EXHIBIT 1

SUPPLEMENTAL REPORT OF DR. STEPHEN ANSOLABEHERE IN SUPPORT OF HUNTER INTERVENOR-PETITIONERS' PROPOSED MAPS

Executive Summary

The purpose of this Supplemental Report is to provide the Court with multiple objective measures for evaluating the extent to which the Congressional, Assembly, and Senate maps submitted by the parties comply with the criteria established by the Court in its November 30 Order. Specifically, using the six categories I list below, I provide objective measures of the maps' compliance with the requirement of population equality; the Court's mandated "least change" approach; federal and state law, including the Voting Rights Act; and traditional redistricting principles.

For the proposed Congressional maps, Governor Evers and Hunter offer maps that have the least change from the Enacted 2011 map in geography and population combined. The Congressmen's and Citizen Scientists' maps offer the most compact districts. The Citizen Scientists' and the Hunter maps have the least divisions of political boundaries. All maps have equal populations in conformity with constitutional standards, and none of the maps has a majority minority district.

For the proposed Assembly maps, across all the measures, the Evers' map, followed by the BLOC map, offers the greatest continuity of district geography and population. The Evers, BLOC, and Hunter maps offer the most districts in which minorities will have the opportunity to elect their preferred candidates. Hunter, Bewley, and Citizen Scientists offer the most compact maps. All maps conform with population equality requirements, with Citizen Scientists having the smallest deviation, followed by the Legislature's map.

And, last, of the proposed Senate maps, the Evers map offers the least change in terms of both geography and populations. The Senate map with the next least degree of change is the Legislature's map, followed closely by the BLOC map. The Hunter map offers the most compact districts in terms of area dispersion, and the Bewley map offers the most compact map in terms of perimeter regularity. There is no clear best plan from the perspective of political divisions. All plans are well within traditional standards in Wisconsin for population deviations. It is unclear what the safe harbor is for delayed voting. Four plans have very low delays (Bewley, Legislature, Evers and BLOC), and all plans are within the conventional 10 percent safe harbor for inequalities in district populations.

Analysis

1. This report offers measures of six aspects of the proposed Wisconsin Congressional, Senate, and Assembly maps submitted by each of the parties in this proceeding. These categories are: (1) district continuity and change, (2) population equality, (3) minority representation, (4) district compactness, (5) division of political units and communities, and (6) delay in voting for state senate. The attached tables offer assessments of multiple measures for each of these criteria. Table 1 presents the information for the Congressional District Maps; Table 2 presents the information for the Assembly District Maps; and Table 3 presents the information for the Senate District Maps. My compensation and qualifications remain unchanged from my opening report.

I. Metrics

A. District Continuity and Change

2. District continuity and change is reflected in change in geography and change in population. For both measures, three metrics are commonly used. (1) *Total Core Continuity*, for either geography or population, is the total area or population in the entire state that is kept in the same districts from the Old Map (2011 Enacted) to the New Map. (2) *Core Continuity 1*, for either land mass or geography, is the percent of people from the old district that remain in that district under the new map. (3) *Core Continuity 2*, for either land mass or geography, is the percent of people in the new district that came from the old version of the same district. Core Continuity 1 and 2 can be calculated for each district and then averaged over all districts to derive a plan-wide measure.

3. Each computation begins by calculating the number of square miles or number of people in both the old and new version of each district. That is, the number of people, in, say, the 2011 version of CD-1 and the 2021 version of CD-1, the 2011 version of CD-2 and the 2021 version of CD-2, and so on. Changes in geography and population occur when the land area in one district is moved to another district, e.g., the parts of CD-1 are moved to CD-2. Geographic changes correspond to the land area of the areas moved from old CD-1 to new CD-2 in this example, and population changes correspond to the count of people living in those areas.

4. Total Core Geographic Continuity is the total land area kept in the same districts summed across all districts. This is normalized by dividing by

the state's total land area. This measure is the percent of all Wisconsin land area that is kept in the same districts from the 2011 Map to each proposed new map. It is the most general continuity measure of district geography.

5. Total Core Population Continuity is the total population from the Census Enumeration in the areas that are kept in the same districts summed across all districts. This is normalized by dividing by the state's total population. This measure is the percent of all Wisconsin residents who are kept in the same districts from the 2011 Map to each proposed new map. It is the most general continuity measure of district population.

6. Core 1 Geography Continuity measures the extent to which individual districts under the 2011 map kept, or lost, area. Some districts, of course, must gain area because they are underpopulated and have to expand their geographic footprint in order to gain population. Other districts are overpopulated and must shrink or move in order to shed population. Core 1 captures the degree to which old districts expanded or shrank. It is the land area that is in both the old and new versions of a given district divided by the land area of the 2011 version of the district. Core 1 Geography is the percent of the old district that is kept in the new district. The average value of Core 1 Geography Continuity is presented as a measure of plan-wide changes.

7. Core 1 Population Continuity is analogous to Core 1 Geography, but uses population instead of land area.

8. Core 2 Geography Continuity measures the extent to which individual districts in the new maps contain parts of the old version of the same district. Core 2 is the land area that is in both the old and new versions of a given district divided by the land area of the proposed 2021 version of the district. Core 2 Geography is the percent of the new district that came from the old district. The average value of Core 2 Geography Continuity is presented as a measure of plan-wide changes.

9. Core 2 Population Continuity is analogous to Core 2 Geography, but uses population instead of land area.

10. Both Core 1 and Core 2 measure flows into and out of districts.

11. A composite indicator of geographic and population continuity is the average of the two for each metric.

B. Population Equality

12. The 2020 Census enumeration of the state of Wisconsin counts 5,893,718 people in the state. Exact population equality would result in 736,715 people, plus or minus 1 person, per Congressional District; 178,598 people, plus or minus 1 person, per senate district; and 59,533 people, plus or minus 1 person, per assembly district.

