Appendix B

LAND USE DOCUMENTATION & PLANNING ASSUMPTIONS

Land Use Assumptions

The Spokane Regional Transportation Council (SRTC) tracks and forecasts land use for a variety of long-range planning functions. These include travel demand modeling, scenario development, capital investment prioritization, freight planning, subarea analysis, and comprehensive plan amendment certification. At a minimum, SRTC updates its land use with each metropolitan transportation plan (MTP) update, to incorporate the most recent base year data and align the forecast with the MTP planning horizon year. This section describes SRTC's 2019 land use update. It starts with an overview of SRTC's land use geographies and categories. Next, an overview of the 2019 base year is provided, detailing data sources, adjustments, and quality control measures taken. This is followed by a summary the process used to forecast land use through this update's 2045 horizon year.

SRTC Land Use Geography

SRTC's tracks and forecasts land use data for its Metropolitan Planning Area (MPA), which consists of Spokane County in its entirety. Land use data is aggregated to transportation analysis zones (TAZ), which are the primary units of analysis in the SRTC travel demand model. SRTC also uses Transportation Analysis Districts (TAD), which are aggregations of TAZs that capture areas with similar characteristics. **Figure B.2** shows the SRTC MPA's TAZs and TADs.

SRTC Land Use Categories

Land use data is grouped into twelve different categories, most of which classify population and employment. Hotels and commuter students are also included. One of SRTC's primary reasons for classifying land use is to capture the travel behavior differences between these categories in its travel demand model. SRTC's land use categories are shown in **figure B.1**.

Figure B.1: SRTC Land Use Categories

Code	Description	Land Use Type	Measure
LU1	Single-family, duplex, triplex, manufactured or mobile home	Population	Housing units
LU2	Four our more residential units on a single parcel	Population	Housing units
LU3	Hotel, motel, or campsite	Other	Rooms/campsites
LU4	Agriculture, forestry, mining, industrial, manufacturing, wholesale	Employment	Employees
LU5	Retail trade (non-central business district [CBD])	Employment	Employees
LU6	Services and offices	Employment	Employees
LU7	Finance, insurance and real estate services (FIRES)	Employment	Employees
LU8	Medical	Employment	Employees
LU9	Retail trade (CBD)	Employment	Employees
LU10	College and university commuter students	Other	Students
LU11	Education employees (K–12)	Employment	Employees
LU12	Education employees (college and university)	Employment	Employees

