dBA CNEL

1. Indoor standard with windows closed. Indoor environment excludes bathrooms, toilets, closets, and corridors.
2. Outdoor environment limited to rear yard of single-family homes, multifamily patios and balconies and common recreation areas. Outdoor environment limited to playground areas, picnic areas, and other areas of frequent human use.
Source: City of Baldwin Park, *Baldwin Park 2020 General Plan Noise Element*, 2002.

City of Baldwin Park Municipal Code

The City of Baldwin Park Municipal Code (BPMC) Section 130.34 limits the exterior noise standards for specific land uses as shown in **Table 6: Baldwin Park Municipal Code Noise Standards**. The BPMC Section 130.34 also limits the interior noise levels at any dwelling unit to 45 dBA at any time. Section 130.37 of the BPMC restricts construction from occurring within 500 feet of a residential zone between the hours of 7:00 p.m. and 7:00 a.m. in such a way the causing discomfort or annoyance unless a permit has been obtained from the Department of Public Works.

Table 6: Baldwin Park Municipal Code Noise Standards

Zone	7 a.m. to 10 p.m.	10 p.m. to 7 a.m.
Single-Family Residential (R-1)	55 dBA	45 dBA
Garden Multi-family Residential (RG) and High Density Multi-family Residential (R-3)	60 dBA	55 dBA
Commercial	65 dBA	60 dBA
Industrial	70 dBA	70 dBA

Source: Baldwin Park Municipal Code, Chapter 130.34

4 EXISTING CONDITIONS

4.1 Existing Noise Sources

The City is impacted by various noise sources. Mobile sources of noise, especially cars, trucks, and trains are the most common and significant sources of noise. Other noise sources are the various land uses (i.e., residential, commercial, institutional, and recreational and parks activities) throughout the City that generate stationary-source noise.

Mobile Sources

The predominant mobile noise source near the Project site is the traffic noise along Live Oak Avenue, which is located directly south of the site, Stewart Avenue, which is located to the west, and Rivergrade road, which is located north of the site. Interstate-605 (I-605) is located approximately 0.6-mile to the west of the Project site and is also a contributor to mobile traffic noise in the vicinity of the site.

Stationary Sources

The primary sources of stationary noise in the vicinity of the Project site are those associated with the operations of adjacent commercial and industrial uses surrounding the site. The noise associated with these sources may represent a single-event noise occurrence or short-term noise. Other noises include those typical of urban areas, including mechanical equipment (e.g., heating ventilation and air conditioning [HVAC] equipment), dogs barking, idling vehicles, and employee/patron talking.

4.2 Noise Measurements

To quantify existing ambient noise levels in the Project area, Kimley-Horn conducted four short-term noise measurements on December 14, 2023; see **Appendix A: Noise Data**. The noise measurement sites were representative of typical existing noise exposure within and immediately adjacent to the Project site. The 15-minute measurements were taken between 8:22 a.m. and 9:40 a.m. near potential and existing sensitive receptors (see **Exhibit 4: Noise Measurement Locations**) surrounding the site. Short-term L_{eq} measurements are considered representative of the noise levels throughout the day. The noise levels and sources of noise measured at each location are listed in **Table 7: Existing Noise Measurements**.

Table 7: Existing Noise Measurements

Site	Location	L_{eq} (dBA)	L_{min} (dBA)	L_{max} (dBA)	Time
ST-1	Stewart Avenue in front of closest residence to Project Site	66.4	46.3	80.8	9:40 a.m.
ST-2	On Live Oak Avenue directly across from Project Site	74.6	60.3	83.5	8:45 a.m.
ST-3	On Rivergrade Road between Steward Avenue and Arrow Highway	65.7	51.6	78.5	8:20 a.m.
ST-4	Corner of Joanbridge Street and Baldwin Park Boulevard	67.9	48.3	85.1	9:11 a.m.
Source: Noise measurements taken by Kimley-Horn, December 14, 2023. See **Appendix A** for noise measurement results.					

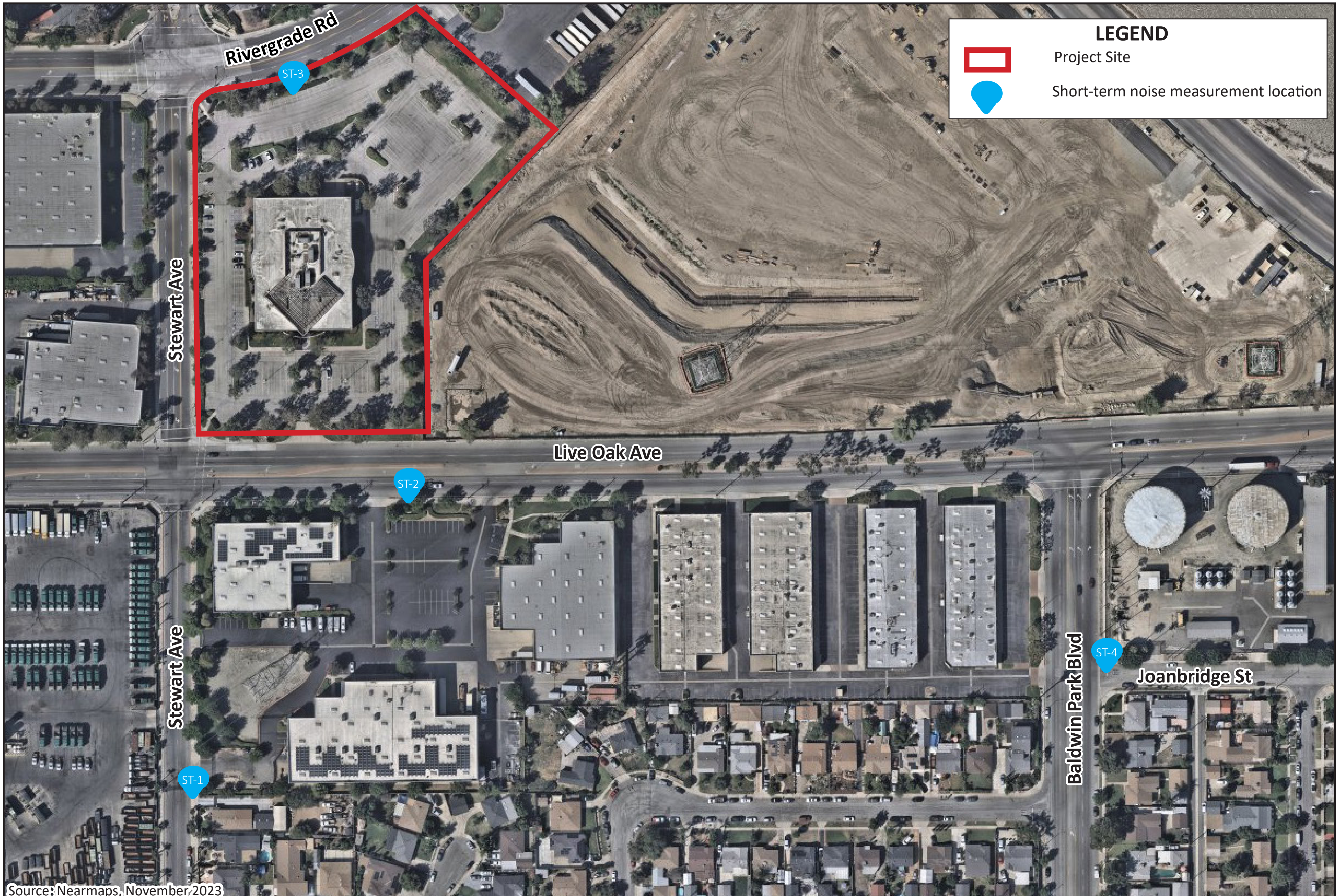

Exhibit 4: NOISE MEASUREMENT LOCATIONS

14005 Live Oak Avenue Project

NOT TO SCALE

Kimley»Horn

4.3 Sensitive Receptors

Sensitive populations are more susceptible to the effects of noise pollution than is the general population. Sensitive receptors that are in proximity to stationary sources of noise and vibration are of particular concern. Noise sensitive uses typically include residences, hospitals, schools, childcare facilities, and places of assembly. Vibration sensitive receivers are generally similar to noise sensitive receivers but may also include businesses, such as research facilities and laboratories that use vibration-sensitive equipment. Sensitive land uses within 1,000 feet of the Project site consist of single-family residential and multi-family communities located within the City of Baldwin Park. The closest sensitive receptor in the City of Irwindale is the Kare Youth League and Chamberlain University located more than 2,741 feet and 3,000 feet away, respectively. Sensitive land uses nearest to the Project site are shown in **Table 8: Sensitive Receptors** and **Exhibit 5: Sensitive Receptors.**

Table 8: Sensitive Receptors

Receptor Description	Distance[1] and Direction from the Project
Single-Family Residences[2]	445 feet to the southeast
Multi-Family Residences[2]	530 feet to the south
Single-Family Residences[2]	580 feet to the south
Margaret Heath Elementary School[2]	1,995 feet to the southeast
Kare Youth League[3]	2,741 feet to the northwest
Chamberlain University[3]	3,000 feet to the southwest

1. Distance measured from the Project site boundary to the nearest sensitive receptor property line.
2. Receptors are located within the City of Baldwin Park.
3. Receptors are located within the City of Irwindale

Source: Google Earth, 2023.

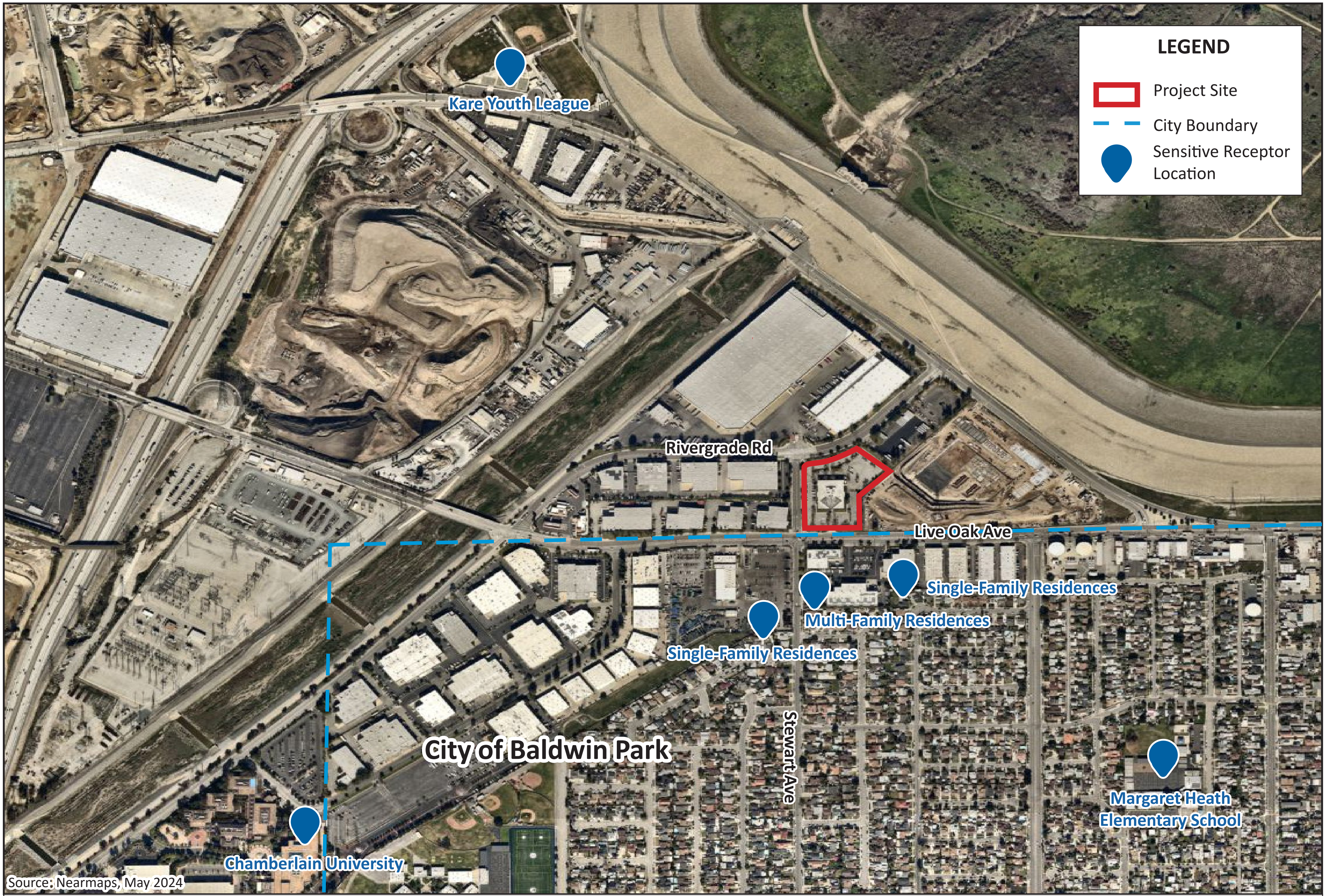

Exhibit 5: SENSITIVE RECEPTORS

14005 Live Oak Avenue Project

NOT TO SCALE

Kimley»Horn

5 SIGNIFICANCE CRITERIA AND METHODOLOGY

5.1 CEQA Thresholds

California Environmental Quality Act (CEQA) Guidelines Appendix G contains analysis guidelines related to noise impacts. These guidelines have been used by the City to develop thresholds of significance for this analysis. A project would create a significant environmental impact if it would:

- Generate a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies;
- Generate excessive ground-borne vibration or ground-borne noise levels; and
- For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, expose people residing or working in the Project area to excessive noise levels.

5.2 Methodology

Construction

Construction noise levels were based on typical noise levels generated by construction equipment published by the Federal Transit Administration (FTA) and FHWA. Construction noise is assessed in dBA L_{eq}. This unit is appropriate because L_{eq} can be used to describe noise level from operation of each piece of equipment separately, and levels can be combined to represent the noise level from all equipment operating during a given period.

Reference noise levels are used to estimate operational noise levels at nearby sensitive receptors based on a standard noise attenuation rate of 6 dB per doubling of distance (line-of-sight method of sound attenuation for point sources of noise). Noise level estimates do not account for the presence of intervening structures or topography, which may reduce noise levels at receptor locations. Therefore, the noise levels presented herein represent a conservative, reasonable worst-case estimate of actual temporary construction noise.

Per the City of Irwindale noise ordinance, if construction activities are within 500 feet of a residential zone, construction activities exceeding 75 dBA ambient base noise levels between 7:00 a.m. and 7:00 p.m. at the property boundary of an industrial zone would be considered a significant impact, unless authorization has been duly obtained beforehand from the building inspector.

The City of Baldwin Park does not have a quantitative threshold for construction noise. Section 130.37 limits the hours of construction between 7:00 a.m. and 7:00 p.m. when within 500 feet of a residential zone.

Operations

The analysis of the Project's noise environment is based on noise prediction modeling and empirical observations. Reference noise level data are used to estimate the Project's operational noise impacts from stationary sources. Noise levels were collected from published sources from similar types of activities and used to estimate noise levels expected with the Project's stationary sources. The reference noise levels are used to represent a worst-case noise environment as noise level from stationary sources can vary throughout the day. Operational noise is evaluated based on the standards within the City's noise standards and General Plan.

As mentioned previously, the closest sensitive receptor located in the City of Irwindale is located approximately 2,741 feet northwest of the Project site. Thus, operational noise levels from the Project would not impact any sensitive receptors in the City of Irwindale. However, the Project site is located adjacent to commercial and industrial uses within the City of Irwindale. Per the City of Irwindale General Plan, exterior noise levels of up to 67 dBA CNEL are "conditionally acceptable" for commercial/professional office buildings and industrial land. Additionally, per the City of Irwindale noise ordinance, noise levels exceeding 75 dBA ambient base noise levels between 7:00 a.m. and 10:00 p.m. at the property boundary of an industrial zone would be considered a significant impact.

For sensitive receptors located in the City of Baldwin Park, noise levels must be below 65 dBA CNEL per the Baldwin Park 2020 General Plan and below 55 dBA L_{eq} during the daytime and 45 dBA L_{eq} during the nighttime per the BPMC. For nearby industrial receptors, noise levels must not exceed 70 dBA L_{eq} per the BPMC.

Vibration

Ground-borne vibration levels associated with construction activities for the Project were evaluated utilizing typical ground-borne vibration levels associated with construction equipment, obtained from FTA published data for construction equipment. Potential ground-borne vibration impacts related to building/structure damage and interference with sensitive existing operations were evaluated, considering the distance from construction activities to nearby land uses and typically applied criteria for structural damage and human annoyance. Per FTA guidance, a vibration limit of 12.7 millimeters per second (mm/sec; 0.5 inch/sec) PPV is used for buildings that are structurally sound and designed to modern engineering standards. A conservative vibration limit of 5 mm/sec (0.2 inches/sec) PPV has been used for buildings that are found to be structurally sound but where structural damage is a major concern. For historic buildings or buildings that are documented to be structurally weakened, a limit of 2 mm/sec (0.08 inches/sec) PPV is used to provide the highest level of protection.

6 POTENTIAL IMPACTS AND MITIGATION

6.1 Acoustical Impacts

Threshold 6.1 Would the Project generate a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?

Construction

Construction noise typically occurs intermittently and varies depending on the nature or phase of construction (e.g., land clearing, grading, excavation, paving). Noise generated by construction equipment, including earth movers, material handlers, and portable generators, can reach high levels. During construction, exterior noise levels could affect the residential neighborhoods located to the northwest and southeast of the construction site. However, it is acknowledged that construction activities would occur throughout the Project site and would not be concentrated at a single point near sensitive receptors.

Construction activities would include site preparation, grading, building construction, paving, and architectural coating. Typical operating cycles for the construction equipment used in these phases may involve 1 or 2 minutes of full power operation followed by 3 to 4 minutes at lower power settings. Other primary sources of acoustical disturbance would be random incidents, which would last less than one minute (such as dropping material or the hydraulic movement of machinery lifts). Noise generated by construction equipment, including earth movers, material handlers, and portable generators, can reach high levels. Typical noise levels associated with individual construction equipment are listed in **Table 9: Typical Construction Noise Levels**.

Table 9: Typical Construction Noise Levels

Equipment	Noise Level (dBA) at 50 feet from Source[1]
Air Compressor	80
Backhoe	80
Compactor	82
Concrete Mixer	85
Concrete Pump	82
Concrete Vibrator	76
Crane, Derrick	88
Crane, Mobile	83
Dozer	85
Generator	82
Grader	85
Impact Wrench	85
Jack Hammer	88
Loader	80
Paver	85
Pile-driver (Sonic)	95

Table 9: Typical Construction Noise Levels	
Equipment	**Noise Level (dBA) at 50 feet from Source[1]**
Pneumatic Tool	85
Pump	77
Roller	85
Saw	76
Scraper	85
Shovel	82
Truck	84
1. Calculated using the inverse square law formula for sound attenuation: $dBA_2 = dBA_1+20Log(d_1/d_2)$ Where: $QWdBA_2$ = estimated noise level at receptor; dBA_1 = reference noise level; d_1 = reference distance; d_2 = receptor location distance.	
Source: Federal Transit Administration, *Transit Noise and Vibration Impact Assessment Manual*, September 2018.	

Following the FTA's methodology for quantitative construction noise assessments, the FHWA Roadway Construction Noise Model (RCNM) was used to predict construction noise. The noise levels identified in **Table 10: Project Construction Noise Levels**, show the exterior construction noise at the nearest sensitive receptors, without accounting for attenuation from existing physical barriers.

Section 9.28.110 of the IMC states that if construction activities within 500 feet of a residential zone, exceed 75 dBA ambient base noise levels at the property boundary of an industrial zone, it would be considered a significant impact. The nearest sensitive receptor within the City of Irwindale is located approximately 2,741 feet northwest. At this distance construction noise levels would remain below the IMC Section 9.28.110 construction threshold of 75 dBA. Construction activities may also cause increased noise along site access routes due to movement of equipment and workers. However, compliance with the IMC would minimize impacts from construction noise, as construction would be limited to daytime hours on weekdays and Saturdays.

The City of Baldwin Park does not have a quantitative construction noise standard. Therefore, the FTA Transit Noise and Vibration Impact Assessment Manual's (2018) (FTA Noise and Vibration Manual) maximum 8-hour noise level standard of 80 dBA L_{eq} at residential uses for short-term construction activities is utilized for the receptors located in the City of Baldwin Park. As shown in **Table 10**, the highest exterior noise level at the nearest sensitive receptors would occur during the site preparation and building construction stage of construction and would be 68.6 dBA and 70.1 dBA, respectively. Therefore, construction noise levels would not exceed the FTA's construction noise standards of 80 dBA L_{eq} at the City of Baldwin Park receptors. Further, the Project would be consistent with Section 130.37 of the BPMC which restricts construction from occurring within 500 feet of a residential zone between the hours of 7:00 p.m. and 7:00 a.m.

As discussed above, construction noise levels associated with the Project would not exceed the FTA's construction noise standards or the IMC Section 9.28.110 construction noise threshold and would be required to comply with the Baldwin Park and Irwindale Municipal Code standards. Therefore, the Project would result in a less than significant construction noise impact.

Table 10: Project Construction Noise Levels						
Construction Phase	**Receptor Location**			**Worst Case Modeled Noise Level, dBA $L_{eq\ (8\text{-hour})}$ [2]**	**Noise Standard, dBA L_{eq} [3,4]**	**Exceeded?**
	Land Use	**Distance (feet)[1]**	**Direction**			
Demolition	Residential	445	Southeast	67.5	80	**No**
	Residential	530	South	65.9	80	**No**
	Residential	580	South	65.2	80	**No**
	School	1,995	Southeast	54.4	80	**No**
Site Preparation	Residential	445	Southeast	68.6	80	**No**
	Residential	530	South	67.1	80	**No**
	Residential	580	South	66.3	80	**No**
	School	1,995	Southeast	55.6	80	**No**
Grading	Residential	445	Southeast	68.3	80	**No**
	Residential	530	South	66.8	80	**No**
	Residential	580	South	66.0	80	**No**
	School	1,995	Southeast	55.2	80	**No**
Paving	Residential	445	Southeast	67.5	80	**No**
	Residential	530	South	66.0	80	**No**
	Residential	580	South	65.2	80	**No**
	School	1,995	Southeast	54.5	80	**No**
Building Construction	Residential	445	Southeast	70.1	80	**No**
	Residential	530	South	68.6	80	**No**
	Residential	580	South	67.8	80	**No**
	School	1,995	Southeast	57.0	80	**No**
Architectural Coating	Residential	445	Southeast	54.7	80	**No**
	Residential	530	South	53.2	80	**No**
	Residential	580	South	52.4	80	**No**
	School	1,995	Southeast	57.0	80	**No**

1. Distance measured from the location of the Project site boundary to the receptor's nearest property line.
2. Modeled noise levels conservatively assume the simultaneous operation of all pieces of equipment.
3. The FTA Noise and Vibration Manual establishes construction noise standards of 80 dBA L_{eq}(8-hour) for residential uses.

Source: Irwindale Municipal Code, 2022. Refer to **Appendix A** for noise modeling results

Operations

Implementation of the Project would create new sources of noise in the vicinity of the Project site. The major noise sources associated with the Project including the following:

- Mechanical equipment (i.e., trash compactors, air conditioners, etc.);
- Parking areas (i.e., car door slamming, car radios, engine start-up, and car pass-by);
- Loading dock activities (i.e., slow moving trucks on the site, maneuvering and idling trucks, air brakes, backup beepers, equipment noise) and;
- Off-site traffic noise

Mechanical Equipment. Potential stationary noise sources related to long-term operation of the Project site would include mechanical equipment. Mechanical equipment (e.g., heating ventilation and air conditioning [HVAC] equipment) typically generates noise levels of approximately 52 dBA L_{eq} at 50 feet.[9] The closest commercial/industrial receptor in the City of Irwindale is located approximately 250 feet to the west of the proposed building. At this distance, noise levels from mechanical equipment would reach 38.0 dBA L_{eq} which is below the 75 L_{eq} dBA standard.

At the closest sensitive receptor in the City of Baldwin Park (the single-family residences located approximately 745 feet southeast of on-site mechanical equipment), mechanical equipment noise would attenuate to 28.5 dBA L_{eq} and would not exceed the City of Baldwin Park's allowable noise levels of 55 dBA L_{eq} during the daytime and 45 dBA L_{eq} during the nighttime for residential uses. The closest industrial receptor in the City of Baldwin Park is located approximately 370 feet south and would experience a noise level of 34.6 dBA L_{eq} which would not be above the 70 dBA L_{eq} standard for industrial uses. Therefore, noise associated with the Project's mechanical equipment would be less than significant.

Truck and Loading Dock Noise. During loading and unloading activities, noise would be generated by the trucks' diesel engines, exhaust systems, and brakes during low gear shifting' braking activities; backing up toward the docks; dropping down the dock ramps; and maneuvering away from the docks. Loading dock noise is approximately 64 dBA L_{eq} at 50 feet.[10] The closest commercial/industrial receptor in the City of Irwindale is located approximately 350 feet to the west of the proposed loading docks. At this distance, noise levels from mechanical equipment would reach 47.5 dBA L_{eq} which is below the 75 L_{eq} dBA standard.

At the closest sensitive receptor in the City of Baldwin Park (the single-family residences located approximately 745 feet southeast of loading docks), loading dock noise levels would be 40.9 dBA L_{eq} and would not exceed the City of Baldwin Park's allowable noise levels of 55 dBA L_{eq} during the daytime and 45 dBA L_{eq} during the nighttime for residential uses. The closest industrial receptor in the City of Baldwin Park is located approximately 410 feet south and would experience a noise level of 46.1 dBA L_{eq} which would not be above the 70 dBA L_{eq} standard for industrial uses.

Furthermore, loading dock doors would be surrounded with protective aprons, gaskets, or similar improvements that, when a trailer is docked, would serve as a noise barrier between the interior warehouse activities and the exterior loading area. This would attenuate noise emanating from interior activities, and as such, interior loading and associated activities would be permissible during all hours of the day. Therefore, the Project would result in a less than significant impact related to stationary noise levels.

Parking Lot Noise. The Project would provide 64 parking stalls for passenger vehicles and 13 electronic vehicle (EV) spaces. Parking stalls would be located throughout the Project site. Nominal parking noise would occur within the on-site parking facilities. Traffic associated with parking lots is typically not of sufficient volume to exceed community noise standards, which are based on a time-averaged scale such as the CNEL scale. The instantaneous maximum sound levels generated by a car door slamming, engine

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9 Elliott H. Berger, Rick Neitzel, and Cynthia A. Kladden, *Noise Navigator Sound Level Database with Over 1700 Measurement Values*, July 6, 2010.

10 Loading docks reference noise level measurements conducted by Kimley-Horn on December 18, 2018. Loading dock activities included trucks arriving at the docks, backing up, and loading/unloading using palette jacks.

starting up, and car pass-bys range from 53 to 61 dBA L_{eq} [11] at 50 feet and may be an annoyance to adjacent noise-sensitive receptors. Conversations in parking areas may also be an annoyance to nearby sensitive receptors. Sound levels of speech typically range from 33 dBA at 50 feet for normal speech to 50 dBA L_{eq} at 50 feet for very loud speech.[12] It should be noted that parking lot noises are instantaneous noise levels compared to noise standards in the hourly L_{eq} metric, which are averaged over the entire duration of a time period.

Parking lot noise would occur at the surface parking lot on-site and would attenuate to approximately 48.0 dBA L_{eq} at the nearest industrial receptors located 280 feet west of the Project parking area and would not exceed the City of Irwindale's noise standard of 75 dBA L_{eq}. At the closest sensitive receptor in the City of Baldwin Park (the single-family residences located approximately 540 feet southeast of parking area), parking area noise levels would be 42.3 dBA L_{eq} and would not exceed the City of Baldwin Park's allowable noise levels of 55 dBA L_{eq} during the daytime and 45 dBA L_{eq} during the nighttime for residential uses. The closest industrial receptor in the City of Baldwin Park is located approximately 170 feet south and would experience a noise level of 52.4 dBA L_{eq} which would not be above the 70 dBA L_{eq} standard for industrial uses.

Furthermore, parking lot noise also currently occurs at the adjacent properties under existing conditions and would be consistent with the existing noise in the vicinity and would be partially masked by background noise from traffic along area roadways. Noise associated with parking lot activities is not anticipated to exceed the City's noise standards during operation. Therefore, noise impacts from parking lots would be less than significant.

Combined Noise Levels. Project operations could potentially result in simultaneous noise generating activities associated with the mechanical equipment, truck loading area, and parking lot area. The combined noise level associated with the simultaneous operation of all on-site noise sources at the nearest commercial/industrial receptor in the City of Irwindale would be approximately 51.0 dBA L_{eq} and would not exceed the City of Irwindale's noise standard of 75 dBA L_{eq}. At the closest sensitive receptor in the City of Baldwin Park (the single-family residences) the combined noise level would approximately 44.8 dBA L_{eq} and would not exceed the City of Baldwin Park's allowable noise levels of 55 dBA L_{eq} during the daytime and 45 dBA L_{eq} during the nighttime for residential uses. Furthermore, the combined noise levels at the nearest industrial receptor in the City of Baldwin Park would be 53.4 L_{eq} and would not exceed the 70 dBA L_{eq} standard for industrial uses. Therefore, noise impacts associated with the simultaneous operation of all on-site noise sources would be less than significant.

Off-Site Traffic Noise. Implementation of the Project would generate increased traffic volumes along nearby roadway segments. Traffic data provided by *Traffic Impact Analysis* (Environmental Planning Development Solutions, Inc., 2023) shows that the proposed Project would generate 174 daily trips which would result in noise increases on Project area roadways. In general, a traffic noise increase of less than 3 dBA is barely perceptible to people, while a 5-dBA increase is readily noticeable.[13] Generally, traffic volumes on Project area roadways would have to approximately double for the resulting traffic noise

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11 Kariel, H. G., *Noise in Rural Recreational Environments*, Canadian Acoustics 19(5), 3-10, 1991.

12 Elliott H. Berger, Rick Neitzel, and Cynthia A. Kladden, *Noise Navigator Sound Level Database with Over 1700 Measurement Values*, 2015.

13 Federal Highway Administration, *Highway Traffic Noise Analysis and Abatement Policy and Guidance, Noise Fundamentals*, https://www.fhwa.dot.gov/environMent/noise/regulations_and_guidance/polguide/polguide02.cfm, accessed January 3, 2024.

levels to increase by 3 dBA. Therefore, permanent increases in ambient noise levels of less than 3 dBA are considered to be less than significant.

According to the City of Irwindale General Plan, the average daily traffic along Live Oak Avenue, west of Arrow Highway (the closest study road segment to the Project site) is 27,300 vehicles. Therefore, the Project would not generate sufficient traffic to double existing volumes and result in a permanent 3-dBA increase in ambient noise levels. Noise impacts associated with traffic would be less than significant.

Mitigation Measures: No mitigation is required.

Level of Significance: Less than significant impact.

Threshold 6.2 Would the Project generate excessive ground-borne vibration or ground-borne noise levels?

Increases in ground-borne vibration levels attributable to the proposed Project would be primarily associated with short-term construction-related activities. Construction on the Project site would have the potential to result in varying degrees of temporary ground-borne vibration, depending on the specific construction equipment used and the operations involved.

The Federal Transit Administration (FTA) has published standard vibration velocities for construction equipment operations in their 2018 *Transit Noise and Vibration Impact Assessment Manual*. The types of construction vibration impacts include human annoyance and building damage. In general, the FTA architectural damage criterion for continuous vibrations (i.e., 0.2 in/sec) appears to be conservative. The types of construction vibration impacts include human annoyance and building damage. Human annoyance occurs when construction vibration rises significantly above the threshold of human perception for extended periods of time (0.20 in/sec annoyance threshold).[14] Building damage can be cosmetic or structural. Ordinary buildings that are not particularly fragile would not experience any cosmetic damage (e.g., plaster cracks) at distances beyond 30 feet. This distance can vary substantially depending on the soil composition and underground geological layer between vibration source and receiver. In addition, not all buildings respond similarly to vibration generated by construction equipment. For example, for a building that is constructed with reinforced concrete with no plaster, the FTA guidelines show that a vibration level of up to 0.20 in/sec is considered safe and would not result in any construction vibration damage.

The nearest structure to the Project site is the Price Impact Wholesale building located approximately 45 feet to the west. **Table 11: Typical Construction Equipment Vibration Levels**, lists vibration levels at 25 feet and 45 feet for typical construction equipment. Ground-borne vibration generated by construction equipment spreads through the ground and diminishes in magnitude with increases in distance. As indicated in **Table 11**, based on FTA data, vibration velocities from typical heavy construction equipment operations that could be used during Project construction range from 0.001 to 0.087 in/sec PPV at 45 feet from the source of activity (the distance from active construction zone to the nearest structure to the west), which is below the FTA's 0.20 PPV threshold for structural damage and Caltrans threshold for

14 California Department of Transportation, *Transportation and Construction Vibration Guidance Manual*, Table 5, April 2020.

annoyance. Therefore, vibration impacts associated with the Project construction would be less than significant.

Table 11: Typical Construction Equipment Vibration Levels		
Equipment	**Peak Particle Velocity at 25 Feet (in/sec)**	**Peak Particle Velocity at 45 Feet (in/sec)**[1]
Vibratory Roller	0.210	0.087
Large Bulldozer	0.089	0.037
Loaded Trucks	0.076	0.032
Small Bulldozer/ Tractors	0.003	0.001
1. Calculated using the following formula: $PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$, where: PPV_{equip} = the peak particle velocity in in/sec of the equipment adjusted for the distance; PPV_{ref} = the reference vibration level in in/sec from Table 7-4 of the Federal Transit Administration, *Transit Noise and Vibration Impact Assessment Manual*, 2018; D = the distance from the equipment to the receiver.		
Source: Federal Transit Administration, *Transit Noise and Vibration Impact Assessment Manual*, 2018.		

Once operational, the Project would not be a significant source of ground-borne vibration. Ground-borne vibration surrounding the Project currently results from heavy-duty vehicular travel (e.g., refuse trucks, heavy duty trucks, delivery trucks, and transit buses) on the nearby local roadways. Operations of the Project would include periodic truck activities. Due to the rapid drop-off rate of ground-borne vibration and the short duration of the associated events, vehicular traffic-induced ground-borne vibration is rarely perceptible beyond the roadway right-of-way, and rarely results in vibration levels that cause damage to buildings in the vicinity. According to the FTA's Transit Noise and Vibration Impact Assessment, trucks rarely create vibration levels that exceed 70 VdB (equivalent to 0.012 inches per second PPV) when they are on roadways. Therefore, trucks operating at the Project site or along surrounding roadways would not exceed FTA thresholds for building damage or annoyance. Impacts would be less than significant in this regard.

Mitigation Measures: No mitigation is required.

Level of Significance: Less than significant impact.

Threshold 6.3 For a Project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the Project expose people residing or working in the Project area to excessive noise levels?

The nearest airport to the Project site is the San Gabriel Valley Airport in El Monte, a public use strip, located approximately four miles to the west. The Project site is not within 2 miles of a public airport or private airfield, or identified within an airport land use plan. Further, there are not any specific flight corridors that overfly the City. During field surveys conducted in the City, helicopter operations were observed within the vicinity of the Santa Fe Dam, however, no observation of helicopters were made during Project field visits. Therefore, the Project would not expose people residing or working in the Project area to excessive airport- or airstrip-related noise levels and no mitigation is required.

Mitigation Measures: No mitigation is required.

Level of Significance: Less than significant impact.

6.2 Cumulative Noise Impacts

Cumulative Construction Noise

The Project's construction activities would not result in a substantial temporary increase in ambient noise levels. Construction noise would be periodic and temporary noise impacts that would cease upon completion of construction activities. The Project would contribute to other proximate construction Project noise impacts if construction activities were conducted concurrently. However, based on the noise analysis above, the Project's construction-related noise impacts would be less than significant by implementing the City of Irwindale Municipal Code.

Construction activities at other planned and approved projects near the Project site would be required to comply with applicable City rules related to noise and would take place during daytime hours on the days permitted by the applicable Municipal Code, and projects requiring discretionary City approvals would be required to evaluate construction noise impacts, comply with the City's standard conditions of approval, and implement mitigation, if necessary, to minimize noise impacts. Construction noise impacts are by nature localized. Based on the fact that noise dissipates as it travels away from its source, noise impacts would be limited to the Project site and vicinity. Therefore, Project construction would not result in a cumulatively considerable contribution to significant cumulative impacts, assuming such a cumulative impact existed, and impacts in this regard are not cumulatively considerable.

Cumulative Operational Noise

Cumulative Off-Site Traffic Noise. Cumulative noise impacts describe how much noise levels are projected to increase over existing conditions with the development of the proposed Project and other foreseeable projects. Cumulative noise impacts generally occur as a result of increased traffic on local roadways due to buildout of the Project and other projects in the vicinity. However, the Project is projected to result in 174 new daily vehicular trips and would result in a minimal traffic noise increase (less than 3.0 dBA) along local roadways. Therefore, the Project's contribution would not be cumulatively considerable.

Cumulative Stationary Noise. Stationary noise sources of the Project would not result in an incremental increase in non-transportation noise sources in the vicinity of the site. Therefore, operational noise caused by the proposed Project would be less than significant. Similar to the Project, other planned and approved projects would be required to mitigate for stationary noise impacts at nearby sensitive receptors, if necessary. As stationary noise sources are generally localized, there is a limited potential for other projects to contribute to cumulative noise impacts.

No known present or reasonably foreseeable projects would combine with the operational noise levels generated by the Project to increase noise levels above acceptable standards because each project must comply with applicable City regulations that limit operational noise. Therefore, the Project, together with other projects, would not create a significant cumulative impact, and even if there was such a significant cumulative impact, the Project would not make a cumulatively considerable contribution to significant cumulative operational noises.

Given that noise dissipates as it travels away from its source, operational noise impacts from on-site activities and other stationary sources would be limited to the Project site and immediate vicinity. Thus, cumulative operational noise impacts from related projects, in conjunction with project-specific noise impacts, would not be cumulatively significant.

Mitigation Measures: No mitigation is required.

Level of Significance: Less than significant impact.

7 REFERENCES

1. California Department of Transportation, *Traffic Noise Analysis Protocol*, 2020.
2. California Department of Transportation, *Technical Noise Supplement to the Traffic Noise Analysis Protocol*, 2013.
3. California Department of Transportation, *Transportation and Construction Vibration Guidance Manual,* 2020.
4. City of Baldwin Park, *Baldwin Park 2020 General Plan*, 2002.
5. City of Baldwin Park, *Municipal Code*, 2023.
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7. City of Irwindale, *Municipal Code*, 2022.
8. Elliott H. Berger, Rick Neitzel, and Cynthia A. Kladden, *Noise Navigator Sound Level Database with Over 1700 Measurement Values*, July 6, 2010.
9. Environment Planning Development Solutions, Inc., *Live Oak Irwindale Traffic Impact Analysis,* August 2023.
10. Federal Highway Administration, *Noise Fundamentals,* 2017.
11. Federal Highway Administration, *Roadway Construction Noise Model*, 2006.
12. Federal Interagency Committee on Noise, *Federal Agency Review of Selected Airport Noise Analysis Issues*, 1992.
13. Federal Transit Administration, *Transit Noise and Vibration Impact Assessment Manual*, 2018.
14. James P. Cowan, *Handbook of Environmental Acoustics,* 1994.
15. Kariel, H. G., *Noise in Rural Recreational Environments*, Canadian Acoustics 19(5), 3-10, 1991.

Appendix A

NOISE DATA

Noise Source	Reference Level (dBA)	Reference Distance (feet)	Distance to Receptor (feet)	Level at Receptor (dBA)[4]	Significant?
Mechanical Equipment[1]	52	50	250	38.0	No
Mechanical Equipment[1]	52	50	370	34.6	No
Mechanical Equipment[1]	52	50	745	28.5	No
Truck and Loading Docks[2]	64.4	50	350	47.5	No
Truck and Loading Docks[2]	64.4	50	410	46.1	No
Truck and Loading Docks[2]	64.4	50	745	40.9	No
Parking[3]	63	50	280	48.0	No
Parking[3]	63	50	170	52.4	No
Parking[3]	63	50	540	42.3	No

1. Source for reference level: Elliott H. Berger, Rick Neitzel, and Cynthia A. Kladden, *Noise Navigator Sound Level Database with Over 1700 Measurement Values* , July 6, 2010.

2. Loading dock reference noise level measurements conducted by Kimley-Horn on December 18, 2018.

3. Source for reference level: Kariel, H. G., *Noise in Rural Recreational Environments* , Canadian Acoustics 19(5), 3-10, 1991.

4. Calculated using the inverse square law formula for sound attenuation: $dBA_2 = dBA_1 + 20Log(d_1/d_2)$, where dBA_2 = estimated noise level at receptor; dBA_1 = reference noise level; d_1 = reference distance; d_2 = receptor location distance.

