Expert Report of Thomas M. Bryan

Expert in Demography for the Wisconsin Legislature

Johnson v. Wisconsin Elections Commission

December 15, 2021

EXPERT REPORT OF THOMAS M. BRYAN

I, Thomas Mark Bryan, affirm the conclusions I express in this report are provided to a reasonable degree of professional certainty.

EXPERT QUALIFICATIONS

1. I am an expert in demography with more than 30 years of experience. Described more fully below, I have been retained by the Wisconsin Legislature as an expert to provide redistricting analysis related to State Senate and State Assembly redistricting plans.

2. I graduated with a Bachelor of Science in History from Portland State University in 1992. I graduated with a Master of Urban Studies (MUS) from Portland State University in 1996, and in 2002 I graduated with a Master in Management and Information Systems (MIS) from George Washington University. Concurrent with earning my Management and Information Systems degree, I earned my Chief Information Officer certification from the GSA.[1]

3. My background and experience with demography, census data and advanced analytics using statistics and population data began in 1996 with an analyst role for the Oregon State Data Center. In 1998 I began working as a statistician for the US Census Bureau in the Population Division – developing population estimates and innovative demographic methods. In 2001 I began my role as a professional demographer for ESRI Business Information Solutions, where I began developing my expertise in Geographic Information Systems (GIS) for population studies. In May 2004 I continued my career as a demographer, data scientist and expert in analytics in continuously advanced corporate roles, including at Altria and Microsoft through 2020.

4. In 2001 I developed a private demographic consulting firm "BryanGeoDemographics" or "BGD". I founded BGD as a demographic and analytic consultancy to meet the expanding demand for advanced analytic expertise in applied demographic research and analysis. Since then, my consultancy has broadened to include litigation support, state and local redistricting, school redistricting, and municipal infrastructure initiatives. Since 2001, I have undertaken over 150 such engagements in three broad areas:

    - state and local redistricting,
    - applied demographic studies, and

[1] Granted by the General Services Administration (GSA) and the Federal IT Workforce Committee of the CIO Council. http://www.gwu.edu/~mastergw/programs/mis/pr.html.

- school redistricting and municipal infrastructure analysis.

5. My background and experience with redistricting began with McKibben Demographics from 2004-2012, when I provided expert demographic and analytic support in over 120 separate school redistricting projects. These engagements involved developing demographic profiles of small areas to assist in building fertility, mortality and migration models used to support long-range population forecasts and infrastructure analysis. Over this time, I informally consulted on districting projects with Dr. Peter Morrison. In 2012 I formally began performing redistricting analytics and continue my collaboration with Dr. Morrison to this day. I have been involved with over 40 significant redistricting projects, serving roles of increasing responsibility from population and statistical analyses to report writing to directly advising and supervising redistricting initiatives. Many of these roles were served in the capacity of performing Gingles analyses, risk assessments and Federal and State Voting Rights Act (VRA) analyses in state and local areas.

6. In each of those cases, I have personally built, or supervised the building of, one or more databases combining demographic data, local geographic data and election data from sources including the 2000, the 2010 and now 2020 decennial Census. I also innovated the use of the US Census Bureau's statistical technique of "iterative proportional fitting" or "IPF" of the Census Bureau's American Community Survey, and the Census Bureau's Special Tabulation of Citizen Voting Age Population Data to enable the development of districting plans at the Census block level. This method has been presented and accepted in numerous cases we have developed or litigated. These data have also been developed and used in the broader context of case-specific traditional redistricting principles and often alongside other state and local demographic and political data.

7. In 2012 I began publicly presenting my work at professional conferences. I have developed and publicly presented on measuring effective voting strength, how to develop demographic accounting models, applications of using big data and statistical techniques for measuring minority voting strength – and have developed and led numerous tutorials on redistricting. With the delivery of the 2020 Census, I have presented on new technical challenges of using 2020 Census data and the impact of the Census Bureau's new differential privacy (DP) system. This work culminated with being invited to chair the "Assessing the Quality of the 2020 Census" session of the 2021 Population Association of America meeting, featuring Census Director Ron Jarmin.

8. I have written professionally and been published since 2004. I am the author of "Population Estimates" and "Internal and Short Distance Migration" in the definitive demographic reference "The Methods and Materials of Demography". In 2015 I joined a group of professional demographers serving as experts in the matter of *Evenwel, et al. v. Texas* case. In *Evenwel* I served in a leadership role in writing an Amicus Brief on the use of the

American Community Survey (ACS) in measuring and assessing one-person, one vote. In 2019 I co-authored "Redistricting: A Manual for Analysts, Practitioners, and Citizens", and in 2021 I co-authored "The Effect of the Differential Privacy Disclosure Avoidance System Proposed by the Census Bureau on 2020 Census Products".

9. I have been deposed once in the last four years, in the matter of *Harding v. County of Dallas*.

10. I maintain membership in numerous professional affiliations, including:

- International Association of Applied Demographers (Member and Board of Directors)
- American Statistical Association (Member)
- Population Association of America (Member)
- Southern Demographic Association (Member)

11. My full CV, including my 30 years of demography experience, is attached as Appendix 5.

12. I am being compensated at my customary rate of $450/hour.

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I. EXECUTIVE SUMMARY

13. My review of the Wisconsin Legislature's Assembly and Senate maps (2021 Wis. Senate Bill 621) reveals that both maps conform with the law. There are 99 Assembly districts and 33 Senate districts – and neither the Assembly nor the Senate districts split even one of Wisconsin's ward boundaries. I have confirmed that the assembly districts are contiguous, and that three contiguous assembly districts make up each senate district.

14. The maps apportion the 2020 Wisconsin population in such way as to achieve a very low deviation of 0.76% deviation in the Assembly and 0.57% in the Senate – well within the +/- 5.0% conventional maximums (**Section IV.A**).

15. By implementing a "least change" approach, the Wisconsin Legislature was able to conform with numerous traditional redistricting principles, including:

- Minimizing county and municipal splits (**Section IV.B.1**);
- Maximizing core retention (leaving roughly 84% of individuals in their existing Assembly districts and 92% of individuals in their existing Senate districts), including comparable core retention of minority Black and Hispanic populations (**Section IV.B.2 & Appendix 2**);
- Minimizing temporal disenfranchisement in Senate districts – impacting a minimal 138,732 individuals who were moved by the SB621 plan from an odd-numbered district to an even-numbered district (**Section IV.B.3**);
- Maintaining existing compactness standards (**Section IV.B.4 & Appendix 3**); and
- Avoiding splitting incumbents, with only 3 districts (and 6 assembly incumbents) being paired (**Section IV.B.5**).

16. The Legislature's plan complies with the Court's request for a "least change" redistricting effort. The Legislature's plan is lawful and complies with established redistricting principles and traditional redistricting criteria.

II. ASSIGNMENT

17. The Wisconsin Legislature has asked me to independently review and assess the features and characteristics of the Wisconsin Legislature's SB 621 senate and assembly redistricting plans. These are the plans submitted by the Legislature here in response to the Court's request for proposed maps "making the minimum changes necessary in order to conform the existing congressional and state legislative redistricting plans to constitutional and statutory requirements." Order of Nov. 30, 2021 ("Order"), ¶ 8.

18. In this report, I analyze how the Legislature's plans address the malapportionment claims at issue in this case. I then analyze how the Legislature's plans do so consistent with the Court's requirement for a "minimum changes" plan, as well as federal and state requirements for any redistricting plan. I conclude that the Legislature's plans make minimum changes necessary to reapportion the legislative districts.

19. In assessing the Legislature's proposed plans, I have also assessed features and characteristics of the existing Assembly and Senate maps (2011 Wis. Act. 43) and other proposals, including the Wisconsin Governor's People's Map Commission (hereafter "PMC") proposed senate and assembly redistricting plans.

20. In **Section III**, I review redistricting legal requirements and traditional redistricting criteria.

21. In **Section IV**, I provide an assessment of: first, compliance of the Wisconsin Legislative plan with redistricting requirements; then second, geographic splits, core retention, temporal disenfranchisement, compactness and continuity of representation (incumbency) as outcomes of the Wisconsin Legislature's "least changes" approach in SB621.

22. In **Section V**, I provide my Appendices.

23. In forming my opinions, I have considered all materials cited in this report and the appendices. I have also considered some pleadings and other filings in this matter; materials from the People's Maps Commission; materials from the Wisconsin LRB, LTSB and Legislature related to 2020 Census data, Act 43 and SB621; the Amended Complaint in *BLOC v. Spindell*, No. 3:21-cv-512 (W.D. Wis. Sept. 21, 2021); opinions from the *Baldus* litigation; Morrison & Bryan, *Redistricting: A Manual for Analysts, Practitioners, & Citizens* (Springer 2019); and U.S. DOJ, Guidance under Section 2 of the Voting Rights Act, 52 U.S.C. 1301, for redistricting and methods of electing government bodies (Sept. 1, 2021).

24. I reserve the right to further supplement my report and opinions.

III. REDISTRICTING LEGAL REQUIREMENTS AND TRADITIONAL REDISTRICTING CRITERIA

25. The first most important objective of redistricting is to equally apportion population based on the results of the latest decennial census. Any redistricting plan must reapportion population, allowing for nearly equal number of inhabitants per district. Equal population is the most fundamental principle in redistricting because it underpins the entire American electoral process. Adherence to the requirement of equal population ensures compliance with the U.S. Supreme Court's one-person, one-vote rule.[2] Today, there is a rebuttable presumption that a state legislative map with a total deviation of 10% or less is constitutional, but the goal is always population equality.[3]

The Loyola Law School redistricting guide states:

"State and local legislative districts have a bit more flexibility on the numbers; they have to be "substantially" equal. Over a series of cases, it has become accepted that a plan will be constitutionally suspect if the largest and smallest districts are more than ten percent apart. This is not a hard line: a state plan may be upheld if there is a compelling reason for a larger disparity, and a state plan may be struck down if a smaller disparity is not justified by a good reason.

"Some states hold their state districts to stricter population equality limits than the federal constitution requires. Colorado, for example, allows at most five percent total deviation between the largest and smallest districts; Missouri asks districts to be no more than one percent above or below the average, except that deviations of up to three percent are permitted to maintain political boundaries. Iowa both limits the total population

[2] From the "Redistricting in Wisconsin Guidebook" Page 5 (http://lrbdigital.legis.wisconsin.gov/digital/collection/p16831coll2/id/1942/): "The concept of one person, one vote arose primarily from three Supreme Court cases decided in the early 1960s: *Gray v. Sanders*, 372 U.S. 368, 381 (1963) ("The conception of political equality from the Declaration of Independence, to Lincoln's Gettysburg Address, to the Fifteenth, Seventeenth, and Nineteenth Amendments can mean only one thing—one person, one vote."); *Reynolds v. Sims*, 377 U.S. 533 (1964) (holding, under the equal protection clause of the Fourteenth Amendment, that the one-person, one-vote principle applies to state legislative redistricting plans); and *Wesberry v. Sanders*, 376 U.S. 1, 7–8 (1964) ("We hold that, construed in its historical context, the command of Art. I, § 2, that Representatives be chosen 'by the People of the several States' means that as nearly as is practicable one man's vote in a congressional election is to be worth as much as another's.")."

[3] *Gaffney v. Cummings*, 412 U.S. 735 (1973) (state legislative map approved with maximum deviation of 7.83% for house districts and 1.81% for senate districts); *White v. Regester*, 412 U.S. 755 (1973) (no justification required when total deviation was 9.9%).

deviation to five percent, and also sets the overall average deviation at no more than one percent."[4]

Similarly in Wisconsin, I understand that "there should be as close an approximation to exactness as possible" when it comes to reapportionment. Order ¶ 28.

26. In addition to the requirement of reapportionment, individual states have their own unique redistricting requirements. The Wisconsin Constitution ties the size of the State Senate to that of the Assembly, by limiting its size to no less than 1/4 nor more than 1/3 of the size of the Assembly. Currently, Wisconsin is divided into 33 Senate Districts (1/3 of the current Assembly membership of 99) apportioned throughout the state based on population as determined by the decennial census. A Senate district must be formed by combining three Assembly districts. Similar to the U.S. Senate, in addition to its duty of reviewing and voting on all legislation passed through the legislature, the State Senate has the exclusive responsibility of confirming certain gubernatorial appointments, particularly cabinet secretaries (as part of the system of checks and balances) and members of boards and commissions. Senators are elected for four-year terms, staggered so that approximately half of the Senate is up for election every two years.

27. Wisconsin districts must also:

- Be "bounded by county, precinct, town or ward lines." Wis. Const. art. IV, § 4;
- Be "in as compact form as practicable." Wis. Const. art. IV, § 4; and
- "Consist of contiguous territory." Wis. Const. art. IV, § 4. Where geography is physically contiguous or where a municipality has annexed "islands" of territory that are not geographically contiguous, those "islands" are politically contiguous and should be included in the same district for contiguity. Order ¶ 36.

28. In addition to the mandatory standards set out by the U.S Constitution, the Voting Rights Act, and Wisconsin law, states may adopt their own redistricting criteria, or principles, for drawing the plans.

29. To reapportion districts, any redistricting plans will have to make some changes to accommodate shifting populations. There is no "no-changes" plan given the state's population shifts. In making those changes, redistricting will employ traditional redistricting criteria, in addition to the federal and state requirements for redistricting.

30. Those traditional redistricting criteria or principles appear in state constitutions or statutes, or may be adopted by a legislature, chamber, or committee, or by a court that is called upon to draw a plan when the legislative process fails.

[4] https://redistricting.lls.edu/redistricting-101/where-are-the-lines-drawn/

31. Different states consider and implement different criteria. For example, in some states, including Texas, state constitutions *require* the use of counties to draw certain legislative boundaries, while others just require them to be considered. The Congressional Research Service explains:

> "Many of the 'rules' or criteria for drawing congressional boundaries are meant to enhance fairness and minimize the impact of gerrymandering. These rules, standards, or criteria include assuring population equality among districts within the same state; protecting racial and language minorities from vote dilution while at the same time not promoting racial segregation; promoting geographic compactness and contiguity when drawing districts; minimizing the number of split political subdivisions and 'communities of interest' within congressional districts; and preserving historical stability in the cores of previous congressional districts."[5]

These same principles apply to redistricting of a state's legislative districts.

32. The National Conference of State Legislatures (NCSL) is widely recognized as the nation's independent, objective, and bipartisan authority on redistricting matters.[6] The NCSL has published a series of principles that reflect traditional districting principles (or criteria) have been both informed by and adopted by many states. This guidance from the NCSL is the basis of any assessment I make as an expert of individual states or organization's criteria.

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[5] https://crsreports.congress.gov/product/pdf/R/R42831/3

[6] https://www.ncsl.org/aboutus/ncslservice/facts-about-ncsl.aspx:

- NCSL is the only organization that advocates solely for states' interests in Washington, D.C.
- NCSL is the only organization that provides support services to legislators and legislative staff.
- NCSL is the only bipartisan organization of its kind with leadership and participation from both sides of the aisle.
- NCSL presents all sides of the issues and provides information based on facts, not politics.
- NCSL promotes the legislative institution as a whole and works to make it stronger and more efficient.
- NCSL's legislator members vote on policy issues that direct the organization's activities on Capitol Hill.
- NCSL's annual Legislative Summit is the largest and most important gathering of the year for legislators and legislative staff.

33. These traditional districting principles (or criteria) have been adopted by many states:

- **Compactness:** Having the minimum distance between all the parts of a constituency (a circle, square or a hexagon is the most compact district).
- **Contiguity:** All parts of a district being connected at some point with the rest of the district.
- **Preservation of counties and other political subdivisions:** This refers to not crossing county, city, or town, boundaries when drawing districts.
- **Preservation of communities of interest:** Geographical areas, such as neighborhoods of a city or regions of a state, where the residents have common political interests that do not necessarily coincide with the boundaries of a political subdivision, such as a city or county.
- **Preservation of cores of prior districts:** This refers to maintaining districts as previously drawn, to the extent possible. This leads to continuity of representation.
- **Avoiding pairing incumbents:** This refers to avoiding districts that would create contests between incumbents and is critical to support continuity of representation.

34. With this NCSL guidance in place, I turn now to redistricting criteria specific to Wisconsin. I consider two sources:

- The Wisconsin Legislature's 2021 Senate Joint Resolution 63; and
- The Wisconsin Legislative Reference Bureau (LRB) redistricting guidebook

35. As part of the 2021 Wisconsin redistricting process, the Wisconsin Legislature passed Joint Resolution 63 identifying their considerations important to the ongoing redistricting process.[7] The resolution announced that "it is the public policy of this state that plans establishing legislative districts should:

1. Comply with federal and state law;
2. Give effect to the principle that every citizen's vote should count the same by creating districts with nearly equal population, having population deviations that are well below that which is required by the U.S. Constitution;
3. Retain as much as possible the core of existing districts, thus maintaining existing communities of interest, and promoting the equal opportunity to vote by minimizing disenfranchisement due to staggered Senate terms;

[7] The resolution is included in **Appendix 6** and is also publicly available here: https://docs.legis.wisconsin.gov/document/enrolledbills/2021/REG/SJR63.pdf.

4. Contain districts that are compact;
5. Contain districts that are legally contiguous;
6. Respect and maintain whole communities of interest where practicable;
7. Avoid municipal splits unless unavoidable or necessary to further another principle stated above, and when splitting municipalities, respect current municipal ward boundaries;
8. Promote continuity of representation by avoiding incumbent pairing unless necessary to further another principle stated above; and
9. Contain districts that follow natural boundaries where practicable and consistent with other principles, including geographic features such as rivers and lakes, manufactured boundaries such as major highways, and political boundaries such as county lines."

36. The joint resolution criteria are consistent with the Legislative Reference Bureau's "Redistricting in Wisconsin 2020" LRB Guidebook.[8] (LRB is a non-partisan service agency of the Legislature. Wis. Stat. § 13.92.) This legislative guidebook aligns with the guidance in the joint resolution, and in fact provides enhanced guidance on measuring equal population, minority protections, preservation of communities of interest, preservation of the unity of political subdivisions and more.

37. The metrics of my report include those traditional redistricting criteria of the NCSL and the Wisconsin-specific redistricting criteria, identified in the Legislature's joint resolution and the LRB guidebook, including: apportionment and equal population / population deviation, compliance of plan boundaries with ward boundaries and geographic splits analysis, core retention analysis (CRA), temporal disenfranchisement, geographic compactness, incumbency and more. Using these measures, I will document the performance and compliance of the Wisconsin Legislature's SB621 plans with the law as well as the Court's request for "minimum changes" redistricting plans (Order ¶ 8).

[8] The guidebook is publicly available here: http://lrbdigital.legis.wisconsin.gov/digital/collection/p16831coll2/id/1942/.

IV. REDISTRICTING PERFORMANCE

A. Apportionment, Equal Population and Population Deviations

38. I began my assessment of the Legislature's Assembly Plan by examining the population movement between 2010 and 2020 that necessitated the decennial redistricting process. By 2020, the population in districts established by Act 43 in 2011[9] had departed significantly from when they had originally been drawn at the beginning of the decade. In **Appendix 1**, I include LTSB-reported deviation analysis, showing that Senate District 26 had 22,874 population (or 12.81%) above ideal, while Senate District 6 had 16,529 population (or 9.25%) below ideal. The same report shows that Assembly District 76 had overpopulation of 12,183 (or 20.46%) above ideal, and Assembly District 10 had 6,905 underpopulation (or -11.6%) below ideal.[10]

39. In **Appendix 4 Map 1** "Existing Assembly District Deviations" and **Appendix 4 Map 1A** (Madison Deviations) and **Appendix 4 Map 1B** (Milwaukee Deviations), I show that the spatial distributions of these changes of these deviations are not equally distributed around the state.

40. Areas around Dane County and Milwaukee represent the majority of over-populated and under-populated areas, respectively. There are other areas in north-central Wisconsin and southwest of Madison and south of Milwaukee that ended up being significantly under-populated.

41. Between 2010 and 2020, population in Dane County (including Madison) *increased* by 73,431 - from 488,073 to 561,504.

42. During that same time between 2010 and 2020, population in the City of Milwaukee *decreased* by 17,611 - from 594,833 to 577,222.

43. While a key objective of the legislative redistricting plan was to implement a "least changes" approach, it is unavoidable with such large deviations that some districts that did not need to

[9] The enacted bill is publicly available here: https://docs.legis.wisconsin.gov/2011/related/acts/43.

[10] The deviations in the joint stipulated facts are reported by LTSB Exs. A & B, Joint Stipulated Facts (Nov. 4, 2021) and included in **Appendix 1**. The LTSB deviations do not match district populations and deviations I generated from my analysis of the correspondence files published by the legislature on https://drawyourdistrict.legis.wisconsin.gov/ProposedMaps. The differences are not significant and do not change my conclusions.

be changed to achieve population balance were nevertheless changed due to a "cascading effect" of districts around them that may have needed to change substantially.

44. It can easily be seen in **Appendix 4 Map 1A** "Existing Assembly District Deviations" (Madison) and **Appendix 4 Map 1B** Existing Assembly District Deviations (Milwaukee) that the new districts drawn between Dane and Milwaukee have changed considerably. This is by necessity.

45. In the face of these population shifts, the Legislature's submitted plans achieve remarkable population equality in my experience.

46. The Legislature's bill begins with an analysis of the plans' low population deviations by the Wisconsin Legislative Reference Bureau (LRB). The analysis states:

> "This bill redistricts, according to the number of inhabitants, the legislative districts of this state based on the results of the 2020 federal decennial census of population. The bill maintains the number of assembly districts at 99 and the number of senate districts at 33. All assembly districts created by the bill are composed of whole counties or municipalities or U.S. census tracts or blocks (subunits of tracts) reflecting population and boundaries as of April 1, 2020. In accordance with article IV, section 5, of the state constitution, no assembly district created under the bill is divided in the creation of a senate district. Current law requires legislative districts to be substantially equal in population. The table below illustrates, for the assembly and senate districts proposed under the bill, the numeric amount and the percentage by which the districts with the smallest and largest populations deviate from the ideal population for the same type of district. The population figures contained in the table are derived from the results of the federal decennial census."[11]

Figure IV.1 Wisconsin LRB Reported Summary Deviation Statistics[12]

	District	Population	Deviation	Pct. Dev.
Smallest:	Assembly District 96	59,312	-221	-0.37
Largest:	Assembly District 2	59,764	231	0.39
Smallest:	Senate District 22	178,092	-506	-0.28
Largest:	Senate District 15	179,118	520	0.29

[11] The LRB analysis is publicly available here: https://docs.legis.wisconsin.gov/document/proposaltext/2021/REG/SB621,1,2.pdf.

[12] The LRB analysis is publicly available here: https://docs.legis.wisconsin.gov/document/proposaltext/2021/REG/SB621,1,2.pdf. Additionally, **Appendix 6** includes the portion of the LRB attachment to SB 621 that lists district-by-district population deviations.

47. Along with the delivery of the Legislature's plans, LRB also analyzed the plans on a variety of metrics, including population equality, in a memorandum to Assembly and Senate leadership:

Figure IV.2 Wisconsin LRB Reported Deviation Statistics[13]

Population deviation

Ideal population represents the target population for each legislative district in a redistricting plan. This figure is calculated by dividing the total population of the state by the number of legislative districts. According to the 2020 U.S. Census, Wisconsin's total population is 5,893,718. Because Wisconsin has 33 senate districts and 99 assembly districts, the ideal population for each senate district is 178,598 and the ideal population for each assembly district is 59,533.

The following table presents deviation scores for legislative districts. Courts will presume that a state legislative plan is constitutional if it has an overall range in deviation of 10 percent or less.[1]

	Deviation from Ideal Population	Persons	Percent
Assembly	Mean Deviation	112	0.19
	Largest Positive Deviation	231	0.39
	Largest Negative Deviation	−221	−0.37
	Overall Range in Deviation	±452	± 0.76

	Deviation from Ideal Population	Persons	Percent
Senate	Mean Deviation	175	0.10
	Largest Positive Deviation	520	0.29
	Largest Negative Deviation	−506	−0.28
	Overall Range in Deviation	±1,026	± 0.57

48. District by district deviations are included in **Appendix 6**.

49. In order to characterize the performance of the plan in a broader context, I refer here to historic research by the NCSL. Subsequent to the 2010 redistricting cycle, NCSL performed an analysis of the deviation of each state's congressional, senate and house plans.[14] In that analysis, they illustrated numerous senate and house plans with 5%, 10% and even over 20% population deviation (in the unique environment that is Hawaii). By comparison, Wisconsin's senate deviation in 2010 was 0.62% and the assembly's deviation was 0.76%. Today in 2020, the Legislative plan results in equal or better reapportionment with a senate deviation of 0.57% and an assembly deviation again of 0.76%. In any context, these very small deviations cannot be considered anything less than exceptionally good.

[13] The full memorandum is included in **Appendix 6** and is also publicly available here: https://drawyourdistrict.legis.wisconsin.gov/download/Sen_LeMahieu_and_Speaker_Vos_LRB_5017_and_5071.pdf.

[14] https://www.ncsl.org/research/redistricting/2010-ncsl-redistricting-deviation-table.aspx

B. Application of Redistricting Criteria to Reapportion Legislative Districts in a "Least Changes" Manner

50. In my experience, there are multiple ways to reapportion districts. How a state reapportions is dependent on the state's exact application and prioritization of traditional redistricting criteria. The Wisconsin Legislature memorialized *their* criteria in a Senate Joint Resolution 63 (**Appendix 6**).

- The Legislature's criteria are consistent with state and federal law requirements;
- The Legislature's criteria are consistent with the Court's November 30 order; and
- The Legislature's criteria are also consistent with LRB memo.

I independently validated the findings of the legislature.

51. In the following sections, I examine the compliance of the Wisconsin Legislature's plans with respect to constitutional provisions regarding nesting of districts and maintaining contiguity. Then, I undertake a comprehensive review of political geographic splits.[15] I investigate compliance of the Legislative plans with the traditional redistricting principles that were manifest to the stated effort of the Legislature to develop and execute a "least-changes" map. The measures that follow are a geographic splits analysis, a core retention analysis (CRA), a temporal disenfranchisement analysis and a continuity of representation (incumbency) analysis.

[15] In Wisconsin, Assembly districts (and by derivation Senate districts) are "to be bounded by county, precinct, town or ward lines." Wis. Const. art. IV, §4; Order ¶ 35.

1. District Boundaries, Ward Boundaries, and Geographic Splits Analysis

52. I have confirmed the LRB's finding that the Legislature's plans draw 99 Assembly districts and 33 Senate districts. Each Senate district is made up of 3 contiguous Assembly districts. My careful, independent investigation demonstrated that all Senate and Assembly districts followed ward boundaries exactly, and that all districts had either physical contiguity or political contiguity.

53. I next turn my attention to the unity of other administrative geography in Wisconsin, beyond the ward boundaries. Traditional redistricting principles (as provided by the NCSL) and Wisconsin-specific redistricting principles (as provided by the Wisconsin legislature) strongly agree that splitting administrative geography should be minimized in a successful redistricting plan. There are three relevant layers of administrative geography in Wisconsin, including counties, county subdivisions (referred to as towns and places). The US Census Bureau provides useful details in understanding the number and characteristics of these layers in Wisconsin as follows:[16]

- **Counties:** There are 72 counties in Wisconsin. Each county is of varying population. All counties in Wisconsin are functioning governmental entities, each governed by a board of supervisors.
- **Places:** There are 773 places in Wisconsin. These include Wisconsin's 594 incorporated places and 179 census designated places (CDPs). The incorporated places consist of 190 cities and 404 villages. The minimum population required for incorporation in Wisconsin is 150. Incorporated places are independent of county subdivisions.
- **County Subdivisions:** Wisconsin has 1,921 county subdivisions known as minor civil divisions (MCDs). These include 1,257 towns with functioning, but not necessarily active, governments. Towns in Wisconsin are each governed by a board of supervisors. The 594 incorporated places in Wisconsin are independent of MCDs and serve as 651 county subdivisions. In addition, there are 13 undefined MCDs consisting entirely of water area.

[16] https://www.census.gov/geographies/reference-files/2010/geo/state-local-geo-guides-2010/wisconsin.html.

54. A "splits" analysis will evaluate the number of times a plan's boundaries split established administrative geography such as counties, cities, places and towns. If a county, for example, is split by three districts, it will be split into at least three constituent pieces.

55. Wisconsin's Legislative Reference Bureau has reported that the number of splits in the 2011 Assembly and Senate District plans are as follows:

Figure IV.3 2011 Act 43 Assembly and Senate County and Municipal Splits[17]

2011 Act 43 Assembly Plan	58 county splits	78 municipal splits
2011 Act 43 Senate Plan	46 county splits	48 municipal splits

56. My geography splits analysis continues with an assessment of how the Legislature's new plans accommodate Wisconsin's county geography. In **Figure IV.4**, "Legislature's Assembly Plan Splits," Row 1 shows the Legislature's Assembly District Plan splits 53 counties into 212 pieces (compared to 58 county splits in the existing districts, **Figure IV.3** above).

57. In **Figure IV.5**, "Legislature's Senate Plan Splits," Row 1 shows that the Legislature's Senate District plan splits 42 counties into 115 pieces (compared to 46 county splits in the existing districts, **Figure IV.3** above).

Figure IV.4 Legislature's Assembly Plan County, City/Village and Town Splits

Row	Legislature Assembly Plan	Splits	Pieces
1	County Splits	53	212
2	City/Village Splits	36	103
3	City/Village Splits (County Splits)	32	93
4	Town Splits (County Splits)	16	32

Figure IV.5 Legislature's Senate Plan County, City/Village and Town Splits

Row	Legislature Senate Plan	Splits	Pieces
1	County Splits	42	115
2	City/Village Splits	23	53
3	City/Village Splits (County Splits)	20	46
4	Town Splits	8	16

[17] https://legis.wisconsin.gov/democrats/media/2209/lrb-s0263-2-ab624-sb621-and-2011-act-43-analysis_bewley.pdf.

The report does not identify whether these reported splits were splits based on Wisconsin's 2011 geography when Act 43 was enacted. Between 2011 and 2020, some boundaries of Wisconsin municipalities will have changed due to annexation - meaning the number of splits when enacted could be different than the number of splits in Act 43 today.

58. **Figure IV.4**, "Legislature's Assembly Plan Splits," Rows 2 and 4 show the Legislature's Assembly District plan splits 36 cities/villages into 103 pieces and 16 towns into 32 pieces (compared to 78 municipal splits in the existing districts, **Figure IV.3** above).

59. **Figure IV.5**, "Legislature's Senate Plan Splits," Rows 2 and 4 show the Legislature's Senate District plan splits 23 cities/villages into 53 pieces and 8 towns into 16 pieces (compared to 48 municipal splits in the existing districts, **Figure IV.3** above).

60. Notably, there can be pre-existing splits of cities/villages by counties if those cities/villages cross county lines. Taking both counties and city/village splits into account – both Assembly and Senate districts end up with slightly fewer splits (because incremental county splits are already taken into account). **Figure IV.4** "Legislature's Assembly Plan Splits," Row 3 shows that the Legislature's Assembly District plan splits 32 cities/villages into 93 pieces. In **Figure IV.5** "Legislature's Senate Plan Splits," Row 3 the Legislative plan splits 20 cities/villages into 46 pieces.

    The conclusions here are that:

    - The Legislative assembly plan has (36-32): 4 county/city/village splits
    - The Legislative senate plan has (23-20): 3 county/city/village splits

2. Core Retention Analysis

61. Courts have recognized the need to preserve the core of a prior established district as a legitimate redistricting criterion,[18] as well as the avoidance of contests between incumbents.[19] Core retention fosters the continuity of political representation. A C*ore Retention Analysis* (CRA) also known as a constituency report is simply a demographic accounting of the addition, subtraction, and substitution of persons that would be brought about by a proposed realignment of a district's existing boundaries. A CRA is a way of quantifying precisely how a proposed realignment would affect the continuity of political representation among a district's current residents and eligible voters.