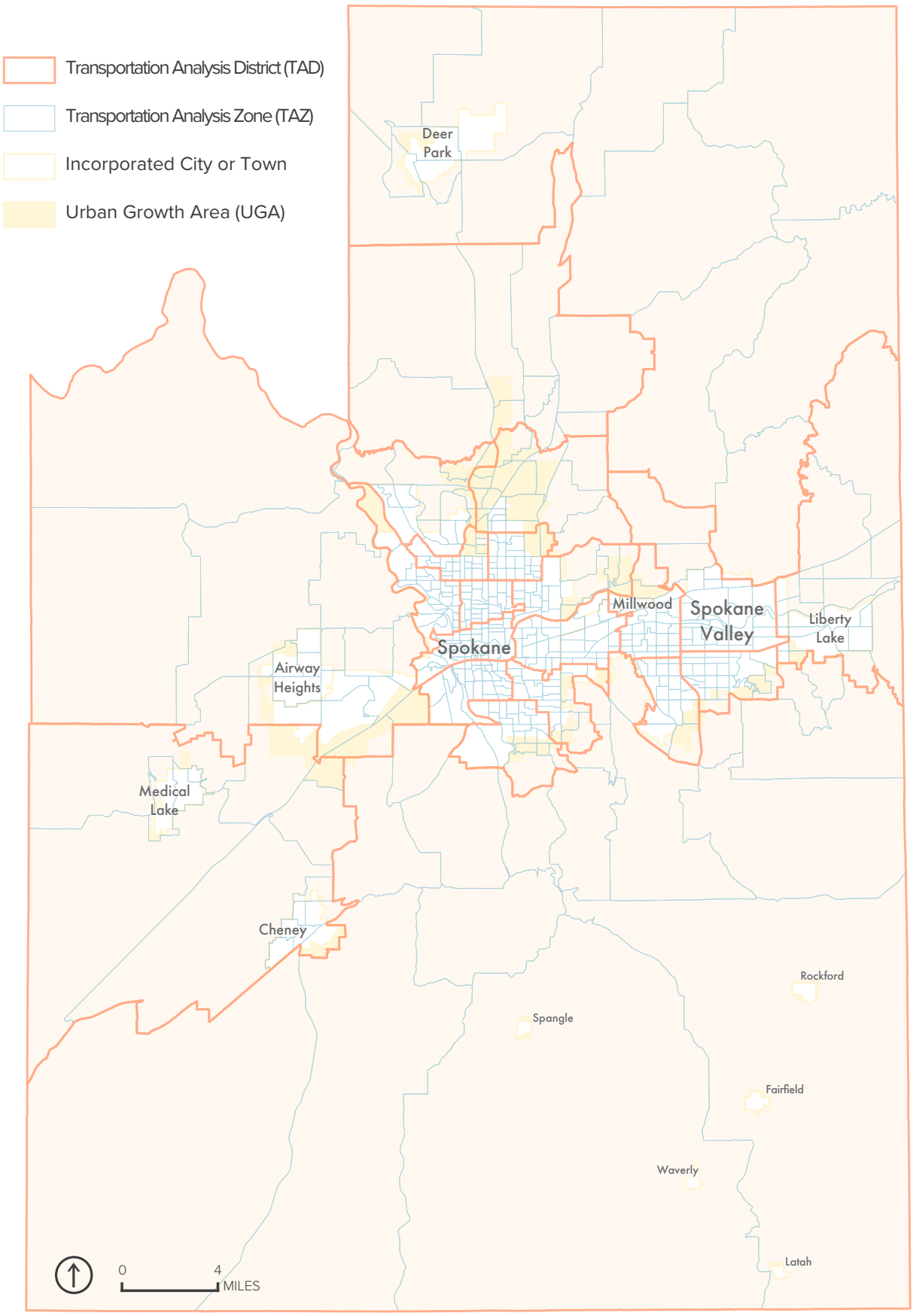

Figure B.2: SRTC's TAD and TAZ Geographies

2019 Base Year Land Use

SRTC's base year land use data provides a foundation for its long-range planning and forecasting efforts. It is an inventory of existing conditions and is used to evaluate the interaction between land use and transportation in the region. This section discusses the data inputs SRTC uses, as well as the adjustments and validation measures taken by SRTC staff to ensure the data's accuracy.

Base Population

SRTC currently tracks population via occupied single-family and multifamily housing units (HU). LU1, SRTC's single-family housing unit (SFHU) category, includes all units in structure containing less than three units. This includes attached and detached SFHUs, mobile homes and duplexes. LU2 is used for multifamily housing units (MFHU). It includes all units in structures containing three or more units (e.g. triplexes, quadplexes, apartment buildings, condominiums, et cetera). Group quarters, which include college and university dormitories, are not currently included in SRTC's land use data. **Figure B.3** shows SRTC's 2019 base year totals for LU1 and LU2.

Population Data Sources & Considerations

SRTC collects population data from a variety of sources. These include: (1) decennial census counts, (2) parcels from the Spokane County Assessor's Office, (3) SRTC's own regional building permit database, and (4) the Office of Financial Management's (OFM) Small Area Estimates Program (SAEP). Additionally, SRTC's previous land use updates are used to validate and adjust figures, as needed. This section briefly describes how SRTC uses data from each of these sources in its land use.

2010 Census & OFM SAEP Data

SRTC uses the most recent decennial census as a base for population land use. For the 2019 update, that was the 2010 Census. Decennial census data is not available at the TAZ level, but HU counts are available at the Census Block level. SRTC's TAZ boundaries generally align with Census Blocks. In order to account for situations where this is not the case, SRTC used SAEP data, which interpolates 2010 Census data to TAZ boundaries.[1]

With the elimination of the long-form questionnaire following the 2000 Census, decennial censuses no longer provide distinct counts for SFHUs and MFHUs. The Census Bureau now provides data on HUs by units in structure via American Community Survey (ACS). ACS data is not available for Census Blocks. Additionally, it is often unreliable for small geographic areas, like Block Groups and Tracts.[2] For these reasons, SRTC staff determined ACS data was not a suitable option for assigning SFHU and MFHU totals to TAZ.

Spokane County Assessor Parcel Data

The 2010 Census' lack of SFHU and MFHU counts made it necessary to find an alternative for this information. After evaluating various data sources, SRTC staff determined the Spokane County Assessor's Office's parcel data to be the best available option. Assessor's Office staff provided SRTC with a dataset containing XY coordinates for all Spokane County parcels. Parcels with one or more structures present were generally assigned coordinates located on, or near, the primary structure. This data was also attributed with three-digit use codes and a field indicating the presence of a dwelling unit on the parcel.

Assessor's Office staff informed SRTC that their parcel data's tracks SFHUs more accurately than MFHUs. This is because parcels with MFHUs often lack information regarding the number of individual units. For this reason, SRTC only used this data to estimate the number of SFHUs in a TAZ. This number was then subtracted from a TAZ's total housing units to derive a MFHUs estimate. The next section describes this process in more detail.

