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December 8, 2008

Honorable William E. Smith
District Judge
United States District Court
One Exchange Terrace
Providence, RI 02903

Re: Joseph M. Bennett, et al. v. Ralph Mollis, et al.
C.A. No. 08-468S

Dear Judge Smith,

Based on a series of conversations last week, you asked me to analyze the election returns from the November 4, 2008 Smithfield Town Council race and attempt to determine how many votes Mr. Hawkins would have drawn from ballots that included a vote for Mr. DiIorio, but not Mr. Hawkins.

Let me note from the outset that we are somewhat limited in the extent to which we can draw conclusions about individuals' voting patterns when all we have to analyze are precinct-level data. In other words, we cannot predict with a high degree of precision the percentages of the DiIorio vote that would have gone to each of the other candidates. Nevertheless, we can discern certain patterns in voting behavior across precincts, as well as generate comparisons between the total number of votes Mr. Hawkins received when Mr. DiIorio's name appeared on the ballot and when it did not. Ultimately, the precinct-level data analysis suggests a compelling statistical improbability that Mr. DiIorio's name on the ballot cost Mr. Hawkins a 5th place finish.

Below, I present the data and logic through which I arrive at this conclusion.

I. Imputing the Morning Vote

Perhaps the best place to begin is with an assessment of the difference in the total percentage of the vote each candidate received in the morning (when Mr. DiIorio's name appeared on the ballot) versus the afternoon (once Mr. DiIorio's name was removed). Because we can consider each vote as the unit of analysis, we can remove the DiIorio votes from our calculations, but still count the other votes on each ballot.

The overall data indicate that Mr. Hawkins performed better when Mr. DiIorio's name did not appear on the ballot. Indeed, when Mr. DiIorio's name appeared, Mr. Hawkins placed 7th overall, compared to his 5th place finish when voters did not have the option of choosing Mr. DiIorio. The issue, therefore, is whether the votes Mr. DiIorio drew in the morning account for Mr. Hawkins' loss. In other words, would the votes Mr. DiIorio received at Mr. Hawkins' expense be enough to put Mr. Hawkins over the top?

In order to answer this question, we can consider three scenarios by which to impute the number of votes each candidate would have received in the morning had Mr. DiIorio's name not appeared on the ballot. In Scenario A (Table 1), I calculated the "imputed morning vote" working under the assumption that Mr. DiIorio's votes would be distributed across the remaining 13 candidates in proportion to the vote each drew in the morning. Without access to individual ballots (through which we could assess patterns and combinations of vote choices), this is a plausible way to proceed.

| Table 1: Vote Totals and Candidate Rank Based on Imputing the Morning Vote (Scenario A) | | | | | | |
|--|--|--|---|--|-------------------------------|------------------------------|
| | Percent Vote Received in the AM (excluding DiIorio Votes) | Total Imputed AM Vote Received (redistributing DiIorio Votes) | Total Vote (PM Total + Imputed AM Total) | Total Percent of Vote (Imputed) | Overall Rank (Imputed) | Overall Rank (Actual) |
| Archambault | 0.105339924 | 1359.833077 | 4598.8331 | 0.109436 | 1 | 1 |
| Flynn | 0.110606920 | 1427.824731 | 4414.8247 | 0.105057 | 3 | 3 |
| Hawkins | 0.090430273 | 1167.364395 | 3874.3644 | 0.092196 | 6 | 6 |
| Cavanagh | 0.098857467 | 1276.151041 | 3973.1510 | 0.094547 | 5 | 5 |
| Cerroni | 0.103233125 | 1332.636415 | 4461.6364 | 0.106171 | 2 | 2 |
| Poirier | 0.097074791 | 1253.138481 | 3793.1385 | 0.090263 | 7 | 7 |
| Fanning | 0.089295843 | 1152.720039 | 3776.7200 | 0.089873 | 8 | 8 |
| Coutu | 0.064743538 | 835.7743295 | 2529.7743 | 0.060200 | 9 | 9 |
| Manni | 0.098209221 | 1267.782838 | 4028.7828 | 0.095871 | 4 | 4 |
| Begin | 0.038165465 | 492.6779840 | 1672.6780 | 0.039804 | 10 | 10 |
| Esposito | 0.035086298 | 452.9290171 | 1627.9290 | 0.038739 | 12 | 12 |
| LaBrie | 0.035734543 | 461.2972206 | 1624.2972 | 0.038653 | 13 | 13 |
| Tocco | 0.033222591 | 428.8704319 | 1646.8704 | 0.039190 | 11 | 11 |
| DiIorio | -- | -- | -- | -- | -- | 14 |

Notes: Imputations are based on reallocating Mr. DiIorio's votes in proportion to the votes each of the candidates received when Mr. DiIorio's name appeared on the ballot. All calculations rely on the recount tallies.