Project: 14005 Live Oak Avenue Project

Construction Noise Impact on Sensitive Receptors

Parameters

Construction Hours:	Daytime hours (7 am to 10 pm)
	Evening hours (7 pm to 10 pm)
	Nighttime hours (10 pm to 7 am)
Leq to L10 factor	

	Receptor (Land Use)	Distance (feet)	Shielding	Direction
1	Single-Family Residences	445	0	SE
2	Multi-Family Residences	530	0	S
3	Single-Family Residences	580	0	S
4	Margaret Heath Elementary School	2,000	0	SE

					RECEPTOR 1		RECEPTOR 2		RECEPTOR 3		RECEPTOR 4	
Construction Phase	**Equipment Type**	**No. of Equip.**	**Acoustical Usage Factor**	**Reference Noise Level at 50ft per Unit, Lmax**	**Noise Level at Receptor 1, Lmax**	**Noise Level at Receptor 1, Leq**	**Noise Level at Receptor 2, Lmax**	**Noise Level at Receptor 2, Leq**	**Noise Level at Receptor 3, Lmax**	**Noise Level at Receptor 3, Leq**	**Noise Level at Receptor 4, Lmax**	**Noise Level at Receptor 4, Leq**
Demolition												
	Dozer	2	40%	82	65.7	61.7	64.2	60.2	63.4	59.4	52.7	48.7
	Excavator	3	40%	81	66.5	62.5	65.0	61.0	64.2	60.2	53.4	49.5
	Concrete Saw	1	20%	90	70.6	63.6	69.1	62.1	68.3	61.3	57.6	50.6
Combined LEQ						**67.5**		**65.9**		**65.2**		**54.4**
Site Preparation												
	Dozer	3	40%	82	67.5	63.5	66.0	62.0	65.2	61.2	54.4	50.5
	Tractor	4	40%	84	71.0	67.1	69.5	65.5	68.7	64.8	58.0	54.0
Combined LEQ						**68.6**		**67.1**		**66.3**		**55.6**
Grading												
	Grader	1	40%	85	66.0	62.0	64.5	60.5	63.7	59.7	53.0	49.0
	Excavator	1	40%	81	61.7	57.7	60.2	56.2	59.4	55.4	48.7	44.7
	Tractor	3	40%	84	69.8	65.8	68.3	64.3	67.5	63.5	56.7	52.8
	Dozer	1	40%	82	62.7	58.7	61.2	57.2	60.4	56.4	49.7	45.7
Combined LEQ						**68.3**		**66.8**		**66.0**		**55.2**

Building Construction													
	Man Lift	6	20%	75	63.5	56.5	62.0	55.0	61.2	54.2	50.4	43.5
	Generator	2	50%	81	64.6	61.6	63.1	60.1	62.3	59.3	51.6	48.6
	Crane	2	16%	81	64.6	56.7	63.1	55.1	62.3	54.4	51.6	43.6
	Welder/Torch	2	40%	74	58.0	54.0	56.5	52.5	55.7	51.7	45.0	41.0
	Tractor	6	40%	84	72.8	68.8	71.3	67.3	70.5	66.5	59.7	55.8
Combined LEQ						**70.1**		**68.6**		**67.8**		**57.0**
Paving												
	Paver	2	50%	77	61.2	58.2	59.7	56.7	58.9	55.9	48.2	45.2
	Pavement Scarafier	2	20%	90	73.5	66.5	72.0	65.0	71.2	64.2	60.5	53.5
	Roller	2	20%	80	64.0	57.0	62.5	55.5	61.7	54.7	51.0	44.0
Combined LEQ						**67.5**		**66.0**		**65.2**		**54.5**
Architectural Coating												
	Compressor (air)	1	40%	78	58.7	54.7	57.2	53.2	56.4	52.4	45.7	41.7
Combined LEQ						**54.7**		**53.2**		**52.4**		**41.7**

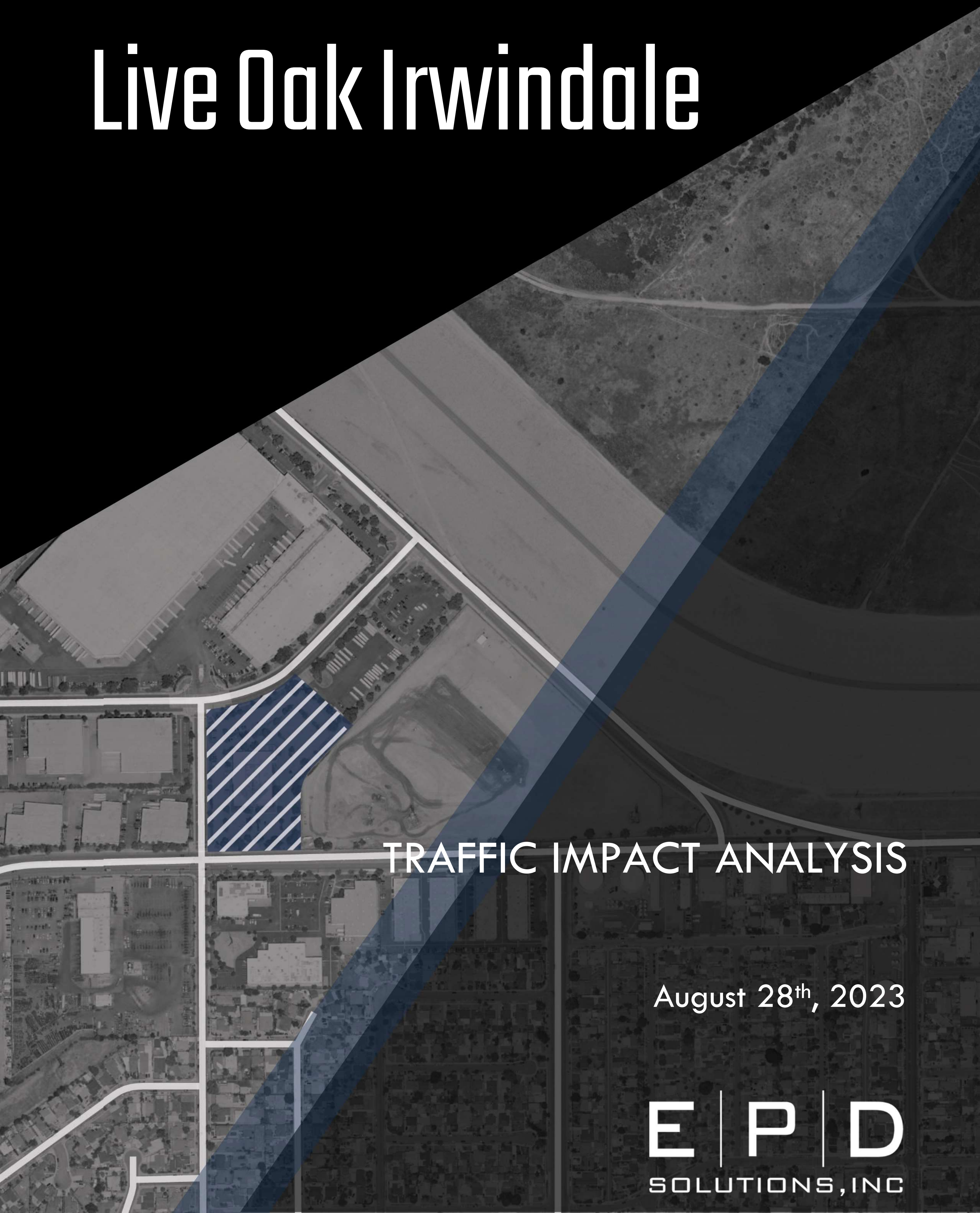
Source for Ref. Noise Levels: RCNM, 2005

Appendix L

Traffic Impact Analysis

Kimley»Horn

Live Oak Irwindale



TRAFFIC IMPACT ANALYSIS

August 28th, 2023

E | P | D
SOLUTIONS, INC

Live Oak Irwindale

Traffic Impact Analysis

City of Irwindale
August 28, 2023

Prepared For

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APPENDICES

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1 EXECUTIVE SUMMARY

This Traffic Impact Analysis (TIA) has been prepared by EPD Solutions, Inc. (EPD) to analyze the potential traffic-related impacts of the proposed project according to the approved scope of work using methodologies and significance criteria consistent with the City of Irwindale Policy Guidelines for Traffic Impact Reports and the City of Irwindale General Plan. The project proposes the demolition of an existing office building and the construction of a one-story warehouse building totaling 102,000 square feet (SF) at the southeast corner of Stewart Avenue and Rivergrade Road in the City of Irwindale.

The trip generation for the proposed development was analyzed in accordance with the ITE Trip Generation Manual, 11th Edition, 2021. The proposed project is estimated to generate approximately 174 daily trips, including 17 AM peak hour trips, and 18 PM peak hour trips. In terms of passenger car equivalent (PCE), the proposed project is estimated to generate approximately 248 daily PCE trips, including 25 PCE AM trips and 26 PCE PM trips.

The following intersections were evaluated during the AM and PM peak hours:

1. Stewart Avenue and Rivergrade Road
2. Stewart Avenue and Live Oak Avenue

AM and PM peak hour traffic operations were evaluated for the following scenarios:

1. Existing Conditions
2. Existing Plus Project Conditions
3. Future (Existing + Ambient Growth) Without Project Conditions
4. Future (Existing + Ambient Growth) Plus Project Conditions

"Future" conditions (scenarios 3 and 4) are analyzed for the year 2025.

Existing Conditions Intersection Analysis Results

All study intersections are forecast to operate at satisfactory levels of service (LOS) during the AM and PM peak hours under existing conditions, based on the Intersection Capacity Utilization (ICU) and Highway Capacity Manual (HCM) intersection analysis methodologies.

Existing Plus Project Traffic Conditions

All study intersections are forecast to operate at satisfactory LOS during the AM and PM peak hours under Existing Plus Project conditions based on ICU and HCM methodologies.

Future without Project (Existing + Ambient Growth) Traffic Conditions

All study intersections are forecast to operate at satisfactory LOS during the AM and PM peak hours under Future Without Project conditions based on ICU and HCM methodologies.

Future with Project (Existing + Ambient Growth) Traffic Conditions

All study intersections are forecast to operate at satisfactory LOS during the AM and PM peak hours under Future With Project conditions based on ICU and HCM methodologies.

Truck Analysis

The distribution for truck traffic generally follows the truck routes designated in the City's General Plan Circulation Element. Based on the analysis in this study, there would be adequate queuing for truck ingress and egress. The project site is expected to have 12 loading docks and appears to have enough space to accommodate truck turning on-site. No truck traffic is expected to disrupt either Live Oak Ave or Rivergrade Road.

Queueing Analysis

No queueing deficiencies were noted as a result of the project.

2 INTRODUCTION

This Traffic Impact Analysis (TIA) has been prepared by EPD Solutions, Inc. (EPD) to analyze the potential transportation-related impacts of the proposed warehouse building located on the southeast corner of the intersection of Stewart Ave. / Rivergrade Road. in the City of Irwindale. The project will have two driveways. The TIA was prepared according to the approved scope of work using methodologies and significance criteria consistent as per the City of Irwindale Policy Guidelines for Traffic Impact Reports and General Plan.

2.1 Project Description

The development plan involves demolishing an existing two-story, 56,000-square-foot office structure and constructing a one-story, 102,000-square-foot warehouse in its place. The project site is 5.13 acres, and the location of the site is shown in Figure 2.1, Project Location. The proposed project site plan is shown in Figure 2.2, Project Site Plan.

The project site will have two driveways. The driveway intersecting Rivergrade Road will be unrestricted. The driveway intersecting Live Oak Avenue will have a right turn-in and a right turn-out configuration as a raised-median acts as a barrier restricting left turn-in and turn-out movements. The gates servicing the driveways at both Live Oak Avenue and Rivergrade Road are intended to remain fully open during operating hours. Passenger and emergency vehicle access would be provided only by the driveway located on Live Oak Road. The warehouse building is expected to have 12 dock positions, 13 truck trailer parking spaces, and 65 passenger vehicle parking spaces.

Figure 2.1: Project Location

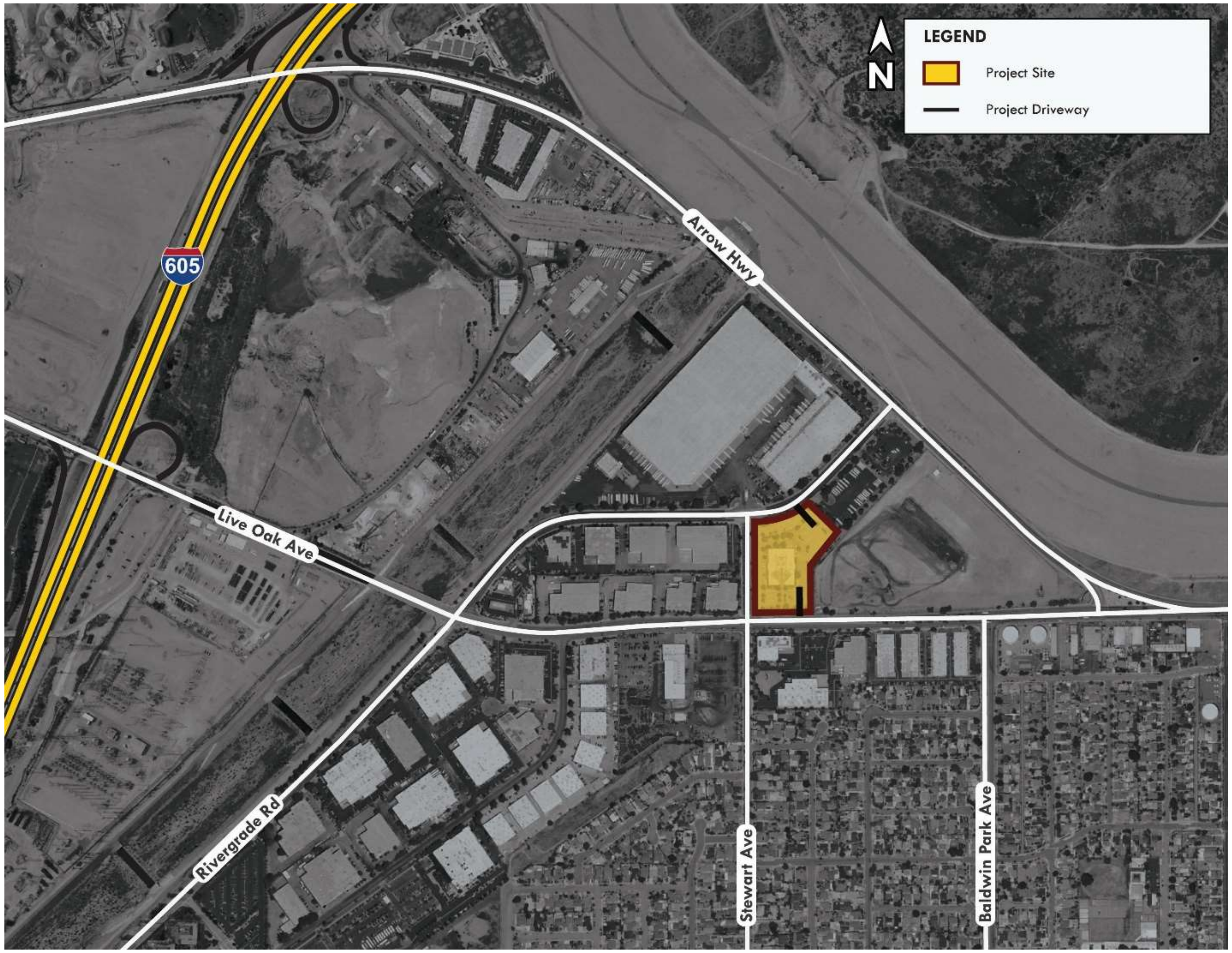
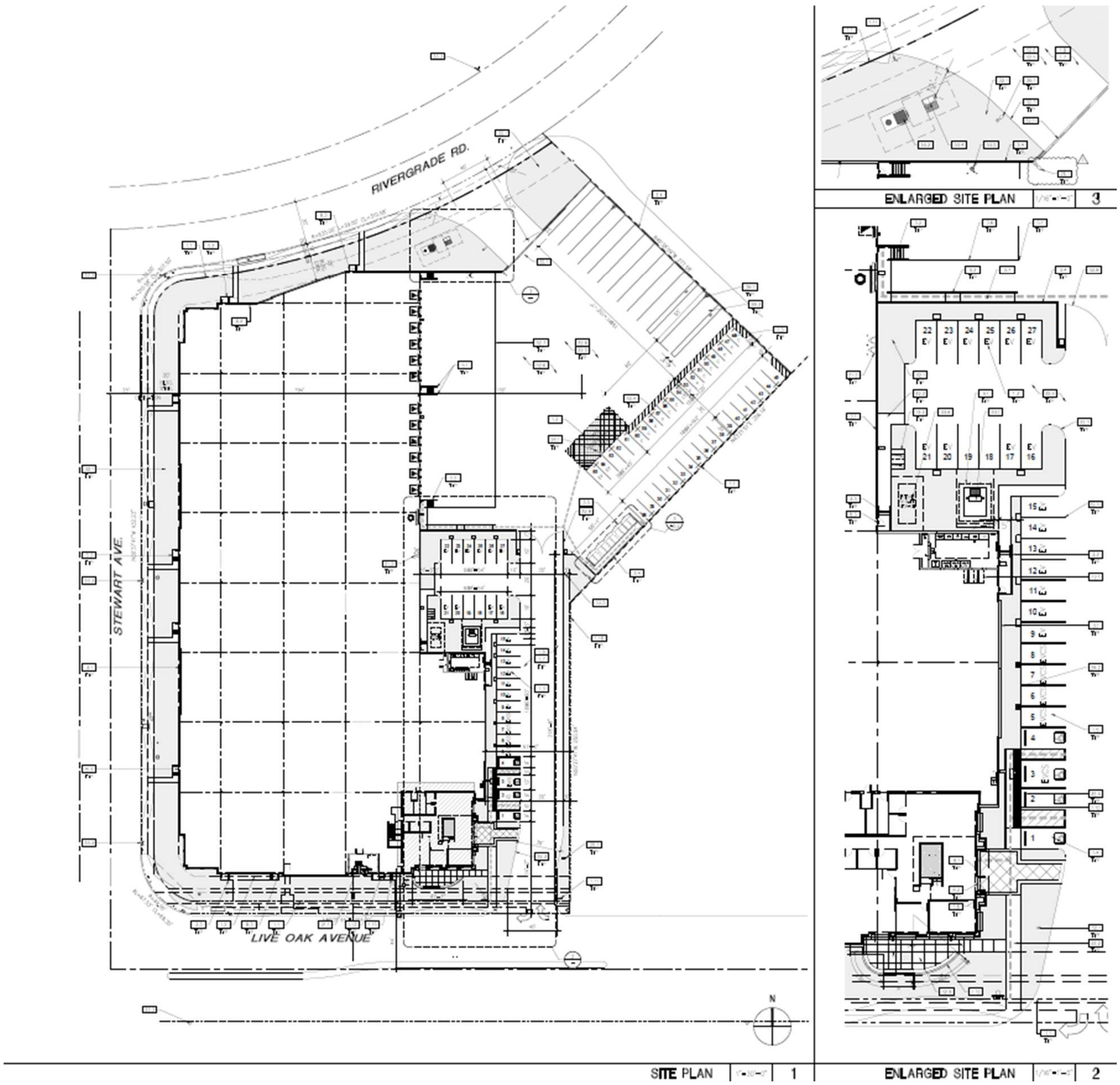


Figure 2.2: Project Site Plan



2.2 Study Area and Analysis Scenarios

As described in Section 1, Executive Summary, the following intersections were selected as part of this study to analyze any LOS and queuing deficiencies as a result of the project:

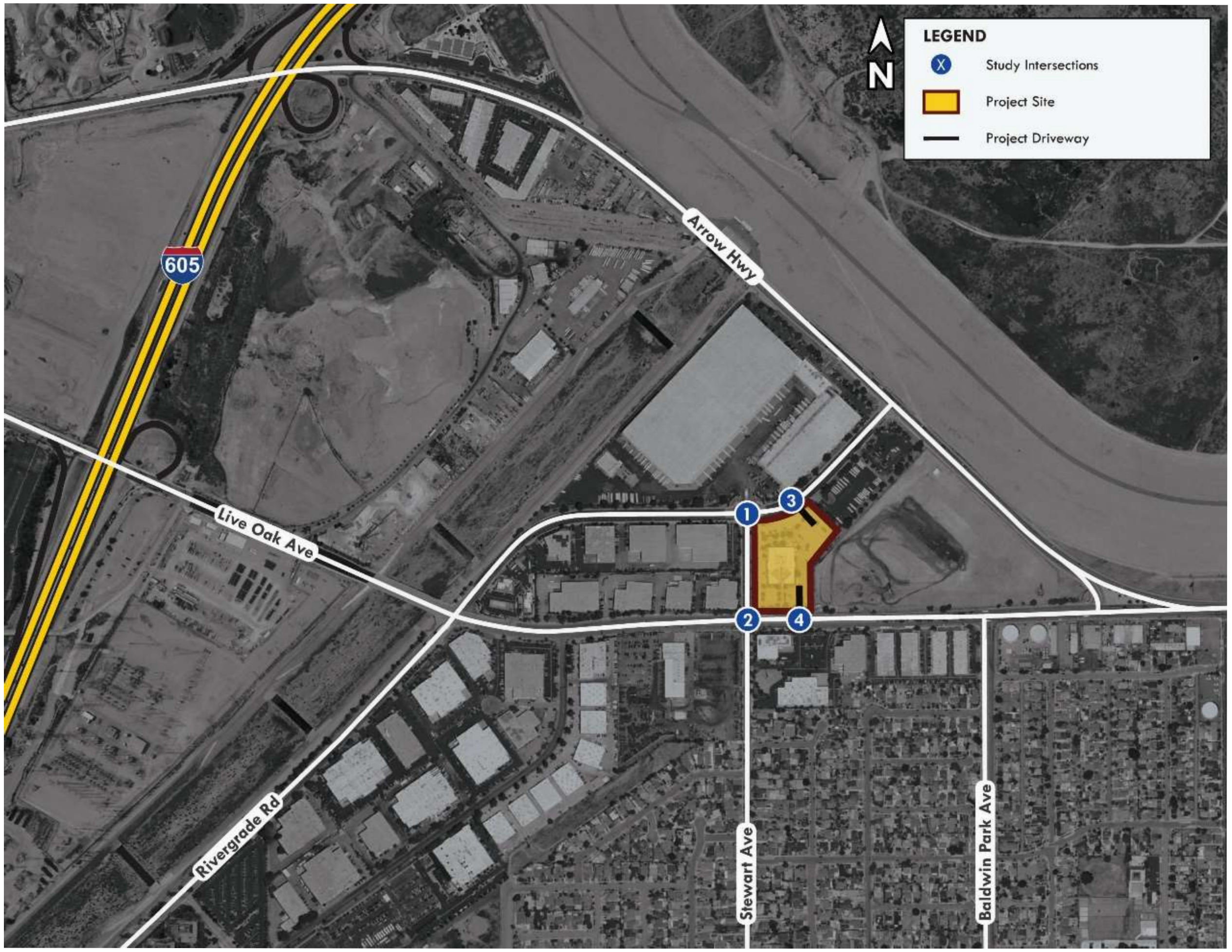
1. Stewart Avenue and Rivergrade Road
2. Stewart Avenue and Live Oak Ave

The locations of the study area intersections are shown in Figure 2.3, Project Study Area. The study area intersections were evaluated during the AM and PM peak hours, which are defined as the hour with the highest traffic volumes during the 7 AM to 9 AM and 4 PM to 6 PM peak commute periods. AM and PM peak hour traffic operations were evaluated for the following scenarios:

1. Existing Conditions (Without Project)
2. Existing Plus Project
3. Future Baseline (Without Project)
4. Future Plus Project

EPD collected counts for the study intersections on July 26, 2023. Existing Plus Project traffic volumes were developed by adding project traffic to the existing volumes. Future (2025) Baseline (Without Project) traffic volumes were developed by adding an ambient growth rate of two percent per year to existing traffic volumes and by adding traffic generated by other approved and pending development projects. Future (2025) Plus Project traffic volumes were developed by adding project traffic to the Future Baseline estimates. All traffic count data are provided in Appendix A.

Figure 2.3: Project Study Area



2.3 Methodology

Intersection operations were evaluated using Level of Service (LOS), which is a measure of the delay experienced by drivers on a roadway facility. "LOS A" indicates free-flow traffic conditions and is generally the best operating conditions. "LOS F" is an extremely congested condition and is the worst operating condition from the driver's perspective. Although the City of Irwindale (City) utilizes Intersection Capacity Utilization Methodology (ICU) to assess impacts, the Highway Capacity Manual (HCM), 7th Edition, methodology was also used in this TIA to assess queueing deficiency and delay at stop-controlled intersections, which cannot be assessed with ICU methodology.

For ICU methodology, the LOS of a signalized intersection or an arterial roadway is based upon the sum of the volume-capacity ratios (V/C) of the critical movements. Table 2.1 shows the relationship between V/C range and LOS.

Table 2.1: Relationship between V/C Range and LOS at a Signalized Intersection for ICU

LOS	V/C Range
A	0.00-0.60
B	0.61-0.70
C	0.71-0.80
D	0.81-0.90
E	0.91-1.00
F	1.00+

For HCM 7th Edition methodology, LOS at signalized intersections is defined in terms of the weighted average control delay for the intersection. Control delay is a measure of the increase in travel time that is experienced due to traffic signal control and is expressed in terms of average control delay per vehicle (in seconds). Control delay is determined based on the intersection geometry and volume, signal cycle length, phasing, and coordination along the arterial corridor. Table 2.2 shows the relationship between control delay and LOS.

Table 2.2: Relationship of Control Delay and LOS at a Signalized Intersection for HCM Methodology

LOS	Delay (Seconds per Vehicle)
A	≤ 10
B	>10 – 20
C	>20 – 35
D	>35 – 55
E	>55 – 80
F	>80

Unsignalized intersections are categorized as either all-way stop control (AWSC) or two-way stop control (TWSC). LOS at AWSC intersections is determined by the weighted average control delay of the overall intersection. The HCM TWSC intersection methodology calculates LOS based on the delay experienced by drivers on the minor (stop-controlled) approaches to the intersection. For TWSC intersections, LOS is determined for each minor-street movement, as well as the major-street left-turns. The relationship between delay and LOS at unsignalized intersections is shown in Table 2.3

Table 2.3: Relationship between Delay and LOS for an Unsignalized Intersection

LOS	Delay (seconds)
A	0-10
B	>10 – 15
C	>15 – 25
D	>25 – 35
E	>35 – 50
F	>50

2.4 Significance Criteria

City of Irwindale

The City refers to the Los Angeles County Traffic Impact Study Guidelines (1997) for traffic study impacts. The City's General Plan states that the minimum acceptable threshold is LOS "D" for planning purposes.

The V/C ratio has an LOS equivalency as shown in Table 2.4.

Table 2.4: Significant Impact Threshold

LOS	V/C
C	0.701 – 0.800
D	0.801 – 0.900
E	0.901-1.000
F	>1.000

3 BASELINE CONDITIONS

This section discusses the baseline (without project) conditions for both existing and future scenarios. Existing Transportation System and Access

Access to the project site is provided via Rivergrade Road, Stewart Avenue, and Live Oak Avenue. Regional access to the project site is provided by Interstate 605 from the west, and Arrow Highway from the east.

Rivergrade Road is an east-west collector road and a major designated truck route according to the City of Irwindale's General Plan. It is a four-lane divided roadway with existing sidewalks in the project's vicinity. The posted speed limit is 35 mph (miles per hour). In the project's vicinity, there are no bicycle lanes. There is a bus stop (route 272) on Rivergrade Road. located 150 feet southwest from the intersection of Rivergrade Road/ Arrow Hwy.

Live Oak Ave is an east-west secondary highway and a major designated truck route according to the City of Irwindale's General Plan. It is a four-lane divided arterial with no sidewalks or bicycle lanes in the project's vicinity. The posted speed limit is 45 mph (miles per hour). There is a bus stop (serving routes 272 and 492) located 100 feet east from the intersection of Stewart Avenue and Live Oak Avenue.

Stewart Avenue is a north-south collector road according to the City of Irwindale's General Plan. It is a four-lane divided roadway with existing sidewalks in the project's vicinity. The posted speed limit is 30 mph. There are no bicycle lanes or transit stops within the project's vicinity on this roadway.

Arrow Highway is an east-west major highway and a major designated truck route according to the City of Irwindale's General Plan. It is a four-lane divided roadway with existing sidewalks in the project's vicinity. The posted speed limit is 45 mph. There are no bicycle lanes or transit stops within the project's vicinity on this roadway.

Interstate 605 (San Gabriel River Freeway) traverses the western boundary of the City in a north-south direction. The freeway originates at the exchange joining State Route (SR) 22 east from Long Beach with Interstate 405 (San Diego Freeway) at Seal Beach. Overhead signs along the route omit control cities and instead read "Thru Traffic." With eight to ten overall lanes, Interstate 605 runs north from Los Alamitos and Lakewood to Cerritos, Bellflower, Norwalk, and Interstate 5 (Santa Ana Freeway) at Downey. Continuing northeast, the San Gabriel River Freeway extends between Pico Rivera and Whittier to Baldwin Park and Interstate 210 (Foothill Freeway) at Duarte.

The existing traffic control and intersection geometrics at study area intersections are shown in Figure 3.1, Existing Lane Geometries and Traffic Control.

Figure 3.1: Existing Lane Geometries and Traffic Control

3.1 Existing Traffic Volumes and Intersection Operations

Existing Conditions are those conditions that exist within the study area in the present year. Existing AM and PM peak hour traffic volumes at the study area intersections are shown in Figure 3.2 and Figure 3.3. Table 3.1 shows the existing AM and PM peak hour levels of service using HCM methodology. Table 3.2 shows the existing AM and PM peak hour levels of service using ICU methodology at study intersections. All LOS calculations are provided in Appendix B. As shown in Table 3.1 and Table 3.2, all the study area intersections operate at a satisfactory LOS "D" or better under the Existing Conditions scenario.

Table 3.1: Existing Conditions AM and PM Peak Hour LOS using HCM Methodology

		AM Peak		PM Peak	
Intersection	**Control Type**	**Delay**	**LOS**	**Delay**	**LOS**
1. Rivergrade Rd/Stewart Ave	Signal	6.2	A	7.5	A
2. Live Oak Ave/Stewart Ave	Signal	10.0	B	7.5	A
3. Rivergrade Rd/Project Dwy 1	TWSC	-	-	-	-
4. Live Oak Rd/Project Dwy 2	TWSC	-	-	-	-

TWSC = Two Way Stop Control
Delay Reported in Seconds per Vehicle
LOS = Level of Service

Table 3.2: Existing Conditions AM and PM Peak Hour LOS using ICU Methodology

		AM Peak		PM Peak	
Intersection	**Control Type**	**Delay**	**LOS**	**Delay**	**LOS**
1. Rivergrade Rd/Stewart Ave	Signal	0.163	A	0.185	A
2. Live Oak Ave/Stewart Ave	Signal	0.607	B	0.609	B
3. Rivergrade Rd/Project Dwy 1	TWSC	-	-	-	-
4. Live Oak Rd/Project Dwy 2	TWSC	-	-	-	-

TWSC = Two Way Stop Control
Delay reported volume to capacity
LOS = Level of Service

Figure 3.2: Existing AM Peak Hour Traffic Volumes

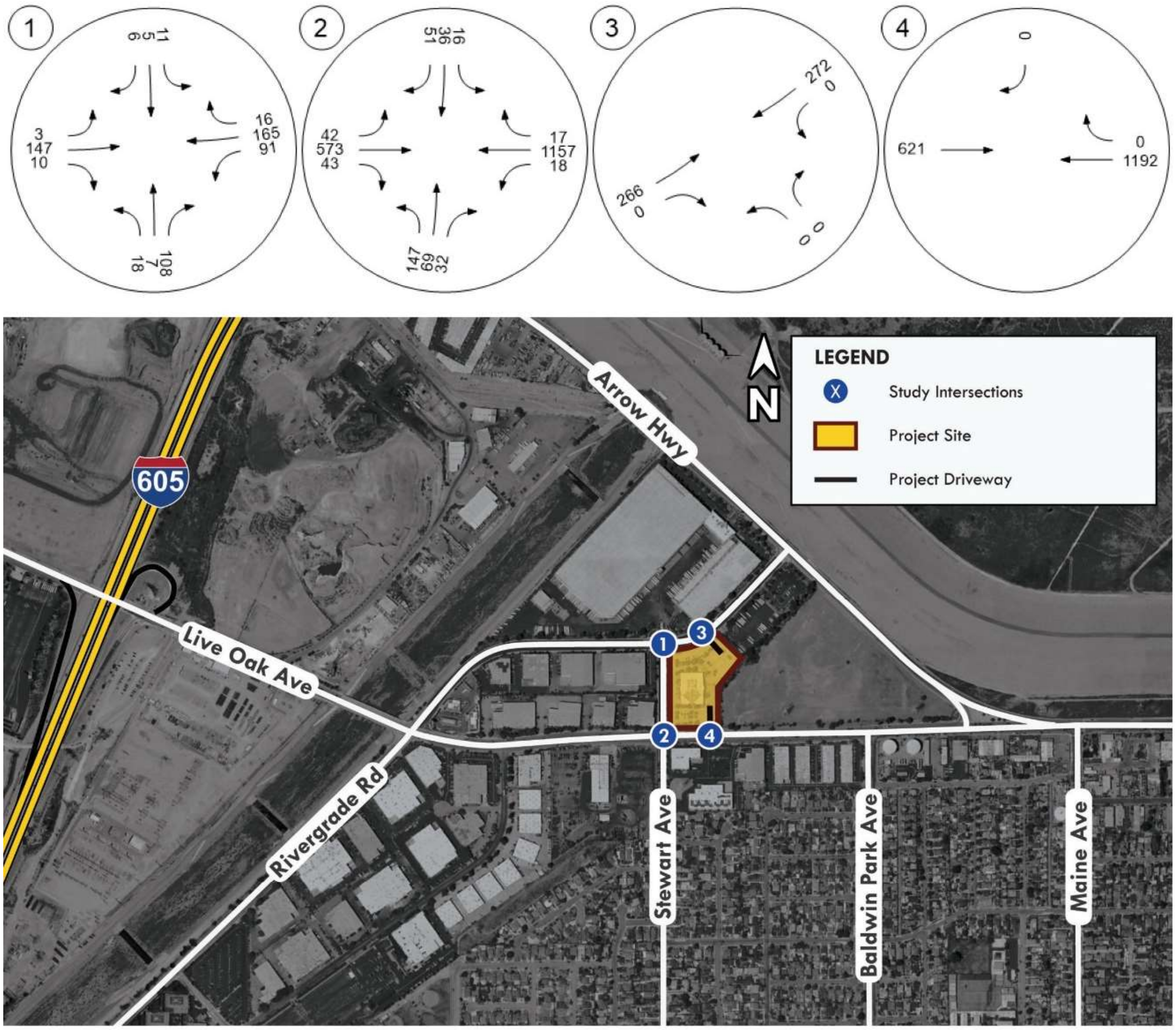
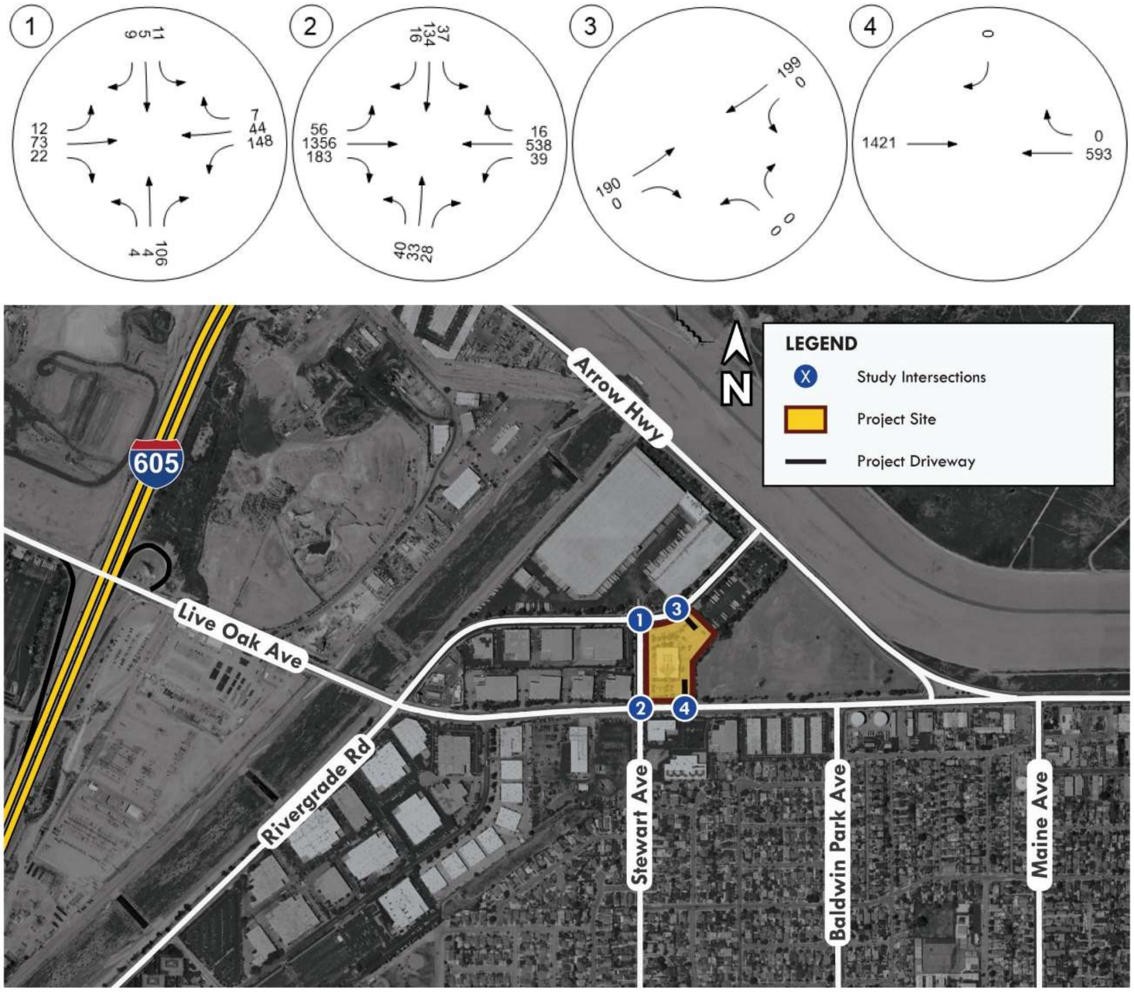


Figure 3.3: Existing PM Peak Hour Traffic Volumes



3.2 Future Traffic Volumes and Intersection Operations

Project Future (2025) traffic volumes were developed by applying a growth factor of 2% to the traffic volumes collected on July 26th, 2023. This growth factor was sourced from The City of Irwindale's Policy Guidelines for Traffic Impact Report. Future Without Project traffic volumes are illustrated in Figure 3.4 and Figure 3.5. Table 3.3 shows the Future AM and PM peak hour levels of service using HCM methodology at study intersections. Table 3.4 shows the Future AM and PM peak hour levels of service using ICU methodology at study intersections. All LOS calculations are provided in Appendix B. As shown in Table 3.3 and Table 3.4, all of the study area intersections operate at a satisfactory LOS "D" or better under the Future Without Project scenario.

Table 3.3: Future (2025) AM and PM Peak Hour LOS using HCM Methodology

		AM Peak		PM Peak	
Intersection	**Control Type**	**Delay**	**LOS**	**Delay**	**LOS**
1. Rivergrade Rd/Stewart Ave	Signal	6.26	A	5.33	A
2. Live Oak Ave/Stewart Ave	Signal	10.54	B	7.55	A
3. Rivergrade Rd/Project Dwy 1	TWSC	-	-	-	-
4. Live Oak Rd/Project Dwy 2	TWSC	-	-	-	-

TWSC = Two Way Stop Control
Delay Reported in Seconds per Vehicle
LOS = Level of Service

Table 3.4: Future (2025) AM and PM Peak Hour LOS using ICU Methodology

		AM Peak		PM Peak	
Intersection	**Control Type**	**Delay**	**LOS**	**Delay**	**LOS**
1. Rivergrade Rd/Stewart Ave	Signal	0.171	A	0.195	A
2. Live Oak Ave/Stewart Ave	Signal	0.633	B	0.633	B
3. Rivergrade Rd/Project Dwy 1	TWSC	-	-	-	-
4. Live Oak Rd/Project Dwy 2	TWSC	-	-	-	-

TWSC = Two Way Stop Control
Delay Reported in Seconds per Vehicle
LOS = Level of Service

Figure 3.4: Future AM Peak Hour Traffic Volumes

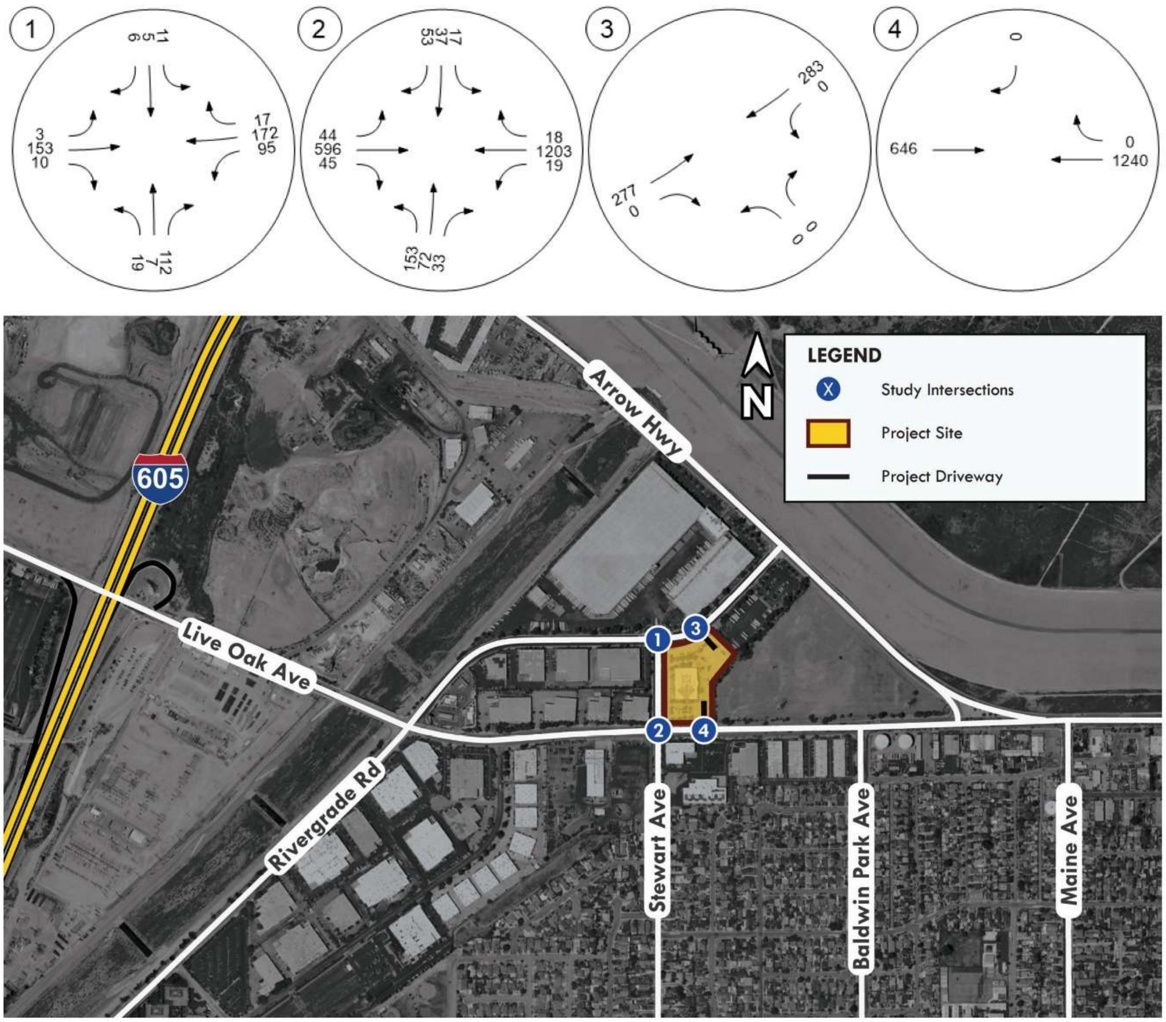
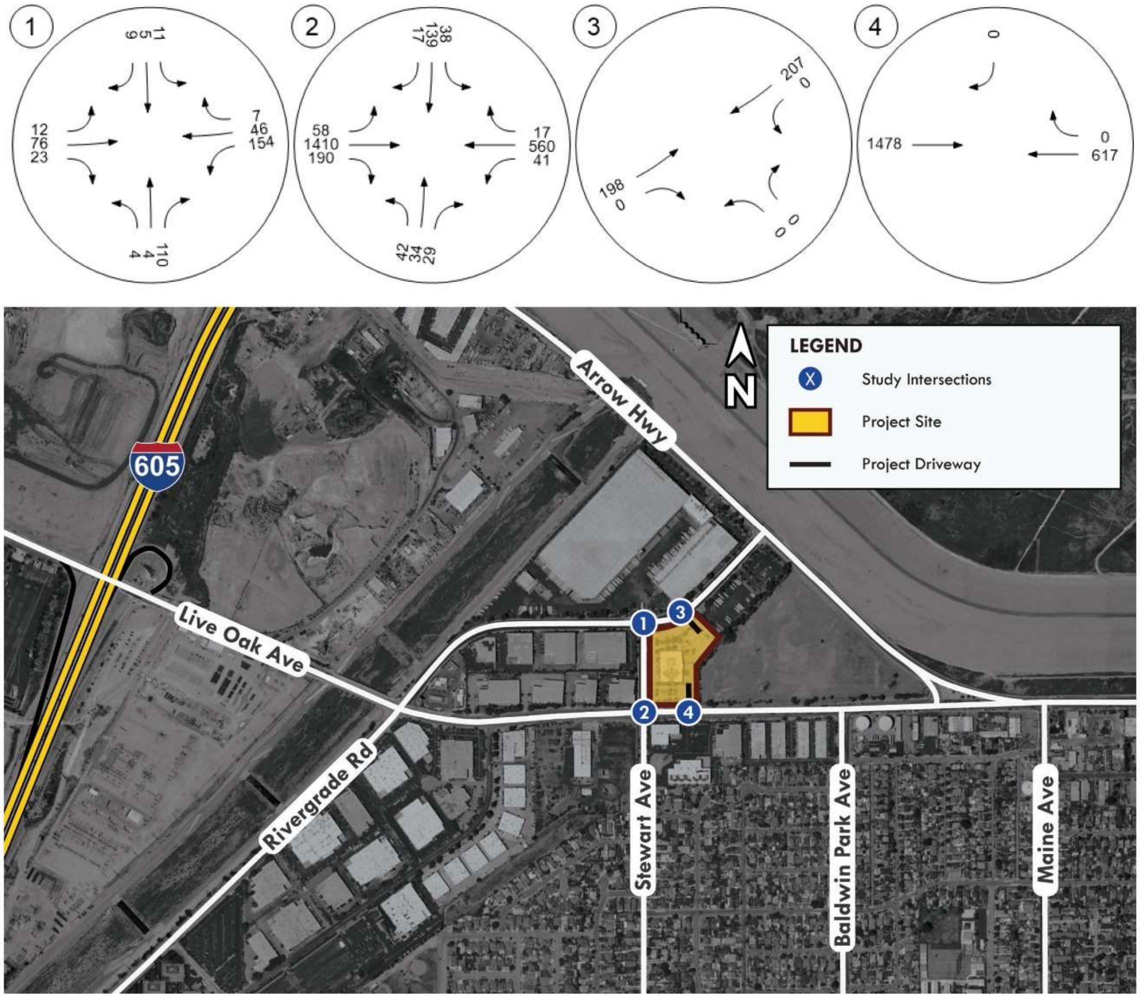


Figure 3.5: Future PM Peak Hour Traffic Volumes



4 PROPOSED PROJECT

4.1 Project Trip Generation

As described in Section 1, Executive Summary, vehicle trips were generated for the proposed industrial development using trip rates from the Institute of Transportation Engineers (ITE) Trip Generation Manual (11th Edition, 2021). The project trip generation is shown in Table 4.1. The proposed project is estimated to generate approximately 174 daily trips, including 17 AM peak hour trips and 18 PM peak hour trips. In terms of passenger car equivalent (PCE), the proposed project is estimated to generate approximately 248 daily PCE trips, including 25 PCE AM trips and 26 PCE PM trips.

