I. ArcGIS Urban Introduction and Purpose

ESRI's ArcGIS Urban is a planning and modeling program with an interactive 3D basemap that has allowed the City of Boulder to evaluate the performance of potential land use changes. General information regarding ArcGIS Urban is available at <u>Create</u> <u>Smart Cities and Communities with ArcGIS Urban</u>. The City of Boulder staff has utilized the ArcGIS Urban Land Use Plan Module as a pilot tool for scenario planning on the East Boulder Subcommunity Plan project.

The platform, when coupled with reliable data, can project and measure future land use alternatives. ArcGIS Urban measures the performance of the changes as "capacity indicators" representing population, jobs, households, energy use, trips, carbon emissions, and water usage. As with any projection or scenario modeling tool, the results of the potential land use changes are estimates.

II. ArcGIS Urban Configuration Methodology

While the ArcGIS comes with a default configuration loaded, the settings were not representative of the City's development code. In order to utilize the ArcGIS Urban platform to create scenarios and projections it was configured to be a close representation of the City's current land use conditions and regulations.

The configuration utilizes two types of data. The first type of data is the City's current geospatial (GIS) data which exists in the City's Open Data Catalogue. The following is a list of GIS data uploaded into the model:

- 1. Parcels
- 2. 3D buildings
- 3. City limits
- 4. East Boulder Subcommunity Plan Boundary
- 5. Railroad
- 6. Streets
- 7. Height Exemption Areas
- 8. Building footprints
- 9. Zoning
- 10. Land use
- 11. Park site boundaries
- 12. Lakes & reservoirs
- 13. Effective floodplains
- 14. OSMP properties

The second type of data came from research of various sources and was input into the "Types" categories. The types configured for the East Boulder Subcommunity Plan land

use plan module were "space use", "land use", and "buildings". ArcGIS Urban allows for the creation of the existing or current types in the permanent configuration of the application along with allowing temporary, proposed types for exploration in the plan editor module. The configuration examples in the following pages do not include any temporary or proposed types as they are flexible and may be temporary in nature based on the needs of the plan development.

Space Use Types

The space use is an activity allowed within a given area. 24 space uses were created from the Boulder Revised Code (BRC), Title 9 Land Use Code, Chapter 6 Use Standards. Spaces uses are the one type within the ArcGIS Urban Model that all the other types are built upon. To create a manageable ArcGIS Urban model and due to the numerous, highly differentiated uses in the BRC, the space uses created were representative examples of the overarching use categories. For example, residential spaces use (RES_) were condensed into 7 residential categories from 25 listed in the BRC Use Standards.

The following is a list of all the space use types created for the ArcGIS Urban Model:

- A. RES_Single Family Detached
- B. RES_Single Family Attached
- C. RES_Multi-Family
- D. RES_Group Quarters
- E. RES_Live-work
- F. RES_Mobile Home Parks
- G. RES_Accessory Dwelling Units
- H. RES_Efficiency Units
- I. DE_Dining
- J. DE_Entertainment
- K. Lodging
- L. Public and Institutional
- M. OMF_Professional and Technical Offices

- N. OMF_Medical Offices
- O. OMF_Financial Offices
- P. Park, Recreation and Leisure
- Q. CRI_Services
- R. CRI_Retail Sales
- S. CRI_Vehicle Related Retail and Services
- T. CRI_Industrial Light
- U. CRI_Industrial Heavy
- V. Agriculture and Natural Resources
- W. Accessory
- X. Parking

Space use types were then populated with additional data and information. The ArcGIS Urban configuration utilizes numerical information in first and second order coefficients to generate results on the capacity indicators.

The first order coefficients included area per household in square feet (sqft) for residential spaces uses which calculated the number of dwelling units by type,

area per person (sqft) within each residential household to calculate population based on the overall residential land use changes, and area per person (sqft) per job within commercial space uses to calculate jobs by type (Table 1).

Second order coefficients populated in each space use included required parking, daily trips, energy use, carbon emissions, internal water use, external water use, waste water and solid waste generation (Table 2 -

Table 3)