In this scenario, Mr. Hawkins still finishes 6th, and Ms. Cavanagh leads Mr. Hawkins for 5th place by roughly 99 votes.

Scenario B errs on the side of Mr. Hawkins and assumes that the voting patterns we saw in the afternoon are exactly what the voting patterns would have looked like in the morning had Mr.

DiIorio's name not appeared on the ballot (see Table 2). In this case, Mr. Hawkins actually moves into 5th place and replaces Ms. Cavanagh as the winner by a margin of 14 votes.

| | Percent Vote Received in the AM (excluding DiIorio Votes) | Total Imputed AM Vote Received (redistributing DiIorio Votes) | Total Vote (PM Total + Imputed AM Total) | Total Percent of Vote (Imputed) | Overall Rank (Imputed) | Overall Rank (Actual) |
|--------------------|--|--|---|--|-------------------------------|------------------------------|
| Archambault | 0.105339924 | 1436.156179 | 4675.156179 | 0.111252 | 1 | 1 |
| Flynn | 0.110606920 | 1324.420657 | 4311.420657 | 0.102597 | 3 | 3 |
| Hawkins | 0.090430273 | 1200.270076 | 3907.270076 | 0.092979 | 5 | 6 |
| Cavanagh | 0.098857467 | 1195.836127 | 3892.836127 | 0.092636 | 6 | 5 |
| Cerroni | 0.103233125 | 1387.382737 | 4516.382737 | 0.107474 | 2 | 2 |
| Poirier | 0.097074791 | 1126.223123 | 3666.223123 | 0.087243 | 8 | 7 |
| Fanning | 0.089295843 | 1163.468297 | 3787.468297 | 0.090128 | 7 | 8 |
| Coutu | 0.064743538 | 751.1110119 | 2445.111012 | 0.058185 | 9 | 9 |
| Manni | 0.098209221 | 1224.213402 | 3985.213402 | 0.094834 | 4 | 4 |
| Begin | 0.038165465 | 523.2060177 | 1703.206018 | 0.040530 | 11 | 10 |
| Esposito | 0.035086298 | 520.9890431 | 1695.989043 | 0.040359 | 12 | 12 |
| LaBrie | 0.035734543 | 515.6683039 | 1678.668304 | 0.039946 | 13 | 13 |
| Tocco | 0.033222591 | 540.0550251 | 1758.055025 | 0.041836 | 10 | 11 |
| DiIorio | -- | -- | -- | -- | -- | 14 |

Notes: Imputations are based on reallocating Mr. DiIorio's votes in proportion to the votes each of the candidates received when Mr. DiIorio's name did not appear on the ballot. All calculations rely on the recount tallies.

There are several theoretical reasons to believe, however, that the patterns we saw in the afternoon (when Mr. DiIorio's name did not appear on the ballot) would not be mirrored exactly in the morning (when his name did appear). The percentage of straight ticket voters, for example, was 6.5 percent higher in the morning than in the afternoon (17.8 percent in the morning, compared to 16.7 percent on the afternoon). This might seem like a minor difference, but in such a close election, it is important, especially since it suggests that Mr. Hawkins drew more votes in the morning than he otherwise might have because of the straight ticket benefit.

Thus, in Scenario C, I split the difference and impute the morning vote such that it is the average total vote share each candidate received in the morning and the afternoon. Under this scenario (see Table 3), Mr. Hawkins does not retake the lead; Ms. Cavanagh maintains her 5th place finish (leading Mr. Hawkins by 42 votes) and the election results do not change.

