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## TABLE OF ATTACHMENTS

- Attachment A Table Comparing the Plans Proposed by the Parties, which was attached to the Gressman Math/Science Petitioners' Post-Trial Submission at the Commonwealth Court, filed January 29, 2022
- Attachment B Table Comparing the GMS Plan and the Plans Proposed by *Amici*, which was attached to the Gressman Math/Science Petitioners' Post-Trial Submission at the Commonwealth Court, filed January 29, 2022

**TABLE OF CITED RECORD MATERIALS FILED WITH  
THE SPECIAL MASTER**

<b>Citation</b>	<b>Description</b>
“Barber Rebuttal”	Rebuttal Report of Professor Michael Barber, attached as Exhibit A to Rebuttal Brief of House Republican Intervenors Kerry Benninghoff, Majority Leader, and Bryan Cutler, Speaker of the Pennsylvania House of Representatives, filed Jan. 26, 2022
“Carter Pet.”	Carter Petitioners’ Petition for Review Addressed to the Commonwealth Court’s Original Jurisdiction, filed Dec. 17, 2021
“Caughey Rebuttal”	Rebuttal Report of Professor Devin Caughey, attached as Exhibit A to Senate Democratic Caucus’ Brief in Response to Proposed Redistricting Plans, filed Jan. 26, 2022
“DeFord Opening”	Expert Report of Professor Daryl R. DeFord, attached as Exhibit 1 to Brief in Support of Gressman Math/Science Petitioners’ Congressional Plan, filed Jan. 24, 2022
“DeFord Rebuttal”	Rebuttal Report of Professor Daryl R. DeFord, attached as Exhibit 1 to Responsive Brief in Support of Gressman Math/Science Petitioners’ Congressional Plan, filed Jan. 26, 2022
“Duchin Opening”	Expert Report of Professor Moon Duchin, attached as Exhibit A to Governor Wolf’s Brief in Support of Proposed 17-District Congressional Redistricting Plan, filed Jan. 24, 2022

Citation	Description
“Duchin Rebuttal”	Expert Report of Professor Moon Duchin, attached as Exhibit A to Governor Wolf’s Responsive Brief in Support of Proposed 17-District Congressional Redistricting Plan, filed Jan. 26, 2022
“GMS Opening Br.”	Brief in Support of Gressman Math/Science Petitioners’ Congressional Plan, filed Jan. 24, 2022
“GMS Pet.”	Gressman Math/Science Petitioners’ Petition for Review Addressed to the Commonwealth Court’s Original Jurisdiction, filed Dec. 17, 2021
“House Dem. Caucus Br.”	Brief of Intervenor Representative Joanna E. McClinton, Leader of the Democratic Caucus of the Pennsylvania House of Representatives, in Support of Proposed Congressional Redistricting Plan, filed Jan. 24, 2022
“House Republican Intervenors’ Br.”	Opening Brief of House Republican Intervenors Kerry Benninghoff, Majority Leader, and Bryan Cutler, Speaker of the Pennsylvania House of Representatives in Support of Proposed Congressional Redistricting Map, filed Jan. 24, 2022
“Report”	Report of Commonwealth Court Judge Patricia McCullough, acting as a Special Master, filed Feb. 7, 2022
“Rodden Opening”	Expert Report of Professor Jonathan Rodden, attached as Exhibit 1 to Carter Petitioners’ Brief in Support of Proposed Congressional Redistricting Plan, filed Jan. 24, 2022

**Citation****Description**

“Rodden Rebuttal”

Expert Report of Professor Jonathan Rodden, attached as Exhibit 1 to Carter Petitioners’ Response Brief in Support of Proposed Congressional Redistricting Plan, filed Jan. 26, 2022

“Tr.”

Official Transcript of Hearings Dated January 27, 2022 and January 28, 2022 before Judge Patricia A. McCullough

## INTRODUCTION

Four years ago, in striking down the most egregious partisan gerrymander in the history of the Commonwealth, this Court expressed confidence in the promise of high-performance computing technology to create maps that “scrupulously adhere to neutral criteria” while also promoting elections that are truly “free and equal,” *League of Women Voters v. Commonwealth*, 178 A.3d 737, 816–18 (Pa. 2018) (*LWV I*)—so that every Pennsylvania citizen can exercise an equal right to vote, regardless of party, race, or region.

The Gressman Math/Science, or GMS, Petitioners—12 professors of mathematics, statistics, computer science, geography, and data science from Pennsylvania’s leading colleges and universities—have come together to deliver on that promise. The GMS Petitioners and their expert team have distilled the legal redistricting criteria from a long line of this Court’s cases culminating in the 2018 *League of Women Voters* decisions, translated the Court’s commands into algorithmic instructions, programmed computers to generate literally millions of maps, searched for the map that best adheres to all the Court’s criteria simultaneously, and crafted what may be the most balanced congressional redistricting plan Pennsylvania has ever seen.

The GMS Plan divides fewer political subdivisions than other maps before this Court and features districts that are equal in population, contiguous, and highly

compact. Furthermore, data from 9,178 precincts in 18 recent statewide general elections confirms that, in the GMS Plan, citizens who voted for Republican candidates and citizens who voted for Democratic candidates are treated with near-perfect evenhandedness. The GMS Plan does all this while properly accounting for Pennsylvania's increasing diversity, as it includes—for the first time in the Commonwealth's history—*three* majority-minority congressional districts, one of which is predominantly Latino.

The Special Master ignored all this and selected a map that is inferior on *every* relevant metric. Her report is replete with factual and legal errors, and it operates from a presumption favoring a map that was vetoed by the Governor. This Court should not repeat these errors.

Unlike other parties in this case, the GMS Petitioners are not here to push a narrow, parochial agenda on behalf of a political party or incumbent officeholder. Rather, their goal is to provide this Court a public service, to show that districting plans can serve the common good, and to help their fellow Pennsylvanians enjoy fair and effective representation in Congress for the next decade.

In choosing a congressional districting plan, the Court need not take sides between Democratic and Republican leaders, between the Governor and the Legislature, between Senators and Representatives, or between state and federal officeholders. Instead, it need only identify the map that most scrupulously adheres

to all the Commonwealth’s traditional neutral redistricting criteria and the map that gives all Pennsylvania citizens an equal opportunity to translate their votes into representation. Fortunately, those maps are one and the same: the GMS Plan.

### **STATEMENT OF JURISDICTION**

This Court has plenary jurisdiction pursuant to 42 Pa. C.S. §726.

### **ORDER IN QUESTION**

On February 7, 2022, the Special Master filed a Report containing proposed findings of fact and conclusions of law and recommending that this Court adopt the vetoed Pennsylvania House Bill 2146 (“HB2146”) as the Commonwealth’s congressional redistricting plan for the next decade.

### **SCOPE AND STANDARD OF REVIEW**

The Special Master’s Report is reviewed *de novo*, see, e.g., *LWV I*, 178 A.3d at 801 n.62; *Erfer v. Commonwealth*, 794 A.2d 325, 329 (Pa. 2002), *abrogated on other grounds by LWV I*, 178 A.3d 737; and its findings “are not binding on this Court,” *In re Office of Phila. Dist. Att’y*, 244 A.3d 319, 326 (Pa. 2020).

### **QUESTION INVOLVED**

What congressional redistricting plan remedies the existing unconstitutional malapportionment of Pennsylvania’s congressional districts while best complying with the Free and Equal Elections Clause, Pennsylvania’s neutral redistricting criteria, the Voting Rights Act, and all other applicable redistricting requirements?

## STATEMENT OF THE CASE

### **A. The Court Must Adopt a New Congressional Redistricting Plan.**

On January 24, 2022, the Republican majority in the General Assembly passed HB2146 without a single vote from any Democratic legislator.<sup>1</sup> The Governor vetoed it two days later.<sup>2</sup> As a result, no constitutional districting plan is in place for the 2022 congressional election cycle. Because elections cannot go forward under the existing malapportioned plan, it is now “the judiciary’s role to determine the appropriate redistricting plan.” *LWV I*, 178 A.3d at 821–22.

### **B. The Record Below Provides a Comprehensive Basis for Selecting a New Congressional Redistricting Plan.**

Two sets of Pennsylvania voters who reside in malapportioned districts petitioned for relief: (1) the Carter Petitioners, 16 voters affiliated with and supported by the national Democratic Party; and (2) the GMS Petitioners, 12 voters who are award-winning professors of mathematics and science at Bryn Mawr College,

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<sup>1</sup> In the House, HB2146 received no Democratic votes, and only two Republicans voted against it. *See* Pennsylvania House of Representatives, *House Roll Calls: House Bill 2146* (Jan. 12, 2022), [https://www.legis.state.pa.us/CFDOCS/Legis/RC/Public/rc\\_view\\_action2.cfm?sess\\_yr=2021&sess\\_ind=0&rc\\_body=H&rc\\_nbr=708](https://www.legis.state.pa.us/CFDOCS/Legis/RC/Public/rc_view_action2.cfm?sess_yr=2021&sess_ind=0&rc_body=H&rc_nbr=708). In the Senate, it received no Democratic votes, and no Republicans voted against it. *See* Pennsylvania State Senate, *Senate Roll Calls: House Bill 2146* (Jan. 24, 2022), [https://www.legis.state.pa.us/CFDOCS/Legis/RC/Public/rc\\_view\\_action2.cfm?sess\\_yr=2021&sess\\_ind=0&rc\\_body=S&rc\\_nbr=429](https://www.legis.state.pa.us/CFDOCS/Legis/RC/Public/rc_view_action2.cfm?sess_yr=2021&sess_ind=0&rc_body=S&rc_nbr=429).

<sup>2</sup> *See* Office of the Governor, Veto Message (Jan. 26, 2022), <https://www.governor.pa.gov/wp-content/uploads/2022/01/20220126-HB-2146-Veto-Message.pdf>.

Bucknell University, Lafayette College, Lehigh University, Penn State University, St. Joseph’s University, the University of Pennsylvania, and Villanova University.<sup>3</sup>

Ten sets of intervenors petitioned to join, including the following elected officials, whose intervention was granted:

- (i) Tom Wolf, Governor of the Commonwealth of Pennsylvania;
- (ii) Speaker Bryan Cutler and Majority Leader Kerry Benninghoff of the Pennsylvania House, and President Pro Tempore Jake Corman and Majority Leader Kim Ward of the Pennsylvania Senate (together, the “House Republicans”);
- (iii) Pennsylvania State Senators Maria Collett, Katie Muth, Sharif Street, and Anthony Williams;
- (iv) Senator Jay Costa and members of the Democratic Caucus of the Pennsylvania Senate (together with Senators Collet, Muth, Street, and Williams, the “Senate Democrats”);<sup>4</sup>
- (v) Representative Joanna McClinton, Leader of the Democratic Caucus of the Pennsylvania House (“the House Democrats”); and

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<sup>3</sup> See Carter Pet. ¶9; GMS Pet. ¶¶10–14.

<sup>4</sup> The Collett and Costa intervenors participated as one party. Jan. 14, 2022 Order ¶2.

- (vi) Congressman Guy Reschenthaler, Swatara Township Commissioner Jeffrey Varner, Tom Marino, Ryan Costello, and Bud Shuster (the “Reschenthaler Intervenors” or the “Congressional Intervenors”).

Four Pennsylvania voter groups were denied intervention but participated as *amici*.<sup>5</sup>

Thirteen maps were timely proposed by parties and *amici*, and after two rounds of briefing, the Commonwealth Court held an evidentiary hearing with testimony from six expert witnesses, whose reports were admitted in evidence.<sup>6</sup>

- Dr. Jonathan Rodden, Professor of Political Science at Stanford University, for the Carter Petitioners;
- Dr. Daryl DeFord, Assistant Professor of Data Analytics in the Department of Mathematics and Statistics at Washington State University, for the GMS Petitioners;
- Dr. Moon Duchin, Professor of Mathematics at Tufts University, for the Governor;
- Dr. Michael Barber, Associate Professor of Political Science at Brigham Young University, for the House Republicans;

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<sup>5</sup> They were: (1) Leslie Osche and other voters, who call themselves “Citizen-Voters”; (2) Voters of the Commonwealth of Pennsylvania, a group of Republican voters; (3) Khalif Ali and other voters, affiliated with Common Cause and other organizations; and (4) voters associated with Draw the Lines PA. *See generally* Jan. 14, 2022 Order.

<sup>6</sup> Tr. 26:2-11.

- Dr. Keith Naughton, co-founder and principal at Silent Majority Strategies, for the Reschenthaler Intervenors; and
- Dr. Devin Caughey, Associate Professor of Political Science at the Massachusetts Institute of Technology, for the Senate Democrats.

In addition, over objection,<sup>7</sup> the Commonwealth Court admitted in evidence four expert reports and witness statements from authors who did not testify and were never subject to cross-examination.<sup>8</sup> The Commonwealth Court also considered three submissions from *amici*, who did not participate in the evidentiary hearing.<sup>9</sup>

On February 2, 2022, this Court accepted jurisdiction over this matter and designated the Commonwealth Court Judge as Special Master. On February 7, the Special Master filed her Report recommending adoption of HB2146.

**C. The GMS Petitioners Used Computational Redistricting to Achieve Superior Performance on All Criteria Simultaneously.**

The parties used different methods to generate their proposed redistricting plans. The GMS Plan was created using “computational redistricting,” which draws

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<sup>7</sup> Tr. 886:20–887:14, 888:23–889:13.

<sup>8</sup> Tr. 1118:25–1119:13. They were: Dr. John Memmi, for the Pennsylvania Senate Republican Caucus; Dr. Thomas Brunell, for the Reschenthaler Intervenors; and Lora Schoenberg and Michael Lamb, both for the Senate Democrats.

<sup>9</sup> They were from Justin Villere, for Draw the Lines PA; Sean Trende, for Voters of the Commonwealth; and Sarah Andre, for the *Ali amici*. Because none of the *amici*’s maps or expert opinions were “subjected to the rigors of evidentiary challenges either for admissibility or accuracy, as tested through cross-examination,” *LWV I*, 178 A.3d at 831 (Baer, J., concurring and dissenting), the Court should not select an *amicus* map unless it is clearly superior to all alternatives.

from advances in mathematics, statistics, and computer science to apply high-performance computing, algorithmic techniques, and spatial demography to redistricting.<sup>10</sup> The premise is simple: “Given the number of [redistricting] criteria typically present and the spatial nature of how the criteria operate, it is not easy for humans to find optimal redistricting outcomes on their own.... Put simply, good maps are needles in a haystack of bad or at least worse maps. Enter redistricting algorithms. They are capable of meticulous exploration of the astronomical number of ways in which a state can be partitioned. They can identify possible configurations of districts and zero in on the maps that best meet the redistricting criteria. The algorithms sort through the haystack more efficiently and more systematically so that the needle—the better maps—can be found.”<sup>11</sup> In this way, a “computer program essentially substitutes for a very large body of neutral experts and the viable, neutral maps they draw.”<sup>12</sup>

As this Court has recognized, redistricting is a complex process that involves balancing multiple legal requirements. *See Holt v. 2011 Legislative Reapportionment Comm’n*, 67 A.3d 1211, 1237–41 (Pa. 2013) (*Holt II*); *Holt v. 2011*

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<sup>10</sup> Tr. 200:24–201:12.

<sup>11</sup> Emily Rong Zhang, *Bolstering Faith with Facts: Supporting Independent Redistricting Commissions with Redistricting Algorithms*, 109 CAL. L. REV. 987, 1011–13 (2021) (internal quotation marks omitted) [hereinafter “Zhang”].

<sup>12</sup> Bruce E. Cain, et al., *A Reasonable Bias Approach to Gerrymandering: Using Automated Plan Generation to Evaluate Redistricting Proposals*, 59 WM. & MARY L. REV. 1521, 1536–37 (2018).

*Legislative Reapportionment Comm’n*, 38 A.3d 711, 759–61 (Pa. 2012) (*Holt I*).

Improving compliance with one requirement often creates “downstream consequences” for compliance with others.<sup>13</sup> For example, achieving population equality necessarily requires splitting some political subdivisions, and keeping certain counties intact could make the map as a whole less compact.<sup>14</sup> Exploring millions of alternatives by computer sheds light on these tradeoffs.

As some of Pennsylvania’s leading mathematicians and scientists, the GMS Petitioners understand how high-performance computers and cutting-edge algorithmic techniques can thwart gerrymandering, streamline the mapmaking process, and promote fair and effective representation. They have taken to heart this Court’s observation that technology can “aid in the expeditious development of districting maps, the boundaries of which are drawn to scrupulously adhere to neutral criteria.” *LWV I*, 178 A.3d at 817–18; *see id.* at 819 n.75. Through computational redistricting, the GMS Petitioners have put forth a plan that “scrupulously adheres” to neutral criteria so effectively, and in a manner so fair to Pennsylvania voters, that it is the best plan before this Court.

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<sup>13</sup> Zhang, *supra*, at 1013.

<sup>14</sup> *Id.*

## SUMMARY OF ARGUMENT

This Court should reject the Special Master’s recommendation and, instead, adopt the GMS Plan.

I. As shown below, of all plans submitted in these proceedings, the GMS Plan best satisfies, all at once, the full set of neutral redistricting criteria that establish a “floor” for complying with the Free and Equal Elections Clause—population equality, respect for political subdivisions, compactness, and contiguity.

II. The GMS Plan is superior to all plans—including the demonstrably Republican-favoring HB2146—in complying with the mandate that a redistricting plan provide “all voters ... an equal opportunity to translate their votes into representation.” *LWV I*, 178 A.3d at 814. The GMS Plan provides equal electoral opportunities not only for Republican and Democratic voters, but also for minority voters: It is the *only* plan with three majority-minority districts, and the *only* plan with a predominantly Latino majority-minority district, reflecting the Commonwealth’s increasingly diverse citizenry.

III. The GMS Plan also addresses other factors traditionally considered in redistricting. It is the only plan that does not “pair” in a single district the homes of two or more incumbents running for reelection; it hews closely to the choices reflected in the 2018 Plan; and it preserves communities of interest.