4.2 Project Trips

The future traffic control and intersection geometrics at study area intersections are shown in Figure 4.1, Future Lane Geometries and Traffic Control.

Project trips were distributed to the study area intersections based on the location of the project and logical routes of travel to and from the site. Project trips were assigned to the study area intersections by multiplying the project trip generation by the trip distribution percent at each location. The passenger vehicle trip distribution for the proposed project is shown in Figure 4.2 and the truck distribution for the proposed project is shown in Figure 4.3. The passenger vehicle AM and PM peak hour project trip assignment is shown in Figure 4.4 and Figure 4.5 respectively. The truck AM and PM peak hour project trip assignment is shown in Figure 4.6 and Figure 4.7 respectively.

Table 4.1: Project Trip Generation

Table 1. 14005 Live Oak Trip Generation

Land Use		Units	Daily	AM Peak Hour In	AM Peak Hour Out	AM Peak Hour Total	PM Peak Hour In	PM Peak Hour Out	PM Peak Hour Total
Trip Rates									
Warehouse [1]		TSF	1.71	0.13	0.04	0.17	0.05	0.13	0.18
General Office Building [2]		TSF	10.84	1.34	0.18	1.52	0.24	1.20	1.44
Existing Building									
Office Building	56	TSF	607	75	10	85	14	67	81
Proposed Building									
Warehouse building	102	TSF	174	13	4	17	5	13	18
Vehicle Mix [3]		***Percent***							
Passenger Vehicles		72%	126	10	3	13	3	10	13
2-Axle Trucks		4.6%	8	1	0	1	0	1	1
3-Axle Trucks		5.7%	10	1	0	1	0	1	1
4+-Axle Trucks		17.2%	30	2	1	3	1	2	3
		100%	174	13	4	17	4	14	18
PCE Trip Generation [4]		***PCE Factor***							
Passenger Vehicles		1.0	126	10	3	13	3	10	13
2-Axle Trucks		1.5	12	1	0	1	0	1	1
3-Axle Trucks		2.0	20	2	0	2	1	1	2
4+-Axle Trucks		3.0	90	7	2	9	3	7	10
Total PCE Trip Generation			248	19	6	25	7	19	26
Total Vehicle Trip Generation			-360	-56	-5	-60	-7	-48	-55

TSF = Thousand Square Feet

PCE = Passenger Car Equivalent

[1] Trip rates from the Institute of Transportation Engineers, Trip Generation,11th Edition, 2021. Land Use Code 150 - Warehouse.

[2] Trip rates from the Institute of Transportation Engineers, Trip Generation,11th Edition, 2021. Land Use Code 710 - General Office Building.

[3] Vehicle Mix from the SCAQMD Warehouse Truck Trip Study Data Results and Usage, July 2014. Classification: Without Cold Storage

[4] Passenger Car Equivalent (PCE) factors from San Bernardino County CMP, Appendix B - Guidelines for CMP Traffic Impact Analysis Reports in San Bernardino County, 2016

Figure 4.1: Future Lane Geometries and Traffic Control

Figure 4.2: Proposed Project Passenger Vehicle Trip Distribution

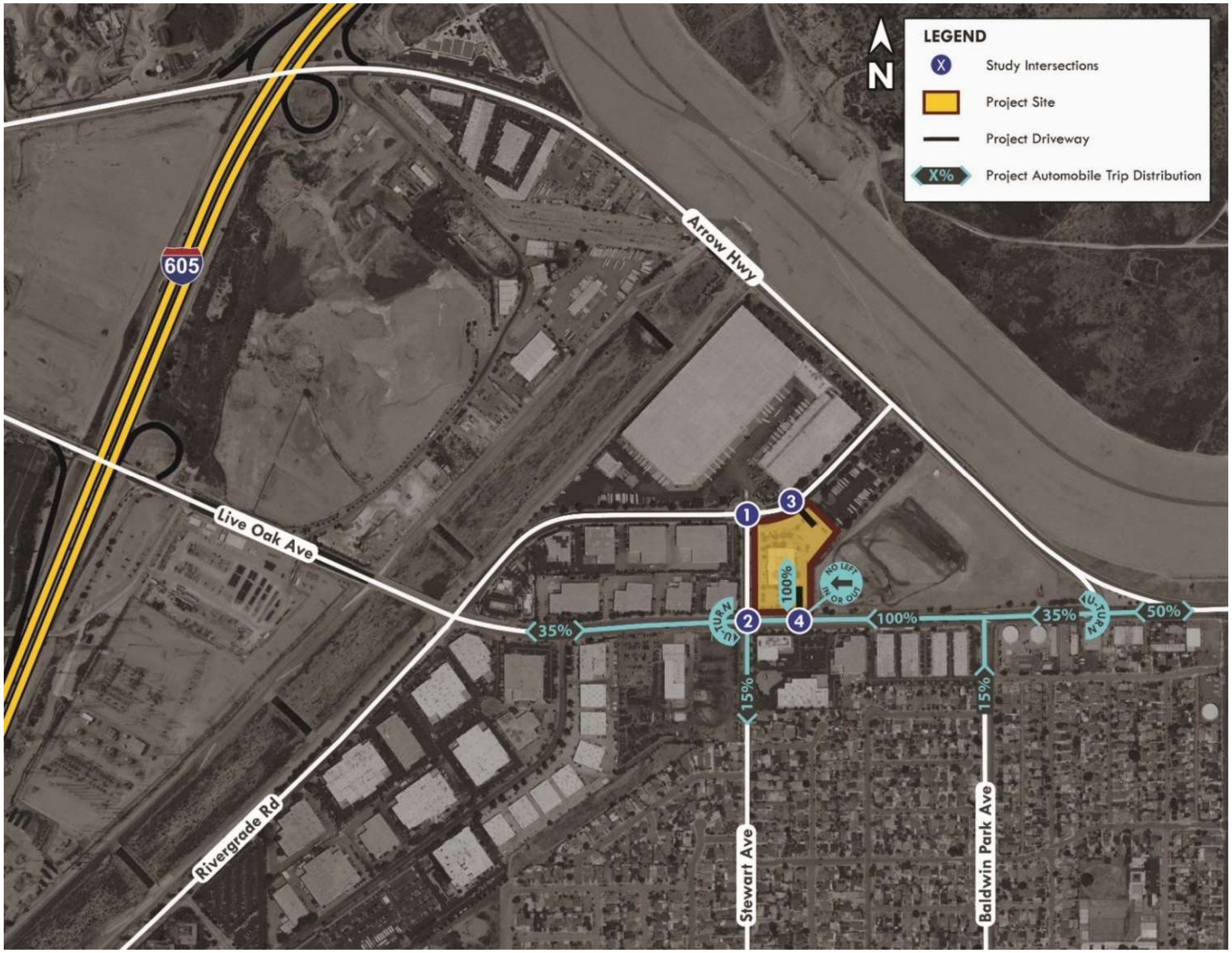


Figure 4.3: Proposed Project Truck Trip Distribution

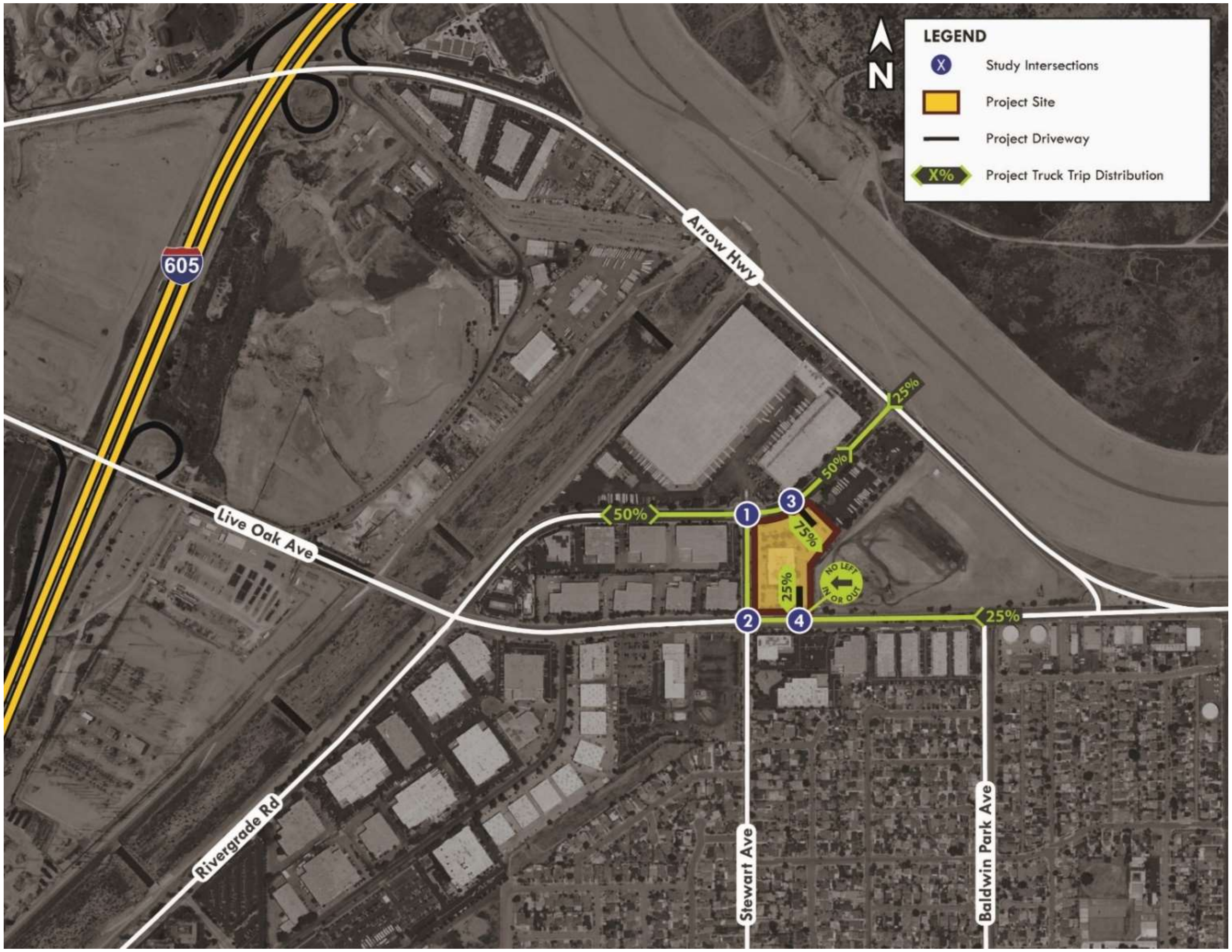


Figure 4.4: Project Passenger Vehicle AM Peak Hour Trip Assignment

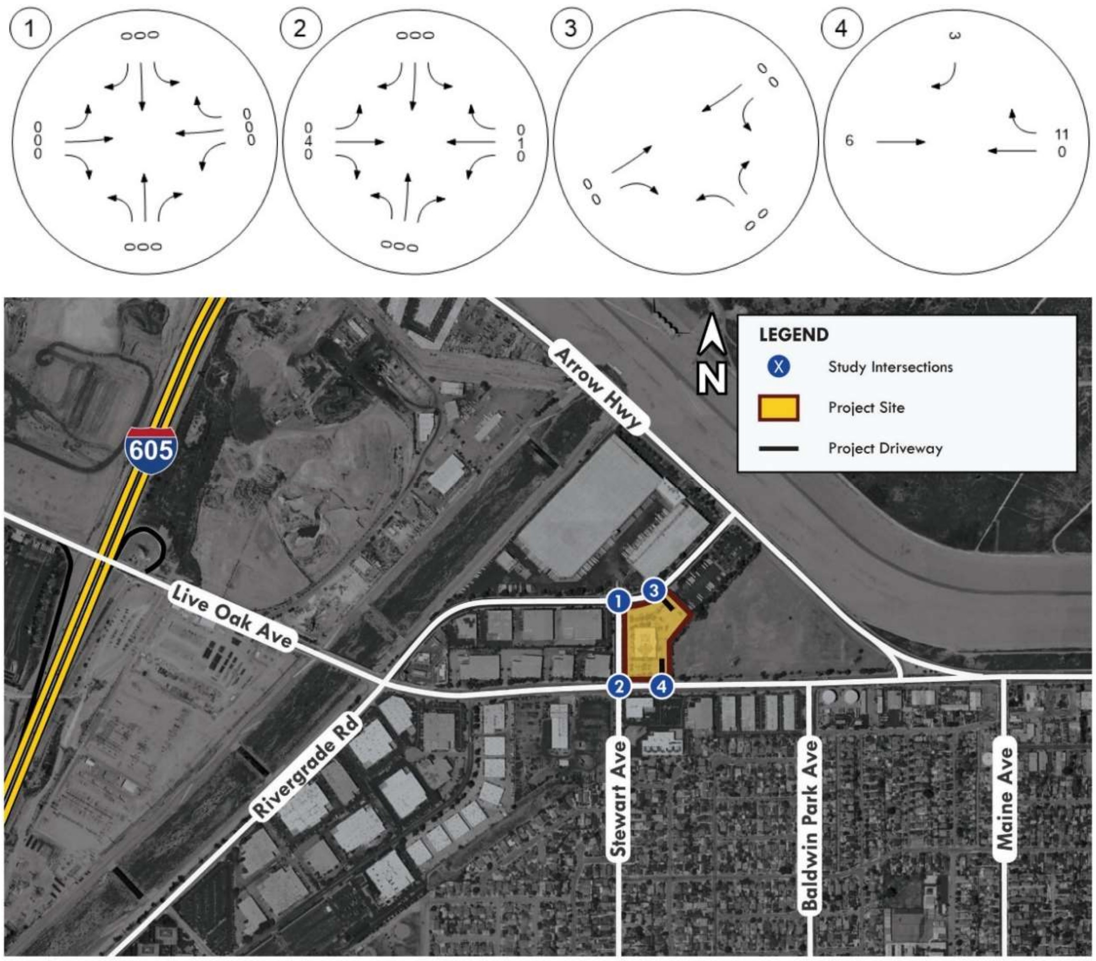


Figure 4.5: Project Passenger Vehicle PM Peak Hour Trip Assignment

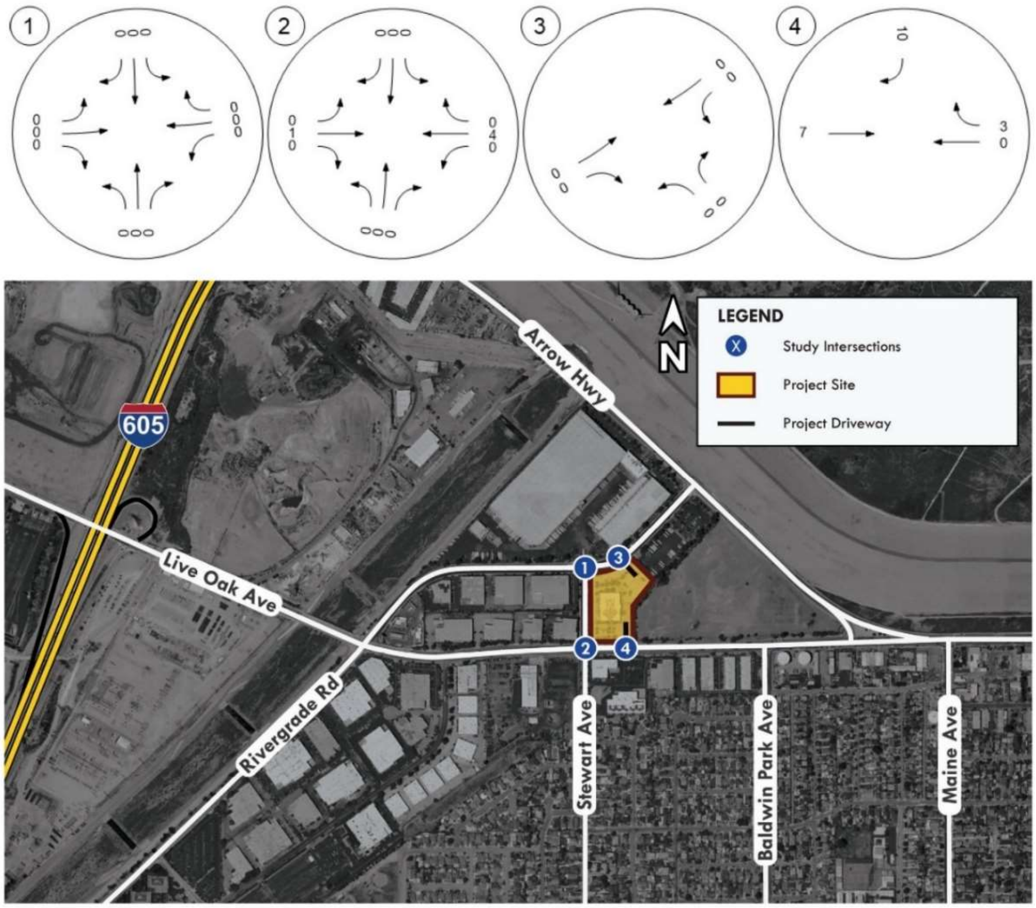


Figure 4.6: Project Truck AM Peak Hour Trip Assignment

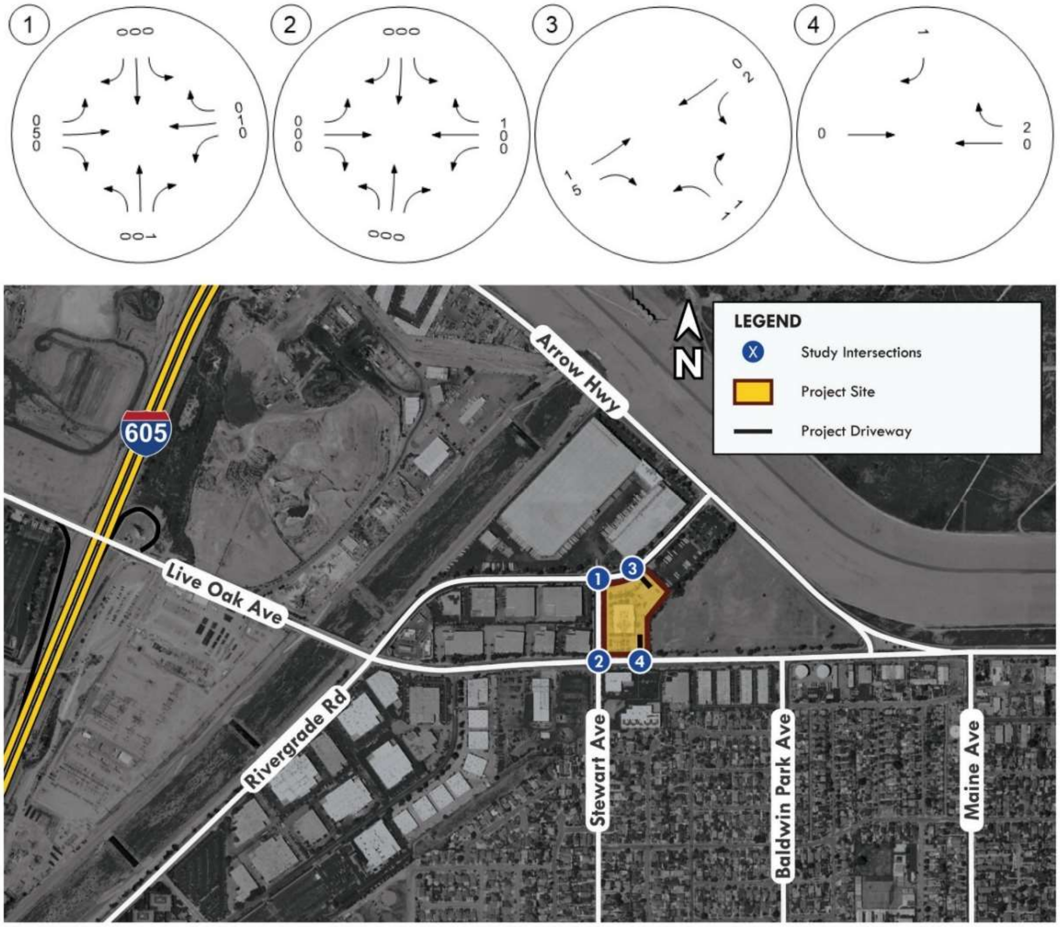


Figure 4.7: Project Truck PM Peak Hour Trip Assignment

5 BASELINE PLUS PROJECT CONDITIONS

5.1 Existing Plus Project Traffic Volumes and Intersection Operations

The Existing Plus Project traffic volumes were developed by adding the project's trip assignment to the Existing traffic volumes. The Existing Plus Project traffic volumes are shown in Figure 5.1 and Figure 5.2. LOS at the study area intersections were determined using both the HCM and ICU methodologies, described previously in Section 2.3. Table 5.1 shows the Existing Plus Project AM and PM peak hour LOS using HCM methodology, and Table 5.2 shows the existing AM and PM peak hour LOS using ICU methodology. All LOS calculations are provided in Appendix B. As shown in Table 5.1 and Table 5.2, all of the study area intersections operate at a satisfactory LOS "D" or better under the Existing Plus Project scenario.

Table 5.1: Existing Plus Project AM and PM Peak Hour LOS using HCM Methodology

		Existing Conditions				Existing plus Project				Increase in Delay		Impact	
		AM Peak		PM Peak		AM Peak		PM Peak					
Intersection	Control Type	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	AM	PM	AM	PM
1. Rivergrade Rd/Stewart Ave	Signal	6.16	A	5.19	A	6.15	A	5.21	A	-0.01	0.02	NO	NO
2. Live Oak Ave/Stewart Ave	Signal	10.03	B	7.35	A	10.03	B	7.34	A	0.00	-0.01	NO	NO
3. Rivergrade Rd/Project Dwy 1	TWSC	-	-	-	-	0.06	B	0.18	B	-	-	-	-
4. Live Oak Rd/Project Dwy 2	TWSC	-	-	-	-	0.03	B	0.06	B	-	-	-	-

TWSC = Two Way Stop Control
Delay Reported in Seconds per Vehicle
LOS = Level of Service

Table 5.2: Existing Plus Project AM and PM Peak Hour LOS using ICU Methodology

		Existing Conditions				Existing plus Project				Increase in Delay		Impact	
		AM Peak		PM Peak		AM Peak		PM Peak					
Intersection	Control Type	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	AM	PM	AM	PM
1. Rivergrade Rd/Stewart Ave	Signal	0.163	A	0.185	A	0.165	A	0.187	A	0.002	0.002	NO	NO
2. Live Oak Ave/Stewart Ave	Signal	0.607	B	0.609	B	0.608	B	0.609	B	0.001	0.000	NO	NO
3. Rivergrade Rd/Project Dwy 1	TWSC	-	-	-	-	-	-	-	-	-	-	-	-
4. Live Oak Rd/Project Dwy 2	TWSC	-	-	-	-	-	-	-	-	-	-	-	-

TWSC = Two Way Stop Control
Delay Reported in Seconds per Vehicle
LOS = Level of Service

Figure 5.1: Existing Plus Project AM Peak Hour Volumes

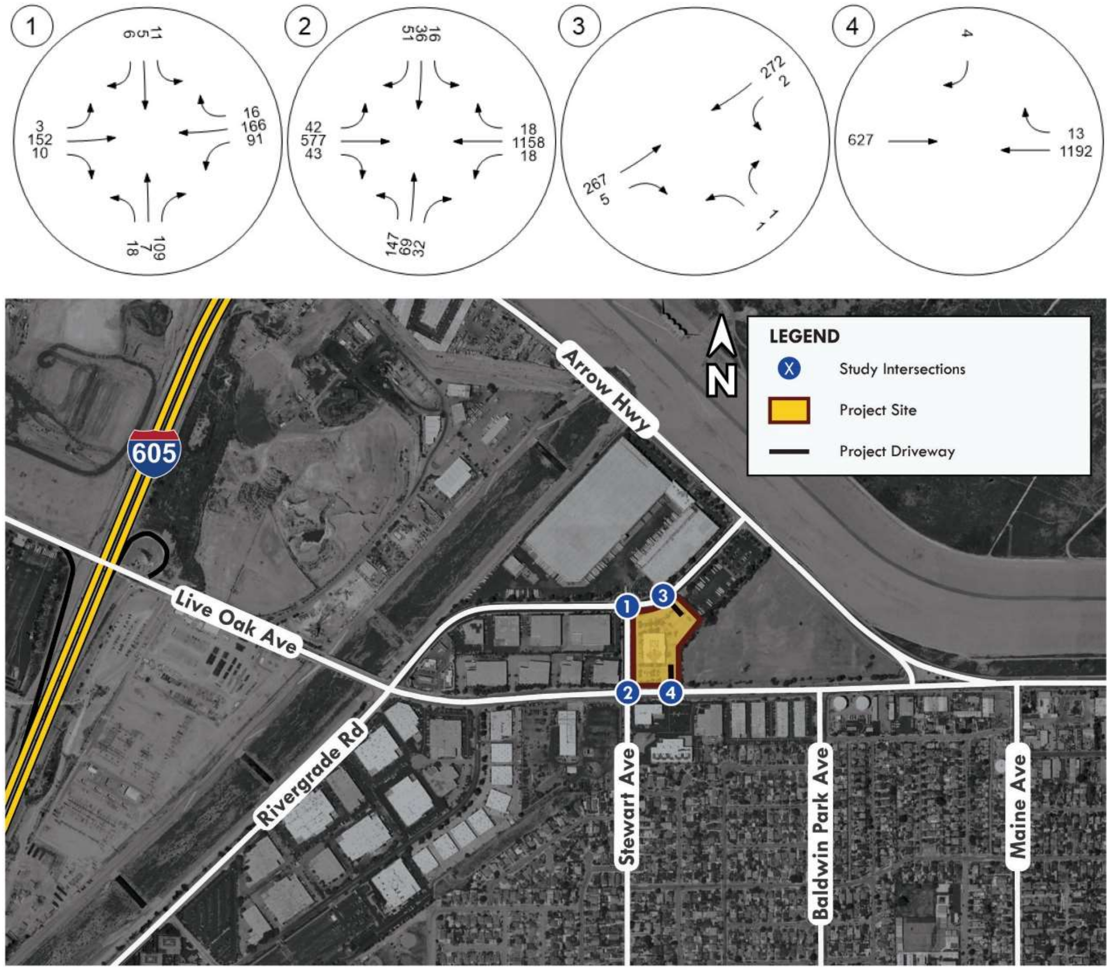
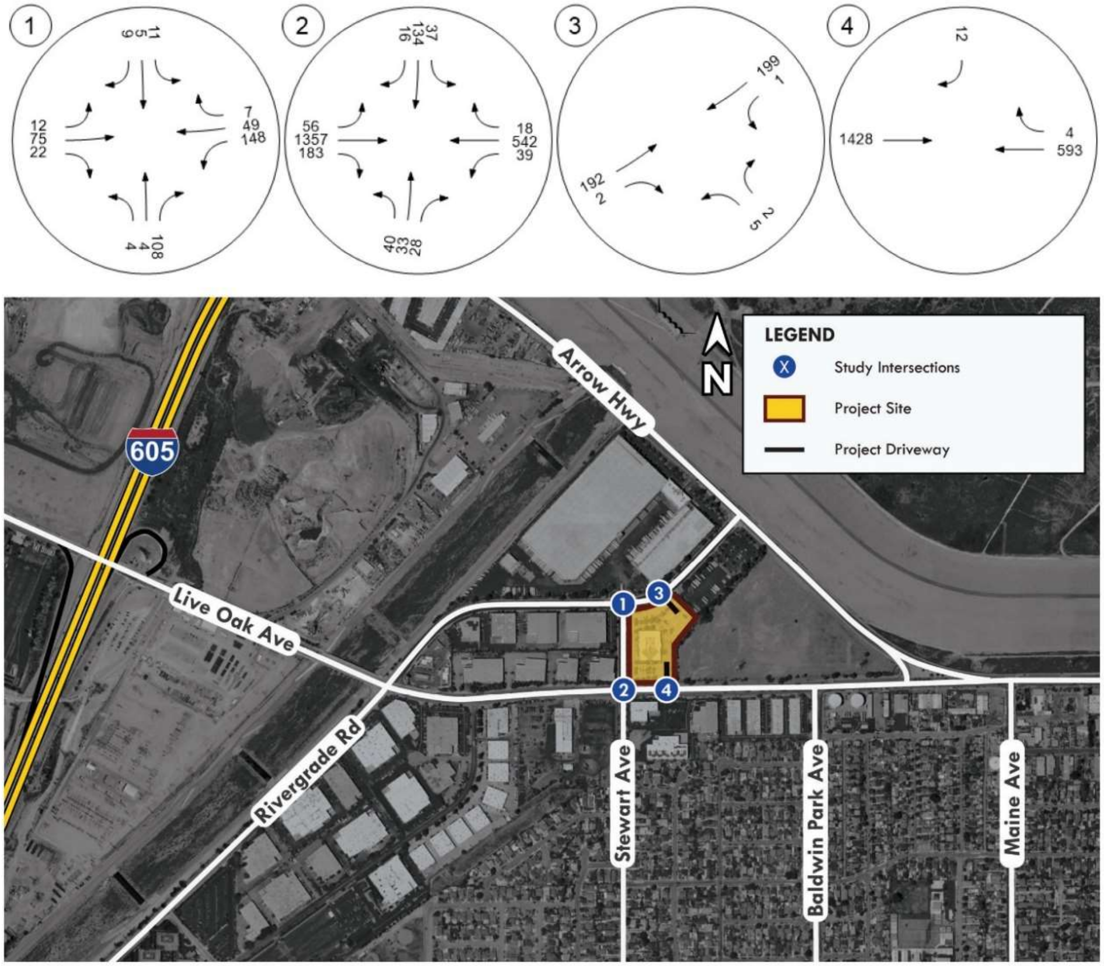


Figure 5.2: Existing Plus Project PM Peak Hour Volumes



5.2 Future Plus Project Traffic Volumes and Intersection Operations

The Future Plus Project traffic volumes were developed by adding the project's trip assignment to the Future Without Project traffic volumes. The Future Plus Project traffic volumes are shown in Figure 5.3 and Figure 5.4. Levels of Service at the study area intersections were determined using the HCM methodology, described previously in Section 2.3. Table 5.3 shows the Future Plus Project AM and PM peak hour levels of service using HCM methodology at study intersections. Table 5.4 shows the Future Plus Project AM and PM peak hour levels of service using ICU methodology at study intersections. All LOS calculations are provided in Appendix B.

As shown in Table 5.3 and Table 5.4, all of the study area intersections operate at a satisfactory LOS "D" or better under the Future Plus Project scenario.

Table 5.3: Future Plus Project AM and PM Peak Hour LOS using HCM Methodology

		Existing Conditions				Existing plus Project							
		AM Peak		PM Peak		AM Peak		PM Peak		Increase in Delay		Impact	
Intersection	**Control Type**	**Delay**	**LOS**	**Delay**	**LOS**	**Delay**	**LOS**	**Delay**	**LOS**	**AM**	**PM**	**AM**	**PM**
1. Rivergrade Rd/Stewart Ave	Signal	0.163	A	0.185	A	0.165	A	0.187	A	0.002	0.002	NO	NO
2. Live Oak Ave/Stewart Ave	Signal	0.607	B	0.609	B	0.608	B	0.609	B	0.001	0.000	NO	NO
3. Rivergrade Rd/Project Dwy 1	TWSC	-	-	-	-	-	-	-	-	-	-	-	-
4. Live Oak Rd/Project Dwy 2	TWSC	-	-	-	-	-	-	-	-	-	-	-	-

TWSC = Two Way Stop Control
Delay Reported in Seconds per Vehicle
LOS = Level of Service

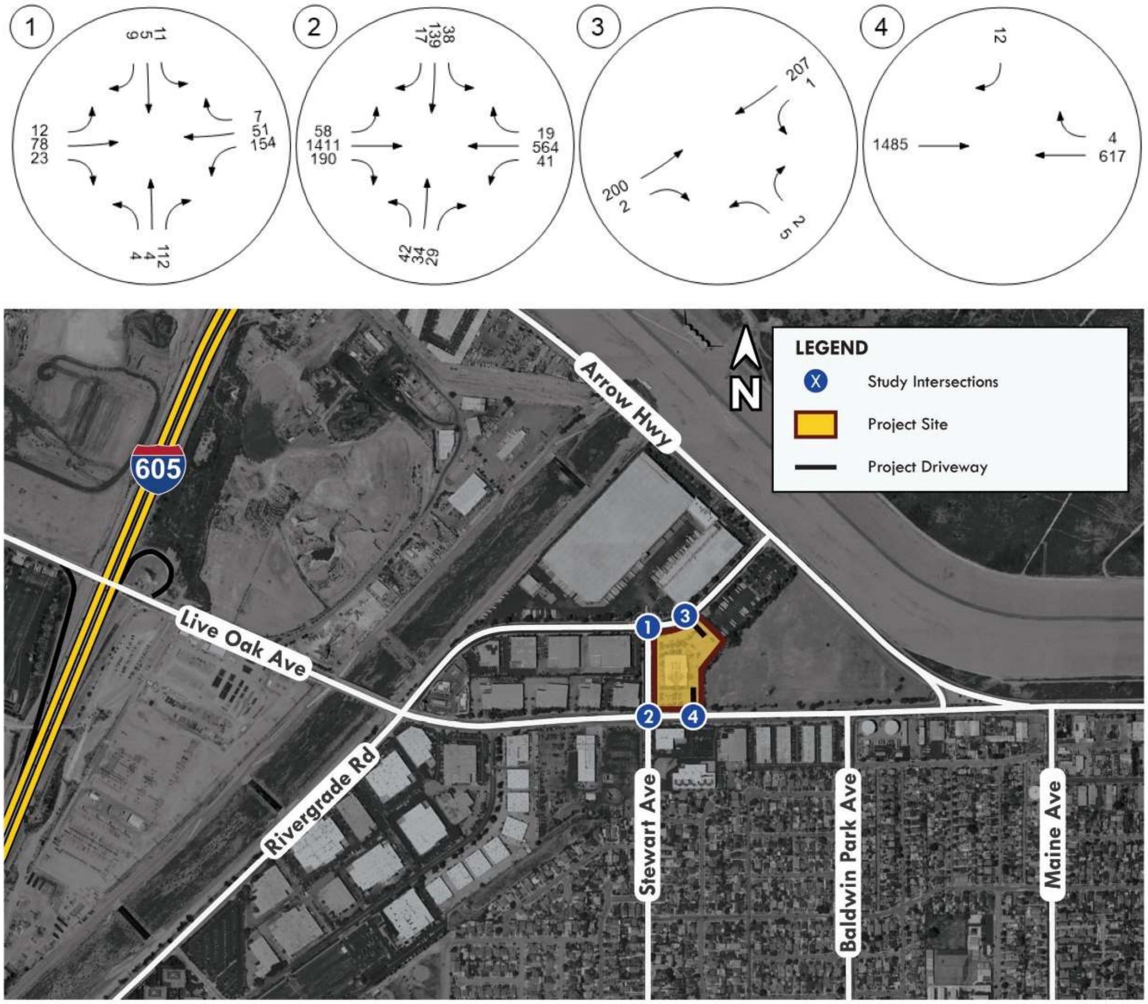
Table 5.4 Future Plus Project AM and PM Peak Hour LOS using ICU Methodology

		Future Year				Future Year Plus Project							
		AM Peak		PM Peak		AM Peak		PM Peak		Increase in Delay		Impact	
Intersection	**Control Type**	**Delay**	**LOS**	**Delay**	**LOS**	**Delay**	**LOS**	**Delay**	**LOS**	**AM**	**PM**	**AM**	**PM**
1. Rivergrade Rd/Stewart Ave	Signal	0.171	A	0.195	A	0.173	A	0.197	A	0.002	0.002	NO	NO
2. Live Oak Ave/Stewart Ave	Signal	0.633	B	0.633	B	0.634	B	0.633	B	0.001	0.000	NO	NO
3. Rivergrade Rd/Project Dwy 1	TWSC	-	-	-	-	-	-	-	-	-	-	-	-
4. Live Oak Rd/Project Dwy 2	TWSC	-	-	-	-	-	-	-	-	-	-	-	-

TWSC = Two Way Stop Control
Delay Reported in Seconds per Vehicle
LOS = Level of Service

Figure 5.3: Future Plus Project AM Peak Hour Volumes

Figure 5.4: Future Plus Project PM Peak Hour Volumes



6 TRUCK ANALYSIS AND QUEUING

6.1 Truck Routes

According to the City's Municipal Code (Section 10.40.020), heavy vehicles, except public transportation buses, are only allowed to operate and park on streets designated as truck traffic routes. There are 14 major designated truck routes within Irwindale including Foothill Boulevard, Arrow Highway, Live Oak Avenue, and Irwindale Avenue.

The proposed project is adjacent to two truck routes: Live Oak Avenue and Rivergrade Road. It is expected that 25 percent of truck trips would approach the site from the east using the southern project driveway on Live Oak Avenue, and 50 percent from the west and 25 percent from the north using the northern project driveway on Rivergrade Road.

6.2 Truck Ingress and Egress

The project site will have one access point for passenger vehicles and emergency vehicles in addition to trucks on Live Oak Avenue. Live Oak Avenue is a major highway with four lanes and a median, therefore the southern project driveway on Live Oak Avenue would allow right-in/right-out access only. Rivergrade Road is a four-lane collector with a two-way left-turn lane (TWLTL). The northern project driveway on Rivergrade Road will provide full access to trucks accessing the driveway. As shown on the site plan, the southernly driveway on Live Oak Avenue allows a storage length of approximately 250 feet. This can accommodate a queue of three WB-67 trucks which are approximately 74 feet in length. The northern driveway on Rivergrade Road allows a driveway approach storage length of approximately 74 feet, and a departure storage length of approximately 65 feet.

The project allows for the queueing of one truck on site within the 74-foot approach storage for trucks that would make a left-in or a right-in entrance into the project site from Rivergrade Road. As shown in Table 4.1, only one three-axle truck and two four-axle trucks would enter the project site, and one four-axle truck would depart the project site during the AM peak hour. In the PM peak hour, it is expected that only one four-axle truck would enter the project site, and one three-axle truck and two four-axle trucks would exit the project site. It is to be noted that the project site gates would be open during business hours causing no impedance to trucks entering the site. The turning template for trucks entering Rivergrade Road is shown in Figure 6.1 and the turning template for trucks entering Live Oak Avenue is shown in Figure 6.2. Given the low project trip generation of four truck trips during the peak hours, and sufficient storage length on both the project's northern and southern driveway, no truck queueing is expected to extend onto the public right-of-way traffic on Rivergrade Road and Live Oak Avenue, impeding traffic flow on these streets.