62. Here, a proposed plan with high core retention scores is indicative of a plan that makes minimum changes to Wisconsin's existing districts, as required by this Court. Order ¶ 8. A proposed plan with mostly low core retention scores is more suspect. Low core retention scores often signify that the new districts are *not* based on existing districts. Under the methodology I employ to measure core retention, core retention is evaluated by assessing the number of persons in an existing district who remain in that district. One can measure core retention by starting with the existing district or starting with the new district. To illustrate "existing district" approach—which I employ here as the better measure of a "minimum changes" plan—assume a district has 800 people based on the 2020 Census, but apportionment requirements indicate that the district must have 1,000. All 800 people in that district can be retained in the new district (100% core retention), even though the district also must add new population. To illustrate the "new district" approach, assume that district has 1,000 people based on the 2020 census, but apportionment requirements indicate that the district must have 800. To achieve population equality, 800 of the district's residents may remain in the district. Examining core retention based on the "new district," retaining the maximum number of individuals from the existing district for the 800-person new district would be 100% core retention.[20]

63. Core Retention Analysis has usually considered only the total populations of districts in comparisons across plans. Here, I have also broadened this standard demographic model, using standard methodology to present district-by-district comparisons, comparisons to alternative redistricting plans, and by also analyzing the core retention of protected group.

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[18] *Abrams v. Johnson*, 521 U.S. 74, 84 (1997).

[19] *Bush v. Vera*, 517 U.S. 952 (1996).

[20] This appears to be the approach that LRB took in the core constituency reports that appear here: https://drawyourdistrict.legis.wisconsin.gov/ProposedMaps. Importantly, under either approach, overall core retention will ultimately be the same. But there will be district-by-district differences.

64. I include all of my Core Retention Analysis charts and tables in **Appendix 2**.

65. My core retention analysis starts with the existing district (here, 2011 Act 43) and measures the departure of a new plan from that year. I illustrate this by showing where the Census 2020 population for the existing Senate District 2 was distributed in the new Wisconsin legislative plan. Shown below in **Figure IV.6**, 92.1% (169,139 out of 183,553) of the existing Senate District 2 is retained in the Legislature's Senate District 2. The remaining 7.9% of existing Senate District 2—which experienced population growth and was thus overpopulated after the 2020 census—went to nearby districts to bring Senate District 2 back to ideal population and to accommodate changes to surrounding districts. As shown in the table below, the Legislature's plan redistricts the remaining 8% of individuals from existing District 2 into the Legislature's District 1 (11 individuals), District 12 (1,803 individuals), District 14 (7,557 individuals), District 19 (3,622 individuals) and District 30 (1,421 individuals).

Figure IV.6 Example Core Retention Analysis of Legislature's Senate District 2

Current Base District	Legislative Plan	Total Population	Percent of Population
2	1	11	0.0%
	2	169,139	92.1%
	12	1,803	1.0%
	14	7,557	4.1%
	19	3,622	2.0%
	30	1,421	0.8%
2 Total		**183,553**	

66. In addition to analyzing the total core retention of a district (as shown above) I enhance my analysis of retention of total population with an additional analysis of the Black and Hispanic population using what I refer to as a "differential" CRA. The "differential" being the findings it generates by district between the total population and the Black / Hispanic population. In the matters of voting rights and redistricting – another population besides total can and does frequently yield significant differences in CRA findings: race and ethnicity. While race cannot be the prevailing factor in drawing a district - in the State of Wisconsin and beyond the impact of redistricting on race and ethnic groups is still of significant legal concern.

67. I begin my analysis by examining statewide summaries of the Legislature's Senate and Assembly plans. I then examine core retention on a district level. To provide context, I provide some comparisons to the PMC plans, which would not be least-changes plans. I then follow with a more in-depth examination of the core retention of the legislative plan for the *Baldus* Black and Hispanic Voting Rights Act (VRA) districts.

a. Overall Senate Core Retention Analysis

68. Starting with **Figure IV.7**, it can plainly be seen that core retention of the total population of the Legislature's Senate plan is very high at 92.2%. This means that 92.2% of the State's population remain in the same Senate district they currently reside under the existing districts. Core retention is even higher at 96.0% for the Black population. This is expected given the least change approach the Legislature took.

Figure IV.7 Act 43 Senate v. SB621: Total and Black Core Retention "By District Number"[21]

Legislative Senate Plan by Largest Component		
	Total Population	Black Alone Population
Number Retained	5,434,396	399,152
Percent Retained	92.2%	96.0%
Number Displaced	459,322	16,827
Grand Total	5,893,718	415,979

69. To put the core retention of the Legislature's senate plan in perspective, I compared it to the core retention of the PMC senate plan in **Figure IV.8** - which retains only 56.5% of Wisconsinites in their existing senate districts. This shows the core retention of the PMC proposed senate plan compared to the existing districts from 2011 Act 43 plan is *much* lower than the legislature plan.

Figure IV.8 Act 43 Senate v. PMC: Total and Black Core Retention "By District Number"

PMC Senate by District Number		
	Total Population	Black Alone Population
Number Retained	3,327,550	255,659
Percent Retained	56.5%	61.5%
Number Displaced	2,566,168	160,320
Grand Total	5,893,718	415,979

70. Part of the low performance of the PMC plan is attributable to the lack of continuity of senate district numbering from the Act 43 plan to their new plan (the PMC appeared to renumber districts, complicating a basic core retention analysis). Therefore, in addition to comparing

[21] **Appendix 6** contains LRB's Memorandum regarding Legislature's Plans, which confirms 92.2% core retention. The memorandum is also publicly available here: https://drawyourdistrict.legis.wisconsin.gov/download/Sen_LeMahieu_and_Speaker_Vos_LRB_5017_and_5071.pdf.

districts by district numbers, I also give the PMC map the benefit of the doubt by extending my analysis to estimate the core retention of whatever the largest share new district is for every existing district.

71. In **Figure IV.9**, I calculate exactly how much of the displacement is attributable to the lack of continuity by matching geographic territories under the Act 43 districts and the PMC proposed districts, without regard to their numbering. Here I show that 2,405,571 total population and 261,375 Black population are still displaced using the more favorable "by largest measure" metric, again without regard to the different district numbering. This improves core retention from 56.5% to 59.2% for total population and from 61.5% to 62.8% for the Black population. The resulting retention is still *significantly* lower than the retention offered by the Legislature's plan.

Figure IV.9 Act 43 Senate v. PMC: Total and Black "By Largest Component"

PMC Senate by Largest Component		
	Total Population	Black Alone Population
Number Retained	3,488,147	261,375
Percent Retained	59.2%	62.8%
Number Displaced	2,405,571	154,604
Grand Total	5,893,718	415,979

72. On either measure, the low core retention scores of the PMC plans are indicative of a map that starts from scratch, versus a map that modifies the existing districts.

b. Overall Assembly Core Retention Analysis

73. I conducted a similar analysis for the Legislature's Assembly districts. Starting with **Figure IV.10**, it can plainly be seen that core retention in the Legislature's Assembly plan is also very high for the total population (at 84.2%) and Black population (87%) which again is expected given the least change approach of the legislature.

Figure IV.10 Act 43 Assembly v. SB621: Total and Black Core Retention "By District Number"

Enacted SB621 Assembly by District Number		
	Total Population	Black Alone Population
Number Retained	4,959,811	362,083
Percent Retained	84.2%	87.0%
Number Displaced	933,907	53,896
Grand Total	5,893,718	415,979

74. Noting the importance of the *Baldus* Voting Rights litigation, I continue my statewide analysis of Assembly districts here with a look at Hispanic population retention. As seen in **Figure IV.11**, core retention of Hispanics in Assembly districts is very similar to both the total and Black population at 87.5%. A more detailed examination of *Baldus* Black and Hispanic VRA districts will follow.

Figure IV.11 Act 43 Assembly v. SB621: Total and Hispanic Core Retention "By District Number"

Legislative Assembly Plan		
	Total Population	Hispanic Population
Number Retained	4,965,885	391,598
Percent Retained	84.3%	87.5%
Number Displaced	927,833	55,692
Grand Total	5,893,718	447,290

75. To put the core retention of the Legislature's Assembly plan in perspective, I again compare the core retention of the PMC plans. In **Figure IV.12**, I show the PMC plan would have only retained 40.0% of Wisconsinites in their existing districts (if one analyzes core retention by district number) or only 58.1% if one analyzes core retention by shared territory (**Figure IV.13**).[22]

Figure IV.12 Act 43 Assembly v. PMC: Total and Black Core Retention "By District Number"

PMC Assembly by District Number		
	Total Population	Black Alone Population
Number Retained	2,360,292	179,858
Percent Retained	40.0%	43.2%
Number Displaced	3,533,426	236,121
Grand Total	5,893,718	415,979

76. In **Figure IV.13** (below), I determine exactly how much of the displacement is attributable to the lack of continuity. Here I show that 2,405,571 total population and 261,375 Black population are displaced using the more favorable "by largest measure" metric (versus comparing by district numbers). This improves PMC core retention significantly from 40.0% to 58.1% for total population and from 43.2% to 59.5% for the Black population. Still: significantly lower than the retention offered by the Legislative plan.

[22] As with the PMC's Senate Plans, core retention by number is complicated by the fact that the PMC appeared to renumber all of the districts in their plan.

Figure IV.13 Act 43 Assembly v. PMC: Total and Black Core Retention "By Largest Component"

PMC Assembly by Largest Component		
	Total Population	Black Alone Population
Number Retained	3,426,080	247,412
Percent Retained	58.1%	59.5%
Number Displaced	2,467,638	168,567
Grand Total	5,893,718	415,979

c. District-by-District Core Retention Analysis

77. I have included a district-by-district ranking and analysis of core retention percentages for the Legislature's SB621 Senate and Assembly plans in **Appendix 2A** "Core Retention Analysis Legislative Plan." In these charts, a 100% core retention percentage means 100% of the existing population remains in the new district. If a district exceeds ideal population, it is not possible to retain 100% of the existing population. These district-by-district bar charts are another way of showing that the Legislature's districts are least changes. In my experience, this distribution of core retention percentages is very high, reflecting the least changes approach requested by the Court.

78. Unsurprisingly, districts with lower core retention scores in the Legislature's plan sit between Madison and Milwaukee. In my opinion, the few instances of relatively low CRA percentages I observe are unavoidable and to be expected given the population shifts in and between Madison and Milwaukee. One cannot simply trade overpopulation of Madison for underpopulation of Milwaukee because they are not contiguous. Instead, select districts *between* Madison and Milwaukee are affected. These include Senate Districts 5, 11, 15, 27, and 28—all districts that have population in the counties of Milwaukee, Waukesha, Jefferson, or Dane. Likewise, the Assembly Districts with the five lowest core retention scores (AD 13, 14, 24, 43 and 83) included territory in the counties of Milwaukee, Waukesha, Jefferson, or Dane. Assembly District 24, for example, previously included Milwaukee territory. But Milwaukee districts to the south, including Assembly Districts 10 and 11, absorbed that Milwaukee territory to bring those Milwaukee districts back to population equality. An analysis and interpretation of the Senate CRA percentages show no districts of concern.

d. Baldus *litigation and Voting Rights Act Core Retention Analysis*

79. I also examined core retention of districts challenged in the 2012 *Baldus* Voting Rights Act litigation.

i. Core Retention Analysis for Baldus *Black VRA Districts*

80. First, I analyzed the core retention of the majority Black Senate District 4 (and embedded Assembly Districts 10, 11, and 12) and Senate District 6 (and embedded Assembly Districts 16, 17, and 18). Shown in **Figure IV.14**, in the Legislature's plan, 100% of the total and Black population of SD4 and SD6 is retained.

Figure IV.14 Senate Districts 4 and 6 Total and Black Population

Current Base District	Legislature Senate District	Total Population	Black Alone Population	Total Percentage	Black Alone Percentage
4	4	163,208	103,694	100.0%	100.0%
4 Total		**163,208**	**103,694**		
6	6	162,069	103,044	100.0%	100.0%
6 Total		**162,069**	**103,044**		

81. In **Figure IV.15** (below) I show the component Assembly Districts (10, 11 12 and 16, 17 18) within Senate Districts 4 and 6. Each district retains almost all of its core. With respect to the Assembly districts making up Senate District 4, AD10 keeps 83.7% of its Black population, AD11 keeps 93.2%, and AD12 keeps 86.6%. There is some slight realignment of population between these districts. And AD10 and AD12 also gained sizeable population from nearby District 24.

82. With respect to the Assembly districts making up Senate District 6, AD16 keeps 100.0% of its Black population, AD17 keeps 93.0%, and AD18 keeps 88.5%. There is some slight realignment of population between AD17 and AD18.

Figure IV.15 Assembly Districts 10, 11, 12 (Within Senate District 4) and Assembly Districts 16, 17, 18 (within Senate District 6) Total and Black Population

Current Base District	Legislative Assembly District	Total Population	Black Alone Population	Total Percentage	Black Alone Percentage
10	10	46,146	26,743	87.7%	83.7%
	11	6,482	5,208	12.3%	16.3%
10 Total		**52,628**	**31,951**		
11	10	6,276	1,595	11.6%	4.4%
	11	46,364	33,843	85.4%	93.2%
	12	1,635	875	3.0%	2.4%
11 Total		**54,275**	**36,313**		
12	11	6,719	4,747	11.9%	13.4%
	12	49,586	30,683	88.1%	86.6%
12 Total		**56,305**	**35,430**		
16	16	53,739	32,105	100.0%	100.0%
16 Total		**53,739**	**32,105**		
17	12	0	0	0.0%	0.0%
	17	52,204	35,415	94.3%	93.0%
	18	3,139	2,654	5.7%	7.0%
17 Total		**55,343**	**38,069**		
18	9	0	0	0.0%	0.0%
	16	5,975	2,708	11.3%	8.2%
	17	1,233	1,088	2.3%	3.3%
	18	45,779	29,074	86.4%	88.5%
18 Total		**52,987**	**32,870**		

ii. Core Retention Analysis for Baldus Hispanic VRA Districts

83. I also evaluated the core retention of the two Hispanic/Latino districts at issue in *Baldus*—Assembly Districts 8 and 9. In **Figure IV.16**, District 8 retains 100% of its population, and District 9 retains 91% of its Hispanic population.

Figure IV.16 Assembly Districts 8 and 9 Total and Hispanic Population

Current Base District	Legislature Assembly District	Total Population	Hispanic Population	Total Percentage	Hispanic Percentage
8	8	53,999	38,111	100.0%	100.0%
8 Total		**53,999**	**38,111**		
9	7	27	23	0.0%	0.1%
	8	5,363	3,098	9.4%	8.9%
	9	51,949	31,731	90.6%	91.0%
9 Total		**57,339**	**34,852**		

3. Temporal Disenfranchisement for Senate Districts

84. Another measure for a "minimum changes" plan is temporal disenfranchisement. Temporal disenfranchisement occurs at the intersection of the legislative redistricting process and staggered election cycles. Under current law, citizens living in existing odd-numbered districts would have the opportunity to vote for state senator in 2022. The population exposed to the risk of temporal disenfranchisement is the universe of people displaced from their existing district in the CRA. Similar to low core retention scores, low disenfranchisement scores are indicative of a map that has been built with "least changes."

85. Currently, 27 of the State Senates in the United States have staggered elections, including Wisconsin. Every two years, half of Wisconsin's state senators are up for election or re-election, with even-numbered districts holding elections in presidential-election years and odd-numbered districts holding elections in midterm-election years. The Wisconsin Constitution provides:

> "Senators, how chosen. SECTION 5. [As amended Nov. 1881 and Nov. 1982] The senators shall be elected by single districts of convenient contiguous territory, at the same time and in the same manner as members of the assembly are required to be chosen; and no assembly district shall be divided in the formation of a senate district. The senate districts shall be numbered in the regular series, and the senators shall be chosen alternately from the odd and even−numbered districts for the term of 4 years. [1880 J.R. 9S, 1881 J.R. 7A, 1881 c. 262, vote Nov. 1881; 1979 J.R. 36, 1981 J.R. 29, vote Nov. 1982]." Wis. Const. art. IV, §5."

86. Under normal circumstances, voters in odd-numbered districts would have had the opportunity to vote for their state Senator in 2018 and then again in 2022. However, when voters are moved out of an odd-numbered district and into an even-numbered district as a result of the redistricting process, they are denied the opportunity to vote within a four-year cycle, having their vote delayed until 2024. These voters can be said to have been "temporally disenfranchised" by the redistricting process, effectively being represented by a state Senator for two years for whom they did not have the opportunity to cast a ballot.

Figure IV.17 Illustrative Example of Temporal Disenfranchisement

	Existing District	New District	Last Voted	Next Voted
1	Odd	Odd	2018	2022
2	**Odd**	**Even**	**2018**	**2024**
3	Even	Even	2020	2024
4	Even	Odd	2020	2022

87. Shown in **Figure IV.17**, the voters and the population they represent in row 2 would be temporally disenfranchised.

88. Some amount of population movement is inevitable. As revealed by the 2020 Census, all but a few of the odd-numbered Senate Districts were overpopulated, meaning individuals would have to be moved out of those districts into even districts to bring all districts back to ideal population no matter what.

89. **Figure IV.18** and **Figure IV.19** show the effects of temporal disenfranchisement for the Legislature's Senate plan. To put the Legislature's plan in perspective, the tables also include a comparison to the PMC plan.

90. Overall, I calculate that the Legislature's plan moves only 138,732 individuals from an odd-numbered district to an even-numbered district.

91. For context, consider the *total* number of individuals moved under the Legislature's plan. Shown above in my core retention analysis, the Legislature's plan moved 459,322 individuals (**Figure IV.7**). In **Figure IV.18** (below), I show that there were only 138,732 (2.4% of the total population of 5,983,718) who moved from an Odd > Even district.

92. I also analyzed whether the movement from odd-to-even Senate districts had an outsized effect on Black population. It did not. As discussed above, the Legislature's plan has exceedingly high core retention for predominately Black districts. Consistent with this, the Legislature's plan moves only 4,196 Black individuals (1.0% of total) from an Odd > Even district.

Figure IV.18 Temporal Disenfranchisement of the Legislative Senate Plan

SB621 Senate Temporal Disenfranchisement				
	Total	Black	Total Percentage	Black Percentage
Stay Even	2,717,690	321,867	46.1%	77.4%
Stay Odd	2,902,754	86,926	49.3%	20.9%
Even to Odd	134,542	2,990	2.3%	0.7%
Odd to Even	138,732	4,196	2.4%	1.0%

93. The total and Black disenfranchised population estimated here in the last row ("Odd to Even") have effectively had their opportunity to vote for their state Senator delayed by two years. If these populations had remained within their existing Senate district, they would have been able to vote in 2022. Instead, they will now vote in 2024. In the Legislature's plan, it is notable in both total and Black populations that the number and percent disenfranchised are relatively small – which I attribute to the "least change" approach that the State of Wisconsin took to drawing their Senate maps. It is also notable that the Black population in Wisconsin is subject to *significantly* less temporal disenfranchisement than the population as a whole in the Legislature's plan.

94. Another tool to put the Legislature's plan in perspective is the PMC plan. Discussed above, (**Figure IV.8**) the PMC Senate plan moves 2,566,168 individuals, and the Black population displaced is 160,320. In **Figure IV.19**, I show that the PMC plan would have moved 543,570 individuals (9.2% of total) from an Odd > Even district. Concurrently, the PMC plan would have moved 16,964 individuals (4.1% of total) who moved from an Odd > Even district.

Figure IV.19 Temporal Disenfranchisement of the 2021 Wisconsin PMC Senate Plan

PMC Senate Temporal Disenfranchisement				
	Total	Black	Total Percentage	Black Percentage
Stay Even	2,313,344	288,505	39.3%	69.4%
Stay Odd	2,497,916	74,158	42.4%	17.8%
Even to Odd	538,888	36,352	9.1%	8.7%
Odd to Even	543,570	16,964	9.2%	4.1%

95. In the PMC plan, the number and percent disenfranchised are significant – each value being approximately *4 times* greater than the Legislature's plan. While the relationship of total population disenfranchised to the Black population disenfranchised is similar to the Legislature's plan (roughly 2:1), the Legislature's plan subjects *significantly* fewer individuals to temporal disenfranchisement.

4. Compactness

96. Compactness of districts is a measure to ensure that districts do not excessively deviate from being "reasonably shaped" that is intended to deter gerrymandering. This of course is an enormously ambiguous and arbitrary description of what compactness actually is. Compactness was relatively easy to attain before "One Person One Vote". For example, Wisconsin's mostly square counties could also serve as compact, single-member districts if Wisconsin was free to disregard population equality.

97. However, with the development of both technology[23] and redistricting law (especially *Baker v. Carr,* which led to splitting of geography to drive population deviations lower) compactness became less and less possible, if not relevant.

98. Today, while most compactness measures are absolute, they can still effectively serve as a tool compare one plan against another and to determine which is superior (even if multiple plans have poor compactness).[24] Compactness is also a tool to compare existing districts against new districts to determine whether the new districts entail minimal or large-scale changes from the existing districts.

99. But what compactness measure does an expert use? The law offers few precise definitions of compactness other than "you know it when you see it," which effectively implies a common understanding of the concept. In contrast, academics have shown that compactness has multiple dimensions and have generated many conflicting measures."[25]

100. There is no professional consensus on a "right" measure, and every widely used measure works differently. A district that is "most compact" by one measure can easily and frequently be less compact by another. For this reason, I pick four of the most common statistical measures (Polsby-Popper, Schwartzberg, Reock and Convex Hull) - each of which has

[23] The 1971 and 1981 Reapportionments used limited computer mapping for the used limited computer mapping for the first time. 1991 Reapportionment added significant geographic technology—Census Tiger Files—Geographic Information Systems.

[24] https://www.ncsl.org/Documents/legismgt/Compactness-Hofeller.pdf.

[25] "How to Measure Legislative District Compactness If You Only Know it When You See it," https://gking.harvard.edu/presentations/how-measure-legislative-district-compactness-if-you-only-know-it-when-you-see-it-7.

unique features, and strengths and weaknesses.[26] I then compare the compactness of each district of each plan individually and in aggregate.

101. In **Appendix 3 Tables 1, 2, 3, and 4**, I assess compactness by Assembly and Senate district, by method. Within each method (columns), the higher the score the better. In each table, the scores shaded in green are the "best" in each measure, that is: most compact. The scores shaded in red are the poorest, that is: least compact. Not all districts are ranked the same in each measure, which is why I use multiple measures and examine each individually as well as in aggregate.

102. This table enables an assessment of the performance of individual districts across methods. This illustrates exactly why it is beneficial to look at multiple, highly regarded methods when performing compactness analysis. Since the values within each method are similar (but are in fact mathematically different), it is not possible to summarize accurately across plans. In order to compare the Legislature's plan with the existing Act 43 plan I summarize and average the compactness scores by method.

103. The last column ("Total") in the **Appendix 3** tables is simply a sum of the scores across plans for that district and is designed to provide a final summary ranking of the compactness of each district. The last row "Sum" is simply a sum of the scores for all districts in the plan for that measure. This is calculated to enable a summary comparison of metrics from one plan to another. A higher score in "Sum" means that by that measure, that plan is more compact. (For this exercise, I interpret whichever plan has the majority of high scores to be the "more compact" plan.)[27]

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[26] The Polsby-Popper and Schwartzberg ratios place high importance on district perimeter. Thus, they are highly susceptible to bias due to shoreline complexity. Therefore, districts that are trimmed around shorelines may end up with a low compactness score through no fault of the district's authors and may not necessarily be a true indicator of gerrymandering. This is precisely why it's important to use multiple compactness scores (in this case the Polsby-Popper, Schwartzberg, Reock and Convex Hull measures) and let the reader judge which one is a better fit based on the geography of the district and method of calculation each score uses. A higher score means more compact, but the scores using different measures cannot be directly compared to each other. *See* Azavea White Paper, "Redrawing the Map on Redistricting," (2012), https://cdn.azavea.com/com.redistrictingthenation/pdfs/Redistricting_The_Nation_Addendum.pdf.

[27] Detailed compactness scores are presented in **Appendix 3**, as follows:

Assembly Compactness Tables

- Table 1 Act 43 Assembly Plan Compactness Scores
- Table 2 Legislative Assembly Plan Compactness Scores

104. In summary **Table IV.19** and **Table IV.20** below, the compactness of the new legislative plans is very similar to the previously enacted plan, meeting the Court's request for a plan with least changes.

Table IV.19 Comparison of Compactness by Assembly Plan by Measure

	Polsby-Popper	Schwartzburg	Reock	Convex-Hull
Act 43	.24	.48	.38	.75
Legislature	.23	.47	.39	.72

Table IV.20 Comparison of Compactness by Senate Plan by Measure

	Polsby-Popper	Schwartzburg	Reock	Convex-Hull
Act 43	.22	.46	.39	.72
Legislature	.22	.46	.39	.71

Senate Compactness Tables

- Table 3 Act 43 Senate Plan Compactness Scores
- Table 4 Legislative Senate Plan Compactness Scores

5. Incumbency Analysis

105. My last analysis was to examine whether either the Wisconsin Legislative plan or the PMC plan resulted in the effect of pairing any incumbents. Minimizing incumbent pairings preserves constituent-legislator relationships allowing voters, not courts, to choose to break (or maintain) the pre-existing representational bonds. Minimizing incumbent pairings thus reflects a least changes approach.

106. The concept of protecting incumbents (that is, not pairing them in a new redistricting plan) for continuity of representation and many other reasons is one of several areas where the Wisconsin Legislature and the PMC approach fundamentally depart. The Legislature's Joint Resolution 63 states explicitly that their plans seek to "Promote continuity of representation by avoiding incumbent pairing unless necessary to further another principle stated above."[28] By comparison, the PMC redistricting criteria expressly reject incumbency as a redistricting criterion.[29] The results of these different philosophies are striking, but not surprising.

107. In the Legislature's Assembly plan, there are only three Assembly districts with paired incumbents as shown in **Figure IV.21**. There are no incumbents paired in the Legislature's Senate plan:

Figure IV.21 Legislature Assembly Paired Incumbents[30]

District 15	District 82	District 93
Current 15: Rep. Joe Sanfelippo (R) Current 84: Rep. Mike Kuglitsch (R)	Current 82: Rep. Ken Skowronski (R) Current 83: Rep. Chuck Wichgers (R)	Current 30: Rep. Shannon Zimmerman (R) Current 93: Rep. Warren Petryk (R)

108. Of these three pairs in the Legislature's Assembly plan, none are in *Baldus* VRA districts.

109. By comparison, in the PMC plan, there are six proposed Senate districts with paired incumbents, including remarkably one district that pairs three senators, as shown in **Figure IV.22**.

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[28] **Appendix 6** contains the joint resolution, which is also available here: https://docs.legis.wisconsin.gov/document/enrolledbills/2021/REG/SJR63.pdf.

[29] People's Maps Commission, Redistricting Criteria Memo, https://evers.wi.gov/Documents/PMCCriteriaMemoFINAL.pdf ("there will be no preference for plans that resemble the current enacted maps or those that favor any incumbent").

[30] **Appendix 6** contains LRB's memorandum regarding Legislature's Plans and paired incumbents, which is also available here: https://drawyourdistrict.legis.wisconsin.gov/download/Sen_LeMahieu_and_Speaker_Vos_LRB_5017_and_5071.pdf.

Figure IV.22 PMC Senate Paired Incumbents

District 2 Current 1: Sen. André M. Jacque (R) Current 2: Sen. Robert L. Cowles (R) Current 30: Sen. Eric Wimberger (R)	**District 8** Current 8: Sen. Alberta Darling (R) Current 20: Sen. Duey Stroebel (R)	**District 23** Current 23: Sen. Kathleen M. Bernier (R) Current 31: Sen. Jeff Smith (D)
District 3 Current 3: Sen. Tim Carpenter (D) Current 7: Sen. Chris Larson (D)	**District 20** Current 9: Sen. Devin LeMahieu (R) Current 18: Sen. Dan Feyen (R)	**District 27** Current 17: Sen. Howard L. Marklein (R) Current 27: Sen. Jon Erpenbach (D)

110. In the PMC plan, there are 20 proposed Assembly districts with incumbents, including remarkably 2 districts that pair 3 representatives as shown in **Figure IV.23**.

Figure IV.23 PMC Assembly Paired Incumbents

District 1 Current 1: Rep. Joel Kitchens (R) Current 2: Rep. Shae A. Sortwell (R)	**District 34** Current 34: Rep. Rob M. Swearingen (R) Current 35: Rep. Calvin T. Callahan (R)	**District 79** Current 37: Rep. William Penterman (R) Current 42: Rep. Jon Plumer (R) Current 81: Rep. Dave L. Considine (D)
District 8 (*Baldus*) Current 7: Rep. Daniel G. Riemer (D) Current 8: Rep. Sylvia Ortiz-Velez (D)	**District 38** Current 24: Rep. Daniel R. Knodl (R) Current 58: Rep. Rick Gundrum (R)	**District 83** Current 83: Rep. Chuck C. Wichgers (R) Current 82: Rep. Ken P. Skowronski (R)
District 11 Current 11: Rep. Dora E. Drake (D) Current 12: Rep. LaKeshia Myers (D)	**District 43** Current 6: Rep. Gary J. Tauchen (R) Current 89: Rep. Elijah Behnke (R)	**District 84** Current 84: Rep. Mike Kuglitsch (R) Current 15: Rep. Joe J. Sanfelippo (R)
District 14 Current 13: Rep. Sara J. Rodriguez (D) Current 22: Rep. Janel E. Brandtjen (R)	**District 45** Current 45: Rep. Mark E. Spreitzer (D) Current 31: Rep. Amy Loudenbeck (R)	**District 86** Current 86: Rep. John S. Spiros (R) Current 69: Rep. Donna M. Rozar (R)
District 16 Current 16: Rep. Kalan Haywood (D) Current 19: Rep. Jonathan F. Brostoff (D)	**District 59** Current 26: Rep. Terry A. Katsma (R) Current 27: Rep. Tyler J. Vorpagel (R) Current 59: Rep. Timothy S. Ramthun (R)	**District 91** Current 67: Rep. Rob L. Summerfield (R) Current 29: Rep. Clint P. Moses (R)
District 17 Current 17: Rep. Supreme Moore Omokunde (D) Current 14: Rep. Robyn Vining (D)	**District 64** Current 64: Rep. Tip McGuire (D) Current 65: Rep. Tod O. Ohnstad (D)	**District 98** Current 98: Rep. Adam Neylon (R) Current 99: Rep. Cindi S. Duchow (R)
District 32 Current 63: Rep. Robin J. Vos (R) Current 61: Rep. Samantha Kerkman (R)	**District 69** Current 68: Rep. Jesse L. James (R) Current 93: Rep. Warren L. Petryk (R)	

111. Assembly District 8 was redrawn by a federal court in the *Baldus* litigation. The PMC plans would pair the minority representative in that district with another representative. Assembly Districts 11, 12, 16, and 17 are predominantly Black Assembly districts that were also challenged (and then abandoned) in the *Baldus* litigation. The PMC plans would pair minority representatives in those districts.

112. In examining the political characteristics, several striking outcomes emerge. The Legislature's Assembly plan has 3 districts with paired incumbents - and they are all Republicans. The PMC Senate plan has 6 Senate districts with paired incumbents. 3 of the 6 districts are all Republicans (one district has three Republican incumbents paired). One district has Democratic incumbents paired and the other 2 districts have one of each (one Republican and one Democrat). The PMC Assembly plan has 20 Assembly districts with paired incumbents. 12 of these districts pair all Republicans, with one district having 3 Republican incumbents. By comparison, only 5 of the Assembly districts have Democrat incumbents paired. 3 districts have Democrats and Republicans (one of these 3 districts has 3 incumbents - 2 Republican and 1 Democrat).

CONCLUSION

113. For the reasons stated in this report and illustrated in the appendices, I conclude that the Legislature's SB 621 Assembly and Senate plans make minimum changes, measured by a variety of metrics, to reapportion Wisconsin's legislative districts.

* * *

Submitted: December 15, 2021

Thomas M. Bryan

APPENDICES

APPENDICES TABLE OF CONTENTS

Appendix 1
Existing 2011 Act 43
Population Deviations (2020)

The deviations in the joint stipulated facts are reported by LTSB. Ex. A, B & C, Joint Stipulated Facts (Nov. 4, 2021). The LTSB deviations do not match district populations and deviations I generated from my analysis of the correspondence files published by the legislature on https://drawyourdistrict.legis.wisconsin.gov/ProposedMaps. The differences are not significant and do not change my conclusions.