Overall, therefore, based on the most plausible scenario by which to reallocate the votes Mr. DiIorio received, Mr. Hawkins falls short of gaining a sufficient number of votes to overtake Ms. Cavanagh and place 5th.

| Table 3: Vote Totals and Candidate Rank Based on Imputing the Morning Vote (Scenario C) | | | | | | |
|--|--|--|---|--|-------------------------------|------------------------------|
| | Percent Vote Received in the AM (excluding DiIorio Votes) | Total Imputed AM Vote Received (redistributing DiIorio Votes) | Total Vote (PM Total + Imputed AM Total) | Total Percent of Vote (Imputed) | Overall Rank (Imputed) | Overall Rank (Actual) |
| Archambault | 0.105339924 | 1397.994628 | 4636.994628 | 0.110344207 | 1 | 1 |
| Flynn | 0.110606920 | 1376.122694 | 4363.122694 | 0.103827016 | 3 | 3 |
| Hawkins | 0.090430273 | 1183.817236 | 3890.817236 | 0.092587803 | 6 | 6 |
| Cavanagh | 0.098857467 | 1235.993584 | 3932.993584 | 0.093591452 | 5 | 5 |
| Cerroni | 0.103233125 | 1360.009576 | 4489.009576 | 0.106822682 | 2 | 2 |
| Poirier | 0.097074791 | 1189.680802 | 3729.680802 | 0.088753321 | 8 | 7 |
| Fanning | 0.089295843 | 1158.094168 | 3782.094168 | 0.090000575 | 7 | 8 |
| Coutu | 0.064743538 | 793.4426707 | 2487.442671 | 0.059192411 | 9 | 9 |
| Manni | 0.098209221 | 1245.998120 | 4006.998120 | 0.09535250 | 4 | 4 |
| Begin | 0.038165465 | 507.9420008 | 1687.942001 | 0.040167099 | 12 | 10 |
| Esposito | 0.035086298 | 486.9590301 | 1661.959030 | 0.039548795 | 11 | 12 |
| LaBrie | 0.035734543 | 488.4827623 | 1651.482762 | 0.039299497 | 13 | 13 |
| Tocco | 0.033222591 | 484.4627285 | 1702.462728 | 0.040512641 | 10 | 11 |
| DiIorio | -- | -- | -- | -- | -- | 14 |

Notes: Imputations are based on reallocating Mr. DiIorio's votes in proportion to the votes each of the candidates received overall (when Mr. DiIorio's name did not appear on the ballot). All calculations rely on the recount tallies.

II. Precinct-Level Analysis

The second way we can analyze the data involves looking at the patterns within each precinct and determining whether Mr. DiIorio's name on the ballot affected certain precincts more than others. If the presence of Mr. DiIorio's name weakened Mr. Hawkins disproportionately in the precincts where he fared the best in the afternoon, for instance, then that suggests that the outcome may have been different had Mr. DiIorio's name not appeared on the ballot.

Table 4 presents Mr. Hawkins' vote share in each precinct when Mr. DiIorio's name appeared on the ballot, and when it did not. In general, the data do not support the notion that Mr. DiIorio's name systematically disadvantaged Mr. Hawkins.

More specifically, we see that Mr. Hawkins' afternoon vote share exceeded his morning vote share in 8 of the 10 precincts. But his margin did not disproportionately increase in the precincts where he fared the worst in the morning. For example, precincts 3103, 3105, and 3106 were Mr. Hawkins' 3 weakest precincts when Mr. DiIorio's name appeared on the ballot. Precincts 3105 and 3106 remained among his 3 weakest precincts when Mr. DiIorio's name did not appear on the ballot. In other words, as we see in the last column of Table 4, Mr. Hawkins' vote share in the afternoon was quite consistent with his morning performance in most precincts. In short, Mr. Hawkins does not appear to have suffered a sizeable systematic disadvantage.

Table 4: Precinct-Level Comparison of Mr. Hawkins' Vote Share

| Precinct | AM Vote Percentage (with DiIorio votes) | AM Vote Percentage (excluding DiIorio votes) | PM Vote Percentage | Margin of Increased Support in the PM |
|----------|--|---|-----------------------|--|
| 3101 | 0.092166 | 0.095808 | 0.095499 | 0.003333 |
| 3102 | 0.095682 | 0.100444 | 0.101345 | 0.005663 |
| 3103 | 0.077277 | 0.081003 | 0.094841 | 0.017564 |
| 3104 | 0.091698 | 0.095855 | 0.098879 | 0.007181 |
| 3105 | 0.077807 | 0.082090 | 0.089990 | 0.012183 |
| 3106 | 0.078614 | 0.082058 | 0.082371 | 0.003757 |
| 3107 | 0.083703 | 0.088098 | 0.092201 | 0.008498 |
| 3108 | 0.085938 | 0.089249 | 0.082633 | -0.003305 |
| 3109 | 0.094146 | 0.097867 | 0.108805 | 0.014659 |
| 3110 | 0.086372 | 0.090361 | 0.077972 | -0.008400 |

Notes: All calculations rely on the recount tallies.