Figure 6.1: Rivergrade Road Project Driveway Truck Turning Template

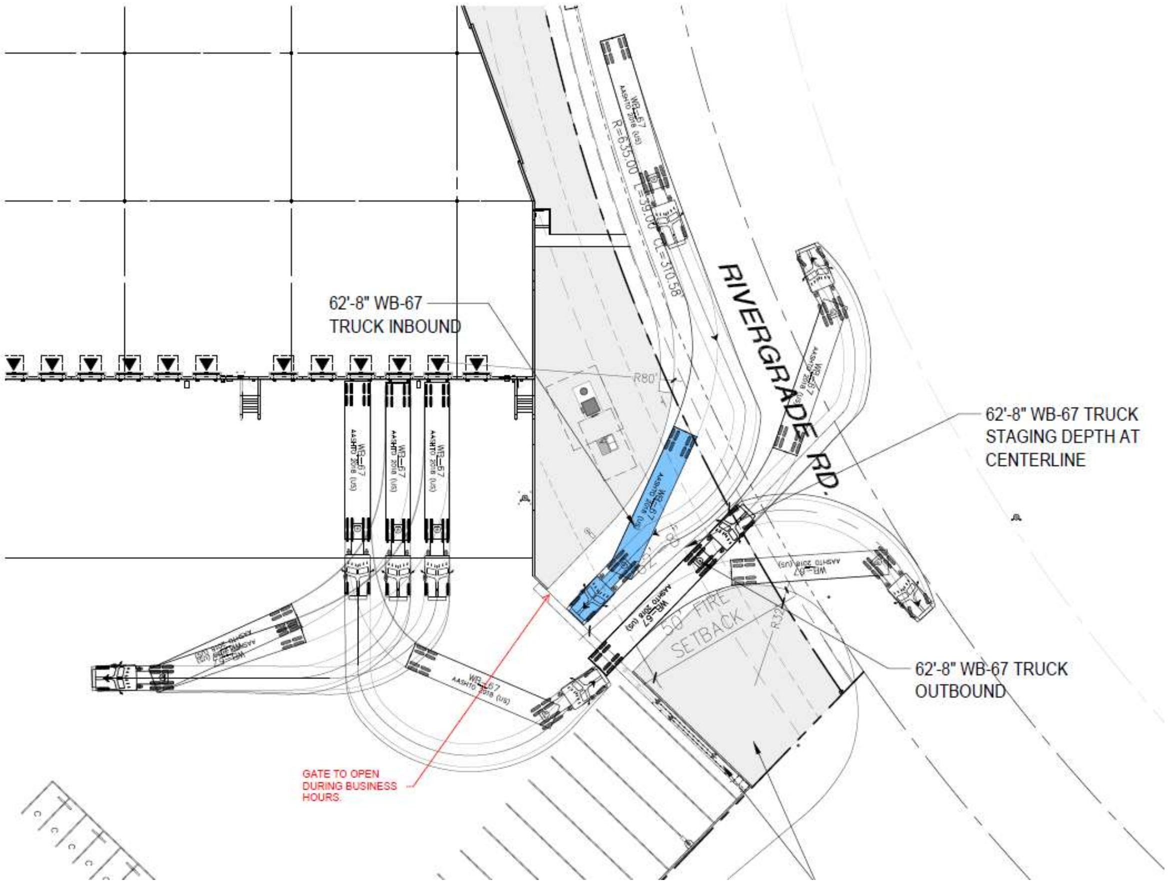
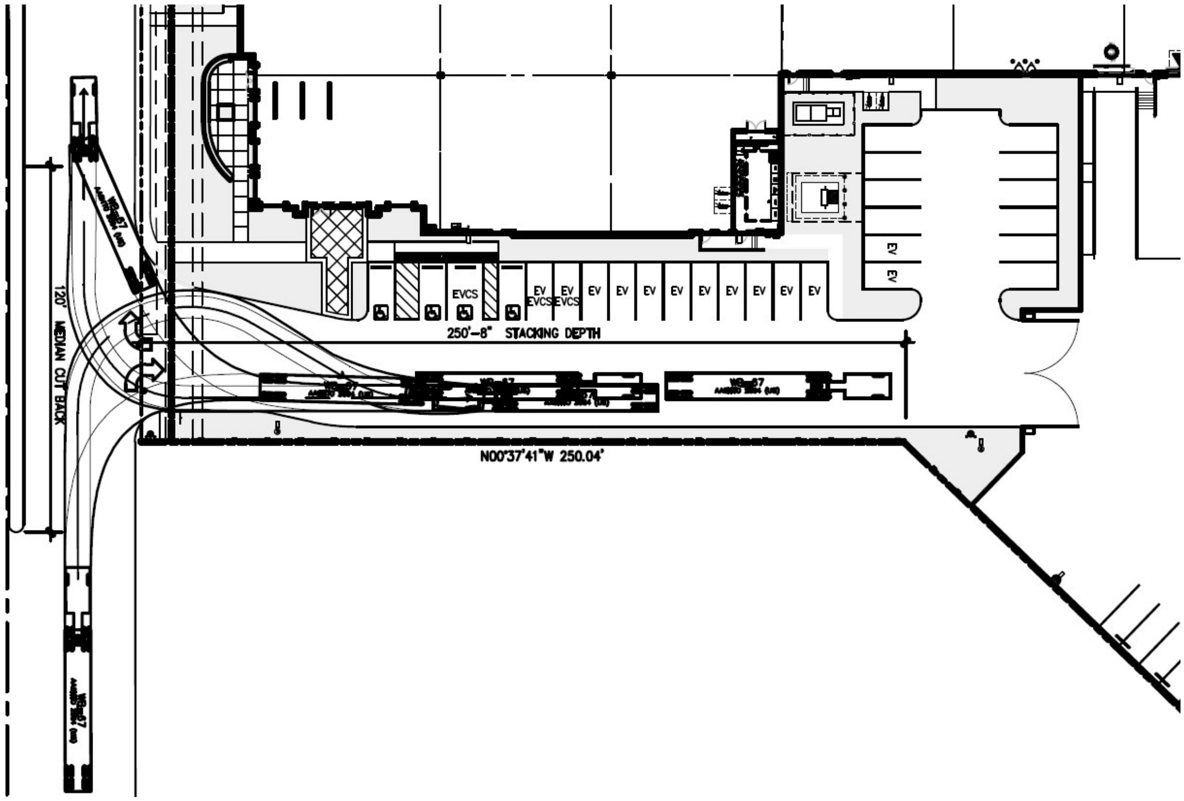


Figure 6.2: Live Oak Avenue Project Driveway Truck Turning Template



6.3 Queueing Analysis

A 95-percentile queue length analysis was performed for all study intersections. As shown in *Table 6.1*, no queuing deficiencies were observed.

Table 6.1: Project Queuing Analysis

Intersection	Turning Movement	Available Storage Length (Ft)	Existing		Existing + Project		Opening Year		Opening Year + Project	
			AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
			Required Queueing (Ft)	Required Queueing (Ft)	Required Queueing (Ft)	Required Queueing (Ft)	Required Queueing (Ft)	Required Queueing (Ft)	Required Queueing (Ft)	Required Queueing (Ft)
1. Stewart Ave/Rivergrade Rd	EBL	170	0	1	0	1	0	1	0	1
	WBL	91	14	18	14	18	15	19	16	19
2. Stewart Ave/Live Oak Ave	EBL	175	22	11	22	12	25	13	25	13
	SBL	115	10	25	10	25	10	26	10	26
	WBL	120	5	18	5	18	6	20	6	20
3. Rivergrade Rd/Project Dwy 1*	NBLR	64	-	-	1	1	-	-	1	1
	EBTR	300	-	-	0	0	-	-	0	0
	WBL	475			1	1			1	1
4. Live Oak Rd/Project Dwy 2*	SBR	250	-	-	1	1	-	-	1	1
	WBTR	1760	-	-	0	0	-	-	0	0

Notes: Through storage length for driveway 1 was measured from the intersection of Stewart Avenue and Rivergrade Road to project driveway 1, plus the approach driveway length of 75 feet. Through queue length for driveway 2 was measured from the intersection of Arrow Highway and Live Oak Avenue to project driveway 2, plus the driveway length of 250 feet. Driveway 1 northbound left and right queue lengths were based off the driveway 1 departure driveway length of 64 feet. Driveway 1 west bound left is a part of the existing two-lane left turn on Rivergrade Road. The available storage length for the westbound left was considered to extend to the end of the two-way left turn lane terminating at Arrow Highway and Rivergrade Road. Driveway 2 southbound right queue length was based on the driveway length of 250 feet.

7 VEHICLE MILES TRAVELED ANALYSIS

Senate Bill (SB) 743 was signed by Governor Brown in 2013 and required the Governor's Office of Planning and Research (OPR) to amend the CEQA Guidelines to provide an alternative to LOS for evaluating transportation impacts. SB 743 specified that the new criteria should promote the reduction of greenhouse gas emissions, the development of multimodal transportation networks and a diversity of land uses. The bill also specified that delay-based LOS could no longer be considered an indicator of a significant impact on the environment. In response, Section 15064.3, Determining the Significance of Transportation Impacts, was added to the CEQA Guidelines in January 2019. Section 15064.3 states that vehicle miles traveled (VMT) is the most appropriate measure for transportation impacts and provides lead agencies with the discretion to choose the most appropriate methodology and thresholds for evaluating VMT. The provisions of Section 15064.3(c) were implemented statewide beginning on July 1, 2020.

The City of Irwindale refers to the LA County TIA guidelines, which include screening thresholds to identify if a project would be considered to have a less-than significant impact on VMT and therefore could be screened out from further VMT analysis. Section 3.1.2.1, Non-Retail Project Trip Generation Screening Criteria, of the LA County TIA guidelines states that:

> "If the answer is no to the question below, further analysis is not required, and a less than significant determination can be made:
>
> > *Does the development project generate a net increase of 110 or more daily vehicle trips?"*
>
> A project's daily vehicle trip generation should be estimated using the most recent edition of the Institute of Transportation Engineers (ITE) Trip Generation Manual. If the project proposed land use is not listed in the ITE Trip Generation Manual, please submit a trip generation study to Public Works for review and approval".

Based on Table 4.1, the proposed project would generate fewer trips with the development of the proposed warehouse compared to the existing land use. Because the proposed project trip generation would result in net negative trips, fewer than the net increase of 110 or more daily vehicle trips threshold as stated in the LA County TIA guidelines, no further analysis is required.

APPENDIX A – TRAFFIC COUNTS

INTERSECTION TURNING MOVEMENT COUNTS

PREPARED BY: AimTD LLC. tel: 714 253 7888 cs@aimtd.com

DATE:	LOCATION:	Irwindale	PROJECT #:	SC4136
7/26/23	NORTH & SOUTH:	Stewart	LOCATION #:	2
WEDNESDAY	EAST & WEST:	Rivergrade	CONTROL:	SIGNAL

PCE Adjusted	NOTES:							AM / PM / MD / OTHER / OTHER	N ▲ / ◄ W / E ► / S ▼
	Class	1	2	3	4	5	6		
	Factor	1	1.5	2	3	2	2		

		NORTHBOUND Stewart			SOUTHBOUND Stewart			EASTBOUND Rivergrade			WESTBOUND Rivergrade				U-TURNS				
		NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL	NB	SB	EB	WB	TTL
	LANES:	1	1	0	0.5	1	0.5	1	2	0	1	2	0						
AM	7:00 AM	7	1	31	3	2	12	5	32	0	21	26	3	141					0
	7:15 AM	0	0	30	4	2	6	0	25	0	16	27	2	110					0
	7:30 AM	4	1	20	2	3	0	1	34	2	23	43	2	134					0
	7:45 AM	6	3	28	5	0	0	2	33	5	20	60	6	166					0
	8:00 AM	6	3	29	4	2	3	0	39	2	26	25	5	143					0
	8:15 AM	2	0	31	2	0	3	0	41	1	23	38	4	144					0
	8:30 AM	3	3	19	7	0	2	3	57	2	18	27	1	141					0
	8:45 AM	1	2	23	7	0	0	3	45	2	13	34	2	130					0
	VOLUMES	29	13	210	32	8	26	13	305	13	159	278	24	1,107	0	0	0	0	0
	APPROACH %	11%	5%	84%	49%	12%	39%	4%	92%	4%	35%	60%	5%						
	APP/DEPART	251	/	49	66	/	180	331	/	547	460	/	332	0					
	BEGIN PEAK HR		7:30 AM																
	VOLUMES	18	7	108	11	5	6	3	147	10	91	165	16	586					
	APPROACH %	13%	5%	82%	50%	23%	27%	2%	92%	6%	33%	61%	6%						
	PEAK HR FACTOR		0.872			0.647			0.949			0.795		0.883					
	APP/DEPART	133	/	26	22	/	106	160	/	266	272	/	189	0					
PM	04:00 PM	1	0	13	6	2	6	7	20	4	32	19	3	112					0
	4:15 PM	5	0	8	4	5	1	0	13	8	28	25	10	106					0
	4:30 PM	4	0	15	3	5	8	6	9	2	30	21	3	104					0
	4:45 PM	4	3	23	7	1	1	0	10	7	26	17	5	103					0
	5:00 PM	0	0	30	1	1	1	2	29	7	53	11	2	136					0
	5:15 PM	0	1	17	0	3	0	8	13	5	31	5	0	82					0
	5:30 PM	0	0	36	3	0	7	3	21	4	38	11	1	123					0
	5:45 PM	1	0	13	0	0	3	6	14	4	32	6	6	84					0
	VOLUMES	15	4	154	24	16	27	31	129	40	269	113	29	848	0	0	0	0	0
	APPROACH %	9%	2%	89%	36%	23%	41%	15%	65%	20%	65%	28%	7%						
	APP/DEPART	173	/	63	67	/	324	199	/	307	410	/	155	0					
	BEGIN PEAK HR		4:45 PM																
	VOLUMES	4	4	106	11	5	9	12	73	22	148	44	7	443					
	APPROACH %	4%	3%	93%	45%	18%	37%	11%	68%	21%	75%	22%	4%						
	PEAK HR FACTOR		0.788			0.613			0.720			0.758		0.817					
	APP/DEPART	114	/	23	25	/	175	107	/	190	199	/	57	0					

Stewart

NORTH SIDE

Rivergrade WEST SIDE

EAST SIDE **Rivergrade**

SOUTH SIDE

Stewart

INTERSECTION TURNING MOVEMENT COUNTS

PREPARED BY: AimTD LLC. tel: 714 253 7888 cs@aimtd.com

DATE: 7/26/23 WEDNESDAY	LOCATION:	Irwindale	PROJECT #:	SC4136
	NORTH & SOUTH:	Stewart	LOCATION #:	3
	EAST & WEST:	Live Oak	CONTROL:	SIGNAL

PCE Adjusted	NOTES:								
	Class	1	2	3	4	5	6		
	Factor	1	1.5	2	3	2	2		

AM / PM / MD / OTHER / OTHER

▲ N ◄ W E ► S ▼

	NORTHBOUND Stewart			SOUTHBOUND Stewart			EASTBOUND Live Oak			WESTBOUND Live Oak				U-TURNS				
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL	NB	SB	EB	WB	TTL
LANES:	1	1	0	1	1	1	1	2	1	1	2	0						
AM																		
7:00 AM	36	15	0	5	11	16	16	145	13	4	300	5	563					0
7:15 AM	36	20	11	5	4	6	3	137	13	8	308	1	550					0
7:30 AM	43	16	14	3	13	18	10	109	9	2	275	4	514					0
7:45 AM	33	19	8	4	8	12	14	182	9	4	275	8	574					0
8:00 AM	30	11	10	4	12	12	30	147	9	5	255	3	525					0
8:15 AM	34	21	4	2	10	15	10	153	5	4	223	5	483					0
8:30 AM	24	13	5	2	7	11	9	124	9	1	198	5	406					0
8:45 AM	24	19	7	1	6	5	5	139	7	3	214	4	432					0
VOLUMES	258	133	58	25	70	94	94	1,134	72	31	2,046	33	4,045	0	0	0	0	0
APPROACH %	58%	30%	13%	13%	37%	50%	7%	87%	6%	1%	97%	2%						
APP/DEPART	448	/	260	189	/	172	1,300	/	1,216	2,109	/	2,397	0					
BEGIN PEAK HR		7:00 AM																
VOLUMES	147	69	32	16	36	51	42	573	43	18	1,157	17	2,200					
APPROACH %	59%	28%	13%	16%	35%	50%	6%	87%	7%	1%	97%	1%						
PEAK HR FACTOR		0.849			0.765			0.804			0.941		0.959					
APP/DEPART	248	/	128	103	/	96	658	/	621	1,192	/	1,355	0					
PM																		
04:00 PM	16	8	9	3	32	4	6	276	31	7	163	0	552					0
4:15 PM	12	7	7	11	19	7	4	318	31	7	126	2	550					0
4:30 PM	14	9	0	6	27	5	7	341	32	10	118	3	569					0
4:45 PM	10	7	4	6	35	3	17	310	53	8	114	2	568					0
5:00 PM	7	5	6	10	36	6	23	347	49	12	162	5	667					0
5:15 PM	6	10	6	10	42	3	6	353	52	10	126	3	627					0
5:30 PM	19	9	8	7	26	5	23	321	45	10	130	5	607					0
5:45 PM	8	9	8	10	30	2	4	336	38	7	121	3	574					0
VOLUMES	91	64	48	63	246	34	89	2,599	330	71	1,057	23	4,712	0	0	0	0	0
APPROACH %	45%	31%	24%	18%	72%	10%	3%	86%	11%	6%	92%	2%						
APP/DEPART	202	/	175	342	/	646	3,018	/	2,709	1,150	/	1,182	0					
BEGIN PEAK HR		5:00 PM																
VOLUMES	40	33	28	37	134	16	56	1,356	183	39	538	16	2,474					
APPROACH %	40%	33%	28%	20%	72%	9%	4%	85%	11%	7%	91%	3%						
PEAK HR FACTOR		0.704			0.848			0.953			0.830		0.928					
APP/DEPART	100	/	105	187	/	356	1,595	/	1,420	593	/	594	0					

Stewart

NORTH SIDE

Live Oak WEST SIDE

EAST SIDE **Live Oak**

SOUTH SIDE

Stewart

APPENDIX B – LOS SHEETS

Vistro File: C:\...\Live Oak Irwindale Mark HCM.vistro
Report File: C:\...\Existing AM HCM.pdf

Scenario 12 Existing AM
8/23/2023

Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
1	Stewart Ave / Rivergrade Rd	Signalized	HCM 7th Edition	NB Left	0.121	6.2	A
2	Stewart Ave / Live Oak Ave	Signalized	HCM 7th Edition	NB Left	0.547	10.0	B
3	Rivergrade Rd / Project Dwy 1	Two-way stop	HCM 7th Edition	WB Thru	0.003	0.0	A
4	Live Oak Ave / Dwy 2	Two-way stop	HCM 7th Edition	WB Thru	0.013	0.0	A

V/C, Delay, LOS: For two-way stop, these values are taken from the movement with the worst (highest) delay value. For all other control types, they are taken for the whole intersection.

Intersection Level Of Service Report
Intersection 1: Stewart Ave / Rivergrade Rd

Control Type:	Signalized	Delay (sec / veh):	6.2
Analysis Method:	HCM 7th Edition	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.121

Intersection Setup

Name												
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	1	0	0	0	0	0	1	0	0	1	0	0
Entry Pocket Length [ft]	320.00	100.00	100.00	100.00	100.00	100.00	173.00	100.00	100.00	91.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	1	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			35.00			35.00		
Grade [%]	0.00			0.00			0.00			0.00		
Curb Present	No			No			No			No		
Crosswalk	Yes			Yes			Yes			No		

Volumes

Name												
Base Volume Input [veh/h]	18	7	108	11	5	6	3	147	10	91	165	16
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Proportion of CAVs [%]	0.00											
Growth Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right Turn on Red Volume [veh/h]	0	0	73	0	0	1	0	0	1	0	0	1
Total Hourly Volume [veh/h]	18	7	35	11	5	5	3	147	9	91	165	15
Peak Hour Factor	0.8717	0.8717	0.8717	0.6471	0.6471	0.6471	0.9494	0.9494	0.9494	0.7953	0.7953	0.7953
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	5	2	10	4	2	2	1	39	2	29	52	5
Total Analysis Volume [veh/h]	21	8	40	17	8	8	3	155	9	114	207	19
Presence of On-Street Parking	No		No	No		No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
v_do, Outbound Pedestrian Volume crossing	0			0			0			0		
v_di, Inbound Pedestrian Volume crossing m	0			0			0			0		
v_co, Outbound Pedestrian Volume crossing	0			0			0			0		
v_ci, Inbound Pedestrian Volume crossing mi	0			0			0			0		
v_ab, Corner Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	60
Active Pattern	Pattern 1
Coordination Type	Time of Day Pattern Coordinated
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	Lead Green - Beginning of First Green
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal Group	0	8	0	0	4	0	0	2	0	0	6	0
Auxiliary Signal Groups												
Lead / Lag	-	-	-	-	-	-	-	-	-	-	-	-
Minimum Green [s]	0	10	0	0	10	0	0	10	0	0	10	0
Maximum Green [s]	0	32	0	0	32	0	0	20	0	0	20	0
Amber [s]	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
All red [s]	0.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0
Split [s]	0	30	0	0	30	0	0	30	0	0	30	0
Vehicle Extension [s]	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Walk [s]	0	5	0	0	5	0	0	5	0	0	5	0
Pedestrian Clearance [s]	0	10	0	0	17	0	0	14	0	0	14	0
Delayed Vehicle Green [s]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rest In Walk		No			No			No			No	
I1, Start-Up Lost Time [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
I2, Clearance Lost Time [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
Minimum Recall		No			No			No			No	
Maximum Recall		No			No			No			No	
Pedestrian Recall		No			No			No			No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering 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

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Lane Group Calculations

Lane Group	L	C	C	C	L	C	C	L	C	C
C, Cycle Length [s]	60	60	60	60	60	60	60	60	60	60
L, Total Lost Time per Cycle [s]	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
l1_p, Permitted Start-Up Lost Time [s]	2.00	0.00	2.00	0.00	2.00	0.00	0.00	2.00	0.00	0.00
l2, Clearance Lost Time [s]	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
g_i, Effective Green Time [s]	7	7	7	7	45	45	45	45	45	45
g / C, Green / Cycle	0.12	0.12	0.12	0.12	0.75	0.75	0.75	0.75	0.75	0.75
(v / s)_i Volume / Saturation Flow Rate	0.01	0.03	0.02	0.01	0.00	0.04	0.04	0.09	0.06	0.06
s, saturation flow rate [veh/h]	1419	1656	855	1580	1173	1900	1864	1241	1900	1845
c, Capacity [veh/h]	241	194	217	185	927	1424	1397	980	1424	1383
d1, Uniform Delay [s]	25.50	24.08	25.43	23.61	2.93	1.97	1.97	3.11	2.00	2.00
k, delay calibration	0.11	0.11	0.11	0.11	0.50	0.50	0.50	0.50	0.50	0.50
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	0.15	0.66	0.16	0.19	0.01	0.08	0.08	0.24	0.11	0.11
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.09	0.25	0.08	0.08	0.00	0.06	0.06	0.12	0.08	0.08
d, Delay for Lane Group [s/veh]	25.65	24.74	25.59	23.79	2.94	2.05	2.05	3.35	2.11	2.12
Lane Group LOS	C	C	C	C	A	A	A	A	A	A
Critical Lane Group	No	Yes	No	No	No	No	No	Yes	No	No
50th-Percentile Queue Length [veh/ln]	0.27	0.62	0.24	0.19	0.01	0.12	0.12	0.31	0.17	0.17
50th-Percentile Queue Length [ft/ln]	6.86	15.54	5.99	4.73	0.20	2.99	2.99	7.85	4.23	4.19
95th-Percentile Queue Length [veh/ln]	0.49	1.12	0.43	0.34	0.01	0.22	0.22	0.57	0.30	0.30
95th-Percentile Queue Length [ft/ln]	12.35	27.97	10.79	8.51	0.35	5.39	5.39	14.14	7.61	7.55

Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	25.65	24.74	24.74	25.59	24.01	23.79	2.94	2.05	2.05	3.35	2.12	2.12
Movement LOS	C	C	C	C	C	C	A	A	A	A	A	A
d_A, Approach Delay [s/veh]	25.01			24.77			2.06			2.53		
Approach LOS	C			C			A			A		
d_I, Intersection Delay [s/veh]	6.16											
Intersection LOS	A											
Intersection V/C	0.121											

Other Modes

g_Walk,mi, Effective Walk Time [s]	9.0	9.0	9.0	0.0
M_corner, Corner Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
M_CW, Crosswalk Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
d_p, Pedestrian Delay [s]	21.68	21.68	21.68	0.00
I_p,int, Pedestrian LOS Score for Intersectio	2.445	2.133	2.404	0.000
Crosswalk LOS	B	B	B	F
s_b, Saturation Flow Rate of the bicycle lane	2000	2000	2000	2000
c_b, Capacity of the bicycle lane [bicycles/h]	867	867	867	867
d_b, Bicycle Delay [s]	9.63	9.63	9.63	9.63
I_b,int, Bicycle LOS Score for Intersection	1.794	1.588	1.698	1.841
Bicycle LOS	A	A	A	A

Sequence

Ring 1	-	2	-	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	-	6	-	8	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Intersection Level Of Service Report
Intersection 2: Stewart Ave / Live Oak Ave

Control Type:	Signalized	Delay (sec / veh):	10.0
Analysis Method:	HCM 7th Edition	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.547

Intersection Setup

Name												
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	1	0	0	1	0	0	1	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	115.00	100.00	100.00	178.00	100.00	100.00	120.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			45.00			45.00		
Grade [%]	0.00			0.00			0.00			0.00		
Curb Present	No			No			No			No		
Crosswalk	Yes			Yes			No			Yes		

Volumes

Name												
Base Volume Input [veh/h]	147	69	32	16	36	51	42	573	43	18	1157	17
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Proportion of CAVs [%]	0.00											
Growth Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right Turn on Red Volume [veh/h]	0	0	13	0	0	23	0	0	9	0	0	3
Total Hourly Volume [veh/h]	147	69	19	16	36	28	42	573	34	18	1157	14
Peak Hour Factor	0.8493	0.8493	0.8493	0.7649	0.7649	0.7649	0.8038	0.8038	0.8038	0.9412	0.9412	0.9412
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	43	20	6	5	12	9	13	178	11	5	307	4
Total Analysis Volume [veh/h]	173	81	22	21	47	37	52	713	42	19	1229	15
Presence of On-Street Parking	No		No	No		No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
v_do, Outbound Pedestrian Volume crossing	0			0			0			0		
v_di, Inbound Pedestrian Volume crossing m	0			0			0			0		
v_co, Outbound Pedestrian Volume crossing	0			0			0			0		
v_ci, Inbound Pedestrian Volume crossing mi	0			0			0			0		
v_ab, Corner Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	60
Active Pattern	Pattern 1
Coordination Type	Time of Day Pattern Coordinated
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	Lead Green - Beginning of First Green
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal Group	0	8	0	0	4	0	0	2	0	0	6	0
Auxiliary Signal Groups												
Lead / Lag	-	-	-	-	-	-	-	-	-	-	-	-
Minimum Green [s]	0	10	0	0	10	0	0	10	0	0	10	0
Maximum Green [s]	0	30	0	0	30	0	0	22	0	0	22	0
Amber [s]	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
All red [s]	0.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0
Split [s]	0	44	0	0	44	0	0	16	0	0	16	0
Vehicle Extension [s]	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Walk [s]	0	5	0	0	5	0	0	5	0	0	5	0
Pedestrian Clearance [s]	0	20	0	0	10	0	0	7	0	0	7	0
Delayed Vehicle Green [s]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rest In Walk		No			No			No			No	
I1, Start-Up Lost Time [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
I2, Clearance Lost Time [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
Minimum Recall		No			No			No			No	
Maximum Recall		No			No			No			No	
Pedestrian Recall		No			No			No			No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering 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

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Lane Group Calculations

Lane Group	C	L	C	R	L	C	R	L	C	C
C, Cycle Length [s]	60	60	60	60	60	60	60	60	60	60
L, Total Lost Time per Cycle [s]	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
l1_p, Permitted Start-Up Lost Time [s]	2.00	2.00	0.00	0.00	2.00	0.00	0.00	2.00	0.00	0.00
l2, Clearance Lost Time [s]	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
g_i, Effective Green Time [s]	16	16	16	16	36	36	36	36	36	36
g / C, Green / Cycle	0.26	0.26	0.26	0.26	0.61	0.61	0.61	0.61	0.61	0.61
(v / s)_i Volume / Saturation Flow Rate	0.22	0.02	0.02	0.02	0.11	0.20	0.03	0.03	0.33	0.33
s, saturation flow rate [veh/h]	1263	1312	1900	1615	454	3618	1615	720	1900	1892
c, Capacity [veh/h]	424	129	490	417	299	2202	983	469	1156	1151
d1, Uniform Delay [s]	22.20	16.94	16.93	16.90	12.46	5.72	4.72	8.16	6.84	6.84
k, delay calibration	0.11	0.11	0.11	0.11	0.50	0.50	0.50	0.50	0.50	0.50
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	1.70	0.59	0.08	0.09	1.27	0.39	0.08	0.16	1.80	1.81
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.65	0.16	0.10	0.09	0.17	0.32	0.04	0.04	0.54	0.54
d, Delay for Lane Group [s/veh]	23.89	17.53	17.02	16.99	13.72	6.12	4.80	8.33	8.64	8.65
Lane Group LOS	C	B	B	B	B	A	A	A	A	A
Critical Lane Group	Yes	No	No	No	No	No	No	No	No	Yes
50th-Percentile Queue Length [veh/ln]	3.63	0.23	0.47	0.37	0.49	1.44	0.15	0.12	3.33	3.32
50th-Percentile Queue Length [ft/ln]	90.73	5.63	11.70	9.23	12.24	35.92	3.76	2.98	83.26	83.02
95th-Percentile Queue Length [veh/ln]	6.53	0.41	0.84	0.66	0.88	2.59	0.27	0.21	5.99	5.98
95th-Percentile Queue Length [ft/ln]	163.31	10.13	21.06	16.62	22.03	64.65	6.76	5.36	149.87	149.43

Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	23.89	23.89	23.89	17.53	17.02	16.99	13.72	6.12	4.80	8.33	8.65	8.65
Movement LOS	C	C	C	B	B	B	B	A	A	A	A	A
d_A, Approach Delay [s/veh]	23.89			17.11			6.54			8.64		
Approach LOS	C			B			A			A		
d_I, Intersection Delay [s/veh]	10.03											
Intersection LOS	B											
Intersection V/C	0.547											

Other Modes

g_Walk,mi, Effective Walk Time [s]	9.0	9.0	0.0	9.0
M_corner, Corner Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
M_CW, Crosswalk Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
d_p, Pedestrian Delay [s]	21.68	21.68	0.00	21.68
I_p,int, Pedestrian LOS Score for Intersectio	1.939	2.286	0.000	2.910
Crosswalk LOS	A	B	F	C
s_b, Saturation Flow Rate of the bicycle lane	2000	2000	2000	2000
c_b, Capacity of the bicycle lane [bicycles/h]	1333	1333	400	400
d_b, Bicycle Delay [s]	3.33	3.33	19.20	19.20
I_b,int, Bicycle LOS Score for Intersection	2.036	1.771	2.233	2.604
Bicycle LOS	B	A	B	B

Sequence

Ring 1	-	2	-	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	-	6	-	8	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Intersection Level Of Service Report
Intersection 3: Rivergrade Rd / Project Dwy 1

Control Type:	Two-way stop	Delay (sec / veh):	0.0
Analysis Method:	HCM 7th Edition	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.003

Intersection Setup

Name						
Approach	Northbound		Eastbound		Westbound	
Lane Configuration						
Turning Movement	Left	Right	Thru	Right	Left	Thru
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00		30.00		30.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	No		No		No	

Volumes

Name						
Base Volume Input [veh/h]	0	0	266	0	0	272
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	0.00	0.00	0.00
Growth Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	0	0	266	0	0	272
Peak Hour Factor	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	0	70	0	0	72
Total Analysis Volume [veh/h]	0	0	280	0	0	286
Pedestrian Volume [ped/h]	0		0		0	

Intersection Settings

Priority Scheme	Stop	Free	Free
Flared Lane	No		
Storage Area [veh]	0	0	0
Two-Stage Gap Acceptance	No		
Number of Storage Spaces in Median	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.00	0.00	0.00	0.00	0.00
d_M, Delay for Movement [s/veh]	11.38	9.05	0.00	0.00	7.78	0.00
Movement LOS	B	A	A	A	A	A
95th-Percentile Queue Length [veh/ln]	0.00	0.00	0.00	0.00	0.00	0.00
95th-Percentile Queue Length [ft/ln]	0.00	0.00	0.00	0.00	0.00	0.00
d_A, Approach Delay [s/veh]	10.22		0.00		0.00	
Approach LOS	B		A		A	
d_I, Intersection Delay [s/veh]	0.00					
Intersection LOS	A					

Intersection Level Of Service Report
Intersection 4: Live Oak Ave / Dwy 2

Control Type:	Two-way stop	Delay (sec / veh):	0.0
Analysis Method:	HCM 7th Edition	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.013

Intersection Setup

Name						
Approach	Southbound		Eastbound		Westbound	
Lane Configuration						
Turning Movement	Left	Right	Left	Thru	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00		30.00		30.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	No		No		No	

Volumes

Name						
Base Volume Input [veh/h]	0	0	0	621	1192	0
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	0.00	2.00	0.00	0.00	0.00
Growth Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	0	0	0	621	1192	0
Peak Hour Factor	1.0000	0.9500	1.0000	0.9500	0.9500	0.9500
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	0	0	163	314	0
Total Analysis Volume [veh/h]	0	0	0	654	1255	0
Pedestrian Volume [ped/h]	0		0		0	

Intersection Settings

Priority Scheme	Stop	Free	Free
Flared Lane			
Storage Area [veh]	0	0	0
Two-Stage Gap Acceptance	No		
Number of Storage Spaces in Median	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.00	0.00	0.01	0.01	0.00
d_M, Delay for Movement [s/veh]	0.00	13.35	0.00	0.00	0.00	0.00
Movement LOS		B		A	A	A
95th-Percentile Queue Length [veh/ln]	0.00	0.00	0.00	0.00	0.00	0.00
95th-Percentile Queue Length [ft/ln]	0.00	0.00	0.00	0.00	0.00	0.00
d_A, Approach Delay [s/veh]	13.35		0.00		0.00	
Approach LOS	B		A		A	
d_I, Intersection Delay [s/veh]	0.00					
Intersection LOS	A					

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Report File: C:\...\Existing AM HCM.pdf

Scenario 12 Existing AM
8/23/2023

Turning Movement Volume: Summary

ID	Intersection Name	Northbound			Southbound			Eastbound			Westbound			Total Volume
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
1	Stewart Ave / Rivergrade Rd	18	7	108	11	5	6	3	147	10	91	165	16	587

ID	Intersection Name	Northbound			Southbound			Eastbound			Westbound			Total Volume
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
2	Stewart Ave / Live Oak Ave	147	69	32	16	36	51	42	573	43	18	1157	17	2201

ID	Intersection Name	Northbound		Eastbound		Westbound		Total Volume
		Left	Right	Thru	Right	Left	Thru	
3	Rivergrade Rd / Project Dwy 1	0	0	266	0	0	272	538

ID	Intersection Name	Southbound	Eastbound	Westbound		Total Volume
		Right	Thru	Thru	Right	
4	Live Oak Ave / Dwy 2	0	621	1192	0	1813

Vistro File: C:\...\Live Oak Irwindale Mark HCM.vistro
Report File: C:\...\Existing Plus Project AM HCM.pdf

Scenario 5 Existing Plus Project AM
8/23/2023

Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
1	Stewart Ave / Rivergrade Rd	Signalized	HCM 7th Edition	NB Left	0.122	6.2	A
2	Stewart Ave / Live Oak Ave	Signalized	HCM 7th Edition	NB Left	0.547	10.0	B
3	Rivergrade Rd / Project Dwy 1	Two-way stop	HCM 7th Edition	NB Left	0.002	11.5	B
4	Live Oak Ave / Dwy 2	Two-way stop	HCM 7th Edition	SB Right	0.009	13.5	B

V/C, Delay, LOS: For two-way stop, these values are taken from the movement with the worst (highest) delay value. For all other control types, they are taken for the whole intersection.

Intersection Level Of Service Report
Intersection 1: Stewart Ave / Rivergrade Rd

Control Type:	Signalized	Delay (sec / veh):	6.2
Analysis Method:	HCM 7th Edition	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.122

Intersection Setup

Name												
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	1	0	0	0	0	0	1	0	0	1	0	0
Entry Pocket Length [ft]	320.00	100.00	100.00	100.00	100.00	100.00	173.00	100.00	100.00	91.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	1	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			35.00			35.00		
Grade [%]	0.00			0.00			0.00			0.00		
Curb Present	No			No			No			No		
Crosswalk	Yes			Yes			Yes			No		

Volumes

Name												
Base Volume Input [veh/h]	18	7	108	11	5	6	3	147	10	91	165	16
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Proportion of CAVs [%]	0.00											
Growth Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	1	0	0	0	0	5	0	0	1	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right Turn on Red Volume [veh/h]	0	0	73	0	0	1	0	0	1	0	0	1
Total Hourly Volume [veh/h]	18	7	36	11	5	5	3	152	9	91	166	15
Peak Hour Factor	0.8717	0.8717	0.8717	0.6471	0.6471	0.6471	0.9494	0.9494	0.9494	0.7953	0.7953	0.7953
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	5	2	10	4	2	2	1	40	2	29	52	5
Total Analysis Volume [veh/h]	21	8	41	17	8	8	3	160	9	114	209	19
Presence of On-Street Parking	No		No	No		No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
v_do, Outbound Pedestrian Volume crossing	0			0			0			0		
v_di, Inbound Pedestrian Volume crossing m	0			0			0			0		
v_co, Outbound Pedestrian Volume crossing	0			0			0			0		
v_ci, Inbound Pedestrian Volume crossing mi	0			0			0			0		
v_ab, Corner Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	60
Active Pattern	Pattern 1
Coordination Type	Time of Day Pattern Coordinated
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	Lead Green - Beginning of First Green
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal Group	0	8	0	0	4	0	0	2	0	0	6	0
Auxiliary Signal Groups												
Lead / Lag	-	-	-	-	-	-	-	-	-	-	-	-
Minimum Green [s]	0	10	0	0	10	0	0	10	0	0	10	0
Maximum Green [s]	0	32	0	0	32	0	0	20	0	0	20	0
Amber [s]	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
All red [s]	0.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0
Split [s]	0	30	0	0	30	0	0	30	0	0	30	0
Vehicle Extension [s]	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Walk [s]	0	5	0	0	5	0	0	5	0	0	5	0
Pedestrian Clearance [s]	0	10	0	0	17	0	0	14	0	0	14	0
Delayed Vehicle Green [s]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rest In Walk		No			No			No			No	
I1, Start-Up Lost Time [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
I2, Clearance Lost Time [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
Minimum Recall		No			No			No			No	
Maximum Recall		No			No			No			No	
Pedestrian Recall		No			No			No			No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering 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

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Lane Group Calculations

Lane Group	L	C	C	C	L	C	C	L	C	C
C, Cycle Length [s]	60	60	60	60	60	60	60	60	60	60
L, Total Lost Time per Cycle [s]	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
l1_p, Permitted Start-Up Lost Time [s]	2.00	0.00	2.00	0.00	2.00	0.00	0.00	2.00	0.00	0.00
l2, Clearance Lost Time [s]	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
g_i, Effective Green Time [s]	7	7	7	7	45	45	45	45	45	45
g / C, Green / Cycle	0.12	0.12	0.12	0.12	0.75	0.75	0.75	0.75	0.75	0.75
(v / s)_i Volume / Saturation Flow Rate	0.01	0.03	0.02	0.01	0.00	0.04	0.05	0.09	0.06	0.06
s, saturation flow rate [veh/h]	1419	1656	850	1581	1171	1900	1865	1236	1900	1845
c, Capacity [veh/h]	242	195	217	187	924	1422	1396	975	1422	1381
d1, Uniform Delay [s]	25.45	24.05	25.42	23.56	2.95	1.98	1.99	3.14	2.02	2.02
k, delay calibration	0.11	0.11	0.11	0.11	0.50	0.50	0.50	0.50	0.50	0.50
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	0.15	0.66	0.16	0.18	0.01	0.08	0.08	0.24	0.11	0.12
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.09	0.25	0.08	0.08	0.00	0.06	0.06	0.12	0.08	0.08
d, Delay for Lane Group [s/veh]	25.60	24.71	25.58	23.74	2.96	2.06	2.07	3.38	2.13	2.14
Lane Group LOS	C	C	C	C	A	A	A	A	A	A
Critical Lane Group	No	Yes	No	No	No	No	No	Yes	No	No
50th-Percentile Queue Length [veh/ln]	0.27	0.63	0.24	0.19	0.01	0.12	0.12	0.32	0.17	0.17
50th-Percentile Queue Length [ft/ln]	6.85	15.85	5.98	4.73	0.20	3.12	3.12	7.93	4.32	4.28
95th-Percentile Queue Length [veh/ln]	0.49	1.14	0.43	0.34	0.01	0.22	0.22	0.57	0.31	0.31
95th-Percentile Queue Length [ft/ln]	12.34	28.53	10.76	8.52	0.35	5.62	5.62	14.28	7.77	7.70

Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	25.60	24.71	24.71	25.58	23.96	23.74	2.96	2.07	2.07	3.38	2.13	2.14
Movement LOS	C	C	C	C	C	C	A	A	A	A	A	A
d_A, Approach Delay [s/veh]	24.98			24.74			2.08			2.55		
Approach LOS	C			C			A			A		
d_I, Intersection Delay [s/veh]	6.15											
Intersection LOS	A											
Intersection V/C	0.122											

Other Modes

g_Walk,mi, Effective Walk Time [s]	9.0	9.0	9.0	0.0
M_corner, Corner Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
M_CW, Crosswalk Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
d_p, Pedestrian Delay [s]	21.68	21.68	21.68	0.00
I_p,int, Pedestrian LOS Score for Intersectio	2.445	2.133	2.406	0.000
Crosswalk LOS	B	B	B	F
s_b, Saturation Flow Rate of the bicycle lane	2000	2000	2000	2000
c_b, Capacity of the bicycle lane [bicycles/h]	867	867	867	867
d_b, Bicycle Delay [s]	9.63	9.63	9.63	9.63
I_b,int, Bicycle LOS Score for Intersection	1.796	1.588	1.702	1.843
Bicycle LOS	A	A	A	A

Sequence

Ring 1	-	2	-	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	-	6	-	8	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Intersection Level Of Service Report
Intersection 2: Stewart Ave / Live Oak Ave

Control Type:	Signalized	Delay (sec / veh):	10.0
Analysis Method:	HCM 7th Edition	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.547

Intersection Setup

Name												
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	1	0	0	1	0	0	1	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	115.00	100.00	100.00	178.00	100.00	100.00	120.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			45.00			45.00		
Grade [%]	0.00			0.00			0.00			0.00		
Curb Present	No			No			No			No		
Crosswalk	Yes			Yes			No			Yes		