Act 43 Senate Deviations with 2020 Populations Appendix 1

Senate District	Persons	Deviation	Dev. %
1	184,526	5,928	3.32%
2	183,268	4,670	2.61%
3	170,693	-7,905	-4.43%
4	163,232	-15,366	-8.60%
5	179,060	462	0.26%
6	162,069	-16,529	-9.25%
7	177,415	-1,183	-0.66%
8	182,453	3,855	2.16%
9	175,990	-2,608	-1.46%
10	183,755	5,157	2.89%
11	177,861	-737	-0.41%
12	174,947	-3,651	-2.04%
13	180,986	2,388	1.34%
14	173,260	-5,338	-2.99%
15	175,773	-2,825	-1.58%
16	192,498	13,900	7.78%
17	173,532	-5,066	-2.84%
18	175,810	-2,788	-1.56%
19	184,502	5,904	3.31%
20	176,557	-2,041	-1.14%
21	178,201	-397	-0.22%
22	171,120	-7,478	-4.19%
23	179,508	910	0.51%
24	173,809	-4,789	-2.68%
25	176,269	-2,329	-1.30%
26	201,472	22,874	12.81%
27	195,790	17,192	9.63%
28	178,048	-550	-0.31%
29	176,185	-2,413	-1.35%
30	180,971	2,373	1.33%
31	179,433	835	0.47%
32	179,156	558	0.31%
33	175,569	-3,029	-1.70%

Act 43 Assembly Deviations with 2020 Populations Appendix 1 (Page 1)

Assembly District	Persons	Deviation	Dev. %
1	59,834	301	0.51%
2	62,808	3,275	5.50%
3	61,884	2,351	3.95%
4	58,716	-817	-1.37%
5	67,155	7,622	12.80%
6	57,397	-2,136	-3.59%
7	59,382	-151	-0.25%
8	53,999	-5,534	-9.30%
9	57,312	-2,221	-3.73%
10	52,628	-6,905	-11.60%
11	54,185	-5,348	-8.98%
12	56,419	-3,114	-5.23%
13	61,779	2,246	3.77%
14	60,136	603	1.01%
15	57,145	-2,388	-4.01%
16	53,739	-5,794	-9.73%
17	55,343	-4,190	-7.04%
18	52,987	-6,546	-11.00%
19	62,056	2,523	4.24%
20	56,812	-2,721	-4.57%
21	58,547	-986	-1.66%
22	60,940	1,407	2.36%
23	60,776	1,243	2.09%
24	60,737	1,204	2.02%
25	57,986	-1,547	-2.60%
26	58,693	-840	-1.41%
27	59,311	-222	-0.37%
28	59,274	-259	-0.44%
29	61,746	2,213	3.72%
30	62,735	3,202	5.38%
31	59,955	422	0.71%
32	59,397	-136	-0.23%
33	58,509	-1,024	-1.72%

Act 43 Assembly Deviations with 2020 Populations Appendix 1 (Page 2)

34	60,803	1,270	2.13%
35	56,431	-3,102	-5.21%
36	57,713	-1,820	-3.06%
37	61,151	1,618	2.72%
38	61,645	2,112	3.55%
39	58,190	-1,343	-2.26%
40	57,150	-2,383	-4.00%
41	57,738	-1,795	-3.02%
42	58,372	-1,161	-1.95%
43	59,504	-29	-0.05%
44	58,605	-928	-1.56%
45	57,664	-1,869	-3.14%
46	65,087	5,554	9.33%
47	63,653	4,120	6.92%
48	63,758	4,225	7.10%
49	57,952	-1,581	-2.66%
50	58,713	-820	-1.38%
51	56,867	-2,666	-4.48%
52	59,848	315	0.53%
53	58,689	-844	-1.42%
54	57,273	-2,260	-3.80%
55	61,992	2,459	4.13%
56	64,544	5,011	8.42%
57	57,966	-1,567	-2.63%
58	59,053	-480	-0.81%
59	58,160	-1,373	-2.31%
60	59,344	-189	-0.32%
61	59,987	454	0.76%
62	58,422	-1,111	-1.87%
63	59,792	259	0.44%
64	57,846	-1,687	-2.83%
65	57,248	-2,285	-3.84%
66	56,026	-3,507	-5.89%
67	60,512	979	1.64%
68	61,863	2,330	3.91%
69	57,133	-2,400	-4.03%
70	58,313	-1,220	-2.05%
71	57,827	-1,706	-2.87%
72	57,669	-1,864	-3.13%
73	58,507	-1,026	-1.72%

Act 43 Assembly Deviations with 2020 Populations Appendix 1 (Page 3)

74	59,010	-523	-0.88%
75	58,752	-781	-1.31%
76	71,716	12,183	20.46%
77	62,918	3,385	5.69%
78	66,838	7,305	12.27%
79	70,111	10,578	17.77%
80	65,735	6,202	10.42%
81	59,944	411	0.69%
82	59,749	216	0.36%
83	58,770	-763	-1.28%
84	59,529	-4	-0.01%
85	58,645	-888	-1.49%
86	60,488	955	1.60%
87	57,052	-2,481	-4.17%
88	62,916	3,383	5.68%
89	60,143	610	1.02%
90	57,912	-1,621	-2.72%
91	59,374	-159	-0.27%
92	59,336	-197	-0.33%
93	60,723	1,190	2.00%
94	62,060	2,527	4.24%
95	58,724	-809	-1.36%
96	58,372	-1,161	-1.95%
97	56,595	-2,938	-4.94%
98	61,423	1,890	3.17%
99	57,551	-1,982	-3.33%

Appendix 2A
Core Retention Analysis
Legislature Plans
Senate and Assembly Charts

Core Retention Analysis

- Senate and Assembly Charts
- Senate Tables
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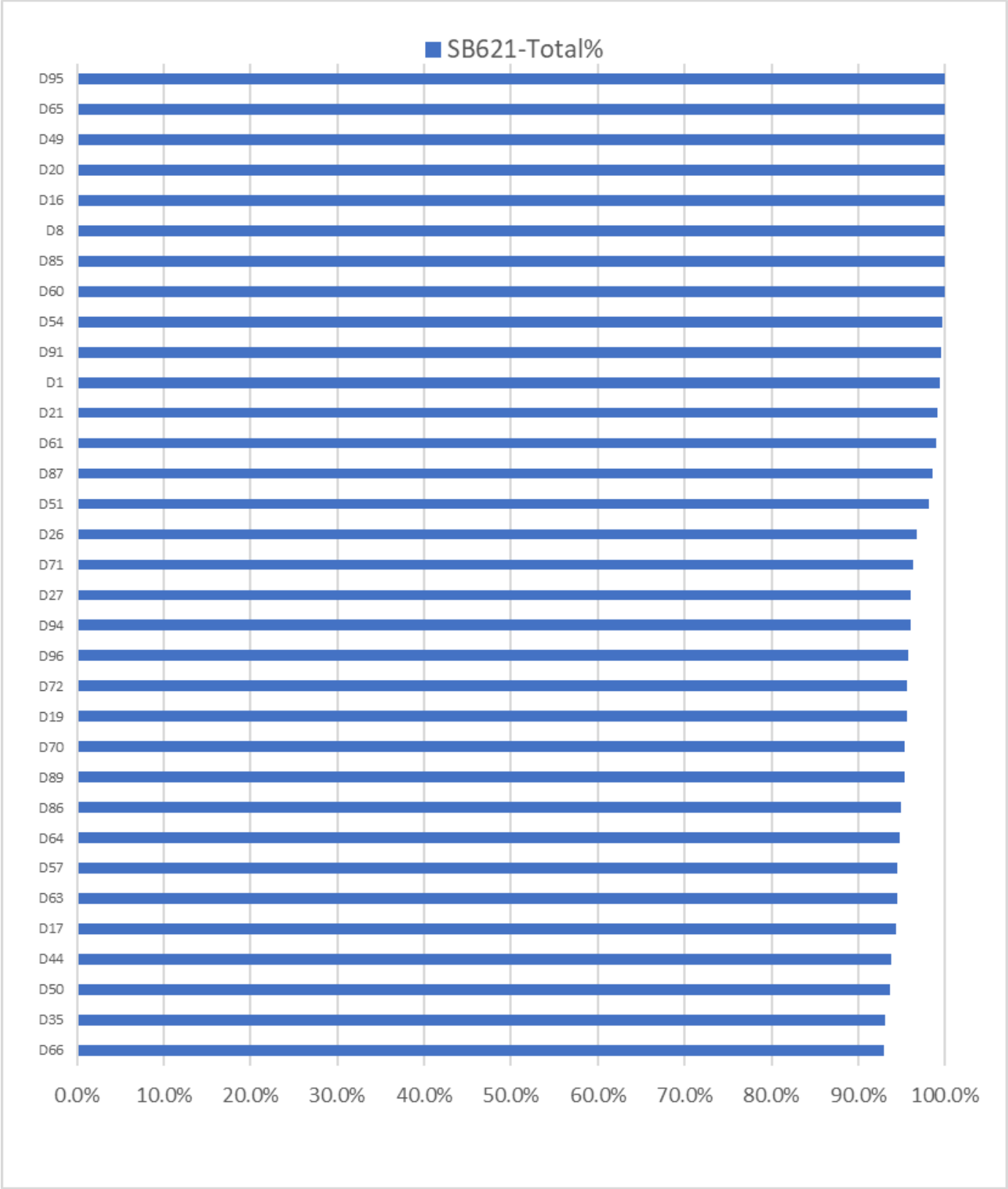
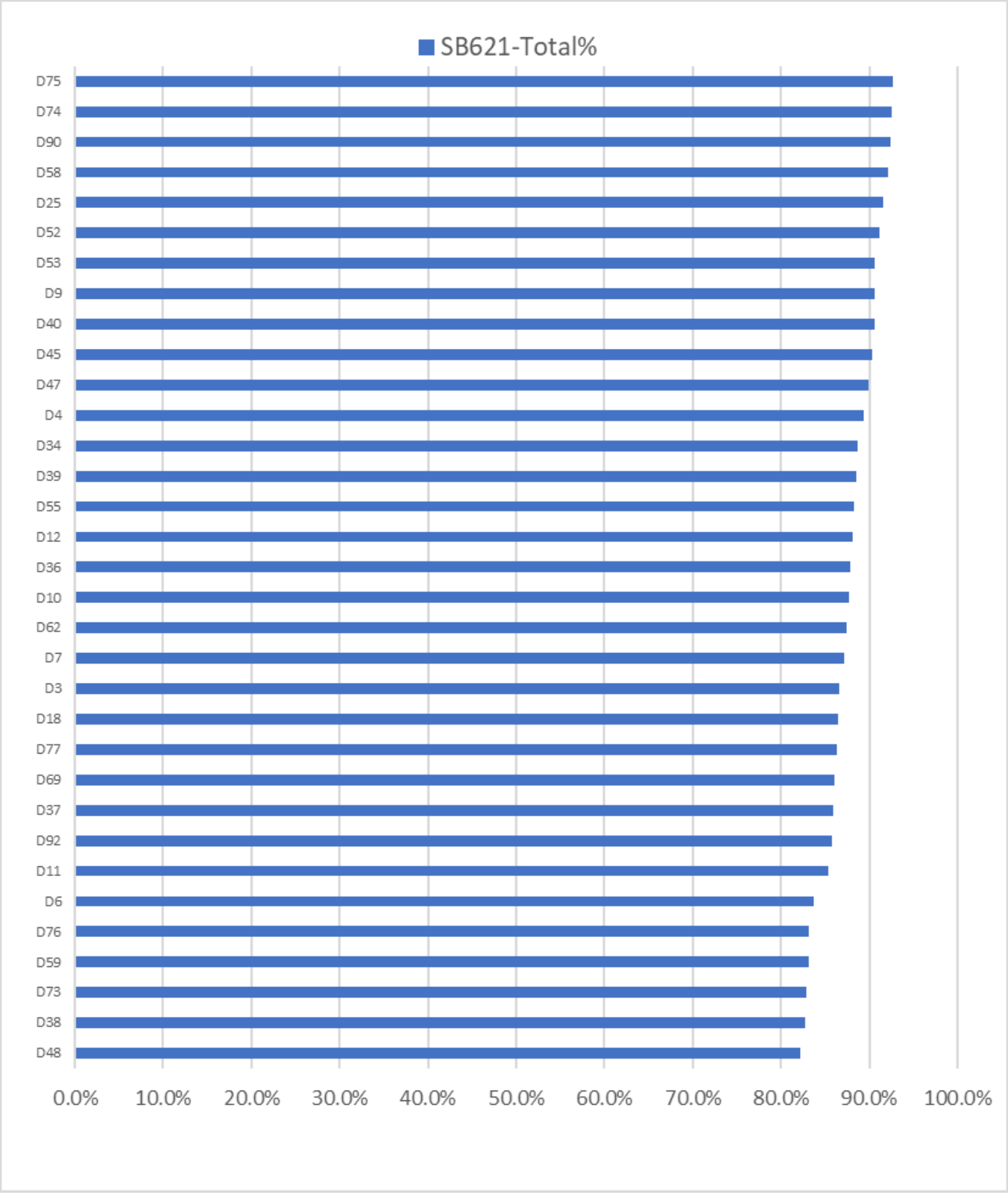
Core Retention of Existing Senate District Populations in SB 621 Appendix 2A

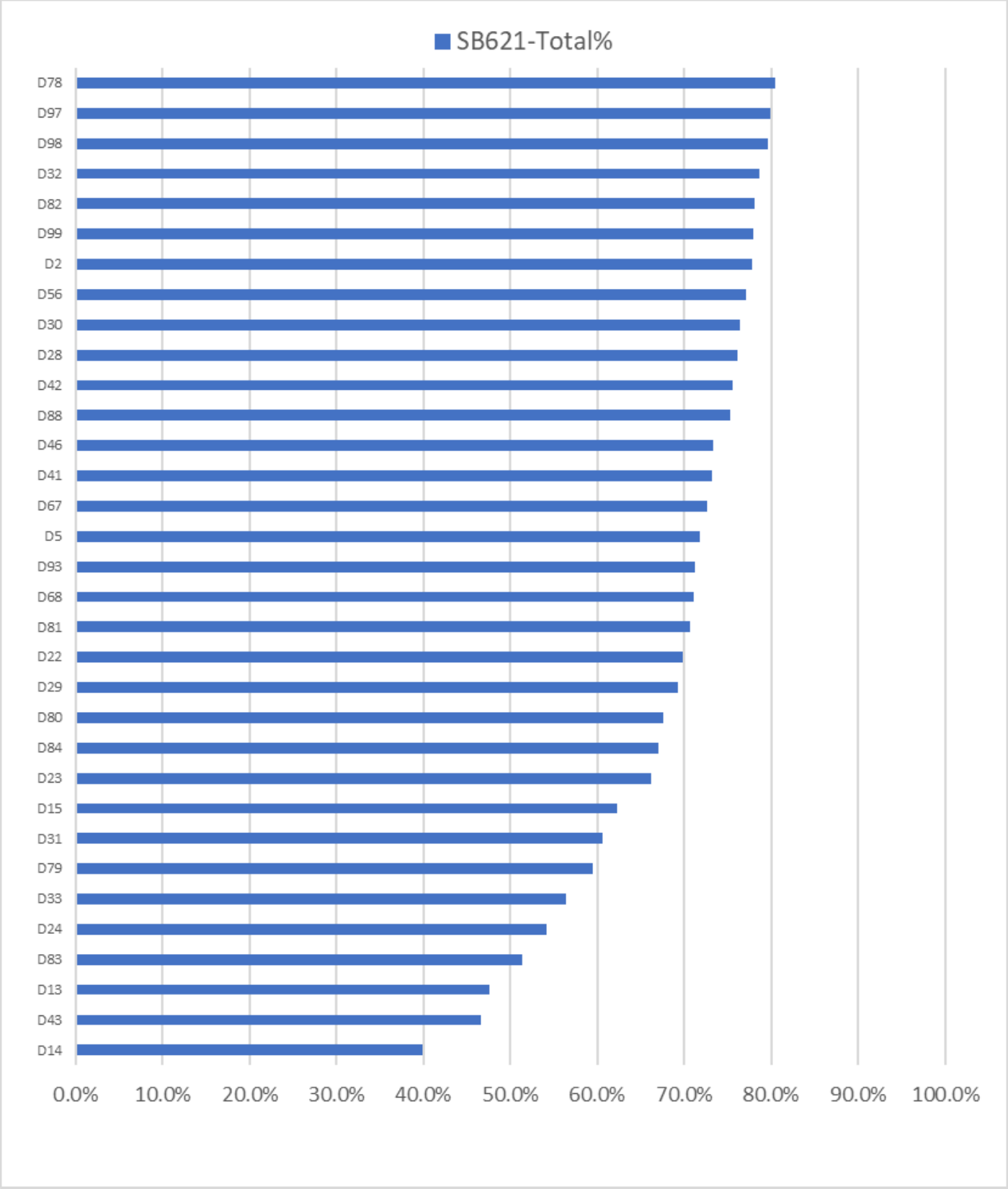
Core Retention of Existing Assembly District Populations in SB 621 Appendix 2A (Page 1)



Core Retention of Existing Assembly District Populations in SB 621 Appendix 2A (Page 2)



Core Retention of Existing Assembly District Populations in SB 621 Appendix 2A (Page 3)



Appendix 2B
Core Retention Analysis
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Core Retention Analysis

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Core Retention of Existing Senate District Populations in SB 621 (Total Population and Black Population) Appendix 2B (Page 1)

Current Base District	New 2021 Enacted District	Total Population	Black Alone Population	Total Percentage	Black Alone Percentage
1	1	162,048	2,145	87.9%	90.8%
	2	6,202	107	3.4%	4.5%
	9	4,185	19	2.3%	0.8%
	20	2,131	4	1.2%	0.2%
	30	9,738	87	5.3%	3.7%
1 Total		**184,304**	**2,362**		
2	1	11	2	0.0%	0.1%
	2	169,139	3,293	92.1%	95.8%
	12	1,803	17	1.0%	0.5%
	14	7,557	60	4.1%	1.7%
	19	3,622	27	2.0%	0.8%
	30	1,421	37	0.8%	1.1%
2 Total		**183,553**	**3,436**		
3	3	170,693	14,298	100.0%	100.0%
	7	0	0	0.0%	0.0%
3 Total		**170,693**	**14,298**		
4	4	163,208	103,694	100.0%	100.0%
4 Total		**163,208**	**103,694**		
5	3	7,843	765	4.4%	8.3%
	5	154,791	7,246	86.4%	78.2%
	6	16,426	1,252	9.2%	13.5%
5 Total		**179,060**	**9,263**		
6	3	0	0	0.0%	0.0%
	4	0	0	0.0%	0.0%
	6	162,069	103,044	100.0%	100.0%
6 Total		**162,069**	**103,044**		
7	3	0	0	0.0%	0.0%
	6	0	0	0.0%	0.0%
	7	177,415	9,241	99.7%	99.9%
	28	553	11	0.3%	0.1%
7 Total		**177,968**	**9,252**		
8	4	15,211	4,625	8.3%	32.6%
	8	161,467	9,499	88.6%	67.1%
	33	5,570	43	3.1%	0.3%
8 Total		**182,248**	**14,167**		
9	1	3,005	14	1.7%	0.4%
	9	171,926	3,946	97.7%	99.5%
	20	1,059	5	0.6%	0.1%
9 Total		**175,990**	**3,965**		
10	10	159,103	1,954	86.6%	79.9%
	25	9,891	76	5.4%	3.1%
	31	14,761	417	8.0%	17.0%
10 Total		**183,755**	**2,447**		
11	11	140,387	2,514	78.9%	82.9%
	13	0	0	0.0%	0.0%
	15	5,908	223	3.3%	7.4%
	21	2,105	21	1.2%	0.7%
	28	29,431	276	16.5%	9.1%
	33	8	0	0.0%	0.0%
11 Total		**177,839**	**3,034**		
12	2	320	3	0.2%	0.3%
	12	173,164	1,118	99.0%	99.5%
	29	1,463	3	0.8%	0.3%
	30	0	0	0.0%	0.0%
12 Total		**174,947**	**1,124**		

Core Retention of Existing Senate District Populations in SB 621 (Total Population and Black Population) Appendix 2B (Page 2)

Current Base District	New 2021 Enacted District	Total Population	Black Alone Population	Total Percentage	Black Alone Percentage
13	11	0	0	0.0%	0.0%
	13	167,467	2,767	92.5%	95.3%
	16	0	0	0.0%	0.0%
	20	2,913	55	1.6%	1.9%
	27	0	0	0.0%	0.0%
	33	10,640	80	5.9%	2.8%
13 Total		**181,020**	**2,902**		
14	2	0	0	0.0%	0.0%
	13	10,970	176	6.3%	5.5%
	14	155,811	2,676	90.0%	82.9%
	18	0	0	0.0%	0.0%
	24	4,371	352	2.5%	10.9%
	27	2,051	24	1.2%	0.7%
14 Total		**173,203**	**3,228**		
15	11	38,354	1,323	21.8%	12.9%
	15	135,205	8,889	76.9%	87.0%
	17	2,171	7	1.2%	0.1%
	27	0	0	0.0%	0.0%
15 Total		**175,730**	**10,219**		
16	15	22,283	473	11.6%	2.6%
	16	167,898	17,235	87.2%	95.5%
	26	179	51	0.1%	0.3%
	27	2,132	291	1.1%	1.6%
16 Total		**192,492**	**18,050**		
17	17	171,652	2,414	98.9%	99.3%
	32	1,880	16	1.1%	0.7%
17 Total		**173,532**	**2,430**		
18	14	0	0	0.0%	0.0%
	18	170,533	8,546	97.0%	99.7%
	20	5,305	24	3.0%	0.3%
18 Total		**175,838**	**8,570**		
19	1	3,150	96	1.7%	1.8%
	18	6,395	46	3.5%	0.9%
	19	174,928	5,134	94.8%	97.3%
19 Total		**184,473**	**5,276**		
20	8	4,688	40	2.7%	1.4%
	9	2,716	4	1.5%	0.1%
	18	1,884	8	1.1%	0.3%
	20	167,282	2,822	94.7%	98.2%
20 Total		**176,570**	**2,874**		
21	21	170,331	8,148	95.6%	89.0%
	22	7,871	1,009	4.4%	11.0%
21 Total		**178,202**	**9,157**		
22	21	898	102	0.5%	0.3%
	22	170,221	30,005	99.5%	99.7%
22 Total		**171,119**	**30,107**		
23	10	13,393	115	7.5%	4.7%
	23	155,577	2,295	86.7%	92.8%
	29	3,715	41	2.1%	1.7%
	31	6,858	22	3.8%	0.9%
23 Total		**179,543**	**2,473**		

Core Retention of Existing Senate District Populations in SB 621 (Total Population and Black Population) Appendix 2B (Page 3)

Current Base District	New 2021 Enacted District	Total Population	Black Alone Population	Total Percentage	Black Alone Percentage
24	23	2	0	0.0%	0.0%
	24	172,306	2,701	99.1%	99.0%
	31	0	0	0.0%	0.0%
	32	1,503	27	0.9%	1.0%
24 Total		**173,811**	**2,728**		
25	10	4,137	17	2.3%	0.7%
	12	3,552	14	2.0%	0.6%
	25	168,579	2,328	95.6%	98.7%
25 Total		**176,268**	**2,359**		
26	16	7,398	723	3.7%	5.2%
	26	178,371	12,396	88.4%	88.7%
	27	16,050	854	8.0%	6.1%
26 Total		**201,819**	**13,973**		
27	13	0	0	0.0%	0.0%
	14	14,963	732	7.7%	15.1%
	15	15,722	275	8.0%	5.7%
	16	3,312	145	1.7%	3.0%
	17	2,582	16	1.3%	0.3%
	26	199	24	0.1%	0.5%
	27	158,727	3,659	81.2%	75.4%
27 Total		**195,505**	**4,851**		
28	5	22,897	233	12.9%	4.0%
	7	1,045	15	0.6%	0.3%
	21	5,034	16	2.8%	0.3%
	28	148,519	5,629	83.7%	95.5%
	33	0	0	0.0%	0.0%
28 Total		**177,495**	**5,893**		
29	23	2,571	23	1.5%	1.1%
	29	173,613	2,164	98.5%	98.9%
29 Total		**176,184**	**2,187**		
30	1	10,722	212	5.9%	2.7%
	2	2,803	76	1.5%	1.0%
	30	167,424	7,481	92.5%	96.3%
30 Total		**180,949**	**7,769**		
31	10	2,177	13	1.2%	0.5%
	23	20,210	652	11.3%	24.0%
	31	157,011	2,054	87.5%	75.5%
31 Total		**179,398**	**2,719**		
32	17	2,424	22	1.4%	0.6%
	24	1,730	14	1.0%	0.4%
	32	175,002	3,717	97.7%	99.0%
32 Total		**179,156**	**3,753**		
33	5	848	7	0.5%	0.2%
	8	12,397	268	7.1%	6.1%
	28	3	0	0.0%	0.0%
	33	162,529	4,100	92.5%	93.7%
33 Total		**175,777**	**4,375**		

Appendix 2C
Core Retention Analysis
Legislature Plans
Assembly Tables

Core Retention Analysis

- Senate and Assembly Charts
- Senate Tables
- Assembly Tables

Core Retention of Existing Assembly District Populations in SB 621 (Total Population and Black Population) Appendix 2C (Page 1)

Current Base District	New 2021 Enacted District	Total Population	Black Alone Population	Hispanic Population	Total Percentage	Black Alone Percentage	Hispanic Percentage
1	1	59,444	474	2,138	99.3%	100.0%	99.5%
	2	390	0	10	0.7%	0.0%	0.5%
1 Total		**59,834**	**474**	**2,148**			
2	2	48,641	849	1,828	77.7%	88.9%	86.9%
	25	4,185	19	59	6.7%	2.0%	2.8%
	88	9,738	87	217	15.6%	9.1%	10.3%
2 Total		**62,564**	**955**	**2,104**			
3	3	53,573	822	2,411	86.5%	88.1%	86.0%
	5	6,202	107	372	10.0%	11.5%	13.3%
	59	2,131	4	19	3.4%	0.4%	0.7%
3 Total		**61,906**	**933**	**2,802**			
4	2	11	2	7	0.0%	0.1%	0.2%
	4	52,489	2,110	2,826	89.4%	94.1%	91.1%
	5	4,795	93	195	8.2%	4.1%	6.3%
	90	1,421	37	73	2.4%	1.7%	2.4%
4 Total		**58,716**	**2,242**	**3,101**			
5	4	4,344	65	100	6.4%	8.4%	4.8%
	5	48,377	603	1,672	71.7%	77.5%	81.0%
	6	11,085	83	239	16.4%	10.7%	11.6%
	56	3,622	27	54	5.4%	3.5%	2.6%
5 Total		**67,428**	**778**	**2,065**			
6	6	48,049	339	1,453	83.7%	81.5%	81.5%
	36	1,803	17	35	3.1%	4.1%	2.0%
	40	7,557	60	295	13.2%	14.4%	16.5%
6 Total		**57,409**	**416**	**1,783**			
7	7	51,733	3,952	13,204	87.2%	82.2%	82.3%
	9	7,622	854	2,841	12.8%	17.8%	17.7%
7 Total		**59,355**	**4,806**	**16,045**			
8	8	53,999	5,135	38,111	100.0%	100.0%	100.0%
	19	0	0	0	0.0%	0.0%	0.0%
8 Total		**53,999**	**5,135**	**38,111**			
9	7	27	2	23	0.0%	0.0%	0.1%
	8	5,363	288	3,098	9.4%	6.6%	8.9%
	9	51,949	4,067	31,731	90.6%	93.3%	91.0%
9 Total		**57,339**	**4,357**	**34,852**			
10	10	46,146	26,743	2,822	87.7%	83.7%	89.1%
	11	6,482	5,208	344	12.3%	16.3%	10.9%
10 Total		**52,628**	**31,951**	**3,166**			
11	10	6,276	1,595	304	11.6%	4.4%	11.8%
	11	46,364	33,843	2,220	85.4%	93.2%	85.8%
	12	1,635	875	63	3.0%	2.4%	2.4%
11 Total		**54,275**	**36,313**	**2,587**			
12	11	6,719	4,747	349	11.9%	13.4%	10.1%
	12	49,586	30,683	3,090	88.1%	86.6%	89.9%
12 Total		**56,305**	**35,430**	**3,439**			
13	7	7,843	765	1,217	12.7%	26.9%	28.5%
	13	29,445	771	1,177	47.7%	27.1%	27.6%
	14	14,063	884	1,447	22.8%	31.1%	33.9%
	18	10,428	421	422	16.9%	14.8%	9.9%
13 Total		**61,779**	**2,841**	**4,263**			

Core Retention of Existing Assembly District Populations in SB 621 (Total Population and Black Population) Appendix 2C (Page 2)

Current Base District	New 2021 Enacted District	Total Population	Black Alone Population	Hispanic Population	Total Percentage	Black Alone Percentage	Hispanic Percentage
14	13	30,106	990	1,047	50.1%	29.5%	43.6%
	14	24,032	1,530	1,008	40.0%	45.7%	41.9%
	17	5,998	831	348	10.0%	24.8%	14.5%
14 Total		**60,136**	**3,351**	**2,403**			
15	7	0	0	0	0.0%	0.0%	0.0%
	14	21,514	1,457	2,957	37.6%	47.4%	52.2%
	15	35,631	1,614	2,707	62.4%	52.6%	47.8%
15 Total		**57,145**	**3,071**	**5,664**			
16	16	53,739	32,105	3,812	100.0%	100.0%	100.0%
16 Total		**53,739**	**32,105**	**3,812**			
17	12	0	0	0	0.0%	0.0%	0.0%
	17	52,204	35,415	2,676	94.3%	93.0%	93.8%
	18	3,139	2,654	176	5.7%	7.0%	6.2%
17 Total		**55,343**	**38,069**	**2,852**			
18	9	0	0	0	0.0%	0.0%	0.0%
	16	5,975	2,708	561	11.3%	8.2%	13.4%
	17	1,233	1,088	47	2.3%	3.3%	1.1%
	18	45,779	29,074	3,586	86.4%	88.5%	85.5%
18 Total		**52,987**	**32,870**	**4,194**			
19	8	0	0	0	0.0%	0.0%	0.0%
	16	0	0	0	0.0%	0.0%	0.0%
	19	59,320	4,124	4,343	95.6%	98.3%	93.2%
	20	2,736	72	315	4.4%	1.7%	6.8%
19 Total		**62,056**	**4,196**	**4,658**			
20	9	0	0	0	0.0%	0.0%	0.0%
	20	56,812	2,589	9,351	100.0%	100.0%	100.0%
20 Total		**56,812**	**2,589**	**9,351**			
21	21	58,547	2,456	6,220	99.1%	99.6%	99.1%
	82	553	11	55	0.9%	0.4%	0.9%
21 Total		**59,100**	**2,467**	**6,275**			
22	12	6,559	3,000	446	10.8%	64.2%	23.9%
	22	42,396	1,383	1,062	69.8%	29.6%	56.8%
	24	6,225	247	207	10.2%	5.3%	11.1%
	99	5,570	43	154	9.2%	0.9%	8.2%
22 Total		**60,750**	**4,673**	**1,869**			
23	23	40,196	1,446	1,601	66.2%	80.7%	73.4%
	24	20,565	346	580	33.8%	19.3%	26.6%
23 Total		**60,761**	**1,792**	**2,181**			
24	10	7,081	973	363	11.7%	12.6%	14.3%
	12	1,571	652	73	2.6%	8.5%	2.9%
	23	19,187	4,736	963	31.6%	61.5%	38.0%
	24	32,898	1,341	1,133	54.2%	17.4%	44.7%
24 Total		**60,737**	**7,702**	**2,532**			
25	3	3,005	14	254	5.2%	1.2%	6.8%
	25	53,065	1,134	3,441	91.5%	97.8%	91.8%
	27	857	6	22	1.5%	0.5%	0.6%
	59	1,059	5	30	1.8%	0.4%	0.8%
25 Total		**57,986**	**1,159**	**3,747**			

Core Retention of Existing Assembly District Populations in SB 621 (Total Population and Black Population) Appendix 2C (Page 3)

