Exhibit A

Report on Proposed Map of Concerned Citizens for Democracy

Anne Hanna and Robert Hess

***Carter v. Chapman*, 7 MM 2022 (Supreme Court of Pennsylvania)**

February 14, 2022

This report presents the proposed remedial 17-seat Congressional map of Concerned Citizens for Democracy (CCFD), analyzes its features, compares it with the present 18-seat Congressional map, and addresses some of the technical issues raised in the Special Master's report to the Court.

This map was designed using the CCFD hand-design mapping methodology, which easily produces districts satisfying the four traditional neutral redistricting criteria of compactness, contiguity, population equality, and minimization of political subdivision splits. In this methodology (set forth in the associated legal brief), one first constructs an initial draft by following four simple steps to produce a first-stage map satisfying the traditional neutral criteria, without yet considering other factors. After this first-stage map is complete, it may then be adjusted, altering some of the initial discretionary decisions while continuing to follow the guidance of the first four steps, to address vote dilution concerns under the federal Voting Rights Act or the Free and Equal Elections Clause (FEEC) of the Pennsylvania Constitution (Article I, Section 5), as well as to incorporate desired subordinate criteria. Given the politically charged nature of the present process, the design process for the CCFD proposed map included incumbent contest avoidance (but *not* intentional incumbent advantage) as a subordinate criterion, in order to produce a final result that may be more palatable to a broader range of stakeholders, while still prioritizing all legal mapping requirements.

1. Qualifications and Experience

Anne Hanna designed and analyzed the CCFD proposed map. She is a data scientist who testified as an expert witness in *Agre v. Wolf*, 284 F. Supp. 3d 591 (E.D. Pa. 2018), the federal anti-gerrymandering case that challenged the 2011 Pennsylvania congressional map before a federal three-judge panel. Her education includes a B.S. in Physics (California Institute of Technology, 2001) and an M.S. in Physics (University of Illinois at Urbana-Champaign, 2005), and she is presently a Ph.D. student in mechanical engineering at the Georgia Institute of Technology, developing data-driven numerical modeling methods for the study of the material properties of composites with complex microstructures. She is a two-time winner of Draw the Lines Congressional mapping competitions. In addition to her work with CCFD, she is a volunteer member of the Draw the Lines Citizen Map Corps and provides mapping and analytical support to Fair Districts PA. She has lived in Philadelphia since 2009.

Robert Hess, Ph.D., CFA® analyzed the Special Master's proposed findings of fact and conclusions of law, as well as her mapping recommendations. He is a research analyst and economist with more than 40 years' experience, specializing in regional economic analysis, regional impact analysis, and real estate investing. He received his Ph.D. in Economics from the University of Colorado in 1978. He completed his undergraduate studies in physics at the Colorado School of Mines (1969). He holds an M.S. degree in Aerospace Engineering Sciences from the University of Colorado (1971). He became a Chartered Financial Analyst (CFA) charter holder in November 2000.

Dr. Hess retired in March 2010 from Prudential Real Estate Investors (now PGIM Real Estate) as a Principal, accumulating more than 16 years of experience providing expertise in the quantitative analysis of regional markets, market selection strategies and investment portfolio analysis. An active industry participant, he served as Chair of the Research Committee of the National Association of Real Estate Investment Fiduciaries (NCREIF) from 2007 to 2009 and served on the NCREIF-PREA (Pension Real Estate Association) Reporting Standards Council from 2011 to 2016. During his working career, he also served on staff research positions at several other financial institutions, consulting firms, and government offices. He has provided data analysis and mapping support to CCFD since 2017.

2. Data Sources and Tools

All map design and most analysis in this report were performed in Dave's Redistricting App (DRA), a free, publicly-available online redistricting mapping and analysis tool available at http://www.davesredistricting.org. The population dataset used was DRA's "Total Population 2020" Census data for Pennsylvania, which does *not* include the prisoner residence adjustments that were used by the Pennsylvania Legislative Reapportionment Commission (LRC).

The site offers a variety of election datasets from 2016 forward. The specific election dataset used for each analysis will be noted in each case.

Some additional analyses were performed offline using QGIS, a free, open-source GIS suite available at http://www.qgis.org. For these analyses, underlying population and geographical data were derived from the "2021 Data Set #1 (Without Prisoner Reallocation)" files provided by the LRC on its website at https://www.redistricting.state.pa.us/maps/.

Incumbent address data, for incumbent contest identification, was obtained from the Pennsylvania Department of State's publicly-accessible version of its voter registration database,

obtained via https://www.pavoterservices.pa.gov/Pages/PurchasePAFULLVoterExport.aspx on July 12, 2021.

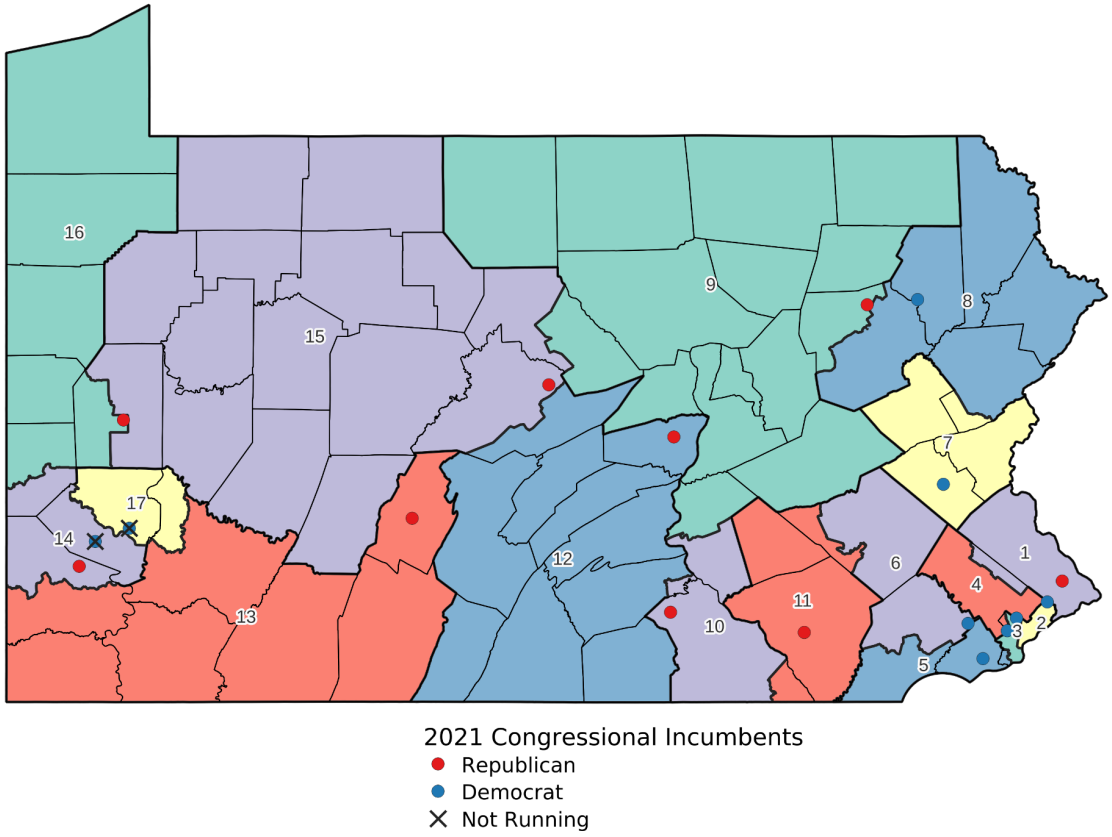
3. The CCFD Proposed Map

The CCFD proposed map can be accessed on Dave's Redistricting at the following link:

https://davesredistricting.org/join/19665c18-15a3-4b94-a254-f93d3feb984c

Full map data can also be downloaded from DRA for analysis in other redistricting software. Figure 1 below is an image of the map.

Fig. 1: CCFD Proposed 17-Seat Map



The map was designed by following the CCFD methodology. There were two major design stages —— producing an initial draft solely based on the four traditional neutral criteria, and then adjusting that draft to avoid vote dilution and address certain subordinate criteria.

4. Map Design Stage 1 (Methodology Steps 1-4)

In the first stage, an initial draft was produced by following steps 1-4 of the CCFD methodology, without close attention to details of partisan impact, incumbent locations, or racial composition of districts, albeit with unavoidable influence from the mapper's knowledge of community and regional identities in our state and previous district designs.