Volumes

Name												
Base Volume Input [veh/h]	147	69	32	16	36	51	42	573	43	18	1157	17
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Proportion of CAVs [%]	0.00											
Growth Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	4	0	0	1	1
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right Turn on Red Volume [veh/h]	0	0	13	0	0	23	0	0	9	0	0	3
Total Hourly Volume [veh/h]	147	69	19	16	36	28	42	577	34	18	1158	15
Peak Hour Factor	0.8493	0.8493	0.8493	0.7649	0.7649	0.7649	0.8038	0.8038	0.8038	0.9412	0.9412	0.9412
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	43	20	6	5	12	9	13	179	11	5	308	4
Total Analysis Volume [veh/h]	173	81	22	21	47	37	52	718	42	19	1230	16
Presence of On-Street Parking	No		No	No		No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
v_do, Outbound Pedestrian Volume crossing	0			0			0			0		
v_di, Inbound Pedestrian Volume crossing m	0			0			0			0		
v_co, Outbound Pedestrian Volume crossing	0			0			0			0		
v_ci, Inbound Pedestrian Volume crossing mi	0			0			0			0		
v_ab, Corner Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	60
Active Pattern	Pattern 1
Coordination Type	Time of Day Pattern Coordinated
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	Lead Green - Beginning of First Green
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal Group	0	8	0	0	4	0	0	2	0	0	6	0
Auxiliary Signal Groups												
Lead / Lag	-	-	-	-	-	-	-	-	-	-	-	-
Minimum Green [s]	0	10	0	0	10	0	0	10	0	0	10	0
Maximum Green [s]	0	30	0	0	30	0	0	22	0	0	22	0
Amber [s]	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
All red [s]	0.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0
Split [s]	0	44	0	0	44	0	0	16	0	0	16	0
Vehicle Extension [s]	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Walk [s]	0	5	0	0	5	0	0	5	0	0	5	0
Pedestrian Clearance [s]	0	20	0	0	10	0	0	7	0	0	7	0
Delayed Vehicle Green [s]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rest In Walk		No			No			No			No	
I1, Start-Up Lost Time [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
I2, Clearance Lost Time [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
Minimum Recall		No			No			No			No	
Maximum Recall		No			No			No			No	
Pedestrian Recall		No			No			No			No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering 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

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Lane Group Calculations

Lane Group	C	L	C	R	L	C	R	L	C	C
C, Cycle Length [s]	60	60	60	60	60	60	60	60	60	60
L, Total Lost Time per Cycle [s]	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
l1_p, Permitted Start-Up Lost Time [s]	2.00	2.00	0.00	0.00	2.00	0.00	0.00	2.00	0.00	0.00
l2, Clearance Lost Time [s]	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
g_i, Effective Green Time [s]	16	16	16	16	36	36	36	36	36	36
g / C, Green / Cycle	0.26	0.26	0.26	0.26	0.61	0.61	0.61	0.61	0.61	0.61
(v / s)_i Volume / Saturation Flow Rate	0.22	0.02	0.02	0.02	0.11	0.20	0.03	0.03	0.33	0.33
s, saturation flow rate [veh/h]	1263	1312	1900	1615	453	3618	1615	717	1900	1891
c, Capacity [veh/h]	424	129	490	417	298	2202	983	467	1156	1151
d1, Uniform Delay [s]	22.20	16.94	16.93	16.90	12.48	5.73	4.72	8.19	6.85	6.85
k, delay calibration	0.11	0.11	0.11	0.11	0.50	0.50	0.50	0.50	0.50	0.50
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	1.70	0.59	0.08	0.09	1.27	0.40	0.08	0.16	1.81	1.82
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.65	0.16	0.10	0.09	0.17	0.33	0.04	0.04	0.54	0.54
d, Delay for Lane Group [s/veh]	23.89	17.53	17.02	16.99	13.75	6.13	4.80	8.35	8.66	8.67
Lane Group LOS	C	B	B	B	B	A	A	A	A	A
Critical Lane Group	Yes	No	No	No	No	No	No	No	No	Yes
50th-Percentile Queue Length [veh/ln]	3.63	0.23	0.47	0.37	0.49	1.45	0.15	0.12	3.34	3.33
50th-Percentile Queue Length [ft/ln]	90.73	5.63	11.70	9.23	12.26	36.24	3.76	2.99	83.49	83.23
95th-Percentile Queue Length [veh/ln]	6.53	0.41	0.84	0.66	0.88	2.61	0.27	0.22	6.01	5.99
95th-Percentile Queue Length [ft/ln]	163.31	10.13	21.06	16.62	22.07	65.22	6.76	5.38	150.28	149.82

Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	23.89	23.89	23.89	17.53	17.02	16.99	13.75	6.13	4.80	8.35	8.66	8.67
Movement LOS	C	C	C	B	B	B	B	A	A	A	A	A
d_A, Approach Delay [s/veh]	23.89			17.11			6.55			8.66		
Approach LOS	C			B			A			A		
d_I, Intersection Delay [s/veh]	10.03											
Intersection LOS	B											
Intersection V/C	0.547											

Other Modes

g_Walk,mi, Effective Walk Time [s]	9.0	9.0	0.0	9.0
M_corner, Corner Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
M_CW, Crosswalk Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
d_p, Pedestrian Delay [s]	21.68	21.68	0.00	21.68
I_p,int, Pedestrian LOS Score for Intersectio	1.939	2.287	0.000	2.912
Crosswalk LOS	A	B	F	C
s_b, Saturation Flow Rate of the bicycle lane	2000	2000	2000	2000
c_b, Capacity of the bicycle lane [bicycles/h]	1333	1333	400	400
d_b, Bicycle Delay [s]	3.33	3.33	19.20	19.20
I_b,int, Bicycle LOS Score for Intersection	2.036	1.771	2.237	2.606
Bicycle LOS	B	A	B	B

Sequence

Ring 1	-	2	-	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	-	6	-	8	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Intersection Level Of Service Report
Intersection 3: Rivergrade Rd / Project Dwy 1

Control Type:	Two-way stop	Delay (sec / veh):	11.5
Analysis Method:	HCM 7th Edition	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.002

Intersection Setup

Name						
Approach	Northbound		Eastbound		Westbound	
Lane Configuration						
Turning Movement	Left	Right	Thru	Right	Left	Thru
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00		30.00		30.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	No		No		No	

Volumes

Name						
Base Volume Input [veh/h]	0	0	266	0	0	272
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	0.00	0.00	0.00
Growth Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	1	1	1	5	2	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	1	1	267	5	2	272
Peak Hour Factor	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	0	70	1	1	72
Total Analysis Volume [veh/h]	1	1	281	5	2	286
Pedestrian Volume [ped/h]	0		0		0	

Intersection Settings

Priority Scheme	Stop	Free	Free
Flared Lane	No		
Storage Area [veh]	0	0	0
Two-Stage Gap Acceptance	No		
Number of Storage Spaces in Median	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.00	0.00	0.00	0.00	0.00
d_M, Delay for Movement [s/veh]	11.48	9.08	0.00	0.00	7.80	0.00
Movement LOS	B	A	A	A	A	A
95th-Percentile Queue Length [veh/ln]	0.01	0.01	0.00	0.00	0.00	0.00
95th-Percentile Queue Length [ft/ln]	0.22	0.22	0.00	0.00	0.08	0.04
d_A, Approach Delay [s/veh]	10.28		0.00		0.05	
Approach LOS	B		A		A	
d_I, Intersection Delay [s/veh]	0.06					
Intersection LOS	B					

Intersection Level Of Service Report
Intersection 4: Live Oak Ave / Dwy 2

Control Type:	Two-way stop	Delay (sec / veh):	13.5
Analysis Method:	HCM 7th Edition	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.009

Intersection Setup

Name						
Approach	Southbound		Eastbound		Westbound	
Lane Configuration						
Turning Movement	Left	Right	Left	Thru	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00		30.00		30.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	No		No		No	

Volumes

Name						
Base Volume Input [veh/h]	0	0	0	621	1192	0
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	0.00	2.00	0.00	0.00	0.00
Growth Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	4	0	6	0	13
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	0	4	0	627	1192	13
Peak Hour Factor	1.0000	0.9500	1.0000	0.9500	0.9500	0.9500
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	1	0	165	314	3
Total Analysis Volume [veh/h]	0	4	0	660	1255	14
Pedestrian Volume [ped/h]	0		0		0	

Intersection Settings

Priority Scheme	Stop	Free	Free
Flared Lane			
Storage Area [veh]	0	0	0
Two-Stage Gap Acceptance	No		
Number of Storage Spaces in Median	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.01	0.00	0.01	0.01	0.00
d_M, Delay for Movement [s/veh]	0.00	13.52	0.00	0.00	0.00	0.00
Movement LOS		B		A	A	A
95th-Percentile Queue Length [veh/ln]	0.00	0.03	0.00	0.00	0.00	0.00
95th-Percentile Queue Length [ft/ln]	0.00	0.71	0.00	0.00	0.00	0.00
d_A, Approach Delay [s/veh]	13.52		0.00		0.00	
Approach LOS	B		A		A	
d_I, Intersection Delay [s/veh]	0.03					
Intersection LOS	B					

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Report File: C:\...\Existing Plus Project AM HCM.pdf

Scenario 5 Existing Plus Project AM
8/23/2023

Turning Movement Volume: Summary

ID	Intersection Name	Northbound			Southbound			Eastbound			Westbound			Total Volume
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
1	Stewart Ave / Rivergrade Rd	18	7	109	11	5	6	3	152	10	91	166	16	594

ID	Intersection Name	Northbound			Southbound			Eastbound			Westbound			Total Volume
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
2	Stewart Ave / Live Oak Ave	147	69	32	16	36	51	42	577	43	18	1158	18	2207

ID	Intersection Name	Northbound		Eastbound		Westbound		Total Volume
		Left	Right	Thru	Right	Left	Thru	
3	Rivergrade Rd / Project Dwy 1	1	1	267	5	2	272	548

ID	Intersection Name	Southbound	Eastbound	Westbound		Total Volume
		Right	Thru	Thru	Right	
4	Live Oak Ave / Dwy 2	4	627	1192	13	1836

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Report File: C:\...\Existing Plus Project PM HCM.pdf 8/23/2023

Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
1	Stewart Ave / Rivergrade Rd	Signalized	HCM 7th Edition	NB Left	0.176	5.2	A
2	Stewart Ave / Live Oak Ave	Signalized	HCM 7th Edition	NB Left	0.530	7.3	A
3	Rivergrade Rd / Project Dwy 1	Two-way stop	HCM 7th Edition	NB Left	0.008	10.5	B
4	Live Oak Ave / Dwy 2	Two-way stop	HCM 7th Edition	SB Right	0.019	10.3	B

V/C, Delay, LOS: For two-way stop, these values are taken from the movement with the worst (highest) delay value. For all other control types, they are taken for the whole intersection.

Intersection Level Of Service Report
Intersection 1: Stewart Ave / Rivergrade Rd

Control Type:	Signalized	Delay (sec / veh):	5.2
Analysis Method:	HCM 7th Edition	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.176

Intersection Setup

Name												
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	1	0	0	0	0	0	1	0	0	1	0	0
Entry Pocket Length [ft]	320.00	100.00	100.00	100.00	100.00	100.00	173.00	100.00	100.00	91.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	1	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			35.00			35.00		
Grade [%]	0.00			0.00			0.00			0.00		
Curb Present	No			No			No			No		
Crosswalk	Yes			Yes			Yes			No		

Volumes

Name												
Base Volume Input [veh/h]	4	4	106	11	5	9	12	73	22	148	44	7
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Proportion of CAVs [%]	0.00											
Growth Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	2	0	0	0	0	2	0	0	5	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right Turn on Red Volume [veh/h]	0	0	96	0	0	3	0	0	1	0	0	0
Total Hourly Volume [veh/h]	4	4	12	11	5	6	12	75	21	148	49	7
Peak Hour Factor	0.7882	0.7882	0.7882	0.6125	0.6125	0.6125	0.7196	0.7196	0.7196	0.7576	0.7576	0.7576
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	1	1	4	4	2	2	4	26	7	49	16	2
Total Analysis Volume [veh/h]	5	5	15	18	8	10	17	104	29	195	65	9
Presence of On-Street Parking	No		No	No		No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
v_do, Outbound Pedestrian Volume crossing	0			0			0			0		
v_di, Inbound Pedestrian Volume crossing m	0			0			0			0		
v_co, Outbound Pedestrian Volume crossing	0			0			0			0		
v_ci, Inbound Pedestrian Volume crossing mi	0			0			0			0		
v_ab, Corner Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	60
Active Pattern	Pattern 1
Coordination Type	Time of Day Pattern Coordinated
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	Lead Green - Beginning of First Green
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal Group	0	8	0	0	4	0	0	2	0	0	6	0
Auxiliary Signal Groups												
Lead / Lag	-	-	-	-	-	-	-	-	-	-	-	-
Minimum Green [s]	0	10	0	0	10	0	0	10	0	0	10	0
Maximum Green [s]	0	22	0	0	22	0	0	30	0	0	30	0
Amber [s]	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
All red [s]	0.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0
Split [s]	0	27	0	0	27	0	0	33	0	0	33	0
Vehicle Extension [s]	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Walk [s]	0	5	0	0	5	0	0	5	0	0	5	0
Pedestrian Clearance [s]	0	10	0	0	17	0	0	14	0	0	14	0
Delayed Vehicle Green [s]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rest In Walk		No			No			No			No	
I1, Start-Up Lost Time [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
I2, Clearance Lost Time [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
Minimum Recall		No			No			No			No	
Maximum Recall		No			No			No			No	
Pedestrian Recall		No			No			No			No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering 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

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Lane Group Calculations

Lane Group	L	C	C	C	L	C	C	L	C	C
C, Cycle Length [s]	60	60	60	60	60	60	60	60	60	60
L, Total Lost Time per Cycle [s]	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
l1_p, Permitted Start-Up Lost Time [s]	2.00	0.00	2.00	0.00	2.00	0.00	0.00	2.00	0.00	0.00
l2, Clearance Lost Time [s]	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
g_i, Effective Green Time [s]	5	5	5	5	47	47	47	47	47	47
g / C, Green / Cycle	0.08	0.08	0.08	0.08	0.79	0.79	0.79	0.79	0.79	0.79
(v / s)_i Volume / Saturation Flow Rate	0.00	0.01	0.02	0.01	0.01	0.04	0.04	0.15	0.02	0.02
s, saturation flow rate [veh/h]	1417	1678	902	1549	1347	1900	1763	1277	1900	1821
c, Capacity [veh/h]	180	130	182	120	1121	1499	1391	1063	1499	1437
d1, Uniform Delay [s]	27.61	25.84	26.63	25.78	2.01	1.38	1.38	2.41	1.36	1.36
k, delay calibration	0.11	0.11	0.11	0.11	0.50	0.50	0.50	0.50	0.50	0.50
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	0.06	0.54	0.28	0.47	0.02	0.06	0.06	0.38	0.03	0.03
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.03	0.15	0.11	0.13	0.02	0.04	0.05	0.18	0.02	0.03
d, Delay for Lane Group [s/veh]	27.67	26.38	26.91	26.25	2.03	1.44	1.45	2.79	1.39	1.39
Lane Group LOS	C	C	C	C	A	A	A	A	A	A
Critical Lane Group	No	No	Yes	No	No	No	No	Yes	No	No
50th-Percentile Queue Length [veh/ln]	0.07	0.27	0.29	0.21	0.03	0.05	0.05	0.39	0.03	0.03
50th-Percentile Queue Length [ft/ln]	1.72	6.82	7.22	5.18	0.69	1.26	1.28	9.83	0.69	0.69
95th-Percentile Queue Length [veh/ln]	0.12	0.49	0.52	0.37	0.05	0.09	0.09	0.71	0.05	0.05
95th-Percentile Queue Length [ft/ln]	3.10	12.28	13.00	9.33	1.24	2.26	2.30	17.69	1.23	1.23

Movement, Approach, & Intersection Results

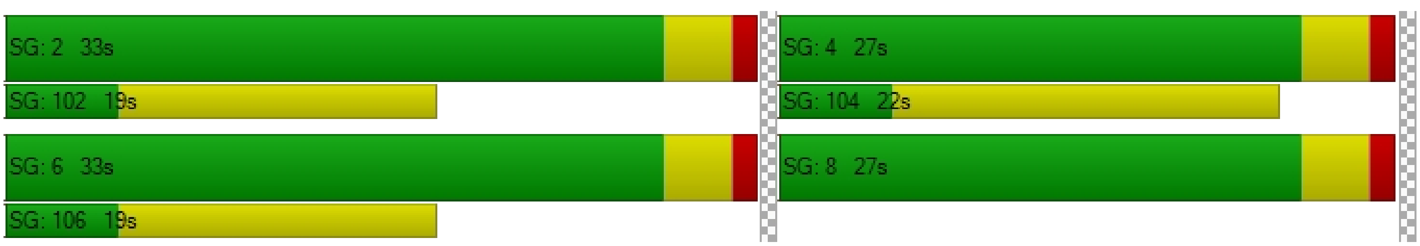
d_M, Delay for Movement [s/veh]	27.67	26.38	26.38	26.91	26.48	26.25	2.03	1.44	1.45	2.79	1.39	1.39
Movement LOS	C	C	C	C	C	C	A	A	A	A	A	A
d_A, Approach Delay [s/veh]	26.64			26.63			1.51			2.41		
Approach LOS	C			C			A			A		
d_I, Intersection Delay [s/veh]	5.21											
Intersection LOS	A											
Intersection V/C	0.176											

Other Modes

g_Walk,mi, Effective Walk Time [s]	9.0	9.0	9.0	0.0
M_corner, Corner Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
M_CW, Crosswalk Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
d_p, Pedestrian Delay [s]	21.68	21.68	21.68	0.00
I_p,int, Pedestrian LOS Score for Intersectio	2.612	2.157	2.342	0.000
Crosswalk LOS	B	B	B	F
s_b, Saturation Flow Rate of the bicycle lane	2000	2000	2000	2000
c_b, Capacity of the bicycle lane [bicycles/h]	767	767	967	967
d_b, Bicycle Delay [s]	11.41	11.41	8.01	8.01
I_b,int, Bicycle LOS Score for Intersection	1.759	1.592	1.684	1.782
Bicycle LOS	A	A	A	A

Sequence

Ring 1	-	2	-	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	-	6	-	8	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Intersection Level Of Service Report
Intersection 2: Stewart Ave / Live Oak Ave

Control Type:	Signalized	Delay (sec / veh):	7.3
Analysis Method:	HCM 7th Edition	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.530

Intersection Setup

Name												
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	1	0	0	1	0	0	1	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	115.00	100.00	100.00	178.00	100.00	100.00	120.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			45.00			45.00		
Grade [%]	0.00			0.00			0.00			0.00		
Curb Present	No			No			No			No		
Crosswalk	Yes			Yes			No			Yes		

Volumes

Name												
Base Volume Input [veh/h]	40	33	28	37	134	16	56	1356	183	39	538	16
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Proportion of CAVs [%]	0.00											
Growth Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	1	0	0	4	2
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right Turn on Red Volume [veh/h]	0	0	7	0	0	11	0	0	40	0	0	2
Total Hourly Volume [veh/h]	40	33	21	37	134	5	56	1357	143	39	542	16
Peak Hour Factor	0.7042	0.7042	0.7042	0.8477	0.8477	0.8477	0.9525	0.9525	0.9525	0.8298	0.8298	0.8298
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	14	12	7	11	40	1	15	356	38	12	163	5
Total Analysis Volume [veh/h]	57	47	30	44	158	6	59	1425	150	47	653	19
Presence of On-Street Parking	No		No	No		No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
v_do, Outbound Pedestrian Volume crossing	0			0			0			0		
v_di, Inbound Pedestrian Volume crossing m	0			0			0			0		
v_co, Outbound Pedestrian Volume crossing	0			0			0			0		
v_ci, Inbound Pedestrian Volume crossing mi	0			0			0			0		
v_ab, Corner Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	60
Active Pattern	Pattern 1
Coordination Type	Time of Day Pattern Coordinated
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	Lead Green - Beginning of First Green
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal Group	0	8	0	0	4	0	0	2	0	0	6	0
Auxiliary Signal Groups												
Lead / Lag	-	-	-	-	-	-	-	-	-	-	-	-
Minimum Green [s]	0	10	0	0	10	0	0	10	0	0	10	0
Maximum Green [s]	0	36	0	0	36	0	0	26	0	0	26	0
Amber [s]	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
All red [s]	0.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0
Split [s]	0	36	0	0	36	0	0	24	0	0	24	0
Vehicle Extension [s]	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Walk [s]	0	5	0	0	5	0	0	5	0	0	5	0
Pedestrian Clearance [s]	0	20	0	0	10	0	0	7	0	0	7	0
Delayed Vehicle Green [s]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rest In Walk		No			No			No			No	
I1, Start-Up Lost Time [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
I2, Clearance Lost Time [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
Minimum Recall		No			No			No			No	
Maximum Recall		No			No			No			No	
Pedestrian Recall		No			No			No			No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering 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

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Lane Group Calculations

Lane Group	C	L	C	R	L	C	R	L	C	C
C, Cycle Length [s]	60	60	60	60	60	60	60	60	60	60
L, Total Lost Time per Cycle [s]	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
l1_p, Permitted Start-Up Lost Time [s]	2.00	2.00	0.00	0.00	2.00	0.00	0.00	2.00	0.00	0.00
l2, Clearance Lost Time [s]	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
g_i, Effective Green Time [s]	10	10	10	10	42	42	42	42	42	42
g / C, Green / Cycle	0.16	0.16	0.16	0.16	0.70	0.70	0.70	0.70	0.70	0.70
(v / s)_i Volume / Saturation Flow Rate	0.14	0.03	0.08	0.00	0.08	0.39	0.09	0.14	0.18	0.18
s, saturation flow rate [veh/h]	986	1343	1900	1615	778	3618	1615	331	1900	1881
c, Capacity [veh/h]	246	145	310	263	586	2545	1136	274	1337	1324
d1, Uniform Delay [s]	24.43	22.29	22.93	21.10	5.23	4.35	2.91	10.01	3.21	3.21
k, delay calibration	0.11	0.11	0.11	0.11	0.50	0.50	0.50	0.50	0.50	0.50
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	1.87	1.17	1.30	0.03	0.34	0.90	0.24	1.36	0.45	0.46
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.54	0.30	0.51	0.02	0.10	0.56	0.13	0.17	0.25	0.25
d, Delay for Lane Group [s/veh]	26.29	23.46	24.23	21.14	5.58	5.25	3.15	11.37	3.66	3.67
Lane Group LOS	C	C	C	C	A	A	A	B	A	A
Critical Lane Group	Yes	No	No	No	No	Yes	No	No	No	No
50th-Percentile Queue Length [veh/ln]	1.89	0.56	2.02	0.07	0.26	1.93	0.30	0.40	0.73	0.73
50th-Percentile Queue Length [ft/ln]	47.34	14.08	50.48	1.73	6.39	48.37	7.59	9.91	18.34	18.22
95th-Percentile Queue Length [veh/ln]	3.41	1.01	3.63	0.12	0.46	3.48	0.55	0.71	1.32	1.31
95th-Percentile Queue Length [ft/ln]	85.21	25.35	90.86	3.11	11.50	87.06	13.66	17.84	33.02	32.79

Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	26.29	26.29	26.29	23.46	24.23	21.14	5.58	5.25	3.15	11.37	3.66	3.67
Movement LOS	C	C	C	C	C	C	A	A	A	B	A	A
d_A, Approach Delay [s/veh]	26.29			23.97			5.07			4.17		
Approach LOS	C			C			A			A		
d_I, Intersection Delay [s/veh]	7.34											
Intersection LOS	A											
Intersection V/C	0.530											

Other Modes

g_Walk,mi, Effective Walk Time [s]	9.0	9.0	0.0	9.0
M_corner, Corner Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
M_CW, Crosswalk Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
d_p, Pedestrian Delay [s]	21.68	21.68	0.00	21.68
I_p,int, Pedestrian LOS Score for Intersectio	2.034	2.296	0.000	2.997
Crosswalk LOS	B	B	F	C
s_b, Saturation Flow Rate of the bicycle lane	2000	2000	2000	2000
c_b, Capacity of the bicycle lane [bicycles/h]	1066	1066	666	666
d_b, Bicycle Delay [s]	6.54	6.54	13.34	13.34
I_b,int, Bicycle LOS Score for Intersection	1.792	1.921	2.941	2.154
Bicycle LOS	A	A	C	B

Sequence

Ring 1	-	2	-	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	-	6	-	8	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Intersection Level Of Service Report
Intersection 3: Rivergrade Rd / Project Dwy 1

Control Type:	Two-way stop	Delay (sec / veh):	10.5
Analysis Method:	HCM 7th Edition	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.008

Intersection Setup

Name						
Approach	Northbound		Eastbound		Westbound	
Lane Configuration						
Turning Movement	Left	Right	Thru	Right	Left	Thru
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00		30.00		30.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	No		No		No	

Volumes

Name						
Base Volume Input [veh/h]	0	0	190	0	0	199
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	0.00	0.00	0.00
Growth Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	5	2	2	2	1	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	5	2	192	2	1	199
Peak Hour Factor	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	1	1	51	1	0	52
Total Analysis Volume [veh/h]	5	2	202	2	1	209
Pedestrian Volume [ped/h]	0		0		0	

Intersection Settings

Priority Scheme	Stop	Free	Free
Flared Lane	No		
Storage Area [veh]	0	0	0
Two-Stage Gap Acceptance	No		
Number of Storage Spaces in Median	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.01	0.00	0.00	0.00	0.00	0.00
d_M, Delay for Movement [s/veh]	10.48	8.88	0.00	0.00	7.61	0.00
Movement LOS	B	A	A	A	A	A
95th-Percentile Queue Length [veh/ln]	0.03	0.03	0.00	0.00	0.00	0.00
95th-Percentile Queue Length [ft/ln]	0.73	0.73	0.00	0.00	0.04	0.02
d_A, Approach Delay [s/veh]	10.02		0.00		0.04	
Approach LOS	B		A		A	
d_I, Intersection Delay [s/veh]	0.18					
Intersection LOS	B					

Intersection Level Of Service Report
Intersection 4: Live Oak Ave / Dwy 2

Control Type:	Two-way stop	Delay (sec / veh):	10.3
Analysis Method:	HCM 7th Edition	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.019

Intersection Setup

Name						
Approach	Southbound		Eastbound		Westbound	
Lane Configuration						
Turning Movement	Left	Right	Left	Thru	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00		30.00		30.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	No		No		No	

Volumes

Name						
Base Volume Input [veh/h]	0	0	0	1421	593	0
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	0.00	2.00	0.00	0.00	0.00
Growth Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	12	0	7	0	4
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	0	12	0	1428	593	4
Peak Hour Factor	1.0000	0.9500	1.0000	0.9500	0.9500	0.9500
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	3	0	376	156	1
Total Analysis Volume [veh/h]	0	13	0	1503	624	4
Pedestrian Volume [ped/h]	0		0		0	

Intersection Settings

Priority Scheme	Stop	Free	Free
Flared Lane			
Storage Area [veh]	0	0	0
Two-Stage Gap Acceptance	No		
Number of Storage Spaces in Median	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.02	0.00	0.02	0.01	0.00
d_M, Delay for Movement [s/veh]	0.00	10.34	0.00	0.00	0.00	0.00
Movement LOS		B		A	A	A
95th-Percentile Queue Length [veh/ln]	0.00	0.06	0.00	0.00	0.00	0.00
95th-Percentile Queue Length [ft/ln]	0.00	1.44	0.00	0.00	0.00	0.00
d_A, Approach Delay [s/veh]	10.34		0.00		0.00	
Approach LOS	B		A		A	
d_I, Intersection Delay [s/veh]	0.06					
Intersection LOS	B					

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Report File: C:\...\Existing Plus Project PM HCM.pdf

Scenario 6 Existing Plus Project PM
8/23/2023

Turning Movement Volume: Summary

ID	Intersection Name	Northbound			Southbound			Eastbound			Westbound			Total Volume
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
1	Stewart Ave / Rivergrade Rd	4	4	108	11	5	9	12	75	22	148	49	7	454

ID	Intersection Name	Northbound			Southbound			Eastbound			Westbound			Total Volume
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
2	Stewart Ave / Live Oak Ave	40	33	28	37	134	16	56	1357	183	39	542	18	2483

ID	Intersection Name	Northbound		Eastbound		Westbound		Total Volume
		Left	Right	Thru	Right	Left	Thru	
3	Rivergrade Rd / Project Dwy 1	5	2	192	2	1	199	401

ID	Intersection Name	Southbound	Eastbound	Westbound		Total Volume
		Right	Thru	Thru	Right	
4	Live Oak Ave / Dwy 2	12	1428	593	4	2037

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Report File: C:\...\Existing PM HCM.pdf

Scenario 11 Existing PM
8/23/2023

Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
1	Stewart Ave / Rivergrade Rd	Signalized	HCM 7th Edition	NB Left	0.175	5.2	A
2	Stewart Ave / Live Oak Ave	Signalized	HCM 7th Edition	NB Left	0.530	7.3	A
3	Rivergrade Rd / Project Dwy 1	Two-way stop	HCM 7th Edition	WB Thru	0.002	0.0	A
4	Live Oak Ave / Dwy 2	Two-way stop	HCM 7th Edition	EB Thru	0.015	0.0	A

V/C, Delay, LOS: For two-way stop, these values are taken from the movement with the worst (highest) delay value. For all other control types, they are taken for the whole intersection.

Intersection Level Of Service Report
Intersection 1: Stewart Ave / Rivergrade Rd

Control Type:	Signalized	Delay (sec / veh):	5.2
Analysis Method:	HCM 7th Edition	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.175

Intersection Setup

Name												
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	1	0	0	0	0	0	1	0	0	1	0	0
Entry Pocket Length [ft]	320.00	100.00	100.00	100.00	100.00	100.00	173.00	100.00	100.00	91.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	1	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			35.00			35.00		
Grade [%]	0.00			0.00			0.00			0.00		
Curb Present	No			No			No			No		
Crosswalk	Yes			Yes			Yes			No		

Volumes

Name												
Base Volume Input [veh/h]	4	4	106	11	5	9	12	73	22	148	44	7
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Proportion of CAVs [%]	0.00											
Growth Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right Turn on Red Volume [veh/h]	0	0	96	0	0	3	0	0	1	0	0	0
Total Hourly Volume [veh/h]	4	4	10	11	5	6	12	73	21	148	44	7
Peak Hour Factor	0.7882	0.7882	0.7882	0.6125	0.6125	0.6125	0.7196	0.7196	0.7196	0.7576	0.7576	0.7576
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	1	1	3	4	2	2	4	25	7	49	15	2
Total Analysis Volume [veh/h]	5	5	13	18	8	10	17	101	29	195	58	9
Presence of On-Street Parking	No		No	No		No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
v_do, Outbound Pedestrian Volume crossing	0			0			0			0		
v_di, Inbound Pedestrian Volume crossing m	0			0			0			0		
v_co, Outbound Pedestrian Volume crossing	0			0			0			0		
v_ci, Inbound Pedestrian Volume crossing mi	0			0			0			0		
v_ab, Corner Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	60
Active Pattern	Pattern 1
Coordination Type	Time of Day Pattern Coordinated
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	Lead Green - Beginning of First Green
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal Group	0	8	0	0	4	0	0	2	0	0	6	0
Auxiliary Signal Groups												
Lead / Lag	-	-	-	-	-	-	-	-	-	-	-	-
Minimum Green [s]	0	10	0	0	10	0	0	10	0	0	10	0
Maximum Green [s]	0	22	0	0	22	0	0	30	0	0	30	0
Amber [s]	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
All red [s]	0.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0
Split [s]	0	27	0	0	27	0	0	33	0	0	33	0
Vehicle Extension [s]	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Walk [s]	0	5	0	0	5	0	0	5	0	0	5	0
Pedestrian Clearance [s]	0	10	0	0	17	0	0	14	0	0	14	0
Delayed Vehicle Green [s]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rest In Walk		No			No			No			No	
I1, Start-Up Lost Time [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
I2, Clearance Lost Time [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
Minimum Recall		No			No			No			No	
Maximum Recall		No			No			No			No	
Pedestrian Recall		No			No			No			No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering 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

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Lane Group Calculations

Lane Group	L	C	C	C	L	C	C	L	C	C
C, Cycle Length [s]	60	60	60	60	60	60	60	60	60	60
L, Total Lost Time per Cycle [s]	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
l1_p, Permitted Start-Up Lost Time [s]	2.00	0.00	2.00	0.00	2.00	0.00	0.00	2.00	0.00	0.00
l2, Clearance Lost Time [s]	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
g_i, Effective Green Time [s]	5	5	5	5	47	47	47	47	47	47
g / C, Green / Cycle	0.08	0.08	0.08	0.08	0.79	0.79	0.79	0.79	0.79	0.79
(v / s)_i Volume / Saturation Flow Rate	0.00	0.01	0.02	0.01	0.01	0.03	0.04	0.15	0.02	0.02
s, saturation flow rate [veh/h]	1417	1685	929	1548	1355	1900	1760	1280	1900	1813
c, Capacity [veh/h]	180	131	184	120	1128	1499	1389	1066	1499	1431
d1, Uniform Delay [s]	27.60	25.81	26.58	25.78	2.00	1.38	1.38	2.41	1.36	1.36
k, delay calibration	0.11	0.11	0.11	0.11	0.50	0.50	0.50	0.50	0.50	0.50
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	0.06	0.48	0.27	0.47	0.02	0.06	0.06	0.38	0.03	0.03
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.03	0.14	0.11	0.13	0.02	0.04	0.05	0.18	0.02	0.02
d, Delay for Lane Group [s/veh]	27.67	26.28	26.85	26.25	2.02	1.44	1.45	2.79	1.39	1.39
Lane Group LOS	C	C	C	C	A	A	A	A	A	A
Critical Lane Group	No	No	Yes	No	No	No	No	Yes	No	No
50th-Percentile Queue Length [veh/ln]	0.07	0.24	0.29	0.21	0.03	0.05	0.05	0.39	0.02	0.02
50th-Percentile Queue Length [ft/ln]	1.72	6.12	7.24	5.15	0.68	1.23	1.25	9.80	0.62	0.62
95th-Percentile Queue Length [veh/ln]	0.12	0.44	0.52	0.37	0.05	0.09	0.09	0.71	0.04	0.04
95th-Percentile Queue Length [ft/ln]	3.10	11.02	13.02	9.27	1.23	2.21	2.24	17.63	1.12	1.12

Movement, Approach, & Intersection Results

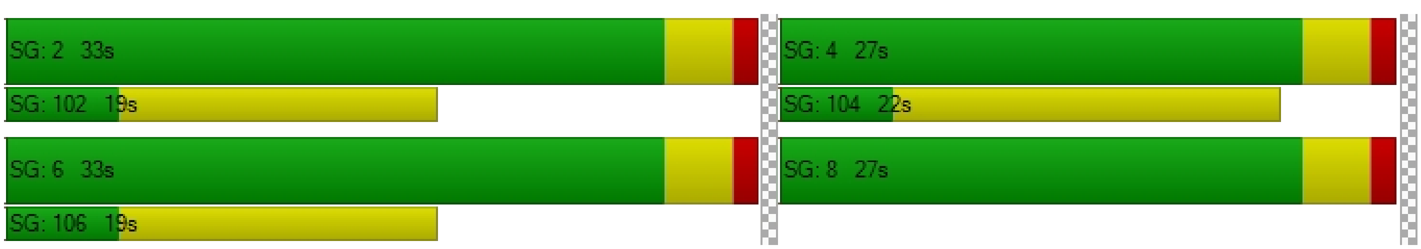
d_M, Delay for Movement [s/veh]	27.67	26.28	26.28	26.85	26.47	26.25	2.02	1.44	1.45	2.79	1.39	1.39
Movement LOS	C	C	C	C	C	C	A	A	A	A	A	A
d_A, Approach Delay [s/veh]	26.58			26.60			1.51			2.43		
Approach LOS	C			C			A			A		
d_I, Intersection Delay [s/veh]	5.19											
Intersection LOS	A											
Intersection V/C	0.175											

Other Modes

g_Walk,mi, Effective Walk Time [s]	9.0	9.0	9.0	0.0
M_corner, Corner Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
M_CW, Crosswalk Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
d_p, Pedestrian Delay [s]	21.68	21.68	21.68	0.00
I_p,int, Pedestrian LOS Score for Intersectio	2.611	2.157	2.340	0.000
Crosswalk LOS	B	B	B	F
s_b, Saturation Flow Rate of the bicycle lane	2000	2000	2000	2000
c_b, Capacity of the bicycle lane [bicycles/h]	767	767	967	967
d_b, Bicycle Delay [s]	11.41	11.41	8.01	8.01
I_b,int, Bicycle LOS Score for Intersection	1.756	1.592	1.682	1.776
Bicycle LOS	A	A	A	A

Sequence

Ring 1	-	2	-	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	-	6	-	8	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Intersection Level Of Service Report
Intersection 2: Stewart Ave / Live Oak Ave

Control Type:	Signalized	Delay (sec / veh):	7.3
Analysis Method:	HCM 7th Edition	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.530

Intersection Setup

Name												
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	1	0	0	1	0	0	1	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	115.00	100.00	100.00	178.00	100.00	100.00	120.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			45.00			45.00		
Grade [%]	0.00			0.00			0.00			0.00		
Curb Present	No			No			No			No		
Crosswalk	Yes			Yes			No			Yes		

Volumes

Name												
Base Volume Input [veh/h]	40	33	28	37	134	16	56	1356	183	39	538	16
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Proportion of CAVs [%]	0.00											
Growth Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right Turn on Red Volume [veh/h]	0	0	7	0	0	11	0	0	40	0	0	2
Total Hourly Volume [veh/h]	40	33	21	37	134	5	56	1356	143	39	538	14
Peak Hour Factor	0.7042	0.7042	0.7042	0.8477	0.8477	0.8477	0.9525	0.9525	0.9525	0.8298	0.8298	0.8298
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	14	12	7	11	40	1	15	356	38	12	162	4
Total Analysis Volume [veh/h]	57	47	30	44	158	6	59	1424	150	47	648	17
Presence of On-Street Parking	No		No	No		No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
v_do, Outbound Pedestrian Volume crossing	0			0			0			0		
v_di, Inbound Pedestrian Volume crossing m	0			0			0			0		
v_co, Outbound Pedestrian Volume crossing	0			0			0			0		
v_ci, Inbound Pedestrian Volume crossing mi	0			0			0			0		
v_ab, Corner Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	60
Active Pattern	Pattern 1
Coordination Type	Time of Day Pattern Coordinated
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	Lead Green - Beginning of First Green
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal Group	0	8	0	0	4	0	0	2	0	0	6	0
Auxiliary Signal Groups												
Lead / Lag	-	-	-	-	-	-	-	-	-	-	-	-
Minimum Green [s]	0	10	0	0	10	0	0	10	0	0	10	0
Maximum Green [s]	0	36	0	0	36	0	0	26	0	0	26	0
Amber [s]	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
All red [s]	0.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0
Split [s]	0	36	0	0	36	0	0	24	0	0	24	0
Vehicle Extension [s]	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Walk [s]	0	5	0	0	5	0	0	5	0	0	5	0
Pedestrian Clearance [s]	0	20	0	0	10	0	0	7	0	0	7	0
Delayed Vehicle Green [s]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rest In Walk		No			No			No			No	
I1, Start-Up Lost Time [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
I2, Clearance Lost Time [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
Minimum Recall		No			No			No			No	
Maximum Recall		No			No			No			No	
Pedestrian Recall		No			No			No			No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering 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

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Lane Group Calculations

Lane Group	C	L	C	R	L	C	R	L	C	C
C, Cycle Length [s]	60	60	60	60	60	60	60	60	60	60
L, Total Lost Time per Cycle [s]	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
l1_p, Permitted Start-Up Lost Time [s]	2.00	2.00	0.00	0.00	2.00	0.00	0.00	2.00	0.00	0.00
l2, Clearance Lost Time [s]	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
g_i, Effective Green Time [s]	10	10	10	10	42	42	42	42	42	42
g / C, Green / Cycle	0.16	0.16	0.16	0.16	0.70	0.70	0.70	0.70	0.70	0.70
(v / s)_i Volume / Saturation Flow Rate	0.14	0.03	0.08	0.00	0.08	0.39	0.09	0.14	0.18	0.18
s, saturation flow rate [veh/h]	986	1343	1900	1615	783	3618	1615	331	1900	1883
c, Capacity [veh/h]	246	145	310	263	589	2545	1136	274	1337	1325
d1, Uniform Delay [s]	24.43	22.29	22.93	21.10	5.21	4.35	2.91	10.00	3.20	3.20
k, delay calibration	0.11	0.11	0.11	0.11	0.50	0.50	0.50	0.50	0.50	0.50
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	1.87	1.17	1.30	0.03	0.34	0.89	0.24	1.36	0.45	0.45
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.54	0.30	0.51	0.02	0.10	0.56	0.13	0.17	0.25	0.25
d, Delay for Lane Group [s/veh]	26.29	23.46	24.23	21.14	5.55	5.24	3.15	11.35	3.65	3.65
Lane Group LOS	C	C	C	C	A	A	A	B	A	A
Critical Lane Group	Yes	No	No	No	No	Yes	No	No	No	No
50th-Percentile Queue Length [veh/ln]	1.89	0.56	2.02	0.07	0.25	1.93	0.30	0.40	0.72	0.72
50th-Percentile Queue Length [ft/ln]	47.34	14.08	50.48	1.73	6.35	48.31	7.59	9.90	18.10	17.99
95th-Percentile Queue Length [veh/ln]	3.41	1.01	3.63	0.12	0.46	3.48	0.55	0.71	1.30	1.29
95th-Percentile Queue Length [ft/ln]	85.21	25.35	90.86	3.11	11.44	86.96	13.66	17.83	32.57	32.37

Movement, Approach, & Intersection Results

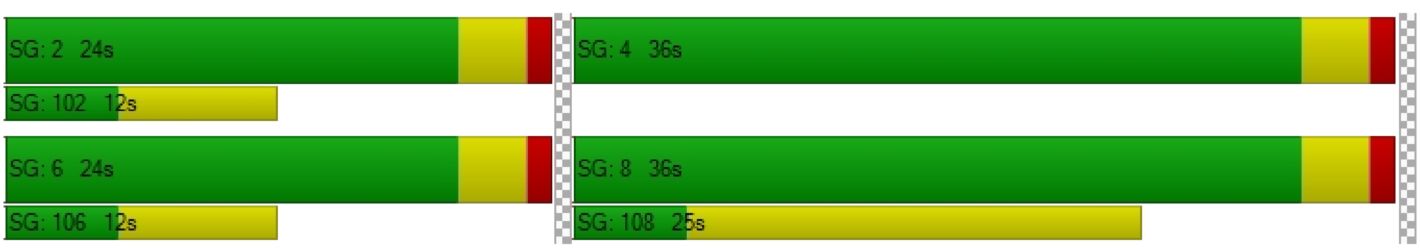
d_M, Delay for Movement [s/veh]	26.29	26.29	26.29	23.46	24.23	21.14	5.55	5.24	3.15	11.35	3.65	3.65
Movement LOS	C	C	C	C	C	C	A	A	A	B	A	A
d_A, Approach Delay [s/veh]	26.29			23.97			5.06			4.16		
Approach LOS	C			C			A			A		
d_I, Intersection Delay [s/veh]	7.35											
Intersection LOS	A											
Intersection V/C	0.530											

Other Modes

g_Walk,mi, Effective Walk Time [s]	9.0	9.0	0.0	9.0
M_corner, Corner Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
M_CW, Crosswalk Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
d_p, Pedestrian Delay [s]	21.68	21.68	0.00	21.68
I_p,int, Pedestrian LOS Score for Intersectio	2.034	2.295	0.000	2.995
Crosswalk LOS	B	B	F	C
s_b, Saturation Flow Rate of the bicycle lane	2000	2000	2000	2000
c_b, Capacity of the bicycle lane [bicycles/h]	1066	1066	666	666
d_b, Bicycle Delay [s]	6.54	6.54	13.34	13.34
I_b,int, Bicycle LOS Score for Intersection	1.792	1.921	2.940	2.149
Bicycle LOS	A	A	C	B

Sequence

Ring 1	-	2	-	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	-	6	-	8	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Intersection Level Of Service Report
Intersection 3: Rivergrade Rd / Project Dwy 1

Control Type:	Two-way stop	Delay (sec / veh):	0.0
Analysis Method:	HCM 7th Edition	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.002

Intersection Setup

Name						
Approach	Northbound		Eastbound		Westbound	
Lane Configuration						
Turning Movement	Left	Right	Thru	Right	Left	Thru
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00		30.00		30.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	No		No		No	

Volumes

Name						
Base Volume Input [veh/h]	0	0	190	0	0	199
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	0.00	0.00	0.00
Growth Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	0	0	190	0	0	199
Peak Hour Factor	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	0	50	0	0	52
Total Analysis Volume [veh/h]	0	0	200	0	0	209
Pedestrian Volume [ped/h]	0		0		0	

Intersection Settings

Priority Scheme	Stop	Free	Free
Flared Lane	No		
Storage Area [veh]	0	0	0
Two-Stage Gap Acceptance	No		
Number of Storage Spaces in Median	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.00	0.00	0.00	0.00	0.00
d_M, Delay for Movement [s/veh]	10.38	8.82	0.00	0.00	7.60	0.00
Movement LOS	B	A	A	A	A	A
95th-Percentile Queue Length [veh/ln]	0.00	0.00	0.00	0.00	0.00	0.00
95th-Percentile Queue Length [ft/ln]	0.00	0.00	0.00	0.00	0.00	0.00
d_A, Approach Delay [s/veh]	9.60		0.00		0.00	
Approach LOS	A		A		A	
d_I, Intersection Delay [s/veh]	0.00					
Intersection LOS	A					

Intersection Level Of Service Report
Intersection 4: Live Oak Ave / Dwy 2

Control Type:	Two-way stop	Delay (sec / veh):	0.0
Analysis Method:	HCM 7th Edition	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.015

Intersection Setup

Name						
Approach	Southbound		Eastbound		Westbound	
Lane Configuration						
Turning Movement	Left	Right	Left	Thru	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00		30.00		30.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	No		No		No	

Volumes

Name						
Base Volume Input [veh/h]	0	0	0	1421	593	0
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	0.00	2.00	0.00	0.00	0.00
Growth Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	0	0	0	1421	593	0
Peak Hour Factor	1.0000	0.9500	1.0000	0.9500	0.9500	0.9500
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	0	0	374	156	0
Total Analysis Volume [veh/h]	0	0	0	1496	624	0
Pedestrian Volume [ped/h]	0		0		0	

Intersection Settings

Priority Scheme	Stop	Free	Free
Flared Lane			
Storage Area [veh]	0	0	0
Two-Stage Gap Acceptance	No		
Number of Storage Spaces in Median	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.00	0.00	0.01	0.01	0.00
d_M, Delay for Movement [s/veh]	0.00	10.22	0.00	0.00	0.00	0.00
Movement LOS		B		A	A	A
95th-Percentile Queue Length [veh/ln]	0.00	0.00	0.00	0.00	0.00	0.00
95th-Percentile Queue Length [ft/ln]	0.00	0.00	0.00	0.00	0.00	0.00
d_A, Approach Delay [s/veh]	10.22		0.00		0.00	
Approach LOS	B		A		A	
d_I, Intersection Delay [s/veh]	0.00					
Intersection LOS	A					

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Report File: C:\...\Existing PM HCM.pdf | 8/23/2023

Turning Movement Volume: Summary

ID	Intersection Name	Northbound			Southbound			Eastbound			Westbound			Total Volume
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
1	Stewart Ave / Rivergrade Rd	4	4	106	11	5	9	12	73	22	148	44	7	445

ID	Intersection Name	Northbound			Southbound			Eastbound			Westbound			Total Volume
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
2	Stewart Ave / Live Oak Ave	40	33	28	37	134	16	56	1356	183	39	538	16	2476

ID	Intersection Name	Northbound		Eastbound		Westbound		Total Volume
		Left	Right	Thru	Right	Left	Thru	
3	Rivergrade Rd / Project Dwy 1	0	0	190	0	0	199	389

ID	Intersection Name	Southbound	Eastbound	Westbound		Total Volume
		Right	Thru	Thru	Right	
4	Live Oak Ave / Dwy 2	0	1421	593	0	2014

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Report File: C:\...\Opening Year AM HCM.pdf

Scenario 10 Opening Year AM
8/23/2023

Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
1	Stewart Ave / Rivergrade Rd	Signalized	HCM 7th Edition	SB Left	0.128	6.3	A
2	Stewart Ave / Live Oak Ave	Signalized	HCM 7th Edition	NB Left	0.569	10.5	B
3	Rivergrade Rd / Project Dwy 1	Two-way stop	HCM 7th Edition	WB Thru	0.003	0.0	A
4	Live Oak Ave / Dwy 2	Two-way stop	HCM 7th Edition	WB Thru	0.013	0.0	A

V/C, Delay, LOS: For two-way stop, these values are taken from the movement with the worst (highest) delay value. For all other control types, they are taken for the whole intersection.