13. I calculate each district's total population and its percentage deviation from exact equality.

14. All Congressional plans submitted by the parties meet that criterion. For the senate and assembly districts, population deviations up to 10 percent between the most and least populous district have been allowed under federal law, and convention in the state of Wisconsin tolerates deviations of 2 percentage points. All plans submitted by the parties conform to federal standards and state practice relating to population deviations.

C. Representation of Minority Voters.

15. The 2020 Census enumeration counts persons of voting age by race and ethnicity, and the 2019 American Community Survey (ACS) provides a tabulation of adult citizens by race and ethnicity. Using these data, I calculate the Voting Age Population (VAP) and Citizen Voting Age Population (CVAP) overall and of Blacks, of Hispanics, and of non-Hispanic Whites. Using these data, I determined which districts are majority-minority (i.e., majority of people are not non-Hispanic Whites). Further, I conducted ecological regression and ecological inference analyses to determine which candidates in eight elections are preferred by each racial or ethnic group, and which elections were won by candidates preferred by each racial or ethnic group. Following academic literature and practice in voting rights cases, I determined that a district is a minority opportunity district if (i) a majority of VAP or CVAP are minorities and (ii) if minority preferred candidates win elections. I further noted which districts are racially polarized.

D. Compactness

16. I measure compactness using the two most commonly applied measures of compactness, both in academic political science research and in voting rights cases. First, the Reock score gauges a district's area dispersion.

It is the area of the district divided by the area of the circle with a diameter that is the same length as the district. Reock penalizes long, narrow districts. Second, the Polsby-Popper score measures perimeter compactness. It is the area of the district divided by the area of the circle that has the same perimeter as the district. Polsby-Popper penalizes districts with highly irregular boundaries or odd shapes.

E. Political Division Splits

17. I use definitions of political units according to the United States Bureau of the Census. For Wisconsin, these are Counties, Places (including all cities), Minor Civil Divisions (including all towns), and Voting Tabulation Districts (precincts).[1]

F. Delayed Voting in state senate elections

18. I measure the number of voters who are delayed in voting by counting the number of people who were in senate districts from which voters chose senators in 2018 and who were assigned to senate districts from which voters chose senators in 2020. These people will have a six-year span between the election of their state senators. I present the total number of persons, rather than voters, as it is unknown who voted in each of these elections and who will (or will not) vote in 2024.

II. Computations

19. All computations involving geography, including continuation, compactness, and splits are performed two ways. First, I use all Wisconsin Census blocks, including those that only cover water, such as along Lakes Michigan and Superior. The primary tables in this report present analyses using all Census blocks in Wisconsin. Second, I exclude all Census blocks that only cover water and re-calculate all computations involving geography. These data are presented in Appendix tables A1, A2, and A3.

20. I obtained map files as geojson files from the Wisconsin LTSB data download page:

[1] https://www.sco.wisc.edu/2016/08/04/what-the-acronym-qmcdq-really-means/; https://www.census.gov/geographies/reference-files/2010/geo/state-local-geo-guides-2010/wisconsin.html

https://data-ltsb.opendata.arcgis.com/search?categories=districts&q=Districts. I obtained the Evers Congressional Map and the Citizen Scientist Congressional Map from counsel.

21. For geographic projections for Wisconsin, I used the NAD83(HARN)/Wisconsin Central files at EPSG 2860. https://epsg.io/2860

22. All software were run in R 4.1.2. Specific packages, versions, and locations are as follows:

Package: `redist`, version: 4.0.0.9000, location: https://github.com/alarm-redist/redist

Package: `tidyverse`, version: 1.3.1, location: https://www.tidyverse.org/blog/2018/12/readr-1-3-1/

Package: `sf`, version: 1.0.4, location: https://cran.r-project.org/web/packages/sf/index.html

Package: `geomander`, version: 2.0.2, location: https://cran.r-project.org/web/packages/geomander/index.html

Package: `here`, version: 1.0.1, location: https://cran.r-project.org/web/packages/here/index.html

Package: `fs`, version: 1.5.2, location: https://cran.r-project.org/web/packages/fs/index.html

Package: `censable`, version: 0.0.3, location: https://cran.r-project.org/web/packages/censable/index.html

Package: `tigris`, version: 1.5, location: https://cran.r-project.org/web/packages/tigris/index.html

Package: `PL94171`, version: 1.0.1, location: https://cran.r-project.org/web/packages/PL94171/index.html

Package: `gt`, version: 0.3.1, location: https://cran.r-project.org/web/packages/gt/index.html

Package: `redistmetrics`, version: 1.0.0, location: https://cran.case.edu/web/packages/redistmetrics/index.html

III. Plans Evaluated

23. I analyzed all plans posted at the LTSB website and provided to me by counsel.

24. For Congress, I analyzed plans submitted by Citizen Mathematicians and Scientists (Citizen Scientists, for short), by the Congressmen Supporting Their Congressional District Map (Congressmen for short), by Governor Tony Evers (Evers, for short), and by Hunter Intervenor-Petitioners (Hunter, for short), as well as the Enacted (2011) Map.

25. For the Assembly, I analyzed plans submitted by Senator Janet Bewley (Bewley, for short), by Black Leaders Organizing for Communities (BLOC, for short), Citizen Scientists, by the Wisconsin Legislature (Legislature, for short), by Evers, and by Hunter, as well as the Enacted (2011) Map.

26. For the Senate, I analyzed plans submitted by Senator Janet Bewley (Bewley, for short), by Black Leaders Organizing for Communities (BLOC, for short), Citizen Scientists, by the Wisconsin Legislature (Legislature, for short), by Evers, and by Hunter, as well as the Enacted (2011) Map.

27. The version of the Hunter senate map analyzed is listed as HunterAlt on the LTSB website. HunterAlt correctly assigns ADs in the SDs (i.e., 10 and 17 are swapped and 69 and 91 are swapped), as described in my expert report (Ansolabehere Report, December 15, 2021).

IV. Evaluation

A. Congressional Map

28. Overall, Governor Evers and Hunter offer maps that have the least change from the Enacted 2011 map in geography and population combined. The Congressmen's and Citizen Scientists' maps offer the most compact districts. The Citizen Scientists' and the Hunter maps have the least divisions of political boundaries. All maps have equal populations in conformity with constitutional standards, and none of the maps has a majority minority district.

