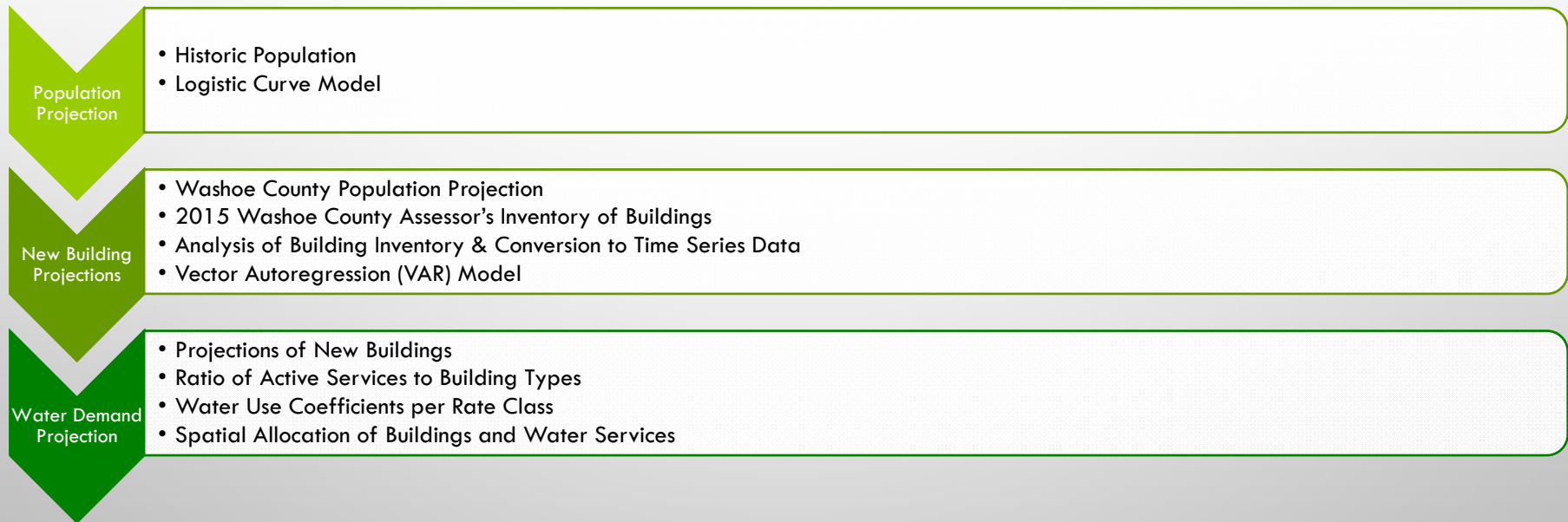


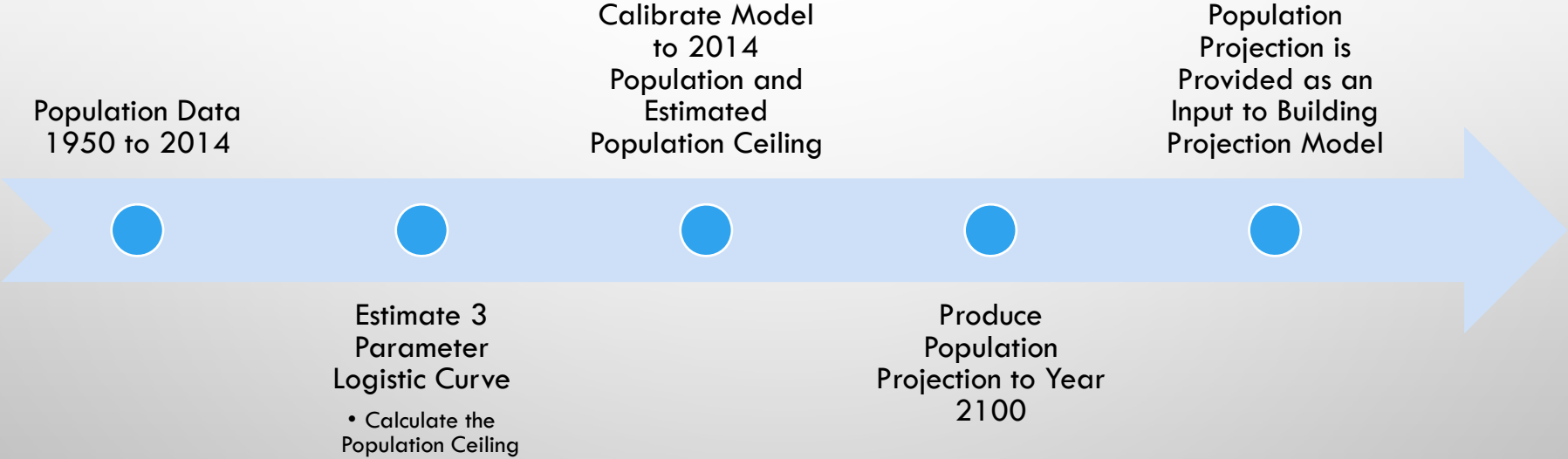
# WRP CHAPTER 4

## POPULATION AND WATER DEMAND PROJECTIONS

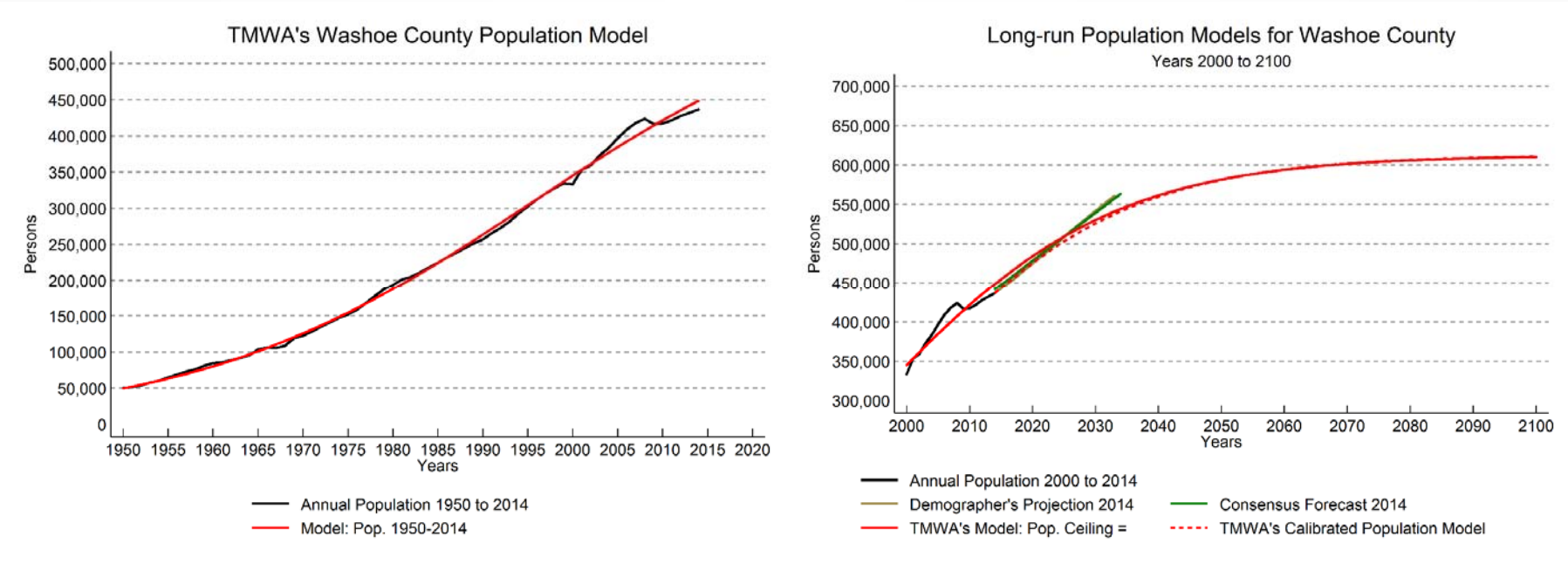
# OVERVIEW POPULATION TO WATER DEMAND



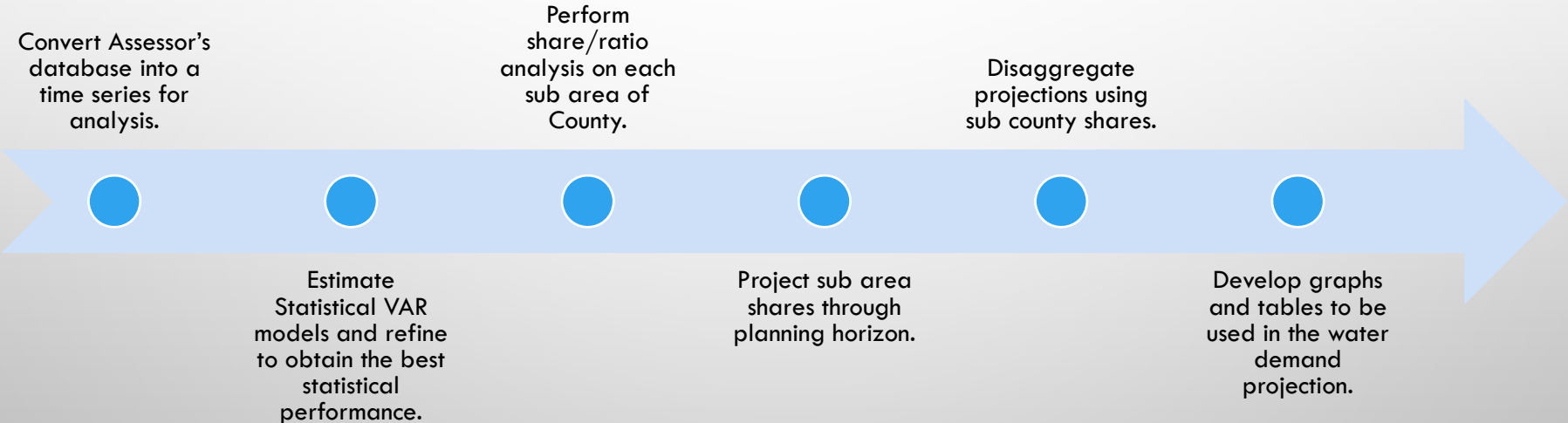
# POPULATION PROJECTION



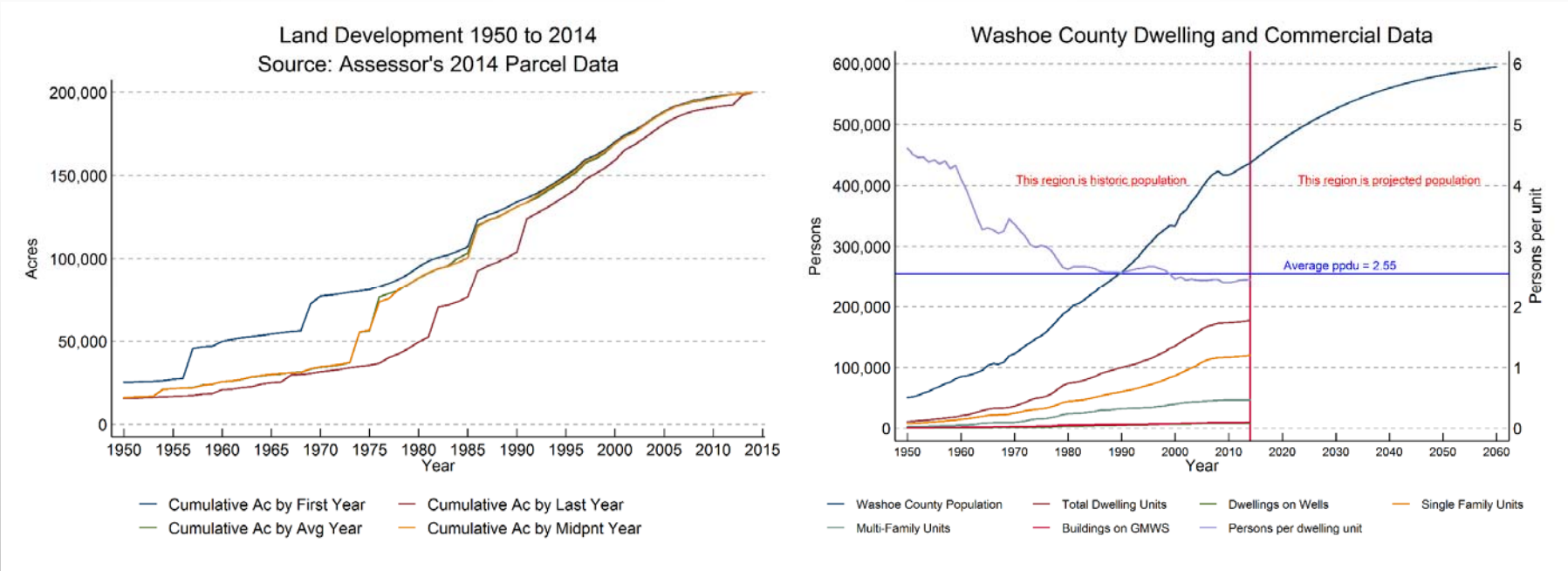