IV. Evaluating all factors collectively, the GMS Plan is superior to all other plans before the Court.

V. The Special Master’s recommendation is factually and legally flawed. The GMS Plan is superior to the Special Master’s recommended plan in every way, as shown in the table below, where green shading highlights metrics on which one plan outperforms the other and yellow indicates a tie:

<b>Redistricting Principle</b>	<b>Metric</b>	<b>GMS</b>	<b>HB2146</b>
Population Equality	Maximum Population Deviation	1 person	1 person
Contiguity	Non-Contiguous Districts	0	0
Compactness	Mean Polsby-Popper (higher is better)	0.33	0.31
	Mean Reock (higher is better)	0.40	0.38
	Mean Convex Hull (higher is better)	0.80	0.78
	Cut Edges (lower is better)	5,546	5,882
Respect for Political Subdivisions	Total Split Political Subdivisions	49	54
	Political Subdivision Pieces Created by Splits (omitting pieces created when boroughs are split along county lines)	49	54
Minority Electoral Opportunity	Minority Opportunity Districts (MODs)	3	2
	MODs with Latino Adult Citizens as Largest Minority Group	1	0
Partisan Fairness	Antimajoritarian Outcomes (DeFord) (fewer is better)	3 (2 favoring Republicans; 1 favoring Democrats)	5 (all favoring Republicans)
	Average Mean-Median Gap (DeFord) (closer to zero is better)	-0.8%	-2.9%
	Average Efficiency Gap (DeFord) (closer to zero is better)	0.8%	-6.3%
Incumbent Pairings	Districts that Pair Incumbents Seeking Reelection	0	1

## ARGUMENT

### **I. The GMS Plan Satisfies, Simultaneously, All the Neutral Criteria that Serve as the Constitutional “Floor” for a Redistricting Plan.**

In *LWV I*, this Court described four “neutral criteria”—population equality, minimizing the division of political subdivisions, compactness, and contiguity—as the “‘floor’ of protection for an individual against the dilution of his or her vote in the creation of [congressional] districts.” 178 A.3d at 817. The GMS Plan satisfies *all* these criteria, simultaneously.

The GMS Petitioners have prepared two tables (Attachments A and B) that identify each redistricting criterion and associated metrics, with the metrics calculated in the same way for every plan before this Court.<sup>15</sup> The GMS Petitioners were the only party to present an expert, Dr. DeFord, who analyzed every plan, top to bottom, and provided all data for review and cross-examination.<sup>16</sup> Rather than wrestle with how to translate the differing methods of measuring performance submitted by the parties and *amici*, the Court can use these tables to make

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<sup>15</sup> These tables were attached to the GMS Petitioners’ January 29 post-trial submission in the Commonwealth Court. All data is found in Dr. DeFord’s Rebuttal Report, except where otherwise stated.

<sup>16</sup> Indeed, Dr. DeFord’s analysis was so comprehensive that, rather than challenge his methodology, parties used cross-examination to cherry-pick particular metrics he had calculated that favored their own map. Tr. 253:23–261:17 (Carter), 263:21–267:1 (Governor), 269:3–270:4 (House Republicans), 285:6–287:20 (Reschenthaler Intervenors), 318:4–25 (Senate Democrats); *see also* Tr. 319:22–321:21.

comprehensive, data-driven, apples-to-apples comparisons of all 13 plans. They show that the GMS Plan outperforms the others in satisfying the neutral criteria.

**A. The GMS Plan Achieves Absolute Population Equality.**

Population equality is the primary consideration, and indeed the entire impetus, for redistricting. The command under Article I, Section 2 of the U.S. Constitution “that Representatives be chosen ‘by the People of the several States,’” *Wesberry v. Sanders*, 376 U.S. 1, 7 (1964), requires “absolute population equality” in congressional districts, *Karcher v. Daggett*, 462 U.S. 725, 732–33 (1983). Accordingly, in *League of Women Voters of Pennsylvania v. Commonwealth*, 181 A.3d 1083 (Pa. 2018) (*LWV II*), this Court held that “the constitutional guarantee of one person, one vote” in congressional redistricting means that “no district has more than a one-person difference in population from any other district.” *Id.* at 1087.

Perfect population equality is possible, and the GMS Plan achieves it. No district has more than a one-person difference in population from any other district; twelve contain 764,865 persons each, and five contain 764,864 persons each.<sup>17</sup>

The Carter Plan, House Democrats Plan, and *Ali Amici* Plan did not achieve absolute population equality.<sup>18</sup> The Carter and House Democrats plans both have a

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<sup>17</sup> DeFord Opening ¶22 & Table 1; Tr. 203:18–204:3.

<sup>18</sup> DeFord Rebuttal, Table 1 and App’x A, Table 1a.

two-person difference from their largest to smallest districts,<sup>19</sup> meaning they could be subject to a federal one-person-one-vote challenge. *See, e.g., Vieth v. Pennsylvania*, 195 F. Supp. 2d 672, 675–76, 678 (M.D. Pa. 2002) (three-judge court) (invalidating a congressional redistricting plan because it had a 19-person maximum population deviation). The *Ali Amici* Plan has a much greater population deviation—8,676 persons<sup>20</sup>—because it used data that reallocated many incarcerated people to their home addresses.<sup>21</sup> To ensure the plan it adopts does not face a federal lawsuit, the Court should choose a plan with a one-person maximum population deviation.

#### **B. The GMS Plan Splits the Fewest Political Subdivisions.**

The congressional plan this Court adopts must not split counties, cities, incorporated towns, boroughs, townships, or wards “[u]nless absolutely necessary.” PA. CONST. art. II, §16; *see LWV I*, 178 A.3d at 816–17. Of course, “some divisions are inevitable” to comply with other legal requirements. *Holt I*, 38 A.3d at 758. But

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<sup>19</sup> *See* Rodden Opening, Table 4; House Dem. Caucus Br. at 9; DeFord Rebuttal, Table 1, and App’x A, Table 1a.

<sup>20</sup> DeFord Rebuttal, App’x A, Table 1a.

<sup>21</sup> All other parties relied on (1) the 2020 Census data, unadjusted for errors in Pennsylvania’s precinct boundaries and populations; or (2) the Legislative Reapportionment Commission’s Data Set #1, which corrects these Pennsylvania-specific errors in the 2020 Census Data. Any plan this Court adopts should be based, as the GMS Plan is, on the LRC’s adjusted Data Set #1. That is consistent with Pennsylvania House Resolution 165 and the Court’s use of adjusted Census data in *LWV I*, 181 A.3d at 1087 n.8, and *Mellow v. Mitchell*, 607 A.2d 204, 218–19 (Pa. 1992). All statistics in this brief and calculated by Dr. DeFord were calculated using Data Set #1.

splitting these six political-subdivision types should be avoided unless “absolutely necessary.”<sup>22</sup>

The GMS Plan outperforms every other plan in preserving the integrity of political subdivisions.<sup>23</sup> It splits 15 counties, 1 city, 0 towns, 3 boroughs, 15 townships, and 15 wards.<sup>24</sup> Of those 15 counties, three (Philadelphia, Allegheny, and Montgomery) must be split because they each have more residents than a single district has, and each is split the minimum number of times dictated by population.<sup>25</sup> The same is true for the GMS Plan’s sole split city, Philadelphia, which is divided among three districts, the mathematical minimum.<sup>26</sup> And each of the GMS Plan’s three borough splits occurs “naturally” along a county boundary that already divides the borough.<sup>27</sup> *LWVI*, 178 A.3d at 762 n.22. The GMS Plan also minimizes political-subdivision “pieces” created by splits.<sup>28</sup> The pieces metric (a) calculates the number of political-subdivision pieces above those required if each political subdivision were

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<sup>22</sup> The Carter Petitioners’ expert, Dr. Rodden, also evaluated the extent to which the Carter Plan preserved voting tabulation districts, or VTDs. *See* Rodden Opening at 22. But VTDs are not one of the six political subdivisions protected by the Constitution. Tr. 143:1–9; *see also* PA. CONST. art. II, §16.

<sup>23</sup> *See* DeFord Rebuttal, Table 6, and App’x A, Table 6a.

<sup>24</sup> DeFord Opening ¶¶29, 38, 41, 42, 48, 52. The GMS Plan also keeps Chester County fully intact; the 2018 Plan placed the county’s discontinuous portion into a second district. *Id.* ¶¶34 & n.3.

<sup>25</sup> *Id.* ¶¶29–33.

<sup>26</sup> *Id.* ¶38.

<sup>27</sup> *Id.* ¶¶42–47.

<sup>28</sup> DeFord Rebuttal, Table 7, and App’x A, Table 7a.

kept solely in one district and (b) omits splits of boroughs that occur along county lines.<sup>29</sup> For example, the GMS Plan has 17 municipality “pieces”: 2 pieces for Philadelphia (which is split two times) plus one piece for each of the plan’s 15 split townships.<sup>30</sup> This metric allows one to quickly and easily evaluate the extent to which political subdivisions are not just split, but split more times than may be necessary or appropriate.<sup>31</sup>

This table shows how the GMS Plan is superior to HB2146 in minimizing political subdivision splits and pieces,<sup>32</sup> with green shading identifying superior numbers and yellow denoting a tie:

<b>Metric</b>	<b>GMS Plan</b>	<b>HB2146</b>
Split Counties	15	15
Split Municipalities ( <i>including boroughs split on county lines</i> )	19	21
Split Wards	15	18
<b>Total Splits</b>	<b>49</b>	<b>54</b>
County Pieces Created by Splits	17	18
Municipality Pieces Created by Splits	17	18
Ward Pieces Created by Splits	15	18
<b>Total Pieces Created by Splits</b>	<b>49</b>	<b>54</b>
Districts Containing Parts of Philadelphia	3	4

<sup>29</sup> *Id.* ¶23.

<sup>30</sup> *Id.* at Tables 3 & 7.

<sup>31</sup> DeFord Opening ¶27.

<sup>32</sup> DeFord Rebuttal, Tables 4, 6, & 7.

The GMS Plan also reflects a prioritization of political-subdivision splits consistent with the plan ordered into effect in *LWV II* (“the 2018 Plan”). Like that plan, the GMS Plan splits only one city (Philadelphia) and keeps Pittsburgh whole.<sup>33</sup> The GMS Plan is one of only two proposed plans that splits Philadelphia into the minimum-population-required districts (three) *and* splits no other cities.<sup>34</sup> Furthermore, the GMS Plan follows the 2018 Plan’s approach in tolerating a small number of split townships to minimize divisions of other municipalities, including county seats.<sup>35</sup> And the GMS Plan follows the 2018 Plan’s approach in minimizing, to the extent possible, the splitting of wards, particularly in Philadelphia. *See LWV II*, 181 A.3d at 1087 n.11. Indeed, the GMS Plan splits the fewest wards of all but one submitted map.<sup>36</sup>

In total, the GMS Plan has only 49 splits across all six types of political subdivisions—*the very best* across all parties’ and *amici*’s maps<sup>37</sup>—and is tied for first in fewest pieces created by splitting the six political-subdivision types:<sup>38</sup>

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<sup>33</sup> *Id.* at Table 4.

<sup>34</sup> *Id.* at Table 4 and App’x A, Table 4a. The other is the House Democrats’ Plan, which is inferior by essentially every other metric. *See* Attachment A.

<sup>35</sup> *See* DeFord Opening ¶48.

<sup>36</sup> DeFord Rebuttal, Table 5 and App’x A, Table 5a. Senate Democrats Plan 2 splits one fewer ward, but splits one more county and five more boroughs along county lines, and it splits Pittsburgh. It is inferior to the GMS Plan by other metrics, too. *See* Attachment A.

<sup>37</sup> Others evaluate splits by ignoring boroughs split along county lines. By that metric, the GMS Plan ties for best (46) with Draw the Lines and Senate Democrats 2. *Id.*

<sup>38</sup> *Id.* at Tables 6 & 7 and App’x A, Tables 6a & 7a; Tr. 212:18–213:12 (DeFord).

<b>Plan</b>	<b>Total Splits</b>	<b>Pieces Created by Splits</b>
GMS	49	49
Sen. Dems. 2	51	49
Draw the Lines	52	49
HB2146	54	54
Citizen-Voters	54	55
Reschenthaler 2	57	57
Reschenthaler 1	58	58
Carter	58	59
Sen. Dems. 1	59	56
House Dems.	61	58
Governor	63	63
Ali	73	71
Voters of PA	79	76

Looking to the sum of splits and pieces across all six political-subdivision types accounts for tradeoffs when respecting political subdivisions.<sup>39</sup> While other parties may tout their performance on one or two subcategories of political subdivisions, no plan outperforms the GMS Plan on *total* splits or *total* pieces created by splits.<sup>40</sup> Simply put, of all the plans submitted by parties and *amici*, the GMS Plan splits the *fewest* political subdivisions, and *no plan* creates fewer political-subdivision pieces.

### **C. The GMS Plan Achieves Highly Compact Districts.**

A congressional plan must contain districts “composed of compact ... territory.” PA. CONST. art. II, §16; *see LWVI*, 178 A.3d at 816–17. Simultaneously

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<sup>39</sup> Tr. 211:11–213:7.

<sup>40</sup> DeFord Rebuttal, Tables 6, 7 and App’x A, Tables 6a, 7a.

complying with other criteria can introduce “elements of unavoidable noncompactness.” *Commw. ex rel. Specter v. Levin*, 293 A.2d 15, 18–19 (Pa. 1972) (internal quotation marks omitted), *abrogated on other grounds by Holt I*, 38 A.3d 711 (Pa. 2012). Nevertheless, in keeping with *LWV II*, the compactness of any plan adopted by the Court should be “superior or comparable” to that of the other submitted plans. 181 A.3d at 1087. The GMS Plan satisfies that standard.

“Compactness” refers to a district’s or plan’s geographic or geometric regularity.<sup>41</sup> Several measures of compactness exist, *LWV I*, 178 A.3d at 771–72, and it is important to consider more than one because each “represents a different, potentially relevant portion of the full geometric information” and “no single compactness measure can perfectly capture all facets of the regularity of a shape.”<sup>42</sup> Consequently, Dr. DeFord calculated the Convex Hull, Reock, Polsby-Popper, and Cut Edges compactness measures for every submitted plan.<sup>43</sup> *Cf. LWV II*, 181 A.3d at 1087 (assessing compactness measures).

The GMS Plan is the *best* among all party-submitted plans in its minimum Convex Hull score, which demonstrates that no single district in the plan is, on its

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<sup>41</sup> DeFord Opening ¶54.

<sup>42</sup> *Id.* ¶57; *see also* Tr. 94:2–7 (Rodden), 214:10–17 (DeFord), 333:14–334:14 (Duchin).

<sup>43</sup> DeFord Rebuttal, Table 8 and App’x A, Table 8a; *see also* DeFord Opening ¶¶54–61 (explaining each compactness measure).

own, noncompact.<sup>44</sup> The GMS Plan also is among the best in other measures of compactness: mean Reock, mean Polsby-Popper, mean Convex Hull, and Cut Edges.<sup>45</sup>

Notably, the GMS Plan achieves these levels of compactness even though two of its districts follow the irregular Pittsburgh border to keep that city intact. As Dr. DeFord testified, given Pittsburgh’s shape, plans that follow the city’s border will tend to have lower Polsby-Popper scores, as compared to maps smoothly slicing Pittsburgh in two.<sup>46</sup> This is an example of a tradeoff in optimizing multiple redistricting criteria simultaneously<sup>47</sup>—one that comports with Pennsylvania law, which calls generally for compact districts, but prioritizes keeping political subdivisions intact “[u]nless absolutely necessary.” PA. CONST. art. II, §16.

#### **D. The GMS Plan Contains Only Contiguous Districts.**

The congressional plan this Court adopts must contain districts “composed of ... contiguous territory.” PA. CONST. art. II, §16; *see LWV I*, 178 A.3d at 816–17. A contiguous district is one “in which no part of the district is wholly physically

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<sup>44</sup> *See* DeFord Rebuttal ¶26.

<sup>45</sup> *Id.* ¶¶25–26 & Table 8; Tr. 214:19–24.

<sup>46</sup> *See* Tr. 215:13–218:7.

<sup>47</sup> *Id.*; *see also id.* at 338:6–18 (Duchin).

separate from any other part.” *Specter*, 293 A.2d at 17–18 (internal quotation marks and footnote omitted). The GMS Plan avoids any discontinuity.<sup>48</sup>

## **II. The GMS Plan Performs Better than Any Other Plan in Providing All Voters an Equal Opportunity to Translate Their Votes into Representation.**

As explained, the GMS Plan is superior on the Pennsylvania Constitution’s full set of neutral “floor” criteria. But the Court must look beyond the “floor.” In *LWV I*, this Court recognized that “advances in map drawing technology and analytical software can potentially allow mapmakers, in the future, to engineer congressional districting maps, which, although minimally comporting with these neutral ‘floor’ criteria, nevertheless operate to unfairly dilute the power of a particular group’s vote for a congressional representative.” 178 A.3d at 817.

With that statement, this Court presciently foresaw HB2146, which would dilute Democratic votes while purporting to comply with the “floor” criteria. By contrast, the GMS Plan scrupulously ensures that all voters will be treated equally. The GMS Plan is far superior to HB2146 on objective metrics of partisan fairness that assess whether a plan is giving “all voters ... an equal opportunity to translate their votes into representation.” *Id.* at 814. The GMS Plan does not surpass just HB2146 on this score. It is either the very best, or effectively tied for the very best,

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<sup>48</sup> See DeFord Rebuttal ¶27.

among every one of the plans, whether submitted by parties or *amici*, on virtually *every* measure of partisan fairness in the record.

Beyond ensuring partisan fairness, the GMS Plan also ensures that the Commonwealth’s minority voters are given an “equal opportunity to translate their votes into representation.” *Id.* Indeed, *only* the GMS Plan has three majority-minority opportunity districts, including one in which Latinos would be the largest group of adult minority citizens.

**A. The GMS Plan Is Fair to Voters from Both Parties.**

Article I, Section 5 of the Pennsylvania Constitution demands that a congressional redistricting plan “prevent dilution of an individual’s vote” and equalize the power of each citizen’s vote “*to the greatest degree possible.*” *Id.* at 817 (emphasis added). Scholars and scientists have several reliable ways to measure whether a redistricting plan will fulfill these aims.<sup>49</sup> Each is a different way of evaluating the extent to which a proposed map comports with majoritarian election principles—the notion that the party whose candidates win a majority of the votes statewide should likewise have a realistic probability of winning a majority of the

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<sup>49</sup> See DeFord Opening §V.E.3; see also Tr. 222:7–24. As with the neutral criteria, parties’ experts calculated partisan-fairness measures in different ways. The Court can use Dr. DeFord’s calculations for all plans, or the PlanScore calculations, to make apples-to-apples assessments among plans. See Attachments A & B.

congressional districts.<sup>50</sup> On these metrics, the GMS Plan achieves the best, or near-best, scores of all the plans.