29. Table 1 presents all metrics for all five Congressional maps assessed. The plan that has the best value for each specific metric is shown in bold.

1. District Continuity

30. The Evers Congressional Map has the highest value for every metric of district continuity. The combined continuity of geography and population is .965. The Evers Map would keep 98.5 percent of the state's land mass in the same districts as in the 2011 Enacted Maps. It would keep 94.5 percent of the state's population in the same districts from 2011 and 2021 maps.

31. The Hunter Congressional Map has the second highest combined Continuity of Geography and Population, a score of .951. The Hunter map has the second highest rate of geographic continuity. It would keep 97.1 percent of the state's land mass in the same districts in the 2011 and 2021 maps. The Hunter map has the third highest rate among the four maps of population continuity. It would keep 93.0 percent of the state's population in the same districts in 2011 and 2021.

32. The Citizen Scientists' Congressional Map has the third highest combined Continuity of Geography and Population, a score of .937. The Citizen Scientists' map has the third highest rate of geographic continuity. It would keep 93.7 percent of the state's land mass in the same districts in the 2011 and 2021 maps. The Citizen Scientists' map has the lowest rate of population continuity. It would keep 91.5 percent of the state's population in the same districts in 2011 and 2021.

33. The Congressmen's Congressional Map has the lowest combined Continuity of Geography and Population, a score of .921. The Congressmen's map has the lowest rate of geographic continuity. It would keep 90.7 percent of the state's land mass in the same districts in the 2011 and 2021 maps. The Congressmen's map has the second highest rate of population continuity. It would keep 93.5 percent of the state's population in the same districts in 2011 and 2021.

34. The geographic scores are sensitive to the inclusion or exclusion of areas covered by water. Table A1 in the appendix recalculates all measures based on geography excluding Census blocks that cover water and have zero population. This calculation does not alter the rank ordering of the measures, although it does alter the values. The combined continuity score for the Evers Map increases from .951 to .965. The combined continuity score for Hunter

increases to .948. The combined continuity score for Citizen Scientists rises to .942. And the combined continuity score for the Congressmen's Map is .921.

35. The reason that the Evers and Hunter maps score better than the Congressmen's map has to do with the way that each approaches CD-3 and CD-7. The districts that had the largest deviations from population equality were CD-2, CD-4, and CD-8. CD-2 was over-populated by more than 50,000 people, and CD-4 was under-populated by more than 40,000 people. CD-1, CD-5 and CD-6 lie between CD-2 and CD-4. The Evers Map and the Hunter Map make most changes in this area. Slight modifications in CD-3 (southwestern Wisconsin) and CD-7 (northwestern Wisconsin) were required to bring them to equal population. The Evers and Hunter maps keep district geography relatively unchanged by focusing the efforts to equalize population on the areas between Dane and Madison Counties.

36. The Congressmen's map takes a different approach and makes extensive changes in CD-3 and CD-7 in west and north Wisconsin, where little change was required. In the Congressmen's map, the continuous population in CD-3 is 654,968 people. The mapmakers moved 117,899 people out of the district and 121,030 people into the district. The district only needed 3,131 people to make it an equal population district.

37. By comparison, the Evers map moved 4,136 people out of CD-3 and 7,268 people into CD-3. In other words, Congressmen's map moved 16 times more people to equalize the population of CD-3 than Governor Evers' map does. The Hunter Map moved 983 people out of CD-3 and 4,645 people into CD-3.

38. Turning to CD-7, the Congressmen's map moved 77,614 people out of the district and 81,747 people into the district. The district only needed 4,133 additional people to reach equality.

39. The Evers Map removes 3 people from CD-7 and adds 4,136 people to the district. The Hunter map adds 511 people to the district and removes 4,645. These changes are orders of magnitude smaller than the changes in CD-3 and CD-7 that Congressmen's map proposes.

40. In changing CD-3 and CD-7, the Congressmen's map eliminates many county and municipal splits. This is accomplished, however, in a way that creates much larger changes in the geography of districts than was necessary, as is shown by the three other maps. In particular, the Enacted

(2011) split Jackson, Juneau, Monroe, and Wood between CD-3 and CD-7. The Congressmen's map placed all of these counties entirely in CD-3, even though that was far in excess of the population that CD-3 needed. The Enacted map split Chippewa between CD-3 and CD-7, and the Congressmen's map places it entirely in CD-7. Clark County was entirely in CD-3, and it would be entirely in CD-7 under the Congressmen's map. The Congressmen's map also introduces new county splits in the area. Dunn County was not split in the Enacted Map; the Congressmen's map splits it between CD-3 and CD-7. Portage County was entirely in CD-3 in the Enacted Map; the Congressmen's map splits it between CD-7 and CD-8. The approach of balancing the population by shifting populations through the western part of the state first, then, is not a least change approach. The more direct route taken by the Evers and Hunter maps required far less change in the geography, and in the case of Evers the population, of the districts.

2. Population Equality

41. All four proposed maps (Citizen Scientists, Congressmen, Evers, and Hunter) meet the constitutional requirement of equal population plus or minus 1 person.

3. Minority Representation

42. None of the maps has a majority-minority congressional district.

4. Compactness

43. Compactness of districts is calculated as the area dispersion (Reock) and the perimeter irregularity (Polsby-Popper). Reock punishes long, narrow districts with lower values; Polsby-Popper punishes districts that have very jagged sides or snake around with lower values.

44. The compactness measures in Table 1 cover all Census blocks in Wisconsin, including those that contain only water.

45. Using the geography that includes water blocks, the Congressmen's map has the highest (best) Reock and highest (best) Polsby-Popper. Including water blocks, the average of the average of all districts' Polsby-Popper is .373 and the average Reock is .482 in the Congressmen's map.

46. Excluding water blocks, the Citizen Scientists' map has the most regular-sided districts. The Reock measure averages .468 when only blocks

with some land mass are included, and the Congressmen's map has the highest Polsby-Popper.

