Democracy Suite® ImageCast® Printing and Finishing Specifications

Version: 5.11-CO::1

May 31, 2019

DOMINION VOTING

Our customers come first.

Table of Contents

CHAPTER 1: INTRODUCTION

1.1 Relevant Disclaimers

This document may make reference to certain Democracy Suite® functionalities that are not part of the current 5.11 campaign and should be disregarded throughout the document.

For a full list of relevant disclaimers, please see the "Relevant Disclaimers" section in the *2.02 - Democracy Suite® System Overview* document.

1.2 Purpose and Scope

This document provides an overview of ballot printing and finishing for all ImageCast® tabulators and scanners - the ImageCast® Central (ICC), ImageCast® Evolution (ICE), ImageCast® Precinct (ICP) and ImageCast® Precinct 2 (ICP2) ballot tabulators. The intended audience is election administrators and their technical support staff, and the content highlights the basic ballot production process and the key factors for quality control and inspection without going into the level of detailed needed for ballot production.

This document is not the full technical specification for the Dominion ballot printer qualification program, nor does it serve to outline every print operation or cover all quality control aspects. The appropriate document for that purpose is the Dominion Voting Systems ImageCast® Printing Specification. Printers undergoing the qualification exercise will be provided with that document during the qualification process itself.

CHAPTER 2: IMAGECAST® BALLOT PRINTING AND FINISHING SPECIFICATIONS

2.1 The Need for Printer Training and Qualification

Printing ballots is different than most commercial printing. The deadlines are fixed and the production timelines are short. Optically scanned ballots must be printed and manufactured with high precision; the tolerance for mistakes or other errors is very small. 'Bad printing' has been the source of several disrupted or contested elections and seemingly small mistakes can have profound consequences. Printing errors can adversely affect election operations, erode voter and candidate confidence, cost hundreds of thousands of dollars in reprinting and potentially lead to litigation and other legal challenges.

Prior to live elections, Dominion trains, tests, and qualifies printers to print and manufacture ImageCast® ballots. These training procedures educate printers in order to eliminate learning curve errors, and evaluates quality control procedures. During the period of qualification, Dominion reviews the ballot quality information, and responds to printer inquiries regarding changes.

The primary goal of the training and qualification program is to increase the quality of ballots being produced by sharing information and quantitatively inspecting sample ballots. In addition to providing information on common pitfalls, the training program outlines several standard test methods used to evaluate the ballots in qualification testing. Printers can adopt these qualitative tests in their own quality control processes. The qualitative measurement and inspection activities reveal possible systematic biases, calibration errors, lapsed preventative maintenance, or alignment issues that need correction.

2.2 Dominion's Printer Qualification Program

When searching for a print vendor to supply ballots, the printer should be a Dominion-qualified ballot printer in good standing. Printers who hold a Dominion Qualification are high quality commercial print- ers who have demonstrated they possess the experience, equipment, and facilities required to successfully produce ballots. A Dominion account representative can provide a list of accessible qualified printers for your type of ballot printing.

The qualification process includes:

- Creation of a test plan based on the print technology, experience, and ballot features of specific customers
- On-site instruction in ballot printing and finishing.
- Ballot inspection.
- Establishment of ballot Quality Control programs.
- Ballot handling testing.
- Release of a Test Report

The printer is required to print and finish a production run of ImageCast® ballots. These are graded and reviewed as part of the process.

If the printer successfully completes testing and inspection, Dominion will qualify the press, the staff, and the facility.

2.3 ImageCast® Ballot Artwork Source Files

Dominion's Democracy Suite Election Management System creates PDF artwork files. Ballot artwork is generated in industry-standard PDF format, PDF/X-1a:2001 (PDF Version 1.3) and CMYK colour space.

Ballot artwork files are full-sized press-ready ballots containing all required ballot elements and the unique ballot ID barcode that distinguishes each ballot style. Each file contains one or two ballot images: a front image (if the ballot is single-sided) or paired front and back ballot images. All fonts used in the ballot artwork are embedded in the PDF file. Ballot artwork files are digitally-signed (X.509) and tied to the election project files produced by the Democracy Suite Election Management System to allow for authentication and revision control.

Recent software version have added functionality for ImageCast® users to add trim lines and stubs directly on the ballot image. Pre-press imposition of ImageCast® ballot artwork to add crop marks, background screens, stub artwork, or other printing, may be required on prior versions. No modifications, post-processing, or image conversion of the original ballot artwork files is allowed.

2.4 Approved Ballot Paper Stocks

The optimal paper base for all ballot types and all scanners except the DRS Photoscribe platform, is **Rolland Opaque 100# Text.** Rolland Opaque is specialty paper with high levels of recycled content, high consistency, low defects, and greater quality control than other commercial papers. This elevated quality reduces potential problems with printing and improves scanning performance. Also of note, it is produced at the leading specialty paper plant in North America for stainability and recycling, and the only North American plant whose energy

source is landfill methane.

There are 3 types of Rolland Opaque 100# Text customized for ImageCast® and specific print technologies:

- Rolland Opaque 100# Text : the base paper for use in offset presses.
- Vote Secure SL: the base paper with a treatment improving the adhesion of xerographic toner.
- Vote Secure IJ: the base paper with a treatment improving ink density and fastness for commercial ink jet presses, as well as improving the sliding resistance of the ballots to meet specification. Vote Secure IJ 100# Text is the only paper qualified for use in ink jet presses.

The optimal paper stock for the DRS Photoscribe platform is Rolland Opaque 80# Text. Outside North America, only Rolland Opaque 100# Text is qualified for use.

The full list of North American papers approved for manufacturing ImageCast® ballots is provided in Table 2.1.

Manufacturer	Type	Weight	Color/Finish	Comments
Rolland Enterprises Inc	Rolland Opaque and Vote Secure SL, IJ, GR	100# Text	Low Brightener, Smooth Finish	Optimal choice. 30% Post consumer fiber, BioGas, EcoLogo, FCS Mixed Sources
	Rolland Opaque	80# Text	Bright White, Smooth Finish	DRS only, 30% Post consumer fiber, BioGas, EcoLogo, FCS Mixed Sources
International Paper	Accent Opaque	100# Text	Smooth	Not recommended for ink jet printing, FCS Forest Management

Table 2-1: Text and Paper Stocks Approved for ImageCast® Ballots

No other papers are qualification for use with ImageCast®. In cases where alternatives are requested, Dominion may perform an additional qualification testing.

2.5 ImageCast® Ballot Printing Methods

ImageCast® ballots can be printed using a range of modern printing technologies:

- Conventional web or sheet-fed offset lithographic presses.
- High-speed digital xerographic or other electrophotographic presses (both web and sheet-fed).
- Ink jet printers, both desktop units to high-speed web print engines.
- Small quantities of tabulator-ready ballots can be printed with a conventional B-size laser printer (600 dpi min., pre-calibrated), directly onto pre-cut blank ballot stock.

Print technologies do not produce ballots of equivalent quality. Each print technique has different aspects of quality and possible errors. For this reason, the print qualification granted to a printer is limited to a specific press, the facility, and the operators. The qualification test is adapted to each technology, as well as the scope of ballot variances that are to be printed.

Successful ballot printing results from strict adherence to ballot specifications.

2.6 ImageCast® Ballot Printing Specifications

2.6.1 Common Specifications for all ImageCast® ballot Production

Common to all ImageCast® ballot production methods is precise reproduction of the ballot image onto the finished ballot:

- Ballot images must be accurately reproduced, properly scaled, correctly registered to the finished card, and printed with the correct inks or toner.
- Ballots must be manufactured on properly-conditioned and approved paper stocks that are accurately trimmed to size.
- Any additional ballot finishing to meet customer and jurisdictional requirements should be of the highest quality.
- Ballots must always be handled correctly and packaged properly to ensure that they are clean and undamaged when the customer receives them.
- In-house ballot inspection, testing and a well-executed quality assurance program, are an essential part of any ballot manufacturing facility.

Finished ballot dimensions broken per ImageCast® tabulator type are presented in Figure B.6.

THE BALLOT PRINTER IS RESPONSIBLE for all aspects of ballot printing and manufacturing and MUST ENSURE that the ballots that they produce meet all Dominion and customer specifications at the time of tabulation.