# POPULATION MODEL GRAPHS



# WASHOE COUNTY BUILDING PROJECTIONS



# LAND, BUILDING, & POPULATION DATA USED

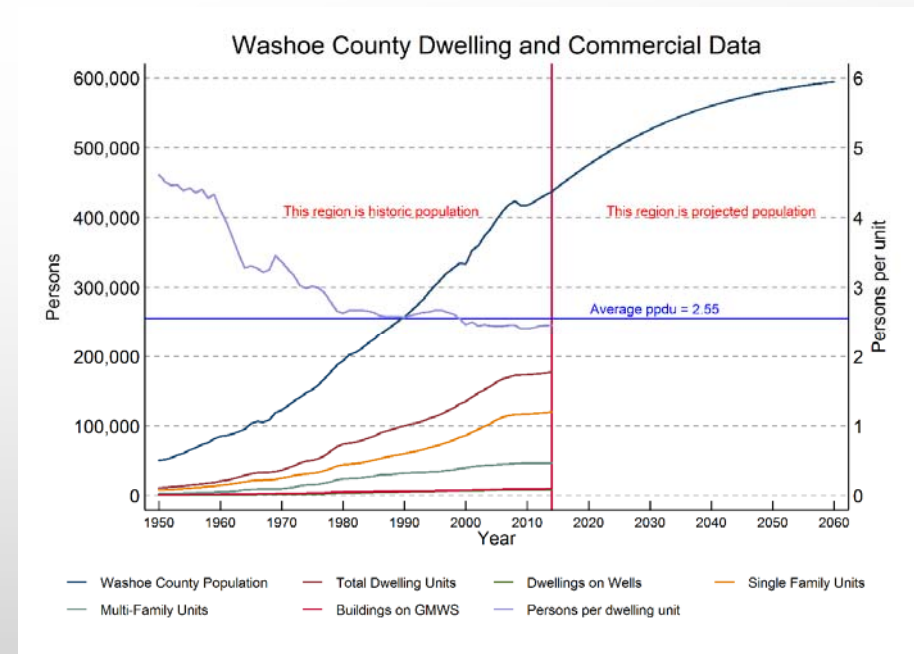


# CLASSIFICATION OF BUILDINGS

- PARCEL AND BUILDING DATA WAS RECLASSIFIED INTO FOUR MAJOR CLASSES OF BUILDINGS THAT CORRESPOND TO TMWA CUSTOMER CLASSES.
  - DWELLING ON WELLS (GENERALLY SINGLE FAMILY HOMES ON DOMESTIC WELLS).
  - SINGLE FAMILY BUILDINGS/DWELLING UNITS (RMWS CUSTOMER CLASS).
  - MULTI-FAMILY DWELLING UNITS (MMWS CUSTOMER CLASS).
  - COMMERCIAL BUILDINGS (GMWS CUSTOMER CLASS).
- THE CLASSIFICATION GOAL WAS TO HAVE PROJECTIONS THAT COULD BE DIRECTLY TRANSLATED INTO ACTIVE WATER SERVICES.

