Documentation for 2019 BY Land Use Allocation Model

1. Converted to V2
    a. Retained developments from V1 model (also constraints and adjustments, but those weren't used)
    b. Used as base for 2022 update
2. Describe development update process/outcomes (Sent existing development data to Land Use contacts for feedback, gathered and analyzed 2022 parcel data for developments, reviewed news reports for major developments)
3. 2019 data year improvements (2020 census and Data Axle)
4. Converted non-res development into job adjustments
5. UrbanSim updates: model update to make vacant housing units more attractive to encourage households to fill DU added via developments
6. Topics to explain
    a. Group quarters not represented in UrbanSim. University students represented through special generators in travel model (Ask Sean: are off-campus students double counted?)
    b. An analysis of how the forecast compares to the 2010 BY forecast? (overall, by GMA?)
    c. Jobs included – agriculture? Home-based jobs/self-employed?

Turning job developments into adjustments

- This was done to allow nonresidential developments to noticeably impact model results. The development function simply adds additional job spaces, which leads to minimal impact due to the very high number of unfilled job spaces already in existence.
- Steps:
    - For all non-residential developments already in the system, download the development file; filter to non-residential developments in 2020 and beyond
    - Find/download the 2019 block-level output from Run 157 or later (i.e. a run that uses the Data Axle and 2020 Census-override data)
    - For non-residential developments that are NOT *re*developments, find 2019 job counts in associated blocks – add together by year to get new job values. If dev is redevelopment, then do not add # to 2019 block total.
    - May need to enter multiple adjustments per development to account for phasing – e.g. 50 jobs in 2020, 250 (total) jobs in 2026

Square foot per worker: 896

Notes for Internal Reference

Note: TAZ references in the land use model for adjustments and developments refer to the 2015 BY TAZ system (expanded to northern weld)

Three disaggregate files are needed for the 2019 BY travel model: households, persons, and jobs. Only select years are currently available in the UrbanSim interface for these files. Ask UrbanSim if additional years are needed.

Edits to the constraint layer based on community feedback were made in the final combined file, not in the original collection of communities' land use constraints. If using the constraint file for future modeling efforts, start with the combined final file and use "explode multipart feature" to make edits to particular areas (and/or delete communities if they have a new land use plan) so as to start from the latest version instead of starting from the original collection file.

Final file: Will be named FLU_05XX2023 or FLU06XX2023 (whichever is later) in S:\9 - GIS\Model Data\Land Use Allocation Model\2010 LUAM (2050 RTP)\Zoning-Future Land Use\Regional

Original collection file: S:\9 - GIS\Model Data\Land Use Allocation Model\2010 LUAM (2050 RTP)\Zoning-Future Land Use\Regional\FutureLandUseConstraint\FLU_Merge_02092023_Windsor.shp

Method for calculating Municipal and County Forecasts

- Download the "Indicators" CSV file from the Block dropdown in Cloud.urbansim.com for the relevant run and year of interest.
- Move the CSV to S:\8 - Models\2 - LAND USE ALLOCATION MODEL\1 - CURRENT\1 - LUAM\LUAM 2019\Runs
- Open the MXD "Draft Run Review – Municipal" in S:\9 - GIS\Model Data\Land Use Allocation Model\2010 LUAM (2050 RTP)
- Join the Indicators CSV to the "V2_ModelArea_BlocksSimple" shapefile
    - NOTE: This shapefile contains four columns of 2010 data, named "total_hh", "total_pers", "total_jobs" and "total_unit". Make sure you don't accidentally select these columns in later steps.
- Export the shapefile to S:\9 - GIS\Model Data\Land Use Allocation Model\2010 LUAM (2050 RTP)\Runs as "Run#_YEAR_MuniCnty"
- Optional: If needing to check income levels, add a field called AggInc (type float) to the exported shapefile. Use field calculator to multiply mean income by # of HH
- In the exported shapefile, dissolve according to the MuniCnty field, which identifies the municipality AND county (for cities in both counties) based on the centroid of each 2010 census block. The municipalities boundaries are from the 202 tigerline file.
    - Output Feature Class: save as "Run#_YEAR_MuniCnty_D" in S:\9 - GIS\Model Data\Land Use Allocation Model\2010 LUAM (2050 RTP)\Runs