ImageCast

Finished Ballot Dimensions

Tabulator		Width (nominal)	Width Tolerance	Length	Length Tolerance
CF-200	All Tabulators	8.500"	+0.020" -0.042"	11" and 14"	+/- 0.032"
ICP	ImageCast Tabulators	8.500"	+0.020" -0.042"	11" - 22"	+/- 0.032"
	BMD Tabulators	8.500"	+0.020" -0.042"	14", 17", 19", and 22"	+/- 0.032"
ICE	All Tabulators	8.500"	+0.020" -0.042"	11" - 22"	+/- 0.032"
ICC	Canon Scanners	8.500"	+/- 0.032"	11" - 22"	+/- 0.032"
	DRS PhotoScribe Scanner	8.500"	+/- 0.032"	11" - 18"	+/- 0.032"

Figure 2-1: ImageCast® Ballot - Finished Dimensions

2.6.2 Image Reproduction

- Print quality: Clean and well-printed images, with sharply defined edges, accurately reproducing the ballot artwork. Ink density must be uniform across the ballot and should be free from smudges, mist, spray, spots, hickeys, voids or other stray marks. No visible set-off, ghosting or bleed-through.
- Black ink: Black ink (or toner) must be dense, opaque, light-fast and permanent, with a measured minimum 1.2 reflection density (log) above the paper base.
- “Drop out” color: Must be tested to confirm that the reproduced color is not imaged by the tabulator if used for a voting position target.
- Image to card registration: +/- 0.016” maximum, worst case in any direction. Registration is most important across ballot width.
- Maximum image skew: +/- 0.032” maximum
- Maximum image scaling error: 0.25% maximum
- Front to back image registration: 0.032” maximum, worst case in any direction
- Minimum print imaging resolution: 600 dpi commercial (200 dpi in-house production of test ballots)
- Restricted areas: No printing in the designated restricted areas.

2.6.3 Ballot Card

- Square and accurately trimmed to size: Ballot edges must be cleanly cut and free from burrs, rolled edges, irregular or bias-cuts, and with the corners undamaged.
- Ballot width and tolerance: 8.500” (nominal), 8.458” min. to 8.520” max., measured at both the top and bottom of the card. (The trim tolerances for the ICC scanners are slightly looser, see the table below).
- Ballot length and tolerance: 11” to 22”, +/- 0.032” of required length.
- Ballot Squareness: 0.0075” maximum deviation
- Squareness of scores, folds, or ballot perforations: 90 degrees +/- 30 seconds maximum.
- Ballot curl: 0.150” max. height from ballot edge to the flat measuring surface (trimmed ballot). This is usually an indication of a damaged ballot or poor stock conditioning.

2.6.4 Other Defects

No offset powder, wax or spray should be used. No self-adhesive labels or stickers should be used on ballots. Ballots should be free from dust, dirt and other particulate matter.

Additional defects are included in the complete specification provided during qualification testing.

The printer is COMPLETELY RESPONSIBLE for any tabulation problems that may result from additional printing in the active ballot area! Dominion recommends that the jurisdiction includes the required elements in the ballot artwork with Democracy Suite EMS, or to block out a reserved area in the ballot artwork for this printing to be added. If in doubt about the placement of any additional printing not found in the ballot artwork, PLEASE ASK before printing the ballots.

2.7 Scoring and Folding Ballots

Absentee and mail ballots are typically folded and inserted into envelopes for distribution to voters. Ballots should always be folded across the ballot width (perpendicular to the transport direction) and parallel to the grain of the ballot stock (short-grain). Ballots should be folded into panels of approximately equal length, with a minimum panel length of at least 3.5 inches. Fold lines are centered between ballot markers and cannot 'touch' a voting position on either side of the ballot. Try and maintain a "guard band" of at least 0.050" from the position of the fold line to the edge of the nearest voting position target. The fold line should be a clean, sharp line of minimum width. All recommended ballot stocks can be folded either by hand or machine, but pre-scoring the ballot on the fold lines is recommended for heavier ballot stocks.

Table 2.2 indicates the guidelines for folding of the ballots.

For ballots with more than two panels, folding a 'Z-shape' will allow for easier unfolding and ballot scanning. Panel lengths of a multi-panel ballot can be varied to 'unstack' the folds (so that each fold is not exactly above another fold), which aids in envelope stuffing and removal. Ballot envelopes should be generously oversized to allow room for ballot segregation and to ease ballot stuffing and opening. Typically add a 0.5" allowance to the folded panel width to get the minimum envelope size required. Consider adding a small punched hole into the design of the return envelope - this hole will allow verification of a ballot inside - without compromising voter secrecy.

Ballot Length	Maximum Allowable Folds	Max Number of Panels
11”	2	3
14”	3	4
17”	3	4
18”	3	4
19”	4	5
20”	4	5
22”	5	6

Table 2-2: Ballot Folding Guidelines

2.8 Ballot Stubs: Perforations, Numbering and Padding

Binding ballots into stacks of 50 or 100 - a process known as ‘padding’ - improves the way in which ballots are handled and counted. Padded ballots are serialized on the ballot stub (or stubs), which allows for a quick accounting of the total issued ballots. The stub used to bind the ballots together onto a pad, is referred to as the ‘binding stub’.

Stubs can be placed at the top or bottom of the ballot artwork. If stub placement is not mandated by jurisdictional or election code requirements, it is recommended that the stub is placed at the bottom of the ballot artwork. This placement makes allowances for imperfections on ballot perforation.

THE BALLOT PRINTER IS RESPONSIBLE for all aspects of ballot printing and manufacturing and MUST ENSURE that the ballots produced meet all Dominion and customer specifications at the time of tabulation.

2.9 Ballot Handling and Print Shop Cleanliness

- All ballot printing facilities should be regularly cleaned, including the floors and all surfaces.
- Special attention should be paid to processes that generate dust, particulate matter, or aerosols.
- Effort should be made to isolate or vent ‘dirty’ air in order to prevent the contamination of paper and working surfaces from occurring.
- Waste should be regularly removed and all inks, solvents, or lubricants

should be properly cleaned- up and stored.

- Implementing a regular cleaning program throughout the print shop will help to ensure that the ballots stay clean.
- Just as important is the cleanliness of the press operators, bindery workers, and other staff who will be handling ballot stock or ballots. Hands should be washed regularly.
- Work surfaces should be regularly cleaned and food should not be allowed in the shop area.
- Remember that all paper and printing defects - dirt, dust, smudges, and spots - will be scanned by the tabulators!
- Always work to protect the edges and corners of finished ballots from damage or wear.
- Finishing or secondary operations that require the jogging of ballots can damage their edges and cause problems in tabulation.
- Ballots with bent or damaged corners, or worn, flattened or rolled edges should be destroyed.

2.10 Qualification Criteria for Printers

Full qualifications are granted when:

- Average dimensional difference is less than 0.020” from nominal
- Standard deviation is under 0.020”
- All outliers are reasonable
- All ballots scan without misreading

Conditional qualifications, which only apply to ballot on demand systems not producing absentee ballots, are granted when:

- Average dimensional difference is less than 0.035” from nominal
- Standard deviation is under 0.035”
- All ballots scan without misreading

Customer exception is required when:

- Average dimensional difference is less than 0.050” from nominal
- Standard deviation is under 0.050”
- All ballots scan without misreading

2.11 Examples of Problems Identified in Qualification Testing

Even with a clear specification, qualification testing reveals issues that are then resolved before any live ballots are produced. The impact of these issues is then almost completely negligible as compared to dealing with them in a real election.

Dimensional measurement reveals systematic issues with the equipment or operators. The nominal measurements are recorded, as well as the minimum, maximum and standard deviation. Typical items are shift image registration in sheet fed printers, or operators incorrectly adjusting the ballot image. These are simple adjustments provided they are done in advance.

Visual inspection quickly reveals problems with ballot packaging, ballot condition, print imperfections, low ink density, toner adhesion, ink fastness, sharpness of cutting tools, and fold alignment. Figures 2.2 to 2.4 show actual test ballots that did not meet specification:

Finally, scan testing on high volumes of ballots is the final proof that the ballots will run well. Typically more than 15,000 ballots are processed for reliability and accuracy. If there are any issues with paper, sheet friction, surface condition, or ballot condition, these will be revealed in qualification testing.