Intersection Level Of Service Report
Intersection 1: Stewart Ave / Rivergrade Rd

Control Type:	Signalized	Delay (sec / veh):	6.3
Analysis Method:	HCM 7th Edition	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.128

Intersection Setup

Name												
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	1	0	0	0	0	0	1	0	0	1	0	0
Entry Pocket Length [ft]	320.00	100.00	100.00	100.00	100.00	100.00	173.00	100.00	100.00	91.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	1	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			35.00			35.00		
Grade [%]	0.00			0.00			0.00			0.00		
Curb Present	No			No			No			No		
Crosswalk	Yes			Yes			Yes			No		

Volumes

Name												
Base Volume Input [veh/h]	18	7	108	11	5	6	3	147	10	91	165	16
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Proportion of CAVs [%]	0.00											
Growth Factor	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right Turn on Red Volume [veh/h]	0	0	73	0	0	1	0	0	1	0	0	1
Total Hourly Volume [veh/h]	19	7	39	11	5	5	3	153	9	95	172	16
Peak Hour Factor	0.8717	0.8717	0.8717	0.6471	0.6471	0.6471	0.9494	0.9494	0.9494	0.7953	0.7953	0.7953
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	5	2	11	4	2	2	1	40	2	30	54	5
Total Analysis Volume [veh/h]	22	8	45	17	8	8	3	161	9	119	216	20
Presence of On-Street Parking	No		No	No		No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
v_do, Outbound Pedestrian Volume crossing	0			0			0			0		
v_di, Inbound Pedestrian Volume crossing m	0			0			0			0		
v_co, Outbound Pedestrian Volume crossing	0			0			0			0		
v_ci, Inbound Pedestrian Volume crossing mi	0			0			0			0		
v_ab, Corner Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	60
Active Pattern	Pattern 1
Coordination Type	Time of Day Pattern Coordinated
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	Lead Green - Beginning of First Green
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal Group	0	8	0	0	4	0	0	2	0	0	6	0
Auxiliary Signal Groups												
Lead / Lag	-	-	-	-	-	-	-	-	-	-	-	-
Minimum Green [s]	0	10	0	0	10	0	0	10	0	0	10	0
Maximum Green [s]	0	32	0	0	32	0	0	20	0	0	20	0
Amber [s]	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
All red [s]	0.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0
Split [s]	0	26	0	0	26	0	0	34	0	0	34	0
Vehicle Extension [s]	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Walk [s]	0	5	0	0	5	0	0	5	0	0	5	0
Pedestrian Clearance [s]	0	10	0	0	17	0	0	14	0	0	14	0
Delayed Vehicle Green [s]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rest In Walk		No			No			No			No	
I1, Start-Up Lost Time [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
I2, Clearance Lost Time [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
Minimum Recall		No			No			No			No	
Maximum Recall		No			No			No			No	
Pedestrian Recall		No			No			No			No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering 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

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Lane Group Calculations

Lane Group	L	C	C	C	L	C	C	L	C	C
C, Cycle Length [s]	60	60	60	60	60	60	60	60	60	60
L, Total Lost Time per Cycle [s]	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
l1_p, Permitted Start-Up Lost Time [s]	2.00	0.00	2.00	0.00	2.00	0.00	0.00	2.00	0.00	0.00
l2, Clearance Lost Time [s]	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
g_i, Effective Green Time [s]	7	7	7	7	45	45	45	45	45	45
g / C, Green / Cycle	0.12	0.12	0.12	0.12	0.75	0.75	0.75	0.75	0.75	0.75
(v / s)_i Volume / Saturation Flow Rate	0.02	0.03	0.02	0.01	0.00	0.04	0.05	0.10	0.06	0.06
s, saturation flow rate [veh/h]	1419	1652	835	1582	1162	1900	1865	1234	1900	1844
c, Capacity [veh/h]	247	202	219	193	913	1415	1389	969	1415	1373
d1, Uniform Delay [s]	25.24	23.88	25.37	23.34	3.03	2.05	2.05	3.23	2.09	2.09
k, delay calibration	0.11	0.11	0.11	0.11	0.50	0.50	0.50	0.50	0.50	0.50
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	0.15	0.68	0.16	0.17	0.01	0.08	0.08	0.26	0.12	0.12
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.09	0.26	0.08	0.08	0.00	0.06	0.06	0.12	0.08	0.09
d, Delay for Lane Group [s/veh]	25.40	24.57	25.52	23.51	3.04	2.13	2.14	3.49	2.21	2.21
Lane Group LOS	C	C	C	C	A	A	A	A	A	A
Critical Lane Group	No	Yes	No	No	No	No	No	Yes	No	No
50th-Percentile Queue Length [veh/ln]	0.29	0.68	0.24	0.19	0.01	0.13	0.13	0.34	0.19	0.19
50th-Percentile Queue Length [ft/ln]	7.14	17.08	5.92	4.74	0.20	3.30	3.30	8.54	4.71	4.66
95th-Percentile Queue Length [veh/ln]	0.51	1.23	0.43	0.34	0.01	0.24	0.24	0.61	0.34	0.34
95th-Percentile Queue Length [ft/ln]	12.86	30.74	10.65	8.53	0.37	5.94	5.94	15.36	8.47	8.39

Movement, Approach, & Intersection Results

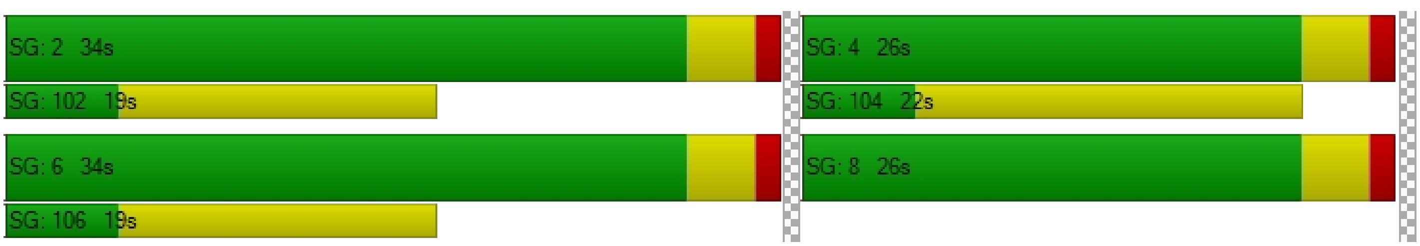
d_M, Delay for Movement [s/veh]	25.40	24.57	24.57	25.52	23.72	23.51	3.04	2.13	2.14	3.49	2.21	2.21
Movement LOS	C	C	C	C	C	C	A	A	A	A	A	A
d_A, Approach Delay [s/veh]		24.81			24.60			2.15			2.64	
Approach LOS		C			C			A			A	
d_I, Intersection Delay [s/veh]	6.26											
Intersection LOS	A											
Intersection V/C	0.128											

Other Modes

g_Walk,mi, Effective Walk Time [s]	9.0	9.0	9.0	0.0
M_corner, Corner Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
M_CW, Crosswalk Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
d_p, Pedestrian Delay [s]	21.68	21.68	21.68	0.00
I_p,int, Pedestrian LOS Score for Intersectio	2.454	2.134	2.409	0.000
Crosswalk LOS	B	B	B	F
s_b, Saturation Flow Rate of the bicycle lane	2000	2000	2000	2000
c_b, Capacity of the bicycle lane [bicycles/h]	733	733	1000	1000
d_b, Bicycle Delay [s]	12.03	12.03	7.50	7.50
I_b,int, Bicycle LOS Score for Intersection	1.804	1.588	1.703	1.853
Bicycle LOS	A	A	A	A

Sequence

Ring 1	-	2	-	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	-	6	-	8	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Intersection Level Of Service Report
Intersection 2: Stewart Ave / Live Oak Ave

Control Type:	Signalized	Delay (sec / veh):	10.5
Analysis Method:	HCM 7th Edition	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.569

Intersection Setup

Name												
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	1	0	0	1	0	0	1	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	115.00	100.00	100.00	178.00	100.00	100.00	120.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			45.00			45.00		
Grade [%]	0.00			0.00			0.00			0.00		
Curb Present	No			No			No			No		
Crosswalk	Yes			Yes			No			Yes		

Volumes

Name												
Base Volume Input [veh/h]	147	69	32	16	36	51	42	573	43	18	1157	17
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Proportion of CAVs [%]	0.00											
Growth Factor	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right Turn on Red Volume [veh/h]	0	0	13	0	0	23	0	0	9	0	0	3
Total Hourly Volume [veh/h]	153	72	20	17	37	30	44	596	36	19	1203	15
Peak Hour Factor	0.8493	0.8493	0.8493	0.7649	0.7649	0.7649	0.8038	0.8038	0.8038	0.9412	0.9412	0.9412
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	45	21	6	6	12	10	14	185	11	5	320	4
Total Analysis Volume [veh/h]	180	85	24	22	48	39	55	741	45	20	1278	16
Presence of On-Street Parking	No		No	No		No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
v_do, Outbound Pedestrian Volume crossing	0			0			0			0		
v_di, Inbound Pedestrian Volume crossing m	0			0			0			0		
v_co, Outbound Pedestrian Volume crossing	0			0			0			0		
v_ci, Inbound Pedestrian Volume crossing mi	0			0			0			0		
v_ab, Corner Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	60
Active Pattern	Pattern 1
Coordination Type	Time of Day Pattern Coordinated
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	Lead Green - Beginning of First Green
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal Group	0	8	0	0	4	0	0	2	0	0	6	0
Auxiliary Signal Groups												
Lead / Lag	-	-	-	-	-	-	-	-	-	-	-	-
Minimum Green [s]	0	10	0	0	10	0	0	10	0	0	10	0
Maximum Green [s]	0	30	0	0	30	0	0	22	0	0	22	0
Amber [s]	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
All red [s]	0.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0
Split [s]	0	44	0	0	44	0	0	16	0	0	16	0
Vehicle Extension [s]	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Walk [s]	0	5	0	0	5	0	0	5	0	0	5	0
Pedestrian Clearance [s]	0	20	0	0	10	0	0	7	0	0	7	0
Delayed Vehicle Green [s]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rest In Walk		No			No			No			No	
I1, Start-Up Lost Time [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
I2, Clearance Lost Time [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
Minimum Recall		No			No			No			No	
Maximum Recall		No			No			No			No	
Pedestrian Recall		No			No			No			No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering 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

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Lane Group Calculations

Lane Group	C	L	C	R	L	C	R	L	C	C
C, Cycle Length [s]	60	60	60	60	60	60	60	60	60	60
L, Total Lost Time per Cycle [s]	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
l1_p, Permitted Start-Up Lost Time [s]	2.00	2.00	0.00	0.00	2.00	0.00	0.00	2.00	0.00	0.00
l2, Clearance Lost Time [s]	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
g_i, Effective Green Time [s]	16	16	16	16	36	36	36	36	36	36
g / C, Green / Cycle	0.27	0.27	0.27	0.27	0.60	0.60	0.60	0.60	0.60	0.60
(v / s)_i Volume / Saturation Flow Rate	0.23	0.02	0.03	0.02	0.13	0.20	0.03	0.03	0.34	0.34
s, saturation flow rate [veh/h]	1269	1305	1900	1615	433	3618	1615	700	1900	1892
c, Capacity [veh/h]	438	130	510	433	279	2165	966	447	1137	1132
d1, Uniform Delay [s]	21.89	16.50	16.48	16.46	13.78	6.08	4.98	8.75	7.34	7.34
k, delay calibration	0.11	0.11	0.11	0.11	0.50	0.50	0.50	0.50	0.50	0.50
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	1.71	0.61	0.08	0.09	1.58	0.43	0.09	0.19	2.08	2.09
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.66	0.17	0.09	0.09	0.20	0.34	0.05	0.04	0.57	0.57
d, Delay for Lane Group [s/veh]	23.59	17.12	16.56	16.55	15.36	6.52	5.07	8.94	9.42	9.43
Lane Group LOS	C	B	B	B	B	A	A	A	A	A
Critical Lane Group	Yes	No	No	No	No	No	No	No	No	Yes
50th-Percentile Queue Length [veh/ln]	3.78	0.23	0.47	0.38	0.56	1.59	0.17	0.13	3.74	3.73
50th-Percentile Queue Length [ft/ln]	94.53	5.81	11.74	9.57	14.07	39.70	4.23	3.32	93.39	93.13
95th-Percentile Queue Length [veh/ln]	6.81	0.42	0.85	0.69	1.01	2.86	0.30	0.24	6.72	6.71
95th-Percentile Queue Length [ft/ln]	170.15	10.46	21.14	17.22	25.32	71.47	7.62	5.97	168.10	167.64

Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	23.59	23.59	23.59	17.12	16.56	16.55	15.36	6.52	5.07	8.94	9.43	9.43
Movement LOS	C	C	C	B	B	B	B	A	A	A	A	A
d_A, Approach Delay [s/veh]	23.59			16.67			7.02			9.42		
Approach LOS	C			B			A			A		
d_I, Intersection Delay [s/veh]	10.54											
Intersection LOS	B											
Intersection V/C	0.569											

Other Modes

g_Walk,mi, Effective Walk Time [s]	9.0	9.0	0.0	9.0
M_corner, Corner Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
M_CW, Crosswalk Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
d_p, Pedestrian Delay [s]	21.68	21.68	0.00	21.68
I_p,int, Pedestrian LOS Score for Intersectio	1.949	2.294	0.000	2.935
Crosswalk LOS	A	B	F	C
s_b, Saturation Flow Rate of the bicycle lane	2000	2000	2000	2000
c_b, Capacity of the bicycle lane [bicycles/h]	1333	1333	400	400
d_b, Bicycle Delay [s]	3.33	3.33	19.20	19.20
I_b,int, Bicycle LOS Score for Intersection	2.058	1.777	2.261	2.646
Bicycle LOS	B	A	B	B

Sequence

Ring 1	-	2	-	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	-	6	-	8	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Intersection Level Of Service Report
Intersection 3: Rivergrade Rd / Project Dwy 1

Control Type:	Two-way stop	Delay (sec / veh):	0.0
Analysis Method:	HCM 7th Edition	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.003

Intersection Setup

Name						
Approach	Northbound		Eastbound		Westbound	
Lane Configuration						
Turning Movement	Left	Right	Thru	Right	Left	Thru
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00		30.00		30.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	No		No		No	

Volumes

Name						
Base Volume Input [veh/h]	0	0	266	0	0	272
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	0.00	0.00	0.00
Growth Factor	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	0	0	277	0	0	283
Peak Hour Factor	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	0	73	0	0	74
Total Analysis Volume [veh/h]	0	0	292	0	0	298
Pedestrian Volume [ped/h]	0		0		0	

Intersection Settings

Priority Scheme	Stop	Free	Free
Flared Lane	No		
Storage Area [veh]	0	0	0
Two-Stage Gap Acceptance	No		
Number of Storage Spaces in Median	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.00	0.00	0.00	0.00	0.00
d_M, Delay for Movement [s/veh]	11.55	9.09	0.00	0.00	7.81	0.00
Movement LOS	B	A	A	A	A	A
95th-Percentile Queue Length [veh/ln]	0.00	0.00	0.00	0.00	0.00	0.00
95th-Percentile Queue Length [ft/ln]	0.00	0.00	0.00	0.00	0.00	0.00
d_A, Approach Delay [s/veh]	10.32		0.00		0.00	
Approach LOS	B		A		A	
d_I, Intersection Delay [s/veh]	0.00					
Intersection LOS	A					

Intersection Level Of Service Report
Intersection 4: Live Oak Ave / Dwy 2

Control Type:	Two-way stop	Delay (sec / veh):	0.0
Analysis Method:	HCM 7th Edition	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.013

Intersection Setup

Name						
Approach	Southbound		Eastbound		Westbound	
Lane Configuration						
Turning Movement	Left	Right	Left	Thru	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00		30.00		30.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	No		No		No	

Volumes

Name						
Base Volume Input [veh/h]	0	0	0	621	1192	0
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	0.00	2.00	0.00	0.00	0.00
Growth Factor	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	0	0	0	646	1240	0
Peak Hour Factor	1.0000	0.9500	1.0000	0.9500	0.9500	0.9500
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	0	0	170	326	0
Total Analysis Volume [veh/h]	0	0	0	680	1305	0
Pedestrian Volume [ped/h]	0		0		0	

Intersection Settings

Priority Scheme	Stop	Free	Free
Flared Lane			
Storage Area [veh]	0	0	0
Two-Stage Gap Acceptance	No		
Number of Storage Spaces in Median	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.00	0.00	0.01	0.01	0.00
d_M, Delay for Movement [s/veh]	0.00	13.67	0.00	0.00	0.00	0.00
Movement LOS		B		A	A	A
95th-Percentile Queue Length [veh/ln]	0.00	0.00	0.00	0.00	0.00	0.00
95th-Percentile Queue Length [ft/ln]	0.00	0.00	0.00	0.00	0.00	0.00
d_A, Approach Delay [s/veh]	13.67		0.00		0.00	
Approach LOS	B		A		A	
d_I, Intersection Delay [s/veh]	0.00					
Intersection LOS	A					

Vistro File: C:\...\Live Oak Irwindale Mark HCM.vistro
Report File: C:\...\Opening Year AM HCM.pdf

Scenario 10 Opening Year AM
8/23/2023

Turning Movement Volume: Summary

ID	Intersection Name	Northbound			Southbound			Eastbound			Westbound			Total Volume
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
1	Stewart Ave / Rivergrade Rd	19	7	112	11	5	6	3	153	10	95	172	17	610

ID	Intersection Name	Northbound			Southbound			Eastbound			Westbound			Total Volume
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
2	Stewart Ave / Live Oak Ave	153	72	33	17	37	53	44	596	45	19	1203	18	2290

ID	Intersection Name	Northbound		Eastbound		Westbound		Total Volume
		Left	Right	Thru	Right	Left	Thru	
3	Rivergrade Rd / Project Dwy 1	0	0	277	0	0	283	560

ID	Intersection Name	Southbound	Eastbound	Westbound		Total Volume
		Right	Thru	Thru	Right	
4	Live Oak Ave / Dwy 2	0	646	1240	0	1886

Vistro File: C:\...\Live Oak Irwindale Mark HCM.vistro
Report File: C:\...\Opening Year Plud Project AM HCM.pdf

Scenario 7 Opening Year Plus Project AM
8/23/2023

Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
1	Stewart Ave / Rivergrade Rd	Signalized	HCM 7th Edition	SB Left	0.130	6.3	A
2	Stewart Ave / Live Oak Ave	Signalized	HCM 7th Edition	NB Left	0.570	10.5	B
3	Rivergrade Rd / Project Dwy 1	Two-way stop	HCM 7th Edition	NB Left	0.002	11.6	B
4	Live Oak Ave / Dwy 2	Two-way stop	HCM 7th Edition	SB Right	0.010	13.9	B

V/C, Delay, LOS: For two-way stop, these values are taken from the movement with the worst (highest) delay value. For all other control types, they are taken for the whole intersection.

Intersection Level Of Service Report

Intersection 1: Stewart Ave / Rivergrade Rd

Control Type:	Signalized	Delay (sec / veh):	6.3
Analysis Method:	HCM 7th Edition	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.130

Intersection Setup

Name												
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	1	0	0	0	0	0	1	0	0	1	0	0
Entry Pocket Length [ft]	320.00	100.00	100.00	100.00	100.00	100.00	173.00	100.00	100.00	91.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	1	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			35.00			35.00		
Grade [%]	0.00			0.00			0.00			0.00		
Curb Present	No			No			No			No		
Crosswalk	Yes			Yes			Yes			No		

Volumes

Name												
Base Volume Input [veh/h]	18	7	108	11	5	6	3	147	10	91	165	16
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Proportion of CAVs [%]	0.00											
Growth Factor	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	1	0	0	0	0	5	0	0	1	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right Turn on Red Volume [veh/h]	0	0	73	0	0	1	0	0	1	0	0	1
Total Hourly Volume [veh/h]	19	7	40	11	5	5	3	158	9	95	173	16
Peak Hour Factor	0.8717	0.8717	0.8717	0.6471	0.6471	0.6471	0.9494	0.9494	0.9494	0.7953	0.7953	0.7953
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	5	2	11	4	2	2	1	42	2	30	54	5
Total Analysis Volume [veh/h]	22	8	46	17	8	8	3	166	9	119	218	20
Presence of On-Street Parking	No		No	No		No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
v_do, Outbound Pedestrian Volume crossing	0			0			0			0		
v_di, Inbound Pedestrian Volume crossing m	0			0			0			0		
v_co, Outbound Pedestrian Volume crossing	0			0			0			0		
v_ci, Inbound Pedestrian Volume crossing mi	0			0			0			0		
v_ab, Corner Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	60
Active Pattern	Pattern 1
Coordination Type	Time of Day Pattern Coordinated
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	Lead Green - Beginning of First Green
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal Group	0	8	0	0	4	0	0	2	0	0	6	0
Auxiliary Signal Groups												
Lead / Lag	-	-	-	-	-	-	-	-	-	-	-	-
Minimum Green [s]	0	10	0	0	10	0	0	10	0	0	10	0
Maximum Green [s]	0	32	0	0	32	0	0	20	0	0	20	0
Amber [s]	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
All red [s]	0.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0
Split [s]	0	26	0	0	26	0	0	34	0	0	34	0
Vehicle Extension [s]	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Walk [s]	0	5	0	0	5	0	0	5	0	0	5	0
Pedestrian Clearance [s]	0	10	0	0	17	0	0	14	0	0	14	0
Delayed Vehicle Green [s]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rest In Walk		No			No			No			No	
I1, Start-Up Lost Time [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
I2, Clearance Lost Time [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
Minimum Recall		No			No			No			No	
Maximum Recall		No			No			No			No	
Pedestrian Recall		No			No			No			No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering 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

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Lane Group Calculations

Lane Group	L	C	C	C	L	C	C	L	C	C
C, Cycle Length [s]	60	60	60	60	60	60	60	60	60	60
L, Total Lost Time per Cycle [s]	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
l1_p, Permitted Start-Up Lost Time [s]	2.00	0.00	2.00	0.00	2.00	0.00	0.00	2.00	0.00	0.00
l2, Clearance Lost Time [s]	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
g_i, Effective Green Time [s]	7	7	7	7	45	45	45	45	45	45
g / C, Green / Cycle	0.12	0.12	0.12	0.12	0.75	0.75	0.75	0.75	0.75	0.75
(v / s)_i Volume / Saturation Flow Rate	0.02	0.03	0.02	0.01	0.00	0.05	0.05	0.10	0.06	0.06
s, saturation flow rate [veh/h]	1419	1652	830	1582	1160	1900	1866	1229	1900	1845
c, Capacity [veh/h]	249	203	219	195	911	1413	1388	964	1413	1372
d1, Uniform Delay [s]	25.20	23.86	25.37	23.30	3.05	2.07	2.07	3.26	2.10	2.10
k, delay calibration	0.11	0.11	0.11	0.11	0.50	0.50	0.50	0.50	0.50	0.50
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	0.15	0.69	0.16	0.17	0.01	0.08	0.09	0.26	0.12	0.12
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.09	0.27	0.08	0.08	0.00	0.06	0.06	0.12	0.08	0.09
d, Delay for Lane Group [s/veh]	25.35	24.55	25.52	23.47	3.06	2.15	2.15	3.52	2.22	2.23
Lane Group LOS	C	C	C	C	A	A	A	A	A	A
Critical Lane Group	No	Yes	No	No	No	No	No	Yes	No	No
50th-Percentile Queue Length [veh/ln]	0.29	0.70	0.24	0.19	0.01	0.14	0.14	0.34	0.19	0.19
50th-Percentile Queue Length [ft/ln]	7.13	17.39	5.91	4.74	0.20	3.44	3.43	8.62	4.79	4.75
95th-Percentile Queue Length [veh/ln]	0.51	1.25	0.43	0.34	0.01	0.25	0.25	0.62	0.35	0.34
95th-Percentile Queue Length [ft/ln]	12.84	31.30	10.63	8.54	0.37	6.18	6.18	15.51	8.63	8.54

Movement, Approach, & Intersection Results

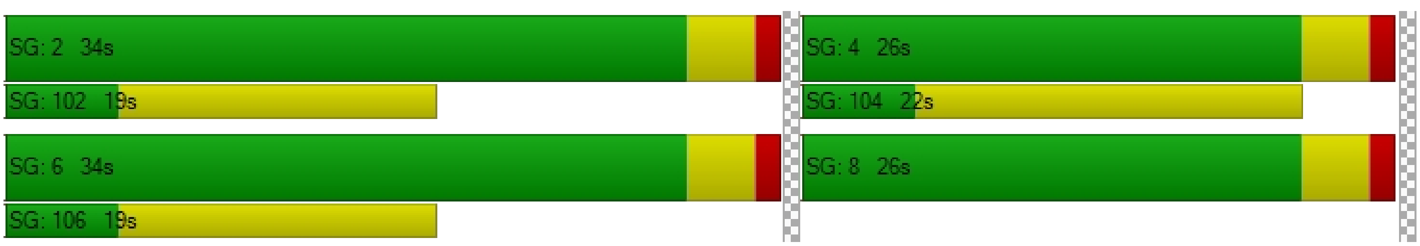
d_M, Delay for Movement [s/veh]	25.35	24.55	24.55	25.52	23.67	23.47	3.06	2.15	2.15	3.52	2.22	2.23
Movement LOS	C	C	C	C	C	C	A	A	A	A	A	A
d_A, Approach Delay [s/veh]	24.78			24.58			2.17			2.66		
Approach LOS	C			C			A			A		
d_I, Intersection Delay [s/veh]	6.26											
Intersection LOS	A											
Intersection V/C	0.130											

Other Modes

g_Walk,mi, Effective Walk Time [s]	9.0	9.0	9.0	0.0
M_corner, Corner Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
M_CW, Crosswalk Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
d_p, Pedestrian Delay [s]	21.68	21.68	21.68	0.00
I_p,int, Pedestrian LOS Score for Intersectio	2.455	2.134	2.411	0.000
Crosswalk LOS	B	B	B	F
s_b, Saturation Flow Rate of the bicycle lane	2000	2000	2000	2000
c_b, Capacity of the bicycle lane [bicycles/h]	733	733	1000	1000
d_b, Bicycle Delay [s]	12.03	12.03	7.50	7.50
I_b,int, Bicycle LOS Score for Intersection	1.805	1.588	1.707	1.855
Bicycle LOS	A	A	A	A

Sequence

Ring 1	-	2	-	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	-	6	-	8	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Intersection Level Of Service Report
Intersection 2: Stewart Ave / Live Oak Ave

Control Type:	Signalized	Delay (sec / veh):	10.5
Analysis Method:	HCM 7th Edition	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.570

Intersection Setup

Name												
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	1	0	0	1	0	0	1	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	115.00	100.00	100.00	178.00	100.00	100.00	120.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			45.00			45.00		
Grade [%]	0.00			0.00			0.00			0.00		
Curb Present	No			No			No			No		
Crosswalk	Yes			Yes			No			Yes		

Volumes

Name												
Base Volume Input [veh/h]	147	69	32	16	36	51	42	573	43	18	1157	17
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Proportion of CAVs [%]	0.00											
Growth Factor	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	4	0	0	1	1
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right Turn on Red Volume [veh/h]	0	0	13	0	0	23	0	0	9	0	0	3
Total Hourly Volume [veh/h]	153	72	20	17	37	30	44	600	36	19	1204	16
Peak Hour Factor	0.8493	0.8493	0.8493	0.7649	0.7649	0.7649	0.8038	0.8038	0.8038	0.9412	0.9412	0.9412
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	45	21	6	6	12	10	14	187	11	5	320	4
Total Analysis Volume [veh/h]	180	85	24	22	48	39	55	746	45	20	1279	17
Presence of On-Street Parking	No		No	No		No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
v_do, Outbound Pedestrian Volume crossing	0			0			0			0		
v_di, Inbound Pedestrian Volume crossing m	0			0			0			0		
v_co, Outbound Pedestrian Volume crossing	0			0			0			0		
v_ci, Inbound Pedestrian Volume crossing mi	0			0			0			0		
v_ab, Corner Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	60
Active Pattern	Pattern 1
Coordination Type	Time of Day Pattern Coordinated
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	Lead Green - Beginning of First Green
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal Group	0	8	0	0	4	0	0	2	0	0	6	0
Auxiliary Signal Groups												
Lead / Lag	-	-	-	-	-	-	-	-	-	-	-	-
Minimum Green [s]	0	10	0	0	10	0	0	10	0	0	10	0
Maximum Green [s]	0	30	0	0	30	0	0	22	0	0	22	0
Amber [s]	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
All red [s]	0.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0
Split [s]	0	44	0	0	44	0	0	16	0	0	16	0
Vehicle Extension [s]	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Walk [s]	0	5	0	0	5	0	0	5	0	0	5	0
Pedestrian Clearance [s]	0	20	0	0	10	0	0	7	0	0	7	0
Delayed Vehicle Green [s]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rest In Walk		No			No			No			No	
I1, Start-Up Lost Time [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
I2, Clearance Lost Time [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
Minimum Recall		No			No			No			No	
Maximum Recall		No			No			No			No	
Pedestrian Recall		No			No			No			No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering 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

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Lane Group Calculations

Lane Group	C	L	C	R	L	C	R	L	C	C
C, Cycle Length [s]	60	60	60	60	60	60	60	60	60	60
L, Total Lost Time per Cycle [s]	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
l1_p, Permitted Start-Up Lost Time [s]	2.00	2.00	0.00	0.00	2.00	0.00	0.00	2.00	0.00	0.00
l2, Clearance Lost Time [s]	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
g_i, Effective Green Time [s]	16	16	16	16	36	36	36	36	36	36
g / C, Green / Cycle	0.27	0.27	0.27	0.27	0.60	0.60	0.60	0.60	0.60	0.60
(v / s)_i Volume / Saturation Flow Rate	0.23	0.02	0.03	0.02	0.13	0.21	0.03	0.03	0.34	0.34
s, saturation flow rate [veh/h]	1269	1305	1900	1615	432	3618	1615	696	1900	1891
c, Capacity [veh/h]	438	130	510	433	278	2165	966	445	1137	1132
d1, Uniform Delay [s]	21.89	16.50	16.48	16.46	13.81	6.09	4.98	8.78	7.35	7.35
k, delay calibration	0.11	0.11	0.11	0.11	0.50	0.50	0.50	0.50	0.50	0.50
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	1.71	0.61	0.08	0.09	1.59	0.44	0.09	0.19	2.09	2.10
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.66	0.17	0.09	0.09	0.20	0.34	0.05	0.04	0.57	0.57
d, Delay for Lane Group [s/veh]	23.59	17.12	16.56	16.55	15.39	6.53	5.07	8.97	9.43	9.45
Lane Group LOS	C	B	B	B	B	A	A	A	A	A
Critical Lane Group	Yes	No	No	No	No	No	No	No	No	Yes
50th-Percentile Queue Length [veh/ln]	3.78	0.23	0.47	0.38	0.56	1.60	0.17	0.13	3.75	3.74
50th-Percentile Queue Length [ft/ln]	94.53	5.81	11.74	9.57	14.09	40.05	4.23	3.33	93.64	93.38
95th-Percentile Queue Length [veh/ln]	6.81	0.42	0.85	0.69	1.01	2.88	0.30	0.24	6.74	6.72
95th-Percentile Queue Length [ft/ln]	170.15	10.46	21.14	17.22	25.37	72.09	7.62	5.99	168.56	168.08

Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	23.59	23.59	23.59	17.12	16.56	16.55	15.39	6.53	5.07	8.97	9.44	9.45
Movement LOS	C	C	C	B	B	B	B	A	A	A	A	A
d_A, Approach Delay [s/veh]	23.59			16.67			7.03			9.43		
Approach LOS	C			B			A			A		
d_I, Intersection Delay [s/veh]	10.55											
Intersection LOS	B											
Intersection V/C	0.570											

Other Modes

g_Walk,mi, Effective Walk Time [s]	9.0	9.0	0.0	9.0
M_corner, Corner Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
M_CW, Crosswalk Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
d_p, Pedestrian Delay [s]	21.68	21.68	0.00	21.68
I_p,int, Pedestrian LOS Score for Intersectio	1.949	2.294	0.000	2.937
Crosswalk LOS	A	B	F	C
s_b, Saturation Flow Rate of the bicycle lane	2000	2000	2000	2000
c_b, Capacity of the bicycle lane [bicycles/h]	1333	1333	400	400
d_b, Bicycle Delay [s]	3.33	3.33	19.20	19.20
I_b,int, Bicycle LOS Score for Intersection	2.058	1.777	2.265	2.648
Bicycle LOS	B	A	B	B

Sequence

Ring 1	-	2	-	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	-	6	-	8	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Intersection Level Of Service Report
Intersection 3: Rivergrade Rd / Project Dwy 1

Control Type:	Two-way stop	Delay (sec / veh):	11.6
Analysis Method:	HCM 7th Edition	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.002

Intersection Setup

Name						
Approach	Northbound		Eastbound		Westbound	
Lane Configuration						
Turning Movement	Left	Right	Thru	Right	Left	Thru
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00		30.00		30.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	No		No		No	

Volumes

Name						
Base Volume Input [veh/h]	0	0	266	0	0	272
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	0.00	0.00	0.00
Growth Factor	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	1	1	1	5	2	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	1	1	278	5	2	283
Peak Hour Factor	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	0	73	1	1	74
Total Analysis Volume [veh/h]	1	1	293	5	2	298
Pedestrian Volume [ped/h]	0		0		0	

Intersection Settings

Priority Scheme	Stop	Free	Free
Flared Lane	No		
Storage Area [veh]	0	0	0
Two-Stage Gap Acceptance	No		
Number of Storage Spaces in Median	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.00	0.00	0.00	0.00	0.00
d_M, Delay for Movement [s/veh]	11.65	9.12	0.00	0.00	7.83	0.00
Movement LOS	B	A	A	A	A	A
95th-Percentile Queue Length [veh/ln]	0.01	0.01	0.00	0.00	0.00	0.00
95th-Percentile Queue Length [ft/ln]	0.22	0.22	0.00	0.00	0.08	0.04
d_A, Approach Delay [s/veh]	10.38		0.00		0.05	
Approach LOS	B		A		A	
d_I, Intersection Delay [s/veh]	0.06					
Intersection LOS	B					

Intersection Level Of Service Report
Intersection 4: Live Oak Ave / Dwy 2

Control Type:	Two-way stop	Delay (sec / veh):	13.9
Analysis Method:	HCM 7th Edition	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.010

Intersection Setup

Name						
Approach	Southbound		Eastbound		Westbound	
Lane Configuration						
Turning Movement	Left	Right	Left	Thru	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00		30.00		30.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	No		No		No	

Volumes

Name						
Base Volume Input [veh/h]	0	0	0	621	1192	0
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	0.00	2.00	0.00	0.00	0.00
Growth Factor	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	4	0	6	0	13
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	0	4	0	652	1240	13
Peak Hour Factor	1.0000	0.9500	1.0000	0.9500	0.9500	0.9500
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	1	0	172	326	3
Total Analysis Volume [veh/h]	0	4	0	686	1305	14
Pedestrian Volume [ped/h]	0		0		0	

Intersection Settings

Priority Scheme	Stop	Free	Free
Flared Lane			
Storage Area [veh]	0	0	0
Two-Stage Gap Acceptance	No		
Number of Storage Spaces in Median	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.01	0.00	0.01	0.01	0.00
d_M, Delay for Movement [s/veh]	0.00	13.85	0.00	0.00	0.00	0.00
Movement LOS		B		A	A	A
95th-Percentile Queue Length [veh/ln]	0.00	0.03	0.00	0.00	0.00	0.00
95th-Percentile Queue Length [ft/ln]	0.00	0.74	0.00	0.00	0.00	0.00
d_A, Approach Delay [s/veh]	13.85		0.00		0.00	
Approach LOS	B		A		A	
d_I, Intersection Delay [s/veh]	0.03					
Intersection LOS	B					

Vistro File: C:\...\Live Oak Irwindale Mark HCM.vistro
Report File: C:\...\Opening Year Plud Project AM HCM.pdf

Scenario 7 Opening Year Plus Project AM
8/23/2023

Turning Movement Volume: Summary

ID	Intersection Name	Northbound			Southbound			Eastbound			Westbound			Total Volume
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
1	Stewart Ave / Rivergrade Rd	19	7	113	11	5	6	3	158	10	95	173	17	617

ID	Intersection Name	Northbound			Southbound			Eastbound			Westbound			Total Volume
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
2	Stewart Ave / Live Oak Ave	153	72	33	17	37	53	44	600	45	19	1204	19	2296

ID	Intersection Name	Northbound		Eastbound		Westbound		Total Volume
		Left	Right	Thru	Right	Left	Thru	
3	Rivergrade Rd / Project Dwy 1	1	1	278	5	2	283	570

ID	Intersection Name	Southbound	Eastbound	Westbound		Total Volume
		Right	Thru	Thru	Right	
4	Live Oak Ave / Dwy 2	4	652	1240	13	1909

Vistro File: C:\...\Live Oak Irwindale Mark HCM.vistro
Report File: C:\...\Opening Year Plud Project PM HCM.pdf

Scenario 8 Opening Year Plus Project PM
8/23/2023

Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
1	Stewart Ave / Rivergrade Rd	Signalized	HCM 7th Edition	NB Left	0.185	5.4	A
2	Stewart Ave / Live Oak Ave	Signalized	HCM 7th Edition	NB Left	0.548	7.5	A
3	Rivergrade Rd / Project Dwy 1	Two-way stop	HCM 7th Edition	NB Left	0.008	10.6	B
4	Live Oak Ave / Dwy 2	Two-way stop	HCM 7th Edition	SB Right	0.019	10.4	B

V/C, Delay, LOS: For two-way stop, these values are taken from the movement with the worst (highest) delay value. For all other control types, they are taken for the whole intersection.