    - Dissolve field: MuniCnty
    - Statistics Fields → Statistic Type (Use the following order, as the output will be missing most of the names and you'll need to readd the headers)
        - Total_hh_1 (not total_hh) → sum
        - Total_pe_1 (not total_pers) → sum
        - Total_jo_1 (not total_jobs) → sum
        - Total_un_1 (not total_unit) → sum
        - Du_spaces (not du_spaces_) → sum
        - Job_spaces (not job_spac_1) → sum
        - Sum_acre_1 → sum
        - AggInc (if created in a previous step) → sum
- Export the attribute table of the dissolved shapefile as a txt file to calculate percentage growth in an excel file. See previous run review spreadsheets for quick formulas to pull – such as adding data together for munis in two counties (paste the county column which shows L vs W and then paste the formulas for the "by municipality" section starting in row 34).

Developments from Parcel Data

Parcel improvement data from Weld County was filtered to identify residential developments between 2011 and 2021 (Data marked as updated October 2022, but only included two residential parcels built in 2022). Data was joined with the travel model TAZs to identify zones with at least 50 residential units built since 2010. [process for jobs??].

Weld (~2022): Identified estimated residential number per parcel: triplex = 3, duplex = 2, multiple 4-8 = 6, multiple with 9+ = residential square feet divided by 2,000 (conservative / accounts for communal space), single family (many variations), townhouse, manufactured housing, condo units = 1. 70 TAZs in Weld had residential development exceeding 50 residential units (with estimated # of units applied to each parcel).

Larimer (circa 2017) – Occdesc. multiple 4-8 = 6, multiple with 9+ = imptotalsf divided by 2,000 (conservative / accounts for communal space) (may include some commercial space?? Not clear what "SF" is compared to "IMPTOTASF"),

Parcel data was also filtered to identify commercial developments between 2011 and 2021, with a simplified classification to reflect potential number of jobs per commercial square foot sourced from the EIA (https://www.eia.gov/consumption/commercial/data/2018/bc/html/b1.php) for Weld County. For larimer county, simplified further to 886 sq ft/worker for all commercial building types.

Parcel data for new res/commercial since 2011 was spatially joined to TAZ to obtain total # of new resi/comm space since 2011 per TAZ.

The LEHD data at the U.S. Census Bureau is a quarterly database of jobs covering over 96% of employment in the United States. The core jobs data is state unemployment insurance (UI) wage records collected via a voluntary federal-state data sharing partnership. These job records are then supplemented with Census Bureau surveys and other federal agency administrative records to supply additional information on the characteristics

of workers and employers. This linked employer-employee data for the U.S. is the source data for Census Bureau's Quarterly Workforce Indicators (QWI), LEHD Origin-Destination Employment Statistics (LODES), and Job-to-Job Flows (J2J). More information about the LEHD data is available in Abowd et al. (2009).

Private-industry employment : Covered private-industry employment in the LEHD data includes most corporate officials, all executives, all supervisory personnel, all professionals, all clerical workers, many farmworkers, all wage earners, all piece workers, and all part-time workers. Workers on paid sick leave, paid holiday, paid vacation, and the like are also covered. Workers on the payroll of more than one firm during the period are counted by each employer that is subject to UI, as long as those workers satisfy the definition of employment (see below). Workers have UI wages filed in every quarter they are covered.

Notable exclusions from UI coverage among private sector employers are independent contractors, the unincorporated self-employed, railroad workers covered by the railroad unemployment insurance system, some family employees of family-owned businesses, certain farm workers, students working for universities under certain cooperative programs, salespersons primarily paid on commission, and workers of some non-profits. States have some leeway in designating coverage; for a complete list, see the coverage section of the most recent Comparison of State UI laws.

State and local government employment: Covered employment in the LEHD data includes most employees of state and local governments with the exception of elected officials, members of a legislative body or members of the judiciary, and some emergency employees.

