



## Montana Legislative Services Division

### Office of Research & Policy Analysis

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**TO:** Rachel Weiss, Research Analyst  
Joe Kolman, Director

**FROM:** Dan Kayser, Data Analyst

**DATE:** August 23, 2022

**RE:** Citizen Voting Age Population Data for the Montana Districting & Apportionment Commission

#### Purpose

This memorandum documents information on compiling information on Citizen Voting Age Population (CVAP) for the maps of proposed state legislative districts by the Montana Districting & Apportionment Commission (MDAC).

#### Background

Estimates on CVAP are generated by the Census Bureau using responses to the American Community Survey (ACS), a nationwide sample survey conducted annually to collect information on a variety of social and economic factors on the nation's population.

Because the ACS samples only a small subset of the actual population, the Census Bureau pools 5 years of responses from the ACS together to generate reliable statistical estimates on the CVAP. While CVAP data are released annually, the 2020 estimates are based on survey responses from years 2016 – 2020.

The primary purpose of CVAP data is aiding the redistricting process and compliance with the Voting Rights Act (VRA) of 1965. Additional information on the Census Bureau's special CVAP tabulation is available at the following [website](#). It should be noted that CVAP is not the same as Voting Age Population (VAP), which is the actual headcount of persons 18 years or older recorded in a decennial census.

The lowest level of geographic enumeration for CVAP data is the Block Group. Because the redistricting process uses Census Blocks for boundary drawing, CVAP data are generally "disaggregated" from Block Groups to Blocks before they are analyzed. Disaggregating data to smaller levels of geography is done using other data (such as population or area) as weighting factors to estimate the allocation of the unknown data.

In this analysis, CVAP data have been disaggregated to the Census Block based on population counts recorded in the 2020 Census. These data were available from [redistrictingdatahub.org](https://redistrictingdatahub.org) at the following [website](#). Methodology used for disaggregating 2020 CVAP data to the census blocks can be found [here](#).

2020 CVAP Data Disaggregated to the Census Block were imported into the Geographic Information Systems (GIS) software programs *Maptitude* and *ArcGIS* with layers for proposed map of state legislative districts from the MDAC. The GIS software programs joined 2020 CVAP data to state legislative districts and aggregated the CVAP estimates by house districts for each map proposal. Results from both GIS programs were compared and verified to be the same.

CC: Ginger Aldrich, Attorney, Office of Legal Services

### CVAP Data Processing in Maptitude

1. ESRI Shapefile of 2020 CVAP Data Disaggregated to 2020 Census Blocks from redistrictingdata.org was downloaded.
  - a. <https://redistrictingdatahub.org/dataset/montana-cvap-data-disaggregated-to-the-2020-block-level-2020/>
2. Import ESRI Shapefile of 2020 CVAP Data Disaggregated to 2020 Census Blocks in Maptitude.
  - a. Map -> Layers -> Add Layer
  - b. Navigate to appropriate directory where ESRI Shapefile is located
  - c. Make sure ESRI .shp file is chosen in the file type.
3. Make "Districts" the working layer
  - a. Right click on the layer and choose "Make Working Layer"
4. Conduct Overlay Analysis (aggregated Census Block CVAP data for each District)
  - a. Tools -> Analysis -> Overlay
  - b. Overlay all features (100) of Districts
  - c. With Layer = 2020 CVAP Data Disaggregated to 2020 Census Blocks
  - d. Include = All Features (88,817)
  - e. Choose the "Attributes" Button
  - f. Deselect the "Average" checkbox on all fields
  - g. Select "Add" checkbox on the CVAP data fields
  - h. Deselect Count Number of Features and Create a Report
  - i. Click OK. (Overlay process may take several minutes)
5. Once Overlay is completed successfully, a new dataview appears with the aggregate CVAP numbers by House District.
6. Export the Overlay Dataview to Excel Spreadsheet
  - a. File -> Export -> Table – Save As .xlsx file type.

### CVAP Data Processing Steps in ArcGIS Pro

1. ESRI Shapefile of 2020 CVAP Data Disaggregated to 2020 Census Blocks from [redistrictingdata.org](https://redistrictingdata.org) was downloaded.
  - a. <https://redistrictingdatahub.org/dataset/montana-cvap-data-disaggregated-to-the-2020-block-level-2020/>
1. ESRI shapefiles of the four (4) House Districts Maps Proposed by the Commission were downloaded from the MDAC's website.
  - a. <https://mtredistricting.gov/state-legislative-maps-proposed-by-the-commission/>
2. Open a New Map and add the shapefiles of 2020 CVAP 2020 CVAP Data Disaggregated to 2020 Census Blocks and the four (4) proposed maps of House Districts.
3. Make sure all Shapefiles have the same Coordinate System and Projection
  - a. The "Project" geoprocessing tool was used to create versions of each shapefile with the following:
    - i. Coordinate System = Lambert\_Conformal\_Conic
    - ii. Geographic Transformation = WGS\_1984\_(ITRF00)\_To\_NAD\_1983
4. The "Spatial Join" geoprocessing tool combines Census Blocks with 2020 CVAP data for each of the four (4) proposed house district maps. Once the Spatial Join is completed successfully, a new layer will be added to the map that includes the House District to each Census Block based on a spatial overlay of the layers.
  - a. Analysis -> Geoprocessing -> Overlay -> Spatial Join
  - b. Target Features = Census Blocks with 2020 CVAP data
  - c. Join Features = House District Proposal
  - d. Join Operation = Join one to one
  - e. Keep All Target Features = Checked
  - f. Match Option = Within
5. Export the attribute data of the new layer using the "Table to DBF" geoprocessing tool.
6. Open Microsoft Excel and create a blank workbook.
7. Open the DFB file of Census Blocks joined to House Districts.
  - a. File->Open->Browse
  - b. Navigate to the DBF file (Make sure All Files are selected) and Open
  - c. Click Save and save the workbook in .xlsx format.
8. Insert a Pivot Table report in the Excel spreadsheet
  - a. Place the cursor in cell A1 of worksheet with CVAP data
  - b. Insert->Pivot Table
  - c. Verify all data in the Table/Range will be used to create the Pivot Table
  - d. Choose "New Worksheet" for the Pivot Table.
9. Place "District" in the Rows area and the CVAP fields in the Values area.
  - a. Make sure the CVAP values are SUMMED
10. Repeat steps 4 – 9 for each map proposed.