Space Use Notes: Person/househol Mean Hours SF SF Allocated PP 1 RES_Single Family Detached Toreihouse, Diplex, Triplex and themes. 2.36 2.279 1008 2 SET_Single Family Detached Toreihouse, Diplex, Triplex and themes. 2.26 2279 1008 3 RES_Single Family Attached Mean actrip form, Single Family Attached Mean actrip form, Single Family Attached 4.87 4 RES_Group Canaterix Mean actrip form, Single Family Attached Mean actrip form, Single Family Attached 4.87 5 RES_Single Family Attached Mean actrip form, Single Family Attached 2.26 2000 2.31 6 SET_Ablaine Park Mean actrip form, Single Family Attached 2.26 2000 2.31 5 SET_Ablaine Park Building consisting of 5 under 2.26 2000 2.31 6 SET_Ablaine Building consisting of 5 under 2.26 2000 2.31 6 SET_Ablaine Building consisting of 5 under 2.26 2000 2.31 7 SE_Ablaine Building consisting of 5 under 2.26 2000 2.31 1 Jobid Farler Building consisting of 5 under 2.26 2.06 2.05 1 Lodging	ArcGIS Urban Space Use Type Configuration 1st & 2nd Order Coefficients Tabular Data		Population Statistics ¹ residential uses		Housing Unit Statistics ^{2,3} square feet (S	Area Per Person		Job Statistics ⁴ square feet (SF)
True Single Family Detailed True Single Family Detailed Top Single Family Detailed Source Single Family Detailed Source Single Family Detailed 1 at S_ Single Family Attached decidate private private and detailed private private private and detailed private private and detailed private private private private and detailed private private private private and detailed private private private private private and detailed private	Space Use	Notes:	Persons/household		Mean Home SF	SF Allocated PP		SF per Job
1 N_2 use is inty relation Nome 1.20 1.17 1.00 1 N_2 use is inty relation Towlones, toples, Trijes and Other statched Single-shariny with deficit and prints, statistic deficit and prints, deficit and statistic deficit and prints, deficit and statistic deficit and prints, deficit and statistic deficit and deficit deficit and deficit deficit and deficit deficit and deficit deficit and deficit deficit and deficit deficit and deficit an	1 DEC Single Earnik Detached	Typical Single-Family Detached	1.16		2220	1002		
2 #5_single raminy Attached declated private granges 2.26 2.279 1008 Mean nursing horm, suited Name nursing horm, suited 1200 4.43 Mean nursing horm, suited 0.28 2.20 111 S #5_jers, white ream ream suited 2.26 2.279 1008 S #5_jers, white ream ream suited 0.23 2.26 2.279 1008 S #5_jers, white ream ream suited 0.23 2.26 2.279 1008 S #5_jers, white ream ream suited 0.236 300 2.21 1000 S #5_jers, white ream ream suited 1000 2.26 300 3.55 S #5_jers, white ream ream suited 1000 3003 303 S #5_jers, white ream ream suited 1000 303 303 S #5_jers, white ream ream suited 1000 303 303 S #5_jers, white ream ream suited 1000 303 303 S #5_jers, white ream suited ream ream suited ream ream suited ream suited ream suited ream suited ream ream suited ream suited ream ream suited ream suited ream suited ream ream suited ream ream suited ream ream suited ream ream ream suited ream ream ream ream ream ream ream ream	1 KES_Single Family Detached	Townhomes, Duplex, Triplex and Other attached Single-Family with	2.20		2279	1008		
3 RE5 Multi-Samity Maan Aut 2-4, Att -5 2.26 1002 443 4 RE5_croup charters Iving dorm 2.26 230 131 5 RE5_Live-work than 25% 2.26 2002 443 6 RE5_croup charters Use SE2_charters to the state less 2.26 2003 221 7 RE5_close-work than 25% 2.26 300 221 7 RE5_close-work Mean retring food a charter 2.26 350 2.26 9 DE_Dining food acharter 500 2.26 303 303 10 DE thertainment 2.26 350 1.50 303 303 12 Lodging Heiel 1.00 1.00 303	2 RES_Single Family Attached	dedicated private garages	2.26	L .	2279	1008	L I	
A RES_cfroup Quarters Wind, form 2.28 2.29 1000 UM SP2 after non-resule sets 2.26 2.279 3.000 2 RES_thole toom Parls 2.26 3000 2.20 3 RES_ffleiency Units 5D 2.26 3000 2.20 4 RES_ffleiency Units Buildings consisting of 5+ Units 2.26 3000 2.20 5 DE_Dining food service 2.26 3000 303 5 DE_Dining food service 2.26 300 303 5 DE_Dining food service 2.26 300 303 6 DE_Dining food service 2.26 300 303 7 RES_frequency Units Man Interrup, Public Acatembly, College, School, Dayners, other poblic and instructional works office jark/v 303 7 DE_Dining Man Interrup, Public Acatembly, College, School, Dayners, other poblic and instructional works office jark/v 303 7 DE_Dining Man Infrage office jark/v Man Infrage office jark/v 303 7 De_Services Man Ref infrage office jark/v 1000 8 Dert Medical Offices Man Infrage office jark/v 303 7 DE_Services Man Infrage office jark/v 1000 8 Dert Medical Offices Man refridge/on refridge 3000	3 RES Multi-Family	Mean Apt 2-4, Apt +5	2.26	L .	1002	443	L I	
5 BES_Low-work than 23% 2.26 2279 1000 6 BES_MODE 50002 4.30 7 BES_Accessory Dwelling Units 570 2.26 500 2.21 8 BES_Efficiency Units Buildings constitute of 5+ Units 2.26 500 3.33 9 DE_Dring food service 500 3.33 3.03 11 Lodging Hotel 500 3.33 3.33 12 Public and institutional public office/safety Sood office, public office/safety Sood 13 OMF_Professional and Technical Offices Mean adia_gr.clinic, public office/safety Sood 3.03 14 OMF_Medical Offices hote Mean strip mail, other service, other office Sood 3.03 12 CH_Services Mean strip mail, other service, other office/service Mean strip mail, other service, other office/service Sood 3.03 13 OMF_Professional and Technical Offices Mean strip mail, other service, other office/service Sood 3.03 14 OMF_Medical Offices Mean string service, service, other office/service Sood	4 RES_Group Quarters	Mean nursing home, assisted living, dorm Use SFA other non-res use less	2.26		250	111		
6 8.85 1002 443 7 8.85 Accessory Dwelling Units 570 2.26 350 221 7 8.85 Accessory Dwelling Units Buildings consisting of 54 Units 2.26 350 155 9 0E_Dining field service 350 155 303 10 0F Extertainment Hotel 303 303 303 11 Dolls and institutional public Accessory Dwelling Units Buildings consisting of 54 Units 2.26 350 155 303 12 Public and Institutional mode consisting of 54 Units Accessory Dwelling Units 303 303 13 OMF_Arcofsolical and Technical Offices office And office and Units/ Archivol office, got Mean actimity/or office, got Accessory Dwelling Units 225 14 OMF_Arcofsolical offices Mean actimity/or office, got Accessory 225 15 Park, Pacrication and Leisure Mean actimity/or office, got Accessory 225 14 OMF_Arcoffice Orita Salet Mean actimity/or office, got	5 RES_Live-work	than 25%	2.26	L .	2279	1008	L I	
7 RE5 Accessory Dwelling Units SPD 2.26 500 221 8 RE5_Efficiency Units Building: consisting of 5+ Units 2.26 350 155 9 DE_Dining food service 2.26 350 155 503 10 DE_Entertainment Colleges, Schools, Opcares, other public diffic/starty Mean Library, Public Asembly, Colleges, Schools, Opcares, other public diffic/starty Mean Library, Public Asembly, Colleges, Schools, Opcares, other public diffic/starty 100 100 100 12 Public and institutional Mean Adminyford fife, got diffic, public diffic/starty Mean Adminyford fife, got diffic, public diffic/starty 100 100 13 OMF_Professional and Technical Offices Mean Strip mall, other service, diffic and mean strip mall, other reavice, diffic reavice Mean strip mall, other reavice, diffic reavice 100 100 13 OMF_Professional and Technical Offices Mean strip mall, other reavice, diffic reavice Mean strip mall, other reavice, diffic reavice 100 100 13 OMF_Professional and Technical Offices Mean strip mall, other reavice, diffic reavice Mean strip mall, other reavice, diffic reavice 100 100 13 OMF_Professional and Technical Offices Mean reavice/diffic reavice, diffic reavice Mean reavice/diffic reavice 100 14 OMF_Medical Offices Mean reavice/diffic reavice Mean reavice/diffic reavice 100	6 RES Mobile Home Parks		2.26	L .	1002	443	L I	
1 RE5_Efficiency Units Buildings consisting of 9- Units 2.26 350 155 9 DE_Dining Mean restrunt, fast food & other food a service 300 155 300	7 RES Accessory Dwelling Units	SFD	2.26	L .	500	221	L I	
8 R5_Efficiency Units Buildings consisting of 54 Units 2.26 350 155 9 DE_Dining food service 303 303 303 303 10 DE Entertainment Colleases, Schools, Davis, expected, Schools, Davis, Schools, Schoo				L .			L I	
Mean retringMean retring </td <td>8 RES_Efficiency Units</td> <td>Buildings consisting of 5+ Units</td> <td>2.26</td> <td></td> <td>350</td> <td>155</td> <td></td> <td></td>	8 RES_Efficiency Units	Buildings consisting of 5+ Units	2.26		350	155		
9 DE_Dhing food service 303 10 DE Intertainment 303 11 Lodging Hotel Mean Libray, Public Assembly, College, School, Daycares, other public office/safety 303 12 Public and institutional public office/safety 303 Mean Admini/port office, port Mean Admini/port office, gotter office 303 303 13 OMF_Professional and Technical Offices office, due office, Mean and mig.port 303 14 OMF_Medical Offices hosp 285 15 OMF_Inancial Offices hosp 285 14 OMF_Medical Offices hosp 285 15 OMF_Inancial Offices other real, other outpatient 600 16 OMF_Inancial Offices hosp 303 17 CRI_Services Mean retail, other retail, strip shopping_enclosed mail, convenince Storas; grocery, other root sales Mean retail, other retail, strip shopping_inn refridge warehouse, ditt rt, lab, other 303 19 CRI_Vehicle Related Retail and Services similar to non-conditioned similar to non-conditioned 600		Mean resturant, fast food & other					L I	
10 DE Entertainment 303 11 Lodging Hotel 30 Attraction of the second of	9 DE_Dining	food service						303
11 Lödging Hotel 503 Mean Library, Public Assembly, Colleges, Schools, Daycares, other public office/safety 303 12 Public and institutional public office/safety 303 13 OMF_Professional and Technical Offices office, MU office, other office Mean Adminy/ord office, gott 285 14 OMF_Medical Offices 285 285 15 OMF_Professional and Technical Offices 285 16 Park, Recreation and Leisure 600 17 CRI_Services Mean strip mail, other service, other reall, other reall, other outpatient other reall, other outpatient	10 DE Entertainment						1.1	303