5. Political Boundaries

47. Four different sorts of Census-designated political boundaries are considered—counties, places (including all cities), minor civil divisions (MCDs, including all towns), and voting tabulation districts (VTDs), which are equivalent to precincts.

48. As a starting point for comparison, the Enacted (2011) Map splits 12 county boundaries (two of them across 3 different CDs). It splits 29 cities or places, 42 towns, villages, or other minor civil divisions, and 42 VTDs or precincts.

49. The Citizen Scientists' Congressional Map has the lowest number of political boundary crossings, for all four types of boundaries. This map crosses only 9 county boundaries, and it does not cross any more than once. The Citizen Scientists' Map divides 21 cities or places, 16 towns or MCDs, and 13 VTDs or precincts.

50. The Hunter Map consistently has the second fewest political boundary divisions. The Hunter Map splits 11 counties, and none are divided across more than 2 CDs. It splits 29 cities or places, 20 towns or MCDs, and 19 VTDs or precincts.

51. The Evers Map crosses 12 counties, and none are divided across more than 2 CDs. It splits 27 cities or places, 33 towns or MCDs, and 33 VTDs or precincts. This is the second most division of VTDs and most division of towns or MCDs.

52. The Congressmen's map crosses 12 counties. In fairness to the map, two of these crossings are water blocks. The inclusion of these blocks significantly affects the compactness scores of the map, but they properly ought to be excluded because they cover only water. Of the remaining 10 counties, two are split by the boundaries of three different CDs, creating a total of 22 county parts (same as the Hunter map and more than the Citizen Scientists' map). The Congressmen's map divides 36 cities or places, 27 towns or MCDs, and 50 precincts or VTDs. This is the second most division of towns or MCDs and most divisions of cities and precincts.

6. Summary

53. The Evers Congressional map, followed by the Hunter Congressional map, have the least change in geography and population, combined. The Congressmen's map, along with Citizens Scientists, has the most compact districts. The Citizen Scientist map, followed by the Hunter map, has the fewest splits of political boundaries.

B. Assembly Map

54. Across all the measures, the Evers map, followed by the BLOC map, offers the greatest continuity of district geography and population. The Evers, BLOC, and Hunter maps offer the most districts in which minorities will have the opportunity to elect their preferred candidates. Hunter, Bewley, and Citizen Scientists offer the most compact maps. All maps conform with population equality requirements, with Citizen Scientists having the smallest deviation, followed by the Legislature's map. No clear picture emerges regarding respect for political boundary crossings.

55. Table 2 presents all metrics for all seven assembly maps assessed. The plan that has the best value for each specific metric is shown in bold.

1. District Continuity

56. The Evers Assembly Map has the highest combined measure of Total Geographic and Population Continuity. The Average of the Total Geographic and Total Population Continuity measures in the Evers Map is .855. The map has the highest Total Population Core Continuity and the second highest Total Geographic Core Continuity. 85.8 percent of the people and 85.2 percent of the land area would be in the same districts in 2022 as in the 2011 Map. The Evers Assembly Map has the least change in population, second least change in geography, and least change in geography and population combined.

57. The BLOC Assembly Map has the second highest combined measure of Total Geographic and Population continuity. It is close behind the Evers Map with a score of .853. It has the highest degree of geographic continuity: 86.5 percent of the area of the state would remain in the same districts in 2022 as in the 2011 Map. It has the third highest population continuity of .840.

58. The maps with the lowest continuity measures are the Hunter Map and the Citizen Scientists' Map. The Hunter Map has a combined continuity

score of .764, and the Citizen Scientists' Map has a combined score of .610. Citizen Scientists' has the lowest percent of area and of population that are kept in the same districts from the Enacted Map to the proposed map.

59. The justification of the Hunter map's deviation from high levels of population and geographic continuity is the effort to create an additional majority Black district in which Black voters would have the opportunity to elect their preferred candidates in the Milwaukee area where voting is racially polarized. (See Ansolabehere, Report, December 15, 2021.)

2. Population Equality

60. All six proposed maps (Bewley, BLOC, Citizen Scientists, Evers, Hunter, and Legislature) propose maps that are within the safe harbor of a 10 percent maximum population deviation. All maps are within a maximum population deviation, from the least to most populated district, of 2 percent. The smallest deviation, of 0.74 percent, comes from the Citizen Scientists' map, and the largest is from the Evers map of 1.89 percent.

3. Minority Representation

61. Three maps – BLOC, Evers, and Hunter – propose 10 majority minority VAP districts. Each of these maps creates a seventh Black opportunity district in the Milwaukee area. In each of these maps, there is an additional majority Black VAP district located in an area where voting is racially polarized. In this additional majority Black VAP district, candidates preferred by black voters won all elections in those assessed in the relevant expert reports. All seven Black majority VAP or Black plurality VAP districts in these maps are districts in which black voters would have the opportunity to elect their preferred candidates. (see Collingwood, Expert Report, December 15, 2021; see Clelland, Expert Report in Support of Governor Evers's Proposed District Plans, December 15, 2021; see Ansolabehere, Report, December 15, 2021).

62. The BLOC and Hunter maps are further distinguished as offering 9 majority minority CVAP districts in which minorities would be able to elect their preferred candidates. This is the largest number of minority opportunity districts using CVAP as a standard for assessing minority population of districts. The BLOC and Hunter maps, then, offer the greatest opportunities for minority voters to elect their preferred candidates.

63. The Bewley and Legislature maps each offer 9 majority minority VAP districts. That is the same as the Enacted 2011 map.

64. The Citizen Scientists' map has the fewest majority minority VAP districts, only 7. That is two fewer than the Enacted 2011 map.

4. Compactness

65. Compactness of districts is calculated as the area dispersion (Reock) and the perimeter irregularity (Polsby-Popper). Reock punishes long, narrow districts with lower values; Polsby-Popper punishes districts that have very jagged sides or snake around with lower values.