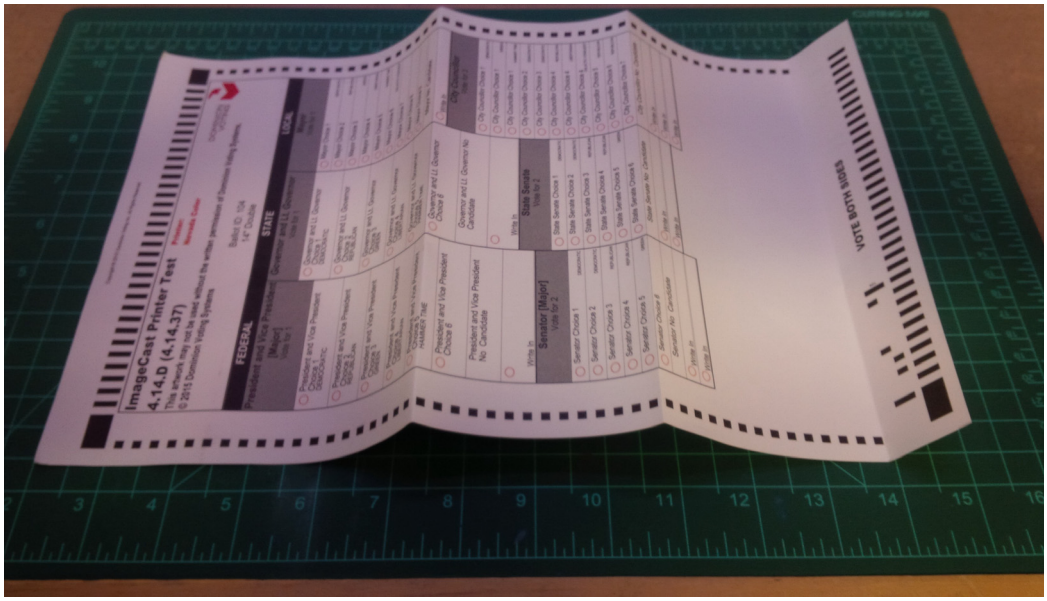

Figure 2-2: This 14” ballot has a panel of only 1 inch, this edge feeds poorly into tabulators

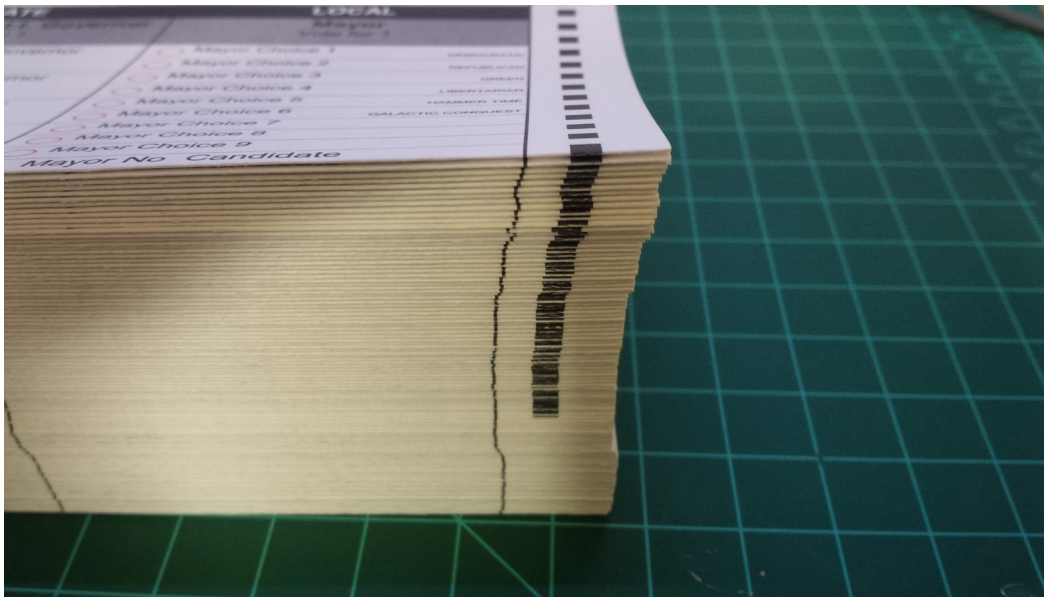

Figure 2-3: Visual inspection of a stack of ballots shows that the fold is cutting across an alignment mark

2.12 Examples of Problem Ballots

Even after qualification, quality control is essential and must remain in place for all ballot printing. Even small problems become major headaches if they occur on every ballot. The following are some ballots that caused scanner misreads:

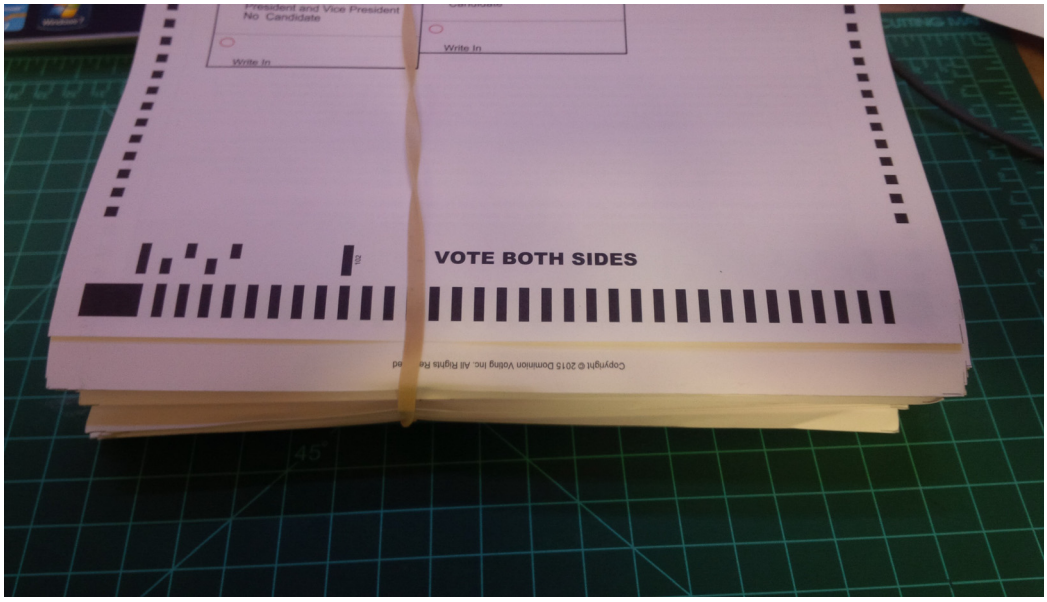

Figure 2-4: Ballots bundled using elastics damage the ballot edges and corners, increasing the number of misfeeds

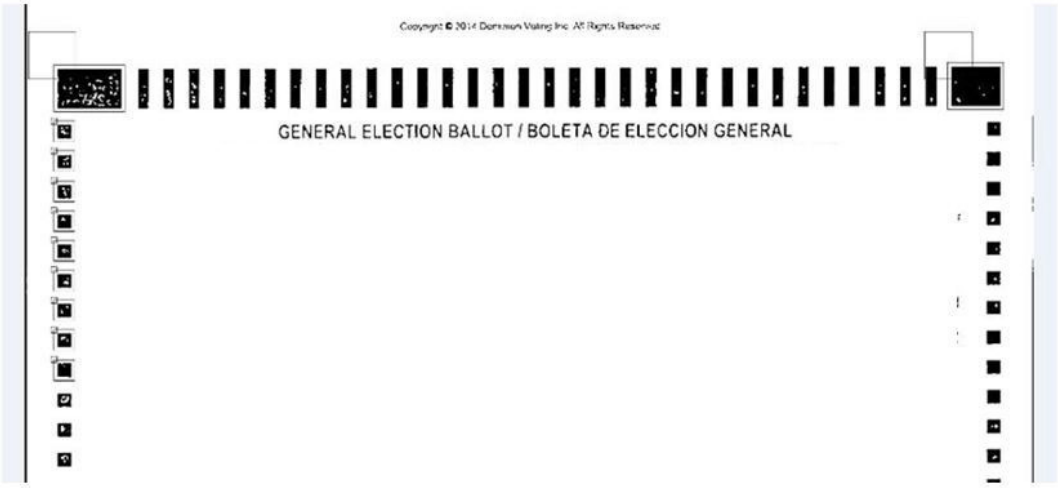

Figure 2-5: For security and accuracy, the system is designed to recognize solid alignment marks only. This ballot shows widespread fading which appears as white blotches

Figure 2-6: When print presses run low on ink, often the corners of the pages fade

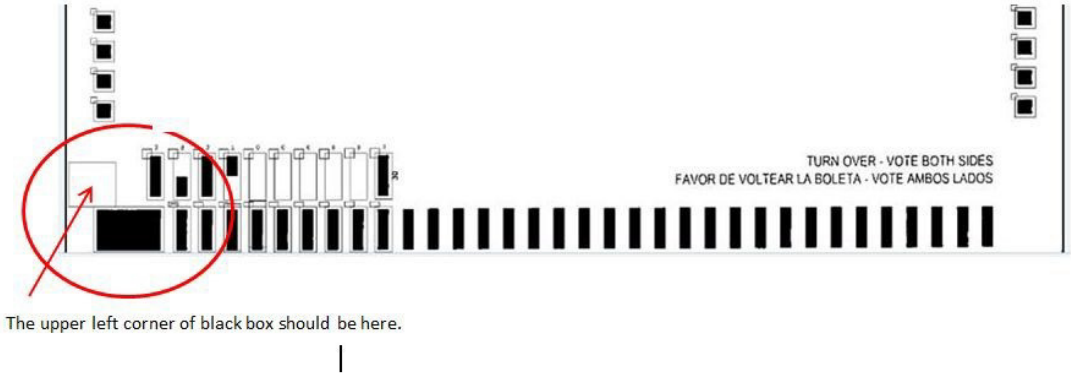

Figure 2-7: Stretched front image: the ink is dark, but the lower left alignment mark is 0.110 out of position (the rectangle indicates the expected location), three times the allowed spec