SRTC Regional Building Permit Data

SRTC's maintains a database of regional building permits, which is updated annually with data from local jurisdictions. The

1 More information on the interpolation methods used by OFM is available in its SAEP User Guide.

2 More information regarding these issues can be found in the ACS User Guide for State and Local Governments.

Figure B.3: 2019 Base Year Population Land Use Category Totals

Code	Description	2019 Occupied Housing Units	Percent of Total
LU1	Single-family, duplex, triplex, manufactured or mobile home	155,442	73%
LU2	Four our more residential units on a single parcel	51,938	27%
Total		**207,380**	**100%**

data identifies whether the permit is for a SFHU or MFHU, as well as the number of units. SRTC used this data to capture new housing added from 2010 through 2019.

Population Data Processing

Estimating 2019 base year LU1 and LU2 figures for TAZs was a multistep process, utilizing the various data sources listed in the previous section. First, 2019 total HUs we estimated using the following basic equation:

Total HUs=2010 Census HUs+Building permits finaled from 2010 through 2019[3]

Next, SRTC determined which parcels from the assessor data contained SFHUs. SFHUs were then subtracted from total HUs to derive an estimate of MFHUs. Once SFHU and MFHU estimates were established, SRTC applied 2019 occupancy rates at the TAZ level from the SAEP data MFHUs to arrive at the final LU1 and LU2 figures used in SRTC's travel demand model. Within these basic steps, multiple adjustments were made to account for intricacies in the data. The remainder of this section describes these adjustments.

OFM Estimates Comparison & Adjustments

SRTC compared its initial 2019 total HU estimate to OFM's 2019 SAEP estimate. When OFM's estimate was over 10 percent higher than SRTC's, SRTC's estimate was replaced with the SAEP estimate.[4]

Identifying Single-Family Housing Units

SRTC used the three-digit use code in the assessor data to determine if a parcel contained a structure categorized as a SFHU by SRTC. Attributes indicating the presence of a dwelling unit and whether the parcel was flagged as residential or commercial by the Assessor's Office were also used to help determine the presence of a SFHU.

Duplexes and Mobile Home Parks

Duplexes are grouped in LU1 with SFHUs, but they were only identified by a single point in the assessor data. These points were multiplied by two in SRTC's final tally. Mobile homes are also included in LU1. They are generally—but not always—shown as a single record in the assessor data. However, Spokane County also maintains a layer named MobilePoints in its ArcSDE geodatabase. This layer was used to identify the total number of units in each mobile home park.

Identifying Multifamily Housing

Once SFHUs were estimated using the assessor data, they were subtracted from the total HU estimate to derive an estimate of MFHUs in each TAZ. This calculation resulted in a negative number of MFHU in some TAZ. Given the total housing unit estimate's alignment with OFM's estimates, this is likely due to error in the SFHU count from the in data. This issue was resolved by adding MFHUs from building permits finaled after 2015 to the MFHU estimate from SRTC's previous land use update, which was completed with a 2015 base year. This resulted in a new MFHU estimate in these TAZ. This was subtracted from the estimated HU total to estimate the number of SFHUs in these TAZ.

Base Employment

SRTC's employment land use is grouped into eight categories, which are included in **figure B1**. These are aggregates of North American Industry Classification System (NAICS) 2-digit sector codes. Retail employment is split into two categories, based on whether it is in the region's central business district (CBD). Figure 1 shows the CBD's boundary which, for SRTC land use purposes, aligns to TAZ boundaries.

Employment Data Sources

As with population, SRTC relies on various data sources for base year employment. These include: (1) Employment Security Department (ESD) Unemployment Insurance Data (UI Data), (2) ReferenceUSA business data, and (3) the Census Bureau's Longitudinal Employer-Household Dynamics (LEHD) data. SRTC's previous land use updates are also used to validate and adjust figures, as needed. This section briefly describes how SRTC uses data from each of these sources in its land use.

ESD UI Data

SRTC evaluated a variety of employment data sources and found ESD's UI Data to be the most accurate by a significant margin. For this reason, it is SRTC's primary source for base year employment. For the 2019 land use update, SRTC used an establishment's mean employment for the second quarter of 2019.

3 Only residential permits finaled after April 1, 2010 are added to avoid double counting, since Census Day is April 1.

4 Generally, OFM and SRTC estimates were closely aligned. Several TAZ did contain significant differences. SRTC spot checked several TAZ via aerial photos and found multiple instances where either SRTC or OFM failed to capture recent residential development. For this reason, SRTC elected to use the higher estimate when the estimates were significantly different. The 10 percent threshold used is the SAEP data's mean absolute percentage error for Census Block Groups, which are comparable to TAZ.

UI Data has substantial confidentiality requirements. Prior to sharing summarized data with any outside parties, SRTC must ensure that any groupings include at least three employers and that no single employer account for more than 80 percent of employment. SRTC moved several employers to neighboring TAZ to comply with this requirement. Additionally, a few of the region's largest employers accounted for more than 80 percent of employment in their respective TAZs. ESD data for these employers was replaced with employment figures from either publicly available sources, or the employers directly.