Mean Library, Public Assembly, College, School, Daycares, other public Office, Statey 303 12 Public and institutional Mean Admin/prof office, govt Mean Admin/prof office, govt office, Mu office, other office 225 13 OMF_Professional and Technical Offices Mean anon-diag and diag, clinic, hosp 225 15 OMF_Inancial Offices Mean strip mall, other service, other reall, other outpatient 285 16 Park, Recreation and Leisure Mean strip mall, other service, other reall, other outpatient 205 17 CRI_Services Mean strip mall, other service, other reall, other outpatient 303 18 CRI_Petail Sales Mean retail, strip shopping_encised mall, convenience stores, proceny, other for dales 600 29 CRI_Vehicle Related Retail and Services Mean refridge/non refridge warehouse, dist crt, lab, other office 600 20 CRI_Industrial Light office Mean refridge/non refridge warehouse, dist crt, lab, other office 600 20 CRI_Industrial Heavy office Mean refridge/non refridge warehouse, dist crt, lab, other office 600 21 CRI_Industrial Heavy office Utilize non-refridge warehouse similar to non-conditioned similar to non-conditioned simila	11 Lodging	Hotel						303
12 Public Miley Staffer, MU office, govt Mean Adminy prof office, govt office, MU office, other office Mean non-diag and diag, clinic, hosp 285 14 OMF_Medical offices hosp 285 15 DMF_Medical offices hosp 285 16 Park, Recreation and Leisure 285 16 Park, Recreation and Leisure 600 17 CRI_Services Health 303 17 CRI_Services Health 303 19 CRI_Retail Sales other retail, strip shopping, enclosed mail, convenines stores, grocery, other rotail, other office 600 19 CRI_Retail Sales other for efridge warehouse, dist ctr, lab, other office 600 20 CRI_industrial Light office warehouse, dist ctr, lab, other similar to non-conditioned similar to non-conditioned similar to non-conditioned 600 21 CRI_industrial Resources storage 600 22 Agriculture and Natural Resources storage 600 23 Accessory office 600 23 Accessory office 600	13. Public and Institutional	Mean Library, Public Assembly, Colleges, Schools, Daycares, other						202
33 OMF_Professional and Technical Offices office, MU office, other office 285 44 OMF_Medical Offices 285 15 OMF_Financial Offices 285 16 Park, Recreation and Leisure 285 17 CRI_Services Mean strip mall, other service, other retail, strip schooled mall, convenience stores, grocery, other retail schooled mall, convenience stores, grocery, other retail schooled mall, convenience stores, grocery, other ford sales 303 18 CRI_Retail Sales other refridge/non refridge warehouse, dist ctr, lab, other 600 20 CRI_industrial Light office 600 21 CRI_industrial Heavy office 600 22 Agriculture and Natural Resources storage 600 23 Accessory utilite non-refridge warehouse 600 23 Accessory utilite non-refridge warehouse 600	12 Public and institutional	Mean Admin/prof office govt						505
Mean non-diag and diag, clinic, hosp hosp 285 14 OMF_Financial Offices 600 15 Park, Recreation and Leisure athen strip mail, other service, other reail, other outpatient 600 17 CRI_Services Mean strip mail, other service, other reail, other outpatient 303 18 CRI_Retail Sales other reail, other retail, strip shopping, enclosed mail, convenience stores, grocery, 303 19 CRI_Vehicle Related Retail and Services Mean refridge/non refridge warehouse, dist ctr, lab, other 600 20 CRI_Industrial Light Mean refridge/non refridge warehouse, dist ctr, lab, other 600 21 CRI_Industrial Heavy office 600 22 Agriculture and Natural Resources storage 600 23 Accessory utilize non-refridge warehouse similar to non-conditioned 600 23 Accessory utilize non-refridge warehouse similar to non-conditioned 600 23 Accessory atorage 600	13 OMF Professional and Technical Offices	office, MU office, other office					L I	285
14 OMF_Medical Offices 285 15 OMF_Financial Offices 285 16 Park, Recreation and Leisure 600 17 CRI_Services Mean strip mall, other service, other retail, strip shopping, enclosed mall, convenience stores, grocery, other rodo sales 303 18 CRI_Retail Sales Other rotod sales 303 19 CRI_Vehicle Related Retail and Services storage 600 20 CRI_Industrial Light office 600 Wean refridge/non refridge warehouse, similar to non-conditioned similar to non-conditioned 600 22 Agriculture and Natural Resources storage 600 22 Agriculture and Natural Resources storage 600	-	Mean non-diag and diag, clinic,					1.1	
15 OMF Financial Offices 285 16 Park, Recreation and Leisure 600 17 CRL_Services Mean strip mall, other service, other reail, strip shopping, enclosed mall, convenience stores, grocery, iconvenience stores, dist ctr, lab, other warehouse, dist ctr, lab, other warehouse, dist ctr, lab, other warehouse, similar to non-conditioned similar to non-conditioned similar to non-conditioned storage 600 22 Agriculture and Natural Resources Utilize non-refridge warehouse similar to non-conditioned 600 23 Accessory 4 600 24 Parking 600 600	14 OMF_Medical Offices	hosp						285
16 Park, Recreation and Leisure Mean strip mall, other service, other reail, other outpatient health 600 17 CRI_Services health 303 Mean retail, other retail, strip shoping, enclosed mall, convenience stores, grocery, 600 303 18 CRI_Retail Sales other froid sales 303 Mean vehicle dealership, service, storage 600 600 19 CRI_Vehicle Related Retail and Services storage 600 Mean vehicle dealership, service, storage 600 600 20 CRI_Industrial Light office 600 21 CRI_industrial Light office 600 22 Agriculture and Natural Resources storage 600 22 Agriculture and Natural Resources storage 600 22 Agriculture and Natural Resources storage 600 23 Accessory Utilize non-refridge warehouse similar to non-conditioned similar	15 OMF Financial Offices							285
Mean strip mall, other reail, other reail, other reail, other reail, other reail, other reail, strip shopping, enclosed mall, convenience stores, grocery, 303 18 CRI_Retail Sales other food sales 303 19 CRI_Vehicle Related Retail and Services storage 600 20 CRI_Industrial Light office 600 20 CRI_Industrial Light office 600 21 CRI_Industrial Light office 600 21 CRI_Industrial Light office 600 22 Agriculture and Natural Resources storage 600 22 Agriculture and Natural Resources storage 600	16 Park, Recreation and Leisure							600
1/ CR_services Mean retail, other retail, strip shopping, enclosed mall, convenience stores, grocery, 303 18 CRI_Retail Sales other food sales 303 Mean refridge/non refridge warehouse, dist ctr, lab, other 600 20 CRI_Industrial Light office warehouse, dist ctr, lab, other 600 21 CRI_industrial Heavy office warehouse, dist ctr, lab, other 600 21 CRI_industrial Heavy office warehouse, dist ctr, lab, other 600 22 Agriculture and Natural Resources storage 600 23 Accessory Utilize non-refridge warehouse similar to non-conditioned 600 23 Accessory atorage 600	17 CBI Services	Mean strip mall, other service, other reail, other outpatient						202
18 CRI_Retail Sales other food sales 303 19 CRI_Vehicle Related Retail and Services storage 600 Mean refridge/non refridge warehouse, dist ctr, lab, other 600 20 CRI_Industrial Light office 600 Mean refridge/non refridge warehouse, dist ctr, lab, other 600 21 CRI_Industrial Heavy office 600 Utilize non-refridge warehouse stict ctr, lab, other 600 22 Agriculture and Natural Resources storage 600 23 Accessory storage 600	17 CK_Services	Mean retail, other retail, strip shopping, enclosed mall, convenience stores, grocery,						202
Mean vehicle dealership, service, Mean vehicle dealership, service, 600 19 CRI_Vehicle Related Retail and Services Mean refridge/non refridge 600 Warehouse, dist ctr, lab, other office 600 20 CRI_Industrial Light Mean refridge/non refridge 600 Warehouse, dist ctr, lab, other office 600 21 CRI_Industrial Heavy Mean refridge warehouse, dist ctr, lab, other 600 Utilize non-refridge warehouse similar to non-conditioned 600 22 Agriculture and Natural Resources storage 600 23 Accessory 4 Parking 600	18 CRI_Retail Sales	other food sales						303
19 CRI_Vehicle Related Retail and Services storage 600 Mean refridge/non refridge warehouse, dist ctr, lab, other office 600 20 CRI_Industrial Light Mean refridge/non refridge warehouse, dist ctr, lab, other 600 21 CRI_Industrial Heavy office 600 Utilize non-refridge warehouse similar to non-conditioned 600 600 22 Agriculture and Natural Resources storage 600 23 Accessory 600 600 24 Parking 600 600		Mean vehicle dealership, service,					L I	
Mean refridge/non refridge warehouse, dist ctr, lab, other 600 20 CRI_Industrial Light office 600 Mean refridge/non refridge warehouse, dist ctr, lab, other 600 21 CRI_Industrial Heavy office 600 Utilize non-refridge warehouse similar to non-conditioned 600 22 Agriculture and Natural Resources storage 600 23 Accessory 600 600 24 Parking storage 600	19 CRI_Vehicle Related Retail and Services	storage						600
20 CRI_industrial Light office 600 21 CRI_industrial Heavy office 600 Utilize non-refridge warehouse similar to non-conditioned 600 22 Agriculture and Natural Resources storage 600 23 Accessory 600 24 Parking 600		Mean refridge/non refridge warehouse, dist ctr, lab, other						600
21 CRI_Industrial Heavy office Utilize non-refridge warehouse similar to non-conditioned 22 Agriculture and Natural Resources storage 23 Accessory 24 Parking	20 Cki_industrial Light	once More refrides (see refrides					11	600
21 CRI_Industrial Heavy office Utilize non-refridge warehouse similar to non-conditioned 22 Agriculture and Natural Resources storage 23 Accessory 24 Parking 600		warehouse dist stralah other						
Utilize non-refridge warehouse similar to non-conditioned 22 Agriculture and Natural Resources storage 23 Accessory 24 Parking	21 CBL Industrial Heavy	office						600
similar to non-conditioned 22 Agriculture and Natural Resources storage 23 Accessory 24 Parking	21 CKI_INGUSCHAI NEAVY	Utilize non-refridee warehoure					11	000
22 Agriculture and Natural Resources storage 600 23 Accessory 24 Parking		similar to non-conditioned			1			
23 Accessory 24 Parking	22 Agriculture and Natural Resources	storage						600
24 Parking	23 Accessory						11	
	24 Parking						1	