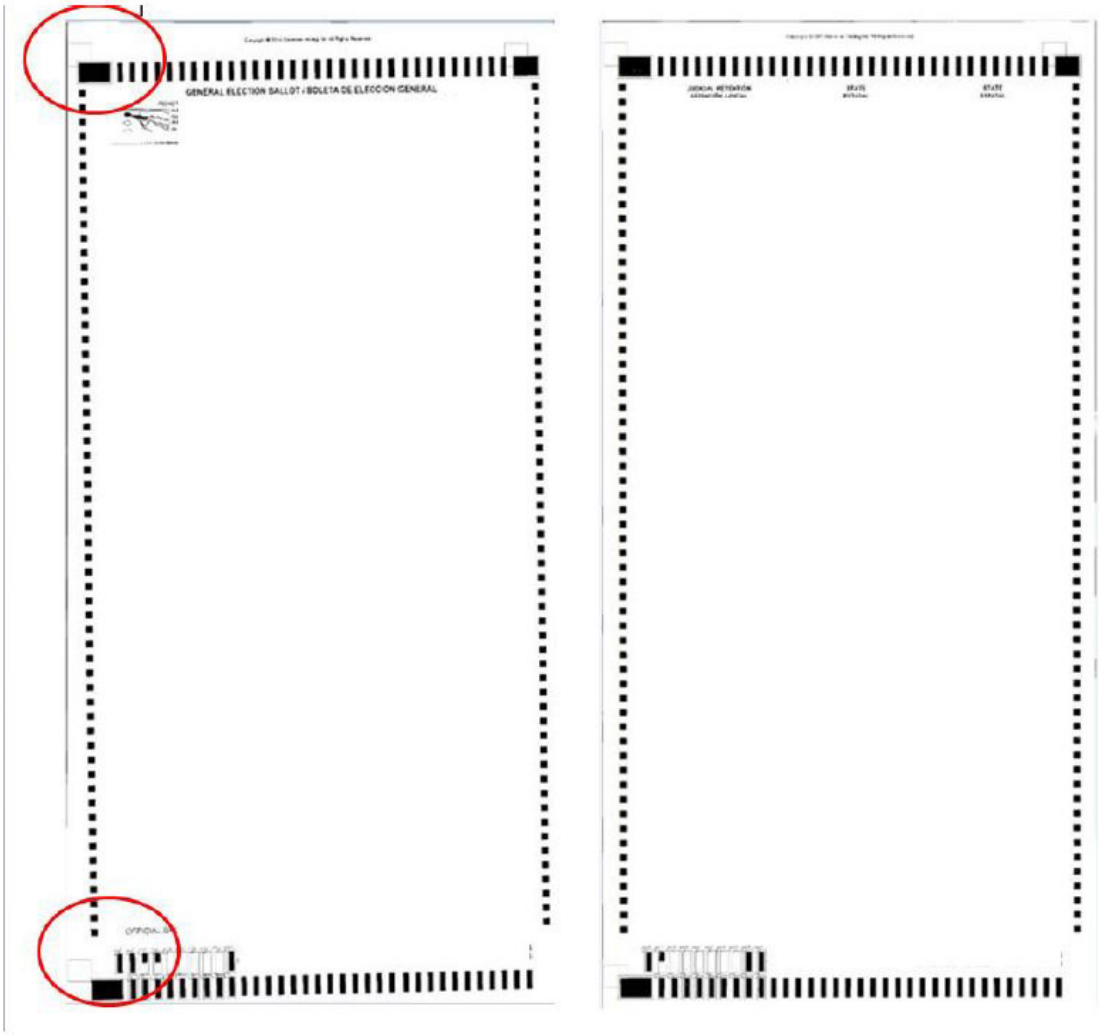

Figure 2-8: The front side of the ballot is drastically skewed when compared to the back

APPENDIX A: APPROVED DROPOUT COLORS FOR IMAGECAST® PRECINCT

Accepted Pantone dropout inks are shown in Figure A.1. CMYK Dropout values can are illustrated in Figures A.1 - A.6.

Figure A-1: Pantone Dropout color swatches.

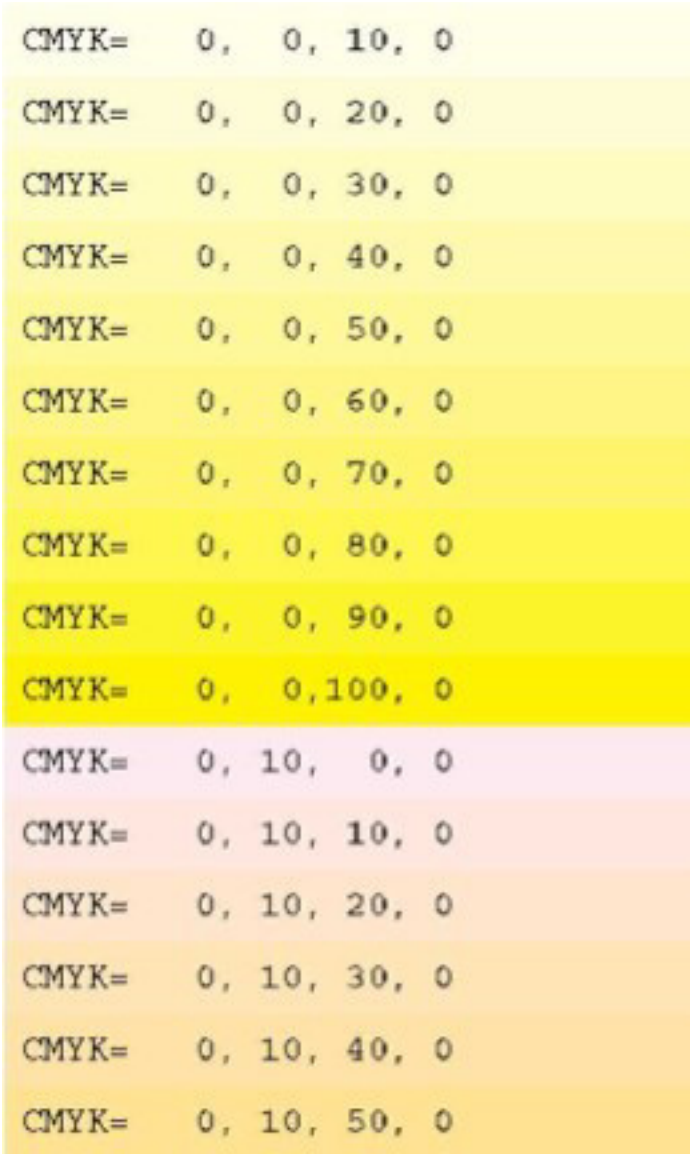

Figure A-2: CMYK Dropout color swatches 1.

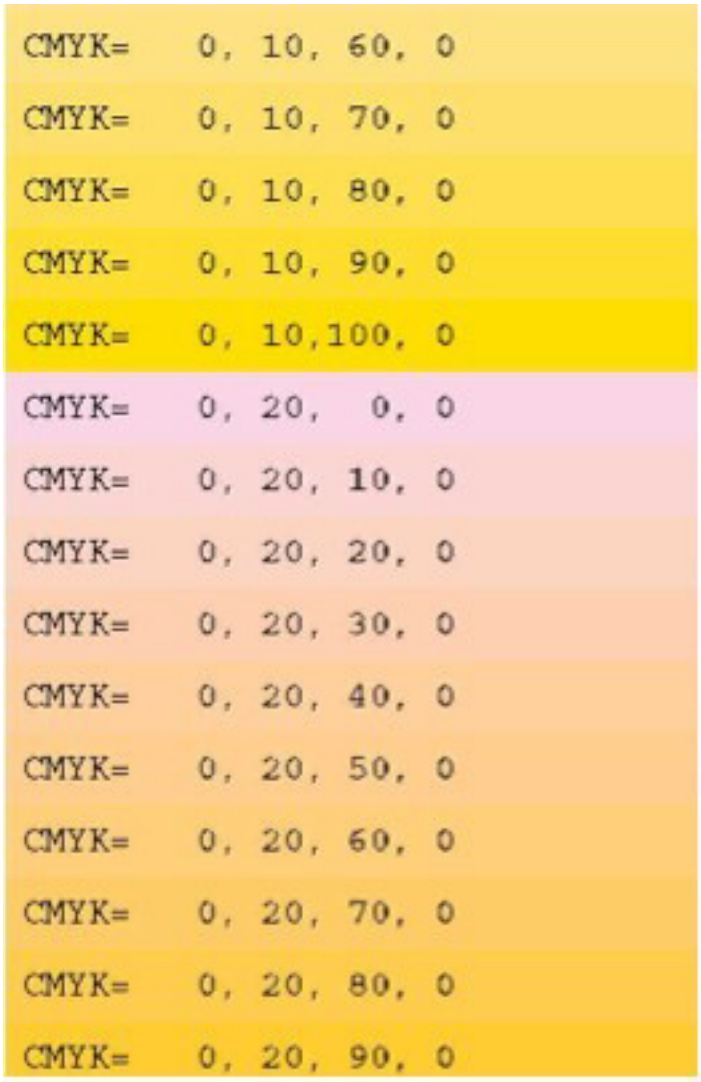

Figure A-3: CMYK Dropout color swatches 2.