LEHD Origin-Destination Employment Statistics & ReferenceUSA Data

The Census Bureau's LEHD Origin-Destination Employment Statistics (LODES) data was used to verify and validate UI Data. The most recent release at the time of the 2019 land use update, LODES 7.4, contains employee counts from 2002 to 2017. They are grouped by NAICS code at the Census Block level. SRTC also used its 2018 ReferenceUSA's business dataset, which contains point-level employment data, to verify and validate UI Data.

Employment Data Processing

While UI Data was deemed the best source of employment data, a significant amount of staff research was required to ensure an acceptable level of accuracy at the TAZ level. This included: (1) assigning SRTC land use categories to the data; (2) reviewing the locational accuracy of the dataset; (3) reviewing and verifying major employer employee counts; and (4) removing duplicate records to avoid double counting.

SRTC Land Use Assignment

SRTC assigned UI Data employees to its land use categories based on their NAICS codes, which are included in UI Data. **figure B.4** shows employment by land use category.

Locational Accuracy Review

SRTC performed an extensive review of employment locations throughout the county to account for inaccuracies in UI Data. In this process SRTC found over 1,000 employer records with null geographic information. Additionally, the dataset contained several spots where large numbers of employers were placed at the same point. These were scatted throughout the county's rural areas, in locations where it was clear no employment was present.

SRTC geolocated null and inaccurate data UI Data in ArcGIS with an updated address location, which utilized Spokane County's most recent address data. SRTC was unable to geolocate several small employers based on their addresses—all these employers had less than three employees. These employers were located at their ZIP Codes' centroids.

Major Employer Review

SRTC verified all employers with more than 250 employees at a single location. Additionally, SRTC requested employee counts, by location, from the region's school districts, colleges, and universities.

Additional Assumptions

While SRTC attempted to contact all major employers, some were either unresponsive or unwilling to provide the requested data. In these cases, SRTC made assumptions regarding employment using the best data available from publicly available sources, ReferenceUSA, and SRTC's previous land use updates.

Figure B.4: 2019 Base Year Employment Land Use Category Totals

Code	Description	2019 Employment	Percent of Total*
LU4	Agriculture, forestry, mining, industrial, manufacturing, wholesale	53,016	23%
LU5	Retail trade (non-central business district [CBD])	59,998	26%
LU6	Services and offices	46,499	20%
LU7	Finance, insurance and real estate services (FIRES)	12,820	6%
LU8	Medical	30,028	13%
LU9	Retail trade (CBD)	7,648	3%
LU11	Education employees (K–12)	12,241	5%
LU12	Education employees (college and university)	6,309	3%
Total		**228,559**	**100%**

*Numbers may not add up due to rounding.

Other Land Use Categories

In addition to population and employment, SRTC tracks hotel and motel rooms—including campsites—and higher education commuter students. This is done with Washington State Department of Health (DOH) Transient Accommodations data.

Higher education commuter student data was obtained directly from the colleges and universities. **Figure B.5** shows the totals for these land uses.

Figure B.5: 2019 Base Year Hotel/Motel and Commuter Student Land Use Category Totals

Code	Description	2019 Occupied Housing Units	Percent of Total
LU3	Hotel, motel, or campsite	7,860	20%
LU10	College and university commuter students	30,791	80%
Total		**38,651**	**100%**

2045 Land Use Forecast

As the metropolitan planning organization (MPO) for the Spokane region, SRTC is federally required to forecast transportation and land use conditions over at least a 20-year planning horizon.[5] State law requires these forecasts to be consistent with local growth assumptions.[6]

SRTC coordinates with local jurisdictions to ensure consistency, however, its forecasts are not identical to those produced by local jurisdictions. There are two primary reasons for this: (1) to meet its federal requirements, SRTC forecasts to a different horizon year; and (2) to effectively project future transportation conditions, SRTC forecasts future growth at the transportation analysis zone (TAZ) level. Forecasts adopted by the Spokane County Board of Commissioners allocate their growth to the jurisdiction level only.

Population Forecast

SRTC's population forecast methodology consists of four primary steps: (1) establishing the population control total, (2) determining population capacity, (3) identifying recent and planned development, and (4) allocating population growth. This section details the methods SRTC used to complete these steps.

Establishing the Population Control Total

The countywide control total is the 2017 Growth Management Act (GMA) medium series projection for Spokane County, from the OFM.[7]

Determining Population Capacity

SRTC compiled the latest parcel-level land quantity analysis (LQA) data from jurisdictions that had recently completed LQAs. This data was used to determine capacity in these jurisdictions. SRTC then performed a capacity analysis based on the methods described in the Department of Commerce's Buildable Lands Guidelines, for jurisdictions that did not have parcel level LQA data available. This utilized data from Spokane County's GIS and Assessor parcel data, as well as zoning and land use data from local jurisdictions. It consisted of the following steps:

Technical Annotation

This annotation is a technical companion to the draft small area land use forecasts generated for SRTC for the 2045 horizon year.