**1. The GMS Plan Achieves a Near-Perfect Mean-Median Score.**

In *LWVI*, this Court credited the *mean-median score* as a measure of partisan fairness. *See* 178 A.3d at 774. The mean-median score captures how much of a state’s vote is needed to capture half the seats in a proposed map.<sup>51</sup> As Dr. DeFord explained, the mean-median score relates to partisan symmetry: If one party is expected to turn a 55%-to-45% statewide vote advantage into a 10-to-7 seat advantage, then a symmetric result would require the other party to achieve the same seats advantage with the same statewide vote advantage. If the mean-median score is close to zero, then about half the districts in the proposed plan are more Democratic than the state as a whole, and about half the districts are more Republican than the state as a whole—an intuitively sensible property for any truly fair map.<sup>52</sup> But if the mean-median score is further away from zero, the proposed plan is skewed to favor one major political party and disfavor the other.

To calculate this measure, Dr. DeFord obtained actual election data showing the votes cast for each candidate in each of the 9,178 voting precincts in each of 18

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<sup>50</sup> Tr. 219:4–18.

<sup>51</sup> Duchin Opening at 17; DeFord Opening ¶78.

<sup>52</sup> DeFord Opening ¶¶78–79; *see also* Tr. 227:18–231:20.

statewide general elections from 2012 through 2020.<sup>53</sup> “By overlaying the precinct-level election results on top of the geographic boundaries as shown on a particular map, he was able to determine whether a particular district had more Republican or Democratic votes during the elections.” *LWV I*, 178 A.3d at 773.<sup>54</sup> He then compared the vote share the Democratic candidate would have obtained in each election in each proposed plan’s “median” district—the ninth-most Democratic and ninth-most Republican district in each 17-district proposed plan—with the vote share that same candidate garnered statewide.<sup>55</sup> That comparison is Dr. DeFord’s mean-median score.<sup>56</sup>

Dr. DeFord reported both whether the mean-median score favored Democrats or Republicans in each of the 18 elections he analyzed, and an average mean-median score across them all.<sup>57</sup> For HB2146, all 18 elections had a mean-median score favoring Republicans, and the average score was 2.9% favoring Republicans.<sup>58</sup> By contrast, the GMS Plan had 13 elections where the mean-median score favored

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<sup>53</sup> DeFord Opening ¶¶68.

<sup>54</sup> *See* DeFord Opening ¶¶70, 78–79.

<sup>55</sup> *Id.* ¶79. In *LWV I*, experts calculated the mean-median score by identifying the median-district vote share and comparing it to the average vote share across the districts. 178 A.3d at 774. Dr. DeFord explained that his manner of calculation—where the statewide vote share is used instead of the average district vote share—better controls for differences in voter turnout across districts in a redistricting plan. DeFord Opening ¶79.

<sup>56</sup> *Id.* ¶78.

<sup>57</sup> *Id.* ¶¶97–100.

<sup>58</sup> DeFord Rebuttal Table 12.

Republicans and 5 where it favored Democrats; its average mean-median score is much closer to zero—0.8% in favor of Republicans.<sup>59</sup> That 0.8% score is the second-best average mean-median score of all plans submitted by all parties and *amici*.<sup>60</sup> For the most recent elections (2018–2020), which are likely to be the most reflective of the current political environment, the GMS Plan has the *best* average mean-median score of all plans.<sup>61</sup> The following figures from Dr. DeFord show his mean-median calculations, averaged across elections from 2018 to 2020, with the bars colored according to the corresponding plan<sup>62</sup>:

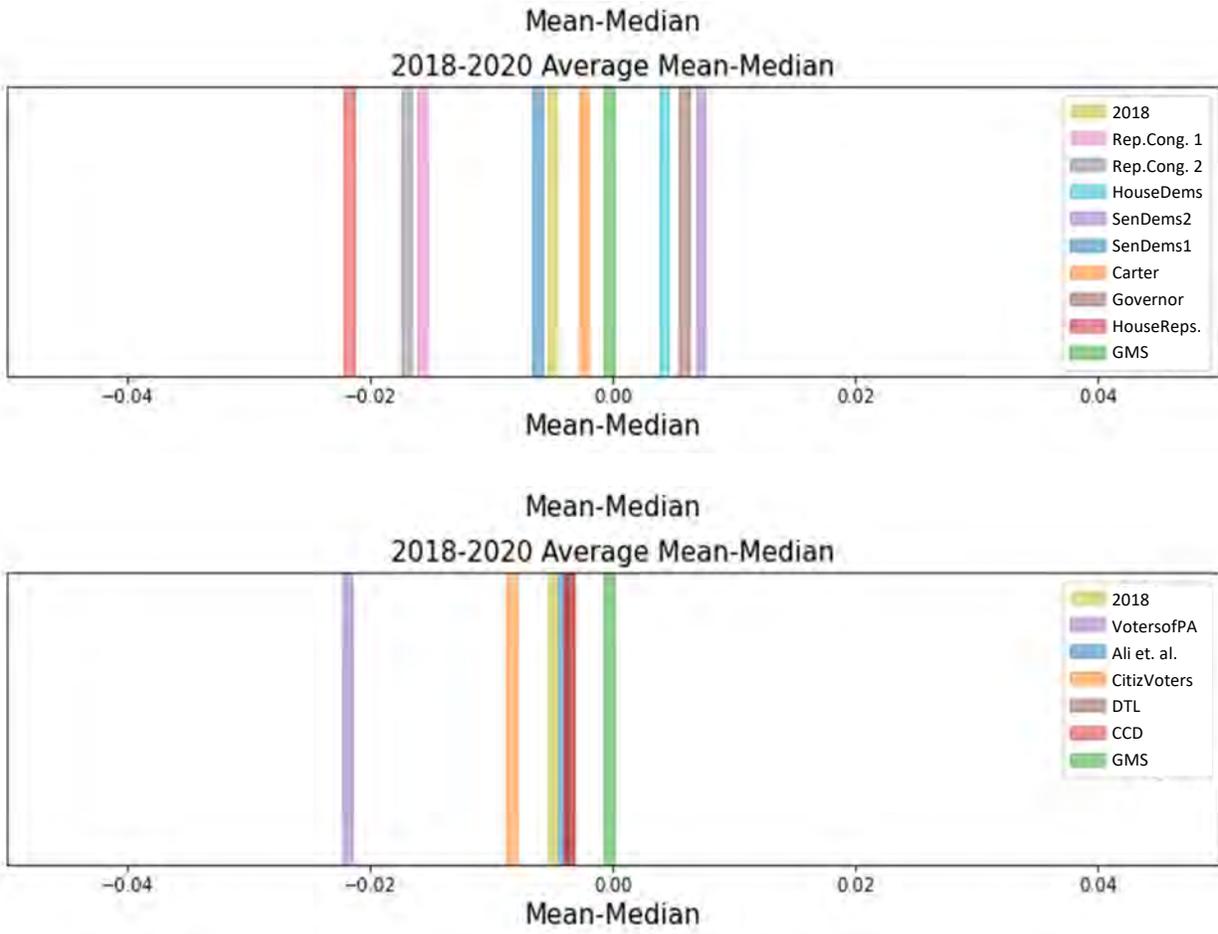
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<sup>59</sup> *Id.*

<sup>60</sup> DeFord Rebuttal ¶38, Table 12 and App’x A, Table 12a.

<sup>61</sup> *See* DeFord Rebuttal ¶39, Figure 3 and App’x A, Figure 3a. Other experts also calculated the mean-median scores of each plan, though with different, less comprehensive sets of election results. While Dr. DeFord relied on the results of 18 statewide elections from 2012 to 2020, Dr. Duchin relied on 12 elections (Duchin Opening at 18–19), Dr. Rodden relied on 11 elections (Rodden Opening at 4; Rodden Rebuttal at 7), and Dr. Barber relied on 17 elections (Barber Rebuttal at 13 n.5). No matter which set of elections is used, the GMS Plan scored close to the ideal score of zero. *See, e.g.*, Duchin Rebuttal at 4; Barber Rebuttal at 21. Indeed, Governor Wolf’s expert, Dr. Duchin, admitted that the GMS Plan is an “excellent plan” with partisan-fairness scores better than several of the plans that she initially had rated as “dominating the field” in this area. Tr. 424:23–433:20.

<sup>62</sup> DeFord Rebuttal, Figure 3 and App’x A, Figure 3a. Comparatively, the Senate Democrats 2 Plan, which scores slightly better than the GMS Plan on average mean-median, scores further away from zero for the more recent elections. *Id.* ¶39.



And as shown in the table below, the **GMS Plan** tied for the *very best* in its mean-median score as calculated by PlanScore.org<sup>63</sup>—an independent site that Dr.

<sup>63</sup> DeFord Rebuttal, App’x D. While Dr. Caughey assessed a few of the proposed plans, Dr. DeFord assessed all the plans. To the extent they reached different results, Dr. DeFord’s results should be used as he assessed all the plans and supplied his backup, *id.*; using his results guarantees an apples-to-apples approach.

Caughey testified is nonpartisan, transparent, and available to any member of the public.<sup>64</sup> HB2146 scored among the very *worst*.<sup>65</sup>

Plan	PlanScore's Mean-Median Score
GMS	0.4% R
Carter	0.4% R
Governor	0.4% R
Sen. Dems. 2	0.5% R
Sen. Dems. 1	0.6% R
House Dems.	0.7% D
Ali	0.7% R
Draw the Lines	1.0% R
Citizen-Voters	1.7% R
Voters of PA	2.2% R
HB2146	2.3% R
Resenthaler 2	2.4% R
Resenthaler 1	2.4% R

## 2. The GMS Plan Achieves a Near-Perfect Efficiency-Gap Score.

The *efficiency gap score*, also credited in *LWV I*, is “a formula that measures the number of ‘wasted’ votes for one party against the number of ‘wasted’ votes for another party,” where “[t]he larger the number, the greater the partisan bias.” 178 A.3d at 777. As Dr. DeFord explained, a vote is considered “wasted” if it was for the losing candidate in a district or for the winning candidate but beyond the number needed to win the district, because “the most efficient distribution of votes is to carry

<sup>64</sup> See Tr. 962:21–964:8, 1009:10–23. PlanScore allows anyone to submit a proposed redistricting plan and receive four partisan-fairness measures based on 2012–2020 election data from Pennsylvania’s presidential and congressional elections. See Tr. 915:21–916:7, 926:24–927:13, 1014:10–1015:8 (Caughey); see also Unified District Model, PLANSCORE (Dec. 2021), <https://planscore.campaignlegal.org/models/data/2021D/>.

<sup>65</sup> See DeFord Rebuttal, App’x D; see also Caughey Rebuttal at 12–15.

as many districts as possible by as narrow a margin as possible, while having the opposing party win its [smaller number of] districts by large majorities.”<sup>66</sup> An efficiency gap that is close to zero suggests neither party’s voters are unfairly favored.<sup>67</sup>

The GMS Plan is among the best, with a mean efficiency-gap score extraordinarily close to zero (0.8%, as calculated by Dr. DeFord over 18 elections).<sup>68</sup> And as calculated by PlanScore.org, the GMS Plan scored better than all but one of the other plans, while HB2146 is again among the worst:<sup>69</sup>

<b>Plan</b>	<b>PlanScore’s Efficiency-Gap Score</b>
House Dems.	1.2% D
GMS	1.4% R
Carter	1.8% R
Governor	1.9% R
Sen. Dems. 2	2.4% R
Ali	2.4% R
Sen. Dems. 1	2.5% R
Draw the Lines	3.5% R
Citizen-Voters	4.6% R
Resenthaler 2	6.3% R
Resenthaler 1	6.4% R
HB2146	6.6% R
Voters of PA	6.8% R

<sup>66</sup> DeFord Opening ¶¶80.

<sup>67</sup> *Id.* ¶¶97, 100.

<sup>68</sup> DeFord Rebuttal, Table 13.

<sup>69</sup> *See* DeFord Rebuttal, App’x D; Tr. 968:16–969:9 (Caughey). Slightly better on this metric is the House Democrats Plan, *see* DeFord Rebuttal, App’x D, which is inferior to the GMS Plan by nearly every other metric. *See infra* page 58.

### 3. The GMS Plan Achieves Superior Majority Responsiveness.

Another test of partisan fairness is a *majority-responsiveness measure* based on the plan's seats-votes curve.<sup>70</sup> This measure evaluates the extent to which a proposed redistricting plan allows each political party to convert a majority of votes into a majority of seats, without making it harder for one party or the other to do so.<sup>71</sup> The GMS Plan is again among the best by this measure, with only three instances across the 18 elections that Dr. DeFord studied in which a majority of votes would not have been converted into a majority of seats.<sup>72</sup> And these three instances were split between the political parties, suggesting that the plan does not make it harder for either party to convert a vote-share majority into a seat-share majority.<sup>73</sup> By contrast, most other submitted plans had more instances when a vote majority did not translate into a seat majority,<sup>74</sup> or had antimajoritarian outcomes that always disadvantaged one party's voters but never the other party's voters.<sup>75</sup> This table compares outcomes under the GMS Plan to those under HB2146, with

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<sup>70</sup> DeFord Opening ¶¶73–76, 88–89; Duchin Opening at 14; Tr. 900:20–903:23 (Caughey).

<sup>71</sup> DeFord Opening ¶¶73–76; Tr. 361:9–364:9 (Duchin).

<sup>72</sup> DeFord Rebuttal, Tables 9 & 10.

<sup>73</sup> *Id.*; see also DeFord Opening ¶84.

<sup>74</sup> These are HB2146, the Governor's Plan, and the two Reschenthaler plans. DeFord Rebuttal, Tables 9 & 10.

<sup>75</sup> No plan had all such outcomes favoring Democrats. The following plans' antimajoritarian outcomes favored only Republicans: HB2146, both Reschenthaler plans, Senate Democrats 1, Draw the Lines, Citizen-Voters, and Voters of PA. *Id.*

antimajoritarian outcomes shaded either in red (favoring Republicans) or blue (favoring Democrats)<sup>76</sup>:

<b>Election</b>	<b>Winner</b>	<b>Dem. Vote %</b>	<b>GMS (Dem. Seats/ 17)</b>	<b>HB2146 (Dem. Seats/ 17)</b>
U.S. President '12	D	52.7%	59% (10)	53% (9)
U.S. Senator '12	D	54.6%	59% (10)	53% (9)
Attorney General '12	D	57.5%	71% (12)	76% (13)
Auditor General '12	D	51.7%	41% (7)	35% (6)
State Treasurer '12	D	54.4%	59% (10)	47% (8)
Governor '14	D	54.9%	59% (10)	53% (9)
U.S. President '16	R	49.6%	47% (8)	41% (7)
U.S. Senator '16	R	49.3%	53% (9)	29% (5)
Attorney General '16	D	51.4%	59% (10)	41% (7)
Auditor General '16	D	52.6%	47% (8)	41% (7)
State Treasurer '16	D	53.4%	59% (10)	59% (10)
Justice '17	R	47.7%	41% (7)	35% (6)
Governor '18	D	58.7%	65% (11)	59% (10)
U.S. Senator '18	D	56.7%	59% (10)	59% (10)
U.S. President '20	D	50.6%	53% (9)	47% (8)
Attorney General '20	D	52.3%	59% (10)	59% (10)
Auditor General '20	R	48.4%	47% (8)	29% (5)
State Treasurer '20	R	49.6%	47% (8)	41% (7)

#### **4. The GMS Plan's Competitive Districts Ensure Evenhanded Responsiveness to Shifts in Voter Opinion.**

The GMS Plan also achieves perfect balance on a measure of districts that are potentially responsive or competitive between the political parties. Again looking across 18 statewide general elections, the GMS Plan contains 5 districts that consistently voted Democratic in those elections, 5 districts that consistently voted

<sup>76</sup> DeFord Rebuttal, Table 9 (percentages rounded).

Republican, and 7 districts that have swung for either party.<sup>77</sup> The GMS Plan is one of only two submitted plans that achieves a perfect balance on this measure, with an equal number of districts that consistently voted in favor of each party.<sup>78</sup>

\* \* \*

In sum, across the full range of measurements for partisan fairness, the GMS Plan is either the very best, or among the very best, of all submitted plans. As measured by PlanScore, the GMS Plan is indisputably the best. *See Attachments A & B.* Thus, the GMS Plan best vindicates the constitutional guarantee to give “all voters ... an equal opportunity to translate their votes into representation.” *LWV I*, 178 A.3d at 814.

**B. The GMS Plan Best Provides Minority Voters with the Opportunity to Translate Their Votes into Representation.**

The GMS Plan also provides minority-group members with an equal opportunity “to translate their votes into representation.” *LWV I*, 178 A.3d at 804. Ensuring minority electoral opportunity requires compliance with both the U.S. Constitution and Section 2 of the Voting Rights Act (VRA), 52 U.S.C. §10301. *See LWV I*, 178 A.3d at 817 n.72; *see also* PA. CONST. art. I, §29 (“Equality of rights under the law shall not be denied or abridged in the Commonwealth of Pennsylvania

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<sup>77</sup> DeFord Rebuttal ¶33 & Table 11; Tr. 224:16–226:4.

<sup>78</sup> DeFord Rebuttal, Table 11 and App’x A, Table 11a. The other is the Draw the Lines Plan. *Id.*

because of the race or ethnicity of the individual.”). A plan cannot make excessive or unjustified use of race or racial data. *See Shaw v. Reno*, 509 U.S. 630, 642, 646–49 (1993). Nor can the plan deny or abridge the right to vote on account of race, color, or membership in a language minority group. 52 U.S.C. §10301.

To satisfy federal law, a redistricting plan should provide effective opportunities for minority-group members to nominate and elect their preferred candidates in a number of reasonably compact districts “roughly proportional” to the minority group’s share of the state’s citizen voting-age population, or CVAP. *LULAC v. Perry*, 548 U.S. 399, 426, 436–38 (2006); *Johnson v. De Grandy*, 512 U.S. 997, 1000 (1994).<sup>79</sup> About 20% of the Commonwealth’s CVAP belongs to a racial or language minority group, with Black and Latino adult citizens constituting about 11% and 6%, respectively.<sup>80</sup> In a 17-district plan, 20% of 17 districts would equal 3.4 districts. Under the “rough” proportionality principle, this means Pennsylvania should have at least three congressional districts where minority voters have a realistic opportunity to nominate and then elect their preferred candidates.