Federal government employment: Federal government workers are not covered by state UI. LEHD uses data from the Office of Personnel Management (OPM) to generate earnings and employment histories for federal workers. The OPM data covers most federal employees but excludes White House officials, members of Congress, and certain national security agencies, which are excluded for security reasons. Members of the armed forces and the U.S. Postal Service are also not covered in OPM data. The OPM data has coverage for 2000-2015.

https://lehd.ces.census.gov/data/veo_experimental.html

2019 Base Year

Households:

- Used 2020 occupied housing units from the 2020 census redistricting data (PL-94-171). Added an acre field using the NFR's favorite projection (NAD 1983 HARN StatePlane Colorado North FIPS 0501)
- Intersected with 2010 blocks within the v2 model area, including the "sum_area" attribute from UrbanSim which identifies the land area per the 2010 census geographies
- Calculated percent of 2020 block area within the intersected geography
- Multiplied percent of 2020 block area by the 2020 occupied housing units to determine est. hh per block intersection
- Reviewed the intersected geographies with 0 land area according to 2010 blocks (sum_area = 0) and at least 10 hh per the above calculation (marked with a flag of 1). Shifted those HH out of the water-only 2010 blocks and into an adjacent block with land. For geographies with less than 10 HH, those were simply subtracted from the geography without adding back.
- Created a final HH est that combined the first estimate with the shifted amount.
- Dissolved the shapefile using the 2010 GeoID as the unique attribute and summing the final HH est.
- Compared sum of the final HH est. to the 2019 control total (as adjusted for northern weld). The adjusted SDO control was 1.448% lower (225,037 vs 221,779).

- Multiplied the final HH est. in each block by (1-0.01448), then rounded the results. The rounded results were too high by 727 households, so subtracted 1 household from the 727 blocks with the most households.
- Provided the resulting HH estimate to urbansim for incorporation into the model. UrbanSim staff used random sampling to add/subtract HH and persons from blocks until HH counts were matched.

Short-term constraint on employment – even though it probably doesn't matter, I pulled the job spaces per acre variable from a recent run (2019 output), joined it to the HH constraint shapefile, and converted it from jobs space/acre into FAR using formula below. (Note: zoning constraint attribute names must be lower case)

To convert FAR into jobs per acre, multiply FAR by 43,560 and divide by 1,000 (e.g. FAR of 1 is 43.6 jobs per acre).

To convert jobs per acre into FAR, multiply by 896 and divide by 43560.

Employment

Cambridge procured 2019 DataAxle data, reviewed it against 2018 Q1 QCEW data provided by NFRMPO, and made a very few changes based on the QCEW review. The data was formatted to fit the input required by UrbanSim (individual row for each job, identifying the block and industry). UrbanSim then adjusted the model code to pull in the 2019 jobs data when running a simulation. Any control total to 2019 will not be applied.

- To be determined: scale down employment control totals for 2020 and beyond? Scale up data axle data? Use data axle without any scaling?

Constraints as of 6/2/2023 (improve formatting of table below for documentation, suggest adding a separate table to identify the date of each community's file, per the "Land Use Plan Tracker" spreadsheet)

Community	Category	zoning	Max DUA	Max FAR
Berthoud		Be_Ag	0.2	0
		Be_D	0	0
		Be_Inno	0	2.0999999
		Be_Nat	0	0
		Be_OTR	0	0
		Be_RR	0.2	0
		Be_SB	0	2.0999999
		Be_SR	14.5200005	0
		Be_UR	49	0.25

Eaton	Ea_CI	0	0.6
	Ea_MU	15	0.35
	Ea_NT-Res	4.5	0
	Ea_OT-Res	6.5	0
	Ea_Park	0	0
	Ea_PU	0	0
	Ea_S-Res	2.5	0
	EP_Acc	0	1
Estes Park	EP_D	2	2.5
	EP_I	0	1
	EP_MRN	10	0
	EP_MU	2	2.5
	EP_NV	4	0
	EP_P	0	1
	EP_SE	2	0
Evans	Ev_Ag	0	0
	Ev_C	0	2
	Ev_Es	1	0
	Ev_I	0	0.5
	Ev_MU	5	0.5
	Ev_OS	0	0
	Ev_Res	16	0
Fort Collins	FC_Campus	0	0
	FC_D	40	12
	FC_Emp	20.7000008	6
	FC_Flex	20.7000008	6
	FC_I	0	3
	FC_MN	3.2	0.02
	FC_N-MU	5	1
	FC_P	0	0
	FC_RR	2	0.01
	FC_Sep	0	0
	FC_SR	5	0.01
	FC_Sub-MU	12.3000002	0.5
	FC_Urb-MU	5	4
Gilcrest	Gi_AG	1	1
	Gi_DMU	12	1.5
	Gi_E	0	1.5
	Gi_HDR	12	1
	Gi_LDR	3	1
	Gi_MDR	8	1
	Gi_NC	0	1