66. The Hunter Assembly Map has the highest (best) Poslby-Popper and highest (best) Reock. This conclusion does not depend on the inclusion or exclusion of water blocks. Table 2 presents the compactness measures including water blocks, and Table A2 in the appendix includes measures excluding water blocks. The average of the Hunter assembly districts' Polsby-Popper scores is .359 and Reock is .447, when water blocks are included. It is the same when water blocks are excluded. See Tables 2 and A2.

67. The Citizen Scientists' and Bewley's maps have the second most compact districts. The average Reock measure in the two plans is nearly the same: .412 in Bewley and .411 in Citizen Scientists. The Citizen Scientists' ADs are, on average, more compact in their area dispersion, with an average Polsby-Popper of .303 compared to .276 in Bewley's map.

68. Both the Legislature map and the BLOC map are, on average, less compact than the Enacted (2011) map. The perimeter irregularity (Polsby-Popper) scores of districts averaged .247 and .262 in the BLOC and Legislature maps, respectively. The average of the perimeter irregularity (Polsby-Popper) of districts in the Enacted assembly map is .277. The area dispersion (Reock) scores averaged .381 and .384 in the BLOC and Legislature maps, respectively. The Enacted map was .401.

5. Political Boundaries

69. No clear picture emerges from the consideration of respect for political boundaries. The Citizen Scientists, followed by Hunter, had the fewest county boundary crossings, and Bewley had the most. The map proposed by the Legislature, followed by Bewley, had the fewest divisions of cities or Census

designate places, and Evers and Hunter had the most. The Legislature, followed by Citizen Scientists, had the fewest town or MCD splits. And, BLOC, followed by Citizen Scientists, had the fewest precinct or VTD splits.

6. Summary

70. The Evers map, followed by the BLOC map, offer the least change in the Assembly district map in geography and population combined. The BLOC, Evers, and Hunter maps create an additional majority Black VAP district in which black voters would have the opportunity to elect their preferred candidates in the Milwaukee area where voting is racially polarized. The Hunter map, followed by Citizen Scientists, offers the most compact assembly districts on average, while the Legislature's map is less compact than the assembly districts in the Enacted map.

C. Senate Map

71. The Wisconsin Senate districts are comprised of triplets of the Wisconsin Assembly Districts. Many of the features of assembly districts will drive the results for the senate districts. The aggregation of area and population will tend to make the plans more similar in many of the metrics examined. As with the Assembly map, the Evers map offers the least deviation from the existing senate districts in geography and population. Hunter and Bewley offer high levels of compactness. Table 3 presents all metrics for all seven senate maps assessed. The plan that has the best value for each specific metric is shown in bold.

1. District Continuity

72. The Evers Senate Map has the highest combined measure of Total Geographic and Population Continuity. The Average of the Total Geography and Total Population Continuity measures in the Evers Map is .936. The map has the highest Total Geography Core Continuity: 94.9 percent of the land area would be the same in Evers's proposed map as in the Enacted (2011) map. The Evers map the highest Total Population Core Continuity: 92.2 percent of the population would be the same in Evers's proposed map as in the Enacted (2011) map.

73. The Legislature map has the second highest combined measure of Total Geography and Total Population Continuity, of .925. The Legislature

map has the third highest total geography continuity, of 92.7 percent, and the second highest Population Continuity of 92.2 percent.[2]

74. The BLOC Assembly Map has the third highest combined measure of Total Geographic and Population continuity, of .918. It has the second highest degree of geographic continuity: 93.9 percent of the area of the state would remain in the same districts in 2022 as in the 2011 Map. It has the fourth highest population continuity of 89.6 percent.

75. The maps with the lowest continuity measures are the Hunter Map and the Citizen Scientists' Map. The Hunter Map has a combined continuity score of .859, and the Citizen Scientists' Map has a combined score of .727. Citizen Scientists' has the lowest percent of area and of population that are kept in the same districts from the Enacted Map to the proposed map.

76. The justification of the Hunter map's deviation from high levels of population and geographic continuity is the effort to create an additional majority Black assembly district in which Black voters would have the opportunity to elect their preferred candidates in the Milwaukee area where voting is racially polarized. The changes in assembly district boundaries necessary to achieve that also affected the senate district boundaries. (See Ansolabehere Report, December 15, 2021.)

2. Population Equality

77. All six proposed maps (Bewley, BLOC, Citizen Scientists, Evers, Hunter, and Legislature) propose maps that are within the safe harbor of a 10 percent maximum population deviation. All maps are within a maximum population deviation, from the least to most populated district, of 2 percent. The smallest deviation, of 0.50 percent, comes from the Citizen Scientists' map, and the largest is from Bewley's map of 1.61 percent.

3. Minority Representation

78. All maps create 2 majority Black VAP and 1 majority Hispanic VAP senate districts. All maps create 2 majority Black CVAP and 0 majority Hispanic CVAP senate districts. The evaluation of minority electoral opportunities in the senate maps, however, must be considered in conjunction

[2] The Evers and Legislature map differ in the hundredths decimal on population, and Evers is slightly higher.

with the electoral opportunities for minorities in the assembly district maps from which each senate map is derived. In this regard, the BLOC, Evers, and Hunter maps create the most electoral opportunities for minority voters across all assembly and senate maps combined.

4. Compactness

79. Compactness of districts is calculated as the area dispersion (Reock) and the perimeter irregularity (Polsby-Popper). Reock punishes long, narrow districts with lower values; Polsby-Popper punishes districts that have very jagged sides or snake around with lower values.

80. The Hunter Assembly Map has the highest (best) Polsby-Popper and second highest Reock. Table 2 presents the compactness measures including water blocks. The average of the Hunter assembly districts' Polsby-Popper scores is .295 and Reock is .413, which is a ten-thousandth of a point behind the Reock for the Bewley map. Excluding water blocks separates the two. The Hunter map has the least area dispersion (and highest average Reock), and Bewley has the best perimeter compactness (and highest Polsby-Popper). See Table A2.