The conceptual approach outlined in the methodology document at left was adhered to in the creation of all projections in the draft forecast. However, the application of that methodology involves detailed steps that may not be obvious to a technical audience attempting to recreate or modify any of the involved projections.

These annotations summarize any data sources, assumptions, definitions, calculations, or other process steps required to translate the conceptual methodology into the spreadsheet deliverable, but not spelled out in the approved methodology.

Base Year

The nominal base year of 2019 is also the latest year of available public-source data. One exception: the SAEP estimates provided by OFM also include an estimate for 2020 population at the TAZ level. These 2020 population estimates were included in calculations for model-based projections, but reporting for population-based residential land uses (LU1 and LU2) maintains 2019 as the nominal base year for consistency across land uses.

Horizon Year

All land use quantities are projected to a horizon year of 2045. Intervening years (2021, 2022, 2023, et cetera) are included in the deliverable spreadsheet as part of the calculation of model-based population projections but should not be considered official projections. Only 2019 and 2045 entries are part of the official draft projections for this forecast.

5 This requirement is described in 23 CFR § 450.324.

6 This requirement is described in WAC 468-86-110.

7 SRTC will use the medium series 2045 Spokane County population from OFM's 2017 supplemental GMA county projections.

1. Identifying vacant and under-utilized land.
    - Parcels not containing a structure valued over $5,000 were classified as vacant.[8]
    - Parcels in the Urban Growth Area (UGA) with an improvement to land value ratio under 1:1 and zoned to allow for high density residential were classified as under-utilized.[9]
2. Removing land that is unsuitable for development.
    - 20 percent of land was removed for utility and road rights of way on parcels larger than five acres.
    - Physical barriers that limit development were removed. These included (1) wetlands and 100-foot wetland buffers; (2) geologically hazardous areas and steep slopes of over 30 percent; and (3) protected open space.

Unlike local LQAs, SRTC does not directly apply a market factor to calculate capacity. This is due to the logistic growth model used to allocated growth to TAZs. The model decreases growth rates as available resources (i.e. developable land) decrease.[10] The purpose of market factors used in local LQAs is to account for the percentage of developable land is likely to remain undeveloped over the course of a planning period due to fluctuating market factors. Because the logistic growth model reduces growth rates as the supply of land decreases, it is essentially accounting for the same fluctuating market factors.[11] Applying a market factor in addition to the logistic growth approach would over count the land that is likely to remain undeveloped during the planning period. The logistic growth model is explained in more detail later in this section.

Identifying Recent & Planned Development

Prior to distributing growth to TAZs, local jurisdiction staff was given the opportunity to identify developments that had either: (1) recently occurred and was not captured in the base year data or (2) was approved or in process. SRTC also incorporated any existing market-based forecasts from subarea plans and studies. For a proposed development or forecast to be included, jurisdictions were required to submit documentation supporting the proposal (i.e., recorded plats, building permits, et cetera).

Distributing Population Growth to TAZ

Once recent and planned development was added, SRTC utilized a logistic growth model to distribute growth among TAZs. TAZ capacities and growth from 2003 to 2019 were used as the model's inputs. The logistic growth function was applied to TAZ, resulting in TAZ growth rates diminishing as their populations approached their capacities. This was done by identifying the theoretical unconstrained growth rate (r–max) of the population (P) and reducing it as capacity (K) decreased. R–max was determined by fitting the logistic growth equation to the geography's historical growth. The following formula was used to determine a given geography's growth rate:

$$r\text{-}max\left(1-\frac{P}{K}\right)$$

Employment Forecast

Like the population forecast, SRTC's employment forecast consisted of four primary steps: (1) establishing the countywide employment control total, (2) determining employment sector growth, (3) identifying recent and planned development, and (4) allocating employment growth. This section details the methods SRTC used to complete these steps.

Establishing the Employment Control Total

Although the forecast assumes job growth moving in proportion to population growth across TADs, it was determined that the countywide total job growth rate may be moderately faster than for population. This determination was supported by two main points:

- ESD's long-term 10-year forecast for calls for 1.14 percent total job growth annually, while the GMA medium series county projections forecast population growth of just 0.83 percent over the same period.
- Census LEHD data on commuting patterns shows a clear historical trend towards an increasing share of jobs in Spokane County being filled by workers residing outside the county (resulting in a rising ratio of jobs-to-population).

8 $5,000 was selected as the threshold for identifying vacant land in response to subject matter expert (SME) team feedback suggesting that SRTC should be aggressive in identifying vacant land.

9 This is in response to SME team input regarding the importance of accounting for redevelopment. An Improvement to land value ratio of 1:1 has been selected based on the methods described in the Department of Commerce's Buildable Lands Guidelines (2018).

10 More information on logistic growth can be found HERE.

11 More information on market factors and their intended purpose can be found in the Department of Commerce's Buildable Lands Guidelines.