# STATISTICAL MODEL (THE BLACK BOX)

- VECTOR AUTOREGRESSION MODEL (VAR)
- MULTIPLE TIME SERIES DATA THAT ARE INTERDEPENDENT.
  - EXAMPLE: NUMBER OF HOMES ARE RELATED TO NUMBER OF JOBS AND NUMBER OF JOBS ARE RELATED TO NUMBER OF COMMERCIAL BUILDINGS.
- THE VALUE OF A VARIABLE AT A POINT IN TIME IS RELATED TO A PAST VALUE OF THE VARIABLE.
  - EXAMPLE: GROWTH IN RMWS IS RELATED TO PAST GROWTH IN RMWS.

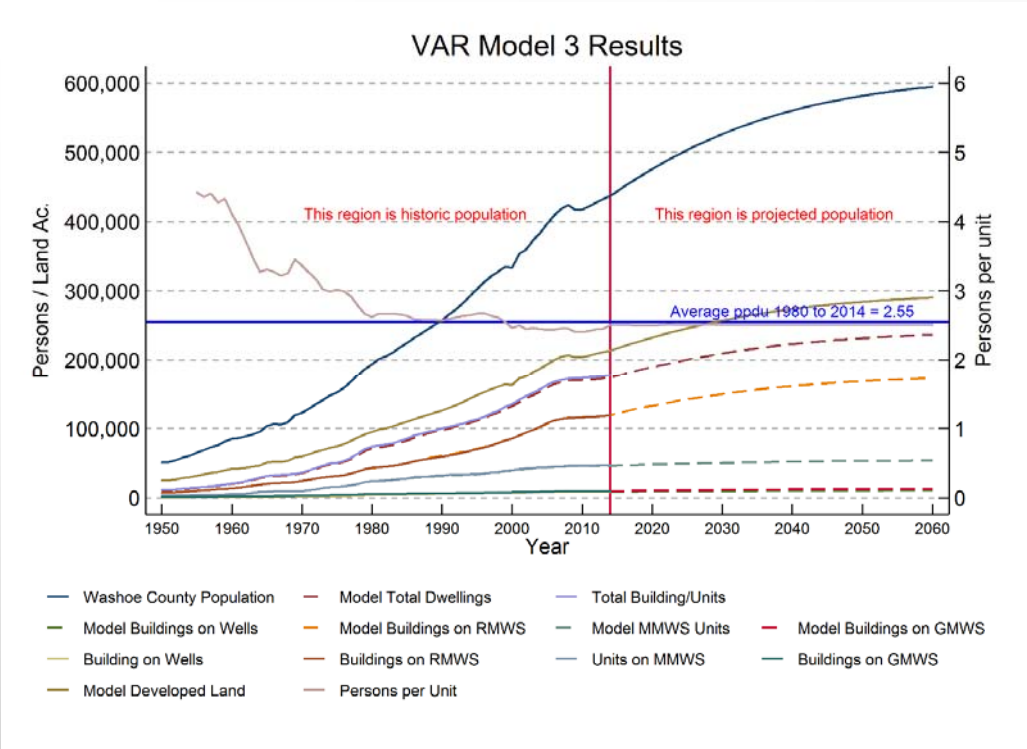