The overriding concerns in this initial draft were simply following the traditional neutral criteria, using methodology steps 1-4 as guides. Rough district prototypes were created as compact assemblages of whole counties, splitting each county no more than necessary,[1] and splitting no more than one county at each boundary between two districts, to begin the population equalization process. District populations were then fully equalized to 12 districts with 764,865 people and 5 districts with 764,864 people by subsequently splitting one municipality at each county split, one political ward in that municipality, and one precinct in that political ward, to equalize district populations while minimizing political subdivision splits.

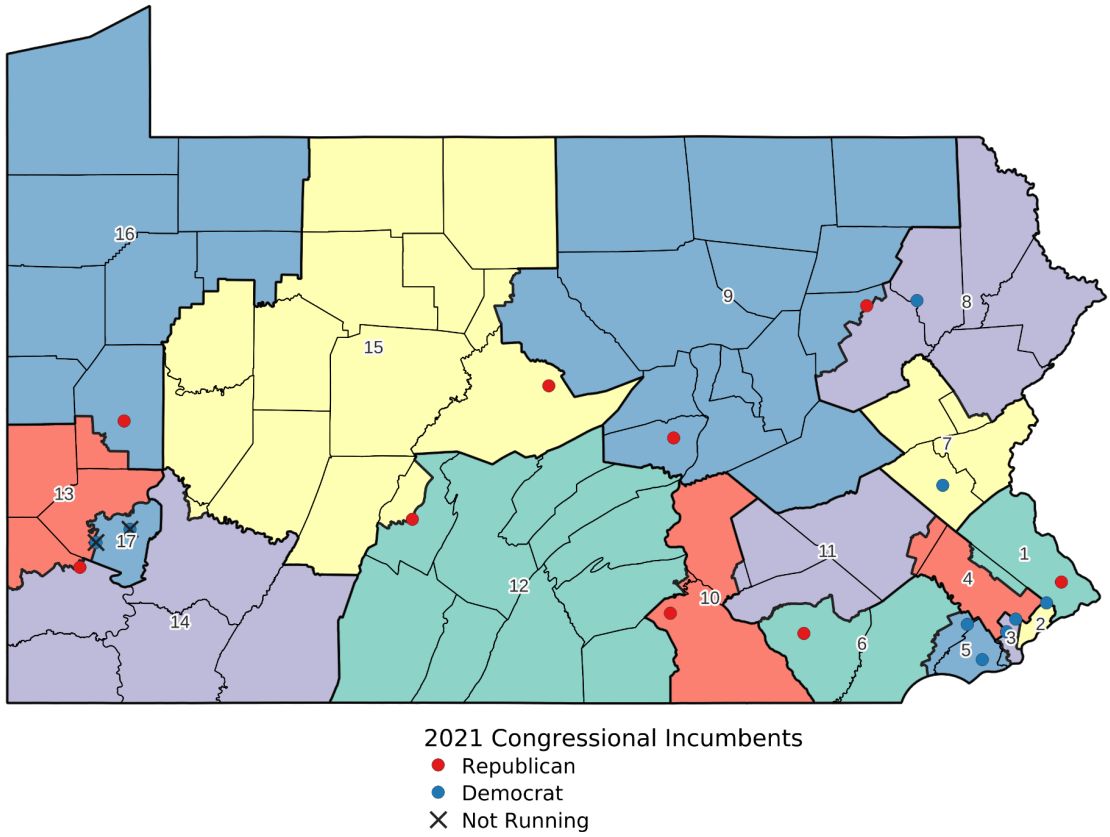
The usual number of county, municipal, ward, and precinct splits by this method is the number of districts minus 1 at each level, i.e., 16 of each type of split on a 17-district map. It is sometimes possible to find clever ways of achieving fewer splits, while additional mapping concerns or anomalies may occasionally require more splits. Larger numbers of districts also tend to produce more variability in the number of splits required, as there may be more anomalous regions to contend with. However, "the number of districts minus 1" is a good rule of thumb to estimate the lowest reasonably feasible number of splits in most maps.

The final results of the first mapping stage are shown in Figure 2 below and may be accessed in more detail at the following URL:

https://davesredistricting.org/join/ed075229-5210-4e51-b4fe-0d5ea9ce59fb

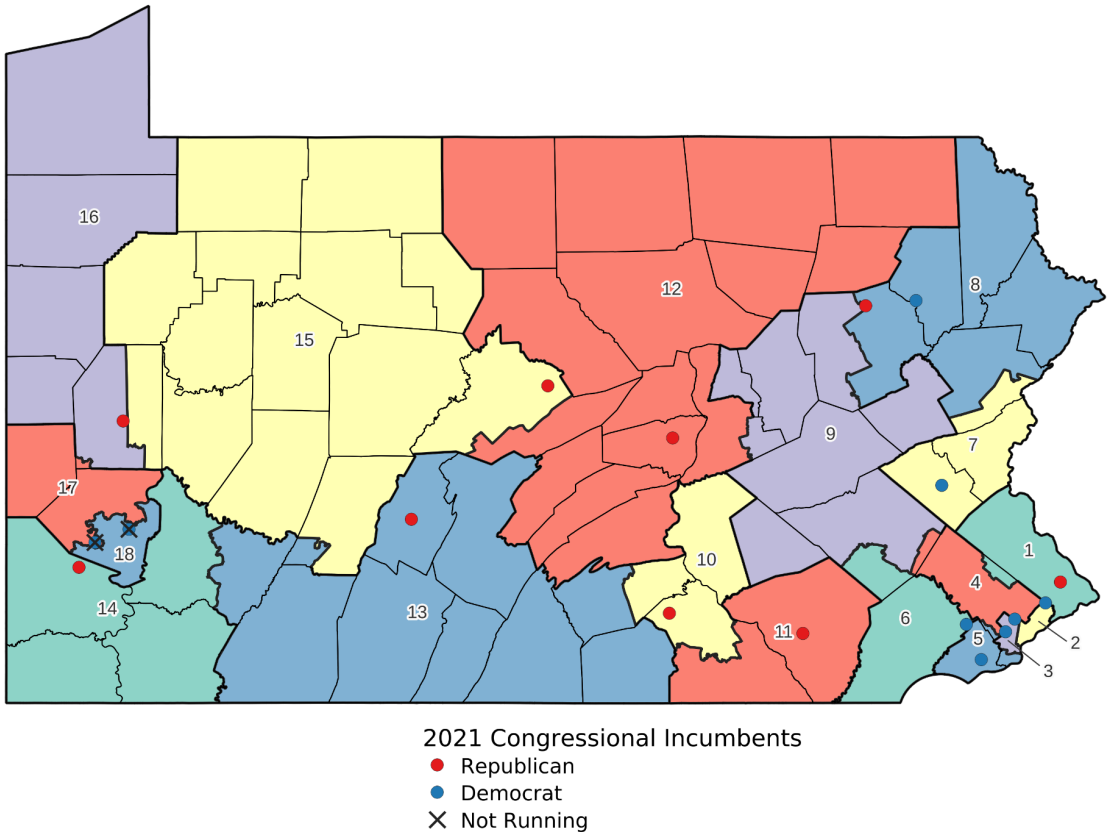
[1] Counties with population less than an ideal district (i.e., the total population of the Commonwealth divided by 17) were split no more than once (i.e., between two districts). Counties with population larger than an ideal district were split amongst no more than the number of districts that could fit entirely within the county, plus 2. (The "plus 2" comes first from the fact that the "remainder" population above the maximum number of whole districts *must* be assigned to at least one additional district, and then from the fact that there are sometimes theoretical or practical limits in certain unusual map topologies that make one additional split beyond the bare minimum necessary or preferable.)

Fig. 2: First design stage of CCFD Proposed 17-Seat Map (traditional neutral criteria only)



The current Congressional map was imposed by the Pennsylvania Supreme Court as part of its 2018 decision in *League of Women Voters v. Pennsylvania, 159 MM 2017* (*LWV*), to remedy the extreme partisan gerrymander of 2011, and was therefore presumptively legal when enacted. As a result, we will use it as a point of comparison for our proposed map, albeit with some caution because of the different number of Congressional seats (18 seats in the current map, *vs.* a coming reduction to 17). Figure 3, below, shows an image of this map.

