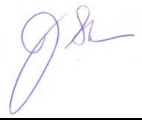
Victorian Electoral Commission

AUDIT OF UPDATED BALLOT COUNTING SOFTWARE

Issued Date	30-August-2018	
Issued To	Victorian Electoral Commission (VEC) ABN 46 583 749 552.	
BMM Reference	VEC.1005.02	
System:	Count Software	**Version:** v1.0.0.416
Signed		
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Executive Summary

The Victorian Electoral Commission (VEC) requested a review of changes to the Computer Count Software module. The module counts ballots to elect candidates for proportional representation and preferential counting systems in accordance with the relevant legislation.

The following changes have been made to the computer count algorithms:

- The preferential algorithm has been extended to allow for State Lower House (District) computerised counts, which:
  - handles deceased candidates differently from the existing Municipal preferential deceased logic; and
  - handles tie resolution logic differently from the existing Municipal preferential tie resolution logic.
- Replace the Microsoft workflow with equivalent C# code that implements the logic of the preferential counting system.
- Replace the Microsoft workflow with equivalent C# code that implements the logic of the proportional representation counting system.

The Computer Count module is part of the Election Management System (EMS). At the time of the audit the other parts of the EMS software were being changed. Those software changes outside the computer count module are outside the scope of this audit.

The scope of the audit included:

1. A review of VECs analysis documents to ensure they correctly define the requirements for deceased candidates and tie resolutions in a State District computer count.
2. A review of VECs test methodology and test cases to confirm that VEC has sufficient test coverage and that the tests are relevant and executed correctly.
3. A review of VECs test results to confirm that a record of successful completion of tests exists.
4. A review of the source code to
   4.1. Inspect changes for any fraudulent code and that all changes relate to the documented requirements.
   4.2. Confirm the C# code replacing the Microsoft workflow is logically equivalent
5. Confirmation that the system complies with the relevant legislation.

BMM found:

a) The quality assurance methodology and software quality control was rigorous and well documented;
b) The test cases in software development and integration testing were adequate to ensure the changes comply with relevant legislation;
c) The system had been tested to ensure that previous election counts could be reproduced with the same candidates being elected at the same stages of the count, and
d) There was no malicious code in the software changes.

BMM concludes that the change to the Computer Count software performs correctly and complies with relevant legislation.

1 Methodology

VEC provided the documentation listed in the Appendix for BMM to review prior to the visit.

BMM reviewed the documents and then visited the VEC on 9th August to conduct the audit.

VEC provided access to the source code, the test environment, and to personnel in development and quality assurance.

BMM took a copy of the source code and the installed files for the count module.

2 Software Change Description

2.1 Workflows replaced with equivalent code.

The counting software was written using a combination of C# workflows and regular C# code. The workflows provided the logic on how to handle the preferential or proportional counting process and the C# code component calculates the results at the relevant points in the workflows. The mechanics of counting and database access was mainly provided by the C# source code.

This change replaces Microsoft workflow with logically equivalent C# code. The previous workflow definitions were in files CalculatePref.xml, CalculatePR.xml. They are replaced by the C# code source files CalculatePR.cs, CalculatePref.cs and CalculateWorkflow.cs.

The relevant legislation to be implemented for a state count is the ELECTORAL ACT 2002 [EA2002] and for a municipal count is the LOCAL GOVERNMENT ACT [LGA1989]

2.2 'Deceased Candidate' and 'Tie Resolution for Victorian State and Municipal elections:

Election	Counting System	Handling of "Deceased" candidates and "Tie Resolution"	
State District (Lower House) *Each district elects one representative*	**Preferential**	[Deceased] where a candidate has a nomination status of Deceased (dies post 6.00pm on day of election) they remain in the count and are treated the same as an active candidate. If such a deceased candidate is elected then election fails. *[Ref: EA2002 Sec 72(b)].* [Tie Resolution] **During the count**: A tie is resolved by drawing the defeated candidates by lot by the election manager. **Final count:** where one vacancy remains with only two continuing candidates, the tie is not resolved and the election is declared 'Tied' *[Ref: EA2002 Sec 117(1-2)]*	**New**
State Region (Upper House) *Each region elects five representatives*	**Proportional Representation**	[Deceased]- In any case in which section 93A(4) applies, a vote marked on the ballot-paper opposite the name of a deceased candidate must be counted to the candidate next in order of the voter's preference, and the numbers indicating subsequent preferences shall be taken to be altered accordingly. *[Ref: EA2002 Sec 114A(27)]* [Tie Resolution] **During the count**: A tie is resolved by declaring defeated the candidate with the fewest votes at the last count where votes were unequal, or if all counts were equal then by the election manager drawing the defeated candidates by lot. **Final count:** If on the final count or transfer 2 candidates have an equal number of votes, the result	*No changes*

Election	Counting System	Handling of "Deceased" candidates and "Tie Resolution"	
		is to be determined by lot by the election manager. *[Ref: EA2002 Sec 114A(25)]*	
Municipal *Single Vacancy Electorate*	**Preferential**	[Deceased] – If a candidate dies before 6:00pm on election night and their name is retained on the ballot paper, the candidate and any figure next to the name are to be treated as removed and the ballot-paper is to be given effect to in the voter's order of preference in respect of the remaining candidates *[Ref: LGA1989 Sec 9(2b)]* [Tie Resolution] - Same as State Region *[Ref: LGA1989 Sch3 10(g)]*	*No changes*
Municipal *Multi-Vacancy Electorate*	**Proportional Representation**	[Deceased] - same as Municipal Preferential [Tie Resolution] - Same as State Region *[Ref: LGA1989 Sch3 11B(25)]*	*No changes*

3 Quality Assurance

VEC use Microsoft's Team Foundation Server to provide source code management, requirements (stories) management, automated builds and unit testing.

VEC employs an "agile" approach for development and testing. This approach provides iterative cycles and quality gates that ensure that the software:

- correctly implements the business stories;
- is subjected to multi-level testing; and
- has formal acceptance before final deployment.

Test cases with results were both stored protected under the HP records management system.

The system provides adequate documentation to allow audit of the process.

4 Test Results

BMM reviewed test cases defined for changes to preferential count to provide for State District elections. BMM witnessed the execution of the software and test cases in the test environment to verify that

- A tie for the final vacancy in State District tied the election;
- A tie during the count in State District is resolved by lot; and
- a deceased candidate in a State district could be elected or defeated

Appendix A – Document Registry

Calculation Solution Overview v1.0 Final.docx
Computer Count Calculation Process Diagrams - Municipal Preferential.pdf
Computer Count Calculation Process Diagrams - Municipal Proportional Representation.pdf
Computer Count Calculation Process Diagrams - Preferential.pdf
Computer Count Calculation Process Diagrams - Proportional Representation.pdf
Computer Count Calculation Process Diagrams - State Preferential.pdf
Computer Count Calculation Process Diagrams - State Proportional Representation.pdf
Deceased and Retired Candidate Matrix.xlsx
Legislation Overview for Results and Computer Counting.docx
PME Project Plan - Calculation Computer Count and Results Final.docx
PR Scenarios Test Matrix.xlsx
Test Strategy - 2018 Computer Count Calculation v1.0 Final.docx
Test Summary Report - Approval Page.pdf
Test Summary Report - Computer Count Calculation v1.0.docx

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