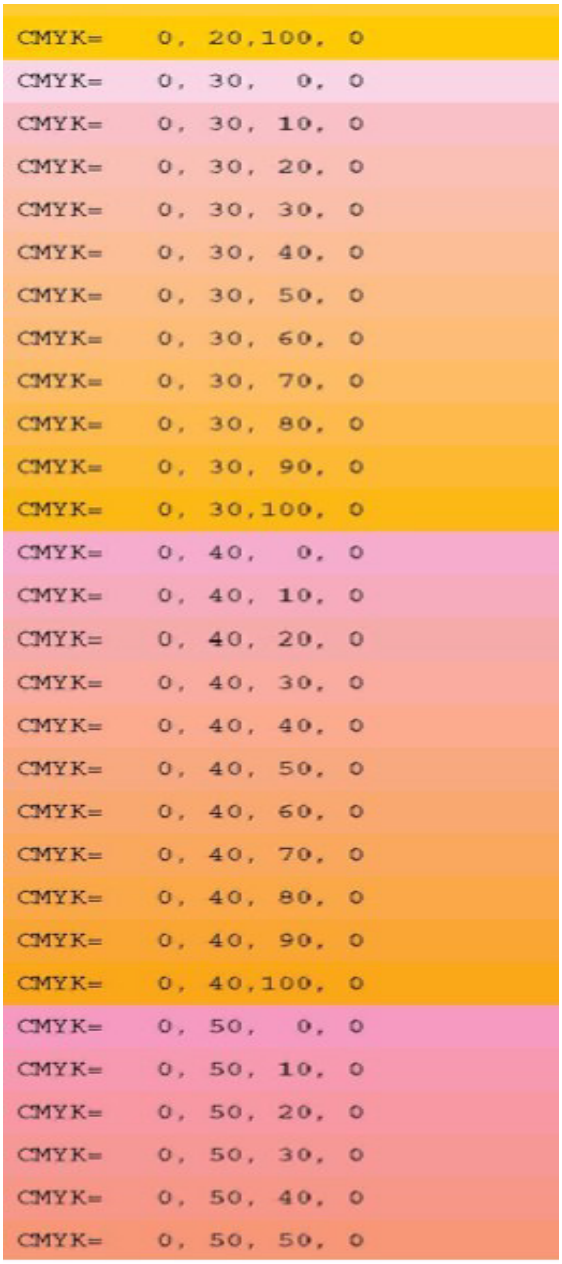

Figure A-4: CMYK Dropout color swatches 3.

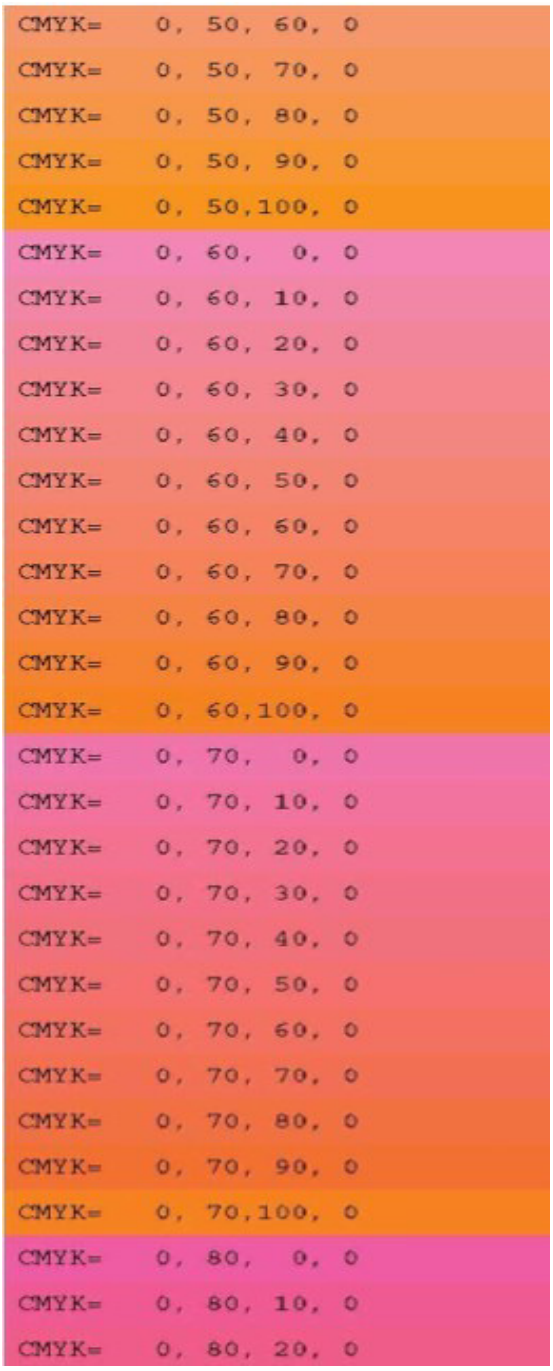

Figure A-5: CMYK Dropout color swatches 4.

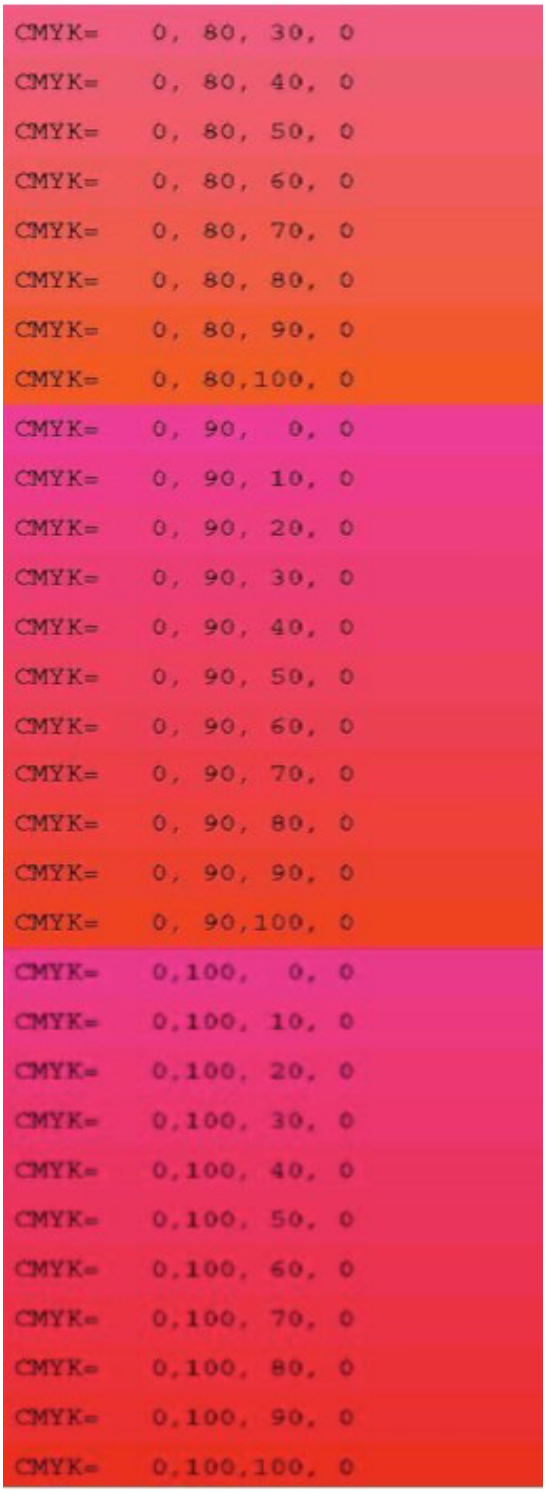

Figure A-6: CMYK Dropout color swatches 5.