5. Political Boundaries

81. As with the Assembly maps, no clear picture emerges. Generally, the Citizen Scientists and Legislature maps minimize political boundary crossings, but there is no uniform dominance of one or the other approach. Citizen Scientists has, by far, the fewest county boundary crossings, and Bewley, the most. The map proposed by the Legislature, followed by Citizen Scientists, has the fewest divisions of cities or Census designate places, and Evers and Hunter have the most. The Legislature, followed by Citizen Scientists, has the fewest town or MCD splits. And, BLOC, followed by Citizen Scientists, had the fewest precinct or VTD splits.

6. Delayed Voting

82. The Bewley map has the fewest people who will experience delays in voting for state senate. A total of 137,408 people (2.33 percent) will be in senate districts in which there are 6 years between senate elections. The next lowest numbers of delays in voting come with the Legislature and Evers maps, with 138,732 and 138,824 people, respectively, in districts in which there are 6 years

between senate elections. The BLOC map has 177,711 people (3.02 percent) who will have been in districts where it has been 6 years since a senate election. The Hunter map is next with 240,723 (4.08 percent), and Citizen Scientists has the most people (423,259) who will have been in districts where there are six years between elections.

83. It is unclear what the standard or threshold beyond which delay is unacceptable. Using an analogy to district population inequalities, the safe harbor for inequalities in legislative districts allows for a 10 percent population deviation. All districts are well within that window.

7. Summary

84. The Evers map offers the least change in the senate map in terms of both geography and populations. The senate map with the next least degree of change is the Legislature's map, followed closely by the BLOC map. The Hunter map offers the most compact districts in terms of area dispersion, and the Bewley map offers the most compact map in terms of perimeter regularity. All maps offer the same minority opportunities in the senate, but minority opportunities of the senate map are linked to those opportunities in the assembly map. There is no clear best plan from the perspective of political divisions. All plans are well within traditional standards in Wisconsin for population deviations. It is unclear what the safe harbor is delayed voting. Four plans have very low delays (Bewley, Legislature, Evers and BLOC), and all plans are within the conventional 10 percent safe harbor for inequalities in district populations.

Dated: December 30, 2021 *<u>/s/ Stephen Ansolabehere</u>*

Dr. Stephen Ansolabehere

Appendix I

Table 1. Comparison of Measures of District Continuity, Compactness, and Political Divisions in Wisconsin Congressional District Maps,
Including Water Blocks

Bold indicates best plan on each indicator

Criterion	Congressmen	Evers	Hunter	Citizen Scientists	Enacted
Continuity of Geography+Population					
Total Population that continues from the Old to the New version of All CDs Divided by State Total Population	.921	**.965**	.951	.937	--
Average of the Percent of each CD's 2010 Population that remains in the New CD	.934	**.951**	.939	.932	--
Average of the Percent of each CD's 2020 Population that came from the Old CD	.908	**.948**	.937	.961	--
Continuity of Geography					
Total Geo Core Continuity: Total Area in Old and New version of ADs Divided by State Total Area	.906	**.985**	.971	.959	--
Core Geo Continuity 1: Average of Percent of Old CD's Area that remains in New CD	.931	**.956**	.947	.950	--
Core Geo Continuity 2: Average of Percent of Old CD's Area that came from the Old CD	.881	**.950**	.944	.908	--
Continuity of Population					
Total Pop Core Continuity: Total Area in Old and New version of CDs Divided by State Total Area *	.935	**.945**	.930	.915	--
Core Pop Continuity 1:	.936	**.945**	.931	.914	--

Average of Percent of the Old CD's Area that remains in the New CD **					
Core Pop Continuity 2: Average of Percent of the New CD's Area that came from the Old CD ***	.935	**.945**	.930	.915	--
Compactness					
Perimeter Dispersion (Polsby-Popper)	**.373**	.306	.361	.370	.292
Area Dispersion (Reock)	**.482**	.449	.451	.472	.444
Political Divisions					
Counties That Are Split	12****	12	11	**9**	12
Counties Split by 3 or more CDs	2	**0**	**0**	**0**	2
Places	36	27	29	**21**	29
Minor Civil Divisions	27	33	20	**16**	42
Voting Tabulation Districts (VTDs-Precincts)	50	33	19	**13**	42

* Formula is (Population in Old CD 1 and New CD1 + Population in Old CD 2 and New CD2 + Population in Old CD 3 and New CD3 + … Population in Old CD 8 and New 8) Divided by Total State Population.

** Formula is first calculation the number of people in both the old and new version of each CD divided by the 2010 population. Then average the values for all CDs.

*** Formula is first calculation the number of people in both the old and new version of each CD divided by the 2020 population. Then average the values for all CDs.

**** Two counties (Manitowoc and Ozaukee) are split across water boundaries.

Table 2. Comparison of Measures of District Continuity, Compactness, and Political Divisions in Wisconsin Assembly District Maps,
Including water blocks

Bold indicates best plan on each indicator

Criterion	Legislature	Evers	Hunter	BLOC	Bewley	Citizen Scientists	Enacted
Minority Opportunity Districts							
Black VAP	7	**8**	**8**	**8**	7	5	7
CVAP	6	**7**	**7**	**7**	6	4	6
Hispanic VAP	2	2	2	2	2	2	2
CVAP	2	1	**2**	**2**	1	2	2
Total VAP	9	**10**	**10**	**10**	9	7	9
CVAP	8	8	**9**	**9**	7	6	8
Continuity of Geography + Population							
Average of *Total Geo Continuity* and *Total Pop Continuity*	.828	**.855**	.764	.853	.820	.610	--
Average of *Core Geo Continuity 1* and *Core Pop Continuity 1*	.810	**.823**	.713	.818	.795	.582	--
Average of *Core Geo Continuity 2* and *Core Pop Continuity 2*	.803	.815	.718	**.822**	.802	.589	--
Continuity of Geography							
Total Geo Core Continuity: Total Area in Old and New version of ADs Divided by State Total Area	.811	.852	.796	**.865**	.806	.610	--
Core Geo Continuity 1: Average Percent of Old AD's Area that remains in the New AD	.777	.785	.693	**.794**	.756	.554	--
Core Geo Continuity 2: Average Percent of New ADs' Area that came from the Old AD	.764	.771	.705	**.804**	.770	.567	--