1 US Census Bureau, Quick Facts City of Boulder, 2019, https://www.census.gov/quickfacts/bouldercitycolorado

US Census Bureau, Number of Multifamily Units Completed by Square Feet per Unit, 2019, https://www.census.gov/construction/chars/B
 US Census Bureau, Median and Average Square Feet of Floor Area in New Single-Family Houses Completed, 2019, https://www.census.gov/construction/chars/B
 The job by square foot estimates by space use were correlated to the City of Boulder Boulder Valley Comprehensive Plan 2010 job projections by zone and use category.

January 19, 2021

ArcGIS Urban Space Use Type Co	onfiguration		Parking Spots ⁵	i		Trips ⁶	;			Energy Use 7,	8			CO2 Emissions ⁹
1st & 2nd Order Coefficients Tabular	Data													
		by D	welling Unit (DU) or	Job	single	occupancy w	ehicle trips			Kilowatt hours				tons
											SF per			
								KBTU/SF/			Person			
					Per			yr			(2.26			
Space Use	Notes:	space/DU	SF	space/job	HH(du)	per KSF	Per Job	(I-P Units)	kWH/SF/yr	kwh/sf/day	P/HH)	kwh/hh	khw/job	t/d/pp
	Typical Single-Family Detached													
1 RES_Single Family Detached	Homes	2.00			9.44			20	5.86	0.0161	1008.4	16.2		0.02
	Townhomes, Duplex, Triplex and Other attached Single-Family with													
2 RES Single Family Attached	dedicated private garages	1.50			7 32			23	6 74	0.0185	1008.4	18.6		0.02
3 RES Multi-Family	Mean Apt 2-4, Apt +5	1.25			5.44			25.5	7.47	0.0205	443.4	9.1		0.02
	Mean nursing home, assisted													
4 RES_Group Quarters	living, dorm	0.50			4			37.5	10.99	0.0301	250.0	7.5		0.02
	Use SFA other non-res use less													
5 RES_Live-work	than 25%	2.00			6.83			23	6.74	0.0185	1008.4	18.6		0.02
6 RES Mobile Home Parks		2.00			5			27	7.91	0.0217	443.4	9.6		0.02
7 RES Accessory Dwelling Units	SFD	1.00			5.44			20	5.86	0.0161	221.2	3.6		0.02
8 RES_Efficiency Units	Buildings consisting of 5+ Units	1.00			5.44			23	6.74	0.0185	154.9	2.9		0.02
	Mean resturant, fast food & other													
9 DE_Dining	food service		175	1.73		25	7.575	95	27.84	0.0763	303		23.1	0.05
10 DE Entertainment	Hotal		175	1.73		25	7.575	13	3.81	0.0104	303		3.2	0.05
11 Loughig	notei		500	1.01		4.5	1.3035	28	8.21	0.0225	505		0.8	0.05
43. Bublic and Institutional	Mean Library, Public Assembly, Colleges, Schools, Daycares, other													
12 Public and institutional	Mean Admin/prof office_govt		300	1.01		11	3.333	25	7.55	0.0201	303		6.1	0.05
13 OMF_Professional and Technical Offices	office, MU office, other office		300	0.95		20	5.7	23.75	6.96	0.0191	285		5.4	0.05
14. OMF. Medical Offices	hosp		300	0.95		20	5.7	30.5	8.04	0.0245	285		7.0	0.05
15 OME Financial Offices	11050		300	0.95		20	5.7	31	9.09	0.0249	285		7.0	0.05
16 Park, Recreation and Leisure			300	2.00		10	6	14	4.10	0.0112	600		6.7	0.05
	Mean strip mall, other service, other reail, other outpatient													
17 CRI_Services	health		300	1.01		20	6.06	30.5	8.94	0.0245	303		7.4	0.05
	Mean retail, other retail, strip shopping, enclosed mall, convenience stores, grocery,													
18 CRI_Retail Sales	other food sales		300	1.01		20	6.06	45.12	13.22	0.0362	303		11.0	0.05
	Mean vehicle dealership, service,													
19 CRI_Vehicle Related Retail and Services	storage		1000	0.60		20	12	18.5	5.42	0.0149	600		8.9	0.05
	Mean refridge/non refridge warehouse, dist ctr, lab, other					_								
20 CRI_Industrial Light	office		1000	0.60		8	4.8	34	9.96	0.0273	600		16.4	0.05
21 CDL Industrial Horas	warehouse, dist ctr, lab, other		1000	0.50			24	24	0.05	0.0373	600		16.4	0.05
21 GRI_INGUSUNAI NEAVY	Utilize pop-refrides warehouse		1000	0.60		4	2.4	54	9.90	0.0273	600		16.4	0.05
	similar to non-conditioned													
22 Agriculture and Natural Resources	storage		300	2.00		2.15	1.29	8	2.34	0.0064	600		3.9	0.05
23 Accessory				2.00				-					0.00	
24 Parking													0.00	

5 Parking estimations taken from City of Boulder Municipal Code https://library.municode.com/co/boulder/codes/municipal code?nodeId=TIT9LAUSCO CH9DEST 9-9-6PAST 6 Fox Tuttle, East Boulder Subcommunity Trip Making and Parking Projection, 30 Nov 2020 7 ASHRAE, Addendum b to ANSI/ASHRAE/IES Standard 100-2015, Energy Efficiency in Existing Buildings, ASHRAE TABLE 7-2c ELECTRIC SITE, Climate Zone 5B, 2017,p8-11

8 Conversion rate: 1 kWh x 3.4121416331 = 3.4121416 kBtu

9 Lotus Engineering & Sustainability, Boulder County's 2016 Greenhouse Gas Emissions Inventory and Modeling Report, 2018, https://assets.bouldercounty.org/wp-content/uploads/2018/12/2016-ghg-inventory-and-strategies-report-october-2018-final.pdf