Fig. 3: Current 18-Seat Congressional map (as of *LWV v. PA*, 2018)



Many of the districts in the CCFD first-stage map bear some resemblance to their counterparts in the current Congressional map, and with good reason —— both maps are constrained by the same traditional neutral criteria, and influenced by the same Pennsylvania mapping traditions and underlying state geography, such as:

- Avoiding splitting Bucks County (which has never been split at the Congressional level)
- Keeping most of Montgomery County in one district (as it is slightly larger than one district in population and was badly and illegally split amongst 6 and 5 districts, respectively, in the gerrymandered 2002 and 2011 maps)
- Keeping the Lehigh Valley in one district
- Keeping Scranton/Wilkes-Barre in one district
- Keeping Reading, Lancaster, York, Harrisburg, and State College mostly together with their respective near suburbs
- Avoiding splitting the city of Pittsburgh
- Avoiding splitting Erie County

The above traditions of privileging certain specific counties, metropolitan areas, and cities for extra attention in split avoidance do not, of course, have the intrinsic status of legal requirements,

although they may, like any mapping decision, have meaningful impacts (positive or negative) on legal questions related to traditional neutral criteria and vote dilution, or on desired subordinate criteria. Rather, following in the tracks of the 2018 *LWV* decision and most past Pennsylvania maps in avoiding splitting these regions, those traditions served as a simple, non-partisan, tiebreaker factor in regions where meaningful mapping discretion existed in this first stage of traditional-neutral-criteria-only mapping.

The changed mapping conditions since 2018 also result in some necessary large-scale structural differences between the present 18-seat Congressional map and this first-draft 17-seat Congressional map, including:

- A decrease in the total number of districts from 18 to 17, requiring each of the remaining districts to absorb a larger total population and thus to increase its land area
- Relative population declines in rural and western Pennsylvania, and relative population increases in urban and eastern Pennsylvania, resulting in districts in the former regions needing to grow more than in the latter

Nevertheless, the traditional neutral criteria statistics of this initial draft are comparable to or better than those of the 2018 *LWV*-imposed Congressional map that is currently in effect, as shown in Table 1 below.

Table 1: Traditional neutral criteria for CCFD first-stage map

	2018 *LWV* 18-seat map	**CCFD 17-seat map, first stage**
Contiguous	Yes	Yes
Maximum-minimum district population difference	1 person (at enactment)	1 person
Polsby-Popper compactness	0.3270	0.3682
Reock compactness	0.4278	0.4328
County splits (Split counties)	18 (14)	16 (15)
Municipal splits (Split municipalities)	19 (18)	16 (15)
Precinct splits	32 (at enactment)	16

Note that an 18-seat map likely requires one more split at each level (expected minimum of 17 splits) than would be needed for a 17-seat map (expected minimum of 16 splits). The first-stage CCFD map achieves the minimum for its seat count of 16 splits of 15 counties (with Philadelphia

split twice), while the 2018 *LWV* map had slightly more than the expected minimum, at 18 splits of 14 counties (Berks, Butler, Montgomery, and Philadelphia all split twice). In all cases except Philadelphia, the second split in each twice-split county of the *LWV* map was a small sliver removed to equalize populations with a neighboring district, and the bulk of each county was in a single district, rendering these excess splits relatively non-disruptive. As Philadelphia has enough population for more than two districts, in both 17-seat and 18-seat maps, a minimum of two splits are always required there.

5. Map Design Stage 2 (Methodology Steps 5-6)

The traditional neutral criteria are not the only factors in play in Pennsylvania redistricting. Concerns about vote dilution based on federal VRA considerations (racial, ethnic, or linguistic minority status) or on Pennsylvania FEEC considerations (other group memberships such as partisan preference) may also be present. Other wholly subordinate considerations, such as avoidance of incumbent contests, may also be present. These considerations necessitate a second design stage, described in steps 5-6 of the CCFD methodology. In these last two steps, the initial map is modified to address considerations beyond the traditional neutral criteria while maintaining the traditional neutral criteria statistics as much as possible. For the second mapping stage of our proposed 17-seat map, we considered the following three factors:

- Majority-minority districts (note that this should not be construed as a full VRA analysis, merely a simple first-order test)
- Partisan proportionality and symmetry (to respect the Pennsylvania FEEC)
- Incumbent contest avoidance, but not incumbent advantage (to improve political palatability of the map; this criterion was considered wholly subordinate to the others)

The relevant statistics for our first-stage 17-seat map, as compared to the 2018 *LWV* map, are in Table 2 below.

Table 2: Racial, partisan, and incumbent statistics for CCFD first-stage map

	2018 *LWV* 18-seat map	**CCFD 17-seat map, first stage**
Majority-minority districts	**District 2:** 59.74% minority *26.97% Black* *23.00% Hispanic* *9.77% other minority* **District 3:** 64.78% minority *51.33% Black* *5.04% Hispanic* *8.41% other minority*	**District 2:** 58.49% minority *26.09% Black* *22.14% Hispanic* *10.26% other minority* **District 3:** 62.95% minority *48.72% Black* *5.47% Hispanic* *8.76% other minority*
Ideal proportional seat count	**18 seats:** 9.44 D, 8.56 R	**17 seats:** 8.92 D, 8.08 R
Likely seat count	9.31 D, 8.69 R	8.35 D, 8.65 R
Raw seat count	10 D, 8 R	9 D, 8 R
Seats bias (+ favors Rs)	+5.07% (+0.91 seats)	+8.05% (+1.37 seats)
Votes bias (+ favors Rs)	+1.79%	+2.74%
Mean-median gap (+ favors Rs)	+0.07%	+0.88%
Incumbent contests	None (at enacttment)	**District 5:** Mary Gay Scanlon (D) Chrissy Houlahan (D) **District 9:** Dan Meuser (R) Fred Keller (R)

Partisan statistics for Table 2 were computed using the DRA "Composite 2016-2020" election dataset, an average of several of the most recent statewide elections. This dataset has a statewide two-party vote share of 52.46% for Democrats and 47.54% for Republicans. Corresponding proportional seat counts for this statewide result are shown in the table.

"Likely" seat counts use DRA's seat win probability estimates to get expected results for an actual election, ignoring incumbent advantage and other variability. "Raw" seat counts assume that the party which is ranked by the election data as having the highest vote share in that district wins the seat, even if narrowly, still ignoring the effects of individual candidate qualities.

Seats bias and votes bias use DRA's model of how precinct-level election outcomes change as the overall statewide vote shares of the two major parties shift, to see whether either party is at a disadvantage. Specifically:

- Seats bias: How much less than half the seats does a party win when it receives 50% of the statewide 2-party vote?
- Votes bias: How much more than 50% of the statewide 2-party vote would a party need to receive in order to win half of the available seats?

Positive numbers mean the Democratic Party is at a disadvantage and the Republican Party has an advantage, while negative numbers indicate the reverse.

The mean-median gap measures the difference between the overall statewide 2-party vote share and the 2-party vote share of the median district. A large difference means that the 2-party vote share distribution of the districts is skewed in favor of one party — more districts are more favorable to them than one would expect. A positive number in the table indicates a Republican advantage.

From this table we can see several points of potential improvement for the first-stage map relative to the vote dilution criteria and our subordinate criterion of incumbent contest avoidance:

Minority-majority districts

While the CCFD first-stage map has approximately the same two majority-minority districts as the 2018 map, Districts 2 and 3, and while the total minority populations of both districts are similar, District 3 is slightly less than majority-Black in the CCFD first-stage map, while it is narrowly majority-Black in the present map. While creating supermajority-minority districts sometimes runs the risk of unnecessarily packing both Black voters and Democratic voters, advocacy groups are often skeptical of changes which push a district from having a majority of a single racial or ethnic group to requiring a cross-ethnic coalition for victory.

Fortunately, the percentage change in racial composition of District 3 is small, and is easily remedied in the final version of the map, without too much change to neighboring district statistics. This is accomplished via relatively minor boundary shifts — a slightly whiter region of Northwest Philadelphia moves to join most of Montgomery County in District 4, allowing District 3 to include more of heavily-Black West Philadelphia. The cost is a single additional county/municipal split in Philadelphia, for a total of 4 Philadelphia splits, still meeting our county split limit for the city, and balanced by the removal of a split in Berks County that was previously providing extra population to District 4.

Incumbent Contests

Two pairs of incumbents are placed into potential contests in the CCFD first-stage map, which was designed without detailed reference to their locations. Two Democrats meet in Democratic-leaning District 5, while two Republicans meet in strongly-Republican District 9. This outcome at least penalizes both parties equally, and so does not impact the partisan fairness of the map, but nevertheless fails to avoid incumbent contests as well as the 2018 *LWV* map did.

The fact that Pennsylvania is losing one seat this year does not intrinsically force any incumbent contests, as one Democratic incumbent (Mike Doyle, District 18) is retiring, and another (Conor Lamb, District 17) has announced a run for the U.S. Senate. However, there is somewhat of a "traffic jam" of Representatives concentrated in eastern Pennsylvania, which produces the two incumbent contests in our initial incumbent-blind draft. These contests therefore require some specific attention, in order to satisfy the incumbent contest avoidance subordinate criterion.