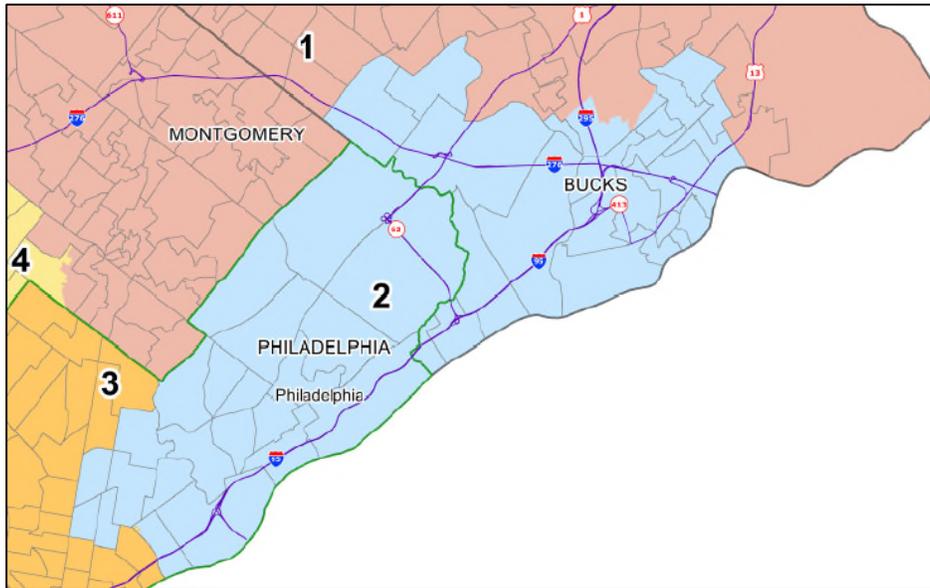
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<sup>79</sup> In *Mellow*, this Court relied on a similar proportionality analysis to conclude that an additional district in which Black voters would have an opportunity to nominate and elect their preferred candidates should be included in the congressional plan. *See* 607 A.2d at 206–07 (discussing the need for a second Black opportunity district in a 21-district plan “in light of Pennsylvania’s 9% African-American population”).

<sup>80</sup> U.S. Census Bureau, *American Community Survey: S2901 Citizen Voting-Age Population by Selected Characteristics*, <https://data.census.gov/cedsci/table?q=citizen&g=0400000US42&d=ACS%201-Year%20Estimates%20Subject%20Tables&tid=ACSST1Y2019.S2901> (last visited Feb. 12, 2022); *see also* Tr. 242:11–15.

The GMS Plan satisfies this principle. Unlike any of the other plans, the GMS Plan includes *three* majority-minority districts in which minority citizens will have such an opportunity, and in one of those, Latino adult citizens would constitute the largest minority group. Both of these features would be historic firsts for the Commonwealth—a reflection of the Commonwealth’s diversifying population. The GMS Plan’s minority opportunity districts are described below.

### District 2



District 2 connects Northeast Philadelphia with similar communities in southern Bucks County, including the relatively diverse townships of Bensalem, Bristol, and Middletown. Minority-group members constitute 52% of the district’s voting-age population,<sup>81</sup> and District 2 would be the first majority-minority

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<sup>81</sup> DeFord Opening ¶117.

congressional district in Pennsylvania to have more Latino than Black adult citizen residents.<sup>82</sup> The district has been carried by Latino-preferred candidates in 18 of 18 recent statewide general elections and 7 of 10 recent statewide Democratic primaries (and the three exceptions were all more than five years ago).<sup>83</sup> The percentage of proposed District 2's adult citizen population that is Latino is increasing by about a half percentage point a year.<sup>84</sup> And a glimpse of the promising future for Latino voters in this proposed district can be seen in the May 2021 Democratic primary election for Philadelphia's District Attorney, in which Latino candidate Carlos Vega, who won only 33% of the vote citywide, nonetheless easily carried the Philadelphia portion of this district with 64% of the vote.<sup>85</sup>

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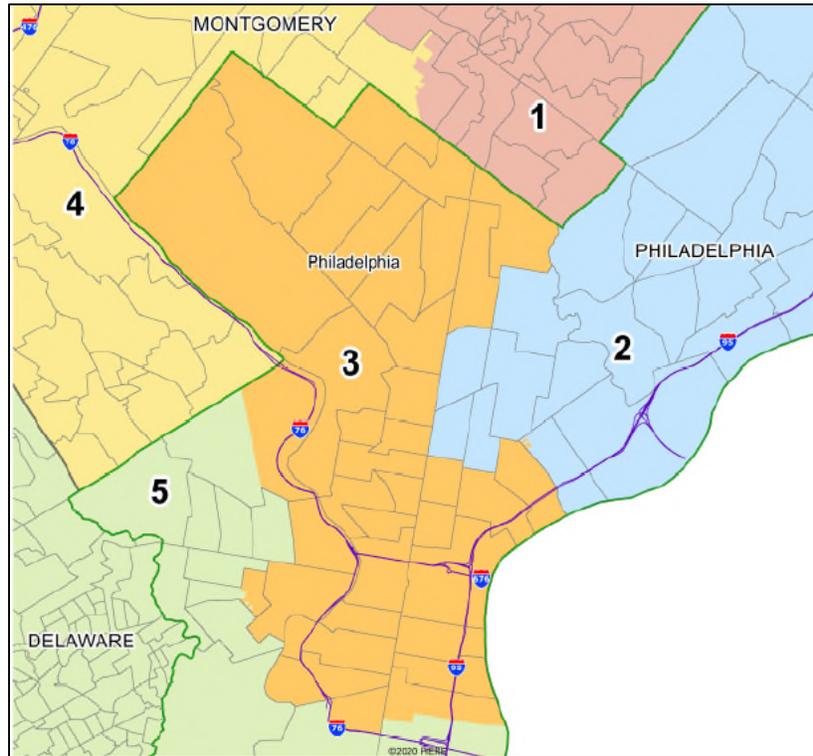
<sup>82</sup> In general elections in the Philadelphia area, Black voters and Latino voters consistently and cohesively support the same candidates, usually by landslide margins, as more than 90% of Black voters and more than 60% of Latino voters cast their ballots for Democratic candidates. *See* DeFord Opening ¶¶9, 119, 135, 140.

<sup>83</sup> *See Id.* ¶55, Table 4.

<sup>84</sup> *Id.* ¶140.

<sup>85</sup> *Id.* About 80% of proposed District 2's residents live in Philadelphia.

## District 3



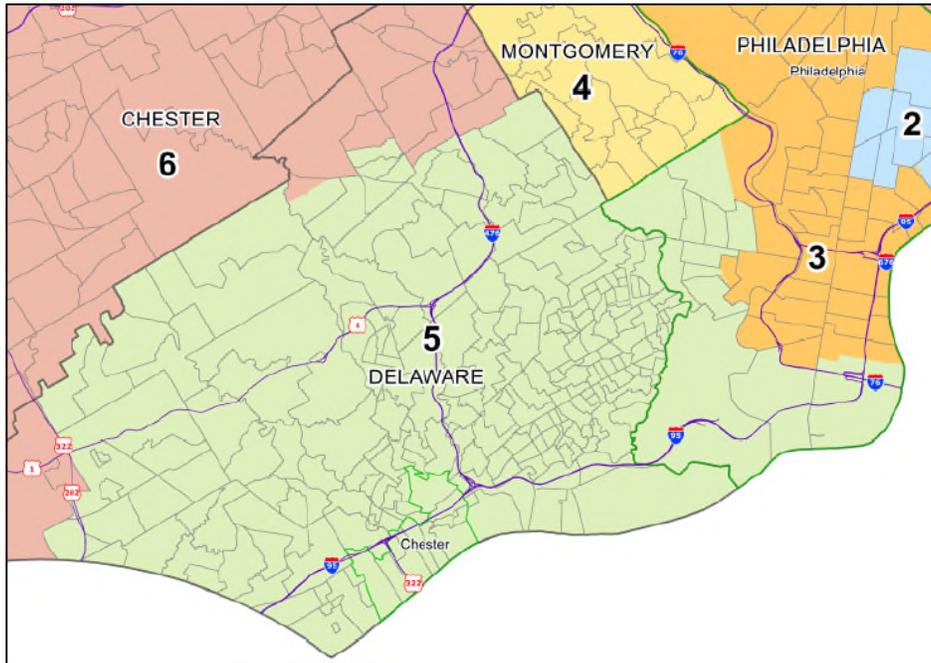
District 3 consists entirely of communities within Philadelphia city limits, joining Northwest Philadelphia, Center City, and parts of West and South Philadelphia. Minority-group members constitute 57% of the district’s voting-age population.<sup>86</sup> Proposed District 3 maintains the core of current District 3 and is a minority opportunity district with a track record of strongly supporting the same Black-preferred candidates that current District 3 supports.<sup>87</sup>

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<sup>86</sup> DeFord Opening ¶117.

<sup>87</sup> Dr. DeFord found that proposed District 3 and current District 3 voted for the same candidate in every citywide Democratic primary since 2015 involving candidates from more than one racial or language minority group. *See id.* ¶48, Table 2.

## District 5



District 5 contains most of Delaware County, linked with parts of West and South Philadelphia. These neighboring communities include the Philadelphia International Airport at the county border, as well as industrial areas in Southwest Philadelphia and the Navy Yard, connecting them with industrial and port facilities south of Philadelphia in Delaware County. Minority-group members constitute 51% of the district's voting-age population.<sup>88</sup> And District 5 is also a minority opportunity district with a track record of strongly supporting the same Black-preferred candidates that the current District 3 supports.<sup>89</sup>

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<sup>88</sup> DeFord Opening ¶117.

<sup>89</sup> *Id.* ¶¶118–19, 128.

The GMS Plan creates these ample opportunities for minority voters without allowing race to predominate. As Dr. DeFord testified, there is no evidence the GMS Plan was created to specifically benefit any racial group or to hit an arbitrary threshold of minority voting-age population.<sup>90</sup> Each of the GMS Plan’s minority opportunity districts is compact, contiguous, and respectful of municipal and ward boundaries and does not raise any concerns associated with racial gerrymandering. Thus, in addition to performing optimally on the neutral criteria and partisan fairness, the GMS Plan also best results in opportunity for Pennsylvania’s diversifying population.

### **III. The GMS Plan Best Addresses Other Legitimate Redistricting Factors.**

Though “wholly subordinate” to the neutral criteria and compliance with the Free and Equal Elections Clause, other factors also may play a legitimate role in redistricting. These can include avoiding incumbent pairings, minimizing unnecessary changes to a prior map, and preserving communities of interest. *See LWV I*, 178 A.3d at 817.

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<sup>90</sup> Tr. 243:13–244:3; *see also Cooper v. Harris*, 137 S. Ct. 1455, 1469 (2017); *Bethune-Hill v. Va. State Bd. of Elections*, 137 S. Ct. 788, 799, 801–02 (2017); *Ala. Legis. Black Caucus v. Alabama*, 575 U.S. 254, 266–67, 275 (2015); *Bush v. Vera*, 517 U.S. 952, 969–73 (1996) (plurality opinion).

**A. Unlike Every Other Plan, the GMS Plan Pairs No Incumbents Seeking Reelection.**

The protection of incumbents can play a role in Pennsylvania’s redistricting process. *See LWV I*, 178 A.3d at 817. Indeed, incumbent “pairing” can be relevant to partisan fairness where a map disproportionately pairs the incumbents of one political party.

The GMS Plan is the only plan that pairs *zero* incumbent Representatives seeking reelection in 2022.<sup>91</sup> By contrast, HB2146, the Carter Plan, the Senate Democrats Plan 1, and the Reschenthaler Plan 2 each pair *two* incumbents seeking reelection, and each of the other plans pairs *four* such incumbents.<sup>92</sup> Some of these pairings have a partisan imbalance: The Senate Democrats Plan 2 and the House Democrats Plan pair three Republicans, while the Reschenthaler Plan 1 pairs three Democrats.<sup>93</sup> The following table summarizes incumbent pairings, with asterisks identifying incumbents not running for reelection<sup>94</sup>:

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<sup>91</sup> DeFord Rebuttal ¶45, Table 15 and App’x A, Table 15a.

<sup>92</sup> *Id.*

<sup>93</sup> *Id.*

<sup>94</sup> *Id.*

<b>Plan</b>	<b>Number of Incumbents Seeking Reelection Who Are Paired</b>	<b>Names of Paired Incumbents (an asterisk indicates the incumbent is not seeking reelection)</b>
GMS	0	<b>District 14:</b> Reschenthaler (R) and Lamb* (D)
HB2146	2	<b>District 8:</b> Meuser (R) and Cartwright (D) <b>District 15:</b> Lamb* (D) and Doyle* (D)
Carter	2	<b>District 15:</b> Keller (R) and Thompson (R) <b>District 17:</b> Lamb* (D) and Doyle* (D)
Sen. Dems. 1	2	<b>District 9:</b> Meuser (R) and Keller (R)
Reschenthaler 2	2	<b>District 7:</b> Keller (R) and Cartwright (D)
Governor	4	<b>District 5:</b> Dean (D) and Scanlon (D) <b>District 12:</b> Keller (R) and Joyce (R)
Sen. Dems. 2	4	<b>District 1:</b> Fitzpatrick (R) and Boyle (D) <b>District 9:</b> Meuser (R) and Keller (R)
House Dems.	4	<b>District 8:</b> Meuser (R) and Cartwright (D) <b>District 11:</b> Perry (R) and Smucker (R) <b>District 17:</b> Lamb (D)* and Doyle (D)*
Reschenthaler 1	4	<b>District 7:</b> Keller (R) and Cartwright (D) <b>District 13:</b> Scanlon (D) and Houlihan (D)
Draw the Lines	4	<b>District 1:</b> Fitzpatrick (R) Boyle (D) <b>District 9:</b> Meuser (R) and Keller (R)
Citizen-Voters	4	<b>District 5:</b> Scanlon (D) Dean (D) <b>District 8:</b> Meuser (R) and Cartwright (D) <b>District 17:</b> Lamb* (D) and Doyle* (D)
Ali	4	<b>District 5:</b> Scanlon (D) Dean (D) <b>District 9:</b> Meuser (R) and Keller (R)
Voters of PA	4	<b>District 1:</b> Fitzpatrick (R) and Boyle (D) <b>District 8:</b> Meuser (R) and Cartwright (D)

Especially given the importance of seniority in Congress, the Commonwealth would benefit from a plan that does not pit incumbents against each other.

## **B. The GMS Plan Pays Proper Deference to the 2018 Plan.**

The “preservation of prior district lines,” otherwise known as “least change,” is another subordinate factor the Court may consider. *LWV I*, 178 A.3d at 817. As Professor Persily has noted, one legitimate purpose of the “least change” approach is to avoid the targeting of specific officeholders for defeat.<sup>95</sup> It appears that some plans, unlike the GMS Plan, may have taken this approach. The most senior Democrat in Pennsylvania’s House delegation, District 8’s Congressman Matt Cartwright—one of only seven Democratic Representatives nationwide who won in November 2020 while President Trump carried his district<sup>96</sup>—finds himself not only paired with a Republican incumbent in six plans (see the table above), but also placed in a district with tens of thousands of new constituents and a significantly larger Republican base in seven of the thirteen proposed plans.<sup>97</sup>

In general, using metrics like “retained population share” to illustrate plan-wide that a redistricting plan is “least change”<sup>98</sup> has limited utility when a change to

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<sup>95</sup> See Nathaniel Persily, *In Defense of Foxes Guarding Henhouses: The Case for Judicial Acquiescence to Incumbent-Protecting Gerrymanders*, 116 HARV. L. REV. 649, 662–63 (2002) (noting that incumbent-protecting districts “frequently operate under a ‘least-change’ principle”).

<sup>96</sup> J. Miles Coleman, *2020’s Crossover Districts*, Ctr. for Politics (Feb. 4, 2021), <https://centerforpolitics.org/crystalball/articles/2020s-crossover-districts/>.

<sup>97</sup> Those seven plans are HB2146, Reschenthaler Plans 1 and 2, the Voters of PA Plan, the Citizen-Voters Plan—and curiously, both the Governor’s Plan and the House Democrats Plan. See DeFord Rebuttal, Table 15 and App’x A, Table 15a.

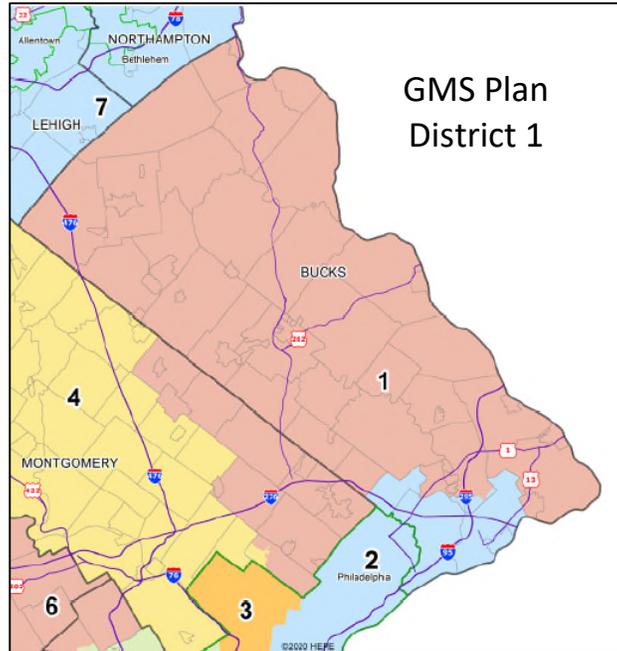
<sup>98</sup> See Rodden Opening at 20.

the number of districts makes it impossible to directly compare the old district to a new district (*i.e.*, there can be no “new” District 18 in a 17-district map). In any event, the GMS Plan performs well on this metric. Between 73% and 95% of the population in most of the GMS Plan’s districts comes from the district’s predecessor in the 2018 Plan, and that is equally true for districts currently represented by Democrats like Representatives Cartwright, Houlihan, and Wild, and by Republicans like Representatives Fitzpatrick, Kelly, and Thompson.

**C. The GMS Plan Preserves Communities of Interest.**

As noted above, the GMS Plan performs better than any other plan in keeping political subdivisions together. Because protecting subdivisions helps “maintain the geographical and social cohesion of the communities in which people live and conduct the majority of their day-to-day affairs,” *LWV I*, 178 A.3d at 814, the GMS Plan likewise preserves communities of interest. However, keeping together communities that do not dovetail precisely with political subdivisions but nonetheless reflect a “common economic base,” “circulation arteries,” shared “schools of higher education,” and common “news media” also can be an appropriate, *Mellow*, 607 A.2d at 208, 220–21, though “wholly subordinate,” *LWV I*, 178 A.3d at 817, consideration in redistricting, *see also Holt II*, 67 A.3d at 1241–42.