Space Use Notes: gpd/hh ¹⁰ gpd/hh ¹² gpd/hh ¹² gpd/hh ¹³ gpd/hl ¹³ gpd/hl ¹³	ArcGIS Urban Space Use Type Configurati 1st & 2nd Order Coefficients Tabular Data	ion Interr	al Water Use Gallons	Externa G	l Water Use	Waste Go	Water ¹⁴	Solid Waste 15 Pounds
Space Use Notes: ppd/h								
Type 2 large - remip backed 123 223 125 125 3.3 Turn banes, Diple, Tryin watched declaration watched declaration watched 3.3	Space Use Notes	: gpd/hl	¹⁰ gpd/job ¹¹	gpd/hh ¹²	gpd/job 13	gpd/hh	gpd/job	pp/d
Two shores: Duple: Trying rank 13 223 135 235 135 365 <	1 RES_Single Family Detached Homes	Single-Family Detached 185		225		185		5.8
1 B 223 100 100 100 100 100 5.8 3 BES_interpretation Man string home, suited hing, down 100 223 100 5.8 4 AES_forup Quarters Ming, down 100 225 105 5.8 5 BES_thework Man 2012 100 100 5.8 5.8 5 BES_thework Man 2012 100 100 5.8 5.8 5.8 6 BES_thefore holes 100 BES_thefore holes 50 225 105 5.8 6 BES_thefore holes 500 100 BES_thefore holes 50.1 100 5.8 5.8 8 BES_thefore holes 50.1 100 External state of a strike 50.1 100 5.8 5.8 10 DE Charing food strike 50.1 100 External state of a strike 50.1 100 5.8 5.8 11 Lodging Man athening ford offics, port 50.1 100 100 5.8 5.8 5.8 5.8 5.8 5.8 12 Public and multitational Man athening ford offics, port 50.1	Townho Other a	omes, Duplex, Triplex and ttached Single-Family with						
3 8.85. Multi-smithy Mean attr2-4, jarts 3 125 223 145 5.8 4 8.55, oroup Quarters Juing form 115 223 115 223 115 5.8 5 8.52, Juhawark Juan 25% 125 223 115 223 115 5.8 6 8.52, Juhawark Juan 25% 125 223 135 5.8 7 8.52, Accessory Developing Juhz 570 125 223 135 5.8 9 0.5, Dining food service 50.1 not available 50.1 5.8 9 0.5, Dining food service 50.1 not available 50.1 5.8 10 0.5, Dining food service 50.1 not available 50.1 5.8 11 Loging Mean Library, Public Assembly, College, School, Daycares, other College, Action, Sort available 50.1 not available 50.1 5.8 12 Public and institutional public office, Hu office, public and dig, circ, jafery 50.1 not available 50.1 5.8 13 OMF_Profesional and Technical Office Mean Anity, Fublic Assembly, College, School, public and dig, circ, jafery 50.1 not available 50.1 5.8	2 RES_Single Family Attached dedicat	ed private garages 185		225		185		5.8
Main nursing home, saited bing dom 135 225 135 53 S RELive-sork man 250 135 223 135 55 P REEfficiency units suiding: consisting of 5 units 135 223 135 55 B REEfficiency units suiding: consisting of 5 units 135 223 135 135 56 B REEfficiency units suiding: consisting of 5 units 135 223 135 135 58 B REEfficiency units suiding: consisting of 5 units 135 223 135 135 58 B REEfficiency units Mean extrain, fact 60 di sother 50.1 not available 50.1 100 100 58 B REEfficiency units Mean strain, fact 60 di sother 50.1 not available 50.1	3 RES Multi-Family Mean A	pt 2-4, Apt +5 185		225		185		5.8
4 BE _ croup Quarters luing_dorm 125 223 125 58 5 BE _ Livework thin 25% 125 233 185 5.8 6 BE S hobits nome farts 125 233 185 5.8 7 BE S keessey Dweling Units 570 125 223 185 5.8 8 BE S_CEF(seevy Units Bellings consisting of 5-1 thin 1500 & other farts 128 223 185 5.8 9 DE Dining food service 50.1 50.1 5.8 5.8 5.8 10 DE Enterainment 50.1 50.1 50.1 50.1 5.8 5.8 11 Lodging Heti 50.1 50.1 ont available 50.1 5.8 12 Public and misthurional public office, gort 50.1 ont available 50.1 5.8 13 DMF_ Professional and Technical Offices host available 50.1 ont available 50.1 5.8 14 OMF_ Medical Offices host available 50.1 ont available 50.1 5.8 13 OMF_ Professional and Technical Offices host available 50.1 ont available 50.1 <td>Mean n</td> <td>ursing home, assisted</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	Mean n	ursing home, assisted						
$ \begin{array}{c c c c c c c } \begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	4 RES_Group Quarters living, d	orm 185		225		185		5.8
1 1 <td>Use SFA</td> <td>other non-res use less</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	Use SFA	other non-res use less						
125 125 123 <td>5 RES_Live-work than 25</td> <td>% 185</td> <td></td> <td>225</td> <td></td> <td>185</td> <td></td> <td>5.8</td>	5 RES_Live-work than 25	% 185		225		185		5.8
135 223 105 105 5.3 115 223 105 5.3 115 115 223 105 5.3 115 115 125 105 5.3 115 115 115 115 115 5.3 115 115 115 115 115 5.3 115 115 115 115 115 5.3 115 115 115 115 115 5.3 115 115 115 115 115 5.3 115 115 115 115 115 5.3 115 115 115 115 115 5.3 115 115 115 115 115 5.3 115 116 115 115 115 115 115 116 116 115 115 115 115 116 115 115 115 115 115 116 116 115 115 115 115 116 116 115 115 115 115 116 116 116 115 115 116	6 RES Mobile Home Parks	185		225		185		5.8
8 RES_Efficiency Units Buildings consisting of 54 Units Mean resturant, fastfood & other food service 318 225 185 5.8 9 DE_Dining food service 50.1 not available 50.1 5.8 12 DE Entertinment 90.1 not available 50.1 5.8 12 Lodging Hotel 50.1 not available 50.1 5.8 12 Public and institutional public condition/starey, thilic Assembly, Colleges, School, Daycare, other 50.1 not available 50.1 5.8 13 OMF_Involusional and Technical Offices office, NU office, other office 50.1 not available 50.1 5.8 14 OMF_Involusional and Technical Offices office, NU office, other office 50.1 not available 50.1 5.8 13 OMF_Involusional and Technical Offices hoos 50.1 not available 50.1 5.8 14 OMF_Involusional and Technical Offices hoos 50.1 not available 50.1 5.8 15 OMF_Involusional and Technical Offices hoos 50.1 not available 50.1 5.8 15 OMF_Involusional and Technical Offices there mail, other retail, strip shopping, enclosed mail, convenience stors; grocery, other retail, other retail, strip 50.1 not available 50.1 5.8 16 CRI_	7 RES Accessory Dwelling Units SFD	185		225		185		5.8
a Reg. Intenticy Units Decking Decking <t< td=""><td>0.055 Efficiency Units Ruilding</td><td>reconsisting of 5 - Units 195</td><td></td><td>225</td><td></td><td>105</td><td></td><td>5.0</td></t<>	0.055 Efficiency Units Ruilding	reconsisting of 5 - Units 195		225		105		5.0
9 DZ_bining Mean iteration, part load a durine interaction and service 50.1 not available 50.1 5.8 11 DOE Entertainment 50.1 not available 50.1 5.8 11 Lodging Metel 50.1 not available 50.1 5.8 12 Public and institutional public Assembly, Colleges, Schools, Daycares, other Colleges, Schools, Daycares, other Schools, Daycar	a RES_Efficiency Offics Building	sturet feet feed & ether		225		165		5.0
10 OC Entertainent 50.1 Intertainent 50.1 Intertainent 50.1 5.8 11 Lodging Hotel 50.1 not available 50.1 5.8 Mean Library, Public Assembly, Colleges, Schoolt, Daycares, other (Colleges, Schoolt, Other outpatient (Convenience stores, grocery, (Convenience stores, g	0 DE Dining food re	price	50.1		not available		50.1	5.0
11 Lodging Hotel 50.1 not evaluable 50.1 5.2 Mean Library, Public Assembly, Colleges, School, Daycares, other Dublic office/stary, 12 Public and institutional public office/stary, Mean Admin/prof office, gott office, MU office, Gutor office 50.1 not available 50.1 5.8 13 OMF_Professional and Technical Offices Mean Admin/prof office, gott office, MU office, Gutor office 50.1 not available 50.1 5.8 14 OMF_Medical Offices Mean anon-diag and dag, clinic, hosp 50.1 not available 50.1 5.8 15 OMF_Francial Offices Mean strip mall, other service, other reail, other reail, other reail, strip shoping, enclosed mall, convenience stores, grocery, 50.1 not available 50.1 5.8 19 CRI_Retail Sales Other freadil and Services Mean refridge/non refridge warehouse, dict cri, lab, other storage 50.1 not available 50.1 5.8 20 CRI_Industrial Light Mean refridge/non refridge warehouse, dict cri, lab, other similar to non-conditioned similar to non-conditioned simi	10 DE Entertainment	TVICE	50.1		not available		50.1	5.8
12 Koging Note Note <td>11 Lodging Hotel</td> <td></td> <td>50.1</td> <td></td> <td>not available</td> <td></td> <td>50.1</td> <td>5.8</td>	11 Lodging Hotel		50.1		not available		50.1	5.8
12 Public and institutional public office/safety 50.1 not available 50.1 5.8 13 OMF_Professional and Technical Offices Mean Admin/prof office, got 50.1 not available 50.1 5.8 14 OMF_Medical Offices hosp 50.1 not available 50.1 50.1 50.1 5.8 14 OMF_Medical Offices hosp 50.1 not available 50.1	Mean Li College	ibrary, Public Assembly, s. Schools. Davcares, other						
Man Admin/prof office, govt office, Mu office, other office Mean non-diag and diag, clinic, hosp not available Sol 14 OMF_Medical Offices hosp hosp Sol not available Sol Sol 15 OMF Financial Offices hosp Sol not available Sol Sol 15 OMF Financial Offices Sol not available Sol Sol Sol 16 OMF Financial Offices Mean strip mail, other service, other reail, other outpatient health Sol not available Sol Sol 17 CRI_Services health Sol not available Sol Sol Sol 18 CRI_Retail Sales other food sales other reail, other outpatient phopping, enclosed mail, conveninee stores, grocery, avaehouse, dist ctr, lab, other warehouse, dist ctr, lab, other warehouse, dist ctr, lab, other Sol not available Sol Sol 20 CRI_industrial Light office Sol Sol not available Sol Sol 21 CRI_industrial Heavy office Sol Sol not available Sol Sol 21 CRI_industrial Heavy office Sol Sol not available Sol Sol 22 Agriculture and Natural Resources storage Sol not available Sol Sol 22 Agriculture and Natural Resources <td>12 Public and Institutional public of</td> <td>office/safety</td> <td>50.1</td> <td></td> <td>not available</td> <td></td> <td>50.1</td> <td>5.8</td>	12 Public and Institutional public of	office/safety	50.1		not available		50.1	5.8
13 OMF Professional and Technical Offices office, MU office, other office 50.1 not available 50.1 5.8 14 OMF_Medical Offices hosp 50.1 not available 50.1 5.8 15 OMF Financial Offices 50.1 not available 50.1 5.8 16 Park, Recreation and Leisure Mean strip mail, other service, other retail, strip schooping, enclosed mail, convenience stores, grocery, other rotal assisting, service, other food sales 50.1 not available 50.1 5.8 17 CRI_Services Mean strip mail, other retail, strip schooping, enclosed mail, convenience stores, grocery, other rotal assisting, service, during an efficie/non refridge warehouse, dist ctr, lab, other 50.1 not available 50.1 5.8 19 CRI_Vehice Related Retail and Services Mean refridge/non refridge warehouse, dist ctr, lab, other 50.1 not available 50.1 5.8 20 CRI_Industrial Light Office 50.1 not available 50.1 5.8 21 CRI_Industrial Heavy Office 50.1 not available 50.1 5.8 22 Agriculture and Natural Resources storage 50.1 not available 50.1 5.8 22 Agriculture and Natural Resources storage	Mean A	dmin/prof office, govt						
Mean non-visigend diag, clinic, hosp50.1not available50.15.815 OMF_Financial Offices50.1not available50.150.15.816 Park, Recreation and LeisureMean strip mall, other service, other reail, other reail, other reail, strip shopping, enclosed mall, convenience store; procery, area wither outpatient50.1not available50.15.817 CRI_ServicesMean retail, other reail, strip shopping, enclosed mall, convenience store; procery, warehouse, dist ctr, lab, other50.1not available50.15.819 CRI_Vehicle Related Retail and Servicesstorage50.1not available50.15.820 CRI_Industrial Lightoffice warehouse, dist ctr, lab, other warehouse, dist ctr, lab, other50.1not available50.15.821 CRI_Industrial Meavyoffice similar to non-conditioned similar to non-	13 OMF_Professional and Technical Offices office, N	MU office, other office	50.1		not available		50.1	5.8
14 OWE_Weblical Offices 50.1 Introduction offices 50.1 S0.1 Introduction offices 50.1 S0.1 S0.1 <t< td=""><td>Mean n</td><td>on-diag and diag, clinic,</td><td>50.4</td><td></td><td>net susibble</td><td></td><td>50.4</td><td>5.0</td></t<>	Mean n	on-diag and diag, clinic,	50.4		net susibble		50.4	5.0
13 OWF maintender 30.1 10 davailable 30.1 3.8 16 Park, Recreation and Leisure Mean strip mall, other service, other reail, other outpatient 50.1 not available 50.1 5.8 17 CRI_Services health 50.1 not available 50.1 5.8 Mean retail, other retail, strip shopping, shopping, s	14 OMF_Medical Offices hosp		50.1		not available		50.1	5.6
Mean strip mall, other service, other reail, other outpatient 17 CRI_Services health Mean retail, other outpatient shopping, enclosed mall, convenience stores, grocery, other food sales 18 CRI_Retail Sales other food sales 19 CRI_Vehicle Related Retail and Services storage Mean retridge/non refridge warehouse, dist crt, lab, other 20 CRI_Industrial Light office 20 CRI_Industrial Light office 21 CRI_Industrial Light office 22 Agriculture and Natural Resources storage 23 Accessory 24 Parking 24 Parking 25 C.1 15	15 OWF Financial Offices		50.1		not available		50.1	5.0
17 CRI_Services health 50.1 not available 50.1 50.1 5.8 Mean retail, other retail, strip shopping, convenience stores, grocery, convenience stores, grocery, 50.1 not available 50.1 5.8 18 CRI_Retail Sales other food sales 50.1 not available 50.1 5.8 19 CRI_Vehicle Related Retail and Services storage 50.1 not available 50.1 5.8 20 CRI_Industrial Light office 50.1 not available 50.1 5.8 Mean refridge/non refridge warehouse, dist ctr, lab, other 50.1 not available 50.1 5.8 21 CRI_Industrial Light office 50.1 not available 50.1 5.8 21 CRI_Industrial Heavy office 50.1 not available 50.1 5.8 22 Agriculture and Natural Resources storage 50.1 not available 50.1 5.8 22 Agriculture and Natural Resources storage 50.1 not available 50.1 5.8 23 Accessory 10 not available 10 10.1 5.8 24 Parking 24 Parking 10 10.1 10.1 10.1	Mean st other re	trip mall, other service, eail, other outpatient	50.1		not available		50.1	3.0
Mean retail, other retail, strip shopping, enclosed mall, convenience stores, grocery, 50.1 not available 50.1 5.8 Mean vehicle Related Retail and Services storage 50.1 not available 50.1 5.8 Mean vehicle Related Retail and Services storage 50.1 not available 50.1 5.8 Mean refridge/non refridge warehouse, dist ctr, lab, other 50.1 not available 50.1 5.8 20 CRI_industrial Light office 50.1 not available 50.1 5.8 Mean refridge/non refridge warehouse, dist ctr, lab, other office 50.1 not available 50.1 5.8 21 CRI_Industrial Heavy office 50.1 not available 50.1 5.8 22 Agriculture and Natural Resources storage 50.1 not available 50.1 5.8 23 Accessory Utilize non-refridge warehouse similar to non-conditioned similar to non-conditioned similar to non-conditioned 50.1 not available 50.1 5.8 24 Parking Storage Storage not available Storage 5.8	17 CRI_Services health		50.1		not available		50.1	5.8
18 CRI_Retail Sales other food sales 50.1 not available 50.1 5.8 19 CRI_Vehicle Related Retail and Services storage 50.1 not available 50.1 5.8 19 CRI_Vehicle Related Retail and Services storage 50.1 not available 50.1 5.8 Mean vehicle dealership, service, warehouse, dist ctr, lab, other warehouse, dist ctr, la	Mean re shoppin conveni	etail, other retail, strip ng, enclosed mall, ience stores, grocery,						
Mean vehicle dealership, service, 19 CRI_Vehicle Related Retail and Services storage 50.1 not available 50.1	18 CRI_Retail Sales other fo	ood sales	50.1		not available		50.1	5.8
19 CRI_Vehicle Related Retail and Services storage 50.1 not available 50.1<	Mean v	ehicle dealership, service,						
Mean refridge/non refridge warehouse, dist ctr, lab, other office 50.1 50.1 50.1 5.8 Mean refridge/non refridge warehouse, dist ctr, lab, other warehouse, dist ctr, lab, other warehouse, dist ctr, lab, other office 50.1 50.1 5.8 121 CRI_industrial Heavy Office 50.1 50.1 5.8 122 Agriculture and Natural Resources storage 50.1 50.1 5.8 123 Accessory Image: Storage Image:	19 CRI_Vehicle Related Retail and Services storage		50.1		not available		50.1	5.8
20 CRI_Industrial Lightoffice50.1not available50.15.8Mean refridge/non refridge warehouse, dist ctr, lab, other office50.1100 available50.15.821 CRI_Industrial Heavyoffice50.150.150.15.8Utilize non-refridge warehouse similar to non-conditioned50.150.150.15.822 Agriculture and Natural Resourcesstorage50.150.1100 available50.15.823 Accessory400 available50.150.15.85.824 Parking50.150.15.85.85.8	Mean ru wareho	efridge/non refridge use, dist ctr, lab, other						
Mean refridge/non refridge warehouse, dist ctr, lab, other warehouse, dist ctr, lab, other not available 50.1<	20 CRI_Industrial Light office		50.1		not available		50.1	5.8
21 CRI_Industrial Heavyoffice50.1not available50.15.8Utilize non-refridge warehouse similar to non-conditioned50.150.1650.15.822 Agriculture and Natural Resourcesstorage50.1not available50.15.823 Accessory650.1100 available50.15.824 Parking100 available100 available100 available100 available5.8	Mean ro wareho	efridge/non refridge use, dist ctr, lab, other						
Utilize non-refridge warehouse similar to non-conditioned 50.1 not available 50.1 50.1 22 Agriculture and Natural Resources storage 50.1 not available 50.1 23 Accessory 1 not available 50.1 5.8 24 Parking 1 not available 1	21 CRI_Industrial Heavy office		50.1		not available		50.1	5.8
22 Agriculture and Natural Resources storage 50.1 not available 50.1 5.8 23 Accessory 1 not available 1 1 5.8 24 Parking 1 1 1 1 1 1	Utilize n similar t	non-refridge warehouse to non-conditioned						
23 Accessory not available 24 Parking not available	22 Agriculture and Natural Resources storage		50.1		not available		50.1	5.8
24 Parking not available	23 Accessory				not available			
	24 Parking				not available			