Resolving the Scanlon/Houlahan contest

Houlahan lives in Chester County, right at the corner where Chester, Montgomery, and Delaware Counties meet. Scanlon lives approximately in the center of Delaware County. The first-stage map puts both in a 5th District that consists of all of Delaware County, a small piece of southwestern Philadelphia, and a number of border municipalities in eastern Chester County. As Houlahan lives in one of those border municipalities, to keep the two Representatives apart, it is necessary to have the 5th District either "go around" her to keep her out of the 5th district, or push the 5th into Montgomery County or further into Philadelphia.

Taking more of Philadelphia would in turn push Philadelphia's 2nd District partway into Bucks County (which we and others have prioritized not splitting), while adding part of Montgomery County threatens to pull Madeleine Dean into the 5th District, as she lives near the southern tip of Montgomery County. So, instead, the 5th District's Chester County portion was reshaped to include the southern portion of the county, along its borders with Delaware and Maryland, moving Houlahan into the 6th District. This unfortunately created a new incumbent contest with Republican Lloyd Smucker, who lives near Lancaster, and so the 6th District was migrated to include most of Berks County (to the north), instead, while the 11th gave up most of Berks and took the rest of Lancaster instead.

The final result was Scanlon remaining in the 5th District, Houlahan moving to the 6th District, and Smucker moving to the 11th District.

The impacts of resolving this contest were relatively localized and did not result in a net increase in political subdivision splits. The new 5th District is somewhat less compact than before, but, as we will see below, the overall impact on the map compactness statistics is small.

Resolving the Meuser/Keller contest

Separating Meuser and Keller has a somewhat broader impact. Snyder County, where Keller lives, is shifted from the 9th District to the 12th, the remainder of Blair County, where Republican John Joyce lives, is shifted to the 13th District, along with Bedford County, and Potter County moves to the 9th to help make up for the population loss of Snyder. There are several additional smaller adjustments around Harrisburg, northern Dauphin County, southern Centre County, and northern Clinton County, to help complete the population rebalancing without introducing excess splits and while keeping districts reasonably compact.

To make up for other population losses, the 15th District now also pushes westward to include Warren, Forest, Venango, and most of Butler County (halted only by the presence of Republican Mike Kelly in the center of Butler County). This, in turn, pushes the 16th District down into the northern half of Beaver County, and moves the 14th District down, out of Butler County and further into the northern portion of Washington County. The Allegheny portion of the 14th District must be reoriented to keep the 14th and 17th Districts compact, but the choice of precisely *how* to reorient it is a matter for the partisan fairness discussion.

The net result of these changes is:

- two additional county/municipal/precinct splits, resulting from:
    - splitting off the northern half of Dauphin County to maintain the population of the 9th District
    - splitting Beaver County to maintain the population of the 16th District
- a slight decrease in overall map compactness, with the most significant contribution arising from the east-west narrowing and north-south lengthening of the 16th District

As with the previous incumbent contest resolution, however, the overall statistics remain well within the reasonable traditional neutral criteria range. (The final results will be summarized in Table 3, below.)

Partisan fairness

At first glance, Table 2 appears to show that both the 2018 *LWV* map and the first-stage CCFD map produce closely balanced maps. The seat count statistics (both raw and likely) hover around 9D/9R to 10D/8R for the *LWV* map and 8D/9R to 9D/8R for the first-stage CCFD map, under the election dataset used. All of this might seem superficially reasonable for our "purple" state.

However, it is important to note that "eyeball" results from a single election dataset, even a multi-election, multi-year average dataset such as the DRA Composite 2016-2020 data underlying that table, are an inadequate measure of the partisan fairness of a map. First, while

Pennsylvania is generally considered to be a well-balanced "purple" state, the 2-party vote share of that dataset is actually 52.46% for Democrats and 47.54% for Republicans. This may seem like a small difference, but, converted proportionally into a district share, the difference in vote shares corresponds to 0.88 of a district on an 18-seat map and 0.84 of a district on a 17-seat map. In other words, one might expect that, if recent Pennsylvania elections averaged around a 52.46% Democratic seat share, Democrats would be expected to win, on average, nearly a full seat more than Republicans. One would therefore expect that analyses of a "fair" map performed using such an underlying election dataset would show a small but meaningful seat count advantage for Democrats.

In this light, even the seat count analysis already shows some warning signs in regard to the partisan fairness of the first-stage CCFD map. While the 2018 *LWV* map shows a slight "likely seat" advantage for Democrats of 9.31 D seats to 8.69 R seats, as one might expect from an election dataset with a slight Democratic advantage, the first-stage CCFD map actually shows a slight "likely seat" disadvantage under the same election data: 8.35 D seats to 8.65 R seats. Other statistics show even more if an imbalance — while both maps show a Republican advantage in seats bias (half the expected seat difference in a 50/50 election) and votes bias (the excess votes above 50% that a party has to win to receive half the seats), both bias scores show a more than 50% greater disadvantage for Democrats in the CCFD first-stage map than in the *LWV* map. The first-stage CCFD map also has a small mean-median gap favoring Republicans (i.e., more districts are more favorable to their candidates than one would expect), compared to the almost zero gap in the *LWV* map.

Despite the strong traditional-neutral-criteria statistics of the CCFD first-stage map, these significantly larger bias scores could potentially raise Free and Equal Elections Clause concerns about whether voters' ability to convert their votes into representation is being unfairly diluted based on their party preference. Thus, adjustments to the initial draft are potentially warranted to address this issue while still preserving the traditional neutral criteria statistics of the map as much as possible.

Fortunately, adjustments for partisan fairness do not, in this case, conflict with the previous adjustments made to preserve majority-minority districts and avoid incumbent contests. The majority-minority voting district adjustments primarily affected strongly Democratic-voting regions of the state and so had little impact on the overall partisan balance of the map. The incumbent contest avoidance adjustments actually improved the partisan balance of the map in several ways:

- Undoing suburban packing in Delaware and eastern Chester Counties
- Shifting more-rural northern Dauphin County into the 9th District, while incorporating more of eastern Cumberland County into the 10th District (reducing, although not eliminating, division of the more Democratic-leaning Harrisburg region)
- Moving more-rural Warren, Forest, Venango and eastern Butler Counties out of the 16th district and including more of somewhat more industrialized northern Beaver County in the district, thereby undoing some division of Pennsylvania's western "Rust Belt" region

The major partisan balance issue which remained after these adjustments was the potential for packing of the Pittsburgh region. The "tradition" of not dividing the city of Pittsburgh during redistricting is relatively recent, unlike most other non-division traditions. In the early part of the 20th Century, when Pennsylvania had more than 30 Congressional seats (for a maximum of 36 from 1913-1933), Congressional district populations were small enough that Pittsburgh was divided amongst multiple districts. This continued until the 1982 redistricting, when Pennsylvania's apportionment fell from 25 to 23 seats, and Pittsburgh was undivided in Congressional redistricting for the first time. Since then, seat counts in Pennsylvania have continued to fall, as other regions of the country grow faster than Pennsylvania, and Pittsburgh has remained undivided ever since.

Avoiding the division of municipalities is not only a traditional neutral redistricting criterion, it can also be important for avoiding cracking, that is, fragmenting the representation of small communities to the point where they are unable to have a meaningful voice in the selection of representatives of their choice. This is the rationale behind the traditions of avoiding division of small metropolitan areas such as the Lehigh Valley, Scranton/Wilkes-Barre, Harrisburg, State College, Lancaster, Reading, York, and Erie — these regions are relatively populous compared to surrounding rural areas, but not so populous that the majority preferences of the residents of those regions can be translated into actual representation if the regions are divided amongst multiple districts. However, the Pittsburgh metropolitan area, while not as large as the Philadelphia region, is still significantly larger than any other metropolitan area in the state.