A district-by-district overview demonstrates how the GMS Plan—beyond preserving political subdivisions—also substantially preserves communities defined by actual shared interests.<sup>99</sup>

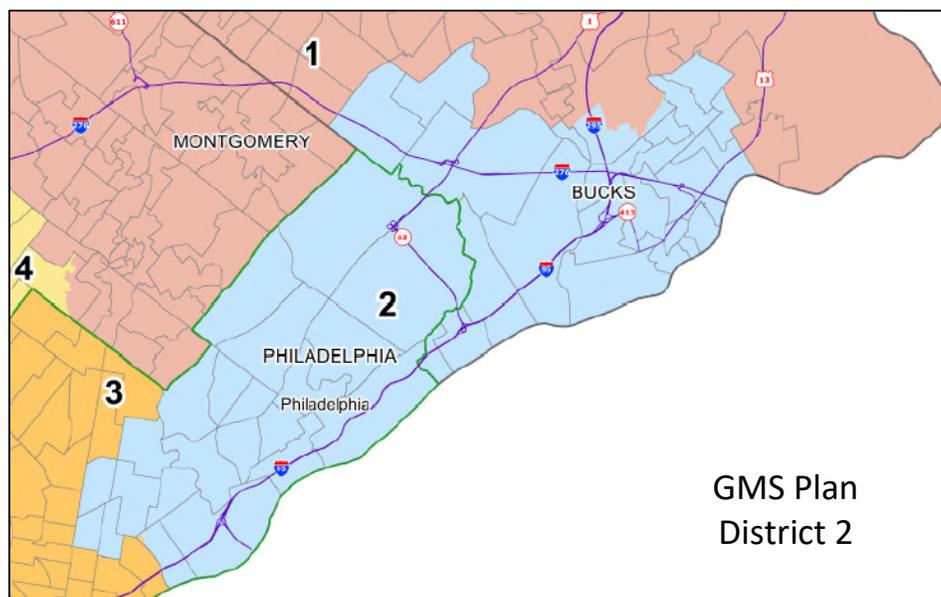


**District 1:** District 1 joins all the communities of Bucks County (other than the relatively diverse inner suburbs nearest to Northeast Philadelphia) with similar communities along the Montgomery County/Bucks County border. This approach is sensible: The communities of Bucks and Montgomery Counties are so closely aligned that the local newspapers in the former county cover news in the latter

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<sup>99</sup> Each of these insets outlines counties in black and cities in green. For most insets, boroughs and townships (along with Pennsylvania’s sole incorporated town) are outlined in gray. For districts in the Philadelphia area, the gray lines show ward boundaries.

county.<sup>100</sup> This area has also experienced notable population growth over the past decade, fueled in part by the rapid expansion of biotechnology in both counties.<sup>101</sup>



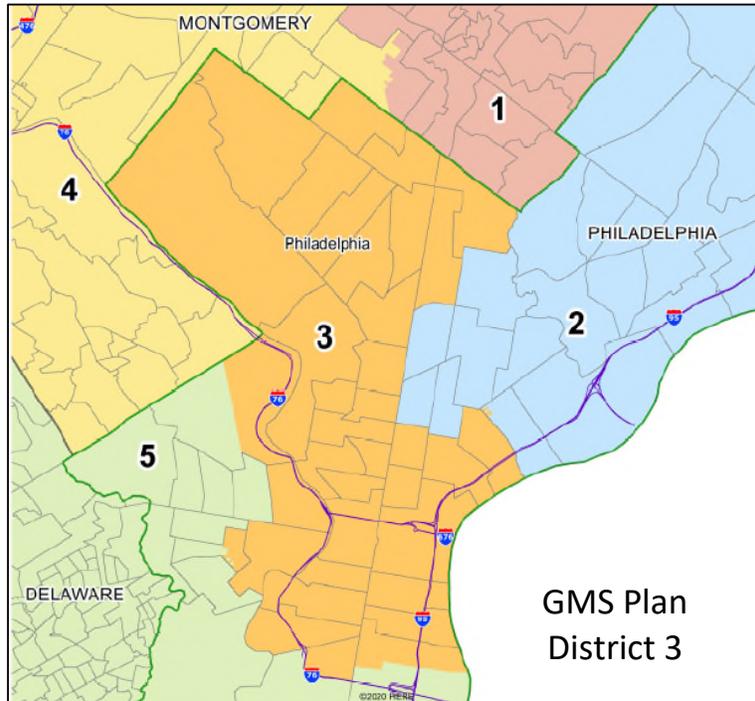
**District 2:** As noted above, District 2 joins a diversifying population in lower Bucks County (including Bensalem, Bristol, and Middletown) with a similar population in Northeast Philadelphia and thus is a minority opportunity district that could provide historic opportunities to Pennsylvania’s growing Latino population. Inner-suburban communities in lower Bucks County, such as Bensalem, also share

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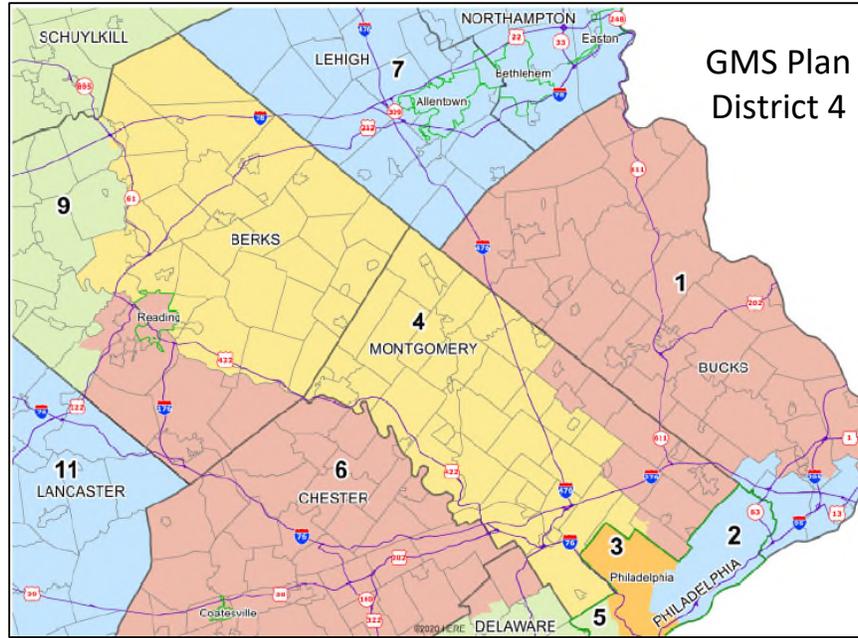
<sup>100</sup> See, e.g., Nick Siano, *Snow Storm Closures: See What's Closed, Delayed in Bucks and Montgomery Counties*, Bucks Cty. Courier Times (Dec. 17, 2020), <https://www.buckscountycouriertimes.com/story/news/2020/12/16/bucks-montgomery-county-closures-see-whats-closed-thursday-pa-storm/3933497001/>; Christopher Dornblaser, *Deed Scam Targeting Montgomery County Homeowners*, Bucks Cty. Courier Times (Sept. 10, 2020), <https://www.buckscountycouriertimes.com/story/news/2020/09/10/deed-scam-targeting-montgomery-county-homeowners/3460196001/>.

<sup>101</sup> See Christine Tarlecki, *Montgomery County Makes List of Top 10 Biopharma Clusters Nationwide*, MontCo.Today (Mar. 23, 2021), <https://montco.today/2021/03/montgomery-county-makes-list-of-top-10-biopharma-clusters-nationwide/>.

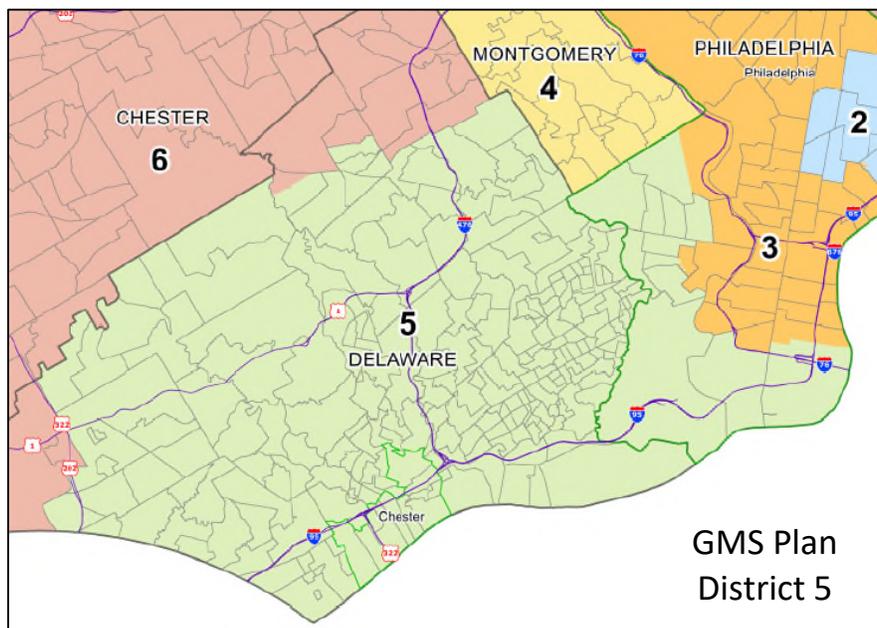
economic interests more akin to their Northeast Philadelphia neighbors than to the more exurban or rural communities in upper Bucks County. This district is connected by Interstate 95, Roosevelt Boulevard (US-1), and multiple SEPTA bus and train lines.



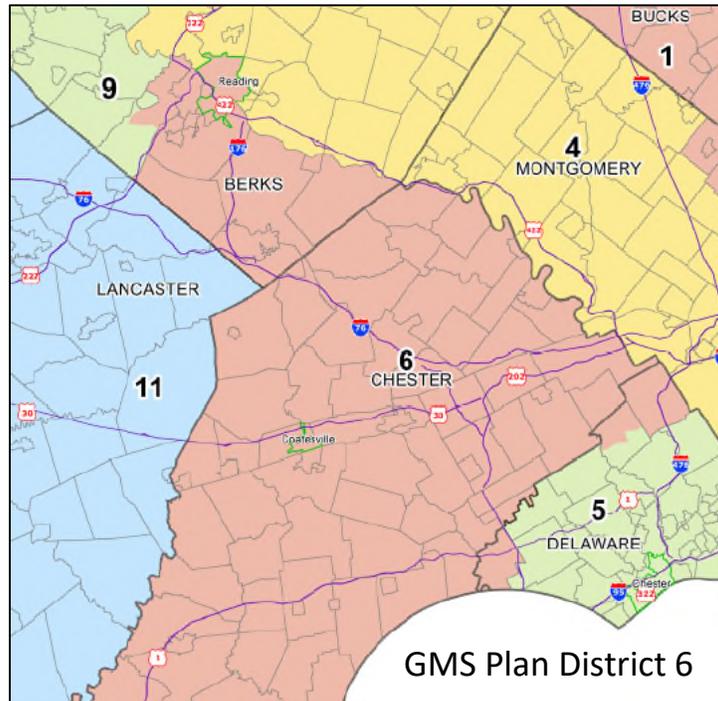
**District 3:** As noted above, District 3 consists entirely of communities within Philadelphia city limits and is a minority opportunity district, much like District 3 in the 2018 Plan.



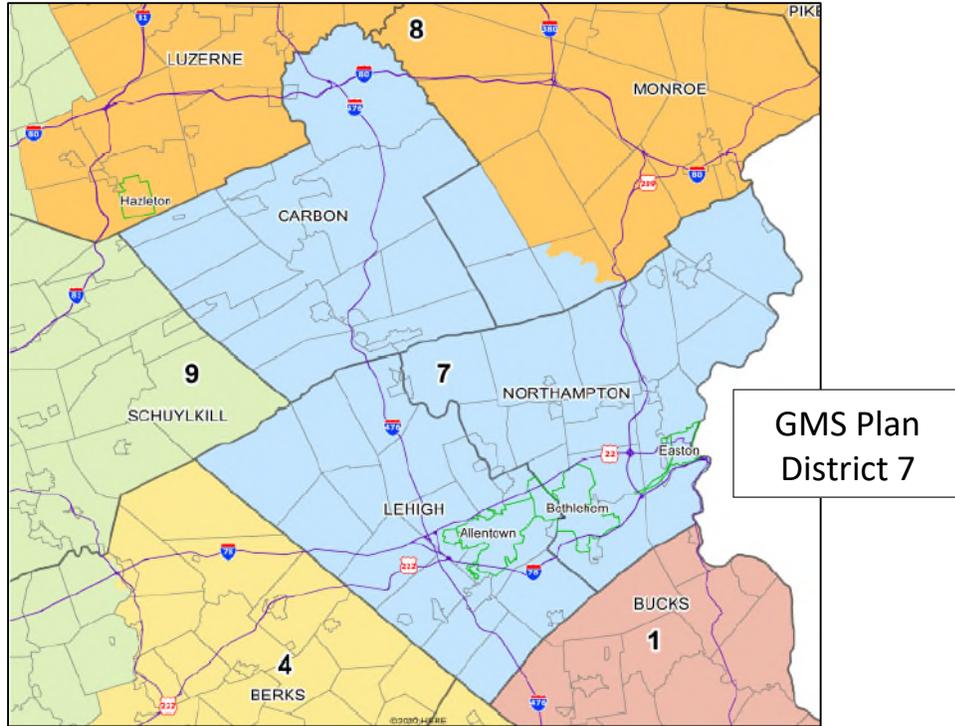
**District 4:** District 4 unites most of rapidly growing Montgomery County with the neighboring communities of eastern Berks County. It follows the northern end of Pottsville Pike (PA-61 N) to the Schuylkill County border, keeping together communities such as Leesport and Hamburg in northern Berks County.



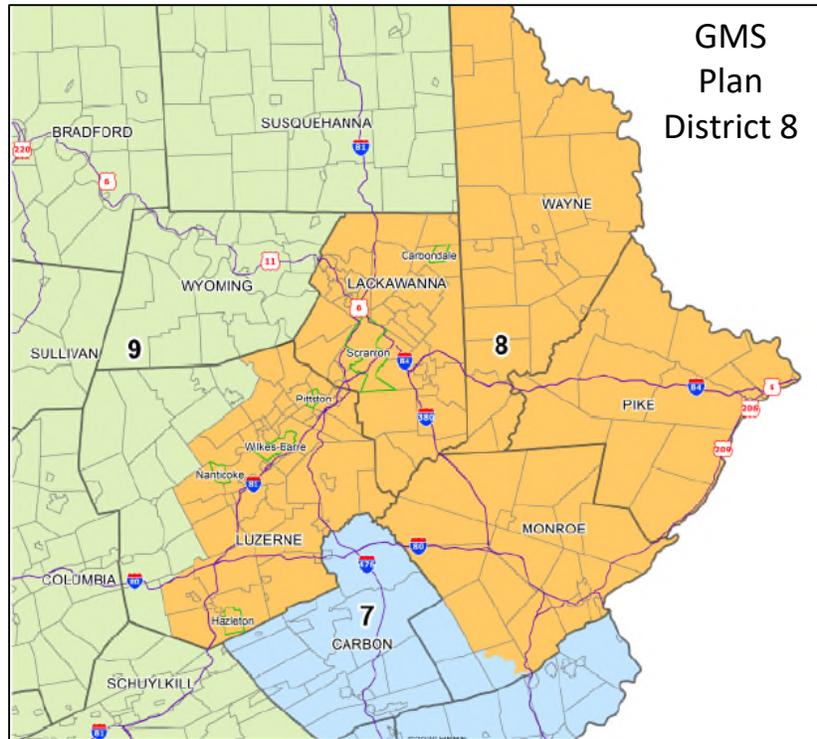
**District 5:** As described above, District 5 is the GMS Plan’s third minority opportunity district and encompasses communities stretching across the Philadelphia-Delaware County border.



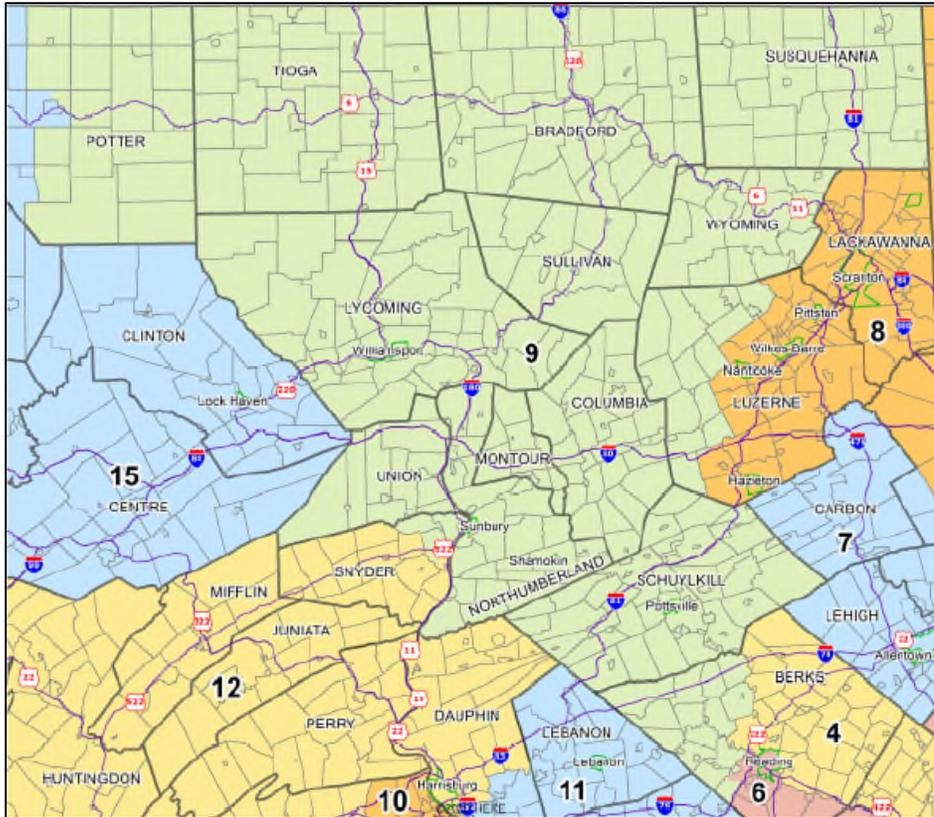
**District 6:** District 6 keeps Chester County intact and, like the 2018 Plan, links it with portions of Delaware County and Berks County, including a region noted for state parks and other natural areas. The district includes all of Reading, Pennsylvania’s fourth largest city, with a growing Latino population. The counties joined in District 6 share strong population growth and increasing diversity.



**District 7:** District 7 joins all of Lehigh, Northampton, and Carbon Counties and thus preserves the core of the Lehigh Valley, keeping the Allentown-Bethlehem-Easton area intact. This district is connected via the Northeast Extension of the Pennsylvania Turnpike (I-476) and its arteries.