APPENDIX B: BALLOT IMAGES

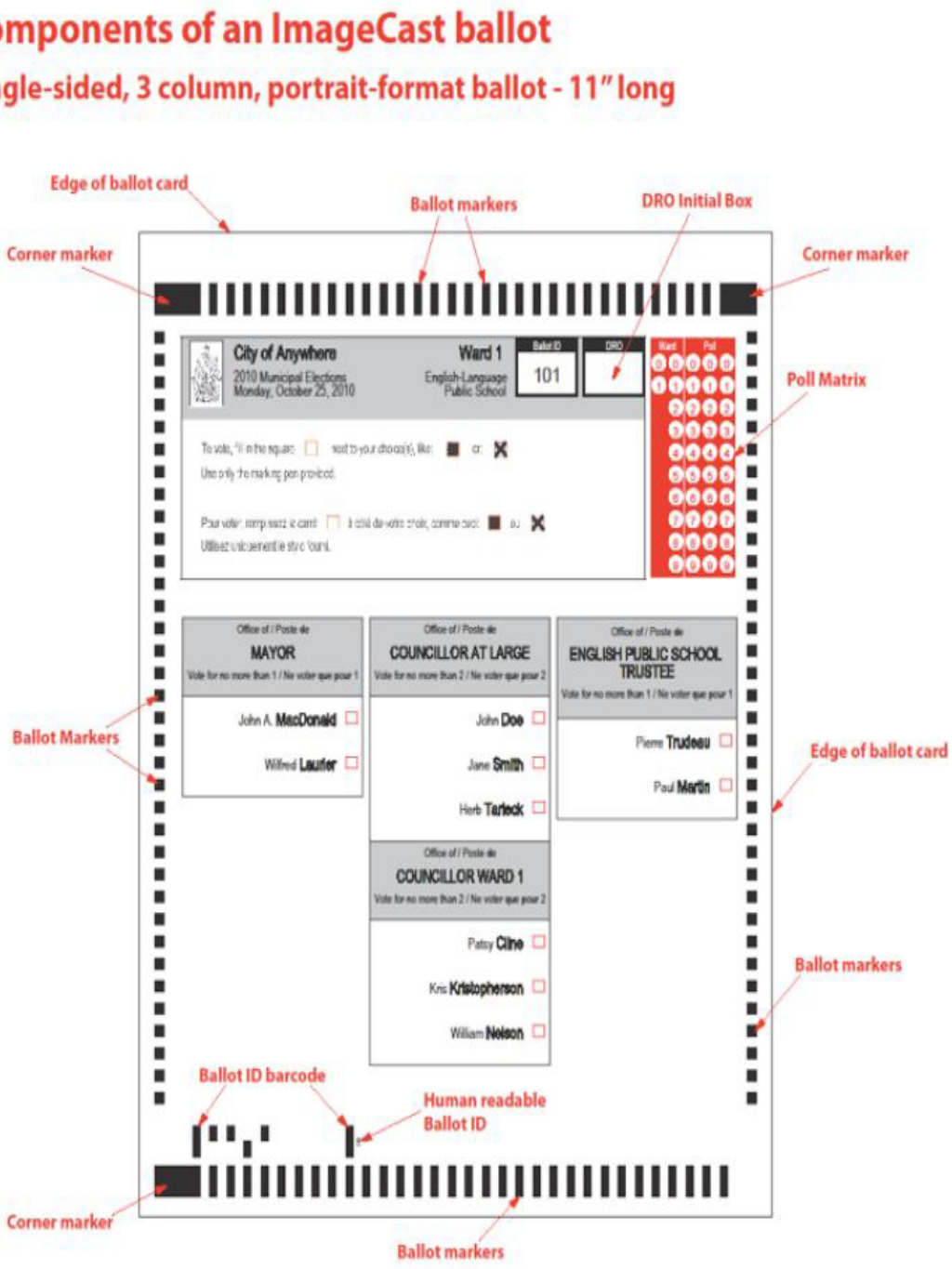

Figure B-1: Components of an ImageCast® Ballot - Three Column.

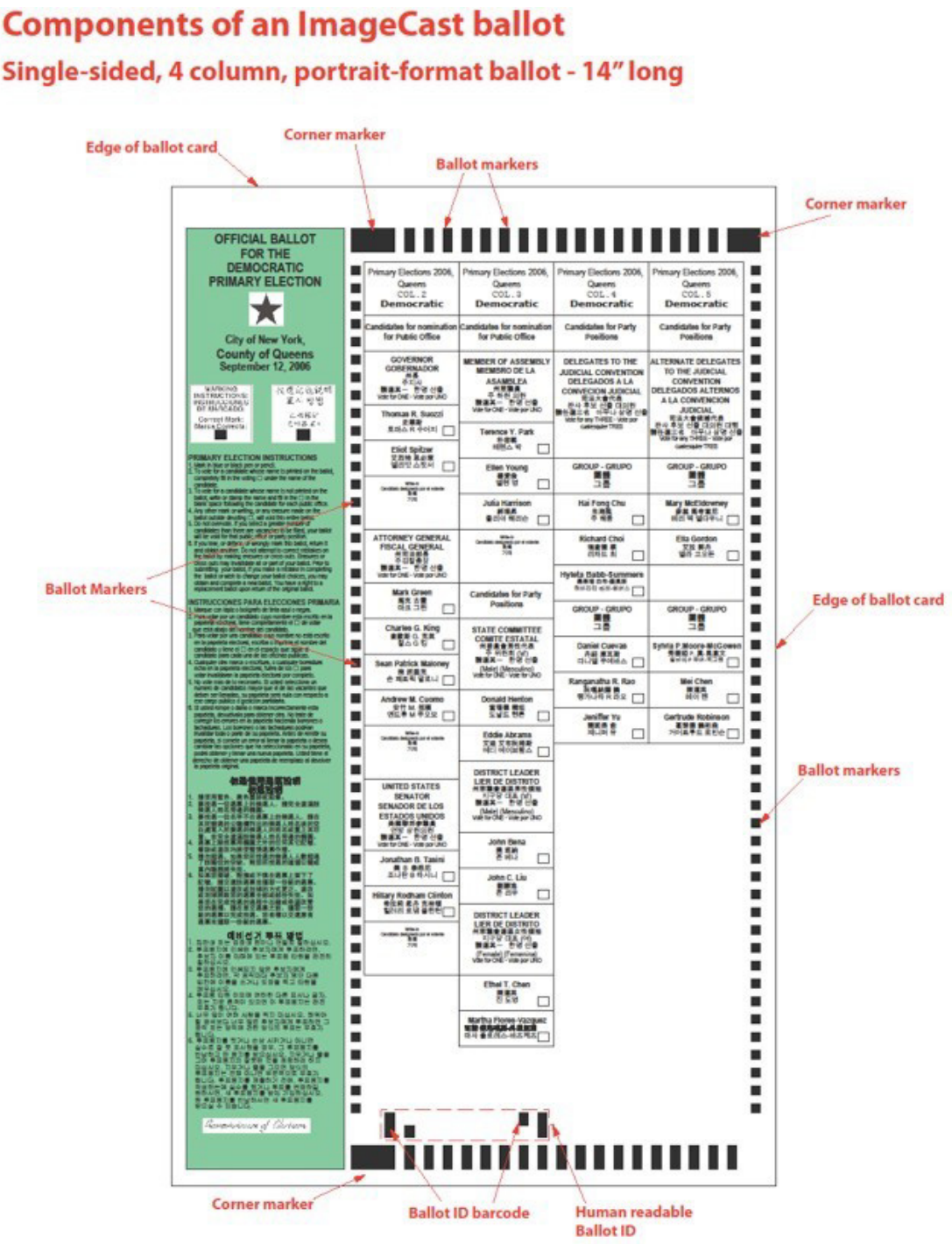

Figure B-2: Components of an ImageCast® Ballot - Four Column.