It is also important to recognize that we cannot view Mr. Hawkins' precinct performance separate from that of Ms. Cavanagh. Indeed, Ms. Cavanagh performed better in 4 of the 10 precincts when Mr. DiIorio's name did not appear on the ballot, too (see Table 5).

Table 5: Precinct-Level Comparison of Ms. Cavanagh's Vote Share

| Precinct | AM Vote Percentage (with DiIorio votes) | AM Vote Percentage (excluding DiIorio votes) | PM Vote Percentage | Margin of Increased Support in the PM |
|----------|--|---|-----------------------|--|
| 3101 | 0.095622 | 0.099401 | 0.094236 | -0.001386 |
| 3102 | 0.087214 | 0.091556 | 0.087593 | 0.000379 |
| 3103 | 0.095676 | 0.100289 | 0.084598 | -0.011078 |
| 3104 | 0.097893 | 0.102332 | 0.089106 | -0.008787 |
| 3105 | 0.095491 | 0.100746 | 0.092686 | -0.002805 |
| 3106 | 0.097935 | 0.102225 | 0.096484 | -0.001451 |
| 3107 | 0.091463 | 0.096266 | 0.092566 | 0.001103 |
| 3108 | 0.110352 | 0.114604 | 0.104575 | -0.005777 |
| 3109 | 0.079662 | 0.082811 | 0.083648 | 0.003986 |
| 3110 | 0.102687 | 0.107430 | 0.107371 | 0.004684 |

Notes: All calculations rely on the recount tallies.

Finally, we should note that even though Mr. Hawkins fared disproportionately better than did Ms. Cavanagh in the morning than in the afternoon, Ms. Cavanagh still outperformed Mr.

Hawkins in 5 of the 10 afternoon precincts. Ms. Cavanagh won precincts 3105, 3106, 3107, 3108, and 3110 in both the morning and the afternoon. This suggests, then, that at least in half of the precincts, Mr. DiIorio's name on the ballot did not produce a different result between Mr. Hawkins and Ms. Cavanagh. If Mr. Hawkins is to recoup the votes that separate him from Ms. Cavanagh, then he would likely need to net them all in only half of the precincts, thereby further reducing his likelihood of success.

III. Analyzing the Questionable Ballots

The final approach we can take to assessing whether Mr. DiIorio's name affected the outcome of the election involves focusing on the ballots that included a vote for Mr. DiIorio, but not a vote for Mr. Hawkins. Once we omit ballots with under votes and over votes, my understanding is that 99 ballots included a vote for Mr. DiIorio, but not Mr. Hawkins. I am also under the impression that the parties agree that 39 votes separate Mr. Hawkins from Ms. Cavanagh. If this is the case, then Mr. Hawkins would have to receive 40 of the 99 DiIorio votes.

Working from Mr. Hawkins' premise – that a vote for Mr. DiIorio came at the expense of Mr. Hawkins – we can assume that the other 4 votes on each of these 99 ballots would be unchanged by the removal of Mr. DiIorio's name. If such is the case, then Mr. Hawkins would need to receive 40 percent of the votes in question, which is an incredibly high bar, considering that in no precinct, in either the morning or the afternoon, did any one candidate receive more than 12 percent of the vote. Moreover, in each of these cases, we are dealing with split ticket voters, so Mr. Hawkins' party identification plays no role and there is no reason to expect that the overall correlation between the votes he and Mr. DiIorio received would hold for these 99 ballots.

Conclusion

Again, let me reiterate that unless we conduct a more sophisticated individual-level analysis of voters' ballots and the combinations of candidates they chose, we cannot arrive at more precise estimates. Considering that the aggregate and precinct-level analysis demonstrates that Mr. Hawkins did not fare considerably worse in the places we might expect when Mr. DiIorio's name appeared on the ballot, coupled with the fact that the data imputation in the most plausible scenario does not alter the outcome of the election, it seems highly unlikely that even more precise estimates would predict a 5th place finish for Mr. Hawkins.

That said, if the parties are interested in such an analysis, then I recommend that the focus be on precincts 3101, 3103, and 3104, precincts in which Mr. Hawkins placed ahead of Ms. Cavanagh when Mr. DiIorio's name did not appear on the ballot. Moreover, I suggest that we compare the 99 ballots in question to a random sample of afternoon ballots, weighted by precinct.

Please let me know if you need any additional information, or if you have any questions.

Sincerely,

Jennifer L. Lawless
Assistant Professor