Continuity of Population							
Total Pop Core Continuity: Total Population in Old and New version of ADs Divided by State Total Area *	.845	**.858**	.731	.840	.833	.610	--
Core Pop Continuity 1: Average Percent of Old AD's Population that remains in the New AD **	.844	**.860**	.732	.841	.834	.609	--
Core Pop Continuity 2: Average Percent of New AD's Population that came from Old AD ***	.842	**.858**	.731	.840	.833	.610	--
Compactness							
Perimeter Dispersion (Polsby-Popper)	.262	.272	**.359**	.247	.276	.303	.277
Area Dispersion (Reock)	.384	.401	**.447**	.381	.412	.411	.401
Political Divisions							
Counties	53	53	50	53	55	**40**	58
Places	**45**	114	114	70	69	75	113
Minor Civil Divisions	**58**	184	189	114	108	80	193
Voting Tabulation Districts (VTDs)	180	228	223	**122**	368	159	394
Population Deviation							
% Difference Largest To Smallest District	0.76%	1.89%	1.82%	1.32%	1.85%	**0.74%**	32.01%

* Formula is (Population in Old AD 1 and New AD1 + Population in Old AD 2 and New AD2 + Population in Old AD 3 and New AD3 + … Population in Old AD 8 and New 8) Divided by Total State Population.

** Formula is first calculation the number of people in both the old and new version of each AD divided by the 2010 population. Then average the values for all ADs.

*** Formula is first calculation the number of people in both the old and new version of each AD divided by the 2020 population. Then average the values for all ADs.

Table 3. Comparison of Measures of District Continuity, Compactness, and Political Divisions in Wisconsin Senate District Maps,
Including Water Blocks

Bold indicates best plan on each indicator

Criterion	Legislature	Evers	Hunter	BLOC	Bewley	Citizen Science	Enacted
Minority Opportunity Districts							
Black VAP	2	2	2	2	2	2	2
CVAP	2	2	2	2	2	2	2
Hispanic VAP	1	1	1	1	1	1	1
CVAP	0	0	0	0	0	0	0
Total VAP	3	3	3	3	3	3	3
CVAP	2	2	2	2	2	2	2
Continuity of Geography+Population							
Average of *Total Geo Continuity* and *Total Pop Continuity*	.925	**.936**	.842	.918	.902	.727	--
Average of *Core Geo Continuity 1* and *Core Pop Continuity 1*	.914	**.916**	.813	.887	.889	.712	--
Average of *Core Geo Continuity 2* and *Core Pop Continuity 2*	.869	**.915**	.808	.886	.893	.713	--
Continuity of Geography							
Total Geo Continuity: Total Area in Old and New version of SDs Divided by State Total Area	.927	**.949**	.876	.939	.901	.710	--
Core Geo Continuity 1: Average Percent of Old SD's Area that remains in the New SD	.904	**.908**	.818	.878	.875	.680	--
Core Geo Continuity 2: Average Percent of New SD's Area that came from Old SD	.815	**.907**	.808	.876	.884	.683	--

Continuity of Population							
Total Population in the Old and the New version of SDs Divided by State Total Population *	.922	**.922**	.808	.896	.902	.743	--
Average of the Percent of each SD's 2010 Population that remains in the New SD **	**.924**	.923	.808	.896	.903	.743	--
Average of the Percent of each CD's 2020 Population that came from the Old SD***	.922	**.922**	.808	.896	.902	.743	--
Compactness							
Perimeter Dispersion (Polsby-Popper)	.257	.257	**.303**	.225	.253	.287	.265
Area Dispersion (Reock)	.410	.410	.407	.402	**.413**	.403	.411
Political Divisions							
Counties	42	45	42	42	48	**28**	46
Places	**31**	75	76	54	51	44	80
Minor Civil Divisions	**34**	123	114	80	73	35	122
Voting Tabulation Districts (VTDs)	86	144	117	**55**	199	75	212
Population Deviation							
% Difference Largest To Smallest District	0.57%	1.12%	0.95%	0.96%	1.61%	**0.50%**	22.26%
Delayed Voting							
Number Delayed	2.35%	2.35%	4.08%	3.02%	**2.33%**	7.18%	--
Percent Delayed	138,732	138,824	240,723	177,711	**137,408**	423,259	--

* Formula is (Population in Old SD 1 and New SD1 + Population in Old SD 2 and New SD2 + Population in Old SD 3 and New SD3 + … Population in Old SD 8 and New 8) Divided by Total State Population.

** Formula is first calculation the number of people in both the old and new version of each SD divided by the 2010 population. Then average the values for all SDs.

*** Formula is first calculation the number of people in both the old and new version of each SD divided by the 2020 population. Then average the values for all SDs.

Table A1. Comparison of Measures of District Continuity, Compactness, and Political Divisions in Wisconsin Congressional District Maps,
EXCLUDING WATER BLOCKS

Bold indicates best plan on each indicator

Criterion	Congressmen	Evers	Hunter	Citizen Scientists	Enacted
Continuity of Geography+Population					
Average of *Total Geo Continuity* and *Total Pop Continuity*	.921	**.965**	.948	.942	--
Average of *Core Geo Continuity 1* and *Core Pop Continuity 1*	.939	**.956**	.931	.926	--
Average of *Core Geo Continuity 2* and *Core Pop Continuity 2*	.925	**.948**	.923	.911	--
Continuity of Geography					
Total Geo Core Continuity: Total Area in Old and New version of ADs Divided by State Total Area	.907	**.985**	.966	.969	--
Core Geo Continuity 1: Average Percent of Old CD's Area that remains in the New CD	.942	**.956**	.932	.936	--
Core Geo Continuity 2: Average Percent of New CD's Area that came from Old CD	.915	**.950**	.915	.908	--
Continuity of Population					
Total Pop Core Continuity: Total Area in Old and New version of ADs Divided by State Total Area *	.935	**.945**	.930	.915	--
Core Pop Continuity 1: Average Percent of Old CD's Area that remains in the New CD **	.936	**.945**	.931	.914	--