10 Waskom, R., et al, HOMEOWNER'S GUIDE TO: Household Water Conservation, Colorado State University Extension, 2018, https://extension.colostate.edu/docs/pubs/consumer/xcm219.pdf 11 US Energy Information Administration, 2012 Commercial Buildings Energy Consumption Survey: Water Consumption in Large Buildings Summary, 2017, https://www.eia.gov/consumption/commercial/reports/2012/water/#.~:text=On%20a%20daily%20basis%2C%20they,and%2050.1%20gallons%20per%20worker. 12 Assumes residential wastewater is equivalent to internal water use. 13 Non-residential water use was not calculated at this time. This coefficient is fairly complicated due the variety of the property types and uses driving external water use. To supply this cofficient would require a further level of research to ensure data reliability.

14 Wastewater is assumed to be the equivalent of internal water use

15 Colorado Department of Public Health and Environment, FY2019 Annual Report to the Colorado General Assembly Status of the Solid Waste Management Program in Colorado, 2020, https://oitco.hylandcloud.com/Pop/docpop/docpop.aspx

January 19, 2021

Land Use Types

Staff reviewed the Boulder Valley Comprehensive Plan (BVCP) for descriptions and general intent of use and intensity for each land use. All 25 land use categories were created as land use types within the ArcGIS Urban model. When configuring the land use types in ArcGIS, the platform required populating the allowed spaces uses into a given land use to measure the possible development impacts as capacity.