Intersection Level Of Service Report
Intersection 1: Stewart Ave / Rivergrade Rd

Control Type:	Signalized	Delay (sec / veh):	5.4
Analysis Method:	HCM 7th Edition	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.185

Intersection Setup

Name												
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	1	0	0	0	0	0	1	0	0	1	0	0
Entry Pocket Length [ft]	320.00	100.00	100.00	100.00	100.00	100.00	173.00	100.00	100.00	91.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	1	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			35.00			35.00		
Grade [%]	0.00			0.00			0.00			0.00		
Curb Present	No			No			No			No		
Crosswalk	Yes			Yes			Yes			No		

Volumes

Name												
Base Volume Input [veh/h]	4	4	106	11	5	9	12	73	22	148	44	7
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Proportion of CAVs [%]	0.00											
Growth Factor	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	2	0	0	0	0	2	0	0	5	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right Turn on Red Volume [veh/h]	0	0	96	0	0	3	0	0	1	0	0	0
Total Hourly Volume [veh/h]	4	4	16	11	5	6	12	78	22	154	51	7
Peak Hour Factor	0.7882	0.7882	0.7882	0.6125	0.6125	0.6125	0.7196	0.7196	0.7196	0.7576	0.7576	0.7576
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	1	1	5	4	2	2	4	27	8	51	17	2
Total Analysis Volume [veh/h]	5	5	20	18	8	10	17	108	31	203	67	9
Presence of On-Street Parking	No		No	No		No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
v_do, Outbound Pedestrian Volume crossing	0			0			0			0		
v_di, Inbound Pedestrian Volume crossing m	0			0			0			0		
v_co, Outbound Pedestrian Volume crossing	0			0			0			0		
v_ci, Inbound Pedestrian Volume crossing mi	0			0			0			0		
v_ab, Corner Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	60
Active Pattern	Pattern 1
Coordination Type	Time of Day Pattern Coordinated
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	Lead Green - Beginning of First Green
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal Group	0	8	0	0	4	0	0	2	0	0	6	0
Auxiliary Signal Groups												
Lead / Lag	-	-	-	-	-	-	-	-	-	-	-	-
Minimum Green [s]	0	10	0	0	10	0	0	10	0	0	10	0
Maximum Green [s]	0	22	0	0	22	0	0	30	0	0	30	0
Amber [s]	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
All red [s]	0.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0
Split [s]	0	27	0	0	27	0	0	33	0	0	33	0
Vehicle Extension [s]	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Walk [s]	0	5	0	0	5	0	0	5	0	0	5	0
Pedestrian Clearance [s]	0	10	0	0	17	0	0	14	0	0	14	0
Delayed Vehicle Green [s]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rest In Walk		No			No			No			No	
I1, Start-Up Lost Time [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
I2, Clearance Lost Time [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
Minimum Recall		No			No			No			No	
Maximum Recall		No			No			No			No	
Pedestrian Recall		No			No			No			No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering 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

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Lane Group Calculations

Lane Group	L	C	C	C	L	C	C	L	C	C
C, Cycle Length [s]	60	60	60	60	60	60	60	60	60	60
L, Total Lost Time per Cycle [s]	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
l1_p, Permitted Start-Up Lost Time [s]	2.00	0.00	2.00	0.00	2.00	0.00	0.00	2.00	0.00	0.00
l2, Clearance Lost Time [s]	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
g_i, Effective Green Time [s]	5	5	5	5	47	47	47	47	47	47
g / C, Green / Cycle	0.08	0.08	0.08	0.08	0.79	0.79	0.79	0.79	0.79	0.79
(v / s)_i Volume / Saturation Flow Rate	0.00	0.02	0.02	0.01	0.01	0.04	0.04	0.16	0.02	0.02
s, saturation flow rate [veh/h]	1417	1665	836	1551	1344	1900	1760	1270	1900	1823
c, Capacity [veh/h]	180	129	177	120	1119	1499	1389	1058	1499	1439
d1, Uniform Delay [s]	27.61	25.92	26.77	25.79	2.01	1.38	1.39	2.44	1.36	1.36
k, delay calibration	0.11	0.11	0.11	0.11	0.50	0.50	0.50	0.50	0.50	0.50
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	0.06	0.72	0.29	0.47	0.02	0.06	0.07	0.40	0.03	0.03
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.03	0.19	0.12	0.13	0.02	0.05	0.05	0.19	0.03	0.03
d, Delay for Lane Group [s/veh]	27.67	26.64	27.06	26.26	2.03	1.44	1.45	2.84	1.39	1.39
Lane Group LOS	C	C	C	C	A	A	A	A	A	A
Critical Lane Group	No	No	Yes	No	No	No	No	Yes	No	No
50th-Percentile Queue Length [veh/ln]	0.07	0.34	0.29	0.21	0.03	0.05	0.05	0.42	0.03	0.03
50th-Percentile Queue Length [ft/ln]	1.72	8.59	7.18	5.26	0.69	1.32	1.34	10.38	0.70	0.70
95th-Percentile Queue Length [veh/ln]	0.12	0.62	0.52	0.38	0.05	0.09	0.10	0.75	0.05	0.05
95th-Percentile Queue Length [ft/ln]	3.10	15.45	12.93	9.46	1.24	2.37	2.41	18.69	1.27	1.27

Movement, Approach, & Intersection Results

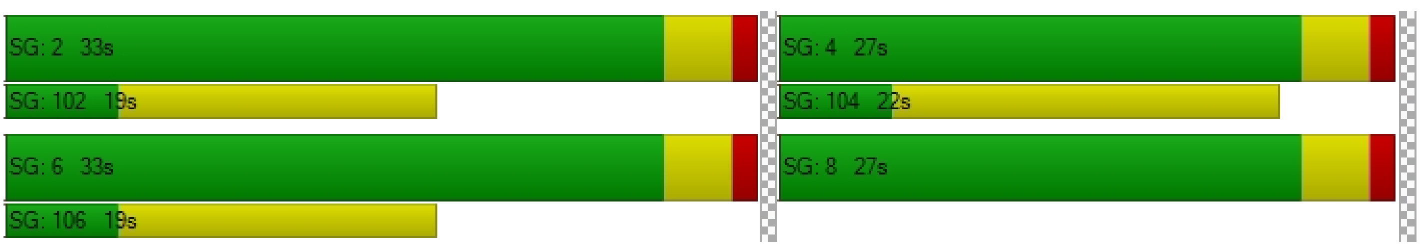
d_M, Delay for Movement [s/veh]	27.67	26.64	26.64	27.06	26.52	26.26	2.03	1.45	1.45	2.84	1.39	1.39
Movement LOS	C	C	C	C	C	C	A	A	A	A	A	A
d_A, Approach Delay [s/veh]	26.82			26.72			1.51			2.45		
Approach LOS	C			C			A			A		
d_I, Intersection Delay [s/veh]	5.36											
Intersection LOS	A											
Intersection V/C	0.185											

Other Modes

g_Walk,mi, Effective Walk Time [s]	9.0	9.0	9.0	0.0
M_corner, Corner Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
M_CW, Crosswalk Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
d_p, Pedestrian Delay [s]	21.68	21.68	21.68	0.00
I_p,int, Pedestrian LOS Score for Intersectio	2.627	2.157	2.344	0.000
Crosswalk LOS	B	B	B	F
s_b, Saturation Flow Rate of the bicycle lane	2000	2000	2000	2000
c_b, Capacity of the bicycle lane [bicycles/h]	767	767	967	967
d_b, Bicycle Delay [s]	11.41	11.41	8.01	8.01
I_b,int, Bicycle LOS Score for Intersection	1.768	1.592	1.689	1.790
Bicycle LOS	A	A	A	A

Sequence

Ring 1	-	2	-	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	-	6	-	8	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Intersection Level Of Service Report
Intersection 2: Stewart Ave / Live Oak Ave

Control Type:	Signalized	Delay (sec / veh):	7.5
Analysis Method:	HCM 7th Edition	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.548

Intersection Setup

Name												
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	1	0	0	1	0	0	1	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	115.00	100.00	100.00	178.00	100.00	100.00	120.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			45.00			45.00		
Grade [%]	0.00			0.00			0.00			0.00		
Curb Present	No			No			No			No		
Crosswalk	Yes			Yes			No			Yes		

Volumes

Name												
Base Volume Input [veh/h]	40	33	28	37	134	16	56	1356	183	39	538	16
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Proportion of CAVs [%]	0.00											
Growth Factor	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	1	0	0	4	2
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right Turn on Red Volume [veh/h]	0	0	7	0	0	11	0	0	40	0	0	2
Total Hourly Volume [veh/h]	42	34	22	38	139	6	58	1411	150	41	564	17
Peak Hour Factor	0.7042	0.7042	0.7042	0.8477	0.8477	0.8477	0.9525	0.9525	0.9525	0.8298	0.8298	0.8298
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	15	12	8	11	41	2	15	370	39	12	170	5
Total Analysis Volume [veh/h]	60	48	31	45	164	7	61	1481	157	49	680	20
Presence of On-Street Parking	No		No	No		No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
v_do, Outbound Pedestrian Volume crossing	0			0			0			0		
v_di, Inbound Pedestrian Volume crossing m	0			0			0			0		
v_co, Outbound Pedestrian Volume crossing	0			0			0			0		
v_ci, Inbound Pedestrian Volume crossing mi	0			0			0			0		
v_ab, Corner Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	60
Active Pattern	Pattern 1
Coordination Type	Time of Day Pattern Coordinated
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	Lead Green - Beginning of First Green
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal Group	0	8	0	0	4	0	0	2	0	0	6	0
Auxiliary Signal Groups												
Lead / Lag	-	-	-	-	-	-	-	-	-	-	-	-
Minimum Green [s]	0	10	0	0	10	0	0	10	0	0	10	0
Maximum Green [s]	0	36	0	0	36	0	0	26	0	0	26	0
Amber [s]	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
All red [s]	0.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0
Split [s]	0	36	0	0	36	0	0	24	0	0	24	0
Vehicle Extension [s]	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Walk [s]	0	5	0	0	5	0	0	5	0	0	5	0
Pedestrian Clearance [s]	0	20	0	0	10	0	0	7	0	0	7	0
Delayed Vehicle Green [s]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rest In Walk		No			No			No			No	
I1, Start-Up Lost Time [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
I2, Clearance Lost Time [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
Minimum Recall		No			No			No			No	
Maximum Recall		No			No			No			No	
Pedestrian Recall		No			No			No			No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering 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

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Lane Group Calculations

Lane Group	C	L	C	R	L	C	R	L	C	C
C, Cycle Length [s]	60	60	60	60	60	60	60	60	60	60
L, Total Lost Time per Cycle [s]	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
l1_p, Permitted Start-Up Lost Time [s]	2.00	2.00	0.00	0.00	2.00	0.00	0.00	2.00	0.00	0.00
l2, Clearance Lost Time [s]	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
g_i, Effective Green Time [s]	10	10	10	10	42	42	42	42	42	42
g / C, Green / Cycle	0.17	0.17	0.17	0.17	0.70	0.70	0.70	0.70	0.70	0.70
(v / s)_i Volume / Saturation Flow Rate	0.14	0.03	0.09	0.00	0.08	0.41	0.10	0.16	0.19	0.19
s, saturation flow rate [veh/h]	1003	1341	1900	1615	758	3618	1615	311	1900	1881
c, Capacity [veh/h]	252	160	314	267	565	2537	1133	256	1333	1319
d1, Uniform Delay [s]	24.48	22.16	22.90	21.01	5.58	4.53	2.97	11.21	3.29	3.29
k, delay calibration	0.11	0.11	0.11	0.11	0.50	0.50	0.50	0.50	0.50	0.50
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	1.89	0.94	1.34	0.04	0.39	0.99	0.26	1.65	0.48	0.49
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.55	0.28	0.52	0.03	0.11	0.58	0.14	0.19	0.26	0.26
d, Delay for Lane Group [s/veh]	26.36	23.11	24.24	21.05	5.96	5.52	3.22	12.86	3.77	3.78
Lane Group LOS	C	C	C	C	A	A	A	B	A	A
Critical Lane Group	Yes	No	No	No	No	Yes	No	No	No	No
50th-Percentile Queue Length [veh/ln]	1.96	0.57	2.10	0.08	0.28	2.14	0.33	0.46	0.79	0.79
50th-Percentile Queue Length [ft/ln]	49.01	14.19	52.39	2.01	7.05	53.45	8.21	11.38	19.87	19.73
95th-Percentile Queue Length [veh/ln]	3.53	1.02	3.77	0.14	0.51	3.85	0.59	0.82	1.43	1.42
95th-Percentile Queue Length [ft/ln]	88.21	25.54	94.31	3.62	12.69	96.21	14.79	20.48	35.77	35.51

Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	26.36	26.36	26.36	23.11	24.24	21.05	5.96	5.52	3.22	12.86	3.77	3.78
Movement LOS	C	C	C	C	C	C	A	A	A	B	A	A
d_A, Approach Delay [s/veh]	26.36			23.90			5.33			4.37		
Approach LOS	C			C			A			A		
d_I, Intersection Delay [s/veh]	7.55											
Intersection LOS	A											
Intersection V/C	0.548											

Other Modes

g_Walk,mi, Effective Walk Time [s]	9.0	9.0	0.0	9.0
M_corner, Corner Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
M_CW, Crosswalk Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
d_p, Pedestrian Delay [s]	21.69	21.69	0.00	21.69
I_p,int, Pedestrian LOS Score for Intersectio	2.046	2.301	0.000	3.025
Crosswalk LOS	B	B	F	C
s_b, Saturation Flow Rate of the bicycle lane	2000	2000	2000	2000
c_b, Capacity of the bicycle lane [bicycles/h]	1066	1066	666	666
d_b, Bicycle Delay [s]	6.55	6.55	13.35	13.35
I_b,int, Bicycle LOS Score for Intersection	1.801	1.934	2.994	2.179
Bicycle LOS	A	A	C	B

Sequence

Ring 1	-	2	-	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	-	6	-	8	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Intersection Level Of Service Report
Intersection 3: Rivergrade Rd / Project Dwy 1

Control Type:	Two-way stop	Delay (sec / veh):	10.6
Analysis Method:	HCM 7th Edition	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.008

Intersection Setup

Name						
Approach	Northbound		Eastbound		Westbound	
Lane Configuration						
Turning Movement	Left	Right	Thru	Right	Left	Thru
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00		30.00		30.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	No		No		No	

Volumes

Name						
Base Volume Input [veh/h]	0	0	190	0	0	199
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	0.00	0.00	0.00
Growth Factor	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	5	2	2	2	1	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	5	2	200	2	1	207
Peak Hour Factor	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	1	1	53	1	0	54
Total Analysis Volume [veh/h]	5	2	211	2	1	218
Pedestrian Volume [ped/h]	0		0		0	

Intersection Settings

Priority Scheme	Stop	Free	Free
Flared Lane	No		
Storage Area [veh]	0	0	0
Two-Stage Gap Acceptance	No		
Number of Storage Spaces in Median	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.01	0.00	0.00	0.00	0.00	0.00
d_M, Delay for Movement [s/veh]	10.58	8.91	0.00	0.00	7.63	0.00
Movement LOS	B	A	A	A	A	A
95th-Percentile Queue Length [veh/ln]	0.03	0.03	0.00	0.00	0.00	0.00
95th-Percentile Queue Length [ft/ln]	0.74	0.74	0.00	0.00	0.04	0.02
d_A, Approach Delay [s/veh]	10.10		0.00		0.03	
Approach LOS	B		A		A	
d_I, Intersection Delay [s/veh]	0.18					
Intersection LOS	B					

Intersection Level Of Service Report
Intersection 4: Live Oak Ave / Dwy 2

Control Type:	Two-way stop	Delay (sec / veh):	10.4
Analysis Method:	HCM 7th Edition	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.019

Intersection Setup

Name						
Approach	Southbound		Eastbound		Westbound	
Lane Configuration						
Turning Movement	Left	Right	Left	Thru	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00		30.00		30.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	No		No		No	

Volumes

Name						
Base Volume Input [veh/h]	0	0	0	1421	593	0
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	0.00	2.00	0.00	0.00	0.00
Growth Factor	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	12	0	7	0	4
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	0	12	0	1485	617	4
Peak Hour Factor	1.0000	0.9500	1.0000	0.9500	0.9500	0.9500
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	3	0	391	162	1
Total Analysis Volume [veh/h]	0	13	0	1563	649	4
Pedestrian Volume [ped/h]	0		0		0	

Intersection Settings

Priority Scheme	Stop	Free	Free
Flared Lane			
Storage Area [veh]	0	0	0
Two-Stage Gap Acceptance	No		
Number of Storage Spaces in Median	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.02	0.00	0.02	0.01	0.00
d_M, Delay for Movement [s/veh]	0.00	10.44	0.00	0.00	0.00	0.00
Movement LOS		B		A	A	A
95th-Percentile Queue Length [veh/ln]	0.00	0.06	0.00	0.00	0.00	0.00
95th-Percentile Queue Length [ft/ln]	0.00	1.47	0.00	0.00	0.00	0.00
d_A, Approach Delay [s/veh]	10.44		0.00		0.00	
Approach LOS	B		A		A	
d_I, Intersection Delay [s/veh]	0.06					
Intersection LOS	B					

Vistro File: C:\...\Live Oak Irwindale Mark HCM.vistro
Report File: C:\...\Opening Year Plud Project PM HCM.pdf

Scenario 8 Opening Year Plus Project PM
8/23/2023

Turning Movement Volume: Summary

ID	Intersection Name	Northbound			Southbound			Eastbound			Westbound			Total Volume
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
1	Stewart Ave / Rivergrade Rd	4	4	112	11	5	9	12	78	23	154	51	7	470

ID	Intersection Name	Northbound			Southbound			Eastbound			Westbound			Total Volume
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
2	Stewart Ave / Live Oak Ave	42	34	29	38	139	17	58	1411	190	41	564	19	2582

ID	Intersection Name	Northbound		Eastbound		Westbound		Total Volume
		Left	Right	Thru	Right	Left	Thru	
3	Rivergrade Rd / Project Dwy 1	5	2	200	2	1	207	417

ID	Intersection Name	Southbound	Eastbound	Westbound		Total Volume
		Right	Thru	Thru	Right	
4	Live Oak Ave / Dwy 2	12	1485	617	4	2118

Vistro File: C:\...\Live Oak Irwindale Mark HCM.vistro
Report File: C:\...\Opening Year PM HCM.pdf

Scenario 9 Opening Year PM
8/23/2023

Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
1	Stewart Ave / Rivergrade Rd	Signalized	HCM 7th Edition	NB Left	0.184	5.3	A
2	Stewart Ave / Live Oak Ave	Signalized	HCM 7th Edition	NB Left	0.548	7.5	A
3	Rivergrade Rd / Project Dwy 1	Two-way stop	HCM 7th Edition	WB Thru	0.002	0.0	A
4	Live Oak Ave / Dwy 2	Two-way stop	HCM 7th Edition	EB Thru	0.016	0.0	A

V/C, Delay, LOS: For two-way stop, these values are taken from the movement with the worst (highest) delay value. For all other control types, they are taken for the whole intersection.

Vistro File: C:\...\Live Oak Irwindale Mark ICU.vistro
Report File: C:\...\Existing AM ICU.pdf

Scenario 9 Existing AM
8/23/2023

Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
1	Stewart Ave / Rivergrade Rd	Signalized	ICU 1	WB Left	0.163	-	A
2	Stewart Ave / Live Oak Ave	Signalized	ICU 1	WB Right	0.607	-	B

V/C, Delay, LOS: For two-way stop, these values are taken from the movement with the worst (highest) delay value. For all other control types, they are taken for the whole intersection.

Intersection Level Of Service Report
Intersection 1: Stewart Ave / Rivergrade Rd

Control Type:	Signalized	Delay (sec / veh):	-
Analysis Method:	ICU 1	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.163

Intersection Setup

Name												
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	1	0	0	0	0	0	1	0	0	1	0	0
Entry Pocket Length [ft]	320.00	100.00	100.00	100.00	100.00	100.00	173.00	100.00	100.00	91.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	1	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			35.00			35.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			Yes			Yes			No		

Volumes

Name												
Base Volume Input [veh/h]	18	7	108	11	5	6	3	147	10	91	165	16
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Growth Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	18	7	35	11	5	5	3	147	9	91	165	15
Peak Hour Factor	0.8717	0.8717	0.8717	0.6471	0.6471	0.6471	0.9494	0.9494	0.9494	0.7953	0.7953	0.7953
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	5	2	10	4	2	2	1	39	2	29	52	5
Total Analysis Volume [veh/h]	21	8	40	17	8	8	3	155	9	114	207	19
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Cycle Length [s]	100
Lost time [s]	0.00

Phasing & Timing

Control Type	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal Group	0	8	0	0	4	0	0	2	0	0	6	0
Auxiliary Signal Groups												
Lead / Lag	-	-	-	-	-	-	-	-	-	-	-	-

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.01	0.03	0.03	0.01	0.01	0.01	0.00	0.05	0.05	0.07	0.07	0.07
Intersection LOS	A											
Intersection V/C	0.163											

Intersection Level Of Service Report
Intersection 2: Stewart Ave / Live Oak Ave

Control Type:	Signalized	Delay (sec / veh):	-
Analysis Method:	ICU 1	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.607

Intersection Setup

Name												
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	1	0	0	1	0	0	1	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	115.00	100.00	100.00	178.00	100.00	100.00	120.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			45.00			45.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			Yes			No			Yes		

Volumes

Name												
Base Volume Input [veh/h]	147	69	32	16	36	51	42	573	43	18	1157	17
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Growth Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	147	69	19	16	36	28	42	573	34	18	1157	14
Peak Hour Factor	0.8493	0.8493	0.8493	0.7649	0.7649	0.7649	0.8038	0.8038	0.8038	0.9412	0.9412	0.9412
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	43	20	6	5	12	9	13	178	11	5	307	4
Total Analysis Volume [veh/h]	173	81	22	21	47	37	52	713	42	19	1229	15
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Cycle Length [s]	100
Lost time [s]	0.00

Phasing & Timing

Control Type	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal Group	0	8	0	0	4	0	0	2	0	0	6	0
Auxiliary Signal Groups												
Lead / Lag	-	-	-	-	-	-	-	-	-	-	-	-

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.11	0.17	0.17	0.01	0.03	0.02	0.03	0.22	0.03	0.01	0.39	0.39
Intersection LOS	B											
Intersection V/C	0.607											

Vistro File: C:\...\Live Oak Irwindale Mark ICU.vistro
Report File: C:\...\Existing AM ICU.pdf

Scenario 9 Existing AM
8/23/2023

Turning Movement Volume: Summary

ID	Intersection Name	Northbound			Southbound			Eastbound			Westbound			Total Volume
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
1	Stewart Ave / Rivergrade Rd	18	7	108	11	5	6	3	147	10	91	165	16	587

ID	Intersection Name	Northbound			Southbound			Eastbound			Westbound			Total Volume
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
2	Stewart Ave / Live Oak Ave	147	69	32	16	36	51	42	573	43	18	1157	17	2201

Vistro File: C:\...\Live Oak Irwindale Mark ICU.vistro Scenario 10 Existing PM
Report File: C:\...\Existing PM ICU.pdf 8/23/2023

Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
1	Stewart Ave / Rivergrade Rd	Signalized	ICU 1	WB Left	0.185	-	A
2	Stewart Ave / Live Oak Ave	Signalized	ICU 1	EB Thru	0.609	-	B

V/C, Delay, LOS: For two-way stop, these values are taken from the movement with the worst (highest) delay value. For all other control types, they are taken for the whole intersection.

Intersection Level Of Service Report
Intersection 1: Stewart Ave / Rivergrade Rd

Control Type:	Signalized	Delay (sec / veh):	-
Analysis Method:	ICU 1	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.185

Intersection Setup

Name												
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	1	0	0	0	0	0	1	0	0	1	0	0
Entry Pocket Length [ft]	320.00	100.00	100.00	100.00	100.00	100.00	173.00	100.00	100.00	91.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	1	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			35.00			35.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			Yes			Yes			No		

Volumes

Name												
Base Volume Input [veh/h]	4	4	106	11	5	9	12	73	22	148	44	7
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Growth Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	4	4	10	11	5	6	12	73	21	148	44	7
Peak Hour Factor	0.7882	0.7882	0.7882	0.6125	0.6125	0.6125	0.7196	0.7196	0.7196	0.7576	0.7576	0.7576
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	1	1	3	4	2	2	4	25	7	49	15	2
Total Analysis Volume [veh/h]	5	5	13	18	8	10	17	101	29	195	58	9
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Cycle Length [s]	100
Lost time [s]	0.00

Phasing & Timing

Control Type	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal Group	0	8	0	0	4	0	0	2	0	0	6	0
Auxiliary Signal Groups												
Lead / Lag	-	-	-	-	-	-	-	-	-	-	-	-

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.04	0.04	0.12	0.02	0.02
Intersection LOS	A											
Intersection V/C	0.185											

Intersection Level Of Service Report
Intersection 2: Stewart Ave / Live Oak Ave

Control Type:	Signalized	Delay (sec / veh):	-
Analysis Method:	ICU 1	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.609

Intersection Setup

Name												
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	1	0	0	1	0	0	1	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	115.00	100.00	100.00	178.00	100.00	100.00	120.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			45.00			45.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			Yes			No			Yes		

Volumes

Name												
Base Volume Input [veh/h]	40	33	28	37	134	16	56	1356	183	39	538	16
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Growth Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	40	33	21	37	134	5	56	1356	143	39	538	14
Peak Hour Factor	0.7042	0.7042	0.7042	0.8477	0.8477	0.8477	0.9525	0.9525	0.9525	0.8298	0.8298	0.8298
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	14	12	7	11	40	1	15	356	38	12	162	4
Total Analysis Volume [veh/h]	57	47	30	44	158	6	59	1424	150	47	648	17
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Cycle Length [s]	100
Lost time [s]	0.00

Phasing & Timing

Control Type	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal Group	0	8	0	0	4	0	0	2	0	0	6	0
Auxiliary Signal Groups												
Lead / Lag	-	-	-	-	-	-	-	-	-	-	-	-

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.04	0.08	0.08	0.03	0.10	0.00	0.04	0.45	0.09	0.03	0.21	0.21
Intersection LOS	B											
Intersection V/C	0.609											

Vistro File: C:\...\Live Oak Irwindale Mark ICU.vistro
Report File: C:\...\Existing PM ICU.pdf

Scenario 10 Existing PM
8/23/2023

Turning Movement Volume: Summary

ID	Intersection Name	Northbound			Southbound			Eastbound			Westbound			Total Volume
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
1	Stewart Ave / Rivergrade Rd	4	4	106	11	5	9	12	73	22	148	44	7	445

ID	Intersection Name	Northbound			Southbound			Eastbound			Westbound			Total Volume
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
2	Stewart Ave / Live Oak Ave	40	33	28	37	134	16	56	1356	183	39	538	16	2476

Vistro File: C:\...\Live Oak Irwindale Mark ICU.vistro
Report File: C:\...\Existing Plus Project AM ICU.pdf

Scenario 5 Existing Plus Project AM
8/23/2023

Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
1	Stewart Ave / Rivergrade Rd	Signalized	ICU 1	WB Thru	0.165	-	A
2	Stewart Ave / Live Oak Ave	Signalized	ICU 1	WB Thru	0.608	-	B

V/C, Delay, LOS: For two-way stop, these values are taken from the movement with the worst (highest) delay value. For all other control types, they are taken for the whole intersection.

Intersection Level Of Service Report
Intersection 1: Stewart Ave / Rivergrade Rd

Control Type:	Signalized	Delay (sec / veh):	-
Analysis Method:	ICU 1	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.165

Intersection Setup

Name												
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	1	0	0	0	0	0	1	0	0	1	0	0
Entry Pocket Length [ft]	320.00	100.00	100.00	100.00	100.00	100.00	173.00	100.00	100.00	91.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	1	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			35.00			35.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			Yes			Yes			No		

Volumes

Name												
Base Volume Input [veh/h]	18	7	108	11	5	6	3	147	10	91	165	16
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Growth Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	1	0	0	0	0	5	0	0	1	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	18	7	36	11	5	5	3	152	9	91	166	15
Peak Hour Factor	0.8717	0.8717	0.8717	0.6471	0.6471	0.6471	0.9494	0.9494	0.9494	0.7953	0.7953	0.7953
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	5	2	10	4	2	2	1	40	2	29	52	5
Total Analysis Volume [veh/h]	21	8	41	17	8	8	3	160	9	114	209	19
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Cycle Length [s]	100
Lost time [s]	0.00

Phasing & Timing

Control Type	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal Group	0	8	0	0	4	0	0	2	0	0	6	0
Auxiliary Signal Groups												
Lead / Lag	-	-	-	-	-	-	-	-	-	-	-	-

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.01	0.03	0.03	0.01	0.01	0.01	0.00	0.05	0.05	0.07	0.07	0.07
Intersection LOS	A											
Intersection V/C	0.165											

Intersection Level Of Service Report
Intersection 2: Stewart Ave / Live Oak Ave

Control Type:	Signalized	Delay (sec / veh):	-
Analysis Method:	ICU 1	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.608

Intersection Setup

Name												
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	1	0	0	1	0	0	1	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	115.00	100.00	100.00	178.00	100.00	100.00	120.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			45.00			45.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			Yes			No			Yes		

Volumes

Name												
Base Volume Input [veh/h]	147	69	32	16	36	51	42	573	43	18	1157	17
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Growth Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	4	0	0	1	1
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	147	69	19	16	36	28	42	577	34	18	1158	15
Peak Hour Factor	0.8493	0.8493	0.8493	0.7649	0.7649	0.7649	0.8038	0.8038	0.8038	0.9412	0.9412	0.9412
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	43	20	6	5	12	9	13	179	11	5	308	4
Total Analysis Volume [veh/h]	173	81	22	21	47	37	52	718	42	19	1230	16
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Cycle Length [s]	100
Lost time [s]	0.00

Phasing & Timing

Control Type	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal Group	0	8	0	0	4	0	0	2	0	0	6	0
Auxiliary Signal Groups												
Lead / Lag	-	-	-	-	-	-	-	-	-	-	-	-

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.11	0.17	0.17	0.01	0.03	0.02	0.03	0.22	0.03	0.01	0.39	0.39
Intersection LOS	B											
Intersection V/C	0.608											

Vistro File: C:\...\Live Oak Irwindale Mark ICU.vistro
Report File: C:\...\Existing Plus Project AM ICU.pdf

Scenario 5 Existing Plus Project AM
8/23/2023

Turning Movement Volume: Summary

ID	Intersection Name	Northbound			Southbound			Eastbound			Westbound			Total Volume
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
1	Stewart Ave / Rivergrade Rd	18	7	109	11	5	6	3	152	10	91	166	16	594

ID	Intersection Name	Northbound			Southbound			Eastbound			Westbound			Total Volume
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
2	Stewart Ave / Live Oak Ave	147	69	32	16	36	51	42	577	43	18	1158	18	2207

Vistro File: C:\...\Live Oak Irwindale Mark ICU.vistro
Report File: C:\...\Existing Plus Project PM ICU.pdf

Scenario 6 Existing Plus Project PM
8/23/2023

Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
1	Stewart Ave / Rivergrade Rd	Signalized	ICU 1	WB Left	0.187	-	A
2	Stewart Ave / Live Oak Ave	Signalized	ICU 1	EB Thru	0.609	-	B

V/C, Delay, LOS: For two-way stop, these values are taken from the movement with the worst (highest) delay value. For all other control types, they are taken for the whole intersection.

Intersection Level Of Service Report
Intersection 1: Stewart Ave / Rivergrade Rd

Control Type:	Signalized	Delay (sec / veh):	-
Analysis Method:	ICU 1	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.187

Intersection Setup

Name												
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	1	0	0	0	0	0	1	0	0	1	0	0
Entry Pocket Length [ft]	320.00	100.00	100.00	100.00	100.00	100.00	173.00	100.00	100.00	91.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	1	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			35.00			35.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			Yes			Yes			No		

Volumes

Name												
Base Volume Input [veh/h]	4	4	106	11	5	9	12	73	22	148	44	7
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Growth Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	2	0	0	0	0	2	0	0	5	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	4	4	12	11	5	6	12	75	21	148	49	7
Peak Hour Factor	0.7882	0.7882	0.7882	0.6125	0.6125	0.6125	0.7196	0.7196	0.7196	0.7576	0.7576	0.7576
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	1	1	4	4	2	2	4	26	7	49	16	2
Total Analysis Volume [veh/h]	5	5	15	18	8	10	17	104	29	195	65	9
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Cycle Length [s]	100
Lost time [s]	0.00

Phasing & Timing

Control Type	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal Group	0	8	0	0	4	0	0	2	0	0	6	0
Auxiliary Signal Groups												
Lead / Lag	-	-	-	-	-	-	-	-	-	-	-	-

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.04	0.04	0.12	0.02	0.02
Intersection LOS	A											
Intersection V/C	0.187											

Intersection Level Of Service Report
Intersection 2: Stewart Ave / Live Oak Ave

Control Type:	Signalized	Delay (sec / veh):	-
Analysis Method:	ICU 1	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.609

Intersection Setup

Name												
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	1	0	0	1	0	0	1	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	115.00	100.00	100.00	178.00	100.00	100.00	120.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			45.00			45.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			Yes			No			Yes		

Volumes

Name												
Base Volume Input [veh/h]	40	33	28	37	134	16	56	1356	183	39	538	16
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Growth Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	1	0	0	4	2
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	40	33	21	37	134	5	56	1357	143	39	542	16
Peak Hour Factor	0.7042	0.7042	0.7042	0.8477	0.8477	0.8477	0.9525	0.9525	0.9525	0.8298	0.8298	0.8298
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	14	12	7	11	40	1	15	356	38	12	163	5
Total Analysis Volume [veh/h]	57	47	30	44	158	6	59	1425	150	47	653	19
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Cycle Length [s]	100
Lost time [s]	0.00

Phasing & Timing

Control Type	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal Group	0	8	0	0	4	0	0	2	0	0	6	0
Auxiliary Signal Groups												
Lead / Lag	-	-	-	-	-	-	-	-	-	-	-	-

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.04	0.08	0.08	0.03	0.10	0.00	0.04	0.45	0.09	0.03	0.21	0.21
Intersection LOS	B											
Intersection V/C	0.609											

Vistro File: C:\...\Live Oak Irwindale Mark ICU.vistro Scenario 6 Existing Plus Project PM
Report File: C:\...\Existing Plus Project PM ICU.pdf 8/23/2023

Turning Movement Volume: Summary

ID	Intersection Name	Northbound			Southbound			Eastbound			Westbound			Total Volume
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
1	Stewart Ave / Rivergrade Rd	4	4	108	11	5	9	12	75	22	148	49	7	454

ID	Intersection Name	Northbound			Southbound			Eastbound			Westbound			Total Volume
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
2	Stewart Ave / Live Oak Ave	40	33	28	37	134	16	56	1357	183	39	542	18	2483

Vistro File: C:\...\Live Oak Irwindale Mark ICU.vistro
Report File: C:\...\Opening Year AM ICU.pdf

Scenario 11 Opening Year AM
8/23/2023

Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
1	Stewart Ave / Rivergrade Rd	Signalized	ICU 1	WB Left	0.171	-	A
2	Stewart Ave / Live Oak Ave	Signalized	ICU 1	WB Thru	0.633	-	B

V/C, Delay, LOS: For two-way stop, these values are taken from the movement with the worst (highest) delay value. For all other control types, they are taken for the whole intersection.

Intersection Level Of Service Report
Intersection 1: Stewart Ave / Rivergrade Rd

Control Type:	Signalized	Delay (sec / veh):	-
Analysis Method:	ICU 1	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.171

Intersection Setup

Name												
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	1	0	0	0	0	0	1	0	0	1	0	0
Entry Pocket Length [ft]	320.00	100.00	100.00	100.00	100.00	100.00	173.00	100.00	100.00	91.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	1	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			35.00			35.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			Yes			Yes			No		

Volumes

Name												
Base Volume Input [veh/h]	18	7	108	11	5	6	3	147	10	91	165	16
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Growth Factor	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	19	7	39	11	5	5	3	153	9	95	172	16
Peak Hour Factor	0.8717	0.8717	0.8717	0.6471	0.6471	0.6471	0.9494	0.9494	0.9494	0.7953	0.7953	0.7953
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	5	2	11	4	2	2	1	40	2	30	54	5
Total Analysis Volume [veh/h]	22	8	45	17	8	8	3	161	9	119	216	20
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Cycle Length [s]	100
Lost time [s]	0.00

Phasing & Timing

Control Type	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal Group	0	8	0	0	4	0	0	2	0	0	6	0
Auxiliary Signal Groups												
Lead / Lag	-	-	-	-	-	-	-	-	-	-	-	-

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.01	0.03	0.03	0.01	0.01	0.01	0.00	0.05	0.05	0.07	0.07	0.07
Intersection LOS	A											
Intersection V/C	0.171											

Intersection Level Of Service Report
Intersection 2: Stewart Ave / Live Oak Ave

Control Type:	Signalized	Delay (sec / veh):	-
Analysis Method:	ICU 1	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.633

Intersection Setup

Name												
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	1	0	0	1	0	0	1	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	115.00	100.00	100.00	178.00	100.00	100.00	120.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			45.00			45.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			Yes			No			Yes		

Volumes

Name												
Base Volume Input [veh/h]	147	69	32	16	36	51	42	573	43	18	1157	17
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Growth Factor	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	153	72	20	17	37	30	44	596	36	19	1203	15
Peak Hour Factor	0.8493	0.8493	0.8493	0.7649	0.7649	0.7649	0.8038	0.8038	0.8038	0.9412	0.9412	0.9412
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	45	21	6	6	12	10	14	185	11	5	320	4
Total Analysis Volume [veh/h]	180	85	24	22	48	39	55	741	45	20	1278	16
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Cycle Length [s]	100
Lost time [s]	0.00

Phasing & Timing

Control Type	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal Group	0	8	0	0	4	0	0	2	0	0	6	0
Auxiliary Signal Groups												
Lead / Lag	-	-	-	-	-	-	-	-	-	-	-	-

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.11	0.18	0.18	0.01	0.03	0.02	0.03	0.23	0.03	0.01	0.40	0.40
Intersection LOS	B											
Intersection V/C	0.633											

Vistro File: C:\...\Live Oak Irwindale Mark ICU.vistro
Report File: C:\...\Opening Year AM ICU.pdf

Scenario 11 Opening Year AM
8/23/2023

Turning Movement Volume: Summary

ID	Intersection Name	Northbound			Southbound			Eastbound			Westbound			Total Volume
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
1	Stewart Ave / Rivergrade Rd	19	7	112	11	5	6	3	153	10	95	172	17	610

ID	Intersection Name	Northbound			Southbound			Eastbound			Westbound			Total Volume
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
2	Stewart Ave / Live Oak Ave	153	72	33	17	37	53	44	596	45	19	1203	18	2290

Vistro File: C:\...\Live Oak Irwindale Mark ICU.vistro
Report File: C:\...\Opening Year PM ICU.pdf

Scenario 12 Opening Year PM
8/23/2023

Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
1	Stewart Ave / Rivergrade Rd	Signalized	ICU 1	WB Left	0.195	-	A
2	Stewart Ave / Live Oak Ave	Signalized	ICU 1	EB Thru	0.633	-	B

V/C, Delay, LOS: For two-way stop, these values are taken from the movement with the worst (highest) delay value. For all other control types, they are taken for the whole intersection.

Intersection Level Of Service Report
Intersection 1: Stewart Ave / Rivergrade Rd

Control Type:	Signalized	Delay (sec / veh):	-
Analysis Method:	ICU 1	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.195

Intersection Setup

Name												
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	1	0	0	0	0	0	1	0	0	1	0	0
Entry Pocket Length [ft]	320.00	100.00	100.00	100.00	100.00	100.00	173.00	100.00	100.00	91.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	1	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			35.00			35.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			Yes			Yes			No		

Volumes

Name												
Base Volume Input [veh/h]	4	4	106	11	5	9	12	73	22	148	44	7
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Growth Factor	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	4	4	14	11	5	6	12	76	22	154	46	7
Peak Hour Factor	0.7882	0.7882	0.7882	0.6125	0.6125	0.6125	0.7196	0.7196	0.7196	0.7576	0.7576	0.7576
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	1	1	4	4	2	2	4	26	8	51	15	2
Total Analysis Volume [veh/h]	5	5	18	18	8	10	17	106	31	203	61	9
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Cycle Length [s]	100
Lost time [s]	0.00

Phasing & Timing

Control Type	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal Group	0	8	0	0	4	0	0	2	0	0	6	0
Auxiliary Signal Groups												
Lead / Lag	-	-	-	-	-	-	-	-	-	-	-	-

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.04	0.04	0.13	0.02	0.02
Intersection LOS	A											
Intersection V/C	0.195											

Intersection Level Of Service Report
Intersection 2: Stewart Ave / Live Oak Ave

Control Type:	Signalized	Delay (sec / veh):	-
Analysis Method:	ICU 1	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.633

Intersection Setup

Name												
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	1	0	0	1	0	0	1	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	115.00	100.00	100.00	178.00	100.00	100.00	120.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			45.00			45.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			Yes			No			Yes		

Volumes

Name												
Base Volume Input [veh/h]	40	33	28	37	134	16	56	1356	183	39	538	16
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Growth Factor	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	42	34	22	38	139	6	58	1410	150	41	560	15
Peak Hour Factor	0.7042	0.7042	0.7042	0.8477	0.8477	0.8477	0.9525	0.9525	0.9525	0.8298	0.8298	0.8298
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	15	12	8	11	41	2	15	370	39	12	169	5
Total Analysis Volume [veh/h]	60	48	31	45	164	7	61	1480	157	49	675	18
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Cycle Length [s]	100
Lost time [s]	0.00

Phasing & Timing

Control Type	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal Group	0	8	0	0	4	0	0	2	0	0	6	0
Auxiliary Signal Groups												
Lead / Lag	-	-	-	-	-	-	-	-	-	-	-	-

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.04	0.09	0.09	0.03	0.10	0.00	0.04	0.46	0.10	0.03	0.22	0.22
Intersection LOS	B											
Intersection V/C	0.633											

Vistro File: C:\...\Live Oak Irwindale Mark ICU.vistro
Report File: C:\...\Opening Year PM ICU.pdf

Scenario 12 Opening Year PM
8/23/2023

Turning Movement Volume: Summary

ID	Intersection Name	Northbound			Southbound			Eastbound			Westbound			Total Volume
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
1	Stewart Ave / Rivergrade Rd	4	4	110	11	5	9	12	76	23	154	46	7	461

ID	Intersection Name	Northbound			Southbound			Eastbound			Westbound			Total Volume
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
2	Stewart Ave / Live Oak Ave	42	34	29	38	139	17	58	1410	190	41	560	17	2575

Vistro File: C:\...\Live Oak Irwindale Mark ICU.vistro
Report File: C:\...\Opening Year Plus Project AM ICU.pdf

Scenario 7 Opening Year Plus Project AM
8/23/2023

Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
1	Stewart Ave / Rivergrade Rd	Signalized	ICU 1	WB Left	0.173	-	A
2	Stewart Ave / Live Oak Ave	Signalized	ICU 1	WB Thru	0.634	-	B

V/C, Delay, LOS: For two-way stop, these values are taken from the movement with the worst (highest) delay value. For all other control types, they are taken for the whole intersection.