Core Pop Continuity 2: Average Percent of New CD's Area that came from Old CD ***	.935	**.945**	.930	.915	--
Compactness					
Perimeter Dispersion (Polsby-Popper)	**.373**	.306	.362	.371	.292
Area Dispersion (Reock)	.461	.463	.430	**.468**	.444
Political Divisions					
Counties That Are Split	10****	12	11	**7**	12
Counties Split by 3 or more CDs	2	**0**	**0**	**0**	2
Places	36	27	29	**21**	29
Minor Civil Divisions	24	33	20	**14**	42
Voting Tabulation Districts (VTDs-Precincts)	47	33	19	**10**	41

* Formula is (Population in Old CD 1 and New CD1 + Population in Old CD 2 and New CD2 + Population in Old CD 3 and New CD3 + … Population in Old CD 8 and New 8) Divided by Total State Population.

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**** Additionally, two counties (Manitowoc and Ozaukee) are split across water boundaries.

Table A2. Comparison of Measures of District Continuity, Compactness, and Political Divisions in Wisconsin Assembly District Maps,
EXCLUDING WATER BLOCKS

Bold indicates best plan on each indicator

Criterion	Legislature	Evers	Hunter	BLOC	Bewley	Citizen Scientists	Enacted
Minority Opportunity Districts							
Black VAP	7	8	**8**	**8**	7	5	7
CVAP	6	7	**7**	**7**	6	4	6
Hispanic VAP	2	2	**2**	**2**	2	2	2
CVAP	2	1	**2**	**2**	1	2	2
Total VAP	9	**10**	**10**	**10**	9	7	9
CVAP	8	8	**9**	**9**	7	6	8
Continuity of Geography+Population							
Average of *Total Geo Continuity* and *Total Pop Continuity*	.840	**.872**	.774	**.872**	.832	.613	--
Average of *Core Geo Continuity 1* and *Core Pop Continuity 1*	.826	**.840**	.727	.833	.813	.600	--
Average of *Core Geo Continuity 2* and *Core Pop Continuity 2*	.820	.834	.731	**.837**	.821	.602	--
Continuity of Geography							
Total Geo Core Continuity: Total Area in Old and New version of ADs Divided by State Total Area	.834	.886	.817	**.904**	.831	.615	--
Core Geo Continuity 1: Average Percent of Old AD's Area that remains in the New AD	.808	.820	.721	**.825**	.791	.591	--
Core Geo Continuity 2: Average Percent of New AD's Area that came from Old AD	.797	.810	.730	**.834**	.808	.593	--
Continuity of Population							

Total Population in the Old and New version of ADs Divided by State Total Population *	.845	**.858**	.731	.840	.833	.610	--
Core Pop Continuity 1: Average Percent of Old AD's Population that remains in New AD **	.844	**.860**	.732	.841	.834	.609	--
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Area Dispersion (Reock)	.384	.401	**.447**	.381	.412	.411	.401
Political Divisions							
Counties	53	53	50	53	55	**40**	58
Places	**45**	110	114	70	69	75	113
Minor Civil Divisions	**58**	177	184	114	108	80	190
Voting Tabulation Districts (VTDs)	170	220	215	**112**	358	151	376
Population Deviation							
% Difference Largest To Smallest AD Pop.	0.76%	1.89%	1.82%	1.32%	1.85%	**0.74%**	32.01%

* Formula is (Population in Old AD 1 and New AD1 + Population in Old AD 2 and New AD2 + Population in Old AD 3 and New AD3 + … Population in Old AD 8 and New 8) Divided by Total State Population.

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EXCLUDING WATER BLOCKS

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Criterion	Legislature	Evers	Hunter	BLOC	Bewley	Citizen Scientists	Enacted
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Black VAP	2	2	2	2	2	2	2
CVAP	2	2	2	2	2	2	2
Hispanic VAP	1	1	1	1	1	1	1
CVAP	0	0	0	0	0	0	0
Total VAP	3	3	3	3	3	3	3
CVAP	2	2	2	2	2	2	2
Continuity of Geography+Population							
Average of *Total Geo Continuity* and *Total Pop Continuity*	.925	**.936**	.834	.918	.902	.727	--
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Continuity of Geography							
Total Geo Core Continuity: Total Area in Old and New version of SDs Divided by State Total Area	.927	**.949**	.859	.939	.901	.710	--
Average of SD Area in Old and New SD Divided by 2010 SD Area	.904	**.908**	.804	.878	.875	.680	--
Average of SD Area in Old and New SD Divided by 2020 SD Area	.886	**.907**	.796	.876	.884	.683	--

Continuity of Population							
Total Population in the Old and the New version of SDs Divided by State Total Population *	.922	**.922**	.808	.896	.902	.743	--
Average of the Percent of each SD's 2010 Population that remains in the New SD **	**.924**	.923	.808	.896	.903	.743	--
Average of the Percent of each SD's 2020 Population that came from the Old SD***	.922	**.922**	.808	.896	.902	.743	--
Compactness							
Perimeter Dispersion (Polsby-Popper)	.257	.257	**.304**	.225	.253	.287	.264
Area Dispersion (Reock)	.400	.398	.402	.401	.407	.406	**.410**
Political Divisions							
Counties	42	45	42	42	48	**28**	46
Places	**31**	75	76	54	51	44	80
Minor Civil Divisions	**34**	117	110	73	67	31	122
Voting Tabulation Districts (VTDs)	80	139	111	**48**	193	71	212
Population Deviation							
% Difference Largest To Smallest SD Pop	0.57%	1.12%	0.95%	0.96%	1.61%	**0.50%**	22.26%
Delayed Voting							
Number Delayed	2.35%	2.35%	4.08%	3.02%	**2.33%**	7.18%	--
Percent Delayed	138,732	138,824	240,723	177,711	**137,408**	423,259	--

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