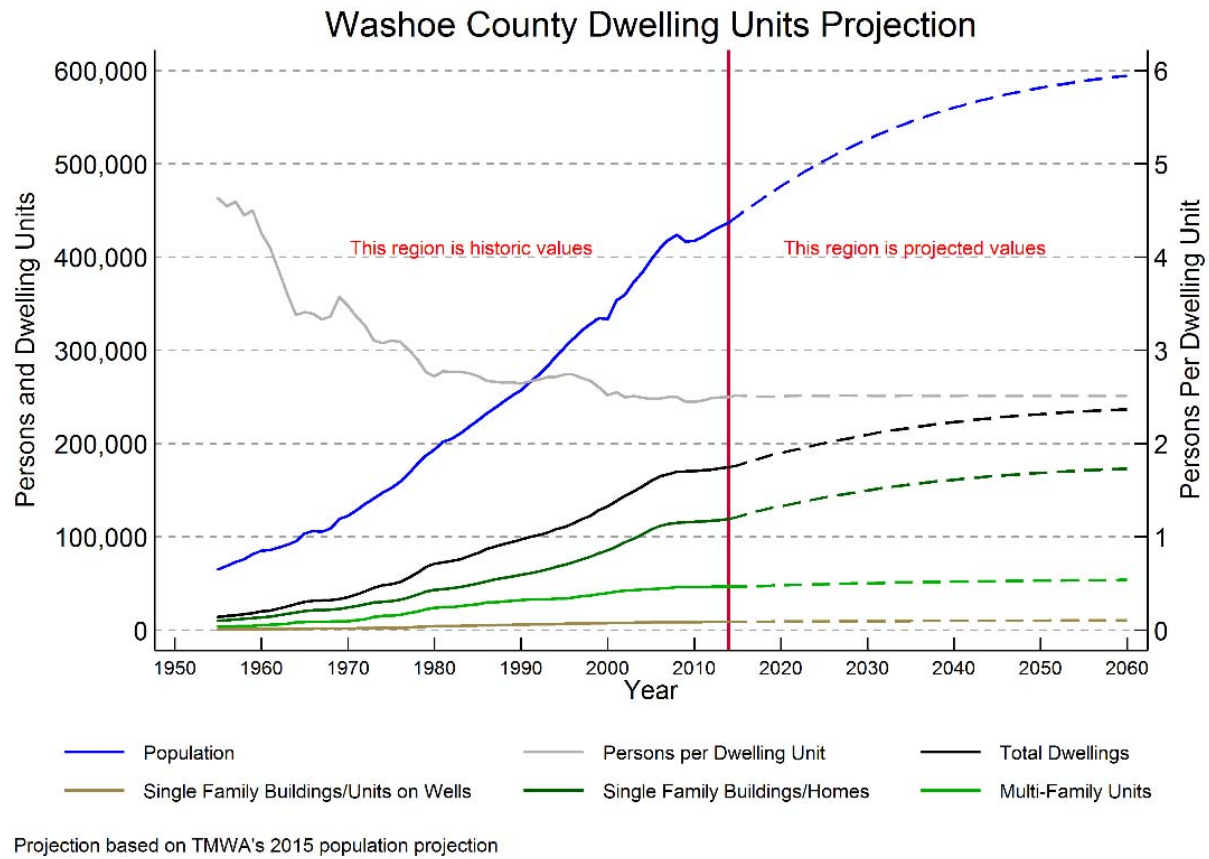
# MODEL ESTIMATION

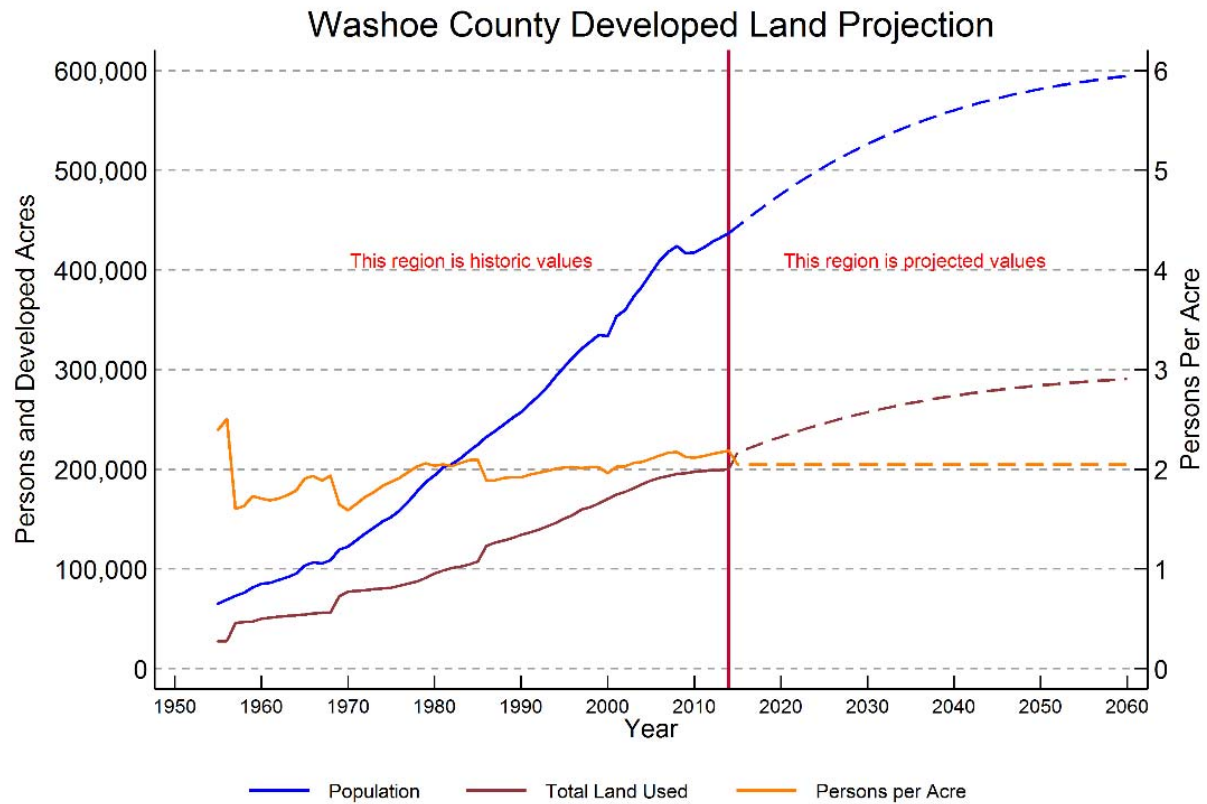
- WAS A MANUAL PROCESS OF ESTIMATING AND TESTING DIFFERENT MODEL SPECIFICATIONS TO FIND MODELS THAT PROVIDED A GOOD BALANCE OF:
  - GOOD FIT TO THE DATA.
  - STABLE STATISTICAL PROPERTIES.
  - ABILITY TO CREATE A USEFUL PROJECTION.
- FOUR MODELS WERE DEVELOPED IN SEQUENCE TO PRODUCE THE FINAL BUILDING PROJECTIONS FOR WASHOE COUNTY.