While the BVCP is not prescriptive in assigning specific use and intensity thresholds there was a correlation between land use category descriptions and the subsequent zoning district characteristics (Table 4). The zoning districts within the BRC provided prescriptive information regarding "Form and Bulk", "Intensity" and "Use" standards that helped to populate Land Use types configuration in sufficient detail to allow the ArcGIS Urban platform to utilize the capacity indicators. For the purposes of the ArcGIS Urban modeling, the following zoning districts were assigned to the land use categories:

Residential Categories		
Land Use Category	Abbreviation	ArcGIS Urban Associated Zoning District
Very Low Density Residential	VLR	RR-1
		RR-2
Low Density Residential	LR	RE,
		RL-1
		RL-2
Manufactured Housing	МН	MH
Medium Density Residential	MR	RM-1 RM-2
		RM-3
Mixed Density Residential	MXR	RMX-1 RMX-2
High Density Residential	HR	RH-1
		RH-2
		RH-3
		RH-4
		RH-5
		RH-6
		RH-7

Table 4 Land Use to Zoning District Association

Mixed Use Categories		
Land Use Category	Abbreviation	ArcGIS Urban Associated Zoning District
Mixed Use Business	MUB	BMS
	-	MU-1
		MU-2
		MU-3 MU-4
Mixed Use Industrial	MUI	IMS
Mixed Lise Residential	MUR	MU-1
	MOIX	MU-1 MU-2
		MU-3
		MU-4
Industrial Categories		
, i i i i i i i i i i i i i i i i i i i		
Land Use Category	Abbreviation	ArcGIS Urban Associated Zoning District
Community Industrial	CI	IS-1
		IS-2
General Industrial	GI	IM,
		IG
Light Industrial	LI	IG
Business Categories		
Land Use Category	Abbreviation	ArcGIS Urban Associated Zoning District
Community Business	СВ	BC-1,
		BC-2
General Business	GB	BC-1,
		BC-2
Transitional Business	ТВ	BT-1,
		BT-2
Regional Business	RB	BR-1
		BR-2
		DT-1
		DT-2
		DT-3
		DT-4
		DT-5
Service Commercial	SC	BCS

Open Space Categories

Land Use Category	Abbreviation	ArcGIS Urban Associated Zoning District
Open Space, Acquired	OS-A	A P
Open Space, Development Rights	OS-DR	A P
Open Space, Other	OS-O	n/a
Other Categories		
Land Use Category	Abbreviation	ArcGIS Urban Associated Zoning District
Agricultural	AG	Α
Park, Urban and Other	PK-U/O	Р
Public	PUB	P
Environmental Preservation	EP	n/a
Natural Ecosystems Overlay	NEO	n/a

Table 5 summarizes the 8 configuration inputs required for the Land Use types. The land use types were configured for the East Boulder Subcommunity Plan to include definition regarding the target percentage of each use within the land use. Considering ArcGIS Urban does not allow for uses to be categorized by limited, conditional or use review, all uses under these categories were categorized allowed for the modeling purposes. The rationale was the limited, conditional, and use review uses were not expressly prohibited. If ESRI updates the ArcGIS Urban application to accommodate a more nuance classification of the allowed uses staff will review and revise the land use configuration accordingly.

In additional to allowed uses, maximum lot coverage was estimated. Currently, the zoning districts do not define maximum lot coverage. Lot coverage was defined in combination with land use efficiency or net area factor, as these two inputs provided a rough estimate of the space needed for circulation and general open space. This set aside a portion of the overall land. The maximum dwelling units per acre (DU/ac) and maximum floor area ratio (FAR) thresholds represented the ceiling of the density scale from the associated zoning districts. Lastly, the maximum height settings represented the by-right height limit and the maximum floors. Any exception to the by-right height limit was programmed into ArcGIS Urban according the Appendix J map and allowed for building height maximums up to 55'.