	Gi_NC		
	NC	0	1
	Gi_OS	0	0
	Gi_PF	0	1
	Gi_RC	0	1.5
Greeley	Gr_AP	0	0.3
	Gr_BL	0	0
	Gr_CS	2	0
	Gr_DT	20	2
	Gr_E-I-C	10	0.3
	Gr_ECC	0	0
	Gr_EDU	1	0.5
	Gr_LU	20	0.5
	Gr_MU	20	2
	Gr_MUHI	20	2
	Gr_NAA	0.1	0
	Gr_RL	0	0
	Gr_RU	2	0.3
	Gr_SUB	10	0
	Gr_UR	0	0.3
Johnstown	Jo_G	0	0
	Jo_HD	20	3.5
	Jo_LD	10	2.0999999
	Jo_MD	16	2.8
	Jo_VLD	2	0
Larimer County	LC_ORR1	0.0048	0.01
	LC_Other	0.0675	0.05
Loveland	Lo_CAC	16	3
	Lo_CC	16	2
	Lo_DAC	16	2
	Lo_DR	0	0
	Lo_E	16	1.5
	Lo_ER	2	0
	Lo_HDR	20	0.75
	Lo_I	0	1
	Lo_LDR	4	0.01
	Lo_MDR	10	0.01
	Lo_NAC	16	0.5
	Lo_OS	0	0

	Lo_POL	0	0
	Lo_PQP	0	0.5
	Lo_RAC	10	2
Mead	Me_Ag	0.4	0
	Me_BP	0	0.3
	Me_CMU	14	0.3
	Me_CR	4	0
	Me_DMU	14	0.3
	Me_LLR	1	0
	Me_MF	14	0
	Me_MU-RC	14	0.1
	Me_P	0	0.3
	Me_PI	0	0.7
	Me_POS	0	0
	Me_RC	0	0.3
	Me_RMU	14	0
	Me_RR	0.4	0
	Me_SFR	4	0
Milliken	Mi_AG	0.66	0
	Mi_BI	0	1
	Mi_CMU	12	1
	Mi_DT	20	2
	Mi_ER	0.05	0
	Mi_GW	0	0
	Mi_PR	0	0
	Mi_PUB	0	1
	Mi_RN	5	0
	Mi_UR	0	0
Severance	Se_DN	8	2.0999999
	Se_RR	0.4	0
	Se_S	2	0.01
	Se_TC	15	2.0999999
Timnath	Ti_C	0	1
	Ti_DC	6	2
	Ti_HD	24	1.5
	Ti_LD	4	1
	Ti_MD	16	1.5
	Ti_MU	16	2
	Ti_OS	0	0.5
	Ti_RR	1	0.15
Weld County	WC_Mix	0.5	0.01
	WC_NU	0.25	0.01
	WC_Opp	0	2.5

	WC_R	0.057	0.005
	WC_R-Con	0	0
	WC_U	1	0.01
Wellington	We_Ag	6	2
	We_C	0	1
	We_D	12	2
	We_DN	12	1
	We_I	0	1
	We_LD	6	0
	We_LDE	3	0
	We_MD	12	0
	We_MU	12	1
	We_POS	0	0
	We_PU	0	2
Windsor	Wi_CBD	2	2
	Wi_CS	0	0
	Wi_EC	0	1
	Wi_HDESFR	2	0
	Wi_HI	0	0.5
	Wi_LDESFR	2	0
	Wi_LI	0	0.5
	Wi_MFR	10	0.5
	Wi_NGC	0	1
	Wi_Null	0	0
	Wi_OPUB	0	1
	Wi_POSF	0	0
	Wi_RMU	6	1
	Wi_SCHL	0	1
	Wi_SFR	4	0
Larimer County	LC_ORR1_RNP	0.0048	0.00002
National Park / Grasslands	PNG; RMNP	0	0
Larimer County	LC_Other_RNP	0.0675	0.00002