# MODEL SUMMARIES

Model 1	Model 2: Residential	Model 3: +Commercial	Model 4: Land use trend	Building Projection
<p>A place to start</p> <p>Data diagnostic</p> <p>Starting parameters</p> <p>Suggested using only 1980 to 2014 data</p>	<p>Dwellings on wells</p> <p>Dwellings single family</p> <p>Dwellings multi-family</p> <p>Population</p> <p>Corrected for autocorrelation</p> <p>Used lags for 1, 2, &amp; 3 years</p>	<p>Fine tune Model 2</p> <p>Change from dwellings to buildings for wells &amp; single family units</p> <p>Expand to include commercial</p> <p>Expand lags to 5 years to reach past the economic down turn.</p>	<p>OLS Regression</p> <p>Simple trend of population and land used</p> <p>Not really used in other planning models</p>	<p>Model 3 Results</p> <p>Model 4 Results</p> <p>Project population</p> <p>Projected to 2060</p>

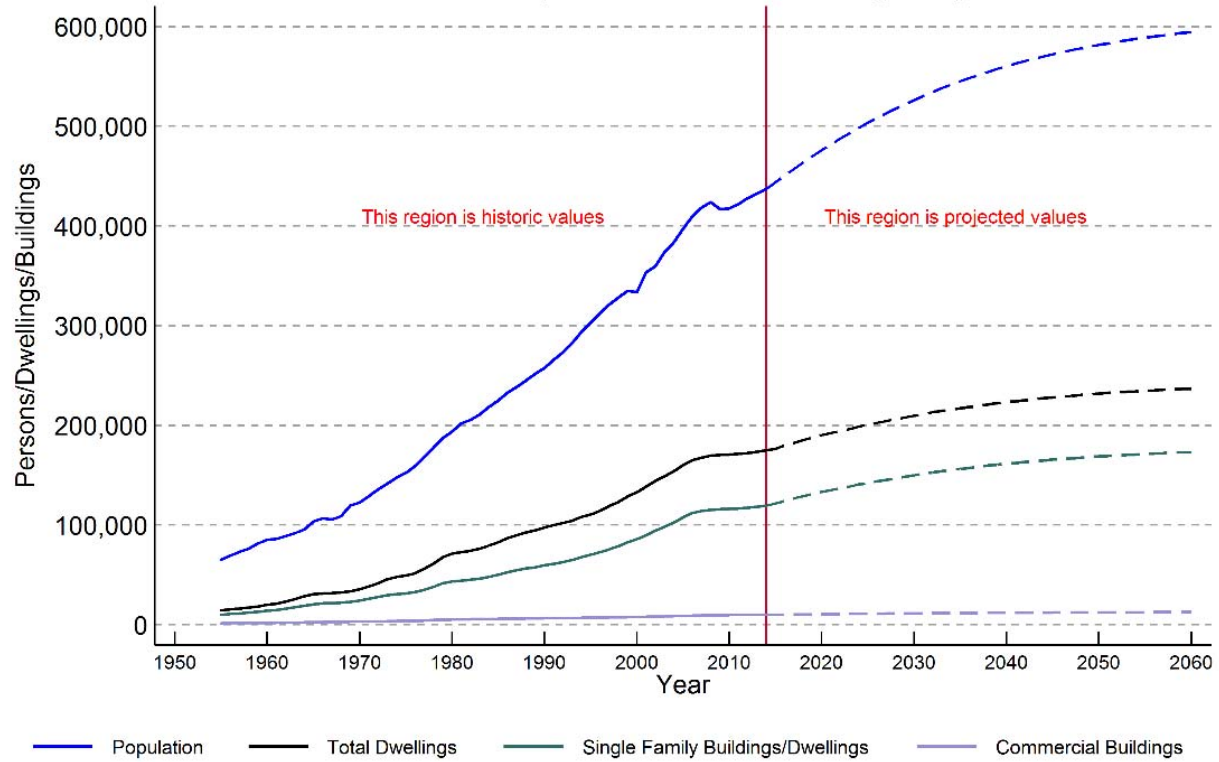




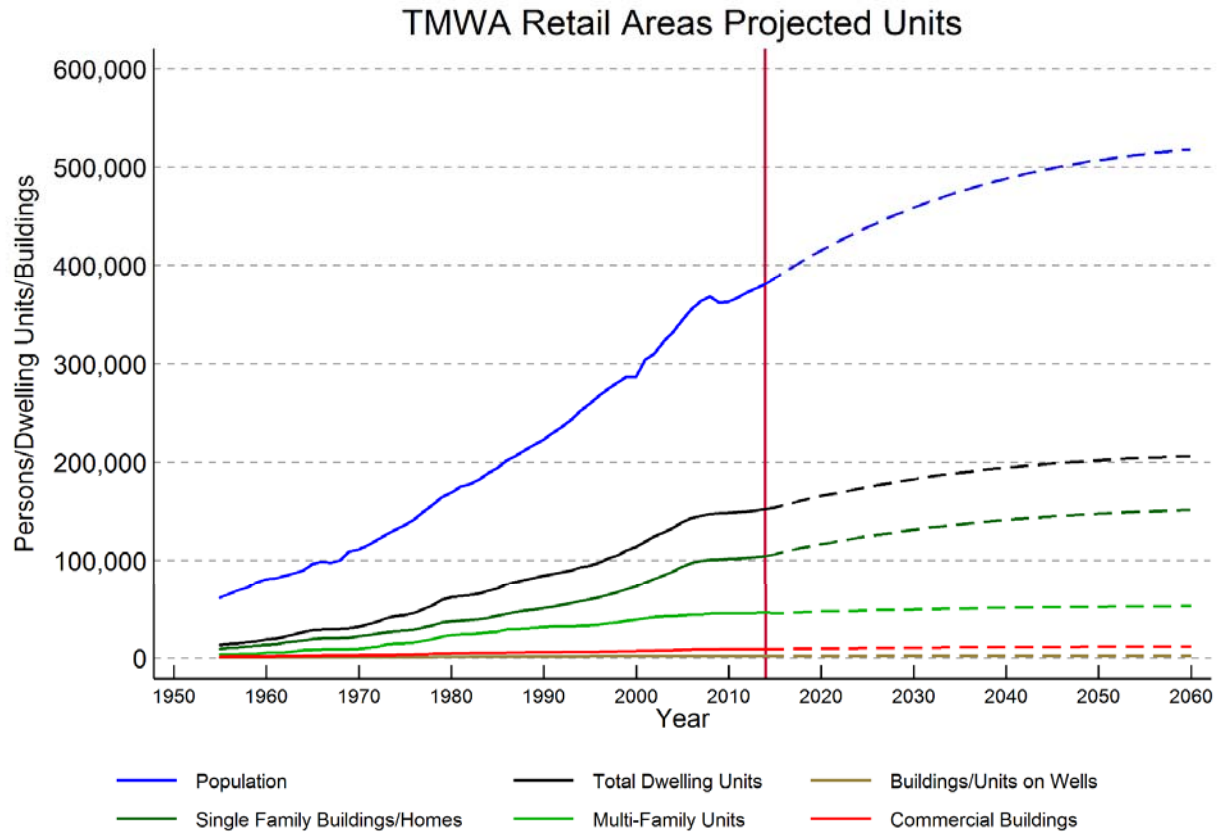


Projection based on TMWA's 2015 population projection

### Washoe County Commercial Building Projection



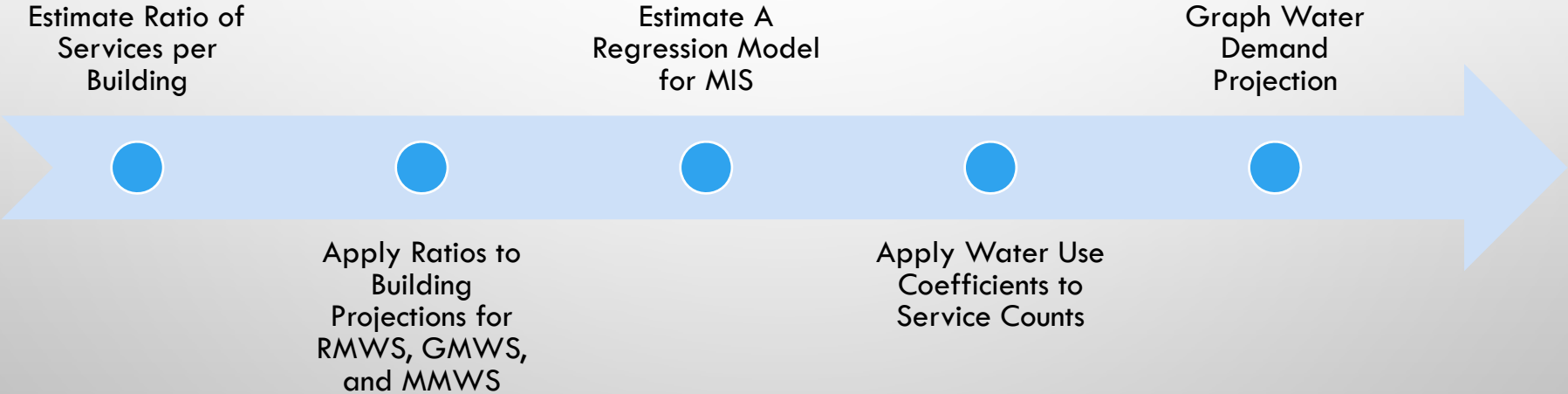