Current Base District	New 2021 Enacted District	Total Population	Black Alone Population	Hispanic Population	Total Percentage	Black Alone Percentage	Hispanic Percentage
26	26	56,829	1,695	5,137	96.8%	97.6%	96.5%
	27	1,881	41	188	3.2%	2.4%	3.5%
26 Total		**58,710**	**1,736**	**5,325**			
27	25	2,210	9	229	3.7%	0.8%	6.7%
	26	96	0	15	0.2%	0.0%	0.4%
	27	56,988	1,061	3,149	96.1%	99.2%	92.8%
	59	0	0	0	0.0%	0.0%	0.0%
27 Total		**59,294**	**1,070**	**3,393**			
28	28	45,092	360	1,034	76.1%	77.3%	78.7%
	30	4,291	30	87	7.2%	6.4%	6.6%
	73	9,891	76	193	16.7%	16.3%	14.7%
	75	0	0	0	0.0%	0.0%	0.0%
28 Total		**59,274**	**466**	**1,314**			
29	28	13,812	277	371	22.4%	29.4%	22.7%
	29	42,813	637	1,135	69.3%	67.7%	69.5%
	30	5,121	27	126	8.3%	2.9%	7.7%
29 Total		**61,746**	**941**	**1,632**			
30	30	47,974	623	1,373	76.5%	59.9%	69.7%
	93	14,761	417	598	23.5%	40.1%	30.3%
30 Total		**62,735**	**1,040**	**1,971**			
31	31	36,364	1,217	4,238	60.7%	70.2%	70.5%
	32	12,844	195	1,333	21.4%	11.2%	22.2%
	33	4,836	99	152	8.1%	5.7%	2.5%
	44	4,678	75	157	7.8%	4.3%	2.6%
	45	1,230	148	132	2.1%	8.5%	2.2%
31 Total		**59,952**	**1,734**	**6,012**			
32	31	4,162	18	144	7.0%	2.7%	2.0%
	32	46,712	556	6,811	78.6%	84.0%	93.5%
	61	0	0	0	0.0%	0.0%	0.0%
	63	2,105	21	94	3.5%	3.2%	1.3%
	83	6,418	67	235	10.8%	10.1%	3.2%
32 Total		**59,397**	**662**	**7,284**			
33	31	2,472	14	80	4.2%	2.2%	2.1%
	33	32,997	415	2,780	56.4%	65.0%	74.7%
	38	0	0	0	0.0%	0.0%	0.0%
	83	23,013	209	861	39.3%	32.8%	23.1%
	97	8	0	3	0.0%	0.0%	0.1%
33 Total		**58,490**	**638**	**3,724**			
34	34	53,892	374	916	88.6%	95.4%	90.5%
	36	6,911	18	96	11.4%	4.6%	9.5%
34 Total		**60,803**	**392**	**1,012**			
35	6	320	3	23	0.6%	0.6%	1.9%
	34	2,076	10	14	3.7%	2.1%	1.1%
	35	52,572	460	1,140	93.2%	96.6%	92.8%
	85	636	0	23	1.1%	0.0%	1.9%
	87	827	3	28	1.5%	0.6%	2.3%
35 Total		**56,431**	**476**	**1,228**			
36	6	0	0	0	0.0%	0.0%	0.0%
	35	6,986	26	88	12.1%	10.2%	6.5%
	36	50,727	230	1,256	87.9%	89.8%	93.5%
	89	0	0	0	0.0%	0.0%	0.0%

Core Retention of Existing Assembly District Populations in SB 621 (Total Population and Black Population) Appendix 2C (Page 4)

Current Base District	New 2021 Enacted District	Total Population	Black Alone Population	Hispanic Population	Total Percentage	Black Alone Percentage	Hispanic Percentage
36 Total		**57,713**	**256**	**1,344**			
37	37	52,570	1,041	3,361	85.9%	89.4%	81.7%
	38	8,612	123	752	14.1%	10.6%	18.3%
	46	0	0	0	0.0%	0.0%	0.0%
	79	0	0	0	0.0%	0.0%	0.0%
	81	0	0	0	0.0%	0.0%	0.0%
37 Total		**61,182**	**1,164**	**4,113**			
38	33	0	0	0	0.0%	0.0%	0.0%
	37	0	0	0	0.0%	0.0%	0.0%
	38	51,006	804	2,787	82.7%	91.0%	92.1%
	97	1,594	21	63	2.6%	2.4%	2.1%
	99	9,046	59	177	14.7%	6.7%	5.8%
38 Total		**61,646**	**884**	**3,027**			
39	37	3,772	26	116	6.5%	3.0%	3.1%
	39	51,507	773	3,583	88.5%	90.5%	94.2%
	59	2,913	55	104	5.0%	6.4%	2.7%
39 Total		**58,192**	**854**	**3,803**			
40	6	0	0	0	0.0%	0.0%	0.0%
	40	51,761	383	1,884	90.6%	51.5%	87.8%
	41	1,006	8	32	1.8%	1.1%	1.5%
	72	4,371	352	230	7.6%	47.4%	10.7%
40 Total		**57,138**	**743**	**2,146**			
41	41	42,250	1,009	2,842	73.2%	79.1%	75.8%
	42	15,493	267	907	26.8%	20.9%	24.2%
	72	0	0	0	0.0%	0.0%	0.0%
41 Total		**57,743**	**1,276**	**3,749**			
42	37	3,040	95	155	5.2%	7.9%	7.9%
	39	7,930	81	300	13.6%	6.7%	15.2%
	41	1,216	5	59	2.1%	0.4%	3.0%
	42	44,085	1,004	1,373	75.6%	83.0%	69.7%
	53	0	0	0	0.0%	0.0%	0.0%
	81	2,051	24	84	3.5%	2.0%	4.3%
42 Total		**58,322**	**1,209**	**1,971**			
43	31	13,154	566	1,527	22.1%	45.1%	38.1%
	33	18,202	319	1,386	30.6%	25.4%	34.6%
	43	27,755	362	1,074	46.7%	28.8%	26.8%
	44	90	9	13	0.2%	0.7%	0.3%
	45	291	0	5	0.5%	0.0%	0.1%
	80	0	0	0	0.0%	0.0%	0.0%
43 Total		**59,492**	**1,256**	**4,005**			
44	31	8	0	4	0.0%	0.0%	0.1%
	33	3,556	99	138	6.1%	3.3%	3.1%
	43	37	2	2	0.1%	0.1%	0.0%
	44	54,973	2,889	4,306	93.9%	96.6%	96.8%
44 Total		**58,574**	**2,990**	**4,450**			
45	31	3,434	339	486	6.0%	5.7%	6.0%
	45	52,059	5,627	7,584	90.3%	94.2%	93.6%
	51	2,171	7	32	3.8%	0.1%	0.4%
45 Total		**57,664**	**5,973**	**8,102**			

Core Retention of Existing Assembly District Populations in SB 621 (Total Population and Black Population) Appendix 2C (Page 5)

Current Base District	New 2021 Enacted District	Total Population	Black Alone Population	Hispanic Population	Total Percentage	Black Alone Percentage	Hispanic Percentage
46	43	17,401	431	556	26.7%	10.6%	17.1%
	46	47,691	3,651	2,700	73.3%	89.4%	82.9%
	47	0	0	0	0.0%	0.0%	0.0%
46 Total		**65,092**	**4,082**	**3,256**			
47	43	4,882	42	176	7.7%	0.8%	2.1%
	46	1,353	11	46	2.1%	0.2%	0.6%
	47	57,221	5,418	7,949	89.9%	98.1%	96.8%
	48	6	0	3	0.0%	0.0%	0.0%
	76	56	10	3	0.1%	0.2%	0.0%
	77	102	41	17	0.2%	0.7%	0.2%
	78	21	0	11	0.0%	0.0%	0.1%
	80	5	0	3	0.0%	0.0%	0.0%
47 Total		**63,646**	**5,522**	**8,208**			
48	46	7,038	569	438	11.0%	6.7%	7.1%
	47	2,165	161	100	3.4%	1.9%	1.6%
	48	52,424	7,425	5,573	82.2%	87.9%	89.9%
	79	2,127	291	87	3.3%	3.4%	1.4%
48 Total		**63,754**	**8,446**	**6,198**			
49	49	57,941	918	1,335	100.0%	100.0%	100.0%
49 Total		**57,941**	**918**	**1,335**			
50	49	975	4	6	1.7%	0.4%	0.3%
	50	54,975	1,052	2,015	93.6%	97.9%	98.1%
	51	883	3	10	1.5%	0.3%	0.5%
	96	1,880	16	24	3.2%	1.5%	1.2%
50 Total		**58,713**	**1,075**	**2,055**			
51	49	552	7	25	1.0%	1.6%	1.0%
	50	496	2	8	0.9%	0.5%	0.3%
	51	55,830	428	2,502	98.2%	97.9%	98.7%
51 Total		**56,878**	**437**	**2,535**			
52	52	54,543	2,575	4,146	91.1%	99.1%	97.3%
	53	0	0	0	0.0%	0.0%	0.0%
	59	5,305	24	114	8.9%	0.9%	2.7%
52 Total		**59,848**	**2,599**	**4,260**			
53	42	0	0	0	0.0%	0.0%	0.0%
	52	3,152	14	64	5.4%	0.4%	2.4%
	53	53,077	2,758	2,463	90.6%	86.0%	94.0%
	54	2,350	434	93	4.0%	13.5%	3.5%
53 Total		**58,579**	**3,206**	**2,620**			
54	53	153	19	18	0.3%	0.7%	0.7%
	54	57,258	2,746	2,546	99.7%	99.3%	99.3%
54 Total		**57,411**	**2,765**	**2,564**			
55	55	54,756	1,309	2,654	88.3%	86.3%	82.8%
	56	6,224	135	492	10.0%	8.9%	15.3%
	57	1,012	73	60	1.6%	4.8%	1.9%
55 Total		**61,992**	**1,517**	**3,206**			
56	53	6,395	46	81	9.9%	3.7%	3.0%
	55	4,781	13	46	7.4%	1.1%	1.7%
	56	49,750	1,072	2,338	77.1%	87.4%	86.6%
	57	3,618	96	236	5.6%	7.8%	8.7%
56 Total		**64,544**	**1,227**	**2,701**			

Core Retention of Existing Assembly District Populations in SB 621 (Total Population and Black Population) Appendix 2C (Page 6)

Current Base District	New 2021 Enacted District	Total Population	Black Alone Population	Hispanic Population	Total Percentage	Black Alone Percentage	Hispanic Percentage
57	3	3,150	96	288	5.4%	3.8%	5.6%
	57	54,787	2,436	4,896	94.6%	96.2%	94.4%
57 Total		**57,937**	**2,532**	**5,184**			
58	22	4,673	40	78	7.9%	3.8%	3.5%
	24	0	0	0	0.0%	0.0%	0.0%
	58	54,381	1,002	2,120	92.1%	96.2%	96.5%
58 Total		**59,054**	**1,042**	**2,198**			
59	26	2,715	4	119	4.7%	0.4%	5.2%
	27	1	0	0	0.0%	0.0%	0.0%
	52	1,884	8	122	3.2%	0.8%	5.3%
	58	5,217	31	124	9.0%	3.2%	5.4%
	59	48,341	919	1,930	83.1%	95.5%	84.1%
59 Total		**58,158**	**962**	**2,295**			
60	24	15	0	9	0.0%	0.0%	0.5%
	58	9	1	5	0.0%	0.1%	0.3%
	60	59,334	869	1,958	100.0%	99.9%	99.3%
60 Total		**59,358**	**870**	**1,972**			
61	61	59,405	1,183	4,122	99.1%	98.7%	98.3%
	64	567	16	71	0.9%	1.3%	1.7%
61 Total		**59,972**	**1,199**	**4,193**			
62	62	51,118	3,348	4,651	87.5%	77.1%	78.4%
	66	7,304	993	1,282	12.5%	22.9%	21.6%
62 Total		**58,422**	**4,341**	**5,933**			
63	62	3,273	311	306	5.5%	8.6%	6.6%
	63	56,535	3,306	4,333	94.5%	91.4%	93.4%
63 Total		**59,808**	**3,617**	**4,639**			
64	61	4	0	1	0.0%	0.0%	0.0%
	63	894	102	54	1.5%	1.7%	0.7%
	64	54,830	5,715	7,603	94.8%	95.7%	94.4%
	65	2,117	156	393	3.7%	2.6%	4.9%
64 Total		**57,845**	**5,973**	**8,051**			
65	64	0	0	0	0.0%	0.0%	0.0%
	65	57,248	8,118	13,577	100.0%	100.0%	100.0%
65 Total		**57,248**	**8,118**	**13,577**			
66	64	3,965	1,241	870	7.1%	7.7%	5.7%
	66	52,061	14,775	14,518	92.9%	92.3%	94.3%
66 Total		**56,026**	**16,016**	**15,388**			
67	29	13,393	115	260	22.1%	16.6%	24.6%
	67	43,935	557	746	72.6%	80.5%	70.7%
	68	1,498	8	20	2.5%	1.2%	1.9%
	93	1,687	12	29	2.8%	1.7%	2.7%
67 Total		**60,513**	**692**	**1,055**			
68	67	12,744	179	262	20.6%	14.7%	18.6%
	68	43,981	1,027	1,054	71.1%	84.5%	74.9%
	91	29	1	1	0.0%	0.1%	0.1%
	92	5,142	9	91	8.3%	0.7%	6.5%
68 Total		**61,896**	**1,216**	**1,408**			

Core Retention of Existing Assembly District Populations in SB 621 (Total Population and Black Population) Appendix 2C (Page 7)

Current Base District	New 2021 Enacted District	Total Population	Black Alone Population	Hispanic Population	Total Percentage	Black Alone Percentage	Hispanic Percentage
69	68	4,255	20	348	7.4%	3.5%	10.4%
	69	49,164	504	2,880	86.1%	89.2%	86.2%
	86	2,276	35	79	4.0%	6.2%	2.4%
	87	1,439	6	36	2.5%	1.1%	1.1%
69 Total		**57,134**	**565**	**3,343**			
70	69	2	0	0	0.0%	0.0%	0.0%
	70	55,576	824	2,393	95.4%	95.9%	96.2%
	71	1,195	8	40	2.1%	0.9%	1.6%
	92	0	0	0	0.0%	0.0%	0.0%
	96	1,503	27	55	2.6%	3.1%	2.2%
70 Total		**58,276**	**859**	**2,488**			
71	70	2,130	6	36	3.7%	0.5%	1.7%
	71	55,736	1,169	2,126	96.3%	99.5%	98.3%
71 Total		**57,866**	**1,175**	**2,162**			
72	70	0	0	0	0.0%	0.0%	0.0%
	71	2,516	11	99	4.4%	1.6%	3.4%
	72	55,153	683	2,773	95.6%	98.4%	96.6%
72 Total		**57,669**	**694**	**2,872**			
73	73	48,523	883	805	82.9%	91.9%	82.6%
	74	4,985	52	71	8.5%	5.4%	7.3%
	75	4,999	26	98	8.5%	2.7%	10.1%
73 Total		**58,507**	**961**	**974**			
74	34	3,552	14	92	6.0%	3.8%	8.8%
	73	856	6	21	1.5%	1.6%	2.0%
	74	54,602	346	938	92.5%	94.5%	89.2%
74 Total		**59,010**	**366**	**1,051**			
75	28	839	3	15	1.4%	0.3%	1.0%
	29	3,298	14	86	5.6%	1.4%	5.7%
	73	197	0	3	0.3%	0.0%	0.2%
	75	54,417	1,015	1,405	92.6%	98.4%	93.1%
75 Total		**58,751**	**1,032**	**1,509**			
76	47	21	0	10	0.0%	0.0%	0.2%
	48	7,193	705	523	10.0%	17.5%	11.7%
	76	59,608	3,169	3,704	83.2%	78.5%	82.6%
	77	4,863	165	246	6.8%	4.1%	5.5%
76 Total		**71,685**	**4,039**	**4,483**			
77	47	176	15	24	0.3%	0.3%	0.4%
	77	54,396	3,787	5,253	86.4%	79.3%	77.3%
	78	5,509	828	1,320	8.7%	17.3%	19.4%
	79	2,911	144	200	4.6%	3.0%	2.9%
77 Total		**62,992**	**4,774**	**6,797**			
78	47	8	3	2	0.0%	0.1%	0.0%
	78	53,995	4,447	4,684	80.4%	86.2%	87.7%
	79	13,128	710	654	19.6%	13.8%	12.2%
	80	11	0	0	0.0%	0.0%	0.0%
78 Total		**67,142**	**5,160**	**5,340**			

Core Retention of Existing Assembly District Populations in SB 621 (Total Population and Black Population) Appendix 2C (Page 8)

Current Base District	New 2021 Enacted District	Total Population	Black Alone Population	Hispanic Population	Total Percentage	Black Alone Percentage	Hispanic Percentage
79	37	0	0	0	0.0%	0.0%	0.0%
	46	3,238	127	160	4.6%	6.3%	4.6%
	47	0	0	0	0.0%	0.0%	0.0%
	48	74	18	18	0.1%	0.9%	0.5%
	78	138	15	9	0.2%	0.7%	0.3%
	79	41,521	1,331	2,187	59.5%	66.2%	63.2%
	80	15,065	429	646	21.6%	21.3%	18.7%
	81	9,696	91	439	13.9%	4.5%	12.7%
79 Total		**69,732**	**2,011**	**3,459**			
80	43	9,610	222	396	14.6%	14.9%	16.8%
	45	6,112	53	140	9.3%	3.5%	5.9%
	78	61	9	1	0.1%	0.6%	0.0%
	80	44,474	1,141	1,708	67.6%	76.4%	72.5%
	81	5,573	69	112	8.5%	4.6%	4.8%
80 Total		**65,830**	**1,494**	**2,357**			
81	41	14,959	732	798	25.0%	54.4%	27.1%
	42	4	0	0	0.0%	0.0%	0.0%
	50	1,801	11	47	3.0%	0.8%	1.6%
	51	781	5	42	1.3%	0.4%	1.4%
	81	42,398	598	2,057	70.7%	44.4%	69.9%
81 Total		**59,943**	**1,346**	**2,944**			
82	21	1,045	15	83	1.8%	0.5%	1.8%
	82	46,230	2,397	3,419	78.1%	85.7%	72.3%
	84	11,921	386	1,228	20.1%	13.8%	26.0%
82 Total		**59,196**	**2,798**	**4,730**			
83	15	3,263	22	162	5.6%	3.8%	6.7%
	62	5,034	16	164	8.6%	2.7%	6.8%
	82	12,581	100	450	21.4%	17.2%	18.6%
	83	30,172	218	1,037	51.3%	37.5%	42.9%
	84	7,720	226	604	13.1%	38.8%	25.0%
	97	0	0	0	0.0%	0.0%	0.0%
	98	0	0	0	0.0%	0.0%	0.0%
83 Total		**58,770**	**582**	**2,417**			
84	15	19,634	211	815	33.0%	8.4%	11.6%
	84	39,895	2,302	6,231	67.0%	91.6%	88.4%
84 Total		**59,529**	**2,513**	**7,046**			
85	85	58,654	1,273	2,090	100.0%	100.0%	99.8%
	86	17	0	4	0.0%	0.0%	0.2%
85 Total		**58,671**	**1,273**	**2,094**			
86	69	1,731	22	48	2.9%	3.8%	3.5%
	85	382	2	8	0.6%	0.3%	0.6%
	86	57,415	560	1,304	95.0%	95.7%	95.3%
	87	934	1	8	1.5%	0.2%	0.6%
86 Total		**60,462**	**585**	**1,368**			
87	68	840	1	3	1.5%	0.3%	0.2%
	86	0	0	0	0.0%	0.0%	0.0%
	87	56,211	328	1,321	98.5%	99.7%	99.8%
87 Total		**57,051**	**329**	**1,324**			

Core Retention of Existing Assembly District Populations in SB 621 (Total Population and Black Population) Appendix 2C (Page 9)

Current Base District	New 2021 Enacted District	Total Population	Black Alone Population	Hispanic Population	Total Percentage	Black Alone Percentage	Hispanic Percentage
88	2	10,722	212	404	17.0%	10.4%	5.4%
	88	47,392	1,698	6,293	75.4%	83.4%	84.1%
	90	4,780	125	788	7.6%	6.1%	10.5%
88 Total		**62,894**	**2,035**	**7,485**			
89	4	2,803	76	147	4.7%	11.6%	9.4%
	89	57,340	582	1,414	95.3%	88.4%	90.6%
89 Total		**60,143**	**658**	**1,561**			
90	4	0	0	0	0.0%	0.0%	0.0%
	88	2,412	189	995	4.2%	3.7%	7.7%
	89	1,988	163	142	3.4%	3.2%	1.1%
	90	53,512	4,724	11,706	92.4%	93.1%	91.1%
90 Total		**57,912**	**5,076**	**12,843**			
91	67	231	6	11	0.4%	0.4%	0.6%
	68	2	0	0	0.0%	0.0%	0.0%
	91	59,164	1,404	1,962	99.6%	99.6%	99.4%
	93	0	0	0	0.0%	0.0%	0.0%
91 Total	**Total**	**59,397**	**1,410**	**1,973**			
92	69	8,450	443	284	14.2%	57.8%	5.8%
	92	50,884	323	4,582	85.8%	42.2%	94.2%
92 Total	**Total**	**59,334**	**766**	**4,866**			
93	30	2,177	13	35	3.6%	2.4%	2.3%
	67	2,681	19	49	4.4%	3.5%	3.3%
	68	8,846	184	332	14.6%	33.9%	22.3%
	91	220	5	36	0.4%	0.9%	2.4%
	92	3,498	13	86	5.8%	2.4%	5.8%
	93	43,245	309	952	71.3%	56.9%	63.9%
93 Total	**Total**	**60,667**	**543**	**1,490**			
94	70	1,711	11	34	2.8%	1.4%	2.8%
	94	59,594	762	1,178	96.0%	96.5%	95.7%
	95	775	17	19	1.2%	2.2%	1.5%
94 Total	**Total**	**62,080**	**790**	**1,231**			
95	94	0	0	0	0.0%	0.0%	0.0%
	95	58,704	2,292	1,820	100.0%	100.0%	100.0%
95 Total		**58,704**	**2,292**	**1,820**			
96	49	240	9	1	0.4%	1.3%	0.1%
	50	2,184	13	51	3.7%	1.9%	3.6%
	70	19	3	1	0.0%	0.4%	0.1%
	96	55,929	646	1,352	95.8%	96.3%	96.2%
96 Total		**58,372**	**671**	**1,405**			
97	15	848	7	20	1.5%	0.3%	0.3%
	97	45,218	1,770	5,792	79.9%	81.4%	76.9%
	98	10,524	398	1,718	18.6%	18.3%	22.8%
97 Total		**56,590**	**2,175**	**7,530**			
98	22	12,397	268	427	20.2%	15.5%	10.3%
	97	144	0	9	0.2%	0.0%	0.2%
	98	48,866	1,457	3,719	79.6%	84.5%	89.5%
98 Total		**61,407**	**1,725**	**4,155**			
99	83	3	0	0	0.0%	0.0%	0.0%
	97	12,700	63	374	22.0%	13.3%	21.6%
	98	16	0	0	0.0%	0.0%	0.0%
	99	45,061	412	1,359	78.0%	86.7%	78.4%
99 Total		**57,780**	**475**	**1,733**			

Appendix 3
Compactness

Compactness Measures

- Polsby-Popper
- Schwartzberg
- Reock
- Convex Hull

Assembly Compactness Tables

- Table 1 Act 43 Assembly Plan Compactness Scores (Page 1-3)
- Table 2 Legislative Assembly Plan Compactness Scores (Page 1-3)

Senate Compactness Tables

- Table 3 Act 43 Senate Plan Compactness Scores
- Table 4 Legislative Senate Plan Compactness Scores

Compactness Measures[31] Appendix 3 (Page 1)

Polsby-Popper

The Polsby-Popper (PP) measure (polsby & Popper, 1991) is the ratio of the area of the district (A_D) to the area of a circle whose circumference is equal to the perimeter of the district (P_D). A district's Polsby-Popper score falls with the range of $[0, 1]$ and a score closer to 1 indicates a more compact district.

$$PP = 4\pi \times \frac{A_D}{P_D^2}$$

Circumfrence Equal to District Perimeter

Schwartzberg

The Schwartzberg score (S) compactness score is the ratio of the perimeter of the district (P_D) to the circumference of a circle whose area is equal to the area of the district. A district's Schwartzberg score as calculated below falls with the range of [0,1] and a score closer to 1 indicates a more compact district.

$$S = \frac{1}{P_D/C} = \frac{1}{P_D/(2\pi\sqrt{A_D/\pi})}$$

Circle with Area Equivalent to the District

[31] https://fisherzachary.github.io/public/r-output.html.

Compactness Measures Appendix 3 (Page 2)

Reock Score

The Reock Score (R) is the ratio of the area of the district A_D to the area of a minimum bounding cirle (A_{MBC}) that encloses the district's geometry. A district's Reock score falls within the range of [0,1] and a score closer to 1 indicates a more compact district.

$$R = \frac{A_D}{A_{MBC}}$$

Minimum Bounding Circle of Original Gerrymander

Convex Hull

The Convex Hull score is a ratio of the area of the district to the area of the minimum convex polygon that can encloses the district's geometry. A district's Convex Hull score falls within the range of [0,1] and a score closer to 1 indicates a more compact district.

$$CH = \frac{A_D}{A_{MCP}}$$

Convex Hull of Original Gerrymander

Table 1 Act 43 Assembly Compactness Scores Appendix 3 (Page 1)

District	Polsby-Popper	Schwartzberg	Reock	Convex_Hull	Total
1	0.09	0.30	0.16	0.49	1.04
2	0.25	0.50	0.30	0.72	1.77
3	0.20	0.45	0.41	0.61	1.67
4	0.15	0.39	0.41	0.63	1.57
5	0.25	0.50	0.40	0.78	1.93
6	0.21	0.45	0.30	0.67	1.63
7	0.20	0.45	0.30	0.67	1.62
8	0.48	0.69	0.61	0.87	2.65
9	0.19	0.44	0.40	0.62	1.66
10	0.17	0.41	0.34	0.65	1.58
11	0.19	0.43	0.35	0.70	1.67
12	0.33	0.58	0.43	0.73	2.07
13	0.26	0.51	0.22	0.89	1.87
14	0.29	0.54	0.24	0.77	1.83
15	0.34	0.58	0.23	0.84	1.99
16	0.32	0.57	0.44	0.71	2.05
17	0.37	0.61	0.40	0.74	2.11
18	0.31	0.56	0.43	0.69	1.99
19	0.12	0.35	0.25	0.50	1.23
20	0.40	0.63	0.42	0.79	2.25
21	0.48	0.69	0.54	0.90	2.62
22	0.18	0.42	0.24	0.70	1.55
23	0.17	0.41	0.24	0.58	1.40
24	0.30	0.55	0.30	0.77	1.91
25	0.37	0.61	0.36	0.79	2.12
26	0.19	0.44	0.35	0.82	1.80
27	0.23	0.48	0.52	0.81	2.05
28	0.36	0.60	0.52	0.75	2.23
29	0.35	0.59	0.31	0.78	2.03
30	0.58	0.76	0.51	0.88	2.73
31	0.23	0.48	0.45	0.83	1.98
32	0.19	0.43	0.42	0.71	1.76
33	0.18	0.42	0.23	0.69	1.52

Table 1 Act 43 Assembly Compactness Scores Appendix 3 (Page 2)

District	Polsby-Popper	Schwartzberg	Reock	Convex_Hull	Total
34	0.30	0.55	0.28	0.86	1.99
35	0.45	0.67	0.43	0.81	2.37
36	0.32	0.57	0.57	0.80	2.26
37	0.14	0.38	0.17	0.64	1.34
38	0.21	0.46	0.26	0.75	1.68
39	0.33	0.58	0.50	0.77	2.18
40	0.34	0.58	0.54	0.81	2.27
41	0.23	0.48	0.26	0.72	1.70
42	0.21	0.46	0.38	0.71	1.76
43	0.13	0.37	0.32	0.70	1.53
44	0.06	0.25	0.49	0.66	1.46
45	0.41	0.64	0.38	0.77	2.21
46	0.22	0.47	0.37	0.75	1.82
47	0.09	0.29	0.34	0.60	1.32
48	0.05	0.22	0.35	0.63	1.25
49	0.36	0.60	0.43	0.71	2.10
50	0.27	0.52	0.43	0.71	1.93
51	0.37	0.61	0.40	0.74	2.13
52	0.30	0.55	0.30	0.73	1.89
53	0.16	0.40	0.49	0.75	1.79
54	0.08	0.27	0.42	0.68	1.45
55	0.43	0.66	0.51	0.80	2.40
56	0.19	0.43	0.26	0.64	1.52
57	0.38	0.61	0.33	0.76	2.08
58	0.15	0.39	0.48	0.74	1.76
59	0.23	0.48	0.37	0.73	1.82
60	0.25	0.50	0.44	0.89	2.08
61	0.15	0.39	0.30	0.80	1.64
62	0.34	0.58	0.24	0.80	1.96
63	0.29	0.54	0.25	0.78	1.85
64	0.07	0.26	0.19	0.49	1.01
65	0.22	0.47	0.65	0.84	2.19
66	0.18	0.42	0.31	0.62	1.54

Table 1 Act 43 Assembly Compactness Scores Appendix 3 (Page 3)

District	Polsby-Popper	Schwartzberg	Reock	Convex_Hull	Total
67	0.29	0.54	0.39	0.81	2.04
68	0.26	0.51	0.45	0.84	2.05
69	0.40	0.64	0.41	0.78	2.23
70	0.16	0.40	0.22	0.65	1.43
71	0.27	0.52	0.50	0.81	2.10
72	0.37	0.61	0.42	0.85	2.25
73	0.33	0.57	0.55	0.77	2.22
74	0.14	0.38	0.42	0.67	1.61
75	0.44	0.66	0.44	0.86	2.40
76	0.24	0.49	0.21	0.65	1.59
77	0.08	0.29	0.42	0.69	1.48
78	0.06	0.25	0.54	0.75	1.61
79	0.06	0.24	0.30	0.53	1.13
80	0.35	0.59	0.51	0.82	2.27
81	0.26	0.51	0.42	0.83	2.03
82	0.44	0.67	0.54	0.90	2.55
83	0.23	0.47	0.29	0.69	1.67
84	0.30	0.54	0.23	0.80	1.87
85	0.19	0.44	0.37	0.75	1.74
86	0.15	0.39	0.33	0.73	1.60
87	0.35	0.59	0.31	0.72	1.96
88	0.21	0.46	0.40	0.73	1.81
89	0.21	0.46	0.29	0.63	1.58
90	0.16	0.41	0.32	0.67	1.56
91	0.07	0.26	0.35	0.69	1.37
92	0.40	0.63	0.31	0.86	2.21
93	0.17	0.41	0.21	0.74	1.54
94	0.22	0.47	0.48	0.83	2.01
95	0.08	0.29	0.25	0.59	1.21
96	0.34	0.59	0.43	0.77	2.13
97	0.23	0.48	0.37	0.76	1.84
98	0.29	0.54	0.51	0.85	2.18
99	0.30	0.55	0.42	0.80	2.07
Sum	**24.91**	**48.32**	**37.08**	**73.08**	
Average	**0.24**	**0.48**	**0.38**	**0.75**	

Table 2 Legislative Assembly Plan Compactness Scores Appendix 3 (Page 1)

District	Polsby-Popper	Schwartzberg	Reock	Convex_Hull	Total
1	0.09	0.30	0.15	0.55	1.09
2	0.17	0.42	0.28	0.55	1.42
3	0.25	0.50	0.42	0.68	1.85
4	0.16	0.40	0.24	0.57	1.36
5	0.24	0.49	0.45	0.81	2.00
6	0.26	0.51	0.38	0.67	1.83
7	0.14	0.37	0.19	0.53	1.22
8	0.36	0.60	0.47	0.81	2.24
9	0.23	0.48	0.36	0.67	1.73
10	0.15	0.39	0.34	0.59	1.48
11	0.25	0.50	0.43	0.73	1.90
12	0.33	0.58	0.39	0.81	2.11
13	0.54	0.74	0.65	0.92	2.85
14	0.14	0.38	0.26	0.59	1.37
15	0.29	0.54	0.39	0.82	2.04
16	0.35	0.59	0.42	0.74	2.10
17	0.33	0.57	0.42	0.74	2.07
18	0.21	0.46	0.27	0.57	1.51
19	0.12	0.35	0.19	0.49	1.14
20	0.40	0.63	0.54	0.77	2.33
21	0.37	0.61	0.41	0.82	2.21
22	0.30	0.55	0.33	0.70	1.87
23	0.22	0.47	0.31	0.70	1.72
24	0.19	0.44	0.31	0.64	1.59
25	0.40	0.64	0.51	0.78	2.33
26	0.24	0.49	0.47	0.89	2.10
27	0.27	0.52	0.48	0.82	2.08
28	0.28	0.53	0.49	0.78	2.07
29	0.26	0.51	0.43	0.75	1.95
30	0.17	0.41	0.39	0.64	1.60
31	0.23	0.47	0.33	0.70	1.73
32	0.34	0.58	0.36	0.85	2.13
33	0.35	0.59	0.45	0.81	2.20