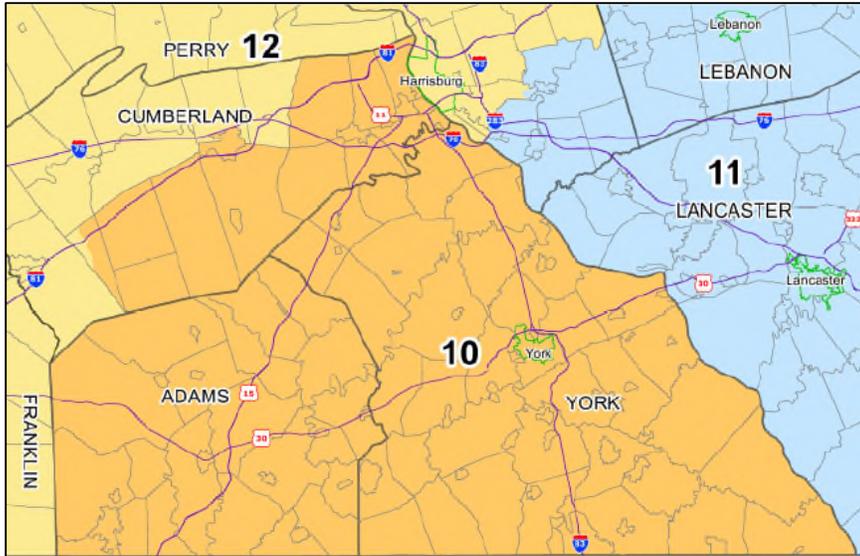


**District 8:** District 8 keeps whole Lackawanna, Wayne, and Pike Counties, and joins them with most of Luzerne and Monroe Counties. This District is anchored by Scranton, Wilkes-Barre, and Hazleton, joining those cities with compatible communities in the Poconos.



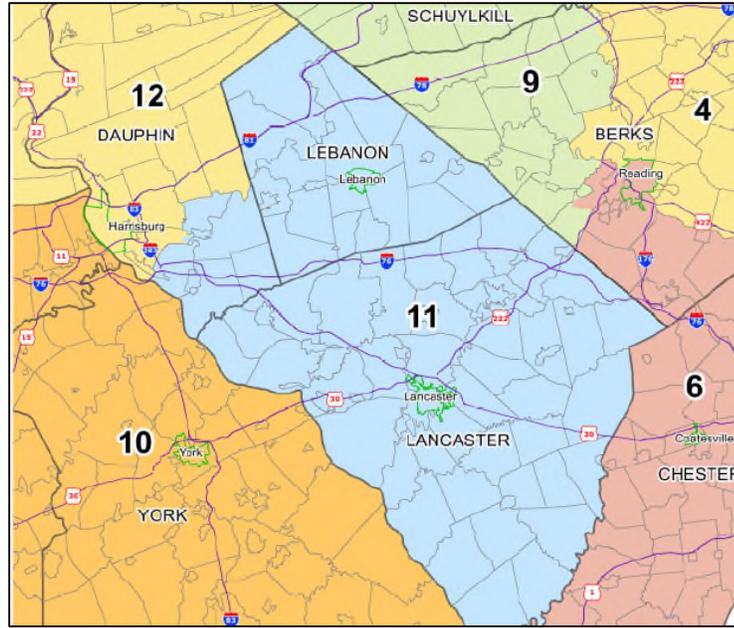
GMS  
Plan  
District 9

**District 9:** District 9 groups the Northern Tier counties of Susquehanna, Bradford, Tioga, and most of Potter with adjoining counties to the south. This portion of the state is experiencing slow population growth, and this district keeps these communities together while preserving 11 counties intact.



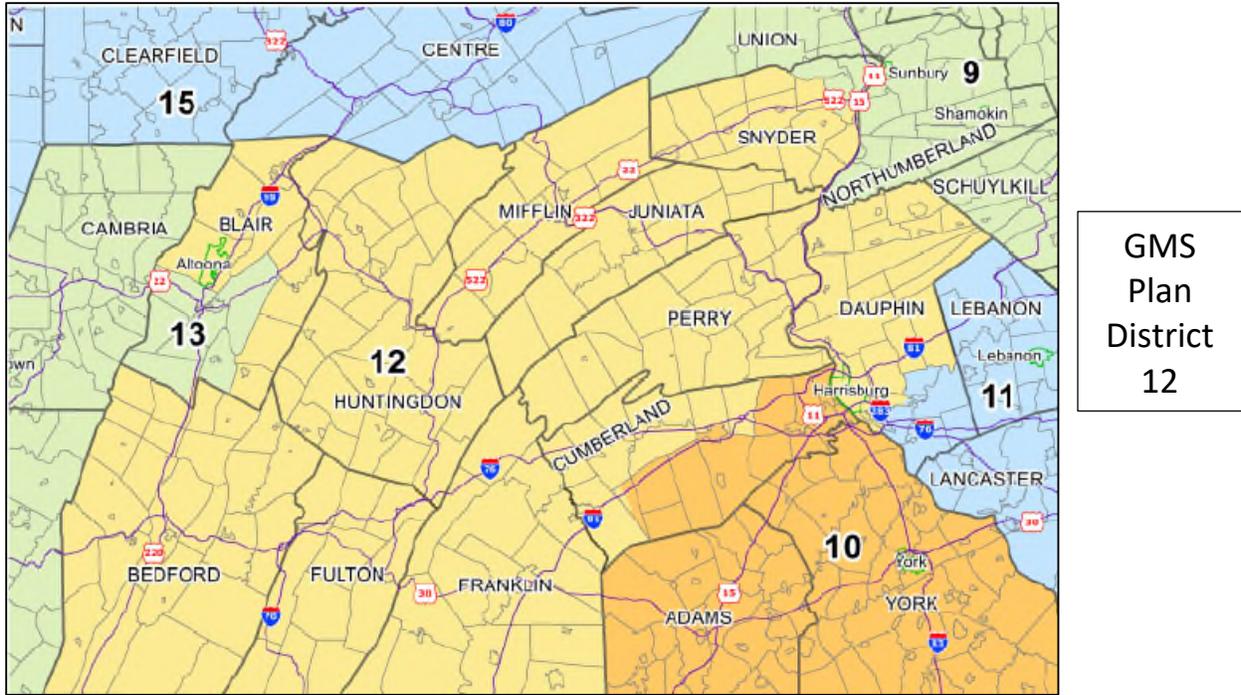
GMS Plan  
District 10

**District 10:** District 10 joins all of Adams County and York County—keeping intact the York-Hanover and Gettysburg Metropolitan Statistical Areas—with adjoining communities in central and eastern Cumberland County, including the county seat of Carlisle. District 10 includes farmland and a shared agricultural heritage but also encompasses a rapidly growing and diversifying area that shares growing manufacturing and logistics industries; is home to many colleges and universities; and is connected by major transportation arteries.



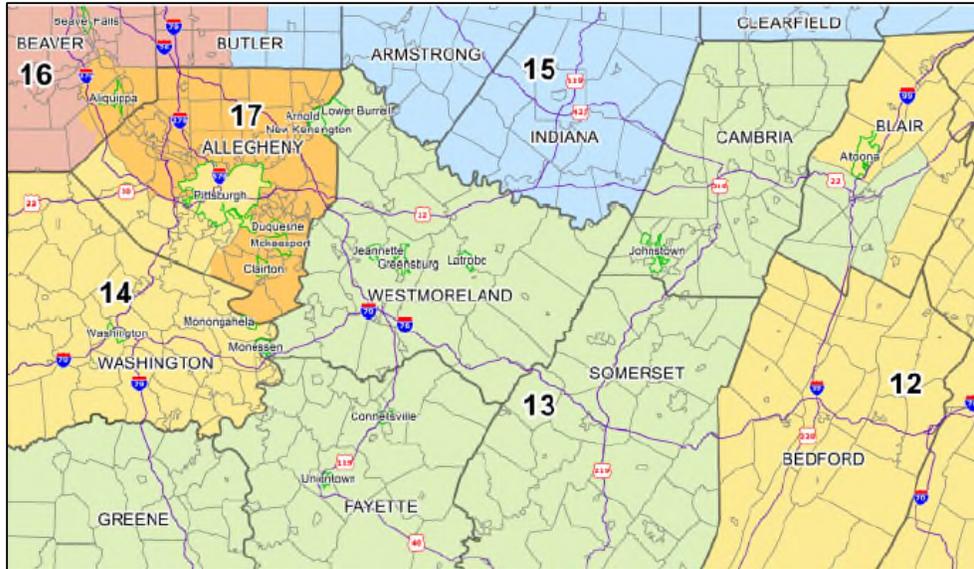
GMS Plan  
District 11

**District 11:** District 11 keeps all of Lancaster and Lebanon Counties intact, as well as the Lancaster and Lebanon MSAs, along with similarly fast-growing and increasingly diverse neighboring communities in Dauphin County. Lebanon and Lancaster Counties feature a shared agricultural history, as well as major regional healthcare providers Lancaster General Hospital and the Penn State Health Milton S. Hershey Medical Center. District 11 is connected by Route 283 and the Turnpike.



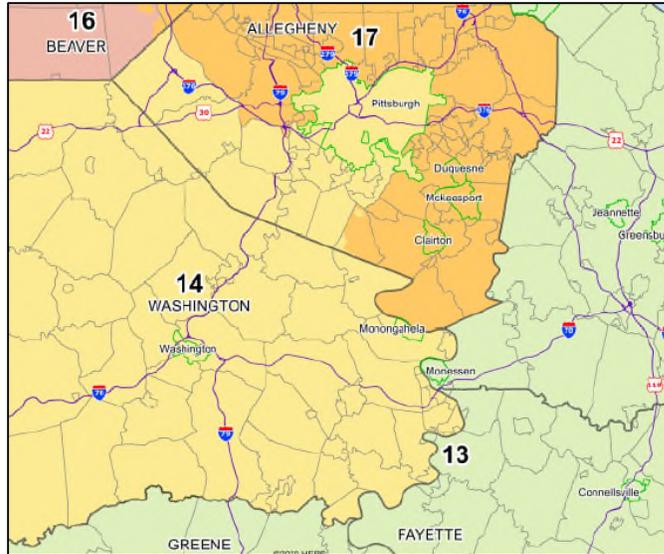
**District 12:** District 12 keeps intact seven whole counties—Bedford, Fulton, Franklin, Huntingdon, Mifflin, Juniata, and Perry—as well as the Chambersburg-Waynesboro MSA. Grouping these counties with parts of Blair, Cumberland, Snyder, and Dauphin Counties, the district contains the mountainous and rural region of south-central Pennsylvania. This district is anchored by the intact cities of Harrisburg and Altoona, whose sports teams compete in the Mid Penn Conference.<sup>102</sup> Amtrak operates a daily train traversing this district from Altoona to Harrisburg.

<sup>102</sup> See, e.g., Jon Fauber, *Harrisburg Girls Fall to Altoona Despite Big Outing from Ahnae Robinson*, PennLive (Feb. 2, 2022), <https://www.pennlive.com/highschoolsports/2022/02/harrisburg-girls-fall-to-altoona-despite-big-outing-from-ahnae-robinson.html>.



GMS Plan  
District  
13

**District 13:** District 13 joins all the Laurel Highlands—Westmoreland, Fayette, and Somerset Counties—with Greene County to the southwest and Cambria County and parts of Blair County to the northeast. This District keeps five counties intact and unites communities with similar economic characteristics and interests in this mountainous area that has historically been a major source of American energy production. Outdoor recreational opportunities in the Laurel Highlands are contributing to a growth in tourism in the area.

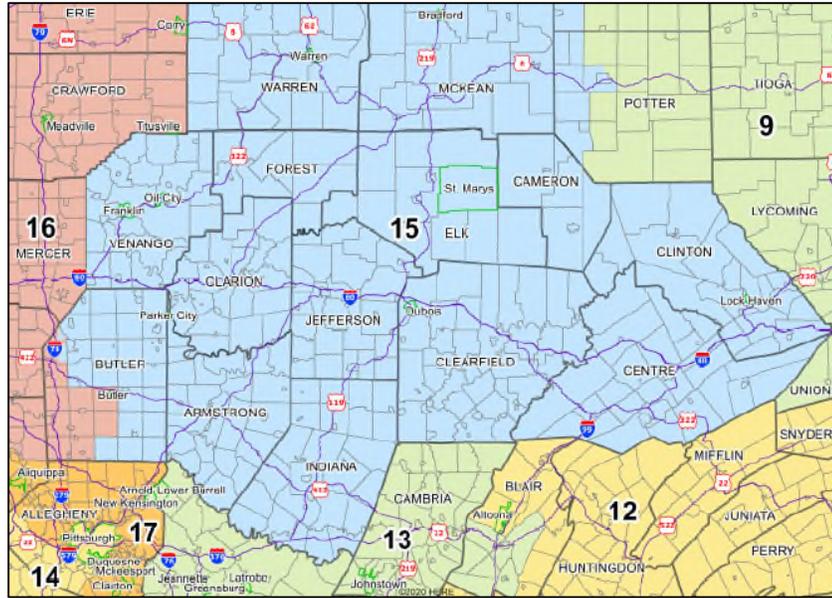


GMS Plan  
District 14

**District 14:** District 14 centers on Pittsburgh, the Commonwealth’s second-largest city, which is kept fully intact. It pairs Pittsburgh with its southwest Allegheny County suburbs and all of neighboring Washington County. The recently opened Southern Beltway runs through District 14, connecting residents of Washington County to southwest Allegheny County, including the Pittsburgh International Airport and surrounding areas—a reflection of the growing economic ties across this district. Indeed, Washington County—home to many Marcellus Shale natural-gas wells—has become an engine of job creation in the Pittsburgh area.<sup>103</sup>

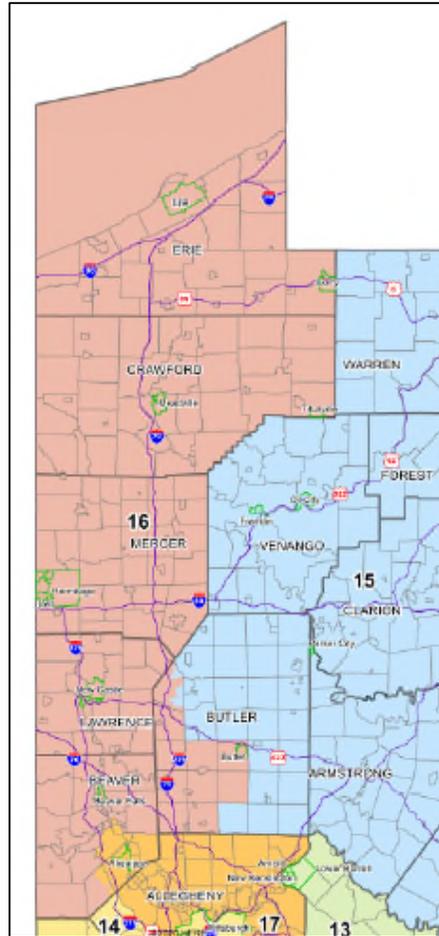
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<sup>103</sup> *Washington County, Pittsburgh Region*, <https://pittsburghregion.org/the-region/washington-county/> (last visited Feb. 12, 2022).



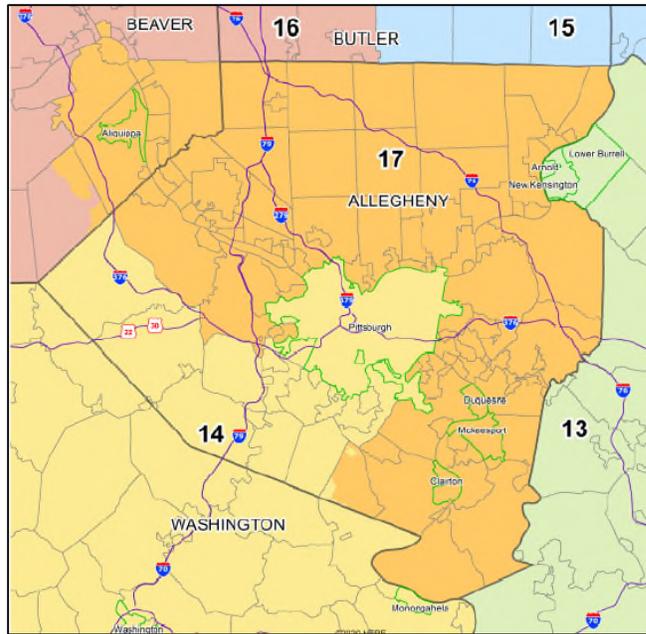
GMS Plan  
District 15

**District 15:** District 15 gathers much of the Pennsylvania Wilds in one district, keeping 13 counties, as well as the State College-Dubois Combined Statistical Area (CSA), whole and intact. District 15 brings together communities that share geological characteristics and economic interests in tourism, outdoor recreational opportunities, and energy production. Whereas the 2018 Plan separated State College from some of its neighbors, this district keeps Centre County whole.



GMS Plan  
District 16

**District 16:** District 16 includes most of Pennsylvania’s western border counties and is anchored by Erie County in the northwest, linking it with other industrial and rural counties to its south: all of Crawford, Mercer, and Lawrence, and most of Beaver and Butler Counties. The district is connected north to south by I-79.



GMS Plan  
District 17

**District 17:** District 17 connects the bulk of the non-Pittsburgh portions of Allegheny County, including Pittsburgh’s northern and eastern suburbs and exurbs, along with neighboring communities in southeastern Beaver County. This keeps the smaller towns and cities that make up Pittsburgh’s North and East Hills together, along with similarly sized former industrial towns in Beaver County.