Projection based on TMWA's 2015 population projection



# REGIONALIZED BUILDING PROJECTIONS

- WASHOE COUNTY BUILDING PROJECTIONS ARE DISAGGREGATED INTO SUB-REGIONS.
  - RETAIL SERVICE AREA
  - SUN VALLEY WHOLESALE AREA
  - HYROGRAPHIC BASINS
    - TRACY SEGMENT
    - SPANISH SPRINGS VALLEY
    - SUN VALLEY
    - TRUCKEE MEADOWS
    - PLEASANT VALLEY EAST AND WEST
    - WASHOE VALLEY
    - LEMMON VALLEY AND REST OF WASHOE COUNTY

# WATER DEMAND PROJECTION



# ACTIVE SERVICE RATIOS

<b>Year</b>	<b>Average Number of Multi-Family Units</b>	<b>Ratio of Active Single Family Units (RMWS)</b>	<b>Ratio of Active Multi-Family Units (MMWS)</b>	<b>Ratio of Active Commercial Units (GMWS)</b>	<b>Hydrobasin</b>	<b>RMWS</b>	<b>MMWS</b>	<b>GMWS</b>
2009	10.123	0.853	1.104	0.725	083	0.752		0.252
2010	10.269	0.865	1.144	0.726	085	0.955	1.074	1.033
2011	10.260	0.873	1.121	0.731	086	0.154	0.748	0.101
2012	10.235	0.879	1.085	0.729	087	0.954	1.102	0.721
2013	10.225	0.886	1.086	0.727	088E	0.895		
2014	10.207	0.894	1.086	0.732	088W	0.959		2.571
2015	10.201	0.964	1.125	0.738	089	0.914		0.418
					092	1.040	1.408	0.966