Although SRTC did not conduct the same capacity-constrained logistic modeling for employment as for population, the forecast does assume the annual job growth rate will decline after year 10, to parallel the gradual flattening of growth over time used in the population projections. Over the full 2019 to 2045 time frame, jobs are projected to increase at an overall effective annual rate of 0.93 percent.

Computing Model-Based Population Growth

For each TAZ, the population capacity, K, is assumed to be the greater of:

- The estimated remaining population capacity (provided by jurisdictions or determined by SRTC as described in 2.2), added to the 2019 estimated population, or
- The maximum historical population (to avoid cases where capacity has been clearly underestimated because it's been exceeded already).

To avoid later division-by-zero errors, this result is multiplied by 1.01. Capacity, K, is assumed constant for historical years (in estimating k), but is allowed to grow by 5% in total between 2020 and 2045 (or 0.2% annually), allowing for future zoning of land currently assumed undevelopable.

Using SAEP historical population data from 2000 to 2020, we estimate the theoretical unconstrained population growth rate: r-max (called k in the full spreadsheets) as follows:

- For each historical year (2000-2019), take the ratio of the standing population to the remaining capacity, or P/(K-P),
- Compute the natural log of each ratio,
- Estimate k as the slope of that series of natural logs (using Excel's SLOPE function)
- Replace any zero estimates of k with 0.01 (again, to avoid later div-by-0 errors)

Then, for each year from 2020 to 2045, compute the projected population, P1, as the prior year's population, P, times 1 plus the unconstrained growth rate, k, reduced by the ratio of remaining population capacity (K-P) to the total capacity, K. Or, as a formula:

$$P1=P(1+k)* (K-P)/K$$

The formula in is somewhat more complicated in the provided calculation spreadsheet because of the assumption allowing capacity, K, to gradually increase annually throughout the projection years.

Again, although each intervening year is used in the model-based calculations only the 2045 estimate is considered as a official output of this forecast.

Incorporating Market-Based Growth Projections and Pipeline Development

Recently-completed market studies provided alternative population projections for study areas covering 72 of the region's 607 TAZs. For each of these TAZs, this forecast assumes a 2045 population equal to the greater of the model-based projections or the market-based projection. In most cases, the market-based projections resulted in higher 2045 population estimates.

Similarly, future population resulting from pipeline development (defined in a previous annotation) for a given TAZ is considered as a minimum 2045 projection in the same fashion as for TAZs covered in the market-based . For TAZs in which pipeline development exceeded model-based projections substantially (by 60 or more), we add the difference in 2045 population (pipeline minus model-based) to the Excel column for 2019-2045 market-based growth.

Allocating Projected Population Growth to LU1 and LU2

This forecast used an assumption that the allocation of future population growth across LU1 and LU2 for each TAZ would be influenced and predicted by three factors, each given equal weight in calculations:

- The standing share of occupied LU1 units relative to LU2 units for that TAZ
- The shares of LU1 and LU2 across recent (2008-2018) development
- The shares of LU2 and LU2 across any pipeline development.

Average Persons per Household

	City of Spokane	Outside City of Spokane
LU1	2.52	2.74
LU2	1.64	1.79

Once those relative shares were estimated, we used 2018 ACS 5-year estimates of household sizes by number of units in structure for Spokane County and the city of Spokane to assign population to households (occupied housing units) for each land use, per the table on the right.

Adjusting to Match Countywide Population Growth Control Total

Of the calculations and assumptions shown above, only minor manual adjustments were needed to ensure that TAZ population projections matched the GMA medium series control total. Using the model (along with market-based adjustment) assuming a constant future population capacity, K, yielded summed growth results 8-10% below the control total. By allowing a reasonable, gradual 5% increase in assumed capacity over the forecast period, the gap was reduced to 1-2%.

The remaining difference between adjusted model projections and control total was bridged by identifying TAZs where pipeline growth exceeded model-based growth and increasing 2045 projections accordingly. Applying that last adjustment to TAZs where the delta between model and pipeline population exceeded 60 was able to bring the TAZ growth total population to within 7 of the control.

Any changes to forecast data (in response to jurisdiction feedback, for example) should be accompanied by additional adjustments to ensure the TAZ total is approximately equal to the control total. Either method described above should be used: a) increasing the assumed future growth in K, or b) further tightening the threshold for making manual increases to the market-based 2045 estimate for TAZs where pipeline growth exceeds model-based growth.

Determining Employment Sector Growth

SRTC's employment land use is divided into eight sections, which are based on NAICS codes. These are shown in **figure B.1**. Each sector was allocated a share of growth based on ESD's long-term occupational projections for Spokane County.

Identifying Recent & Planned Development

As with population, local jurisdiction staff were given the opportunity to identify developments that had either: (1) recently occurred and were not captured in the base year data or (2) were approved or in process. SRTC also incorporated any existing market-based forecasts from subarea plans and studies. For a proposed development or forecast to be included, jurisdictions were required to submit documentation supporting the proposal (i.e., recorder plats, building permits, et cetera).