While Pittsburgh itself, with a population of 302,971 as of the 2020 Census, is smaller than an ideal 17-seat Congressional district (764,864 or 764,865 people), its metropolitan area includes more than 2 million people (2,370,930) across 7 counties, equivalent to 3.14 Congressional districts. The next-largest metropolitan area in the state is the Lehigh Valley, which, at 861,889 people, is only a little larger than 1 Congressional district (1.14 districts), small enough that it could easily be cracked by careless or malicious map design. The Pittsburgh region, on the other hand, is large enough to potentially face the opposite challenge, that of being "packed" into as few districts as possible, to reduce the substantial ability of voters in the region to translate their votes into representation. An insistence on abiding by the aforementioned relatively modern

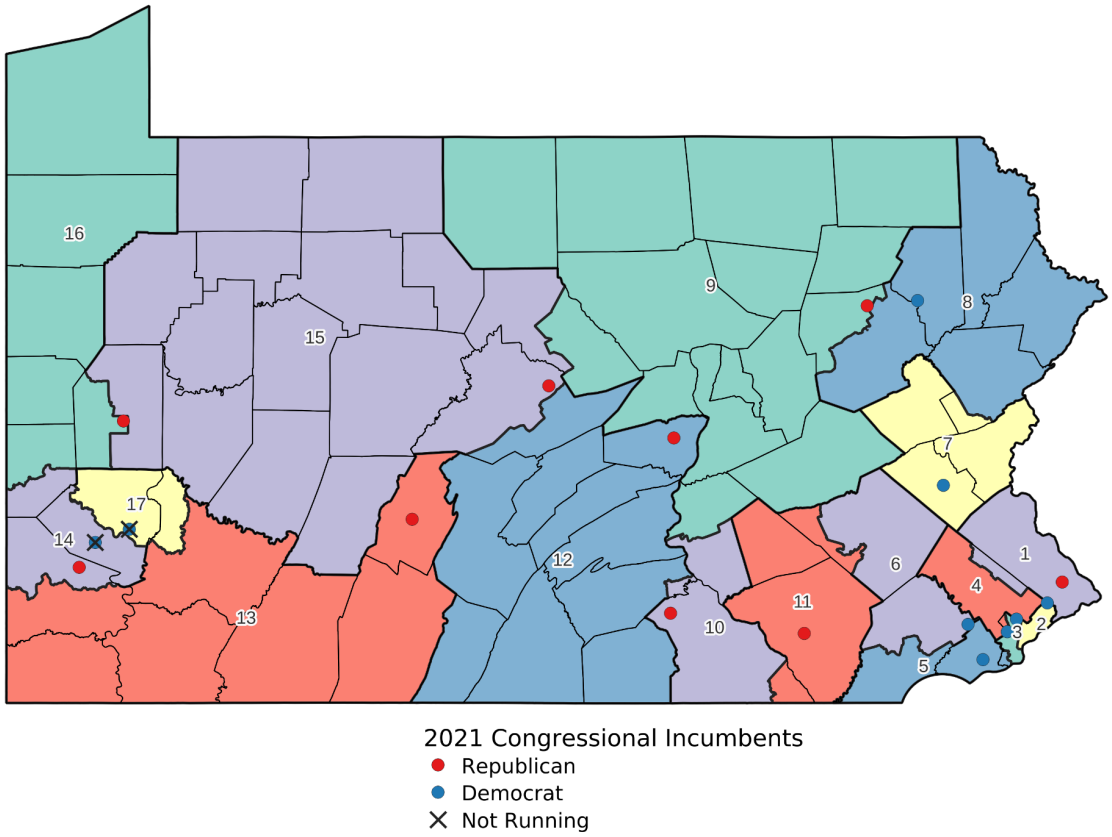
"tradition" of refusing to split the city of Pittsburgh, the single largest concentration of voters in the region, significantly exacerbates this risk of packing

Moreover, Pittsburgh has the largest concentration of Democratic voters in the southwestern part of the state, and the second-largest such concentration in the entire state. A short-lived pseudo-tradition of privileging one specific municipality above all others for split avoidance may be a reasonable mapping criterion in a vacuum, but it becomes difficult to justify in the face of the overriding legal requirement to reduce the partisan bias of the map in order to abide by the Free and Equal Elections Clause of the state constitution.

Thus, the final major adjustment for partisan fairness in the CCFD 17-seat map was to split the city of Pittsburgh between the 14th and 17th Districts, along the natural dividing line at the Monongahela and Ohio Rivers, which cut the city approximately in half. This relieves the previous packing of Democratic Pittsburgh voters solely into the 17th District, by somewhat reducing the overwhelming Democratic supermajority there (previously 68.69% Democratic 2-party vote share in the Composite 2016-2020 election data, now 62.88%). Combined with previous changes for incumbent contest avoidance, the 14th District now moves from being a solidly-Republican district with a 38.97% Democratic 2-party vote share to being a competitive district with a 54.74% Democratic 2-party vote share, only slightly more Democratic than the dataset's statewide average Democratic vote share of 52.46%.

The end result of this second mapping stage is our final proposed map, which is shown again in Figure 4.

Fig. 4: CCFD Proposed 17-Seat Map (reprise)



6. Key Metrics of the CCFD Proposed Map

Together, the second-stage adjustments described above significantly improve the majority-minority, incumbent, and partisan fairness statistics of the CCFD proposed map, bringing it well in line with the example set by the Supreme Court's 2018 *LWV* map without significant harm to traditional neutral criteria statistics, as shown in Tables 3 and 4 below.

Table 3: Traditional neutral criteria for both map stages

	2018 *LWV* 18-seat map	**CCFD 17-seat map, first stage**	**CCFD 17-seat map, second (final) stage**
Contiguous	Yes	Yes	Yes
Maximum-minimum district population difference	1 person (at enactment)	1 person	1 person
Polsby-Popper compactness	0.3270	0.3682	0.3461
Reock compactness	0.4278	0.4328	0.4162
County splits (Split counties)	18 (14)	16 (15)	18 (16)
Municipal splits (Split municipalities)	19 (18)	16 (15)	18 (16)
Precinct splits	32 (at enactment)	16	18

The number of county/municipal/precinct splits, while increased relative to the first-stage map, is still only 2 more than the expected minimum, identical to the excess in the 2018 map. The Reock and Polsby-Popper compactness scores have both slightly decreased, but the Polsby-Popper score remains higher than in the 2018 map, although Reock is now slightly lower. The contiguity and population equality are maintained, so that overall the second-stage map, our final proposed map, is comparable, on traditional neutral criteria grounds, to the 2018 map.

Table 4: Racial, partisan, and incumbent statistics for both map stages

	2018 *LWV* 18-seat map	**CCFD 17-seat map, first stage**	**CCFD 17-seat map, second (final) stage**
Majority-minority districts	**District 2:** 59.74% minority *26.97% Black* *23.00% Hispanic* *9.77% other* **District 3:** 64.78% minority *51.33% Black* *5.04% Hispanic* *8.41% other*	**District 2:** 58.49% minority *26.09% Black* *22.14% Hispanic* *10.26% other* **District 3:** 62.95% minority *48.72% Black* *5.47% Hispanic* *8.76% other*	**District 2:** 58.49% minority *26.09% Black* *22.14% Hispanic* *10.26% other* **District 3:** 65.40% minority *51.37% Black* *5.41% Hispanic* *8.62% other*
Ideal proportional seat count	**18 seats:** 9.44 D, 8.56 R	**17 seats:** 8.92 D, 8.08 R	**17 seats:** 8.92 D, 8.08 R
Likely seat count	9.31 D, 8.69 R	8.35 D, 8.65 R	8.96 D, 8.04 R
Raw seat count	10 D, 8 R	9 D, 8 R	10 D, 7 R
Seats bias (+ favors Rs)	+5.07% (+0.91 seats)	+8.05% (+1.37 seats)	+4.60% (+0.782 seats)
Votes bias (+ favors Rs)	+1.79%	+2.74%	+1.54%
Mean-median gap (+ favors Rs)	+0.07%	+0.88%	+0.88%
Incumbent contests	None (at enactment)	**District 5:** Mary Gay Scanlon (D) Chrissy Houlahan (D) **District 9:** Dan Meuser (R) Fred Keller (R)	None (of those running)

The 3rd District is now reinstated as a majority-Black district, with similar racial balance to the 2018 3rd District, and all incumbent contests are removed. The likely seat count almost exactly matches the ideal proportional seat count for this election dataset, and the votes bias and seats bias are dramatically reduced to even below the levels found in the 2018 map. The mean-median gap, relatively small to begin with, did not significantly change.

Overall, this map demonstrates that the CCFD methodology enables mappers to easily and simultaneously meet the standards of the 2018 *LWV* decision with respect to the traditional neutral criteria, protection against vote dilution based on race or political views, and incumbent contest avoidance. Neither traditional neutral criteria nor incumbent contest avoidance requires maps to enshrine discrimination against particular groups of voters. Any map which must be defended by claims that unfair and disproportionate vote dilution is simply "natural" should be considered highly suspect. The CCFD second-stage map sets a standard which any adopted map should be expected to meet or exceed.

With this in mind, we turn to an analysis of the Special Master's proposed map selection methodology.

7. Response to the Special Master's Proposed Findings of Fact and Conclusions of Law (Section V)

The remaining portion of this report addresses Sections V and VI of the Special Master's (SM) report. These sections presented, respectively, her proposed findings of fact and conclusions of law (Section V) and her map selection recommendations (Section VI).