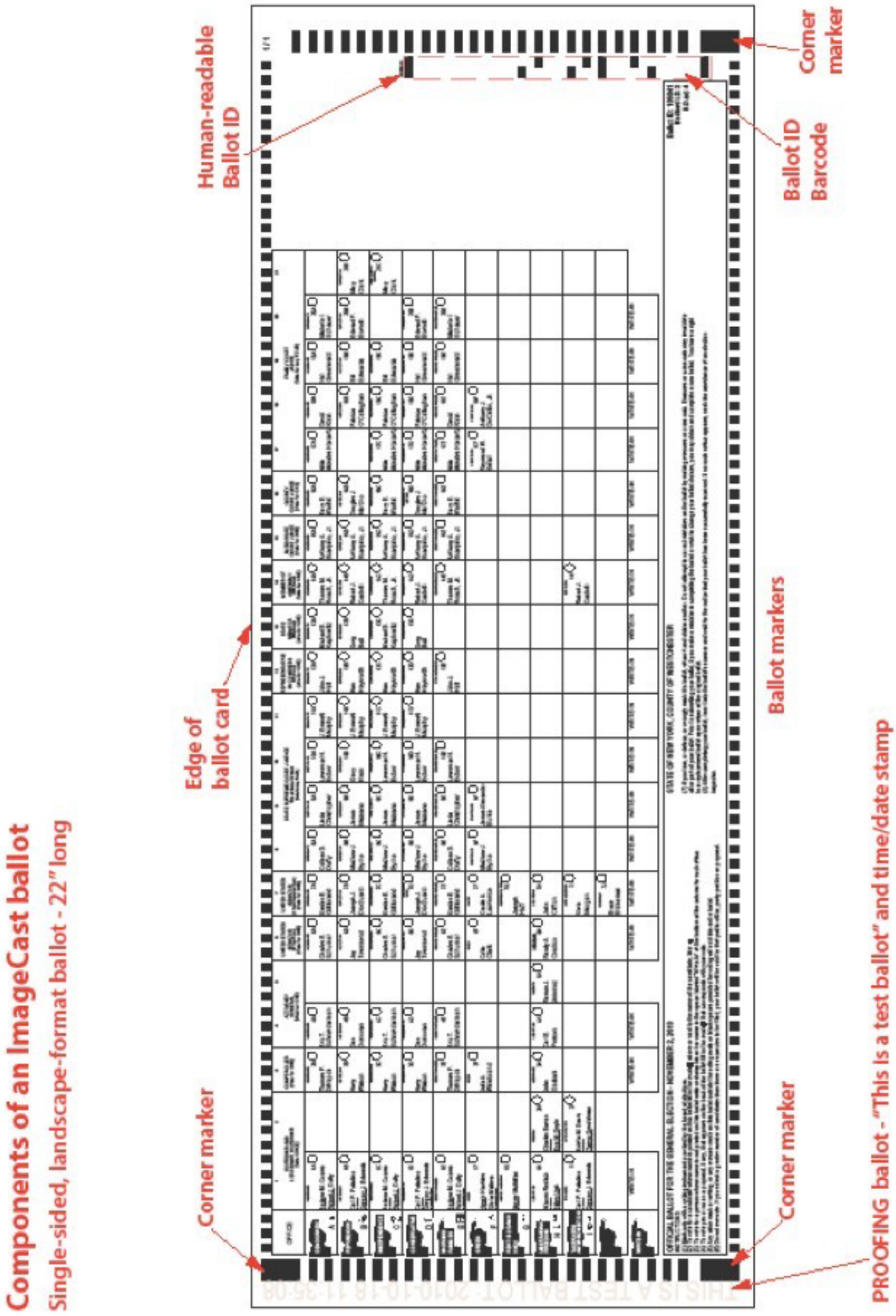

Figure B-3: Components of an ImageCast® Ballot - Landscape

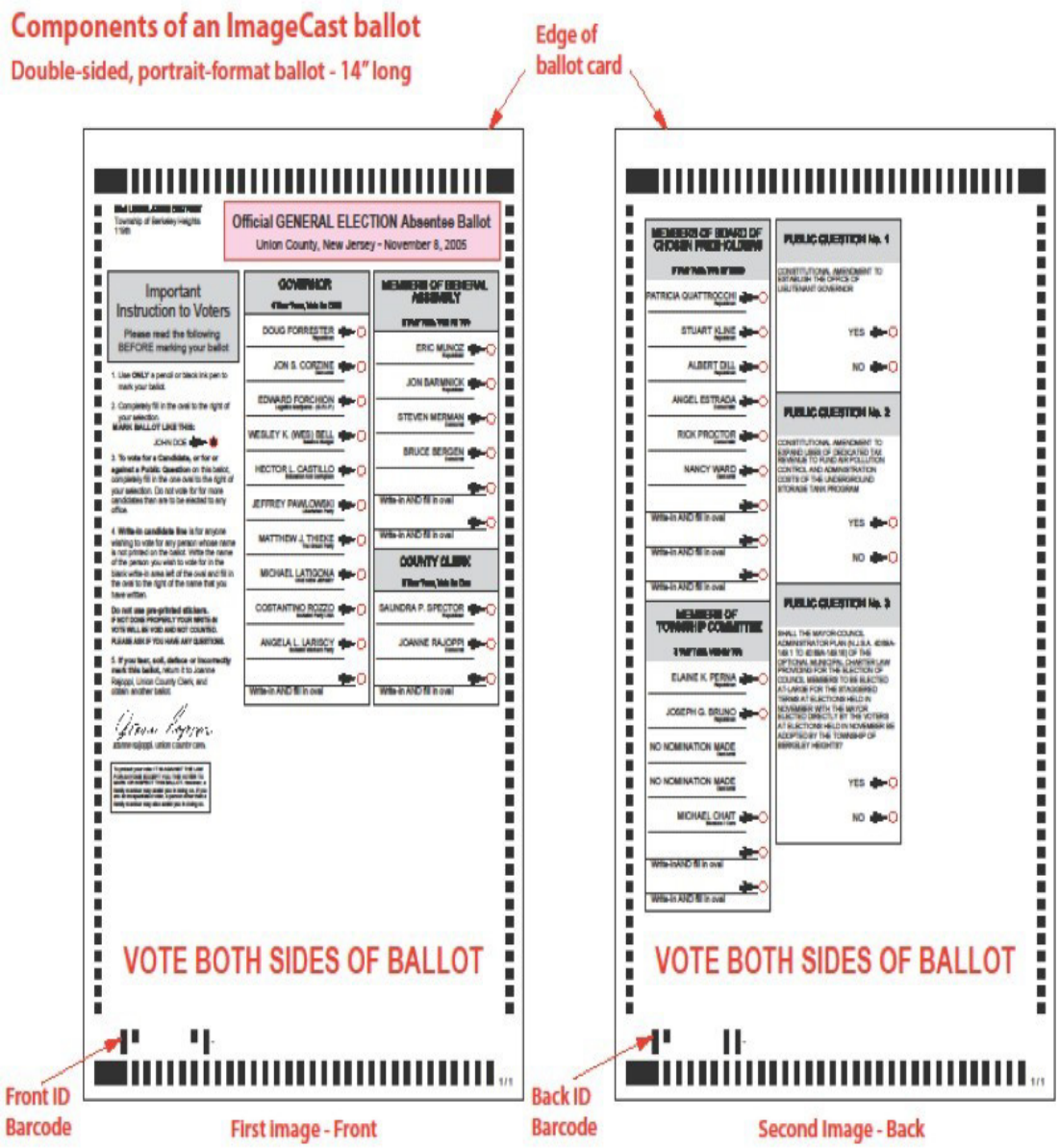

Figure B-4: ImageCast® Ballot - Double-sided 14" Ballot..

ImageCast Ballot Stock

Ballot Paper		Product Name / Grade	Basis Weight	Grammage	Type of paper	Thickness (Caliper)	Opacity	Color	Brightness	Smoothness
CF-200	Conventional Stock	Approved Opaque Text	80# -100#	110 - 155 gsm	Text	0.006" - 0.008"	>95%	White	> 90%	80-150
		Approved Opaque Cover	65#	160 - 190 gsm	Cover	0.007" - 0.009"	>95%	White	> 90%	80-150
ICP	Conventional Stock	Approved Opaque Text	80# -100#	110 - 155 gsm	Text	0.006" - 0.008"	>95%	White	> 90%	80-150
		Approved Opaque Cover	65#	160 - 190 gsm	Cover	0.007" - 0.009"	>95%	White	> 90%	80-150
	Secure Stock	Approved Secure Opaque Text	60# - 80#	90 - 110 gsm	Text	0.004" - 0.008"	>95%	White or Natural	> 80%	80-150
		Approved Secure Opaque Cover	65#	160 - 190 gsm	Cover	0.007" - 0.009"	>95%	White or Natural	> 80%	80-150
	NYS BMD Tabulators	Approved Opaque or Secure Opaque Cover	65#	160 - 190 gsm	Cover	0.007" - 0.009"	>95%	White	> 90%	80-150
ICE	Conventional Stock	Approved Opaque Text	60# -100#	90 - 155 gsm	Text	0.004" - 0.008"	>95%	White	> 90%	80-150
		Approved Opaque Cover	65#	160 - 190 gsm	Cover	0.007" - 0.009"	>95%	White	> 90%	80-150
	Secure Stock	Approved Secure Opaque Text	60# -100#	90 - 155 gsm	Text	0.004" - 0.008"	>95%	White or Natural	> 80%	80-150
		Approved Secure Opaque Cover	65#	160 - 190 gsm	Cover	0.007" - 0.009"	>95%	White or Natural	> 80%	80-150
ICC	Conventional Stock	Approved Opaque Text	60# -100#	90 - 155 gsm	Text	0.004" - 0.008"	>95%	White	> 90%	80-150
		Approved Opaque Cover	65#	160 - 190 gsm	Cover	0.007" - 0.009"	>95%	White	> 90%	80-150
	Secure Stock	Approved Secure Opaque Text	60# -100#	90 - 155 gsm	Text	0.004" - 0.008"	>95%	White or Natural	> 80%	80-150
		Approved Secure Opaque Cover	65#	160 - 190 gsm	Cover	0.007" - 0.009"	>95%	White or Natural	> 80%	80-150
	DRS PhotoScribe Scanner	Approved Opaque Text	60# - 80#	90 - 110 gsm	Text	0.004" - 0.006"	>95%	White	> 90%	80-150
Paper Industry Standard Code			TAPPI 410	TAPPI 410		TAPPI 411	TAPPI 519		ISO 2469 or TAPPI 489 or T525	Sheffield TAPPI 538

Figure B-5: Stock Description.