Distributing Employment Growth

SRTC distributed employment from the county control total to TADs, as opposed to jurisdictions, because employment growth trends do not necessarily follow jurisdiction boundaries. TADs are aggregations of TAZs that have been grouped to capture areas with similar economic characteristics. They are shown in **figure B.2**.

TAD employment allocations were determined based on historical growth rates, by sector. These were derived from the U.S. Census Bureau's LEHD Origin-Destination Employment Statistics (LODES) dataset. This data is available from 2002 through 2017 and will be aggregated to TADs. The trend data was fitted to countywide control totals.

Recent Development

Recent development (permitted in 2018) is assumed to be already included in the 2019 base year estimates by LU category.

Pipeline Development

Data provided on planned and improved development was incorporated into a new variable called "pipeline development" weighted to assume 100% of approved units and 50% of planned units will occur. This variable is used in steps described below.

Assigning Industry Sector Growth to SRTC Land Uses

The ESD's long-term forecasts use industry sector categories that do not exactly match the SRTC land use categories. To reflect the different expected growth rates across industry groupings, forecast calculations had to estimate the shares of each ESD sector (mostly 2-digit NAICS codes) to apply to each LU category. While this step was informed by a detailed "crosswalk" table of which 6-digit NAICS codes are contained in each LU category, that table does not include job quantities. Since many LUs include jobs from multiple 2-digit sectors, the exact proportions had to be estimated in many cases. The full calculation spreadsheets include formulas to reflect those proportion assumptions.

Unlike employment-based LUs, growth in commuter student population (LU10) was informed by projections supplied by those institutions for both countywide totals and TAD allocation.

Market-based Projections and Pipeline Development

As with the population forecast, we combined projections from recent market studies (converted to LU employment estimates) and planned/approved project data from jurisdictions to adjust model-based projections for TADs in cases where market-based and/or pipeline growth exceeded model predictions.

Allocating Land Use Growth Across TADs

Once the countywide growth totals for each industry-based LU was determined based on the above exercise, we used historical LEHD data for 2002 to 2018 (rather than 2017, as assumed in the methodology) to inform how that growth would be geographically distributed.

For each LU category, we assumed that each TAD would receive the same percentage of countywide growth in the LU as it did in the 2002-2018 period. Those percentage were calculated by plotting 2002 and 2018 LEHD employment estimates across industry sectors at the Census block level in GIS, then spatially joining that information to the 607 county TAZs. The resulting data table was brought into Excel, where a Pivot Table was used to sum the industry-wise job growth totals for each of the county's 22 TADs. As with ESD data, the LEHD sector categories had to be reconciled with SRTC LU categories.

Although some TADs experienced negative historical growth for some LUs, this forecast assumed zero growth as a minimum expectation for any LU in a TAD. This is a common practice for MPOs, as industry specific job losses are difficult to predict in terms of timing and location.

As part of the final review process detailed in the next section, SRTC provided the TAD employment allocations to local jurisdictions to distribute the growth among TAZs.

Final Review

Upon completing initial TAZ-level population and TAD-level employment allocations, SRTC provided the draft forecast to jurisdictions to review these figures and distribute employment growth from TADs to TAZs within their boundaries. If a local jurisdiction disagreed with the forecast, they were provided the opportunity to recommend changes. As with recent and planned development, jurisdictions were required to submit sufficient documentation supporting their recommendations in order for the changes to go into effect. Based on input from local jurisdictions and other SRTC partner agencies during the final review, several adjustments were made to the forecast. These are detailed in **figure B.6**.

Figure B.6: Additional Adjustments to the 2045 Land Use Forecast Based on Input from Local Jurisdictions and Other SRTC Partner Agencies.

Land Use Forecast Adjustments
Central Spokane Multifamily Housing Adjustment Adjustment converts all forecasted housing unit growth in selected TAZs to multifamily (LU2). The adjustment is made to better align with the City's planning efforts and account for the fact that single-family is generally not financially feasible in and around Downtown Spokane. It is applied to any TAZ that is either: (1) identified as part of downtown or the University District in the City's 2015 Land Quantity Analysis, or (2) contains only high and medium density residential land use in the City's Comprehensive Plan.
Additional City of Spokane Adjustments • Various housing unit (LU 1 & LU 2) adjustments, as noted in the City's growth worksheet • TAD 17: 400 office (LU 6) and 334 medical (LU 8) employees added to control totals • TAD 18: 1200 office (LU 6) and 600 medical (LU 8) employees removed from control totals • TAD 20: 300 FIRES (LU 7) employees added • TAD 22: 800 office (LU 6) and 300 FIRES (LU 7) employees added
Cheney Employment Adjustment Cheney submitted original employment growth worksheet, instead of the revised version that was sent out and included market-based growth. This resulted in the City allocating an additional 412 LU 5 jobs that would have been in the unincorporated county. However, since the county did not submit a growth worksheet, these employees were allowed to remain in Cheney.
Spokane Valley Hotel/Motel Adjustment 184 hotel rooms added to TAZ 321 based on Spokane Valley staff input.