First, we address Section V. In this section, the SM itemized many criteria for judging the suitability of the maps. For purposes of SM's discussion, the criteria fall into two groups: 1) the "Traditional Neutral Criteria" arising from requirements in the Pennsylvania Constitution and other court judgements; and (2) "Extra-Constitutional Considerations" drawn from the reports of the expert witnesses.

Table 5 (below) tabulates all of the criteria and applicable metrics the SM assembled in Section V.

Traditional Neutral Criteria

1) **Contiguity**

The SM found that all of the maps satisfy this criterion.

> *Comment:* With the development of several online tools for creating districts (e.g. Dave's Redistricting App), the process ensuring contiguity has become relatively easy. This is particularly true at the Congressional level, as the number of discrete boundaries tends to be relatively small. As a result, achieving contiguity no longer requires focused effort.

2) **Population Equality**

The SM addressed two aspects of the population equality criterion: 1) selection of the proper database of population figures: all but the Ali Plan use the approved Legislative

Reapportionment Commission (LRC) Dataset #1; 2) the variation of populations among the districts: the SM noted that the Carter plan and the House Democratic Caucus plan achieve a variation of 2 persons, while all others achieve a variation of 1 person.

> *Comment:* Selection of the proper dataset for computing populations seems, on the surface, to be a simple decision. However, the LRC certified two different datasets: 1) one relatively consistent with the Census Redistricting database; and 2) one adjusted for prisoner residence to home instead of the prison location. Complicating the issue somewhat is the fact that Dave's Redistricting App, one of the online redistricting software tools, continues to apply the Census Redistricting populations. This has little impact on the populations of districts except when differences between the Census and the LRC Datasets lie across a district boundary.
>
> The U.S. Supreme Court has ruled that there are no *de minimis* population variations that satisfy the requirements of one person, one vote. Nonetheless, in *Karcher v. Daggett*, the case that rejected a New Jersey redistricting plan with 0.7% population deviation, the problem was not the population deviation itself, but that New Jersey "did not meet their burden of proving that the population deviations in the plan were necessary to achieve a consistent, nondiscriminatory legislative policy." The 2 person variation in the Carter and House Democratic Caucus plans are allowable as the submissions articulate explicit justification for the plans they submit. According to the National Conference of State Legislatures, 14 other states have population deviations of greater than 1 person in their Congressional districts, with no precedent establishing that those deviations *automatically* violate the Constitutional requirement of one person, one vote.
>
> As a matter of fact, very small population uncertainties exist in all population statistics. From an enumeration point of view, knowing the exact populations of districts is impossible. Many factors can contribute to uncertainties in the tabulation of region membership at any point in time. Examples include reporting errors (or even deliberate mis-reporting) on the part of individual households, tabulation errors creating misidentification of actual address locations, deliberate adjustment of small-area data points by the Census to insure resident anonymity. Beyond tabulation errors, populations change over time, so that even if the population was known on April 1, 2020 to perfect precision, it would not apply beyond that moment due to births, deaths, internal relocations by citizens, and in- and out-migration by non-citizens.
>
> As a result, distinguishing between a population variation of 1 or of 2 in a district total population of over 750,000 persons is a distinction without a difference.

3) Compactness

The SM noted Dr. Duchin's expert witness testimony to stipulate that all of the maps satisfy the constitutional compactness criterion.

> *Comment:* Maps can achieve maximal compactness by assembling counties compactly (or dividing more populous counties compactly) and then adding or subtracting whole townships and other political subdivisions, one at a time, along a county boundary, in layers until equal population is achieved. Then one and only one municipal subdivision need be divided along an electoral district's border. This uniform approach would allow a reviewing court to detect even subtle gerrymandering, such as where a boundary is both non-compact and non-uniform. This non-uniformity can then be analyzed by the Court and the parties to determine if a boundary line is the result of innocent drafting, or the result of an impermissible attempt to engage in partisan gerrymandering, that is, gaining anticipated seat share beyond the party's state-wide vote share.
>
> We believe that compactness scores can highlight important strengths and weaknesses of individual district designs within a redistricting plan. Moreover, identifying outliers among the districts with particularly poor compactness scores can provide guidance for incorporating important improvements in the overall plan. We find it disappointing that the SM deferred careful analysis of this important criterion in the assessment of the plans.

4) Subdivision Splitting

The SM noted that Drs. Barber, deFord and Duchin provided expert analyses of plan splits (of political subdivisions) and the SM relied on them. The SM also noted, however, that not much "… evidence challenging … methodology" came from testimony and participant reviews. For analytical purposes, the SM consolidated the enumerations of splits for counties, municipalities and wards from the three expert sources to construct a single tabulation of the splits for each plan.

> *Comment:* Like population deviation, enumerating splitting of political subdivisions provides a specific quantitative, verifiable metric. Setting forth these splits arguably creates a simple and clear measurement of a plan's compliance with a constitutional requirement. The splitting criterion can conflict at times (but not always) with the compactness criterion and the population equality criterion, though careful drafting can balance these criteria.
>
> As discussed in Section 3 above, theory suggests, and the CCFD methodology strongly supports, that there is a lower reasonable limit to the number of subdivision splits required at each subdivision scale (county, municipality, ward, precinct) when district populations must be exactly equal.

The CCFD methodology achieves this theoretically best possible result (lowest number of splits possible) with its step-down sequence, which calls for incorporating whole subdivisions when possible in sequence along a district border until adding the next subdivision would exceed the population limit. At that point, the subdivision will be split by including, again in sequence, subdivisions of the next smaller scale (e.g. municipalities of a county when the entire county population is too large) until adding the next subdivision would exceed the allowable population, and so on.

Special Issue – Splitting Pittsburgh

The SM highlighted certain specific splits, deeming them "… an important consideration …".[2] Quoting Dr. Barber, the SM noted that splitting has the capacity, particularly as it applies to the city of Pittsburgh to "… serve partisan ends."[3] As a result, the SM concluded that the five plans that split Pittsburgh should be viewed less favorably than those that keep Pittsburgh within a single district. In addition, the SM identified one plan that retains Pittsburgh in a single district but distorts the district design by surrounding it in a way that violates this requirement in an indirect way.

Comment: In general terms, we agree that good districting designs avoid unnecessary splitting of subdivisions. However, all residents of every subdivision benefit from avoiding the dilution of their representation due to splitting.

We believe that the SM should have addressed splitting issues associated with all subdivisions containing populations above some floor. For example, at least 10 counties have populations exceeding that of Pittsburgh, but the SM did not consider the implications of splitting any of these. Moreover, as discussed above, the greater Pittsburgh metropolitan area hosts a population far greater than that of a single district. Considerations extending beyond the Pittsburgh county boundary may very well apply and deserve attention.

Special Issue – Splitting Bucks County

The SM acknowledged that subdivision splitting shares importance with other "communities of interest" considerations. Highlighting Bucks County, the SM noted that both Dr. Naughton and Dr. Duchin expressed opinions about keeping communities of interest whole in district design plans. Noting strong sentiment that residents desire Bucks County to remain whole, the SM indicated that plans splitting Bucks County should carry lower weight. In addition, the SM added the additional consideration to the district containing Bucks County that the additional population needed to achieve the target district population should come from Montgomery

[2] SM Report at 148.
[3] SM Report at 149, quoting Barber report at 28.

County and not from Philadelphia County, citing communities of interest considerations mentioned in Dr. Naughton's report.

> *Comment:* We agree that communities of interest considerations can take place in the context of determining final district designs. However, there are many, many such considerations that could take place throughout the state. We believe that focusing on Bucks County considerations without doing so in a more comprehensive manner weakens the importance of this single consideration. In any event, the Supreme Court emphasized in *LWV* that all criteria other than the four neutral criteria are "wholly subordinate" to the four criteria.
>
> Moreover, the argument that Bucks remain whole because this has been the case for many years[4] relies on a "least change" argument, a consideration that the SM dismissed in the context of the Carter submission.[5]

Special Issue – Splitting Philadelphia County

The Philadelphia County population is large enough to accommodate two whole districts plus part of a third. The map designs have the option to attach the surplus Philadelphia population to districts in the neighboring counties of Bucks, Delaware, and Montgomery. The SM noted the recommendation of Dr. Naughton that the surplus should be attached to a district in Delaware County as a result of communities of interest considerations.

> *Comment:* This consideration is comparable to the Bucks County situation, even though it addresses the allocation of a surplus population rather than the acquisition of population to address a shortfall. Thus, our comments concerning the Bucks County designs apply here equally. There are many specific circumstances in every design in which residents of a political subdivision are grouped or split. The SM's highlighting of some such subdivision splits, while ignoring others, appears arbitrary.