Table 2 Legislative Assembly Plan Compactness Scores Appendix 3 (Page 2)

District	Polsby-Popper	Schwartzberg	Reock	Convex_Hull	Total
34	0.57	0.75	0.55	0.88	2.75
35	0.33	0.58	0.39	0.71	2.01
36	0.21	0.46	0.44	0.72	1.83
37	0.20	0.45	0.23	0.71	1.58
38	0.24	0.49	0.38	0.79	1.90
39	0.27	0.52	0.34	0.72	1.86
40	0.36	0.60	0.45	0.84	2.25
41	0.22	0.47	0.35	0.67	1.72
42	0.20	0.44	0.37	0.68	1.68
43	0.17	0.41	0.39	0.77	1.74
44	0.05	0.23	0.35	0.65	1.28
45	0.29	0.54	0.31	0.68	1.82
46	0.33	0.57	0.54	0.89	2.33
47	0.05	0.22	0.20	0.29	0.76
48	0.08	0.29	0.38	0.61	1.36
49	0.34	0.58	0.36	0.69	1.97
50	0.26	0.51	0.34	0.72	1.82
51	0.30	0.55	0.36	0.68	1.89
52	0.44	0.67	0.48	0.87	2.45
53	0.12	0.35	0.35	0.66	1.49
54	0.06	0.24	0.25	0.62	1.18
55	0.34	0.58	0.40	0.73	2.05
56	0.29	0.53	0.35	0.72	1.89
57	0.24	0.49	0.36	0.73	1.82
58	0.16	0.40	0.52	0.75	1.83
59	0.21	0.45	0.23	0.73	1.62
60	0.24	0.49	0.47	0.88	2.09
61	0.17	0.41	0.40	0.80	1.78
62	0.26	0.51	0.27	0.79	1.83
63	0.33	0.58	0.32	0.80	2.03
64	0.06	0.25	0.23	0.48	1.02
65	0.21	0.46	0.59	0.85	2.10
66	0.11	0.34	0.26	0.52	1.23

Table 2 Legislative Assembly Plan Compactness Scores Appendix 3 (Page 3)

District	Polsby-Popper	Schwartzberg	Reock	Convex_Hull	Total
67	0.26	0.51	0.50	0.78	2.05
68	0.28	0.53	0.50	0.82	2.12
69	0.30	0.54	0.32	0.68	1.84
70	0.16	0.40	0.20	0.67	1.43
71	0.29	0.54	0.45	0.82	2.09
72	0.28	0.53	0.46	0.80	2.08
73	0.17	0.41	0.26	0.58	1.42
74	0.15	0.38	0.41	0.65	1.60
75	0.56	0.75	0.47	0.92	2.70
76	0.23	0.48	0.20	0.62	1.53
77	0.09	0.30	0.45	0.70	1.53
78	0.06	0.25	0.47	0.64	1.41
79	0.07	0.26	0.23	0.53	1.08
80	0.14	0.37	0.41	0.67	1.59
81	0.24	0.48	0.36	0.68	1.76
82	0.39	0.62	0.37	0.86	2.25
83	0.28	0.53	0.37	0.78	1.97
84	0.35	0.59	0.50	0.77	2.22
85	0.17	0.41	0.46	0.69	1.73
86	0.13	0.37	0.30	0.69	1.49
87	0.36	0.60	0.32	0.73	2.00
88	0.19	0.44	0.37	0.72	1.73
89	0.20	0.44	0.28	0.62	1.55
90	0.18	0.43	0.46	0.69	1.76
91	0.07	0.27	0.42	0.73	1.49
92	0.40	0.63	0.48	0.85	2.35
93	0.25	0.50	0.26	0.76	1.77
94	0.21	0.46	0.49	0.78	1.94
95	0.10	0.32	0.27	0.58	1.27
96	0.32	0.56	0.37	0.77	2.01
97	0.14	0.38	0.40	0.65	1.57
98	0.47	0.69	0.50	0.82	2.48
99	0.20	0.45	0.52	0.80	1.98
Sum	**24.03**	**47.43**	**37.53**	**71.01**	
Average	**0.23**	**0.47**	**0.39**	**0.72**	

Table 3 Act 43 Senate Compactness Scores Appendix 3

District	Polsby-Popper	Schwartzberg	Reock	Convex_Hull	Total
1	0.07	0.27	0.13	0.49	0.96
2	0.18	0.43	0.32	0.74	1.68
3	0.39	0.62	0.63	0.86	2.49
4	0.23	0.47	0.29	0.69	1.68
5	0.44	0.67	0.57	0.92	2.60
6	0.31	0.56	0.39	0.74	1.99
7	0.21	0.46	0.32	0.70	1.70
8	0.13	0.36	0.27	0.59	1.34
9	0.31	0.56	0.50	0.72	2.09
10	0.28	0.53	0.44	0.71	1.97
11	0.18	0.42	0.41	0.74	1.75
12	0.32	0.57	0.47	0.86	2.23
13	0.22	0.47	0.40	0.73	1.82
14	0.15	0.39	0.40	0.63	1.57
15	0.25	0.50	0.33	0.79	1.87
16	0.07	0.27	0.47	0.72	1.53
17	0.28	0.53	0.40	0.68	1.89
18	0.22	0.47	0.47	0.74	1.90
19	0.39	0.63	0.36	0.87	2.25
20	0.27	0.52	0.54	0.78	2.10
21	0.18	0.42	0.48	0.79	1.87
22	0.07	0.26	0.23	0.54	1.10
23	0.25	0.50	0.30	0.78	1.84
24	0.23	0.48	0.31	0.76	1.77
25	0.12	0.35	0.41	0.63	1.52
26	0.05	0.23	0.36	0.72	1.36
27	0.11	0.34	0.56	0.76	1.77
28	0.27	0.52	0.33	0.77	1.89
29	0.22	0.47	0.22	0.63	1.53
30	0.12	0.34	0.26	0.50	1.22
31	0.24	0.49	0.23	0.78	1.74
32	0.33	0.57	0.51	0.77	2.17
33	0.22	0.46	0.53	0.79	2.00
Sum	**7.32**	**15.13**	**12.84**	**23.92**	
Average	**0.22**	**0.46**	**0.39**	**0.72**	

Table 4 Legislative Senate Plan Compactness Scores Appendix 3

District	Polsby-Popper	Schwartzberg	Reock	Convex_Hull	Total
1	0.06	0.25	0.13	0.47	0.91
2	0.20	0.45	0.36	0.68	1.69
3	0.30	0.54	0.42	0.79	2.05
4	0.23	0.48	0.38	0.71	1.79
5	0.25	0.50	0.48	0.77	2.00
6	0.24	0.49	0.52	0.71	1.97
7	0.18	0.42	0.24	0.63	1.48
8	0.18	0.42	0.34	0.61	1.56
9	0.39	0.63	0.39	0.80	2.21
10	0.33	0.57	0.43	0.71	2.04
11	0.33	0.58	0.50	0.84	2.24
12	0.38	0.62	0.53	0.88	2.41
13	0.24	0.49	0.51	0.79	2.03
14	0.19	0.44	0.35	0.61	1.58
15	0.26	0.51	0.50	0.75	2.03
16	0.09	0.30	0.36	0.64	1.38
17	0.29	0.54	0.35	0.67	1.85
18	0.26	0.51	0.40	0.77	1.94
19	0.37	0.61	0.42	0.78	2.17
20	0.26	0.51	0.34	0.74	1.85
21	0.15	0.39	0.56	0.80	1.91
22	0.06	0.24	0.23	0.48	1.00
23	0.23	0.48	0.44	0.73	1.88
24	0.21	0.46	0.35	0.76	1.78
25	0.13	0.37	0.43	0.64	1.56
26	0.05	0.22	0.38	0.66	1.31
27	0.16	0.40	0.47	0.76	1.80
28	0.25	0.50	0.32	0.72	1.78
29	0.25	0.50	0.25	0.62	1.62
30	0.10	0.32	0.24	0.47	1.13
31	0.27	0.52	0.39	0.86	2.05
32	0.28	0.53	0.43	0.77	2.01
33	0.22	0.47	0.59	0.84	2.12
Sum	**7.41**	**15.25**	**13.02**	**23.44**	
Average	**0.22**	**0.46**	**0.39**	**0.71**	

Appendix 4
Wisconsin Maps

Map 1 Existing Assembly District Deviations

- Map 1A Existing Assembly District Deviations (Madison)
- Map 1B Existing Assembly District Deviations (Milwaukee)
- Map 2 Act 43 Deviation and Assembly District and Legislature Assembly Plan (I-94 Corridor)

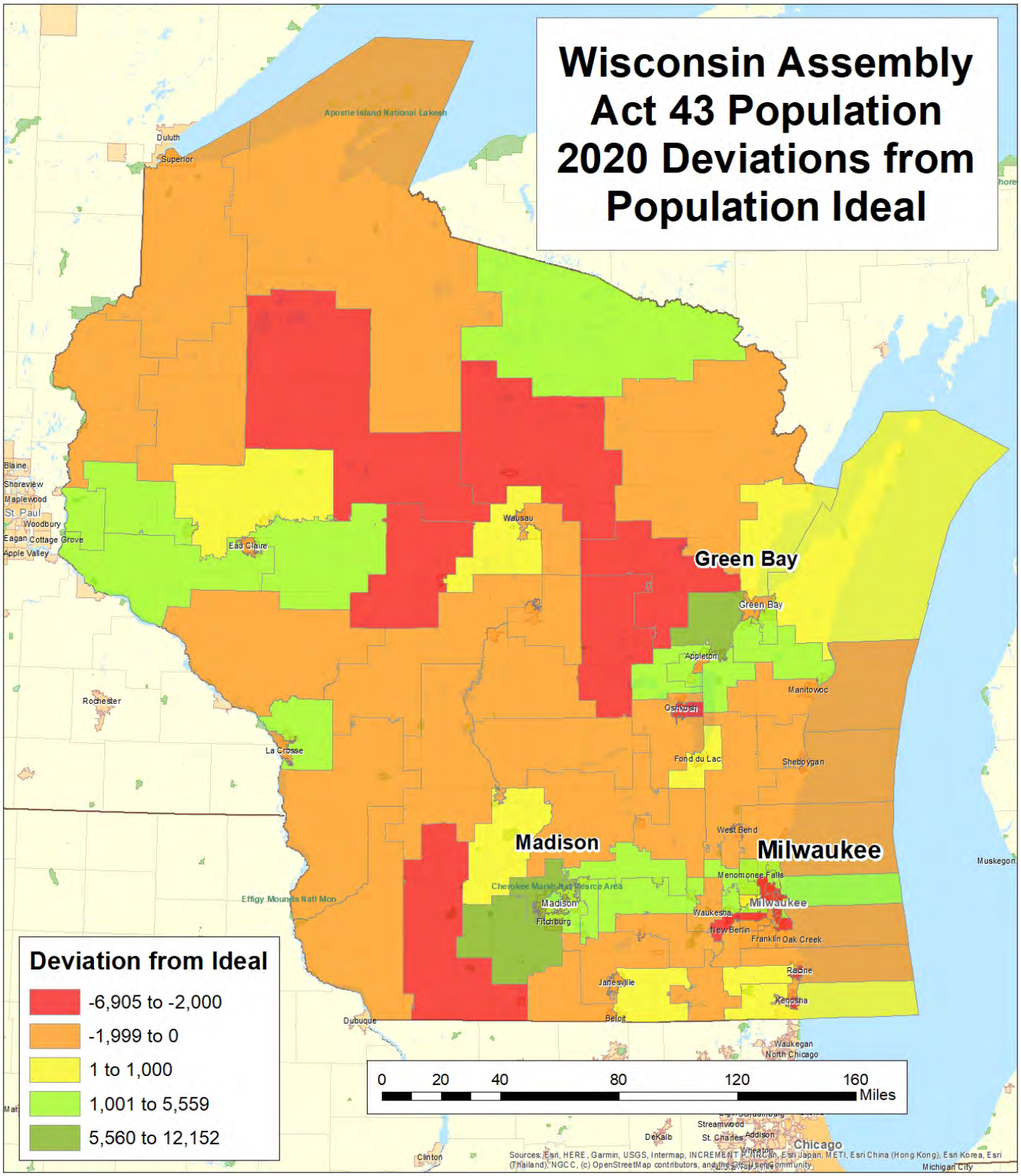
Map 3 Legislature Assembly Plan

- Map 3A Legislature Assembly Plan (Milwaukee)
- Map 4 Legislature Assembly Plan and Act 43

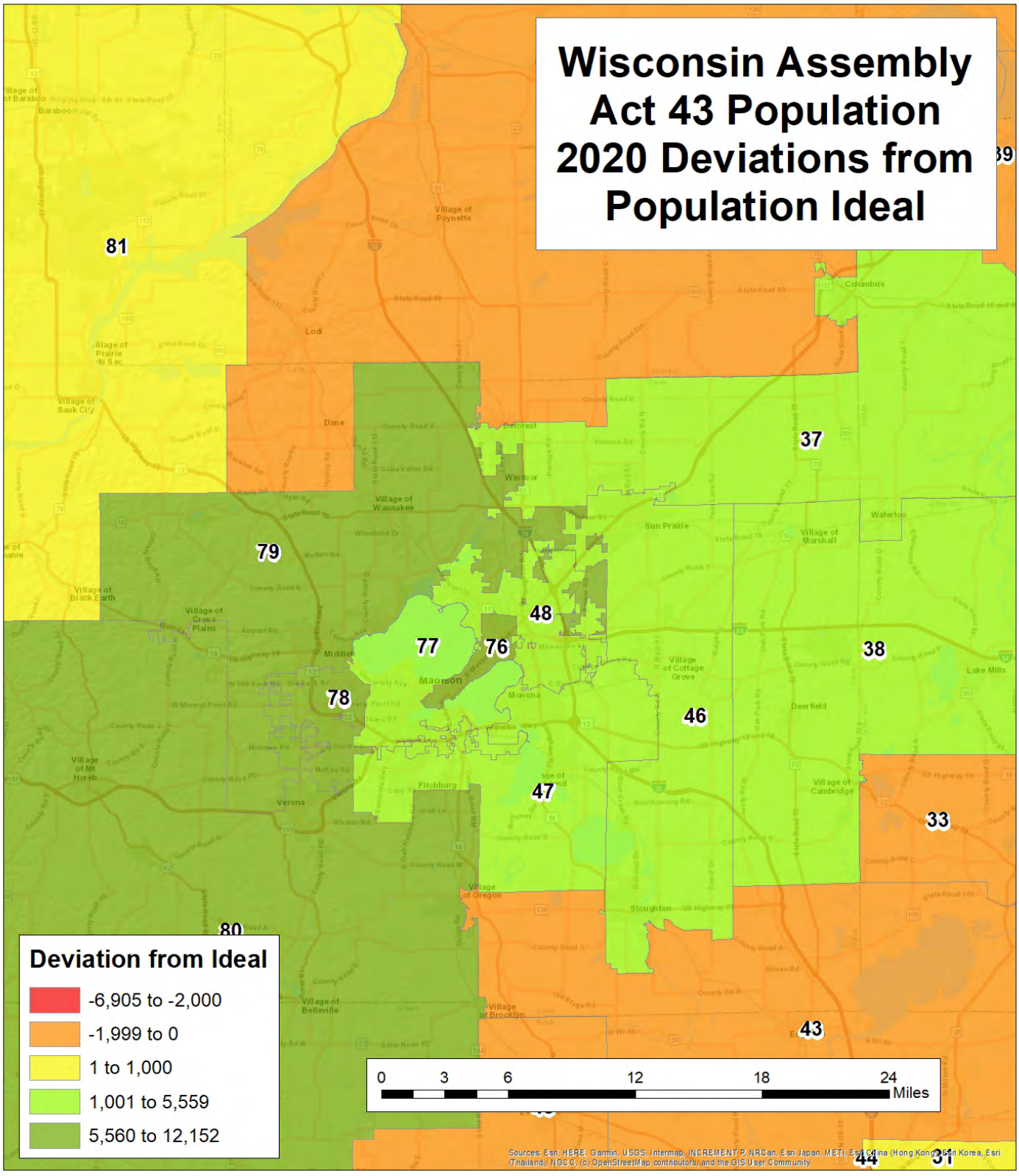
Map 5 Legislature Senate Plan

- Map 5A Legislature Senate Plan (Milwaukee)
- Map 6 Legislature Senate Plan and Act 43

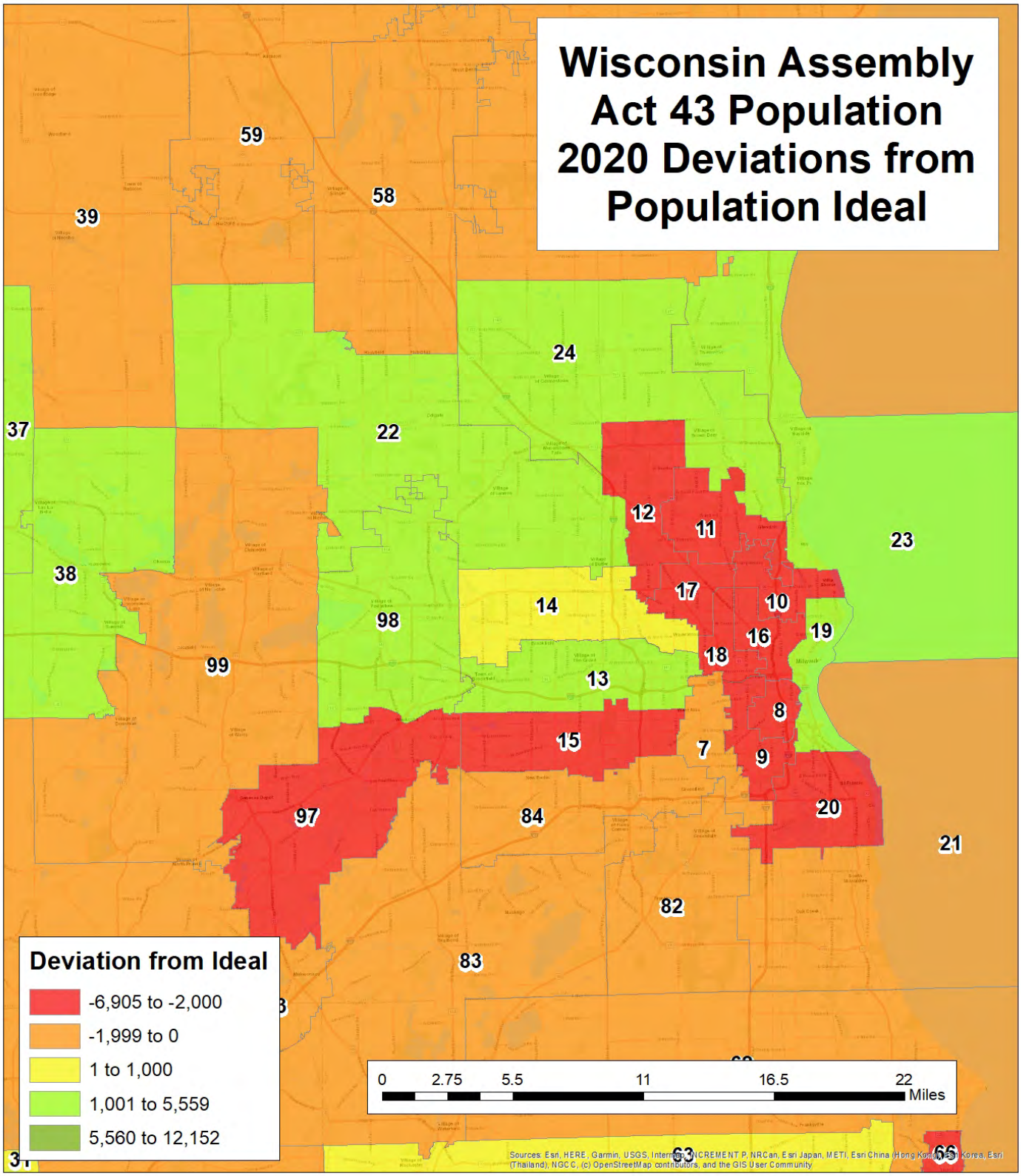
Map 1 Existing Assembly District Deviations Appendix 4



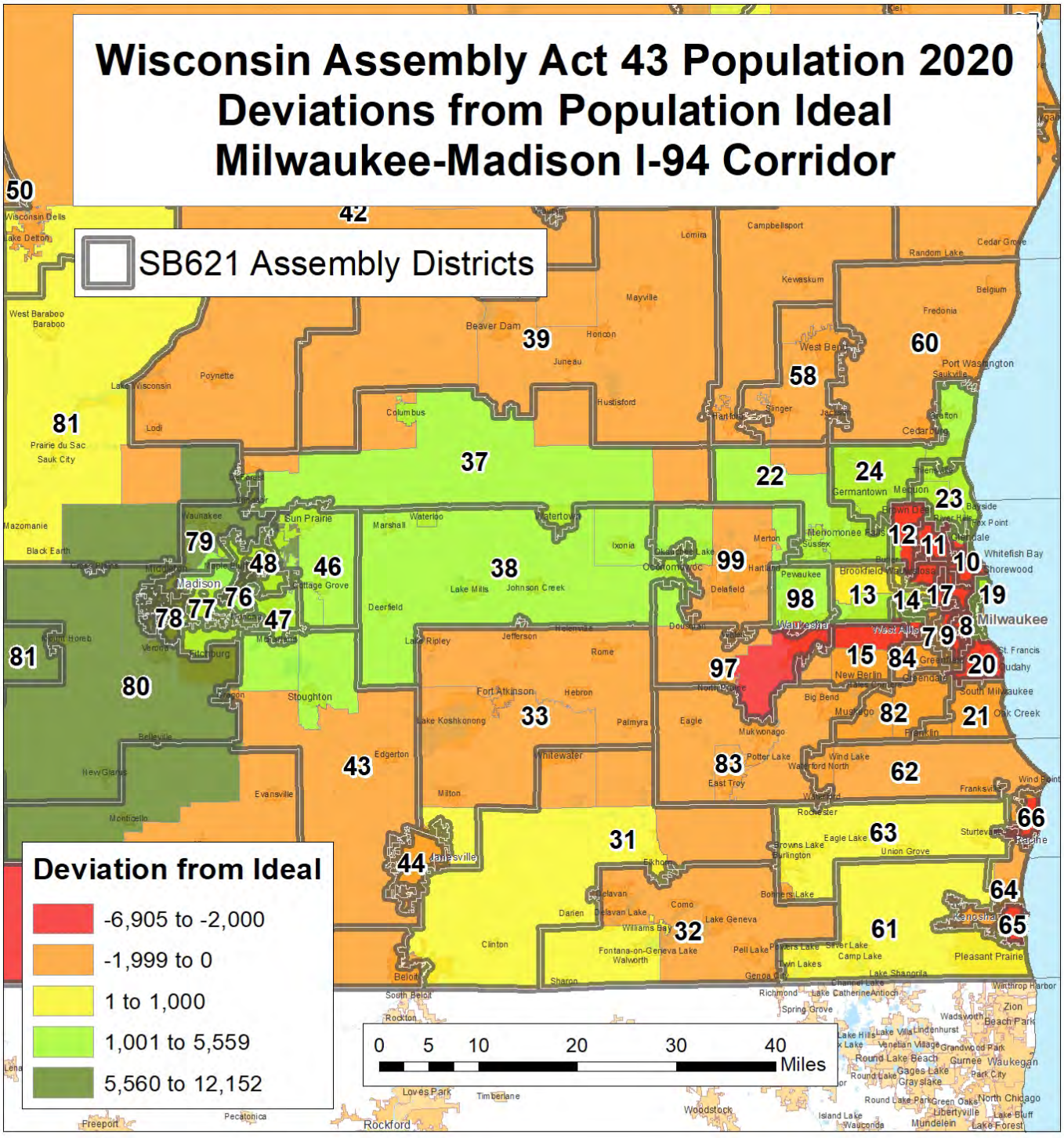
Map 1A Existing Assembly District Deviations (Madison) Appendix 4



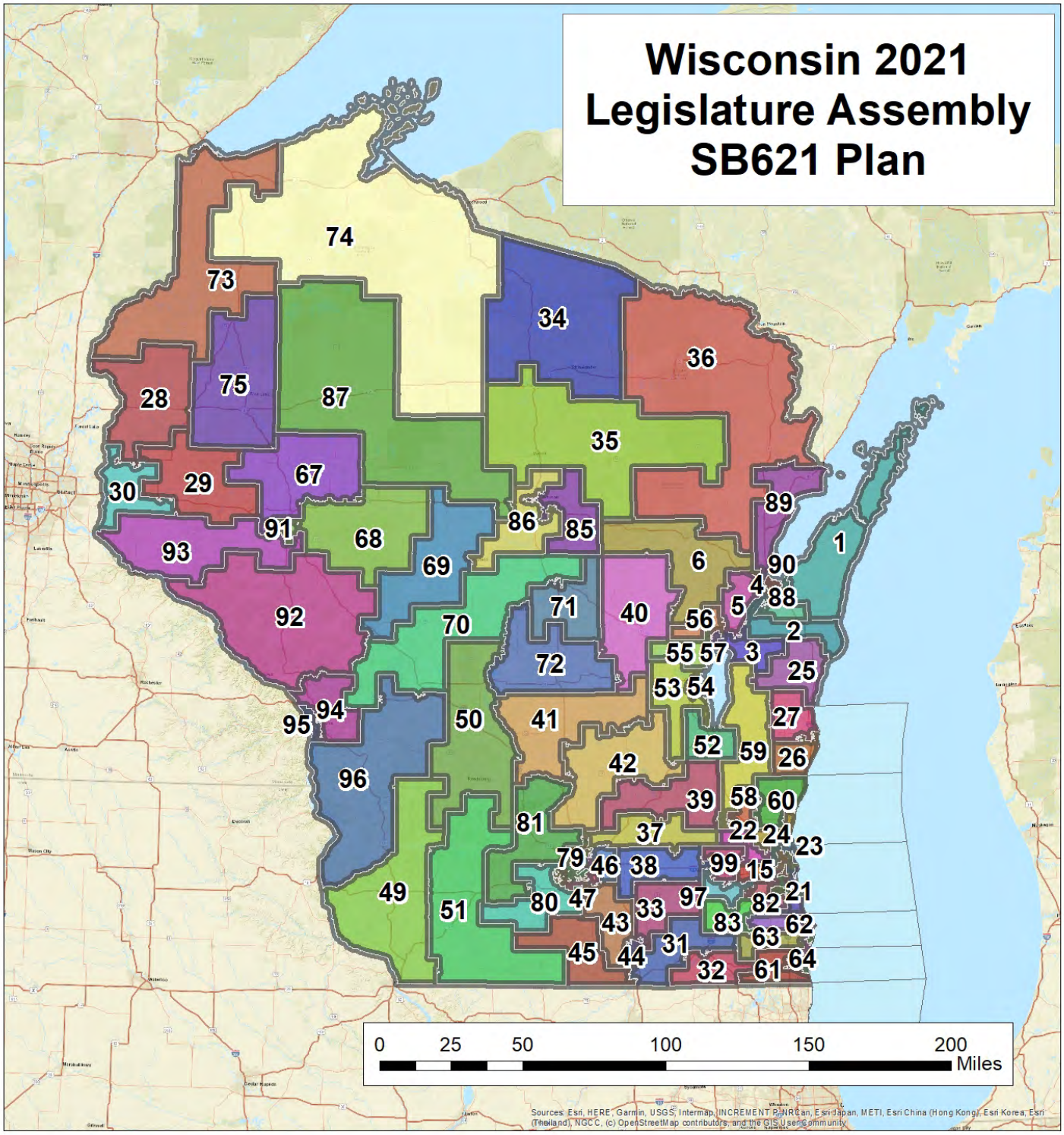
Map 1B Existing Assembly District Deviations (Milwaukee) Appendix 4



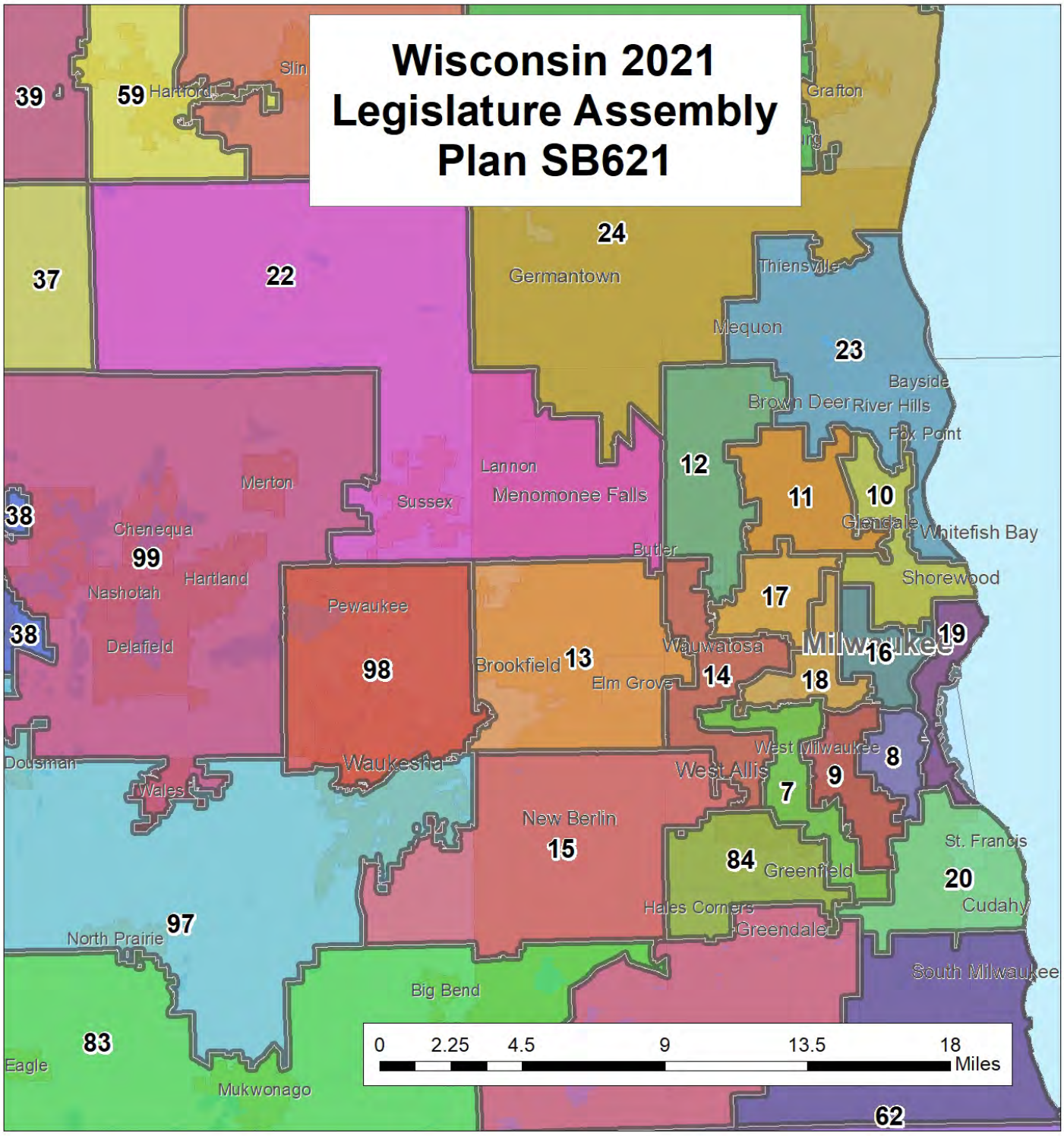
Map 2 Act 43 Deviation and Assembly District
and Legislature Assembly Plan (I-94 Corridor) Appendix 4