Intersection Level Of Service Report
Intersection 1: Stewart Ave / Rivergrade Rd

Control Type:	Signalized	Delay (sec / veh):	-
Analysis Method:	ICU 1	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.173

Intersection Setup

Name												
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	1	0	0	0	0	0	1	0	0	1	0	0
Entry Pocket Length [ft]	320.00	100.00	100.00	100.00	100.00	100.00	173.00	100.00	100.00	91.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	1	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			35.00			35.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			Yes			Yes			No		

Volumes

Name												
Base Volume Input [veh/h]	18	7	108	11	5	6	3	147	10	91	165	16
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Growth Factor	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	1	0	0	0	0	5	0	0	1	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	19	7	40	11	5	5	3	158	9	95	173	16
Peak Hour Factor	0.8717	0.8717	0.8717	0.6471	0.6471	0.6471	0.9494	0.9494	0.9494	0.7953	0.7953	0.7953
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	5	2	11	4	2	2	1	42	2	30	54	5
Total Analysis Volume [veh/h]	22	8	46	17	8	8	3	166	9	119	218	20
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Cycle Length [s]	100
Lost time [s]	0.00

Phasing & Timing

Control Type	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal Group	0	8	0	0	4	0	0	2	0	0	6	0
Auxiliary Signal Groups												
Lead / Lag	-	-	-	-	-	-	-	-	-	-	-	-

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.01	0.03	0.03	0.01	0.01	0.01	0.00	0.05	0.05	0.07	0.07	0.07
Intersection LOS	A											
Intersection V/C	0.173											

Intersection Level Of Service Report
Intersection 2: Stewart Ave / Live Oak Ave

Control Type:	Signalized	Delay (sec / veh):	-
Analysis Method:	ICU 1	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.634

Intersection Setup

Name												
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	1	0	0	1	0	0	1	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	115.00	100.00	100.00	178.00	100.00	100.00	120.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			45.00			45.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			Yes			No			Yes		

Volumes

Name												
Base Volume Input [veh/h]	147	69	32	16	36	51	42	573	43	18	1157	17
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Growth Factor	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	4	0	0	1	1
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	153	72	20	17	37	30	44	600	36	19	1204	16
Peak Hour Factor	0.8493	0.8493	0.8493	0.7649	0.7649	0.7649	0.8038	0.8038	0.8038	0.9412	0.9412	0.9412
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	45	21	6	6	12	10	14	187	11	5	320	4
Total Analysis Volume [veh/h]	180	85	24	22	48	39	55	746	45	20	1279	17
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Cycle Length [s]	100
Lost time [s]	0.00

Phasing & Timing

Control Type	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal Group	0	8	0	0	4	0	0	2	0	0	6	0
Auxiliary Signal Groups												
Lead / Lag	-	-	-	-	-	-	-	-	-	-	-	-

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.11	0.18	0.18	0.01	0.03	0.02	0.03	0.23	0.03	0.01	0.41	0.41
Intersection LOS	B											
Intersection V/C	0.634											

Vistro File: C:\...\Live Oak Irwindale Mark ICU.vistro Scenario 7 Opening Year Plus Project AM
Report File: C:\...\Opening Year Plus Project AM ICU.pdf 8/23/2023

Turning Movement Volume: Summary

ID	Intersection Name	Northbound			Southbound			Eastbound			Westbound			Total Volume
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
1	Stewart Ave / Rivergrade Rd	19	7	113	11	5	6	3	158	10	95	173	17	617

ID	Intersection Name	Northbound			Southbound			Eastbound			Westbound			Total Volume
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
2	Stewart Ave / Live Oak Ave	153	72	33	17	37	53	44	600	45	19	1204	19	2296

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Scenario 8 Opening Year Plus Project PM
8/23/2023

Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
1	Stewart Ave / Rivergrade Rd	Signalized	ICU 1	WB Left	0.197	-	A
2	Stewart Ave / Live Oak Ave	Signalized	ICU 1	EB Thru	0.633	-	B

V/C, Delay, LOS: For two-way stop, these values are taken from the movement with the worst (highest) delay value. For all other control types, they are taken for the whole intersection.

Intersection Level Of Service Report
Intersection 1: Stewart Ave / Rivergrade Rd

Control Type:	Signalized	Delay (sec / veh):	-
Analysis Method:	ICU 1	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.197

Intersection Setup

Name												
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	1	0	0	0	0	0	1	0	0	1	0	0
Entry Pocket Length [ft]	320.00	100.00	100.00	100.00	100.00	100.00	173.00	100.00	100.00	91.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	1	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			35.00			35.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			Yes			Yes			No		

Volumes

Name												
Base Volume Input [veh/h]	4	4	106	11	5	9	12	73	22	148	44	7
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Growth Factor	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	2	0	0	0	0	2	0	0	5	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	4	4	16	11	5	6	12	78	22	154	51	7
Peak Hour Factor	0.7882	0.7882	0.7882	0.6125	0.6125	0.6125	0.7196	0.7196	0.7196	0.7576	0.7576	0.7576
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	1	1	5	4	2	2	4	27	8	51	17	2
Total Analysis Volume [veh/h]	5	5	20	18	8	10	17	108	31	203	67	9
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Cycle Length [s]	100
Lost time [s]	0.00

Phasing & Timing

Control Type	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal Group	0	8	0	0	4	0	0	2	0	0	6	0
Auxiliary Signal Groups												
Lead / Lag	-	-	-	-	-	-	-	-	-	-	-	-

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.02	0.02	0.01	0.01	0.01	0.01	0.04	0.04	0.13	0.02	0.02
Intersection LOS	A											
Intersection V/C	0.197											

Intersection Level Of Service Report
Intersection 2: Stewart Ave / Live Oak Ave

Control Type:	Signalized	Delay (sec / veh):	-
Analysis Method:	ICU 1	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.633

Intersection Setup

Name												
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	1	0	0	1	0	0	1	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	115.00	100.00	100.00	178.00	100.00	100.00	120.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			45.00			45.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			Yes			No			Yes		

Volumes

Name												
Base Volume Input [veh/h]	40	33	28	37	134	16	56	1356	183	39	538	16
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Growth Factor	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	1	0	0	4	2
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	42	34	22	38	139	6	58	1411	150	41	564	17
Peak Hour Factor	0.7042	0.7042	0.7042	0.8477	0.8477	0.8477	0.9525	0.9525	0.9525	0.8298	0.8298	0.8298
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	15	12	8	11	41	2	15	370	39	12	170	5
Total Analysis Volume [veh/h]	60	48	31	45	164	7	61	1481	157	49	680	20
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Cycle Length [s]	100
Lost time [s]	0.00

Phasing & Timing

Control Type	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal Group	0	8	0	0	4	0	0	2	0	0	6	0
Auxiliary Signal Groups												
Lead / Lag	-	-	-	-	-	-	-	-	-	-	-	-

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.04	0.09	0.09	0.03	0.10	0.00	0.04	0.46	0.10	0.03	0.22	0.22
Intersection LOS	B											
Intersection V/C	0.633											

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Report File: C:\...\Opening Year Plus Project PM ICU.pdf

Scenario 8 Opening Year Plus Project PM
8/23/2023

Turning Movement Volume: Summary

ID	Intersection Name	Northbound			Southbound			Eastbound			Westbound			Total Volume
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
1	Stewart Ave / Rivergrade Rd	4	4	112	11	5	9	12	78	23	154	51	7	470

ID	Intersection Name	Northbound			Southbound			Eastbound			Westbound			Total Volume
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
2	Stewart Ave / Live Oak Ave	42	34	29	38	139	17	58	1411	190	41	564	19	2582

Intersection Level Of Service Report
Intersection 1: Stewart Ave / Rivergrade Rd

Control Type:	Signalized	Delay (sec / veh):	5.3
Analysis Method:	HCM 7th Edition	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.184

Intersection Setup

Name												
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	1	0	0	0	0	0	1	0	0	1	0	0
Entry Pocket Length [ft]	320.00	100.00	100.00	100.00	100.00	100.00	173.00	100.00	100.00	91.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	1	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			35.00			35.00		
Grade [%]	0.00			0.00			0.00			0.00		
Curb Present	No			No			No			No		
Crosswalk	Yes			Yes			Yes			No		

Volumes

Name												
Base Volume Input [veh/h]	4	4	106	11	5	9	12	73	22	148	44	7
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Proportion of CAVs [%]	0.00											
Growth Factor	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right Turn on Red Volume [veh/h]	0	0	96	0	0	3	0	0	1	0	0	0
Total Hourly Volume [veh/h]	4	4	14	11	5	6	12	76	22	154	46	7
Peak Hour Factor	0.7882	0.7882	0.7882	0.6125	0.6125	0.6125	0.7196	0.7196	0.7196	0.7576	0.7576	0.7576
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	1	1	4	4	2	2	4	26	8	51	15	2
Total Analysis Volume [veh/h]	5	5	18	18	8	10	17	106	31	203	61	9
Presence of On-Street Parking	No		No	No		No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
v_do, Outbound Pedestrian Volume crossing	0			0			0			0		
v_di, Inbound Pedestrian Volume crossing m	0			0			0			0		
v_co, Outbound Pedestrian Volume crossing	0			0			0			0		
v_ci, Inbound Pedestrian Volume crossing mi	0			0			0			0		
v_ab, Corner Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	60
Active Pattern	Pattern 1
Coordination Type	Time of Day Pattern Coordinated
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	Lead Green - Beginning of First Green
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal Group	0	8	0	0	4	0	0	2	0	0	6	0
Auxiliary Signal Groups												
Lead / Lag	-	-	-	-	-	-	-	-	-	-	-	-
Minimum Green [s]	0	10	0	0	10	0	0	10	0	0	10	0
Maximum Green [s]	0	22	0	0	22	0	0	30	0	0	30	0
Amber [s]	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
All red [s]	0.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0
Split [s]	0	27	0	0	27	0	0	33	0	0	33	0
Vehicle Extension [s]	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Walk [s]	0	5	0	0	5	0	0	5	0	0	5	0
Pedestrian Clearance [s]	0	10	0	0	17	0	0	14	0	0	14	0
Delayed Vehicle Green [s]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rest In Walk		No			No			No			No	
I1, Start-Up Lost Time [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
I2, Clearance Lost Time [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
Minimum Recall		No			No			No			No	
Maximum Recall		No			No			No			No	
Pedestrian Recall		No			No			No			No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering 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

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Lane Group Calculations

Lane Group	L	C	C	C	L	C	C	L	C	C
C, Cycle Length [s]	60	60	60	60	60	60	60	60	60	60
L, Total Lost Time per Cycle [s]	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
l1_p, Permitted Start-Up Lost Time [s]	2.00	0.00	2.00	0.00	2.00	0.00	0.00	2.00	0.00	0.00
l2, Clearance Lost Time [s]	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
g_i, Effective Green Time [s]	5	5	5	5	47	47	47	47	47	47
g / C, Green / Cycle	0.08	0.08	0.08	0.08	0.79	0.79	0.79	0.79	0.79	0.79
(v / s)_i Volume / Saturation Flow Rate	0.00	0.01	0.02	0.01	0.01	0.04	0.04	0.16	0.02	0.02
s, saturation flow rate [veh/h]	1417	1669	862	1550	1352	1900	1758	1272	1900	1817
c, Capacity [veh/h]	180	129	179	120	1125	1499	1387	1060	1499	1434
d1, Uniform Delay [s]	27.61	25.89	26.71	25.79	2.00	1.38	1.39	2.44	1.36	1.36
k, delay calibration	0.11	0.11	0.11	0.11	0.50	0.50	0.50	0.50	0.50	0.50
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	0.06	0.65	0.28	0.47	0.02	0.06	0.07	0.40	0.03	0.03
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.03	0.18	0.12	0.13	0.02	0.05	0.05	0.19	0.02	0.02
d, Delay for Lane Group [s/veh]	27.67	26.54	26.99	26.26	2.03	1.44	1.45	2.84	1.39	1.39
Lane Group LOS	C	C	C	C	A	A	A	A	A	A
Critical Lane Group	No	No	Yes	No	No	No	No	Yes	No	No
50th-Percentile Queue Length [veh/ln]	0.07	0.32	0.29	0.21	0.03	0.05	0.05	0.41	0.03	0.03
50th-Percentile Queue Length [ft/ln]	1.72	7.88	7.20	5.23	0.69	1.30	1.32	10.36	0.65	0.65
95th-Percentile Queue Length [veh/ln]	0.12	0.57	0.52	0.38	0.05	0.09	0.09	0.75	0.05	0.05
95th-Percentile Queue Length [ft/ln]	3.10	14.18	12.96	9.41	1.23	2.33	2.37	18.65	1.17	1.17

Movement, Approach, & Intersection Results

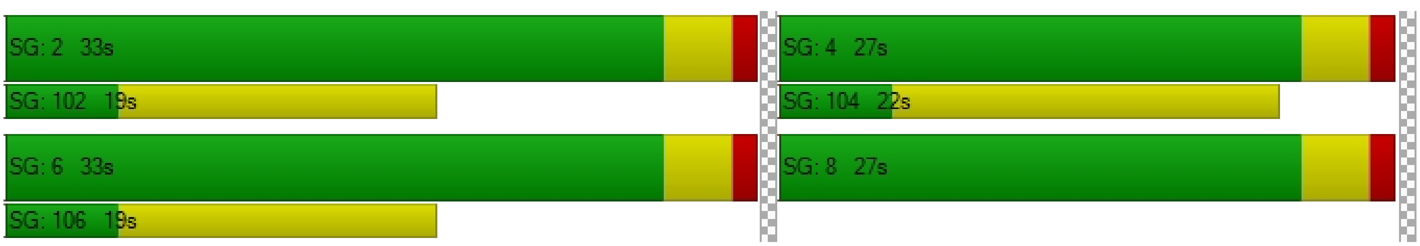
d_M, Delay for Movement [s/veh]	27.67	26.54	26.54	26.99	26.51	26.26	2.03	1.45	1.45	2.84	1.39	1.39
Movement LOS	C	C	C	C	C	C	A	A	A	A	A	A
d_A, Approach Delay [s/veh]	26.74			26.68			1.51			2.47		
Approach LOS	C			C			A			A		
d_I, Intersection Delay [s/veh]	5.33											
Intersection LOS	A											
Intersection V/C	0.184											

Other Modes

g_Walk,mi, Effective Walk Time [s]	9.0	9.0	9.0	0.0
M_corner, Corner Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
M_CW, Crosswalk Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
d_p, Pedestrian Delay [s]	21.68	21.68	21.68	0.00
I_p,int, Pedestrian LOS Score for Intersectio	2.627	2.157	2.342	0.000
Crosswalk LOS	B	B	B	F
s_b, Saturation Flow Rate of the bicycle lane	2000	2000	2000	2000
c_b, Capacity of the bicycle lane [bicycles/h]	767	767	967	967
d_b, Bicycle Delay [s]	11.41	11.41	8.01	8.01
I_b,int, Bicycle LOS Score for Intersection	1.764	1.592	1.687	1.785
Bicycle LOS	A	A	A	A

Sequence

Ring 1	-	2	-	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	-	6	-	8	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Intersection Level Of Service Report
Intersection 2: Stewart Ave / Live Oak Ave

Control Type:	Signalized	Delay (sec / veh):	7.5
Analysis Method:	HCM 7th Edition	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.548

Intersection Setup

Name												
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	1	0	0	1	0	0	1	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	115.00	100.00	100.00	178.00	100.00	100.00	120.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			45.00			45.00		
Grade [%]	0.00			0.00			0.00			0.00		
Curb Present	No			No			No			No		
Crosswalk	Yes			Yes			No			Yes		

Volumes

Name												
Base Volume Input [veh/h]	40	33	28	37	134	16	56	1356	183	39	538	16
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Proportion of CAVs [%]	0.00											
Growth Factor	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right Turn on Red Volume [veh/h]	0	0	7	0	0	11	0	0	40	0	0	2
Total Hourly Volume [veh/h]	42	34	22	38	139	6	58	1410	150	41	560	15
Peak Hour Factor	0.7042	0.7042	0.7042	0.8477	0.8477	0.8477	0.9525	0.9525	0.9525	0.8298	0.8298	0.8298
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	15	12	8	11	41	2	15	370	39	12	169	5
Total Analysis Volume [veh/h]	60	48	31	45	164	7	61	1480	157	49	675	18
Presence of On-Street Parking	No		No	No		No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
v_do, Outbound Pedestrian Volume crossing	0			0			0			0		
v_di, Inbound Pedestrian Volume crossing m	0			0			0			0		
v_co, Outbound Pedestrian Volume crossing	0			0			0			0		
v_ci, Inbound Pedestrian Volume crossing mi	0			0			0			0		
v_ab, Corner Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	0			0			0			0		

Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	60
Active Pattern	Pattern 1
Coordination Type	Time of Day Pattern Coordinated
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	Lead Green - Beginning of First Green
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal Group	0	8	0	0	4	0	0	2	0	0	6	0
Auxiliary Signal Groups												
Lead / Lag	-	-	-	-	-	-	-	-	-	-	-	-
Minimum Green [s]	0	10	0	0	10	0	0	10	0	0	10	0
Maximum Green [s]	0	36	0	0	36	0	0	26	0	0	26	0
Amber [s]	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
All red [s]	0.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0
Split [s]	0	36	0	0	36	0	0	24	0	0	24	0
Vehicle Extension [s]	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Walk [s]	0	5	0	0	5	0	0	5	0	0	5	0
Pedestrian Clearance [s]	0	20	0	0	10	0	0	7	0	0	7	0
Delayed Vehicle Green [s]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rest In Walk		No			No			No			No	
I1, Start-Up Lost Time [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
I2, Clearance Lost Time [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
Minimum Recall		No			No			No			No	
Maximum Recall		No			No			No			No	
Pedestrian Recall		No			No			No			No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering 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

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Lane Group Calculations

Lane Group	C	L	C	R	L	C	R	L	C	C
C, Cycle Length [s]	60	60	60	60	60	60	60	60	60	60
L, Total Lost Time per Cycle [s]	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
l1_p, Permitted Start-Up Lost Time [s]	2.00	2.00	0.00	0.00	2.00	0.00	0.00	2.00	0.00	0.00
l2, Clearance Lost Time [s]	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
g_i, Effective Green Time [s]	10	10	10	10	42	42	42	42	42	42
g / C, Green / Cycle	0.17	0.17	0.17	0.17	0.70	0.70	0.70	0.70	0.70	0.70
(v / s)_i Volume / Saturation Flow Rate	0.14	0.03	0.09	0.00	0.08	0.41	0.10	0.16	0.18	0.18
s, saturation flow rate [veh/h]	1003	1341	1900	1615	763	3618	1615	311	1900	1883
c, Capacity [veh/h]	252	160	314	267	568	2537	1133	257	1333	1321
d1, Uniform Delay [s]	24.48	22.16	22.90	21.01	5.55	4.53	2.97	11.20	3.28	3.28
k, delay calibration	0.11	0.11	0.11	0.11	0.50	0.50	0.50	0.50	0.50	0.50
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	1.89	0.94	1.34	0.04	0.38	0.99	0.26	1.65	0.48	0.48
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.55	0.28	0.52	0.03	0.11	0.58	0.14	0.19	0.26	0.26
d, Delay for Lane Group [s/veh]	26.36	23.11	24.24	21.05	5.93	5.52	3.22	12.85	3.76	3.76
Lane Group LOS	C	C	C	C	A	A	A	B	A	A
Critical Lane Group	Yes	No	No	No	No	Yes	No	No	No	No
50th-Percentile Queue Length [veh/ln]	1.96	0.57	2.10	0.08	0.28	2.14	0.33	0.45	0.78	0.78
50th-Percentile Queue Length [ft/ln]	49.01	14.19	52.39	2.01	7.01	53.38	8.21	11.37	19.61	19.49
95th-Percentile Queue Length [veh/ln]	3.53	1.02	3.77	0.14	0.50	3.84	0.59	0.82	1.41	1.40
95th-Percentile Queue Length [ft/ln]	88.21	25.54	94.31	3.62	12.62	96.09	14.79	20.46	35.30	35.07

Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	26.36	26.36	26.36	23.11	24.24	21.05	5.93	5.52	3.22	12.85	3.76	3.76
Movement LOS	C	C	C	C	C	C	A	A	A	B	A	A
d_A, Approach Delay [s/veh]	26.36			23.90			5.32			4.36		
Approach LOS	C			C			A			A		
d_I, Intersection Delay [s/veh]	7.55											
Intersection LOS	A											
Intersection V/C	0.548											

Other Modes

g_Walk,mi, Effective Walk Time [s]	9.0	9.0	0.0	9.0
M_corner, Corner Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
M_CW, Crosswalk Circulation Area [ft²/ped]	0.00	0.00	0.00	0.00
d_p, Pedestrian Delay [s]	21.69	21.69	0.00	21.69
I_p,int, Pedestrian LOS Score for Intersectio	2.046	2.301	0.000	3.022
Crosswalk LOS	B	B	F	C
s_b, Saturation Flow Rate of the bicycle lane	2000	2000	2000	2000
c_b, Capacity of the bicycle lane [bicycles/h]	1066	1066	666	666
d_b, Bicycle Delay [s]	6.55	6.55	13.35	13.35
I_b,int, Bicycle LOS Score for Intersection	1.801	1.934	2.993	2.173
Bicycle LOS	A	A	C	B

Sequence

Ring 1	-	2	-	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	-	6	-	8	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Intersection Level Of Service Report
Intersection 3: Rivergrade Rd / Project Dwy 1

Control Type:	Two-way stop	Delay (sec / veh):	0.0
Analysis Method:	HCM 7th Edition	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.002

Intersection Setup

Name						
Approach	Northbound		Eastbound		Westbound	
Lane Configuration						
Turning Movement	Left	Right	Thru	Right	Left	Thru
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00		30.00		30.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	No		No		No	

Volumes

Name						
Base Volume Input [veh/h]	0	0	190	0	0	199
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	0.00	0.00	0.00
Growth Factor	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	0	0	198	0	0	207
Peak Hour Factor	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	0	52	0	0	54
Total Analysis Volume [veh/h]	0	0	208	0	0	218
Pedestrian Volume [ped/h]	0		0		0	

Intersection Settings

Priority Scheme	Stop	Free	Free
Flared Lane	No		
Storage Area [veh]	0	0	0
Two-Stage Gap Acceptance	No		
Number of Storage Spaces in Median	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.00	0.00	0.00	0.00	0.00
d_M, Delay for Movement [s/veh]	10.48	8.84	0.00	0.00	7.62	0.00
Movement LOS	B	A	A	A	A	A
95th-Percentile Queue Length [veh/ln]	0.00	0.00	0.00	0.00	0.00	0.00
95th-Percentile Queue Length [ft/ln]	0.00	0.00	0.00	0.00	0.00	0.00
d_A, Approach Delay [s/veh]	9.66		0.00		0.00	
Approach LOS	A		A		A	
d_I, Intersection Delay [s/veh]	0.00					
Intersection LOS	A					

Intersection Level Of Service Report
Intersection 4: Live Oak Ave / Dwy 2

Control Type:	Two-way stop	Delay (sec / veh):	0.0
Analysis Method:	HCM 7th Edition	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.016

Intersection Setup

Name						
Approach	Southbound		Eastbound		Westbound	
Lane Configuration						
Turning Movement	Left	Right	Left	Thru	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00		30.00		30.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	No		No		No	

Volumes

Name						
Base Volume Input [veh/h]	0	0	0	1421	593	0
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	0.00	2.00	0.00	0.00	0.00
Growth Factor	1.0400	1.0400	1.0400	1.0400	1.0400	1.0400
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	0	0	0	1478	617	0
Peak Hour Factor	1.0000	0.9500	1.0000	0.9500	0.9500	0.9500
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	0	0	389	162	0
Total Analysis Volume [veh/h]	0	0	0	1556	649	0
Pedestrian Volume [ped/h]	0		0		0	

Intersection Settings

Priority Scheme	Stop	Free	Free
Flared Lane			
Storage Area [veh]	0	0	0
Two-Stage Gap Acceptance	No		
Number of Storage Spaces in Median	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.00	0.00	0.02	0.01	0.00
d_M, Delay for Movement [s/veh]	0.00	10.32	0.00	0.00	0.00	0.00
Movement LOS		B		A	A	A
95th-Percentile Queue Length [veh/ln]	0.00	0.00	0.00	0.00	0.00	0.00
95th-Percentile Queue Length [ft/ln]	0.00	0.00	0.00	0.00	0.00	0.00
d_A, Approach Delay [s/veh]	10.32		0.00		0.00	
Approach LOS	B		A		A	
d_I, Intersection Delay [s/veh]	0.00					
Intersection LOS	A					

Vistro File: C:\...\Live Oak Irwindale Mark HCM.vistro
Report File: C:\...\Opening Year PM HCM.pdf

Scenario 9 Opening Year PM
8/23/2023

Turning Movement Volume: Summary

ID	Intersection Name	Northbound			Southbound			Eastbound			Westbound			Total Volume
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
1	Stewart Ave / Rivergrade Rd	4	4	110	11	5	9	12	76	23	154	46	7	461

ID	Intersection Name	Northbound			Southbound			Eastbound			Westbound			Total Volume
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
2	Stewart Ave / Live Oak Ave	42	34	29	38	139	17	58	1410	190	41	560	17	2575

ID	Intersection Name	Northbound		Eastbound		Westbound		Total Volume
		Left	Right	Thru	Right	Left	Thru	
3	Rivergrade Rd / Project Dwy 1	0	0	198	0	0	207	405

ID	Intersection Name	Southbound	Eastbound	Westbound		Total Volume
		Right	Thru	Thru	Right	
4	Live Oak Ave / Dwy 2	0	1478	617	0	2095

Appendix M

Trip Generation, Circulation and Project Driveway Queuing Memorandum

Kimley»Horn

Date:	October 20, 2023
Prepared by:	Abby Pal, Maryam Javanmardi
To:	City of Irwindale
Site:	14005 Live Oak Avenue, Irwindale
Subject:	Trip Generation, Circulation and Project Driveway Queuing Memorandum

This technical memo examines trip generation and the necessity for a level of service (LOS) and vehicle miles traveled (VMT) study for the planned industrial development at 14005 Live Oak Avenue, in the City of Irwindale. Additionally, this document covers both access to and from the site, as well as internal traffic operations. Based on the site plan and the number of trucks identified from the trip generation analysis, a qualitative evaluation of truck queuing on the site was performed. The development plan involves demolishing the existing 56,000 square foot two stories office structure and constructing a 102,000 square-foot warehouse in its place. The site would have one access point for passenger vehicles on Live Oak Avenue, which would also be used for emergency vehicles. Trucks will be able to access the site from the northern driveway located on Rivergrade Road. The site plan for the project is shown in *Figure 1*.

Project Trip Generation

The project trip generation was prepared using trip rates from the Institute of Transportation Engineers (ITE)[1]. The trip rates for the General Office Building (Land Use Code 710) were used to evaluate the existing land use and the rates for Warehousing (Land Use Code 150) were used to evaluate the proposed project. Project truck trips were determined using data from the Vehicle Mix from the SCAQMD Warehouse Truck Trip Study Data Results and Usage [2]. A passenger car equivalent (PCE) factor was applied to project truck trips to account for the greater roadway capacity utilized by heavy trucks.

Table 1 presents the trip generation estimate for the proposed project. As shown in *Table 1*, the project is forecast to generate 360 fewer net daily PCE trips, including 60 net fewer PCE trips during the AM peak hour and 55 net fewer PCE trips during the PM peak hour when compared to the existing land use. The screening criteria provided in the *City of Irwindale Policy Guidelines for Traffic Impact Reports* state projects generating less than 25 peak hour trips screen from the requirement to prepare a level of service (LOS) analysis. The City of Irwindale has adopted guidelines for vehicle miles traveled (VMT) screening based on the OPR guidelines which screen projects generating less than 110 daily trips from the requirement of a VMT analysis. Per project trip generation as shown in *Table 1*, the project generates less than net 110 daily trips and less than net 25 peak hour trips. The decrease in the net trip generation is due to the change in the use associated with the proposed project. The existing use is considered a general office building which has a higher trip rate per square foot than a warehousing use. Because the project would generate fewer trips than the existing use, no further analysis of vehicle trips is warranted, and no LOS and VMT analyses would be required for the project.

Regional Access

Regional access to the project site will be facilitated via three major roadways: Interstate 605, Interstate 210, and California State Route 39. Interstate 605, a crucial north-south auxiliary Interstate Highway in Southern California's Greater Los Angeles area, spans 27 miles, running from I-405 and State Route 22 in

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[1] *Trip Generation, 11th Edition, Institute of Transportation Engineers (ITE). 2021.*

[2] *Vehicle Mix from the SCAQMD Warehouse Truck Trip Study Data Results and Usage, July 2014. Classification: Without Cold Storage.*

Seal Beach to I-210 in Duarte. Interstate 210, also known as the Foothill Freeway, stretches from the Sylmar district of Los Angeles to Redlands in the east. State Route 39 is a Californian state highway traversing through Orange and Los Angeles counties, beginning at the Pacific Coast Highway in Huntington Beach.

Truck Routes and Circulation

As per the *City's Municipal Code (Section 10.40.020)*, heavy vehicles, except public transportation buses, are only allowed to operate and park on streets designated as truck traffic routes. Figure 2 shows the designated truck routes within the City of Irwindale. *Table 2* illustrates that there are 14 major designated Truck Routes within Irwindale including Foothill Boulevard, Arrow Highway, Live Oak Avenue, and Irwindale Avenue.

The proposed project is surrounded by three truck routes: Live Oak Avenue, Rivergrade Road, and Stewart Avenue. Notably, Live Oak Avenue and Rivergrade Road are recognized as significant designated truck routes within the City of Irwindale, where trucks are permitted to operate. It is expected that 25% of truck trips would approach the site from the east via Arrow Highway, 50% from the west and 25% from the north using the project driveway on Rivergrade Road.

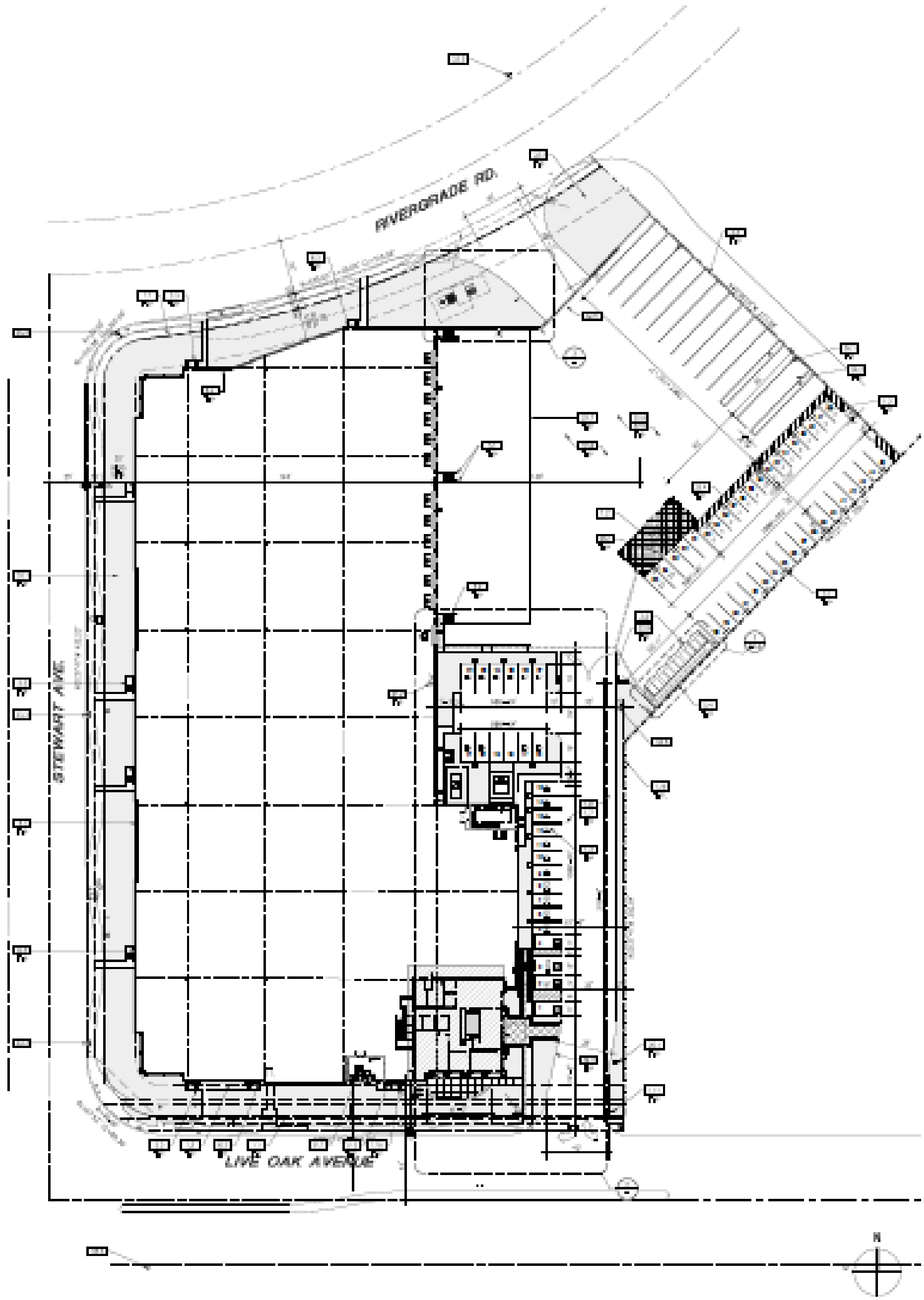
Project Access and Queueing

The project site will have a single access point for passenger vehicles on Live Oak Avenue, which will also serve as an entry for emergency vehicles. Live Oak Avenue is a Major Highway with four lanes and a median and therefore the southernly project driveway on Live Oak Avenue would allow right-in/right-out access only. Rivergrade Road is a four-lane Collector with a two-way left-turn lane (TWLTL) in the vicinity of the project. The northernly project driveway on Rivergrade Road will provide full access to trucks accessing the driveway. The northern driveway on Rivergrade Rd allows a driveway approach storage of approximately 74 feet in length, and a departure storage of approximately 65 feet.

The project allows for the queueing of one truck on site within the 74 feet approach storage for trucks that would make a left-in or a right-in into the project site from Rivergrade Road. As shown in *Table 1*, only one three-axle truck and two four-axle trucks would enter the project site, and one 4-axle truck would depart the project site during the AM peak hour. In the PM peak hour, it is expected that only one four-axle truck would enter the project site, and one three-axle truck and two four-axle trucks would exit the project site. It is to be noted that the project site gates would be open during business hours causing no impedance to trucks entering the site. The truck turning template for trucks entering Rivergrade Road is shown in *Figure 3*. Given the low project trip generation of four truck trips during the peak hours, and sufficient storage length provide on both the project's northern driveway along with the project gates being open during business hours, no truck queueing is expected such the truck queue would extend onto the public right-of-way past the intersection of Rivergrade Road and Live Oak Avenue.

If you have any questions about this information, please contact me at (412) 636-2713 or abby@epdsolutions.com.

Figure 1: Project Site Plan



Source: Rexford Industrial

Table 1: Project Trip Generation

				AM Peak Hour			PM Peak Hour		
Land Use		**Units**	**Daily**	**In**	**Out**	**Total**	**In**	**Out**	**Total**
Trip Rates									
Warehouse[1]		TSF	1.71	0.13	0.04	0.17	0.05	0.13	0.18
General Office Building [2]		TSF	10.84	1.34	0.18	1.52	0.24	1.20	1.44
Existing Building									
Office Building	56	TSF	607	75	10	85	14	67	81
Proposed Building									
Warehouse building	102	TSF	174	13	4	17	5	13	18
Vehicle Mix[3]		***Percent***							
Passenger Vehicles		72%	126	10	3	13	3	10	13
2-Axle Trucks		4.6%	8	1	0	1	0	1	1
3-Axle Trucks		5.7%	10	1	0	1	0	1	1
4+-Axle Trucks		17.2%	30	2	1	3	1	2	3
		100%	174	13	4	17	4	14	18
PCE Trip Generation[4]		***PCE Factor***							
Passenger Vehicles		1.0	126	10	3	13	3	10	13
2-Axle Trucks		1.5	12	1	0	1	0	1	1
3-Axle Trucks		2.0	20	2	0	2	1	1	2
4+-Axle Trucks		3.0	90	7	2	9	3	7	10
Total PCE Trip Generation			248	19	6	25	7	19	26
Total Vehicle Trip Generation			-360	-56	-5	-60	-7	-48	-55

TSF = Thousand Square Feet

PCE = Passenger Car Equivalent

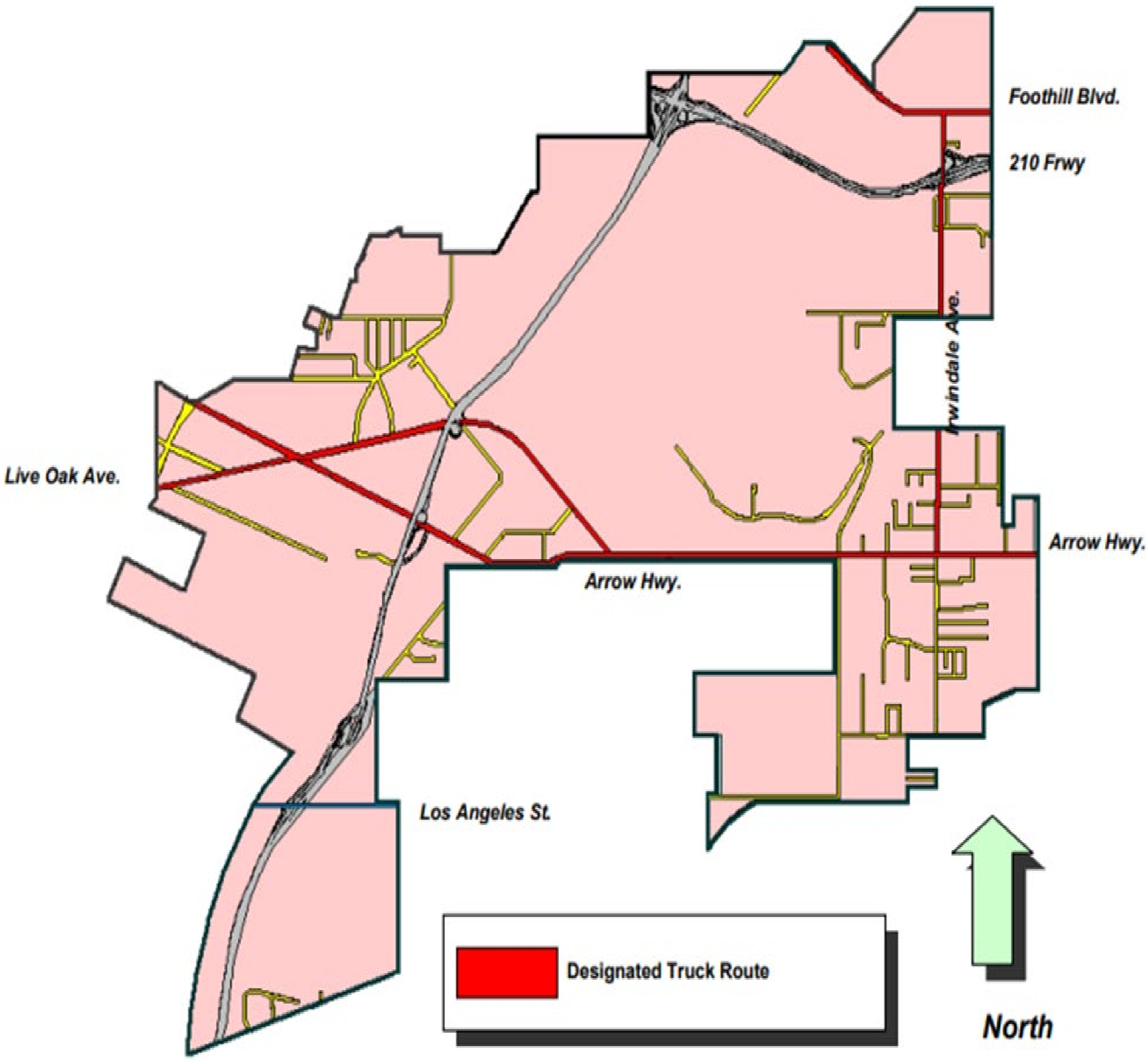
[1] Trip rates from the Institute of Transportation Engineers, Trip Generation,11th Edition, 2021. Land Use Code 150 - Warehouse.

[2] Trip rates from the Institute of Transportation Engineers, Trip Generation,11th Edition, 2021. Land Use Code 710 - General Office Building.

[3] Vehicle Mix from the SCAQMD Warehouse Truck Trip Study Data Results and Usage, July 2014. Classification: Without Cold Storage

[4] Passenger Car Equivalent (PCE) factors from San Bernardino County CMP, Appendix B - Guidelines for CMP Traffic Impact Analysis Reports in San Bernardino County, 2016

Figure 2: Designated Truck Routes in Irwindale



Source: City of Irwindale-2020 General Plan

Table 2: Major Designated Truck Routes in Irwindale

Truck Route	Truck Route	Truck Route
Irwindale Avenue	Peck Road	Lower Azusa Road
Arrow Highway	Vincent Avenue	Foothill Boulevard
Live Oak Avenue	Cypress Street	Myrtle Avenue
Los Angeles	Azusa Canyon Road	Azusa Canyon Road
Longden Avenue	Rivergrade Road	
Source: City of Irwindale Public Works Department		

Figure 3: Rivergrade Road Project Driveway Truck Turning Template