Extra-Constitutional Considerations

The SM continued collecting factual information from the experts relating to other design considerations, but noted that "Our inquiry into these subordinate considerations is strictly circumscribed."[6] This is consistent with the cautionary language of the Pennsylvania Supreme Court in *LWV* regarding subordinate criteria.[7]

[4] SM Report at 157, paraphrasing Dr. Naughton's testimony.
[5] SM Report at 183 ff.
[6] SM Report at 161.
[7] SM Report at 161 referencing LWV: 178 A.3d at 817.

1) Partisan Fairness

The SM found as a matter of fact that the distribution of partisan residents within the state tilts in favor of Republicans. From a standpoint of political geography, at least in Pennsylvania, Democrats are concentrated in large metropolitan areas, while Republicans are distributed throughout the state with a much lower propensity to congregate in densely populated areas. Accordingly, the SM noted that this will have a bearing on issues of partisan advantage.

The Special Master noted three approaches to measuring partisan fairness articulated in the expert witness testimony – Mean-Median scores, the Efficiency Gap, and Simulations.

2) Mean-Median Scores

The SM listed mean-median scores computed for the plans from seven expert witness statements, although not all experts provided such scores for every plan. In addition, the SM referred to testimony of an expert witness in *LWV* that a typical mean-median score ranges from -4% to 4%.[8] The SM also noted that such scores are computed from specific elections and that: a) the expert witnesses did not use identical historical elections in computing their metrics, and b) that not all experts specified the elections used. After excluding the Duchin figures as not credible, the SM found that the mean-median scores for all of the plans fell within the acceptable range.

3) Efficiency Gap

The SM listed efficiency gap scores from five expert witness statements. As with mean-median scores, not all of the experts provided estimates for every plan. In addition, the SM referred to testimony of an expert witness in *LWV* that a typical efficiency gap score ranges from -20% to +20%.[9] Finally, the SM noted that the elections selected for efficiency gap calculations were the same ones used for the mean-median calculations. After excluding the Duchin figures as not credible, the SM found that the efficiency gaps for all of the plans fell within the acceptable range.

4) Simulations

The SM noted that simulations of many plans can help to place partisan fairness issues into perspective by providing a design variation context with which to measure the fairness of any given plan. SM referenced the simulations prepared by Dr. Barber in this context. Regarding the simulations, the SM noted that all of the maps submitted "… are at least 54% more favorable to Democrats than the simulated maps" and that the House Democrats map has "… [a] more favorable efficiency gap outcome for Democrats than 100% of his simulated maps."[10]

Comment: We were puzzled by the exclusion of these analyses by Dr. Duchin. Moreover, we could not find in Dr. Duchin's report the numerical figures listed as those set forth in the

[8] SM Report at 166 referencing *LWV*: 178 A.3d at 774.
[9] SM Report at 172 referencing *LWV*: 178 A.3d at 777.
[10] SM Report at 176.

SM's report. The testimony and report by this witness employed the use of graphical comparisons. In doing so, Dr. Duchin presented graphical representations of these metrics from twelve separate elections for three of the plans and included in the graphs representations of the results of 100,000 simulated elections.[11] The SM did not speak to either these simulations or the graphical representations in this context. In addition, Dr. Duchin employed the use of a seats-votes figure to elucidate the outcomes of many elections. We found the Duchin approach to provide more insight into the likely dynamic behavior of the plans than a single metric representing the aggregate results of several elections.

5) Partisan Fairness - Proportionality

Extracting statements regarding design objectives stated in and by the plan submissions, the SM stated unequivocally that "proportionality is not a requirement or goal of redistricting."[12] She found that the "Gressman Plan was purposefully created using an algorithm that sought to optimize on partisan fairness."[13] In addition, the SM found that "The Draw the Lines Plan admittedly split Pittsburgh into two congressional districts to maximize political competitiveness."[14] It should be noted that the CCFD amicus brief argues for the addition of partisan fairness as another mandatory criterion in addition to four Constitutional criteria.

6) Protection of Incumbents

The SM noted that plans that avoid "pairing" incumbents in the same new district (the term "stacking" is also used) can play a role in evaluating redistricting plans. Citing *LWV* and *Mellow* cases, the SM acknowledged that these considerations are "… among the factors that a court may consider in evaluating a redistricting plan …."[15] Additionally, the SM claimed that the reduction in the number of Congressional districts will by necessity, create at least one such pairing. Finally, the SM stated that deliberate selection of specific pairings could "… favor one party by pairing incumbents from the other party, effectively eliminating one of them."[16] Subsequently, the SM noted that some current incumbents – Lamb (D) of the 17th District and Doyle (D) of the 18th District – are not seeking reelection, which allows one to ignore a theoretical pairing in these districts as "… less indicative of any unfair distribution …."[17] The SM analysis of pairings focused on the number of incumbents of the same party included in any pairings, finding five plans for which 3 incumbents from a single party would experience pairing. The SM noted that as a result, the SM would place less weight on these plans.

Comment: CCFD acknowledges that various parties have argued that the same consideration of incumbent pairs in plan design should be considered. However, we

[11] Moon Duchin expert witness report at 17 ff.
[12] This an following bullets from SM Report at 176-178.
[13] SM Report at 178 referencing Gressman Petitioners Brief at 14.
[14] SM Report at 178 referencing Villere Report at 4.
[15] SM Report at 178.
[16] SM Report at 179. The SM also noted that both Dr. deFord and Dr. Duchin cited this potential.
[17] SM Report at 179.

suggest that this take place near the end of the design process. Further, we suggest that the home locations of incumbents also play a role in the analysis of this factor. Incumbents whose residences lie geographically close to each other may by simple location experience a high likelihood of pairing for that reason alone, as a district boundary would have to pass between these two residences to eliminate a pairing.

We suggest that the SM's conclusion that pairings reflect partisan design motivations carries with it the material risk of incorrectly assigning to the designer a motivation that may not in fact apply. The large number of factors playing a role in any district design can make such attributions difficult to prove.

7) VRA Considerations

The SM noted that Pennsylvania is subject to Section 2 of the VRA, and, citing Dr. Duchin's report, that the current district map includes two majority-minority districts. However, the SM also noted that no party presented evidence directed to this issue and that no party lodged a challenge to a plan based on this issue. As a consequence of this, the SM noted that "… the Court is thus unable to determine that any specific number of majority-minority districts is strictly necessary in any particular location in Pennsylvania…. The Court accordingly cannot conclude that any plan would be likely to violate section 2 of the VRA or any other requirements of federal law."[18]

Comment: We believe that VRA considerations not only are important but indeed are legally mandated, and should be a factor in selecting the best plan.

8) Least Change

The SM, referring to *LWV*, noted that "… preservation of prior district lines, or 'least change,' is another 'subordinate' factor the Court may consider in determining which plan to adopt."[19] Only Dr. Rodden (for the Carter petitioners) presented an analysis relevant to least change considerations and the SM recognized the analysis performed by Dr. Rodden's tabulation of the "Retained Population Share" for each plan. However, lacking a measure of acceptable retention, the SM declined to use this metric, stating "… this Court is left with attempting to decipher enigmatic data."[20]

As an alternative to comparative analysis of the plans, the SM examined past legal opinions regarding the use of least change approaches to redistricting and concludes that it is "… deeply troubled by the prospect of any court applying [this doctrine] … because that court could theoretically continuously adopt features of its prior plans, effectively rendering impossible any

[18] SM Report at 183.
[19] SM report at 183.
[20] SM report at 185.

future challenge to the plan."[21] The SM further "… conclude[d] that the Carter Petitioners have misconstrued and misapplied the "Least Change" doctrine, which does not apply in this circumstance …" and recommends that the high court not adopt the Carter Plan.[22]

> *Comment:* **Focusing on the least change from a prior map, as opposed to starting fresh in redistricting, can lead to a fair map or an unfair map depending on the qualities of the map being used as a model. If the prior map was the product of a partisan gerrymander, the new map will contain elements of a partisan gerrymander.**
>
> We suggest that the Court keep in mind and analyze changes in design from two perspectives: 1) from the perspective of the resident population, who benefit from continuity of representation and continuity of group sentiment; 2) from the perspective of incumbent representatives, who benefit from continuity of their constituents' communal concerns, and continuity of relevant administrative oversight functions.

[21] SM report at 188.
[22] SM Report at 188.