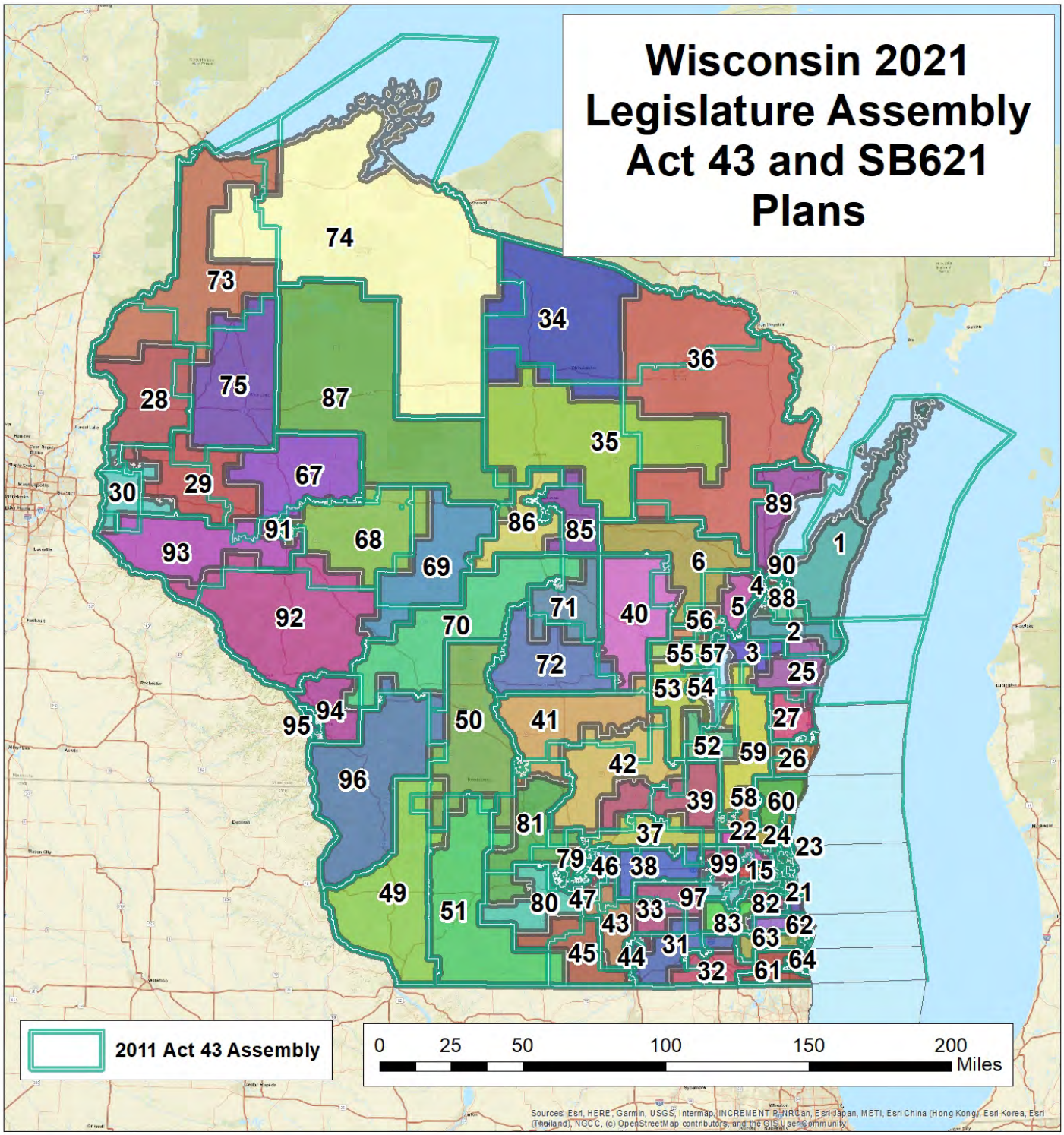
Map 3 Legislature Assembly Plan Appendix 4



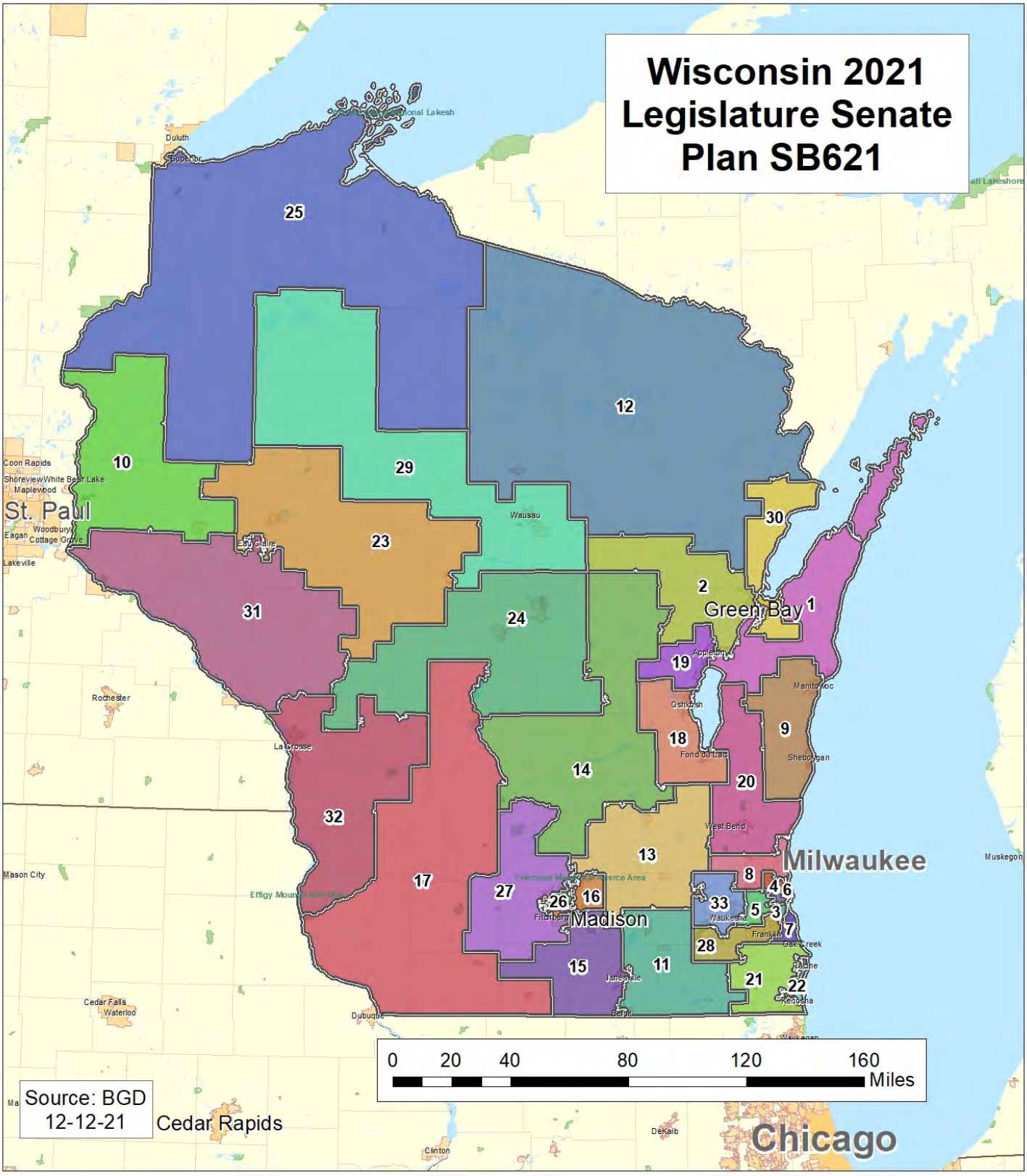
Map 3A Legislature Assembly Plan (Milwaukee) Appendix 4



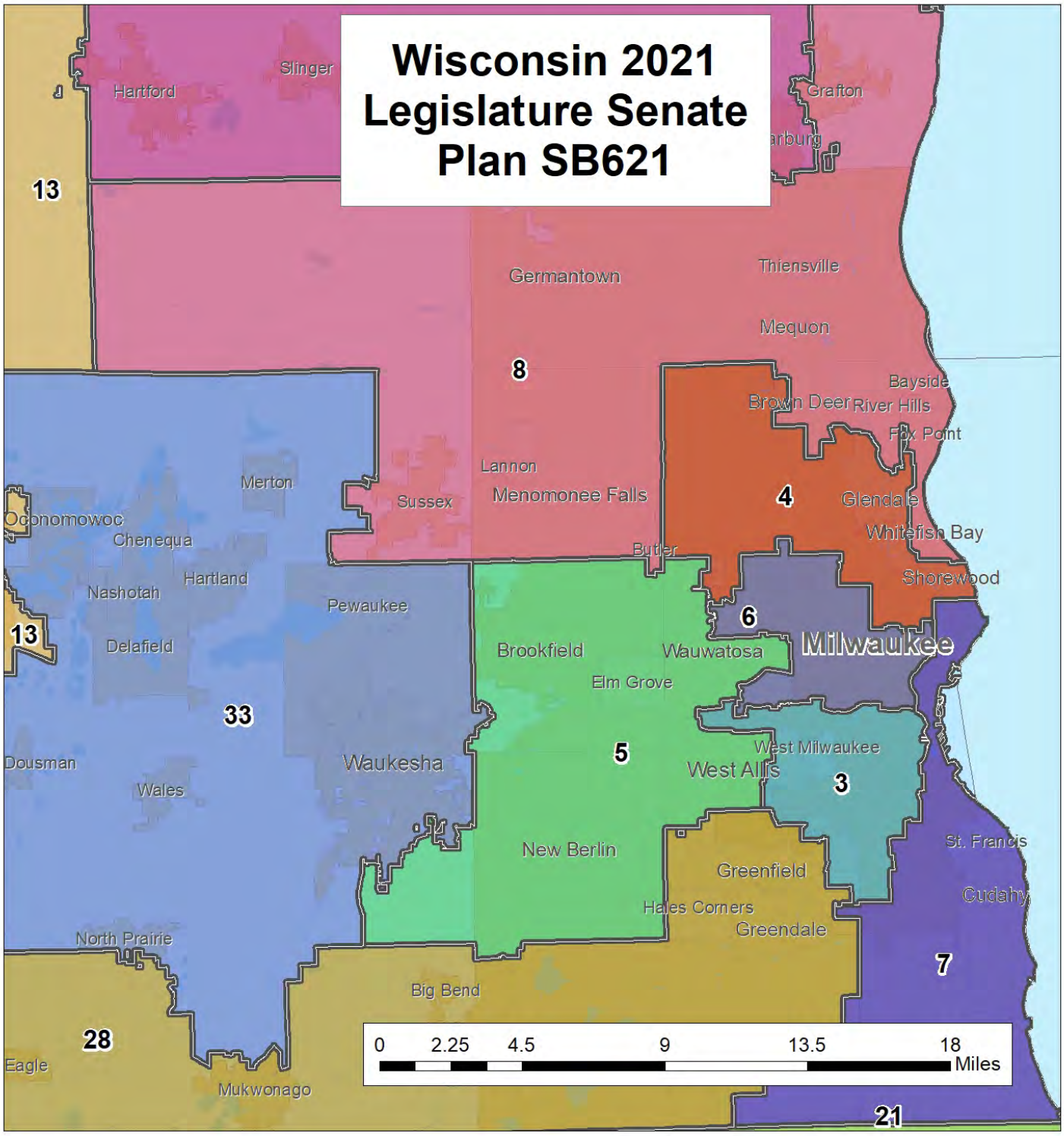
Map 4 Legislature Assembly Plan and Act 43 Appendix 4



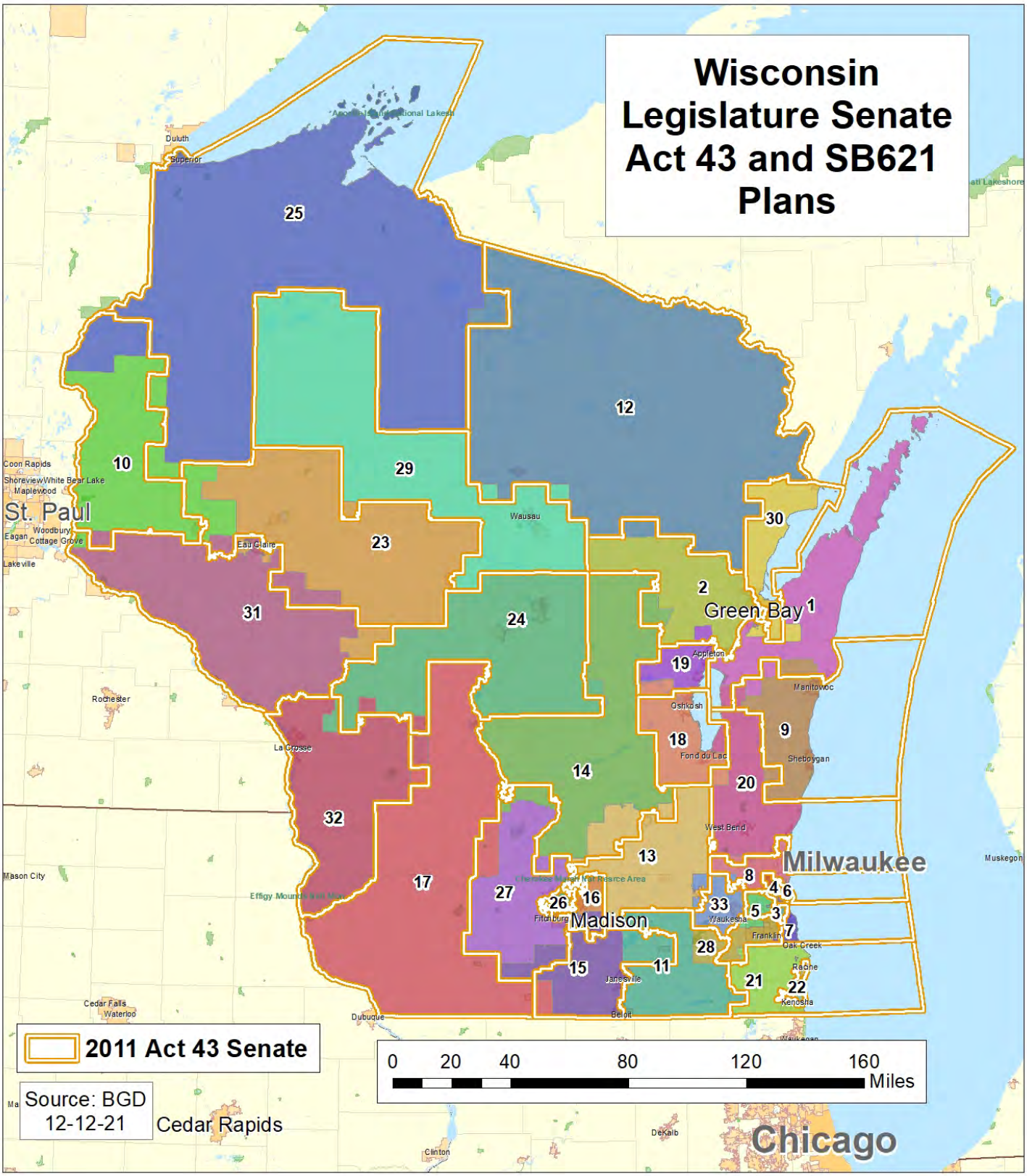
Map 5 Legislature Senate Plan Appendix 4



Map 5A Legislature Senate Plan (Milwaukee) Appendix 4



Map 6 Legislature Senate Plan and Act 43 Appendix 4



Appendix 5
Thomas M. Bryan CV

Thomas M. Bryan

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Redistricting Résumé and C.V.

Introduction

I am an applied demographic, analytic and research professional who leads a team of experts in state and local redistricting cases. I have subject matter expertise in political and school redistricting and Voting Rights Act related litigation, US Census Bureau data, geographic information systems (GIS), applied demographic techniques and advanced analytics.

Education & Academic Honors

2002 MS, Management and Information Systems - George Washington University

2002 GSA CIO University graduate* - George Washington University

1997 Graduate credit courses taken at University of Nevada at Las Vegas

1996 MUS (Master of Urban Studies) Demography and Statistics core - Portland State University

1992 BS, History - Portland State University

Bryan GeoDemographics, January 2001-Current: Founder and Principal

I founded Bryan GeoDemographics (BGD) in 2001 as a demographic and analytic consultancy to meet the expanding demand for advanced analytic expertise in applied demographic research and analysis. Since then, my consultancy has broadened to include litigation support, state and local redistricting, school redistricting, and municipal infrastructure initiatives. Since 2001, BGD has undertaken over 150 such engagements in three broad areas:

1) state and local redistricting,
2) applied demographic studies, and
3) school redistricting and municipal Infrastructure analysis.

The core of the BGD consultancy has been in state and local redistricting and expert witness support of litigation. Engagements include:

Granted by the General Services Administration (GSA) and the Federal IT Workforce Committee of the CIO Council. http://www.gwu.edu/~mastergw/programs/mis/pr.html.

State and Local Redistricting

- 2021: Served as Consultant to the Arizona Independent Redistricting Commission, presenting "Pros and Cons of (Census data) Differential Privacy". July 13, 2021.
    - https://irc.az.gov/sites/default/files/meeting-agendas/Agenda%207.13.21.pdf
- 2021: Chosen by Virginia Senator Tommy Norment to be the Republican nominee for the position of Special Master to the Virginia Supreme Court in designing the Legislative, Senate and Congressional redistricting plans for the State of Virginia. Did not end up serving.
    - https://www.vacourts.gov/courts/scv/districting/special_masters_nominations_senator_norment.pdf
- 2021: Retained as demographic and redistricting expert for the Wisconsin Legislature in Johnson v. Wisconsin Elections Commission, No. 2021AP001450-OA (Wis. Supreme Court) and related Wisconsin redistricting litigation. Offering opinions on demography and redistricting for redistricting plans proposed as remedies in impasse suit.
- 2021: Retained as demographic and redistricting expert by the State of Alabama Attorney General's office. Currently serving as the State's demographic and redistricting expert witness in the matters of Milligan v. Merrill, Thomas v. Merrill and Singleton v. Merrill over Alabama's Congressional redistricting initiatives.
- 2021: Retained as nonpartisan demographic and redistricting expert in the State of North Carolina to prepare commissioner redistricting plans for Granville County, Harnett County, Jones County and Nash County. Each proposed plan was approved and successfully adopted.
- 2021: Retained as demographic and redistricting expert by Democratic Counsel for the State of Illinois in the case of McConchie v. State Board of Elections. Prepared expert report in defense of using the American Community Survey to comply with state constitutional requirements in the absence of the (then) delayed Census 2020 data.
    - https://redistricting.lls.edu/case/mcconchie-v-ill-state-board-of-elections/
- 2021: Retained by counsel for the Chairman and staff of the Texas House Committee on Redistricting as a consulting demographic expert. Texas House Bill 1 subsequently passed by the Legislature 83-63.
    - https://capitol.texas.gov/BillLookup/History.aspx?LegSess=873&Bill=HB1
- 2021: In the matter of the State of Alabama, Representative Robert Aderholt, William Green and Camaran Williams v. the US Department of Commerce; Gina Raimondo; the US Census Bureau and Ron Jarmin in US District Court of Alabama Eastern Division. Prepared a demographic report for Plaintiffs analyzing the effects of using Differential Privacy on Census Data in Alabama and was certified as an expert witness by the Court.
    - https://www.alabamaag.gov/Documents/news/Census%20Data%20Manipulation%20Lawsuit.pdf
    - https://redistricting.lls.edu/case/alabama-v-u-s-dept-of-commerce-ii/
- 2020: In the matter of The Christian Ministerial Alliance (CMA), Arkansas Community Institute v. the State of Arkansas. In collaboration with demographic testifying expert Dr. Peter Morrison, on behalf of Defendants. Providing demographic and analytic litigation support.

- https://www.naacpldf.org/wp-content/uploads/CMA-v.-Arkansas_FILED-without-stamp.pdf

- 2020: In the matter of Louisiana State Conference of the NAACP, Allen and Anthony v. the State of Louisiana in US District Court. In collaboration with demographic testifying expert Dr. Peter Morrison, on behalf of Defendants. Providing demographic and analytic litigation support for the analysis and testing of LA Supreme Court Districts.
  - https://apnews.com/c44c986a29ec4035a87e5ca94d4e6324
  - https://www.bloomberglaw.com/public/desktop/document/AllenetalvStateofLouisianaOfficeoftheGovernorDivisionofAdministra?1595341263
- 2020: In the matter of Aguilar, Gutierrez, Montes, Palmer and OneAmerica v. Yakima County in Superior Court of Washington under the Washington Voting Rights Act ("WVRA" Wash. Rev. Code § 29A.92.60). In collaboration with demographic testifying expert Dr. Peter Morrison, on behalf of Defendants. Providing demographic and analytic litigation support.
  - https://bloximages.newyork1.vip.townnews.com/yakimaherald.com/content/tncms/assets/v3/editorial/a/4e/a4e86167-95a2-5186-a86c-bb251bf535f1/5f0d01eec8234.pdf.pdf
- 2018-2020: In the matter of Flores, Rene Flores, Maria Magdalena Hernandez, Magali Roman, Make the Road New York, and New York Communities for Change v. Town of Islip, Islip Town Board, Suffolk County Board of Elections in US District Court. On behalf of Defendants - provided a critical analysis of plaintiff's demographic and environmental justice analysis. The critique revealed numerous flaws in both the demographic analysis as well as the tenets of their environmental justice argument, which were upheld by the court. Ultimately developed mutually agreed upon plan for districting.
  - https://nyelectionsnews.wordpress.com/2018/06/20/islip-faces-section-2-voting-rights-act-challenge/
  - https://www.courthousenews.com/wp-content/uploads/2018/06/islip-voting.pdf
- 2017-2020 In the matter of NAACP, Spring Valley Branch; Julio Clerveaux; Chevon Dos Reis; Eric Goodwin; Jose Vitelio Gregorio; Dorothy Miller; and Hillary Moreau v East Ramapo Central School District (Defendant) in United States District Court Southern District Of New York (original decision May 25, 2020), later the U.S. Second Circuit Court of Appeals. On behalf of Defendants, developed mutually agreed upon district plan and provided demographic and analytic litigation support.
  - https://www.lohud.com/story/news/education/2020/05/26/federal-judge-sides-naacp-east-ramapo-voting-rights-case/5259198002/
- 2017-2020: In the matter of Pico Neighborhood Association et al v. City of Santa Monica brought under the California VRA. In collaboration with demographic testifying expert Dr. Peter Morrison, on behalf of Defendants. Providing demographic and analytic litigation support. Executed geospatial analysis to identify concentrations of Hispanic and Black CVAP to determine the impossibility of creating a minority majority district, and demographic analysis to show the dilution of Hispanic and Black voting strength in a district (vs at-large) system. Work contributed to Defendants prevailing in landmark ruling in the State of California Court of Appeal, Second Appellate District.
  - https://www.santamonica.gov/press/2020/07/09/santa-monica-s-at-large-election-system-affirmed-in-court-of-appeal-decision

- 2019: In the matter of Johnson v. Ardoin / the State of Louisiana in United States District Court. In collaboration with demographic testifying expert Dr. Peter Morrison, on behalf of Defendants. Provided expert demographic and analytic litigation support.
    - https://www.brennancenter.org/sites/default/files/2019-10/2019-10-16-Johnson%20v_%20Ardoin-132-Brief%20in%20Opposition%20to%20MTS.pdf
- 2019: In the matter of *Suresh Kumar v. Frisco Independent School District et al*. in United States District Court. In collaboration with demographic testifying expert Dr. Peter Morrison, on behalf of Defendants. Provided expert demographic and analytic litigation support. Successfully defended.
    - https://www.friscoisd.org/news/district-headlines/2020/08/04/frisco-isd-wins-voting-rights-lawsuit
    - https://www.courthousenews.com/wp-content/uploads/2020/08/texas-schools.pdf
- 2019: At the request of the City of Frisco, TX in collaboration with demographic testifying expert Dr. Peter Morrison. Provided expert demographic assessment of the City's potential liability regarding a potential Section 2 Voting Rights challenge.
- 2019: In the matter of *NAACP v. East Ramapo Central School District* in US District Court Southern District of NY. In collaboration with demographic testifying expert Dr. Peter Morrison, on behalf of Defendants. Provided expert demographic and analytic litigation support.
- 2019: In the matter of *Johnson v. Ardoin* in United States District Court. In collaboration with demographic testifying expert Dr. Peter Morrison, on behalf of Defendants. Provided expert demographic and analytic litigation support. Prepared analysis of institutionalized prison population versus noninstitutionalized eligible to vote population.
    - https://casetext.com/case/johnson-v-ardoin
- 2019: In the matter of *Vaughan v. Lewisville Independent School District et al.* in United States District Court. In collaboration with demographic testifying expert Dr. Peter Morrison, on behalf of Defendants. Provided expert demographic and analytic litigation support.
    - https://www.nbcdfw.com/news/local/lawsuit-filed-against-lewisville-independent-school-district/1125/
- 2019: In the matter of *Holloway, et al. v. City of Virginia Beach in* United States District Court, Eastern District of Virginia. In collaboration with demographic testifying expert Dr. Peter Morrison, on behalf of Defendants. Provided expert demographic and analytic litigation support.
    - https://campaignlegal.org/cases-actions/holloway-et-al-v-city-virginia-beach
- 2018: At the request of Kirkland City, Washington in collaboration with demographic testifying expert Dr. Peter Morrison. Performed demographic studies to inform the City's governing board's deliberations on whether to change from at-large to single-member district elections following enactment of the Washington Voting Rights Act. Analyses included gauging the voting strength of the City's Asian voters and forming an illustrative district concentrating Asians; and compared minority population concentration in pre- and post-annexation city territory.

  - https://www.kirklandwa.gov/Assets/City+Council/Council+Packets/021919/8b_SpecialPresentations.pdf#:~:text=RECOMMENDATION%3A%20It%20is%20recommended%20that%20City%20Council%20receive,its%20Councilmembers%20on%20a%20citywide%2C%20at-%20large%20basis

- 2018: At the request of Tacoma WA Public Schools in collaboration with demographic testifying expert Dr. Peter Morrison. Created draft concept redistricting plans that would optimize minority population concentrations while respecting incumbency. Client will use this plan as a point of departure for negotiating final boundaries among incumbent elected officials.
- 2018: At the request of the City of Mount Vernon, Washington., in collaboration with demographic testifying expert Dr. Peter Morrison. Prepared a numerous draft concept plans that preserves Hispanics' CVAP concentration. Client utilized draft concept redistricting plans to work with elected officials and community to agree upon the boundaries of six other districts to establish a proposed new seven-district single-member district plan.
- 2017: In the matter of Pico Neighborhood Association v. City of Santa Monica. In collaboration with demographic testifying expert Dr. Peter Morrison. Worked to create draft district concept plans that would satisfy Plaintiff's claim of being able to create a majority-minority district to satisfy Gingles prong 1. Such district was not possible, and the Plaintiffs case ultimately failed in California State Court of Appeals Second Appellate District.
  - https://law.justia.com/cases/california/court-of-appeal/2020/b295935.html
- 2017: In the matter of John Hall, Elaine Robinson-Strayhorn, Lindora Toudle, Thomas Jerkins, v. Jones County Board of Commissioners. In collaboration with demographic testifying expert Dr. Peter Morrison. Worked to create draft district concept plans to resolve claims of discrimination against African Americans attributable to the existing at-large voting system.
  - http://jonescountync.gov/vertical/sites/%7B9E2432B0-642B-4C2F-A31B-CDE7082E88E9%7D/uploads/2017-02-13-Jones-County-Complaint.pdf
- 2017: In the matter of Harding v. County of Dallas in U.S. District Court. In collaboration with demographic testifying expert Dr. Peter Morrison. In a novel case alleging discrimination against White, non-Hispanics under the VRA, I was retained by plaintiffs to create redistricting scenarios with different balances of White-non-Hispanics, Blacks and Hispanics. Deposed and provided expert testimony on the case.
  - https://www.courthousenews.com/wp-content/uploads/2018/08/DallasVoters.pdf
- 2016: Retained by The Equal Voting Rights Institute to evaluate the Dallas County Commissioner existing enacted redistricting plan. In collaboration with demographic testifying expert Dr. Peter Morrison, the focus of our evaluation was twofold: (1) assess the failure of the Enacted Plan (EP) to meet established legal standards and its disregard of traditional redistricting criteria; (2) the possibility of drawing an alternative Remedial Plan (RP) that did meet established legal standards and balance traditional redistricting criteria.
  - http://equalvotingrights.org/wp-content/uploads/2015/01/Complaint.pdf

- 2016: In the matter of Jain v. Coppell ISD et al in US District Court. In collaboration with demographic testifying expert Dr. Peter Morrison. Consulted in defense of Coppell Independent School District (Dallas County, TX) to resolve claims of discriminatory at-large voting system affecting Asian Americans. While Asians were shown to be sufficiently numerous, I was able to demonstrate that they were not geographically concentrated - thus successfully proving the Gingles 1 precondition could not be met resulting the complaint being withdrawn.
    - https://dockets.justia.com/docket/texas/txndce/3:2016cv02702/279616

- 2016: In the matter of Feldman et al v. Arizona Secretary of State's Office et al in SCOTUS. In collaboration with demographic testifying expert Dr. Peter Morrison, on behalf of Defendants. Provided analytics on the locations and proximal demographics of polling stations that had been closed subsequent to Shelby County v. Holder (2013) which eliminated the requirement of state and local governments to obtain federal preclearance before implementing any changes to their voting laws or practices. Subsequently provided expert point of view on disparate impact as a result of H.B. 2023. Advised Maricopa County officials and lead counsel on remediation options for primary polling place closures in preparation for 2016 elections.
    - https://arizonadailyindependent.com/2016/04/05/doj-wants-information-on-maricopa-county-election-day-disaster/
    - https://www.supremecourt.gov/DocketPDF/19/19-1257/142431/20200427105601341_Brnovich%20Petition.pdf

- 2016: In the matter of Glatt v. City of Pasco, et al. in US District Court (Washington). In collaboration with demographic testifying expert Dr. Peter Morrison, on behalf of Defendants. Provided analytics and draft plans in defense of the City of Pasco. One draft plan was adopted, changing the Pasco electoral system from at-large to a six-district + one at large.
    - https://www.pasco-wa.gov/DocumentCenter/View/58084/Glatt-v-Pasco---Order---January-27-2017?bidId=
    - https://www.pasco-wa.gov/923/City-Council-Election-System

- 2015: In the matter of The League of Women Voters et al. v. Ken Detzner et al in the Florida Supreme Court. In collaboration with demographic testifying expert Dr. Peter Morrison, on behalf of Defendants. Performed a critical review of Florida state redistricting plan and developed numerous draft concept plans.
    - http://www.miamiherald.com/news/politics-government/state-politics/article47576450.html
    - https://www.floridasupremecourt.org/content/download/322990/2897332/file/OP-SC14-1905_LEAGUE%20OF%20WOMEN%20VOTERS_JULY09.pdf

- 2015: In the matter of *Evenwel, et al. v. Abbott / State of Texas* in SCOTUS. In collaboration with demographic testifying expert Dr. Peter Morrison, on behalf of Plaintiffs. Successfully drew map for the State of Texas balancing both total population from the decennial census and citizen population from the ACS (thereby proving that this was possible). We believe this may be the first and still only time this technical accomplishment has been achieved in the nation at a state level. Coauthored SCOTUS Amicus Brief of Demographers.
    - https://www.supremecourt.gov/opinions/15pdf/14-940_ed9g.pdf
    - https://www.scotusblog.com/wp-content/uploads/2015/08/Demographers-Amicus.pdf

- 2015: In the matter of *Ramos v. Carrollton-Farmers Branch Independent School District* in US District Court (Texas). In collaboration with demographic testifying expert Dr. Peter Morrison, on behalf of Defendants. Used 2009-2013 5-year ACS data to generate small-area estimates of minority citizen voting

age populations and create a variety of draft concept redistricting plans. Case was settled decision in favor of a novel cumulative voting system.