**IV. Considering All the Factors Together, the GMS Plan Is Best.**

Taking all the constitutional and subordinate factors together, the GMS Plan is the best choice for the people of the Commonwealth. It optimizes performance on the full set of neutral criteria, while maximizing partisan fairness and equal opportunity for Pennsylvanians of all races and ethnicities. The Court need look no further than the data set forth in Attachments A and B to see this is true. Nevertheless, when evaluating the plans, it may be useful for the Court to consider

them in various categories. The chart below illustrates some categories that may aid the Court in evaluating the options:

Category	Plans
Plans that are inferior to the GMS Plan on nearly every redistricting metric	HB2146 House Democrats Senate Democrats 1
Plans with extreme Republican partisan bias	HB2146 Resenthaler 1 Resenthaler 2 Voters of PA
Plans with significant Republican partisan bias	Draw the Lines Ali Citizen-Voters Senate Democrats 1
Plans with more than 1-person population deviation	Ali Carter House Democrats
Plans nearly as fair to both major political parties as the GMS Plan, but inferior on other metrics	Carter Governor Senate Democrats 2

As noted, with respect to partisan fairness, the plans generally fall neatly into three categories: those that are fair, those exhibiting significant partisan bias, and those exhibiting extreme partisan bias. The below table groups the plans based on their performance on fairness metrics as measured by Dr. DeFord and the independent PlanScore.org website (*see also* Attachments A & B):

<b>Partisan Fairness Metric</b> <i>(closer to zero is better)</i>	<b>Most Fair</b>	<b>Significant Partisan Bias</b>	<b>Extreme Partisan Bias</b>
<b>Dr. DeFord’s Average Mean-Median</b> (using all 18 elections from 2012 to 2020)	Sen. Dems 2 (-0.3%) <b>GMS (-0.8%)</b> House Dems (-0.9%) Governor (-1.0%) Draw the Lines (-1.2%)	Carter (-1.6%) Ali (-1.8%) Sen. Dems 1 (-1.9%) Citizen-Voters (-2.0%)	Resenthaler 2 (-2.6%) Resenthaler 1 (-2.7%) Voters of PA (-2.7%) HB2146 (-2.9%)
<b>Dr. DeFord’s Average Efficiency Gap</b> (using the same 18 elections)	Carter (-0.4%) Governor (0.6%) <b>GMS (0.8%)</b> Sen. Dems 2 (1.0%)	Draw the Lines (-1.6%) Sen. Dems 1 (-2.5%) Citizen-Voters (-2.6%) Ali (-2.7%) House Dems (3.3%)	Voters of PA (-4.8%) HB2146 (-6.3%) Resenthaler 1 (-7.8%) Resenthaler 2 (-7.8%)
<b>PlanScore Efficiency Gap</b>	House Dems (1.2% D) <b>GMS (1.4% R)</b> Carter (1.8% R) Governor (1.9% R)	Ali (2.4% R) Sen. Dems 2 (2.4% R) Sen. Dems 1 (2.5% R) Draw the Lines (3.5% R) Citizen-Voters (4.6% R)	Resenthaler 2 (6.3% R) Resenthaler 1 (6.4% R) HB2146 (6.6% R) Voters of PA (6.8% R)
<b>PlanScore Declination</b>	<b>GMS (0.03 R)</b> House Dems (0.04 D) Carter (0.05 R) Governor (0.05 R)	Ali (0.07 R) Sen. Dems 1 (0.07 R) Sen. Dems 2 (0.07 R) Draw the Lines (0.10 R) Citizen-Voters (0.13 R)	Resenthaler 2 (0.18 R) HB2146 (0.19 R) Resenthaler 1 (0.19 R) Voters of PA (0.20 R)
<b>PlanScore Partisan Bias</b>	<b>GMS (0.9% R)</b> Governor (1.1% R) Carter (1.3% R) Sen. Dems 2 (1.5% R)	Sen. Dems 1 (1.8% R) Ali (1.9% R) House Dems (1.9% D) Draw the Lines (2.9% R)	Citizen-Voters (4.3% R) Resenthaler 2 (5.9% R) Resenthaler 1 (6.2% R) Voters of PA (6.5% R) HB2146 (6.3% R)
<b>PlanScore Mean-Median Difference</b>	<b>GMS (0.4% R)</b> Carter (0.4% R) Governor (0.4% R) Sen. Dems 2 (0.5% R)	Sen. Dems 1 (0.6% R) House Dems (0.7% D) Ali (0.7% R) Draw the Lines (1.0% R)	Citizen-Voters (1.7% R) Voters of PA (2.2% R) HB2146 (2.3% R) Resenthaler 1 (2.4% R) Resenthaler 2 (2.4% R)

Following this Court’s mandate in *LWV I* to equalize Pennsylvanians’ votes “to the greatest degree possible,” 178 A.3d at 817, only three maps come close to the **GMS Plan’s** consistently superior performance on all partisan-fairness metrics: Carter, the Governor, and Senate Democrats 2. But none of these plans is as strong on other metrics as the **GMS Plan**:

- The Carter Plan is less fair than the GMS Plan on most fairness metrics, albeit less substantially than other maps. But it also has a population deviation of more than one person; has more total splits and pieces, including two split cities when only one is “absolutely necessary”; is slightly less compact; pairs two incumbents seeking reelection compared to none in the GMS Plan; and has only two majority-minority districts compared to the GMS Plan’s three.<sup>104</sup>
- The Governor’s Plan has substantially more political-subdivision splits than the GMS Plan—indeed, it has **the most total splits of all the parties’ maps**, and the third-most total splits of all the maps, including *amici*’s.<sup>105</sup> Those splits include unnecessarily bisecting Pittsburgh.<sup>106</sup> The Governor’s Plan also pairs four incumbents seeking reelection, moves Representative Cartwright into a substantially more Republican district, and has only two majority-minority districts.<sup>107</sup>
- The Senate Democrats Plan 2 has slightly more splits than the GMS Plan, including the unnecessary splitting of Pittsburgh.<sup>108</sup> This plan also pairs four incumbents seeking reelection, when the GMS Plan pairs none.<sup>109</sup> And this

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<sup>104</sup> DeFord Rebuttal, Tables 1, 3, 6, 7, 8, 14, & 15.

<sup>105</sup> *Id.* at Table 6 and App’x A, Table 6a.

<sup>106</sup> *Id.* at Table 4.

<sup>107</sup> *Id.* at Tables 14 & 15.

<sup>108</sup> *Id.* at Tables & 6.

<sup>109</sup> *Id.* at Table 15.

plan has only two majority-minority districts compared to the GMS Plan's three.<sup>110</sup>

Thus, even the few plans that approach the GMS Plan's level of partisan fairness are inferior under the neutral criteria and other key measures of equal electoral opportunity.

**V. The Court Should Reject the Special Master's Recommendation Because It Rests on Clearly Erroneous Findings and the Misapplication of Redistricting Law.**

Despite the GMS Plan's clear superiority, the Special Master counseled this Court to adopt the vetoed HB2146. *See* Report 216. As summarized here and in the GMS Petitioners' Exceptions, the Special Master's Report is replete with errors of fact and law that wholly undermine its recommendation.

**A. The Special Master Improperly Deferred to the General Assembly's Vetoed Plan.**

At the outset, while the Special Master claimed she was not providing any "presumptive deference" to HB2146 and was instead applying "the same rigorous scrutiny" to that plan and all others, Report 208, only deference could explain selecting a plan that is so clearly inferior to the GMS Plan on all the neutral criteria and objective measures of partisan fairness, minority opportunity, and incumbent non-pairing. *See supra* page 11. The Special Master erroneously believed that "the

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<sup>110</sup> *Id.* at Table 14.

Court *must* find that the decisions and policy choices expressed by the legislative branch are *presumptively reasonable and legitimate*, absent a showing of an unconstitutional defect or deficiency.” Report 208–09 (emphasis added). So, without legal basis, the Special Master *presumed* that HB2146 ought to be adopted and improperly placed a burden on other parties to prove otherwise. *See id.* at 213–15.

The presumption that an unenacted, vetoed bill is entitled to judicial deference is a fatal legal error that infects the entire Report. HB2146 decidedly did not reflect “the will of the people,” *id.*, because it did not attract a single Democratic vote in the General Assembly, was vetoed by Governor Wolf, and did not become law. To adopt the Legislature’s proposed map on this basis would effect a judicial override of the Governor’s veto, in violation of the separation-of-powers doctrine. *Cf. Mental Health Ass’n in Pa. v. Corbett*, 54 A.3d 100, 104 (Commw. Ct. 2012) (citing *Sweeney v. Tucker*, 375 A.2d 698, 705 (Pa. 1977)).

For this reason, other courts addressing redistricting have overwhelmingly declined to defer to maps that made it only partway through the legislative process but failed to become law. *See, e.g., Johnson v. Wis. Elections Comm’n*, 967 N.W.2d 469, 490 n.8 (Wis. 2021); *Hippert v. Ritchie*, 813 N.W.2d 379, 380 n.6 (Minn. 2012); *Hartung v. Bradbury*, 33 P.3d 972, 979 (Or. 2001); *O’Sullivan v. Brier*, 540 F. Supp.

1200, 1202 (D. Kan. 1982) (three-judge court); *Carstens v. Lamm*, 543 F. Supp. 68, 79 (D. Colo. 1982) (three-judge court).

Ignoring this precedent, the Special Master instead relied on *Upham v. Seamon*, 456 U.S. 37, 41–42 (1982) (*per curiam*), cited in Report 208–09. But *Upham* concerned a plan that Texas actually *did enact*. See *id.* at 37–38. Although the plan had not yet received preclearance under then-applicable provisions of the Voting Rights Act, there was no dispute that the legislature passed it and the governor signed it into law. *Id.* So the Special Master disregarded the precedent affording no deference to vetoed plans and instead relied on a case in which the plan had been enacted. This Court should eschew that approach and evaluate all plans equally.

**B. The Special Master Incorrectly Evaluated Political-Subdivision Splits.**

The Special Master adopted a fundamentally flawed approach to evaluating political-subdivision splits. The Special Master claimed that she “accept[ed] the figures offered by each Party’s expert with respect to that Party’s plan” and, when no figure was provided, used the figures in Dr. Duchin’s and Dr. Barber’s reports because their numbers were “highly consistent” with one another. Report 142–43. But the Special Master acknowledged that the experts’ figures—including those from Dr. Duchin and Dr. Barber—were *not* fully consistent. See *id.* at 142 (noting that the numbers “do not always agree”). And what she termed “a few small

differences” (*id.*) were actually material inconsistencies in what each party deemed a “split.” As a result, the Special Master made apples-to-oranges comparisons that led her to incorrectly assess the number of political subdivisions each plan divides.

Dr. DeFord offered comprehensive data on the number of splits in all 13 plans from the parties and *amici* for all six political-subdivision types, all calculated the same way. His calculations show that the Special Master made the following errors:

- Some plans (but not the GMS Plan) split off into a separate district the discontinuous portion of Chester County. The Special Master counted this as a county split for the Governor’s Plan, the Senate Democrats Plan 1, the House Democrats Plan, the Ali Plan, and the Citizen-Voters Plan, but *not* the Carter Plan. *See* Report 143–45.
- The Special Master included municipalities split along county lines in reporting the GMS Plan’s total municipality splits, but *subtracted* municipalities split along county lines in reporting the total municipality splits for all other plans. *See* Report 143–46. This rendered erroneous all the rest of the Special Master’s findings related to municipality splits. *Compare id., with* DeFord Rebuttal, Table 3 & App’x A, Table 3a.
- One of these errors, on which plans split the fewest municipalities, was particularly material: Contrary to what the Special Master erroneously reported, the GMS Plan is tied for splitting the *fewest* municipalities (19)

when including splits along county lines and is also *tied for the fewest* split municipalities (16) when excluding such splits. *Compare* Report 146, with DeFord Rebuttal, Table 3 & App’x A, Table 3a.

- The Special Master reported the wrong totals for split wards in the Carter Plan, Senate Democrats Plan 1, and the House Democrats Plan. *Compare* Report 143–44, with DeFord Rebuttal, Table 5.
- The Special Master reported the wrong totals for overall political-subdivision splits for the Senate Democrats Plan 2, HB2146, Citizen-Voters Plan, and Reschenthaler Plans 1 and 2. Report 147. This error was, again, material: While the Special Master erroneously found that the Senate Democrats Plan 2 split the fewest total political subdivisions and that HB2146 and the GMS Plan were tied for second, in reality the GMS Plan splits the *fewest* political subdivisions. *Compare id.*, with DeFord Rebuttal, Table 6 & App’x A, Table 6a.
- The Special Master mentioned, but failed to use, Dr. DeFord’s pieces metric. Report 67–69. This metric assesses how political subdivisions are split, revealing whether, for example, a plan minimizes the total number of split subdivisions yet heavily carves up those subdivisions it does split. On this metric the GMS Plan is tied for the best.<sup>111</sup>

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<sup>111</sup> DeFord Rebuttal, Table 7 and App’x a, Table 7A.

Individually and collectively, these errors demonstrate that the Court cannot rely on the Special Master’s proposed findings. Instead, the Court should evaluate the evidence in the record for itself—evidence that clearly demonstrates the superiority of the GMS Plan.

**C. The Special Master Incorrectly Analyzed Partisan Fairness.**

The Special Master’s analysis of partisan fairness similarly contains numerous factual errors,<sup>112</sup> but most fundamentally, it misapplies the holding of *LWV I*: that “the overarching objective” of the Constitution’s Free and Equal Elections Clause “is to prevent dilution of an individual’s vote by mandating that the power of his or her vote in the selection of representatives be equalized to the greatest degree possible with all other Pennsylvania citizens.” 178 A.3d at 817. Rather than comprehensively evaluate each plan in light of this objective, the Special Master instead operated from the erroneous premise that “Pennsylvania’s unique ‘political geography,’” which she found benefits Republicans, forecloses the possibility of a map that is truly fair and evenhanded to both parties’ voters. *See* Report 162–63. Indeed, the Special Master asserted that “[t]o overcome this natural geographic disadvantage, ‘Democrats would need a redistricting process that intentionally

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<sup>112</sup> For example, the Special Master inexplicably faults Dr. DeFord for not including Lieutenant Governor races when he calculated partisan-fairness metrics. Report 167. But in general elections, candidates for Lieutenant Governor run on the same ticket as their party’s candidate for Governor, PA. CONST. art. IV, §4, and Dr. DeFord’s analysis included the general elections for Governor (and thus Lieutenant Governor) in both 2014 and 2018.

carved up large cities like pizza slices or spokes of a wheel, so as to combine some very Democratic urban neighborhoods with some Republican exurbs in an effort to spread Democrats more efficiently across districts.” *Id.* at 162–63 (quoting Republican Intervenors’ Br. at 23 n.20).

The GMS Plan proves that premise is false. The GMS Plan does not “carve up large cities like pizza slices.” Indeed, it has a perfect score for city integrity (including keeping Pittsburgh intact) and scores *better* on compactness and political-subdivision splits than the Special Master’s recommended map, while also outperforming that map on all measures of partisan fairness. *See* Parts I–II, *supra*. Both of those things could not be true in the same map if the Special Master was right about the constraints of Pennsylvania’s political geography. And this Court’s 2018 Plan further demonstrates that political geography does not dictate maps that favor Republicans to the degree that HB2146 does:

<b>Metric</b>	<b>HB2146</b>	<b>2018 Plan</b>
DeFord Antimajoritarian Outcomes	5 (all favoring R)	1 (favoring R)
DeFord Avg. Mean-Median	2.9% R	1.9% R
DeFord Avg. Efficiency Gap	6.3% R	2.6% R
PlanScore Mean-Median	2.3% R	0.8% R
PlanScore Efficiency Gap	6.6% R	2.9% R
PlanScore Partisan Bias	6.3% R	2.1% R

This same misunderstanding about Pennsylvania’s political geography led the Special Master to find, erroneously, that the GMS Plan “provides a partisan

advantage to the Democratic party in contravention to the natural state of political voting behavior and bias towards Republicans in Pennsylvania.” Report 205. In fact, each of PlanScore’s partisan-fairness metrics shows that the GMS Plan, like the 2018 Plan, has a very slight *pro-Republican* tilt.<sup>113</sup>

The Special Master further erred in concluding that differences of “a few percentage points” in partisan-fairness metrics do not matter. *See* Report 172. That conclusion apparently rested on her erroneous assumption that expert evidence in *LWV* established specific ranges of “normal” or “acceptable” mean-median and efficiency-gap scores—0% to 4% for mean-median and plus-or-minus 10% for the efficiency gap. *Id.* at 166, 172. But that mean-median expert evidence was based on simulations conducted to demonstrate that the 2011 congressional map was a partisan gerrymander, and the efficiency-gap evidence was not specific to Pennsylvania. *See LWV I*, 178 A.3d at 774–75, 777–78. This Court did not adopt that evidence as setting a universal standard for mean-median and efficiency-gap scores going forward. *See id.* In any event, there is no basis to select HB2146, which bumps up against even the Special Master’s supposed “maximum” acceptable level of partisan bias, when there is an alternative map that *both* is demonstrably fairer on all metrics of partisan fairness *and* performs best on Pennsylvania’s neutral criteria.

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<sup>113</sup> DeFord Rebuttal, App’x D.

The Special Master also erred in relying on Dr. Barber’s testimony on partisan fairness. Despite never having published a single peer-reviewed article about redistricting,<sup>114</sup> Dr. Barber purported to evaluate the fairness of each map by comparing it to the fairness of 50,000 maps generated by a computer-based methodology that he admitted on cross-examination had never been peer-reviewed or adopted by a court.<sup>115</sup> His theory was that Pennsylvania’s political geography creates a natural Republican bias that flows from the spatial distribution of Democratic and Republican voters throughout the state.<sup>116</sup> Accordingly, he opined that if a map is drawn with fidelity to the neutral redistricting criteria but nevertheless contains a partisan bias in favor of Republicans, that bias ought to be considered natural (and thus appropriate) rather than intentional (and thus improper).<sup>117</sup>

On cross-examination, however, Dr. Barber admitted that a skewed map harms voters regardless of whether the skew was intentional or unintentional.<sup>118</sup>

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<sup>114</sup> See Tr. 562:4–12; *see also* Chairman Mark Nordenberg, Opening Statement, Pa. Legis. Reapportionment Comm’n 16–18 (Feb. 4, 2022) (concluding that Dr. Barber’s testimony to the Commission was entitled to little or no weight).

<sup>115</sup> See Barber Rebuttal at 13–14; Tr. 516:4–517:12, 598:21–600:11. In addition, other experts testified that Dr. Barber’s methodology was flawed. Tr. 388:23–390:10 (DeFord), 948:17–950:22, 952:16–24 (Caughey). And multiple courts have “concluded or found that [Dr. Barber’s] testimony should be given little weight or no credit.” Tr. 564:3–565:22 (Barber).

<sup>116</sup> Barber Opening at 10.

<sup>117</sup> Tr. 509:10–512:5.

<sup>118</sup> *Id.* at 581:13–18.

Moreover, he acknowledged that courts generally should prefer an “atypical” map with low partisan bias to a “typical” map with more partisan bias—an admission that rendered his entire testimony largely pointless.<sup>119</sup> Dr. Barber thus effectively conceded that the *LWV I* Court had it right that the “overarching objective” of redistricting in Pennsylvania is to prevent vote dilution. 178 A.3d at 817.

The Special Master erred in selecting a plan that treats voters less equally, when presented with the GMS Plan that treats voters more equally *and also* exceeds HB2146’s performance on all neutral redistricting criteria. The Special Master inexplicably asserted that the GMS Plan “was purposefully created using an algorithm that sought to optimize on partisan fairness.” Report 178, 205. But the “evidence” she cited to support this finding is page 14 of the GMS Petitioners’ opening brief, which says no such thing.<sup>120</sup> More fundamentally, the Special Master did not articulate any reason that a map that optimized partisan fairness would be invalid. As the U.S. Supreme Court has held, there is nothing wrong with designing a redistricting map to “achieve ‘political fairness’ between the political parties.” *Gaffney v. Cummings*, 412 U.S. 735, 735–36 (1973).