Table 5: Special Master's Section V Analysis Metrics by Plan

Criterion	Carter	Gressman	Governor	HB 2146	Senate Dem I	Senate Dem II	House Dem	Reschenthaler I	Reschenthaler II	Draw the Lines	Ali	Citizen-Voters	Voters of PA
Traditional Neutral Criteria													
Contiguity	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Population Equality													
Data Set	LRC Set #1	LRC Set #1	LRC Set #1	LRC Set #1	LRC Set #1	LRC Set #1	LRC Set #1	LRC Set #1	LRC Set #1	LRC Set #1	LRC Set #2	LRC Set #1	LRC Set #1
Metric	+1,-1	+1	+1	+1	+1	+1	+1,-1	+1	+1	+1	+1	+1	+1
Compactness	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Splitting[1]													
County	13	15	16	15	17	16	16	13	13	14	16	14	15
Municipality	19	19	18	16	19	16	18	16	16	16	18	16	17
Ward	25	15	25	18	18	14	22	25	24	16	33	21	41
Focus													
Pittsburgh	Whole	Whole	Split	Whole	Split	Split	Whole/ Nbr	Whole	Whole	Split	Split	Whole	Whole
Bucks			Split	Whole									
Bucks add			from PHL	not from PHL									
PHL surplus			to Bucks	to Delaware									
Extra-Constitutional Considerations													
Partisan Fairness		Design								Split Pittsburgh			
Simulations	No specific references												
Mean-Median Scores[2]													
Dr. Barber	-0.6	1.4	-0.04	-1.5	-0.5	-0.03	0.7	-2.1	-2.2	-0.6	-1.2	-1.3	-1.2
Dr. Brunell[3]								-1.86**	-1.89				
Dr. Caughy			1	-2.3	-0.7	-0.5			-2.4				
Dr. deFord[4]	-1.6	-0.8*	-1	-2.9	-1.9	-0.3	-0.9	-2.7	-2.6	-1.2	-1.8	-2	-2.7
Dr. Duchin[5]	~~-11.3~~	~~3.85~~	~~-0.77~~	~~-29.27~~	~~-13.82~~	~~1.06~~	~~-0.71~~	~~-25.24~~	~~-25.34~~	~~-10.42~~	~~-12.09~~	~~-18.47~~	~~-27.34~~
Dr. Rodden[6]	?0.5	?0.5	?0.6	-2.4	?0.7	?0.7	?0.4	-0.1	-0.1	?0.6	?0.4	?1.4	-2.6
S. Trende[6]			-1.1, ?0.3									?2.0, ?2.2	
Efficiency Gap7													
Dr. Barber	3.4	3.4	3.4	-2.5	-2.5	3.4	9.3	-2.5	-2.5	3.4	3.4	3.4	-2.5
Dr. Caughy			-3.5	-6.6	-2.3	-2.4			-6.3				
Dr. deFord	-0.4	0.8	0.6	-6.3	-2.5	1	3.3	-7.8	-7.8	-1.6	-2.7	-2.6	-4.8
Dr. Duchin8	~~-0.58~~	~~13.94~~	~~10.07~~	~~-83.36~~	~~-26.01~~	~~12.21~~	~~18.14~~	~~-110.24~~	~~-110.42~~	~~-16.78~~	~~-31.66~~	~~-40.74~~	~~-56.58~~
S. Trende9			-3.5, -0.10									?3.0, ?5.6	
Proportionality as Goal		✓								✓			
Incumbent Protection[10]													
Pairings	1	0	2[11]	1	1	2	2	2	1	2	--	2	2[11]
R-R Pairing	x		x			x	x			x			
D-D Pairing			x					x				x	
D-R Pairing				x	x	x	x	x	x	x		x	x - x
VRA Considerations													
Maj-Min Districts	2	3	2	2	2	2	2	2	2	2	2	2	2
Least Change													
Retained Pop Share	86.6	72.8	81.2	78.5	72.5	72.5	73.3	76.5	76.5	78.8	81.5	82.4	80.6

Note: Red shaded cells indicate values or characteristics that the Special Master deemed important for reduced weight of plan.
See additional notes and references on the following page.

Notes for Table 5:

1. SM Report at 143, ff.
2. SM Report at 168-171. Our entries here: figures in %, positive sign favors Democrats
3. Use of "**" on this row: Inconsistent in the report: 0.0186 and 1.6%
4. Use of "*" on this row: Incorrectly reported as -0.08%.
5. Strikethroughs: The SM finds these figures from Dr. Duchin to be not credible, and therefore removed them from consideration.
6. Use of "?" in this report: Dr. Rodden and S Trende did not specify score sign.
7. SM Report at 172-175.
8. Strikethroughs: The SM noted that Dr. Duchin's figures were extreme outliers and therefore not credible
9. Use of "?" on this row: S Trende did not specify score sign for the Voters of PA analysis.
10. Dr. deFord analyzed all of the plans for incumbent pairings in his report.
11. The SM report did not address the Governor's plan or the Voters of PA plan for pairings. These pairings are from the deFord report.

8. Response to the Special Master's Map Selection Recommendations (Section VI)

Section VI of the SM report sets forth the recommendations arising from the facts and metrics listed in Section V.

In the simplest terms, the SM in this section selected its recommended plan by way of an elimination process, identifying and removing plans one at a time and in groups, depending on the criterion, from the acceptable collection. This process appears in Table 6 below:

Table 6: Summary of Eliminations by Plan

Reason for Exclusion	Carter	Gressman	Governor	HB 2146	Senate Dem I	Senate Dem II	House Dem	Reschenthaler I	Reschenthaler II	Draw the Lines	Ali	Citizen-Voters	Voters of PA
Plans not using LRC Dataset #1 (Page 192):											X		
Plans that split Pittsburgh (Pages 194-195):			X		X	X				X	X		
Plans that split Bucks county			X										
Pairing two Republican Incumbents (Page 195)	X				X								
Use of "least change" approach (Pages 195-196)	X												
Mean-median metric (Page 197)		X					X						
Efficiency gap metric (Page 197)	X	X	X			X	X			X			
VRA Considerations(Page 198)													
Population Variation - 2 difference (Pages 192-199)	X						X					X	
Lack of expert witness support							X					X	
Odd district shape near Pittsburgh (Page 203)							x						
Inadequate COI consideration (Page 205)		X											

Note: Green shaded columns highlight plans with no identified reasons to eliminate.

The remaining maps the SM considered from the standpoint of the Free and Equal Elections Clause are:[23]

- Voters of PA plan
- Reschenthaler 1 plan
- HB 2146 plan

For these three plans, the SM listed the supporting benefits of these plans along with support statements by their experts. The SM noted that based on "… credibility and weight determinations,... " these maps "… are consistent with the Free and Equal Elections Clause … and, also, the aspirations and ideals expressed by that constitutional provision as pronounced by the Court in *LWV*…."[24] The SM then turned to a more comprehensive review of the HB 2146 plan's strengths[25]:

[23] SM report at 207. We note from Exhibit 2 above that the Reschenthaler 2 plan also survived the exclusion process, but the SM did not include it in the list of surviving plans. We found no explanation for this in the SM's report.
[24] SM report at 207.
[25] These points appear in the SM report, starting at 207.

- This plan arose from the legislative process laid out in the state Constitution
- The methodology laid out by the expert witness, Dr. Barber
- The plan performs well with regard to subdivision splits
- One incumbent pairing which does not impart a partisan advantage
- The plan does not split Bucks County
- The district including Bucks County draws from Montgomery County to complete
- The surplus Philadelphia population was added to a district in Delaware County
- The plan maintains two minority-majority districts
- The plan's compactness scores are near the 2018 Remedial Plan
- The plan has only a modest and unreducible partisan lean (8-D, 9-R)
- Several expert witnesses attested to the partisan fairness of the plan
- The plan has more competitive districts than the "other" plans
- The mean-median score is close to zero, indicating unbiased partisan fairness
- The efficiency gap is close to zero, indicating unbiased partisan fairness
- No parties have argued that the plan does not meet "… all the neutral, traditional redistricting criteria…"

As a final statement, the SM argued strongly for the use of HB 2146 because it arose from the constitutional legislative process and because it satisfies all precedents set in prior court judgments.

> *Comment:* In our opinion, the elimination process the SM used fails to articulate the relative importance of the various criteria for elimination, which weakens the argument that only three plans survive this process. The criteria that the SM listed cannot be equally important. Yet the SM did not identify how or whether she prioritized them. A different process could very well employ different criteria and produce a different result. We acknowledge the difficulty of choosing a plan due to the very large number of factors which might come into play. For this reason, we would prefer that the Court employ a district construction process rather than a plan selection process going forward.
>
> Finally, we remind the Supreme Court that CCFD offers such a district construction process that, by its very nature, satisfies the constitutional requirements, avoids partisan interference, and offers process transparency that vastly improves the opportunity for judicial oversight.