  - https://starlocalmedia.com/carrolltonleader/c-fb-isd-approves-settlement-in-voting-rights-lawsuit/article_92c256b2-6e51-11e5-adde-a70cbe6f9491.html

- 2015: In the matter of *Glatt v. City of Pasco et al.* in US District Court (Washington). In collaboration with demographic testifying expert Dr. Peter Morrison, on behalf of Defendants. Consulted on forming new redistricting plan for city council review. One draft concept plan was agreed to and adopted.
  - https://www.pasco-wa.gov/923/City-Council-Election-System
- 2015: At the request of Waterbury, Connecticut, in collaboration with demographic testifying expert Dr. Peter Morrison. As a result of a successful ballot measure to convert Waterbury from an at-large to a 5-district representative system, consulted an extensive public outreach and drafted numerous concept plans. The Waterbury Public Commission considered alternatives and recommended one of our plans, which the City adopted.
  - http://www.waterburyobserver.org/wod7/node/4124
- 2014-15: In the matter of *Montes v. City of Yakima* in US District Court (Washington). In collaboration with demographic testifying expert Dr. Peter Morrison, on behalf of Defendants. Analytics later used to support the Amicus Brief of the City of Yakima, Washington in the U.S. Supreme Court in *Evenwel v. Abbott*.
  - https://casetext.com/case/montes-v-city-of-yakima-3
- 2014: In the matter of *Harding v. County of Dallas* in the US Court of Appeals Fifth Circuit. In the novel case of Anglo plaintiffs attempting to claim relief as protected minorities under the VRA. Served as demographic expert in the sole and limited capacity of proving Plaintiff claim under Gingles prong 1. Claim was proven. Gingles prongs 2 and 3 were not and the case failed.
  - https://electionlawblog.org/wp-content/uploads/Dallas-opinion.pdf
- 2014: At the request of Gulf County, Florida in collaboration with demographic testifying expert Dr. Peter Morrison. Upon the decision of the Florida Attorney General to force inclusion of prisoners in redistricting plans – drafted numerous concept plans for the Gulf County Board of County Commissioners, one of which was adopted.
  - http://myfloridalegal.com/ago.nsf/Opinions/B640990E9817C5AB85256A9C00631387
- 2012-2015: In the matter of *GALEO and the City of Gainesville* in Georgia. In collaboration with demographic testifying expert Dr. Peter Morrison, on behalf of Defendants -consulted on defense of existing at-large city council election system.
  - http://atlantaprogressivenews.com/2015/06/06/galeo-challenges-at-large-voting-in-city-of-gainesville/
- 2012-: Confidential. Consulted (through Morrison & Associates) to support plan evaluation, litigation, and outreach to city and elected officials (1990s - mid-2000s). Executed first statistical analysis of the American Community Survey to determine probabilities of minority-majority populations in split

statistical/administrative units of geography, as well as the cumulative probabilities of a "false-negative" minority-majority reading among multiple districts.

- 2011-: Confidential. Consulted on behalf of plaintiffs in Committee (Private) vs. State Board of Elections pertaining to citizen voting-age population. Evaluated testimony of defense expert, which included a statistical evaluation of Hispanic estimates based on American Community Survey (ACS) estimates. Analysis discredited the defendant's expert's analysis and interpretation of the ACS.

School Redistricting and Municipal Infrastructure Projects

BGD worked with McKibben Demographics from 2004-2012 providing expert demographic and analytic support. These engagements involved developing demographic profiles of small areas to assist in building fertility, mortality and migration models used to support long-range population forecasts and infrastructure analysis in the following communities:

Fargo, ND 10/2012
Columbia, SC 3/2012
Madison, MS 9/2011
Rockwood, MO 3/2011
Carthage, NY 3/2011
NW Allen, IN 9/2010
Fayetteville, AR 7/2010
Atlanta, GA 2/2010
Caston School Corp., IN 12/09
Rochester, IN 12/09
Urbana, IL 11/09
Dekalb, IL 11/09
Union County, NC 11/09
South Bend, IN 8/09
Lafayette, LA 8/09
Fayetteville, AR 4/09
New Orleans, LA 4/09
Wilmington New Hanover 3/09
New Berry, SC 12/08
Corning, NY 11/08
McLean, IL 11/08
Lakota 11/08
Greensboro, NC 11/08
Guilford 9/08
Lexington, SC 9/08
Plymouth, IN 9/08
Charleston, SC 8/08
Woodland, IL 7/08
White County, IN 6/08
Gurnee District 56, IL 5/08
Central Noble, IN 4/08
Charleston First Baptist, SC 4/08
Edmond, OK 4/08
East Noble, IN 3/08
Mill Creek, IN 5/06
Rhode Island 5/06
Garrett, IN 3/08
Meridian, MS 3/08
Madison County, MS 3/08
Charleston 12/07
Champaign, IL 11/07
Richland County, SC 11/07
Lake Central, IN 11/07
Columbia, SC 11/07
Duneland, IN 10/07
Union County, NC 9/07
Griffith, IN 9/07
Rensselaer, IN 7/07
Hobart, IN 7/07
Buffalo, NY 7/07
Oak Ridge, TN 5/07
Westerville, OH 4/07

Projects Continued

Baton Rouge, LA 4/07
Cobb County, GA 4/07
Charleston, SC District 20 4/07
McDowell County, NC 4/07
East Allen, IN 3/07
Mt. Pleasant, SC District 2 2/07
Peach County, GA 2/07
North Charleston, SC District 4 2/07
Madison County, MS revisions 1/07
Portage County, IN 1/07
Marietta, GA 1/07
Porter, IN 12/06
Harrison County, MS 9/06
New Albany/Floyd County, IN 9/06
North Charleston, SC 9/06
Fairfax, VA 9/06
Coleman 8/06
DeKalb, GA 8/06
LaPorte, IN 7/06
NW Allen, IN 7/06
Brunswick, NC 7/06
Carmel Clay, IN 7/06
Calhoun, SC 5/06
Hamilton Community Schools, IN 4/06
Dilworth, MN 4/06
Hamilton, OH 2/06
West Noble, IN 2/06
New Orleans, LA 2/06
Norwell, IN 2/06
Middletown, OH 12/05
West Noble, IN 11/05
Madison, MS 11/05
Fremont, IN 11/05
Concord, IN 11/05
Allen County 11/05
Bremen, IN 11/05
Smith Green, IN 11/05
Steuben, IN 11/05
Plymouth, IN 11/05
North Charleston, SC 11/05
Huntsville, AL 10/05
Dekalb, IN 9/05
East Noble, IN 9/05
Valparaiso, IN 6/05
Penn-Harris-Madison, IN 7/05
Elmira, NY 7/05
South Porter/Merriville, IN 7/05
Fargo, ND 6/05
Washington, IL 5/05
Addison, NY 5/05
Kershaw, SC 5/05
Porter Township, IN 3/05
Portage, WI 1/05
East Stroudsburg, PA 12/04
North Hendricks, IN 12/04
Sampson/Clinton, NC 11/04
Carmel Clay Township, IN 9/04
SW Allen County, IN 9/04
East Porter, IN 9/04
Allen County, IN 9/04
Duplin, NC 9/04
Hamilton County / Clay TSP, IN 9/04
Hamilton County / Fall Creek TSP, IN 9/04
Decatur, IN 9/04
Chatham County / Savannah, GA 8/04
Evansville, IN 7/04
Madison, MS 7/04
Vanderburgh, IN 7/04
New Albany, IN 6/04

Publications

- "The Effect of the Differential Privacy Disclosure Avoidance System Proposed by the Census Bureau on 2020 Census Products: Four Case Studies of Census Blocks in Alaska" PAA Affairs, (with D. Swanson and Richard Sewell, Alaska Department of Transportation and Public Facilities). March 2021.
    - https://www.populationassociation.org/blogs/paa-web1/2021/03/30/the-effect-of-the-differential-privacy-disclosure?CommunityKey=a7bf5d77-d09b-4907-9e17-468af4bdf4a6 .
    - https://redistrictingonline.org/2021/03/31/study-census-bureaus-differential-privacy-disclosure-avoidance-system-produces-produces-concerning-results-for-local-jurisdictions/
    - https://www.ncsl.org/research/redistricting/differential-privacy-for-census-data-explained.aspx
- In the matter of the State of Alabama, Representative Robert Aderholt, William Green and Camaran Williams v. the US Department of Commerce; Gina Raimondo; the US Census Bureau and Ron Jarmin in US District Court of Alabama Eastern Division. Declaration of Thomas Bryan, Exhibit 6. Civil Action NO. 3:21-CV-211, United States District Court for Middle Alabama, Eastern Division. Assessing the impact of the U.S. Census Bureau's approach to ensuring respondent privacy and Title XIII compliance by using a disclosure avoidance system involving differential privacy. March 2021.
    - https://redistricting.lls.edu/wp-content/uploads/AL-commerce2-20210311-PI.zip
- Peter A. Morrison and Thomas M. Bryan, Redistricting: A Manual for Analysts, Practitioners, and Citizens (2019). Springer Press: Cham Switzerland.
- "Small Area Business Demography." in D. Poston (editor) Handbook of Population, 2nd Edition. (2019). Springer Press: London (with P. Morrison and S. Smith).
- "From Legal Theory to Practical Application: A How-To for Performing Vote Dilution Analyses." *Social Science Quarterly*. (with M.V. Hood III and Peter Morrison). March 2017
    - http://onlinelibrary.wiley.com/doi/10.1111/ssqu.12405/abstract
- In the Supreme Court of the United States Sue Evenwel, Et Al., *Appellants,* V. Greg Abbott, in his official capacity as Governor of Texas, et al., *Appellees. On appeal from the United States District Court for the Western District of Texas*. Amicus *Brief of Demographers Peter A. Morrison, Thomas M. Bryan, William A. V. Clark, Jacob S. Siegel, David A. Swanson, and The Pacific Research Institute* - As *amici curiae* in support of Appellants. August 2015.
    - www.scotusblog.com/wp-content/uploads/2015/08/Demographers-Amicus.pdf
- Workshop on the Benefits (and Burdens) of the American Community Survey, Case Studies/Agenda Book 6 "Gauging Hispanics' Effective Voting Strength in Proposed Redistricting Plans: Lessons Learned Using ACS Data." June 14–15, 2012
    - http://docplayer.net/8501224-Case-studies-and-user-profiles.html
- "Internal and Short Distance Migration" by Bryan, Thomas in J. Siegel and D. Swanson (eds.) The Methods and Materials of Demography, Condensed Edition, Revised. (2004). Academic/Elsevier Press: Los Angeles (with D. Swanson and P. Morrison).

- "Population Estimates" by Bryan, Thomas in J. Siegel and D. Swanson (eds.) The Methods and Materials of Demography, Condensed Edition, Revised. (2004). Academic/Elsevier Press: Los Angeles (with D. Swanson and P. Morrison).
- Bryan, T. (2000). U.S. Census Bureau Population estimates and evaluation with loss functions. *Statistics in Transition,* 4, 537–549.

Professional Presentations and Conference Participation

- Session Chairman on Invited Session "Assessing the Quality of the 2020 Census", including Census Director Ron Jarmin at the 2020 Population Association of America meeting May 5, 2021.
    - https://paa2021.secure-platform.com/a/organizations/main/home
- "The Effect of the Differential Privacy Disclosure Avoidance System Proposed by the Census Bureau on 2020 Census Products: Four Case Studies of Census Blocks in Alaska". 2021 American Statistical Association - Symposium on Data Science and Statistics (ASA-SDSS). With Dr. David Swanson.
    - https://ww2.amstat.org/meetings/sdss/2021/index.cfm
- "New Technical Challenges in Post-2020 Redistricting" 2020 Population Association of America Applied Demography Conference, 2020 Census Related Issues, February 2021. With Dr. Peter Morrison.
    - https://www.youtube.com/watch?v=ETvvoECt9sc&feature=youtu.be
- "Tutorial on Local Redistricting" 2020 Population Association of America Applied Demography Conference, February 2021. With Dr. Peter Morrison.
    - https://www.youtube.com/watch?v=ETvvoECt9sc&feature=youtu.be

- "Demographic Constraints on Minority Voting Strength in Local Redistricting Contexts" 2019 Southern Demographic Association meetings (coauthored with Dr. Peter Morrison) New Orleans, LA, October 2019. Winner of annual E. Walter Terrie award for best state and local demography presentation.
    - http://sda-demography.org/2019-new-orleans
- "Applications of Big Demographic Data in Running Local Elections" 2017 Population and Public Policy Conference, Houston, TX.
- "Distinguishing 'False Positives' Among Majority-Minority Election Districts in Statewide Congressional Redistricting," 2017 Southern Demographic Association meetings (coauthored with Dr. Peter Morrison) Morgantown, WV.
- "Devising a Demographic Accounting Model for Class Action Litigation: An Instructional Case" 2016 Southern Demographic Association (with Peter Morrison), Athens, GA.
- "Gauging Hispanics' Effective Voting Strength in Proposed Redistricting Plans: Lessons Learned Using ACS Data." 2012 Conference of the Southern Demographic Association, Williamsburg, VA.
- "Characteristics of the Arab-American Population from Census 2000 and 1990: Detailed Findings from PUMS." 2004 Conference of the Southern Demographic Association, (with Samia El-Badry) Hilton Head, SC.
- "Small-Area Identification of Arab American Populations," 2004 Conference of the Southern Demographic Association, Hilton Head, SC.
- "Applied Demography in Action: A Case Study of Population Identification." 2002 Conference of the Population Association of America, Atlanta, GA.

Primary Software Competencies

ESRI ArcGIS: advanced
SAS: intermediate
Microsoft Office: advanced

Professional Affiliations

International Association of Applied Demographers (Member and Board of Directors)
American Statistical Association (Member)
Population Association of America (Member)
Southern Demographic Association (Member)
American BAR Association (Affiliated Professional: Solo, Small Firm and General Practice Division)

Relevant Work Experience

January 2001- April 2003 ESRI Business Information Solutions / Demographer
Responsibilities included demographic data management, small-area population forecasting, IS management and software product and specification development. Additional responsibilities included developing GIS-based models of business and population forecasting, and analysis of emerging technology and R&D / testing of new GIS and geostatistical software.

May 1998-January 2001 U.S. Census Bureau / Statistician
Responsibilities: developed and refined small area population and housing unit estimates and innovative statistical error measurement techniques, such as Loss Functions and MAPE-R.

Service

Eagle Scout, 1988, Boy Scouts of America. Member of the National Eagle Scout Association. Involved in leadership of the Boy Scouts of America Heart of Virginia Council.

References

Dr. David Swanson
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Appendix 6
Legislative Materials

Excerpt of LRB Attachment to SB621 (enrolled)

- Legislature's Senate plan population deviations
- Legislature's Assembly plan population deviations
- Legislature's Senate map
- Legislature's Assembly map

LRB Memorandum Regarding SB621

2021 Wis. Joint Senate Resolution 63

Public Hearing Statement of Assembly Speaker Robin J. Vos

Public Hearing Statement of Senate Majority Leader Devin LeMahieu

2021 - 2022 LEGISLATURE

STATISTICS AND MAPS

Appendix to: SB-621 LRB-5017/1
CMH:cjs

POPULATION STATISTICS

				Minority Population	
District	**Population**	**Deviation**	**Pct. Dev.**	**Hispanic**	**Other**
Sen. Dist. 1	178,936	338	0.19	7,340	18,917
Asm. Dist. 1	59,444	–89	–0.15	2,138	4,633
Asm. Dist. 2	59,764	231	0.39	2,249	6,742
Asm. Dist. 3	59,728	195	0.33	2,953	7,542
Sen. Dist. 2	178,464	–134	–0.08	7,027	27,039
Asm. Dist. 4	59,636	103	0.17	3,073	11,038
Asm. Dist. 5	59,374	–159	–0.27	2,239	9,206
Asm. Dist. 6	59,454	–79	–0.13	1,715	6,795
Sen. Dist. 3	178,536	–62	–0.03	90,225	119,526
Asm. Dist. 7	59,603	70	0.12	14,444	24,583
Asm. Dist. 8	59,362	–171	–0.29	41,209	50,262
Asm. Dist. 9	59,571	38	0.06	34,572	44,681
Sen. Dist. 4	178,419	–179	–0.10	10,074	134,414
Asm. Dist. 10	59,503	–30	–0.05	3,489	36,254
Asm. Dist. 11	59,565	32	0.05	2,913	52,942
Asm. Dist. 12	59,351	–182	–0.31	3,672	45,218
Sen. Dist. 5	178,536	–62	–0.03	11,340	34,673
Asm. Dist. 13	59,551	18	0.03	2,224	11,689
Asm. Dist. 14	59,609	76	0.13	5,412	13,018
Asm. Dist. 15	59,376	–157	–0.26	3,704	9,966
Sen. Dist. 6	178,495	–103	–0.06	11,628	129,590
Asm. Dist. 16	59,714	181	0.30	4,373	44,426
Asm. Dist. 17	59,435	–98	–0.16	3,071	44,530
Asm. Dist. 18	59,346	–187	–0.31	4,184	40,634
Sen. Dist. 7	178,460	–138	–0.08	20,312	43,819
Asm. Dist. 19	59,320	–213	–0.36	4,343	13,586
Asm. Dist. 20	59,548	15	0.03	9,666	16,377
Asm. Dist. 21	59,592	59	0.10	6,303	13,856
Sen. Dist. 8	178,552	–46	–0.03	6,060	29,342
Asm. Dist. 22	59,466	–67	–0.11	1,567	7,478
Asm. Dist. 23	59,383	–150	–0.25	2,564	13,904
Asm. Dist. 24	59,703	170	0.29	1,929	7,960
Sen. Dist. 9	178,827	229	0.13	12,359	30,451
Asm. Dist. 25	59,460	–73	–0.12	3,729	8,726
Asm. Dist. 26	59,640	107	0.18	5,271	12,541
Asm. Dist. 27	59,727	194	0.33	3,359	9,184
Sen. Dist. 10	178,810	212	0.12	4,522	15,453
Asm. Dist. 28	59,743	210	0.35	1,420	4,762
Asm. Dist. 29	59,504	–29	–0.05	1,481	5,661

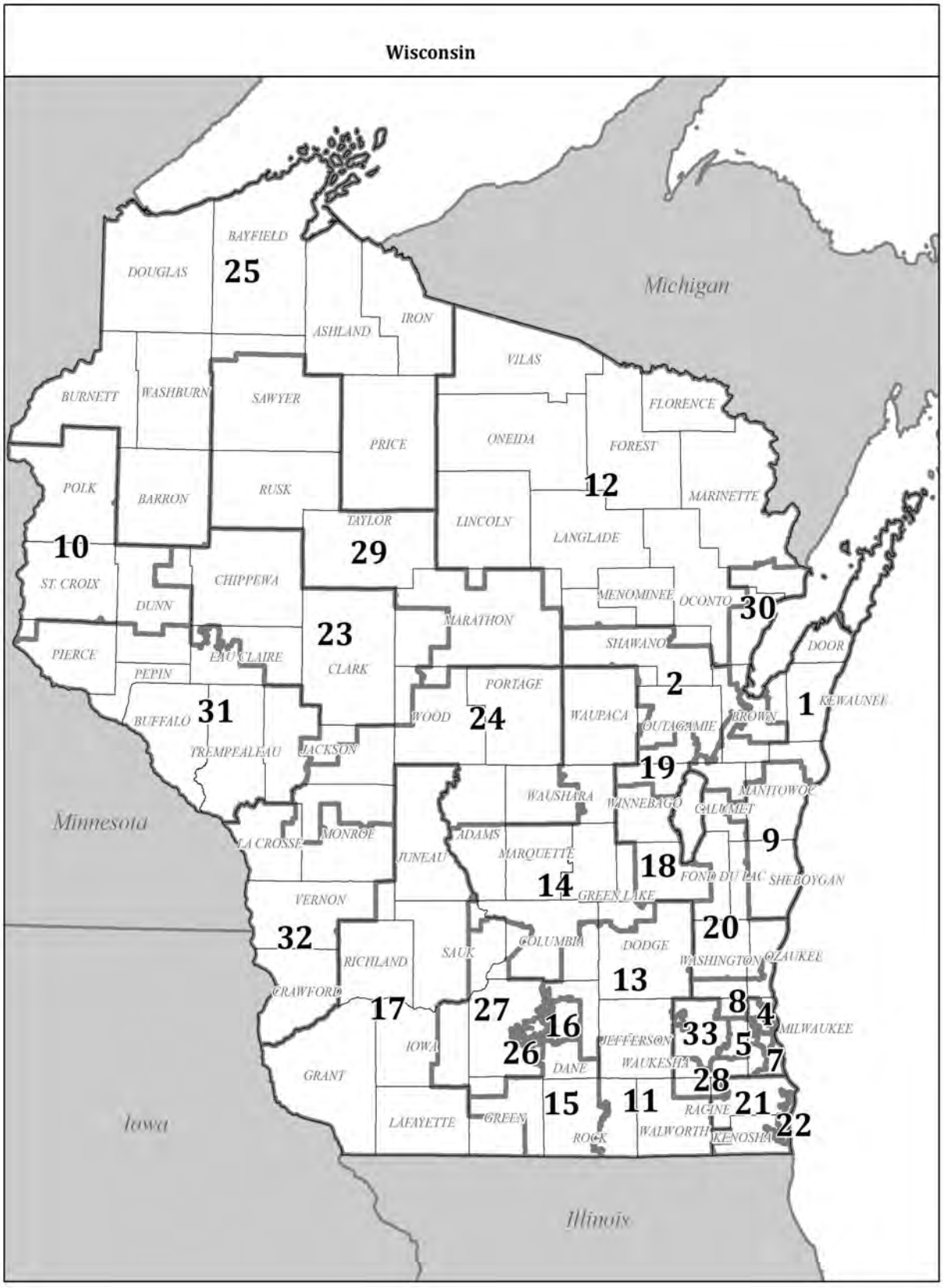
				Minority Population	
District	**Population**	**Deviation**	**Pct. Dev.**	**Hispanic**	**Other**
Asm. Dist. 30	59,563	30	0.05	1,621	5,030
Sen. Dist. 11	178,741	143	0.08	19,079	30,175
Asm. Dist. 31	59,594	61	0.10	6,479	11,081
Asm. Dist. 32	59,556	23	0.04	8,144	11,324
Asm. Dist. 33	59,591	58	0.10	4,456	7,770
Sen. Dist. 12	178,519	–79	–0.04	3,637	19,911
Asm. Dist. 34	59,520	–13	–0.02	1,022	5,974
Asm. Dist. 35	59,558	25	0.04	1,228	4,018
Asm. Dist. 36	59,441	–92	–0.15	1,387	9,919
Sen. Dist. 13	178,437	–161	–0.09	11,054	20,584
Asm. Dist. 37	59,382	–151	–0.25	3,632	7,194
Asm. Dist. 38	59,618	85	0.14	3,539	6,686
Asm. Dist. 39	59,437	–96	–0.16	3,883	6,704
Sen. Dist. 14	178,331	–267	–0.15	8,190	18,146
Asm. Dist. 40	59,318	–215	–0.36	2,179	4,639
Asm. Dist. 41	59,431	–102	–0.17	3,731	8,104
Asm. Dist. 42	59,582	49	0.08	2,280	5,403
Sen. Dist. 15	179,118	520	0.29	14,541	32,606
Asm. Dist. 43	59,685	152	0.26	2,204	5,817
Asm. Dist. 44	59,741	208	0.35	4,476	10,416
Asm. Dist. 45	59,692	159	0.27	7,861	16,373
Sen. Dist. 16	178,608	10	0.01	17,546	51,505
Asm. Dist. 46	59,320	–213	–0.36	3,344	13,743
Asm. Dist. 47	59,591	58	0.10	8,085	18,378
Asm. Dist. 48	59,697	164	0.28	6,117	19,384
Sen. Dist. 17	178,829	231	0.13	6,074	14,595
Asm. Dist. 49	59,708	175	0.29	1,367	4,017
Asm. Dist. 50	59,456	–77	–0.13	2,121	5,730
Asm. Dist. 51	59,665	132	0.22	2,586	4,848
Sen. Dist. 18	178,812	214	0.12	9,533	28,411
Asm. Dist. 52	59,579	46	0.08	4,332	9,782
Asm. Dist. 53	59,625	92	0.15	2,562	8,232
Asm. Dist. 54	59,608	75	0.13	2,639	10,397
Sen. Dist. 19	178,550	–48	–0.03	10,776	29,841
Asm. Dist. 55	59,537	4	0.01	2,700	7,754
Asm. Dist. 56	59,596	63	0.11	2,884	8,955
Asm. Dist. 57	59,417	–116	–0.19	5,192	13,132
Sen. Dist. 20	178,690	92	0.05	6,404	15,631
Asm. Dist. 58	59,607	74	0.12	2,249	5,527
Asm. Dist. 59	59,749	216	0.36	2,197	5,076
Asm. Dist. 60	59,334	–199	–0.33	1,958	5,028
Sen. Dist. 21	178,368	–230	–0.13	13,725	30,743
Asm. Dist. 61	59,409	–124	–0.21	4,123	8,282

				Minority Population	
District	**Population**	**Deviation**	**Pct. Dev.**	**Hispanic**	**Other**
Asm. Dist. 62	59,425	–108	–0.18	5,121	11,652
Asm. Dist. 63	59,534	1	0.00	4,481	10,809
Sen. Dist. 22	178,092	–506	–0.28	38,314	77,959
Asm. Dist. 64	59,362	–171	–0.29	8,544	19,297
Asm. Dist. 65	59,365	–168	–0.28	13,970	24,933
Asm. Dist. 66	59,365	–168	–0.28	15,800	33,729
Sen. Dist. 23	178,360	–238	–0.13	6,037	18,079
Asm. Dist. 67	59,591	58	0.10	1,068	5,053
Asm. Dist. 68	59,422	–111	–0.19	1,757	5,595
Asm. Dist. 69	59,347	–186	–0.31	3,212	7,431
Sen. Dist. 24	178,407	–191	–0.11	7,732	20,495
Asm. Dist. 70	59,436	–97	–0.16	2,464	6,168
Asm. Dist. 71	59,447	–86	–0.14	2,265	7,412
Asm. Dist. 72	59,524	–9	–0.02	3,003	6,915
Sen. Dist. 25	178,470	–128	–0.07	3,534	19,990
Asm. Dist. 73	59,467	–66	–0.11	1,022	6,644
Asm. Dist. 74	59,587	54	0.09	1,009	7,883
Asm. Dist. 75	59,416	–117	–0.20	1,503	5,463
Sen. Dist. 26	178,749	151	0.08	15,248	54,348
Asm. Dist. 76	59,664	131	0.22	3,707	15,998
Asm. Dist. 77	59,361	–172	–0.29	5,516	19,103
Asm. Dist. 78	59,724	191	0.32	6,025	19,247
Sen. Dist. 27	178,960	362	0.20	8,177	25,483
Asm. Dist. 79	59,687	154	0.26	3,128	11,965
Asm. Dist. 80	59,555	22	0.04	2,357	7,641
Asm. Dist. 81	59,718	185	0.31	2,692	5,877
Sen. Dist. 28	178,506	–92	–0.05	14,120	32,358
Asm. Dist. 82	59,364	–169	–0.28	3,924	11,653
Asm. Dist. 83	59,606	73	0.12	2,133	4,917
Asm. Dist. 84	59,536	3	0.01	8,063	15,788
Sen. Dist. 29	178,791	193	0.11	4,901	24,430
Asm. Dist. 85	59,672	139	0.23	2,121	11,069
Asm. Dist. 86	59,708	175	0.29	1,387	6,653
Asm. Dist. 87	59,411	–122	–0.20	1,393	6,708
Sen. Dist. 30	178,583	–15	–0.01	21,628	43,538
Asm. Dist. 88	59,542	9	0.02	7,505	14,140
Asm. Dist. 89	59,328	–205	–0.34	1,556	5,300
Asm. Dist. 90	59,713	180	0.30	12,567	24,098
Sen. Dist. 31	178,630	32	0.02	8,337	20,689
Asm. Dist. 91	59,413	–120	–0.20	1,999	8,931
Asm. Dist. 92	59,524	–9	–0.02	4,759	6,805
Asm. Dist. 93	59,693	160	0.27	1,579	4,953
Sen. Dist. 32	178,385	–213	–0.12	4,448	19,255

				Minority Population	
District	**Population**	**Deviation**	**Pct. Dev.**	**Hispanic**	**Other**
Asm. Dist. 94	59,594	61	0.10	1,178	6,442
Asm. Dist. 95	59,479	–54	–0.09	1,839	8,936
Asm. Dist. 96	59,312	–221	–0.37	1,431	3,877
Sen. Dist. 33	178,747	149	0.08	13,368	27,704
Asm. Dist. 97	59,664	131	0.22	6,241	11,056
Asm. Dist. 98	59,406	–127	–0.21	5,437	11,806
Asm. Dist. 99	59,677	144	0.24	1,690	4,842
TOTAL	5,893,718			447,290	1,259,700

ASSEMBLY	Persons	Percent
Mean Deviation:	112	0.19
Largest Positive Deviation:	231	0.39
Largest Negative Deviation:	–221	–0.37
Overall Range in Deviation:	± 452	± 0.76