The Special Master’s flawed approach to partisan fairness is particularly evident from her selection of the four maps that she asserted best comply with the

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<sup>119</sup> *Id.* at 582:17–586:3.

<sup>120</sup> *See* GMS Opening Br. at 14; *see also* Tr. 277:11–278:23.

Free and Equal Elections Clause and the Constitution’s neutral redistricting criteria. *See* Report 207. Those four receive the most Republican-favoring scores of *all plans* across virtually all metrics of partisan fairness. *See supra* page 59.

**D. The Special Master Incorrectly Analyzed the Communities-of-Interest Factor.**

As explained, a congressional plan’s districts can be drawn to preserve communities of interest. *See* Part III, *supra*. But the Pennsylvania Constitution does not require that a plan preserve communities of interest, beyond those communities defined by the boundaries of political subdivisions, which should not be split “[u]nless absolutely necessary.” PA. CONST. art. II, §16. As this Court has explained, preservation of communities of interest is “wholly subordinate” to the neutral criteria and all other legal requirements. *LWV I*, 178 A.3d at 817.

Ignoring this Court’s guidance, the Special Master elevated the preservation of communities of interest from a permissible, but secondary, redistricting consideration, to a chief requirement. *See* Report 152 (“A common thread running through the Supreme Court’s opinion in *LWV II* is that, to the greatest degree practicable, a congressional redistricting plan should avoid dividing a community with shared interests and concerns.”).

The Special Master compounded this error by erroneously concluding that “the Gressman Petitioners did not adequately establish that they considered community interests when deciding to erect boundary lines across the

Commonwealth.” *Id.* at 155. To the contrary, the GMS Plan appropriately optimizes compliance with the neutral criteria and other legal requirements, while respecting communities of interest throughout the Commonwealth, as described above and conveyed in 15 pages of briefing to the Commonwealth Court.<sup>121</sup>

The Special Master further erred by giving undue weight to Dr. Keith Naughton’s testimony on communities of interest. *See* Report 154–55. Cross-examination revealed that Dr. Naughton’s opinions were based on *ipse dixit* rather than actual expertise.<sup>122</sup> Dr. Naughton admitted he had no particular experience in redistricting;<sup>123</sup> had never published any peer-reviewed articles on redistricting;<sup>124</sup> had never tried to draw a congressional plan for the Commonwealth;<sup>125</sup> identified no

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<sup>121</sup> *See* GMS Opening Brief at 48–63. The Special Master credited Dr. Naughton’s testimony that Bucks County should not be split into two districts because “no other party put forth any evidence or expert opinion that refuted the veracity of his opinion.” Report 157. But in combining parts of Northeast Philadelphia and lower Bucks Counties, the GMS Plan puts together communities with similar interests and, as Dr. DeFord explained, results in a third, and historic, majority-minority district, with Latino adult citizens as the largest minority population. DeFord Opening ¶¶134–140.

<sup>122</sup> As noted, the Special Master frequently credited Dr. Naughton’s opinion simply because “no other party put forth any evidence or expert opinion that refuted the veracity of his opinion.” *See, e.g.*, Report 154–55, 157. The parties, however, had no opportunity to “put forth any evidence or expert opinion” to refute Dr. Naughton, because his sole expert report was not filed until the final deadline for all expert *rebuttal* reports, less than 16 hours before the evidentiary hearing commenced; the Special Master refused to allow rebuttal witnesses; and the Special Master unilaterally decided the order of witnesses, with Dr. Naughton testifying next-to-last.

<sup>123</sup> Tr. 777:22–778:9.

<sup>124</sup> *Id.* 810:14–18.

<sup>125</sup> *Id.* 778:11–20.

polling on what communities in Pennsylvania want in redistricting;<sup>126</sup> used no particular methodology to arrive at his opinions on redistricting in Pennsylvania;<sup>127</sup> and cited no scholarly literature to support his opinions.<sup>128</sup> He admitted that his opinions were based simply on his experience and that he had spent his entire career working only for Republicans.<sup>129</sup> The Special Master’s overreliance on a single biased witness’s *personal opinions* about a consideration subordinate to the constitutional requirements for redistricting was one more in a string of factual and legal errors underpinning her recommendation of the inferior HB2146 Plan.

## CONCLUSION

The Court should adopt the GMS Plan. It fully complies with all state and federal legal requirements, outperforms the other plans on nearly every metric, ensures that all voters will have an equal opportunity to translate votes into representation, expands electoral opportunities for minority voters, preserves numerous communities of interest, pits no incumbents against each other in the upcoming elections, and is fundamentally fair to all citizens of the Commonwealth.

Pennsylvania is entitled to not just a “good” map or even a “great” map to govern its congressional elections for the next decade but, rather, the very best and

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<sup>126</sup> *Id.* 775:24–776:23.

<sup>127</sup> *Id.* at 779:12–17.

<sup>128</sup> *Id.* at 813:6–13.

<sup>129</sup> *Id.* at 698:12–20.

fairest map. Because the GMS Plan is that map, the GMS Petitioners respectfully ask this Court to adopt it for the people of the Commonwealth.

Dated: February 14, 2022

Respectfully submitted,

By: /s/ Kim M. Watterson

Sam Hirsch (PHV)  
Jessica Ring Amunson (PHV)  
Lindsay C. Harrison (PHV)  
Tassity S. Johnson (PHV)  
Claire M. Lally (PHV)  
JENNER & BLOCK LLP  
1099 New York Avenue, NW, Ste. 900  
Washington, DC 20001  
(202) 639-6000  
SHirsch@jenner.com  
JAmunson@jenner.com  
LHarrison@jenner.com  
TJohnson@jenner.com  
CLally@jenner.com

April A. Otterberg (PHV)  
JENNER & BLOCK LLP  
353 N. Clark Street  
Chicago, IL 60654  
(312) 222-9350  
aotterberg@jenner.com

Kim M. Watterson (PA 63552)  
Devin M. Misour (PA 311892)  
REED SMITH LLP  
225 Fifth Avenue, Ste. 1200  
Pittsburgh, PA 15222  
(412) 288-3131  
kwatterson@reedsmith.com  
dmisour@reedsmith.com

Shannon E. McClure (PA 164502)  
REED SMITH LLP  
Three Logan Square  
1717 Arch Street, Ste. 3100  
Philadelphia, PA 19103  
(215) 851-8100  
smcclure@reedsmith.com

*Counsel for Gressman Math/Science  
Petitioners*

## CERTIFICATION OF WORD COUNT

Per Pa.R.A.P. 2135(a)(1), I hereby certify that this Brief contains 13,980 words, exclusive of the supplementary matter as defined by Pa.R.A.P. 2135(b).

Dated: February 14, 2022

/s/ Kim M. Watterson  
Kim M. Watterson (PA 63552)  
REED SMITH LLP  
225 Fifth Avenue, Ste. 1200  
Pittsburgh, PA 15222  
(412) 288-3131  
kwatterson@reedsmith.com

## CERTIFICATE OF COMPLIANCE

I certify that this filing complies with the provisions of the *Case Records Public Access Policy of the Unified Judicial System of Pennsylvania* that require filing confidential information and documents differently than non-confidential information and documents.

Submitted by: Kim M. Watterson  
Signature: /s/ Kim M. Watterson  
Name: Kim M. Watterson  
Attorney No. PA 63552

## **PROOF OF SERVICE**

On February 14, 2022, I caused a copy of the foregoing to be served on all counsel of record via the electronic filing system, PACFile:

/s/ Kim M. Watterson  
Kim M. Watterson (PA 63552)  
REED SMITH LLP  
225 Fifth Avenue, Ste. 1200  
Pittsburgh, PA 15222  
(412) 288-3131  
kwatterson@reedsmith.com

# **ATTACHMENT A**

### Comparison of the Parties' Proposed Congressional Plans

REDISTRICTING PRINCIPLE	METRIC	GMS	CARTER	HB 2146	GOV'R	CONG. INTERV. 1	CONG. INTERV. 2	HOUSE DEMS.	SEN. DEMS. 1	SEN. DEMS. 2	2018 PLAN
Population Equality	Maximum Population Deviation	1 person	2 people	1 person	1 person	1 person	1 person	2 people	1 person	1 person	1 person
Contiguity	Non-Contiguous Districts	0	0	0	0	0	0	0	0	0	0
Compactness	Mean Polsby-Popper <i>(larger is more compact)</i>	0.33	0.31	0.31	0.37	0.35	0.34	0.27	0.30	0.32	0.32
	Mean Reock <i>(larger is more compact)</i>	0.40	0.41	0.38	0.40	0.43	0.41	0.39	0.37	0.38	0.43
	Mean Convex Hull <i>(larger is more compact)</i>	0.80	0.78	0.78	0.81	0.81	0.80	0.75	0.77	0.79	0.79
	Cut Edges <i>(smaller is more compact)</i>	5,546	5,896	5,882	5,154	5,061	5,208	6,821	6,016	5,476	5,789
Respect for Political Subdivisions*	Split Counties	15	14**	15	16**	13	13	16**	17**	16	14**
	Split Municipalities	19 (incl. 3 boroughs on county lines)	23 (incl. 3 boroughs on county lines)	21 (incl. 5 boroughs on county lines)	22 (incl. 4 boroughs on county lines)	20 (incl. 4 boroughs on county lines)	20 (incl. 4 boroughs on county lines)	24 (incl. 6 boroughs on county lines)	25 (incl. 6 boroughs on county lines)	21 (incl. 5 boroughs on county lines)	29 (incl. 6 boroughs on county lines)
	Split Wards	15	21	18	25	25	24	21	17	14	29***
	Total Splits	49	58	54	63	58	57	61	59	51	72
	County Pieces	17	17	18	19	16	16	18	19	18	20
	Municipality Pieces	17	21	18	19	17	17	19	20	17	24
	Ward Pieces	15	21	18	25	25	24	21	17	14	29***
	Total Pieces	49	59	54	63	58	57	58	56	49	73
	Split Cities	1	2	1	2	2	2	1	2	2	1
	Philadelphia Pieces	3	3	4	3	3	3	3	3	3	3
Pittsburgh Pieces	1	1	1	2	1	1	1	2	2	1	
Minority Electoral Opportunity	Majority-Minority Districts (MMDs)	3	2	2	2	2	2	2	2	2	2
	MMDs with Latino Citizens as the Largest Minority Group	1	0	0	0	0	0	0	0	0	0

REDISTRICTING PRINCIPLE	METRIC	GMS	CARTER	HB 2146	GOV'R	CONG. INTERV. 1	CONG. INTERV. 2	HOUSE DEMS.	SEN. DEMS. 1	SEN. DEMS. 2	2018 PLAN
Partisan Fairness	Majority Responsiveness <i>(closer to zero is better; equal split between the two parties is better)</i>	3 (1 D; 2 R)	3 (1 D; 2 R)	5 (all R)	4 (2 D; 2 R)	6 (all R)	6 (all R)	3 (1 D; 2 R)	3 (all R)	3 (2 D; 1 R)	1 (R)
	Potentially Competitive Districts <i>(larger is better; equal split between remaining districts is better)</i>	7 (remaining districts 5 D, 5 R)	8 (remaining districts 5 D, 4 R)	8 (remaining districts 5 D, 4 R)	7 (remaining districts 6 D, 4 R)	9 (remaining districts 5 D, 3 R)	9 (remaining districts 5 D, 3 R)	7 (remaining districts 6 D, 4 R)	7 (remaining districts 6 D, 4 R)	8 (remaining districts 5 D, 4 R)	8 (remaining districts 5 D, 5 R)
	Average Mean-Median <i>(closer to zero is better)</i>	-0.8%	-1.6%	-2.9%	-1.0%	-2.7%	-2.6%	-0.9%	-1.9%	-0.3%	-1.9%
	Average Efficiency Gap <i>(closer to zero is better)</i>	0.8%	-0.4%	-6.3%	0.6%	-7.8%	-7.8%	3.3%	-2.5%	1.0%	-2.6%
	Dr. Duchin's Eguia Metric <i>(closer to zero is better)</i>	-0.0486	-0.1663	-0.9898	-0.0486	-1.2251	-1.2251	0.0102	-0.4015	-0.0486	N/A
	PlanScore Efficiency Gap <i>(closer to zero is better)</i>	1.4% R	1.8% R	6.6% R	1.9% R	6.4% R	6.3% R	1.2% D	2.5% R	2.4% R	2.9% R
	PlanScore Declination <i>(closer to zero is better)</i>	0.03 R	0.05 R	0.19 R	0.05 R	0.19 R	0.18 R	0.04 D	0.07 R	0.07 R	0.08 R
	PlanScore Partisan Bias <i>(closer to zero is better)</i>	0.9% R	1.3% R	6.3% R	1.1% R	6.2% R	5.9% R	1.9% D	1.8% R	1.5% R	2.1% R
	PlanScore Mean-Median Difference <i>(closer to zero is better)</i>	0.4% R	0.4% R	2.3% R	0.4% R	2.4% R	2.4% R	0.7% D	0.6% R	0.5% R	0.8% R
Incumbent Pairings	Districts with Paired Incumbents Who Are Seeking Re-Election	0	1	1	2	2	1	2	1	2	N/A

All metrics are as calculated and reported by Dr. Daryl R. DeFord, except where expressly noted.

\* With respect to the "pieces" metrics, if a political subdivision is wholly contained in one district, it has one *piece*; if a political subdivision is divided between two districts, it has two *pieces*; and so on. Dividing a municipality by drawing a district boundary along a county boundary does not create an additional piece. The pieces numbers subtract the minimum required pieces; for example, 67 county pieces are required because there are 67 counties in the Commonwealth.

\*\* Includes a split of the discontinuous piece of Chester County.

\*\*\* This figure is from *League of Women Voters* materials and is based on ward boundaries at the time. Ward pieces assumes 4,310 wards existed at the time.

# **ATTACHMENT B**

### Comparison of the Gressman Proposed Congressional Plan and the Congressional Plans Proposed by *Amici*

REDISTRICTING PRINCIPLE	METRIC	GMS	DRAW THE LINES	CITIZEN VOTERS	ALI ET AL.	VOTERS OF PA	2018 PLAN
Population Equality	Maximum Population Deviation	1 person	1 person	1 person	8,676 people	1 person	1 person
Contiguity	Non-Contiguous Districts	0	0	0	0	0	0
Compactness	Mean Polsby-Popper <i>(larger is more compact)</i>	0.33	0.37	0.34	0.34	0.38	0.32
	Mean Reock <i>(larger is more compact)</i>	0.40	0.44	0.42	0.41	0.44	0.43
	Mean Convex Hull <i>(larger is more compact)</i>	0.80	0.79	0.79	0.79	0.79	0.79
	Cut Edges <i>(smaller is more compact)</i>	5,546	5,202	5,144	5,233	5,120	5,789
Respect for Political Subdivisions*	Split Counties	15	14	14**	16**	15	14**
	Split Municipalities	19 <i>(incl. 3 boroughs on county lines)</i>	22 <i>(incl. 6 boroughs on county lines)</i>	19 <i>(incl. 3 boroughs on county lines)</i>	24 <i>(incl. 6 boroughs on county lines)</i>	23 <i>(incl. 5 boroughs on county lines)</i>	29 <i>(incl. 6 boroughs on county lines)</i>
	Split Wards	15	16	21	33	41	29***
	Total Splits	49	52	54	73	79	72
	County Pieces	17	16	17	19	16	20
	Municipality Pieces	17	17	17	19	19	24
	Ward Pieces	15	16	21	33	41	29***
	Total Pieces	49	49	55	71	76	73
	Split Cities	1	2	2	2	2	1
	Philadelphia Pieces	3	3	3	3	3	3
Pittsburgh Pieces	1	2	1	2	1	1	
Minority Electoral Opportunity	Majority-Minority Districts (MMDs)	3	2	2	2	2	2
	MMDs with Latino Citizens as the Largest Minority Group	1	0	0	0	0	0

REDISTRICTING PRINCIPLE	METRIC	GMS	DRAW THE LINES	CITIZEN VOTERS	ALI ET AL.	VOTERS OF PA	2018 PLAN
Partisan Fairness	Majority Responsiveness <i>(closer to zero is better; equal split between the two parties is better)</i>	3 (1 D; 2 R)	2 (all R)	2 (all R)	3 (1 D; 2 R)	3 (all R)	1 (R)
	Potentially Competitive Districts <i>(larger is better; equal split between remaining districts is better)</i>	7 (remaining districts 5 D, 5 R)	9 (remaining districts 4 D, 4 R)	8 (remaining districts 5 D, 5 R)			
	Average Mean-Median <i>(closer to zero is better)</i>	-0.8%	-1.2%	-2.0%	-1.8%	-2.7%	-1.9%
	Average Efficiency Gap <i>(closer to zero is better)</i>	0.8%	-1.6%	-2.6%	-2.7%	-4.8%	-2.6%
	Dr. Duchin's Eguia Metric <i>(closer to zero is better)</i>	-0.0486	-0.3427	-0.5192	-0.4604	-0.6957	N/A
	PlanScore Efficiency Gap <i>(closer to zero is better)</i>	1.4% R	3.5% R	4.6% R	2.4% R	6.8% R	2.9% R
	PlanScore Declination <i>(closer to zero is better)</i>	0.03 R	0.10 R	0.13 R	0.07 R	0.20 R	0.08 R
	PlanScore Partisan Bias <i>(closer to zero is better)</i>	0.9% R	2.9% R	4.3% R	1.9% R	6.5% R	2.1% R
	PlanScore Mean-Median Difference <i>(closer to zero is better)</i>	0.4% R	1.0% R	1.7% R	0.7% R	2.2% R	0.8% R
Incumbent Pairings	Districts with Paired Incumbents Who Are Seeking Re-Election	0	2	2	2	2	N/A

All metrics are as calculated and reported by Dr. Daryl R. DeFord, except where expressly noted.

\* With respect to the "pieces" metrics, if a political subdivision is wholly contained in one district, it has one *piece*; if a political subdivision is divided between two districts, it has two *pieces*; and so on. Dividing a municipality by drawing a district boundary along a county boundary does not create an additional piece. The pieces numbers subtract the minimum required pieces; for example, 67 county pieces are required because there are 67 counties in the Commonwealth.

\*\* Includes a split of the discontinuous piece of Chester County.

\*\*\* This figure is from *League of Women Voters* materials and is based on ward boundaries at the time. Ward pieces assumes 4,310 wards existed at the time.