Market-Based TAZ Adjustments
• 1,500 industrial employees (LU 4) added to TAZ 558, based on input from WSDOT and Spokane County staff, to account for Abbot Grove Industrial Park
• Northern Quest Casino expansion—190 hotel rooms (LU3) added to TAZ 461 based on Airway Heights staff input
• Various City of Spokane adjustments:
  • LU 5 & LU6 added to TAZ 547
  • LU 3 added to TAZ 109
  • LU 6 added to TAZ 162
• LU 8, LU 11, and LU 12 added to market based TAZ by local jurisdictions, since it was not included in market forecasts

Fairchild Air Force Base (TAZ 549) For TAZ 549, which contains Fairchild Air Force Base, SRTC used base and forecast year land use figures that were provided by the Base.
Unincorporated Spokane County Employment Distribution to TAZs For a variety of reasons, Spokane County was unable distribute forecasted TAD-level employment growth within its jurisdiction, as part of its final review. Absent local input, SRTC staff distributed this growth by calculating growth shares for these TAZs based on SRTC's previous 2015 to 2040 land use forecast.

Demographic & Travel Behavior

The Horizon 2045 models are based on the demographic characteristics and travel behavior identified by the 2005 Spokane and Kootenai County Regional Travel Survey. The most recent major model updates occurred in 2012 using Census 2010 data and other information.

Demographics currently utilized in the model include household income, household size (in persons), and number of workers per household. For modeling purposes, the demographic characteristics included in the model are assumed to remain stable through the planning horizon. With the completion of a new regional household travel survey (scheduled for 2022), it may be possible to analyze historical trends and make reasonable assumptions about demographic changes for future horizon year models.

Travel behavior is also discerned from the travel survey. Behaviors such as mode preference, number of trips per household per day, fluctuations in parking prices and/or gas prices, may be revealed with additional travel surveys over time. However, the current model sets do not assume any fundamental changes in household travel behavior between the 2019 and 2045 models.

Forecasting Methods

The complexity of an MPO's forecasting methods can vary considerably, depending on current transportation conditions, and on the future transportation investments and policies being evaluated. Current forecasting methods and model details are described below.

Model Specification

SRTC utilizes the software program VISUM to run a traditional four step, trip-based model for travel forecasting. The four major steps of the modeling process are trip generation, trip distribution, mode choice and network assignment.

Trip Generation

The model utilizes household characteristics and land use data to generate the demand for trips by trip purpose for each TAZ.

Trip Distribution

Trip demand that is generated in the trip generation step are distributed geographically throughout the region based on gravity model functions for the follow trip purposes: home-based work (HBW), home based retail (HBR), home-based school (HBSc), home-based college (HBColl), home-based other (HBO), non-home based (NHB), and commercial (COM).

Mode Choice

The mode choice model uses a nested Logit structure. This structure takes into account that mode choice requires more than one decision point. Trip makers must first choose between auto, transit or walking/biking, and then they choose between drive alone or carpool (auto) or to walk or drive to transit (transit). The utility of a mode varies by household characteristics and trip purpose, and includes variables such as travel time, distance, and parking costs (auto); perceived journey time (transit), and fares (transit).

Auto & Transit Assignment

The assignment step allocates trips to the active links and transit routes from origin to destination. The current model is run for all time periods; however, the model is primarily validated for the PM peak hour and the daily total.

Assignment Validation

The 2019 model assignment results are validated against the most recent traffic counts available using a screenline analysis. Transit assignment is validated to 2019 ridership and park and ride usage data.

Network Characteristics

Network characteristics vary slightly for each model in the Horizon 2045 model set. This is due to different projects and associated network changes that are present in each model. All existing and committed projects, including the regionally significant projects listed in Chapter 4, are included in the 2045 forecast model. The network characteristics described below are for the 2019 base model.

The model includes 567 Transportation Analysis Zones (TAZs). Of the total 14 are park and ride locations, 34 are external zones, and the remaining 519 are standard TAZs.

There are more than 17,000 active links, or roadway segments, in the model (approx. 66,000 in total). Active links include all roadways classified as a collector or higher. In addition, a number of local roads are also activated for assignment to better reflect local travel patterns and transit routing. There are many inactive links that are included in the model for illustrative purposes; they are not utilized in the modeling process.

There are over 8,400 active nodes in the model (more than 24,000 total). Many nodes represent intersections and may be classified as signalized, stop controlled, roundabout, yield, or uncontrolled.

The model uses zone connectors to emulate traffic generated on local roads, driveways or other local access. There are more than 5,300 connectors in the model; some of these connectors connect external zones or park and rides to the active links in the model network.