SENATE	Persons	Percent
Mean Deviation:	175	0.10
Largest Positive Deviation:	520	0.29
Largest Negative Deviation:	–506	–0.28
Overall Range in Deviation:	± 1,026	± 0.57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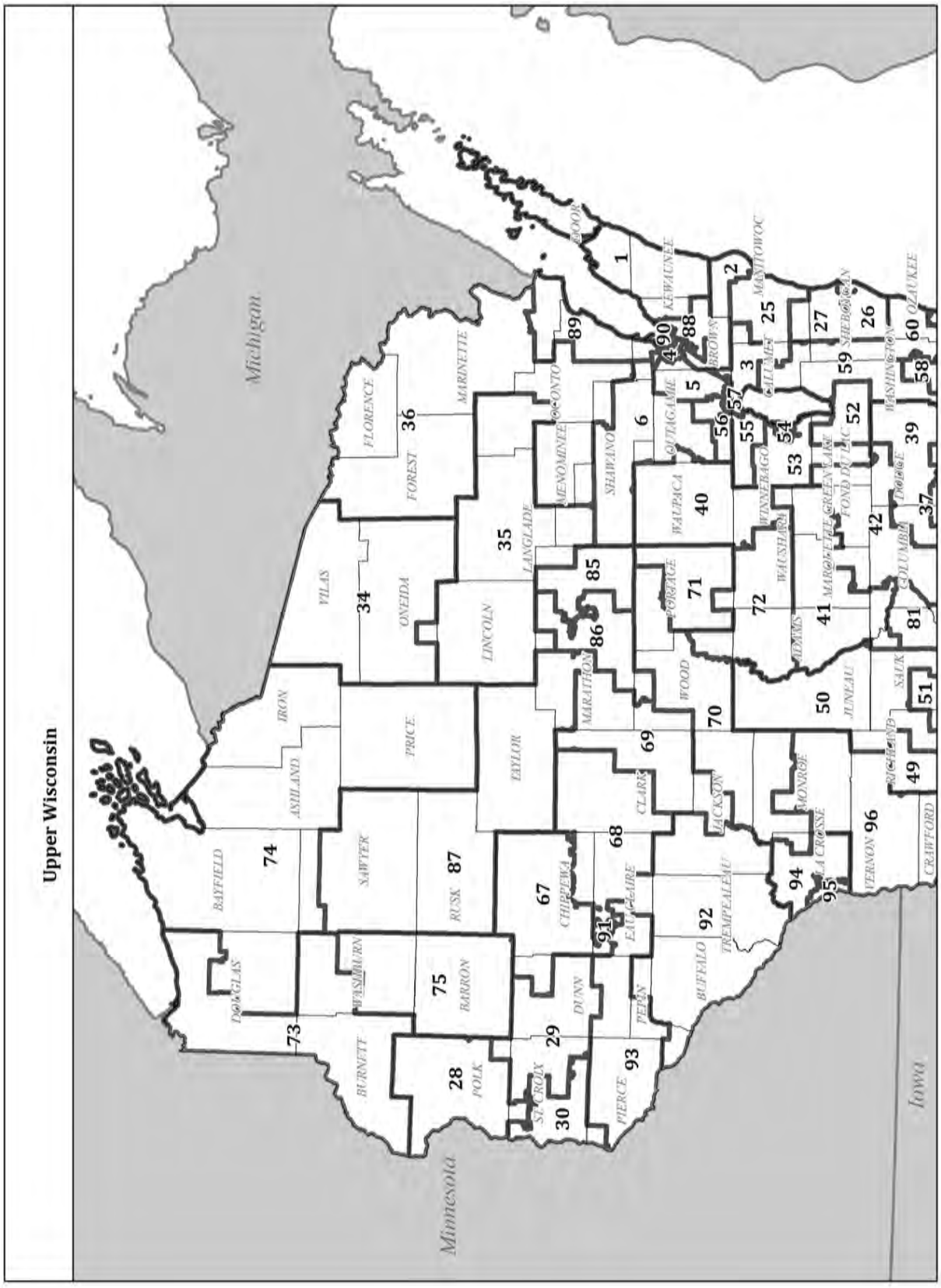
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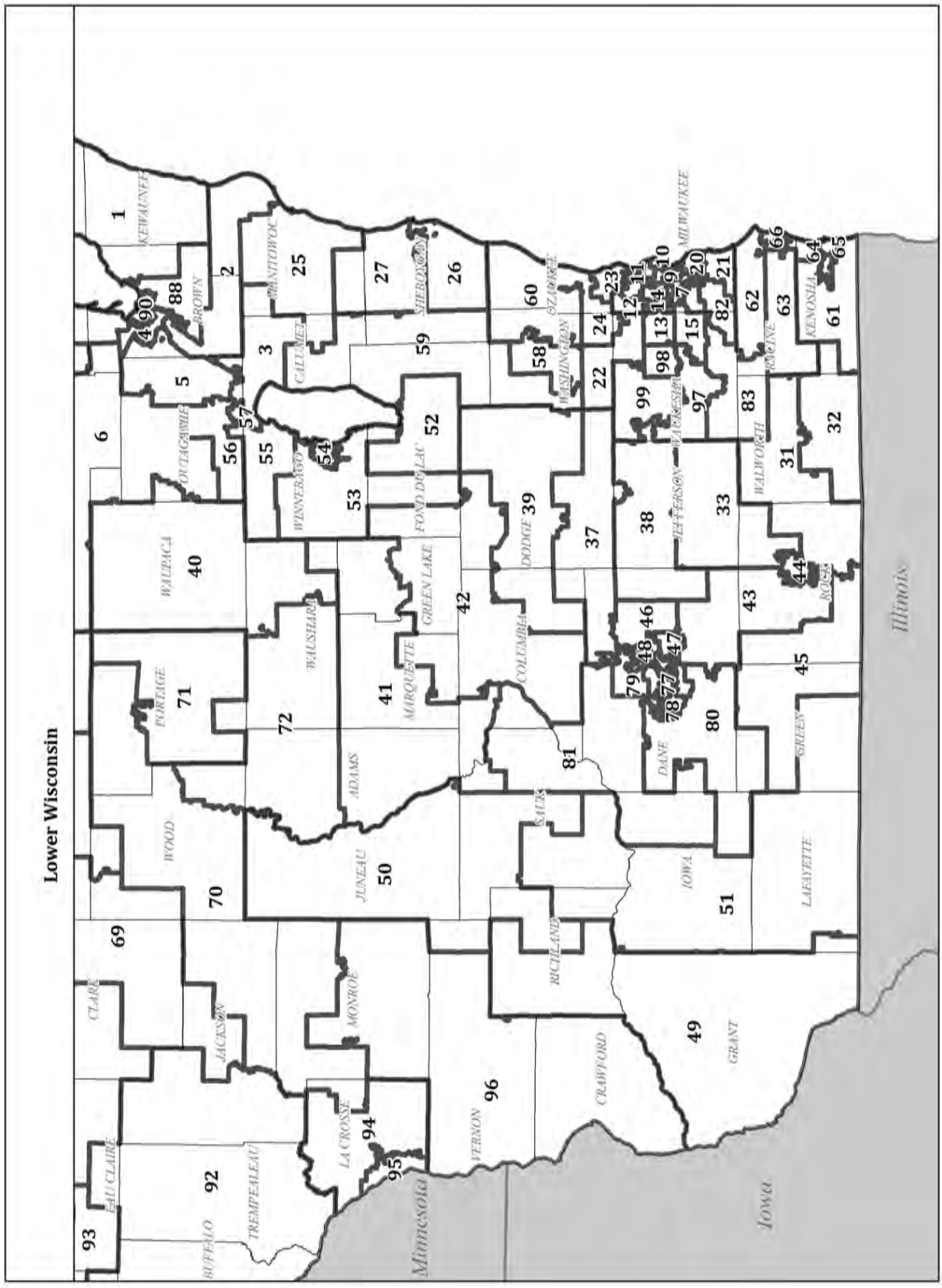
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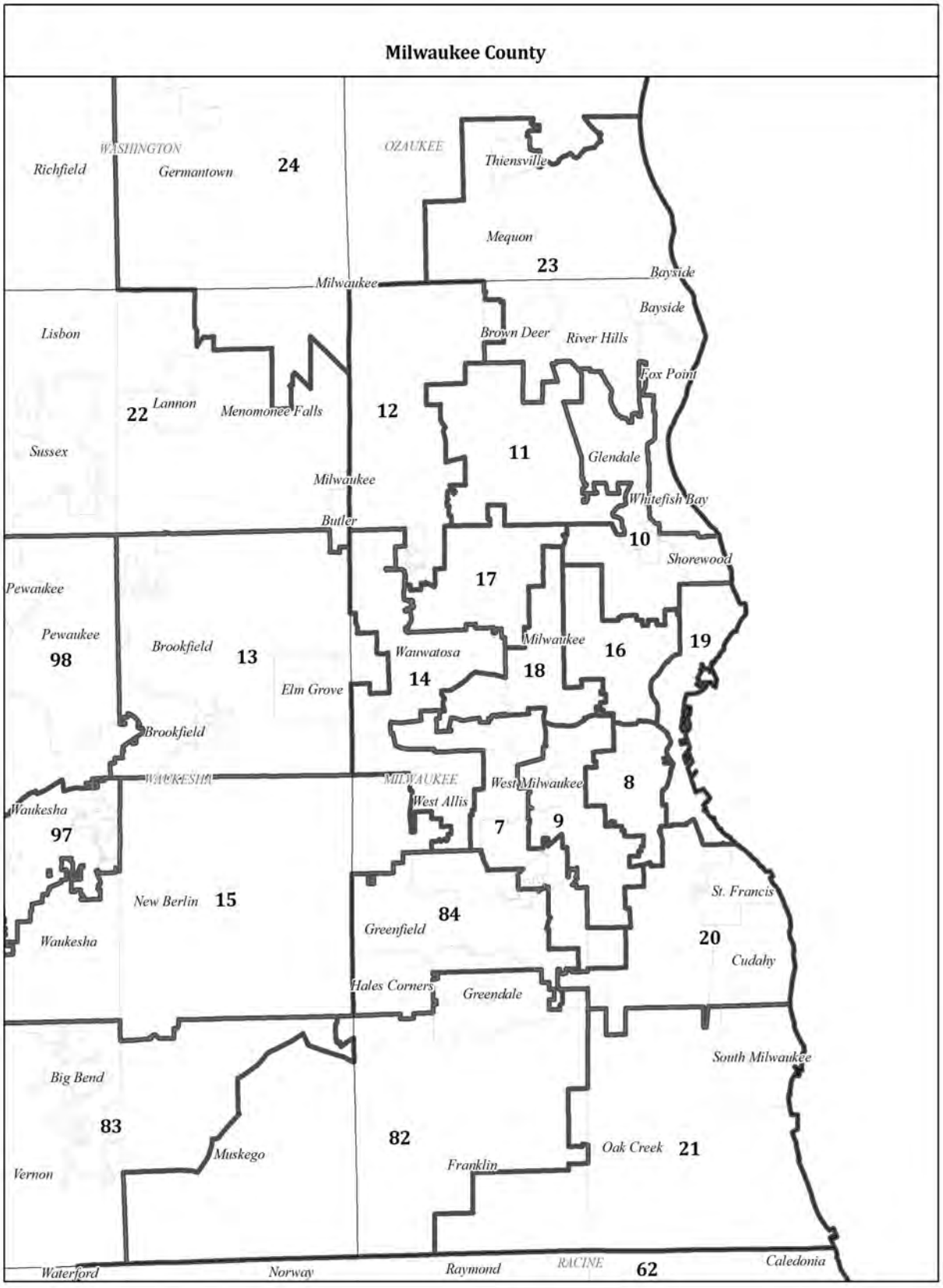
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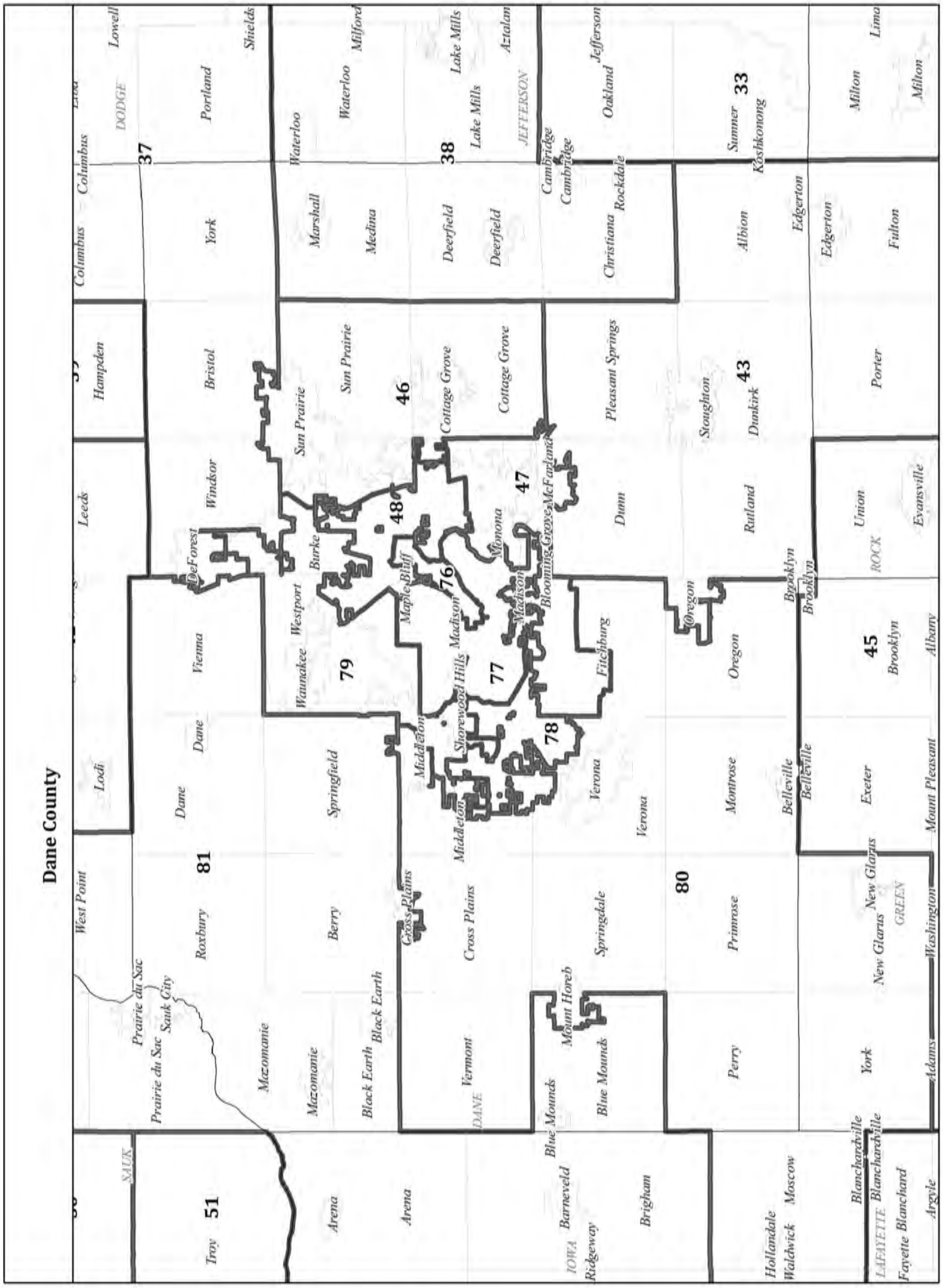
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Waldwick
Moscow
Blanchardville
Fayette
Blanchard
Argyle

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Madison, WI 53703 • http://legis.wisconsin.gov/lrb

MEMORANDUM

TO: Majority Leader Devin LeMahieu and Speaker Robin Vos

FROM: Legislative Reference Bureau

DATE: October 20, 2021

SUBJECT: LRB-5017/1 and LRB-5071/1 State Legislative Data

You requested information related to LRB-5017/1 and LRB-5071/1 on state legislative redistricting. Specifically, you asked for data on the bill's population deviation, core retention, disenfranchised population, compactness, split geographies, and incumbent pairings.

The data provided in this memo is derived from the Legislative Technology Services Bureau's WISE-District Application unless otherwise stated.

Population deviation

Ideal population represents the target population for each legislative district in a redistricting plan. This figure is calculated by dividing the total population of the state by the number of legislative districts. According to the 2020 U.S. Census, Wisconsin's total population is 5,893,718. Because Wisconsin has 33 senate districts and 99 assembly districts, the ideal population for each senate district is 178,598 and the ideal population for each assembly district is 59,533.

The following table presents deviation scores for legislative districts. Courts will presume that a state legislative plan is constitutional if it has an overall range in deviation of 10 percent or less.[1]

	Deviation from Ideal Population	Persons	Percent
Assembly	Mean Deviation	112	0.19
	Largest Positive Deviation	231	0.39
	Largest Negative Deviation	−221	−0.37
	Overall Range in Deviation	±452	± 0.76

[1] Brown v. Thomson, 462 U.S. 835, 842–3 (1983).

	Deviation from Ideal Population	Persons	Percent
Senate	Mean Deviation	175	0.10
	Largest Positive Deviation	520	0.29
	Largest Negative Deviation	−506	−0.28
	Overall Range in Deviation	±1,026	± 0.57

Core retention

The average core retention rate for assembly districts is 84.16 percent and the average core retention rate for senate districts is 92.21 percent.

Disenfranchisement

138,753 voters from odd-numbered senate districts were moved to even-numbered senate districts. These voters, had they not been moved, would have voted in a state senate election at the 2022 general election, but will now not have the opportunity to vote in a state senate election until the 2024 general election. This movement from one district to another involved 14 senate districts.

Compactness

Compactness, in the redistricting context, refers to the "tightness" of a district's geometric shape. Compactness is measured by comparing a district to the shape of a perfect circle, but no district is expected to be perfectly compact. The two most common mathematical models to measure compactness are the Reock Degree of Compactness Score and the Polsby–Popper Test. A perfectly compact district would have a compactness score of 1.0 under either model.

The Reock Degree of Compactness Score is calculated by dividing the area of the voting district by the area of the smallest circle that would completely enclose it.

The Polsby–Popper Test is calculated by dividing the area of a circle with the same perimeter as the district by the square of the perimeter of the district.

Assembly	Reock Degree of Compactness Score	Polsby–Popper Test
Mean	0.363	0.234
Maximum	0.688	0.603
Minimum	0.152	0.048

Senate	Reock Degree of Compactness Score	Polsby–Popper Test
Mean	0.374	0.216
Maximum	0.647	0.409
Minimum	0.129	0.046

Split geographies

The assembly map splits 53 counties and 48 municipalities, while the senate map splits 42 counties and 28 municipalities.

According to the Department of Administration's Demographic Services Center, there are 57 municipalities that are split between two or more counties.[2] Therefore, the data on split geographies may reflect the overall number of municipal splits rather than an indicator of a district not drawn according to traditional redistricting principles.

Incumbent pairings

Under LRB-5017/1 and LRB-5071/1, there are three incumbent pairings in the assembly and none in the senate.

LRB-5017/1 and LRB-5071/1 District	Current Elected District	Name	Party
Assembly District 15	Assembly District 15	Rep. Joe Sanfelippo	Republican
	Assembly District 84	Rep. Mike Kuglitsch	Republican
Assembly District 82	Assembly District 82	Rep. Ken Skowronski	Republican
	Assembly District 83	Rep. Chuck Wichgers	Republican
Assembly District 93	Assembly District 30	Rep. Shannon Zimmerman	Republican
	Assembly District 93	Rep. Warren Petryk	Republican

We hope you find this information useful. Please let us know if you have any questions or if we can provide any additional assistance.

[2] "Population and Housing Unit Estimates – Minor Civil Division Final Population Estimates," Department of Administration, Demographic Services Center, accessed October 19, 2021, https://doa.wi.gov/pages/home.aspx.

State of Wisconsin

2021 Senate Joint Resolution 63

ENROLLED JOINT RESOLUTION

Relating to: public policy regarding plans that establish state legislative districts.

Whereas, the Wisconsin Constitution requires the legislature to reapportion the state legislative districts after each federal census; now, therefore, be it

Resolved by the senate, the assembly concurring, That it is the public policy of this state that plans establishing legislative districts should:

1. Comply with the federal and state law;

2. Give effect to the principle that every citizen's vote should count the same by creating districts with nearly equal population, having population deviations that are well below that which is required by the U.S. Constitution;

3. Retain as much as possible the core of existing districts, thus maintaining existing communities of interest, and promoting the equal opportunity to vote by minimizing disenfranchisement due to staggered Senate terms;

4. Contain districts that are compact;

5. Contain districts that are legally contiguous;

6. Respect and maintain whole communities of interest where practicable;

7. Avoid municipal splits unless unavoidable or necessary to further another principle stated above, and when splitting municipalities, respect current municipal ward boundaries;

8. Promote continuity of representation by avoiding incumbent pairing unless necessary to further another principle stated above; and

9. Contain districts that follow natural boundaries where practicable and consistent other principles, including geographic features such as rivers and lakes, manufactured boundaries such as major highways, and political boundaries such as county lines.

Representative Robin J. Vos
Speaker of the Assembly

Senator Chris Kapenga
President of the Senate

Date

Michael J. Queensland
Senate Chief Clerk

ROBIN J. VOS

SPEAKER OF THE WISCONSIN STATE ASSEMBLY

October 28, 2021
Senate Committee on Government Operations, Legal Review and Consumer Protection
Assembly Committee on State Affairs
Testimony on Senate Bill 621 and Assembly Bill 624

Chairman Swearingen and Stroebel, and members of the Joint Committee,

Thank you for the opportunity to testify in support of SB621 and AB624, bills to amend existing Legislative districts to reflect 2020 census data.

Every ten years, following the release of data from the U.S. Census Bureau, Wisconsin's Legislature is charged with redrawing legislative district boundaries in order to balance population. To be clear, it is the duty of the state Legislature, as laid out in our state constitution, to "apportion and district anew the members of the Senate and Assembly..." It is not the duty of appointed commissions or the executive branch.

The Legislative redistricting process began by providing Democrats and Republicans in both houses with equal access to redistricting equipment and resources. Republican Legislative employees crafted these maps within the confines of the state capitol and completed this work on their own without the involvement of outside counsel or redistricting experts. These employees were instructed not to consider race when drafting the legislative maps, instead, relying on classic redistricting principles, adjusting for population changes.

To ensure adherence to classic redistricting principles and reaffirm their importance, the Legislature passed Senate Joint Resolution 63. The resolution furthers transparency in the process by informing the public of the criteria being considered. Briefly, the resolution requires that districts:

1. comply with state and federal law
2. have equal population
3. retain the core of existing districts
4. are compact
5. are contiguous
6. maintain communities of interest
7. avoid municipal splits
8. promote continuity of representation by avoiding incumbent pairing
9. follow natural and manufactured boundaries

Our goal from start to finish was to produce a "least-changes" map that prioritized core retention while adjusting for population change. The strength of this proposal is a result of strict adherence to the governing principles included in our resolution, along with significant public input.

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DISTRICT: 960 ROCK RIDGE ROAD · BURLINGTON, WI 53105
OFFICE: (608) 266-9171 · TOLL-FREE: (888) 534-0063
HOME: (262) 514-2597 · REP.VOS@LEGIS.WI.GOV

ROBIN J. VOS

SPEAKER OF THE WISCONSIN STATE ASSEMBLY

The 2021 redistricting process has been open, transparent, and has invited broad public input. On August 1, the Legislature launched our Draw Your District Wisconsin website allowing Wisconsinites to provide input on the 2021 redistricting process in an easy and efficient way. We asked all members of the Legislature, both Republican and Democrat, to promote this website and public participation in the process. This is the first time in state history the public has been able to submit maps directly to the Legislature for consideration. We also sent a letter to Governor Evers' hand-picked 'People's Maps Commission' asking for their participation.

The amount of public feedback received exceeded expectations. Those who participated were able to create statewide and regional versions of Legislative or Congressional maps. Members of the public were also able to identify communities of interest throughout the state.

Overall, we received 401 total submissions through the draw your district website. There were 53 statewide entries, 46 regional entries, and over 300 communities of interest identified. This was an incredible amount of feedback, and although there are too many to discuss today, we would like to highlight some common themes incorporated in the map you see before you:

- Milwaukee North Shore Communities – Each submission defined this community of interest with slight differences but most included Whitefish Bay, Bayside, Fox Point, and River Hills. Other submissions occasionally included Brown Deer, Glendale and Shorewood.
- The City of Brookfield, Town of Brookfield, and City of New Berlin – Under the existing map, these municipalities are split between Assembly and Senate districts. Our proposal before you today would keep these municipalities whole as was done in many community of interest and map submissions.
- Menominee Reservation and Neighboring Townships – Bartelme and Red Springs Townships are adjacent to the Menominee Reservation but include tribal land. Previously, these townships were located in separate Assembly and Senate districts. Our proposal ensures all these tribal lands are incorporated into the same district.
- The Villages of Deforest and Windsor – Public input notes that these two municipalities are a community of interest. Under the previous map, three Assembly districts shared these areas. Our proposal reduces the number of splits to two as was done in multiple map submissions.

Throughout the process, we have continued to track public submissions and have incorporated them into our proposal when possible while also adhering to the redistricting principles laid out in our joint resolution. To further our commitment to transparency our draft maps were released to the public well in advance of today's hearing, allowing citizens adequate time to review our work.

I mentioned earlier in my testimony our commitment to traditional redistricting principles. The map being presented today scores well on these metrics and improves on past maps in several key areas:

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ROBIN J. VOS
SPEAKER OF THE WISCONSIN STATE ASSEMBLY

Population Deviation is the metric used to measure the overall difference in population from the largest district to the smallest. For example, a map with the largest district being 3% above the ideal population and the smallest being 2% below the ideal population would have a total deviation of 5%. A deviation below 1% overall has been considered in the past to be very desirable and this map ensures we are well below that mark. The Legislature's proposal has an overall range of population deviation of .76% for the Assembly map and .57% for the Senate map. This is the same deviation as was approved in Act 43 for the Assembly and is better than the 2002 court-approved map. The Senate map has a lower deviation than both Act 43 and the 2002 court-approved map.

Counties and Municipalities are a defined community of interest - the fewer county and municipal splits, the better. While it is not currently possible to completely eliminate county and municipal splits, the new maps are an improvement when compared to recently approved maps. The Assembly map splits 53 counties and 48 municipalities for a total of 101 overall splits while the Senate map splits 42 counties and 28 municipalities for a total of 70.

Core retention calculates the percentage of individuals in a district who are represented by the same individual under this map as under our existing map. Continuity of representation or core retention is a long-time redistricting principle. Not only does prioritizing this metric maintain existing relationships between incumbents and constituents, it also helps to ensure that contests between incumbents are avoided. Due to significant population changes in southeast and south central Wisconsin, this was difficult to achieve. Several districts in the Milwaukee area needed to grow significantly as they had lost population over the decade while the reverse was true in Dane County. Under this proposal, the average core retention for Assembly districts is 84 percent and 92 percent for Senate districts. Our proposal scores better on this metric than both Act 43 and the 2002 U.S. Court maps.

Limiting incumbent pairs ensures accountability and continuity of representation. Under our map, six representatives and zero senators were paired. This is well below Act 43. No Assembly or Senate Democrats have been paired under the proposed map.

These metrics show that the map before you today is a fair and legal map. Statewide election results point to the fact that both Democrats and Republicans can achieve a majority in the state Assembly. Under both the enacted map and the proposed map, former Governor Walker and Senator Tammy Baldwin would each win a majority of Assembly districts in their respective elections. In fact, former Governor Walker would win fewer Assembly seats under this map than the enacted map.

This information reveals a common trend here in Wisconsin. Candidates determine who is successful in our elections, not simply the partisan makeup of a district. Under our proposed map, Senator Baldwin carried sixteen Assembly districts also won by a Republican. Sixteen. The same is true under the current map where Senator Baldwin took the majority in seventeen Assembly seats also won by an Assembly Republican. If Legislative Democrats were able to find candidates able to win even a portion of these seats, they would have a majority in the state Assembly under both the current map and our proposal.

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ROBIN J. VOS
SPEAKER OF THE WISCONSIN STATE ASSEMBLY

The drawing of legislative boundaries is a legislative duty. The People's Maps Commission is an attempt by Governor Evers to circumvent the constitutional duty of the Legislature for political gain under the guise of partisan fairness. When Governor Evers announced the formation of his People's Maps Commission, he laid out a list of traditional redistricting criteria similar to the resolution passed by the Legislature. These criteria were later incorporated by the commission to guide their process. As you will see, the draft maps released prioritize partisanship over traditional map-making criteria.

As a brief disclaimer, the draft maps released by the commission contained inconsistent district numbering making our analysis difficult. The following figures are our best attempt to interpret the work done by the commission.

- The population deviation in the commission's Assembly maps was at least three times as large as the population deviation in our proposal.
- Even though the commission ranked limiting county and municipal splits as a top priority, they failed in comparison to both the current map and the proposal before you today. Both draft maps contain nearly 50 more total splits than the Legislature's map.
- A quick analysis of the Governor's maps would conclude core retention was completely ignored. Each map paired over 40 incumbent representatives compared to six under our proposal. A core retention score was nearly impossible to calculate due to inconsistent district numbering, but will be considerably worse as the commission did not prioritize a least changes map.

Finally, while difficult to quantify, both the Legislature and the People's Maps Commission claimed to prioritize communities of interest, however, the following examples illustrate how the Governor's hand-picked commission misses the mark:

- Many Wisconsinites would agree that Madison's isthmus is one of the most well-known and identifiable communities of interest in the state. However, the commission split this community in half just blocks from the capitol square.
- When drawing a map, there is no doubt that municipal splits are unavoidable, especially with heavily populated cities. But, the Governor's commission split a city of fewer than 3,000 people three times. Any Wisconsinite you ask would be able to identify that city by its popular moniker *"The Waterpark Capital of the World"*. With visitors from as far away as Massachusetts, you'd think a commission hand-picked by the Governor would be able to identify this popular tourist destination as a community of interest.
- In clear partisan fashion, the Governor's non-partisan commission drew a district that reaches from Lake Mills in Jefferson County to the shores of Lake Monona in Madison. This district ignores multiple traditional principles in the name of partisan gain.

These examples make it clear that partisanship was first and foremost on the commission's mind. Traditional criteria were only considered when it was politically expedient.

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ROBIN J. VOS

SPEAKER OF THE WISCONSIN STATE ASSEMBLY

The map before you today is a fair map that scores well on traditional redistricting criteria. Our proposal maintains core constituencies, avoids significant incumbent pairs, has exceptionally low population deviation, and drives down municipal splits. We accomplish all of this despite significant population shifts in Milwaukee and Dane counties. This success is attributable to our first-of-its-kind, transparent approach that emphasized the public's role in the map drawing process.

We are happy to answer any questions.

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DEVIN LEMAHIEU
SENATE MAJORITY LEADER

October 28, 2021
Senate Committee on Government Operations, Legal Review and Consumer Protection
Assembly Committee on State Affairs
Testimony on Senate Bill 621 and Assembly Bill 624

Chairmen Stroebel and Swearingen, and members of the Joint Committee,

Thank you for the opportunity to testify in support of SB621 and AB624, bills to amend existing Legislative districts to reflect the 2020 Census data.

Every ten years, the Legislature re-draws Legislative districts to reflect changes in population and ensure compliance with state and federal law. This year, the Legislature committed to a transparent process that incorporated input from the public to help determine how the new maps would be drawn. The resulting maps, introduced as SB621 and AB624, comply with state and federal law, reflect the public's input, and were guided by the established criteria outlined in Senate Joint Resolution 63.

Before discussing dive into the specifics on the new maps, it is good to revisit why the Legislature must take up this process.

The U.S. Constitution requires a census every ten years. The first census took place in 1790 and 2020 marks the 24th time the census has been conducted.

In Wisconsin, the new census data is used to redraw state legislative boundaries to reflect changes in population to ensure equal representation. Typically, the state receives census data by March 31 and the Legislature begins its work shortly thereafter. This year, census data was delayed until mid-August as a result of the pandemic delaying the Census Bureau's ability to execute the census in a timely fashion.

The state constitution vests the duty for redistricting with the Legislature. The bills before you fulfill the Legislature's constitutional responsibility to complete the redistricting process. The lines were drawn by the Legislature in the State Capitol without outside advice on how the lines should be drawn.

On September 28, the Legislature passed Senate Joint Resolution 63, which outlined the Legislature's criteria for the creation of new legislative districts, which is based on state and federal law and legal precedent. Specifically, the Joint Resolution established that legislative districts should:

- Comply with state and federal law;
- Maintain equal population;
- Retain the core of existing districts;
- Minimize disenfranchisement due to staggered Senate terms;
- Be compact;
- Be contiguous;

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- Maintain communities of interest;
- Avoid county and municipal splits;
- Avoid incumbent pairing; and,
- Follow natural boundaries.

The bills before you today reflect the criteria laid out in Senate Joint Resolution 63.

The notion of "one-person, one-vote" is central to our representative democracy. State and federal law, as well as legal precedent, has reinforced the importance of equally balanced legislative districts. As a result of the 2020 Census, Wisconsin's legislative districts no longer comply with the federal requirement for equal population.

Not adjusting legislative boundaries would ignore federal law and leave some parts of the state under-represented and other parts of the state over-represented.

The new maps protect the notion of "one-person, one-vote" by producing districts that have strong population balance while also balancing other, sometimes competing, map-drawing criteria.

To attain maximum input, we reached out to minority rights groups seeking feedback on Wisconsin's current majority-minority districts to ensure maps that fully comply with state and federal law. The 14th Amendment prohibits us from passing a law that discriminates on the basis of race. Accordingly, we asked the public whether we should draw the new maps with race data.

The new maps were drafted without the use of race data at any point in the process, to ensure compliance with the 14th Amendment.

SB621 and AB624 fulfill Wisconsin's legal and constitutional requirement for redistricting.

Not only do these bills fulfill our constitutional requirements, the new maps were drafted with a historic level of public input and influence.

For the first time in state history, the public could submit full state maps or communities of interest for consideration. Wisconsinites submitted, directly to the Legislature, over 400 statewide legislative maps and communities of interest which were considered during the map drawing process.

We also proactively reached out to the People's Maps Commission, minority rights groups, and interested stakeholder groups to gather additional feedback to inform the map drawing process.

We heard overwhelmingly from Wisconsinites that the new maps should be drawn using wards instead of census blocks. The new maps were drawn using wards.

We heard from our friends and neighbors that communities of interest should be considered as part of the map drawing process. As a result, the new maps place over 500 communities of interest, identified by Wisconsinites in every corner of the state, wholly within Senate or Assembly districts.

We heard about the burden created for local units of government when counties and municipalities are split between Senate and Assembly lines. The new maps limit both the number of counties and local municipalities split between legislative districts.

Since only half of the 33 State Senate districts are up for election every two years, we heard concerns about staggered-term disenfranchisement. The new maps move fewer voters from odd-numbered Senate districts to even-numbered Senate districts than were moved in redistricting since at least 1990, a period that includes two maps that were drawn by the court.

SB621 and AB624 reflect the input we received.

In summary, the Legislature committed to a transparent process that incorporated input from the public to help determine how the new maps would be drawn. The resulting maps, introduced as SB621 and AB624, comply with state and federal law, reflect the public's input, and were guided by the established criteria outlined in Senate Joint Resolution 63.

Thank you Committee members for hearing SB621 and AB624 today, and I would be happy to answer any questions you have.