Table 5 Land Use Type Configuration Summary Table

~~~~~		~		-				
			Maximum Lot		Maximum Height	Max Dwelling Units	Maximum	Land Use Efficiency
Land Use	Description	Allowed Space UseTypes and Target Distribution	Coverage	Maximum FAR	in feet	per acre	Floors	net area factor
AG	AGRICULTURAL	AG 80%; PUB 15%; RES_SFD 5%	10%	0	35		3	70%
		DE_ENT 15%; DE_DIN 15%; OMF_FIN 7%; OMF_MED 7%;						
CB	COMMUNITY BUSINESS	OMF_PRO 6%; CRI_SVCS 15%; CRI_RET 20%; CRI_VEH 15%	80%	1	35		3	70%
CI	COMMERCIAL INDUSTRIAL	OMF_PRO 20%; CRI_INDL 60%; CRI_INDH 20%	80%	0.5	40		3	70%
EP	ENVIRONMENTAL PRESERVATION	N/A		0	0		0	70%
		DE_DIN 5%; DIN_ENT 5%; OMF_FIN 10%; OMF_MED 10%;						
		OMF_PRO 10%; CRI_RET 10%; CRI_SVCS 10 %, CRI_VEH 10%;						
GB	GENERAL BUSINESS	LOD 5%; PKG 25%	80%	2.5	35		3	70%
GI	GENERAL INDUSTRIAL	OMF_PRO 20%; CRI_INDI 20%; CRI_INDH 60%	80%	0.5	40		3	70%
		RES_SFA 20%; RES_MF 40%; RES_GQ 5%; RES_EFF 10%;						
HR	HIGH DENSITY RESIDENTIAL	PKG 25%	80%		35	80	3	70%
LI	LIGHT INDUSTRIAL	CRI_INDI 60%'; CRI_INDH 20%; OMF_PRO 20%	80%	0.5	40		3	70%
LR	LOW DENSITY RESIDENTIAL	RES_SFD 90%; RES_ADU 10%	25%		35	7	3	70%
MH	MANUFACTURED HOME	RES_MH 100%	50%		35		3	70%
MR	MEDIUM DENSITY RESIDENTIAL	RES_SFA 45%; RES_MF 45%; RES_ADU 10%	80%		38	25	3	70%
		RES_MF 35%; DE_DIN 75%; DE_ENT 75%; LOD 5%; OMF_FIN						
		3%; OMF_MED 3%; OMF_PRO 4%; CRI_RET 5%, CRI_SVCS						
MUB	MIXED-USE BUSINESS	5%, PKG 25%	80%	2	38		3	70%
MUI	MIXED-USE INDUSTRIAL	OMF_PRO 20%; CRI_INDI 50%; RES_MF 20%; RES_LW 10%	80%	0.5	40		3	70%
		RES_SFA 20%; RES_MF 30%; DE_DIN 7.5%; DE_ENT 7.5%;						
MUR	MIXED-USE RESIDENTIAL	CRI_RET 5%; CRI_SVCS 5%; PKG 25%	80%	2	38	80	3	85%
MXR	MIXED DENSITY RESIDENTIAL	RES_SFA 75%; RES_MF 20%; RES_GQ 5%	80%		35	20	3	70%
NSO	NATURAL SYSTEMS OVERLAY			0	0		0	0%
OS-A	OPEN SPACE - AQUIRED	PR 20%; AG 70%; PUB 10%	10%		35		3	70%
	OPEN SPACE - DEVELOPMENT							
OS-DR	RIGHTS	PR 20%; AG 70%; PUB 10%	10%	0	35		3	70%
OS-O	OPEN SPACE - OTHER	AG 70%; PR 20%; PUB 10%	10%	0	35		3	70%
PK-U/O	PARK, URBAN AND OTHER	PUB 20%; PR 80%	10%	0	35		3	70%
PUB	PUBLIC/SEMI-PUBLIC	PUB 100%		0.5	35		3	70%
		RES_SFA 50%; RES_MF 20%; DE_DIN 10%; DE_ENT 10%; LOD						
		5%; OMF_FIN 3%; OMF_MED 3%; OMF_PRO 4%; CRI_RET 5%;						
RB	REGIONAL BUSINESS	CRI_SVCS 5%; CRI_VEH 5%; PKG 25%	80%	2.5	35		3	70%
		OMF_FIN 10%; OMF_MED 15%; OMF_PRO 15%; CRI_RET 20%;						
SC	SERVICE COMMERCIAL	CRI_SVCS 20%; CRI_VEH 20%	80%	0.5	35		3	70%
		RES_SFA 5%; RES_MF 20%; OMF_FIN 17%; OMF_MED 17%;						
TB	TRANSITIONAL BUSINESS	OMF_PRO 16%; CRI_RET 12.5%; CRI_SVCS 12.5%	80%	0.5	35		3	70%
VLR	VERY LOW DENSITY RESIDENTIAL	RES_SFD 90%; RES_ADU 10%	25%		35		3	70%

### **Building Types**

Configuration of the building types included inputting spatial organization details by building floor and the associated space use (Figure 1). The buildings types were created to include a mix of the 69 space use types, e.g. Single-Family Res -2 Story (Low Density), Mid-Rise Mixed-Use Residential with Multifamily and Efficiency Units over Retail, and Industrial Warehouse (Table 6-Table 7). ArcGIS Urban allowed for new building types to be proposed on an as-needed basis. Possible proposed building types could include identifying affordable housing or affordable commercial uses.

Name			
Low-Rise	e MU MF Residential over Re	tail	
Туре			
Building	Dwelling Units		
Building P	arts Configuration		
		Space Use Type	
		CRI_Retail Sales	
		Number of Floors (e	xact)
		1 –	- 1
	2	Massing	
Building Typ	2 1 ···	Massing Tower	existing)
Building Typ	2 1	Massing Tower	existing)
Building Typ Name	2 1 we: Low-Rise MU MF Re	Massing Tower	existing)
Building Typ Name Low-Rise	2 1 we: Low-Rise MU MF Re MU MF Residential over Ret	Massing Tower esidential over Retail (e	existing)
Building Typ Name Low-Rise Type	2 1 we: Low-Rise MU MF Re MU MF Residential over Ret	Massing Tower esidential over Retail (e	existing)
Building Typ Name Low-Rise Type Building	2 1 we: Low-Rise MU MF Re MU MF Residential over Ret Dwelling Units	tail	existing)
Building Typ Name Low-Rise Type Building Building Pa	2 1 we: Low-Rise MU MF Re MU MF Residential over Ret Dwelling Units arts Configuration	Massing Tower essidential over Retail (e tail	existing)
Building Typ Name Low-Rise Type Building Building Pa	2 1 1 we: Low-Rise MU MF Re MU MF Residential over Ret Dwelling Units arts Configuration	tail	existing)
Building Typ Name Low-Rise Type Building Building Pa	2 1 we: Low-Rise MU MF Re MU MF Residential over Ret Dwelling Units arts Configuration	tail  Space Use Type RES_Multi-Family Number of Floors (ra	existing)

Figure 1 Building Type Spatial Organization by Floor and Space Use

January 19, 2021

Table 6 Building Type Summary Table – Part A

	BuildingTypeName	Above Grade Building Parts
1	Cultural	DE_ENT, maximum floors 5
2	Industrial Facility - Heavy Manufacturing	CRI_INDH, maximum floors 2
3	Industrial Flex + Tech	OMF_PRO, maximum floors 5
4	Industrial Warehouse	CRI_INDI, maximum floors 2
5	Low-Rise Hotel	LOD, maximum floors 3
6	Low-Rise Prof/Tech Office	OMF_PRO, maximum floors 3
7	Low-Rise MU Prof Tech Office over Retail	CRI_RET, maximum floors 1;OMF_PRO, maximum floors 2
8	Low-Rise Multifamily Residential	RES_MF, maximum floors 3
9	Low-Rise MU MF Residential over Retail	CRI_RET, maximum floors 1; RES_MF, maximum floors 2
10	Main Street Retail	CRI_RET, maximum floors 2
11	Main Street Retail w/ Prof/Tech Office	CRI_RET, maximum floors 1; OMF_PRO, maximum floors 2
12	Main Street Retail w/ MF Residential	CRI_RET, maximum floors 1; RES_MF, maximum floors 2
13	Medical Facility	OMF_MED, maximum floors 5
14	Mid-Rise Hotel	LOD, maximum floors 5
15	Mid-Rise Hotel w/ Retail	CRI_RET, maximum floors 1; LOD, maximum floors 4
16	Mid-Rise Prof/Tech Office	OMF_PRO, maximum floors 5
17	Mid-Rise MU Prof/Tech Office over Retail	CRI_RET, maximum floors 1; OMF_PRO, maximum floors 4
18	Mid-Rise Multifamily Residential	RES_MF, maximum floors 5
19	Mid-Rise MU Res over Prof Services	CRI_SVCS, maximum floors 1; RES_MF, maximum floors 4
20	Mid-Rise MU Residential MF and Eff Units w/ Retail	CRI_RET, maximum floors 1; RES_MF, maximum floors 2; RES_EFF, maximum floors 2
21	Surface Parking Lot	PKG, maximum floors 0
22	Parking Structure 3 Story	PKG, maximum floors 3
23	Parking Structure 4-5 Story	PKG, maximum floors 5
24	Neighborhood Strip Mall 1 Story	CRI_SVCS, maximum floors 1
25	Neighborhood Strip Mall 2 Story	CRI_RET, maximum floors 1; CRI_SVCS2, maximum floors 2
26	School 1 Story	PUB, maximum floors 1
27	School 2-3 Story	PUB, maximum floors 3
28	Main Street Retail w/ Med Office	CRI_RET, maximum floors 1; OMF_MED, maximum floors 2
29	Main Street Retail w/ Financial Office	CRI_RET, maximum floors 1; OMF_FIN, maximum floors 2
30	Low-Rise Med Office	OMF_MED, maximum floors 3
31	Low-Rise Financial Office	OMF_FIN, maximum floors 3
32	Big Box Retailer	CRI_RET, maximum floors 1
33	Big Box Retailer Auto Related	CRI_VEH, maximum floors 1
34	Mid-Rise Hotel w/ Dining	DE_DIN, maximum floors 1; LOD, maximum floors 4
35	Mid-Rise Med Office	OMF_MED, maximum floors 5

Substructure Building Parts
PKG, maximum floors 1
 PKG, maximum floors 1
PKG, maximum floors 1

Table 7 Building Type Summary Table – Part B

		BuildingTypeName	Above Grade Building Parts
-E	36	Mid-Rise MU Med Office over Retail	CRI_RET, maximum floors 1; OMF_MED, maximum floors 4
	37	Mid-Rise Financial Office	OMF_FIN, maximum floors 5
	38	Mid-Rise MU Financial Office over Retail	CRI_RET, maximum floors 1; OMF_FIN, maximum floors 4
	39	Mid-Rise Public Office	PUB, maximum floors 5
	40	Mid-Rise MU Public Office w/ Retail	CRI_RET, maximum floors 1; PUB, maximum floors 4
	41	Main Street Retail w/ Public Office	CRI_RET, maximum floors 1; PUB, maximum floors 2
	42	Mid-Rise MU Financial Office over Dining	DE_DIN, maximum floors 1; OMF_FIN, maximum floors 4
	43	Mid-Rise MU Financial Office over Entertainment	DE_ENT, maximum floors 1; OMF_FIN, maximum floors 4
	44	Main Street Retail w/ Prof Services	CRI_RET, maximum floors 1; CRI_SVCS, maximum floors 2
	45	Mid-Rise MU Public Office over Dining	DE_DIN, maximum floors 1; PUB, maximum floors 4
	46	Low-Rise MU Public Office over Retail	CRI_RET, maximum floors 1; PUB, maximum floors 2
	47	Mid-Rise Hotel w/ Entertainment	DE_ENT, maximum floors 1; LOD, maximum floors 4
	48	Mid-Rise MU Public Office over Entertainment	DE_ENT, maximum floors 1; PUB, maximum floors 4
	49	Single Family Res - 2 Story (Low Density)	RES_SFD, maximum floors 2
	50	Single Family Res - 1 Story (Low Density)	RES_SFD, maximum floors 1
	51	Single Family Res - 3 Story (Medium Density)	RES_SFD, maximum floors 3
	52	Livework	RES_LW, maximum floors 3
	53	Single Family Res - 1 Story (Medium Density)	RES_SFD, maximum floors 1
	54	Single Family Res - 2 Story (Very Low Density)	RES_SFD, maximum floors 2
	55	Single Family Res - 1 Story (Very Low Density)	RES_SFD, maximum floors 1
	56	Single Family Res - 2 Story (Medium Density)	RES_SFD, maximum floors 2
	57	Single Family Res - 3 Story (Very Low Density)	RES_SFD, maximum floors 3
	58	Town/Row Houses	RES_SFA, maximum floors 3
	59	Low-Rise MU MF Residential over Dining	DE_DIN, maximum floors 1; RES_MF, maximum floors 2
	60	Low-Rise MU Med Office over Retail	CRI_RET, maximum floors 1,OMF_MED, maximum floors 2
	61	Mid-Rise MU Residential w/ Dining	DE_DIN, maximum floors 1; RES_MF, maximum floors 4
	62	Low-Rise MU MF Residential over Light Industrial	CRI_INDI, maximum floors 1; RES_MF, maximum floors 2
	63	Low-Rise Multifamily & Efficiency Residential	RES_MF, maximum floors 2; RES_EFF, maximum floors 1
	64	Low-Rise MU MF Residential over Prof/Tech Office	OMF_PRO, maximum floors 1; RES_MF, maximum floors 2
	65	Main Street Retail w/ Efficiency Units	CRI_RET, maximum floors 1; RES_EFF, maximum floors 2
	66	Manufactured/Mobile Homes	RES_MH1, maximum floors 1
	67	Mid-Rise MU Med Office over Dining	DE_DIN, maximum floors 1; OMF_MED, maximum floors 4
	68	Mid-Rise MU Fin & Prof/Tech Office over Retail	CRI_RET, maximum floors 1; OMF_FIN, maximum floors 2; OMF_PRO, maximum floors 2
	69	Single Family Res - 3 Story (Low Density)	RES_SFD, maximum floors 3

Substructure Building Parts
PKG, maximum floors 1
PKG, maximum floors 1
PKG, maximum floors 1
PKG, maximum floors 1
PKG, maximum floors 1
PKG, maximum floors 1
PKG, maximum floors 1
PKG, maximum floors 1
PKG, maximum floors 1