# METER IRRIGATION SERVICES

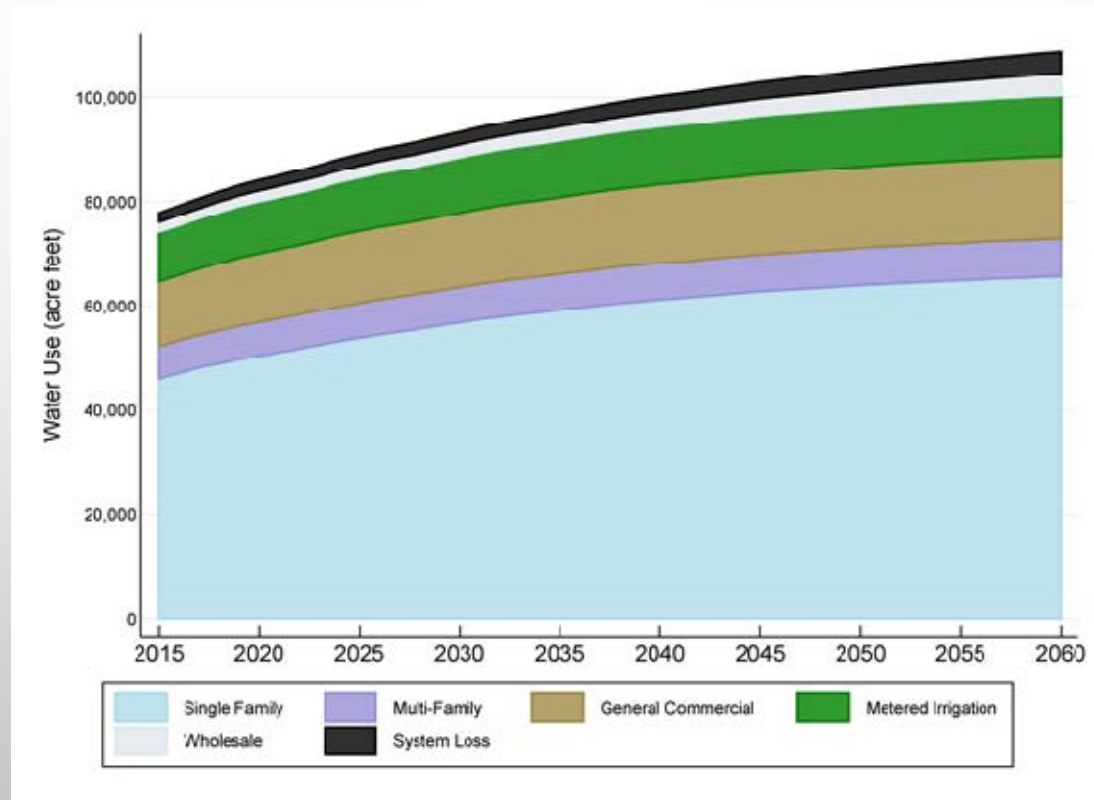
Restricted Model 1 - GMWS only		Restricted Model 2 - Multi-Family only		Unrestricted Model	
VARIABLES	MIS		MIS		MIS
GMWS	0.435*** (0.00545)	MMWS/MRFS	0.956*** (0.0201)	GMWS	0.289*** (0.0339)
				MMWS/MRFS	0.323*** (0.0746)
Observations	13		13		13
R-squared	0.998		0.995		0.999
Standard errors in parentheses					
*** p<0.01, ** p<0.05, * p<0.1					

# WATER USE COEFFICIENTS

RMWS	MMWS	GMWS	MIS	Average*	HydroBasin
				149.57	083
161.96	359.94	326.90	1140.28		085
98.80	191.03	171.50	735.50		086
144.49	421.01	632.30	895.30		087
254.78					088E
262.59		301.55	1036.00		088W
368.75		375.80	118.00		089
110.45	636.46	600.94	849.24		092

\* Average used for basins with very small service counts.

# WATER DEMAND PROJECTION





# CONSERVATION RESULTS 2015

# ESTIMATED RATES OF CONSERVATION, SUMMER 2015

Estimated Rates of Conservation, Summer 2015  
Study Periods: May to September

Customer Class	Services	2013 Use		2015 Use		Percent Change	
		Median	Mean	Median	Mean	Median	Mean
Single Family Metered - TMWA	68,193	78	88.90	61	69.80	-19.70	-16.40
Single Family Metered - DWR	16,999	98	111.80	78	89.20	-19.10	-16.00
Single Family Metered - STMGID	3,164	146	160.40	112	125.10	-20.30	-18.50
Single Family Flat Rate - TMWA	3,473	185	219.60	137	165.40	-23.10	-21.60
Single Family Flat Rate - DWR	103	140	139.40	107	101.10	-24.60	-27.00
Single Family Flat Rate - STMGID	78	154	153.40	103	109.70	-29.10	-27.30
Commercial	4,945	92	423.20	71	368.20	-10.00	-8.70
Metered Irrigation	2,398	437	853.50	350	681.50	-18.00	-15.10

Note: this study looks only at water services with 2013 & 2015 data.

# ESTIMATED RATES OF CONSERVATION, SUMMER 2014

Estimated Rates of Conservation, Summer 2014  
Study Periods: August to September

Customer Class	Services	2013 Use		2014 Use		Percent Change	
		Median	Mean	Median	Mean	Median	Mean
Single Family Metered	88,256	38	43.90	32	37.80	-11.80	-9.50
Single Family Flat Rate - TMWA	3,866	84	101.50	70	84.50	-14.70	-12.30
Single Family Flat Rate - DWR	114	61	59.80	46	47.50	-19.30	-17.80
Single Family Flat Rate - STMGID	80	74	74.00	59	59.40	-19.90	-19.10
Commercial	4,405	49	213.20	42	189.30	-5.70	-4.60
Metered Irrigation	2,328	218	417.90	192	373.80	-6.70	-4.90

Note: this study looks only at water services with 2013 & 2014 data.