ImageCast
Finished Ballot Dimensions

Tabulator		Width (nominal)	Width Tolerance	Length	Length Tolerance
CF-200	All Tabulators	8.500"	+0.020" -0.042"	11" and 14"	+/- 0.032"
ICP	ImageCast Tabulators	8.500"	+0.020" -0.042"	11" - 22"	+/- 0.032"
	BMD Tabulators	8.500"	+0.020" -0.042"	14", 17", 19", and 22"	+/- 0.032"
ICE	All Tabulators	8.500"	+0.020" -0.042"	11" - 22"	+/- 0.032"
ICC	Canon Scanners	8.500"	+/- 0.032"	11" - 22"	+/- 0.032"
	DRS PhotoScribe Scanner	8.500"	+/- 0.032"	11" - 18"	+/- 0.032"
				Lengths over 22" are not certified	

Figure B-6: ImageCast® Ballots: Finished Descriptions

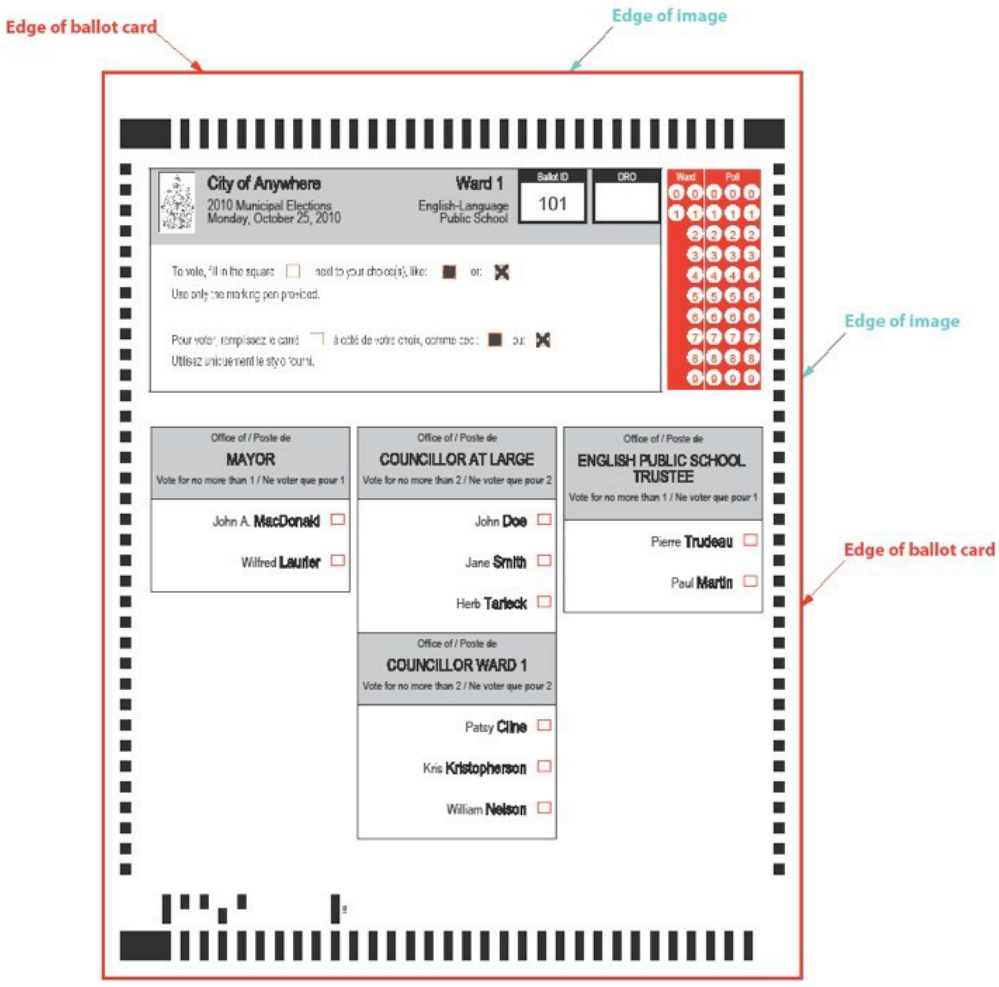

Figure B-7: ImageCast® Ballots Correctly Printed

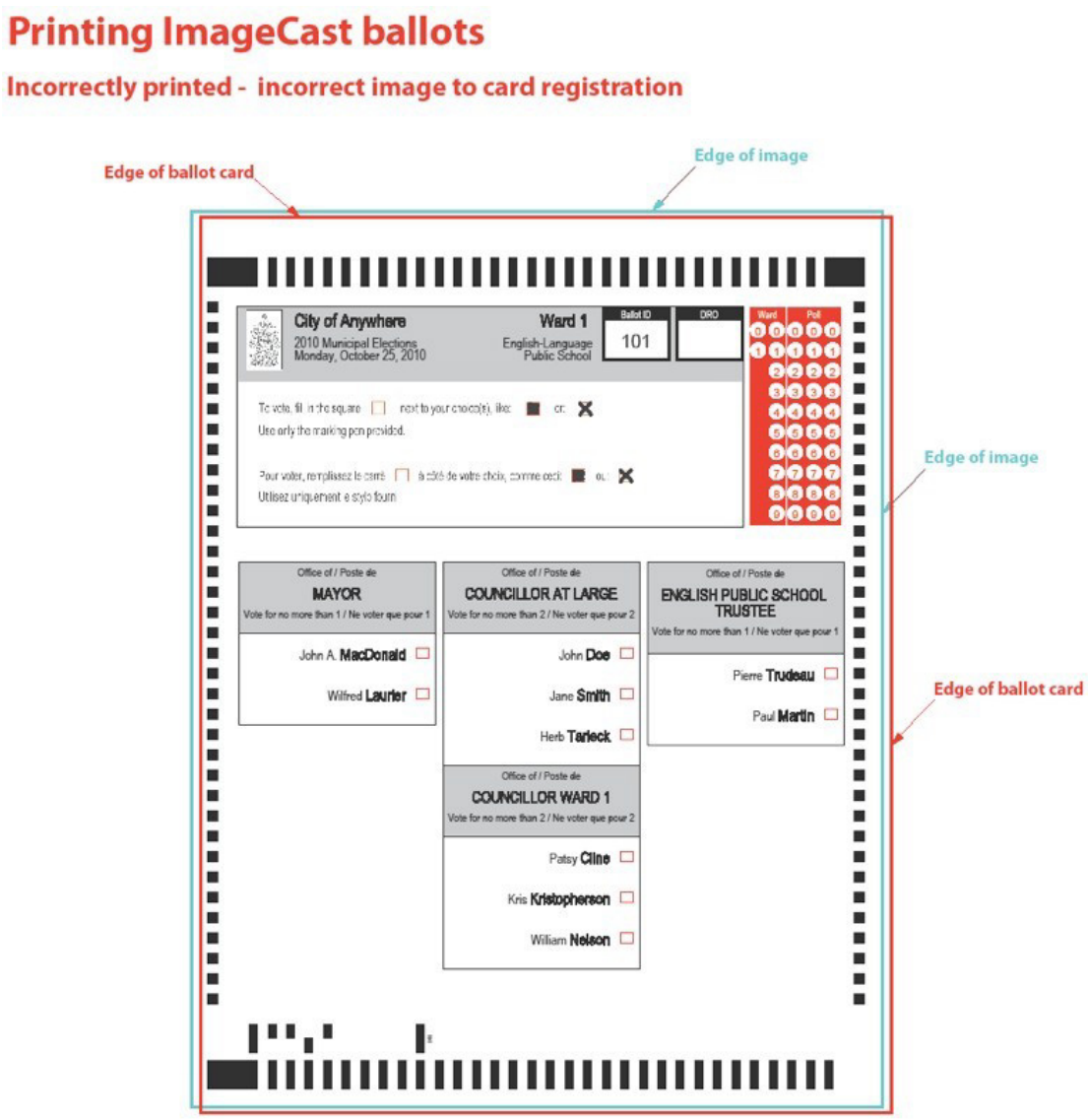

Figure B-8: ImageCast® Ballots Incorrectly Printed - Incorrect Image to Card Registration..

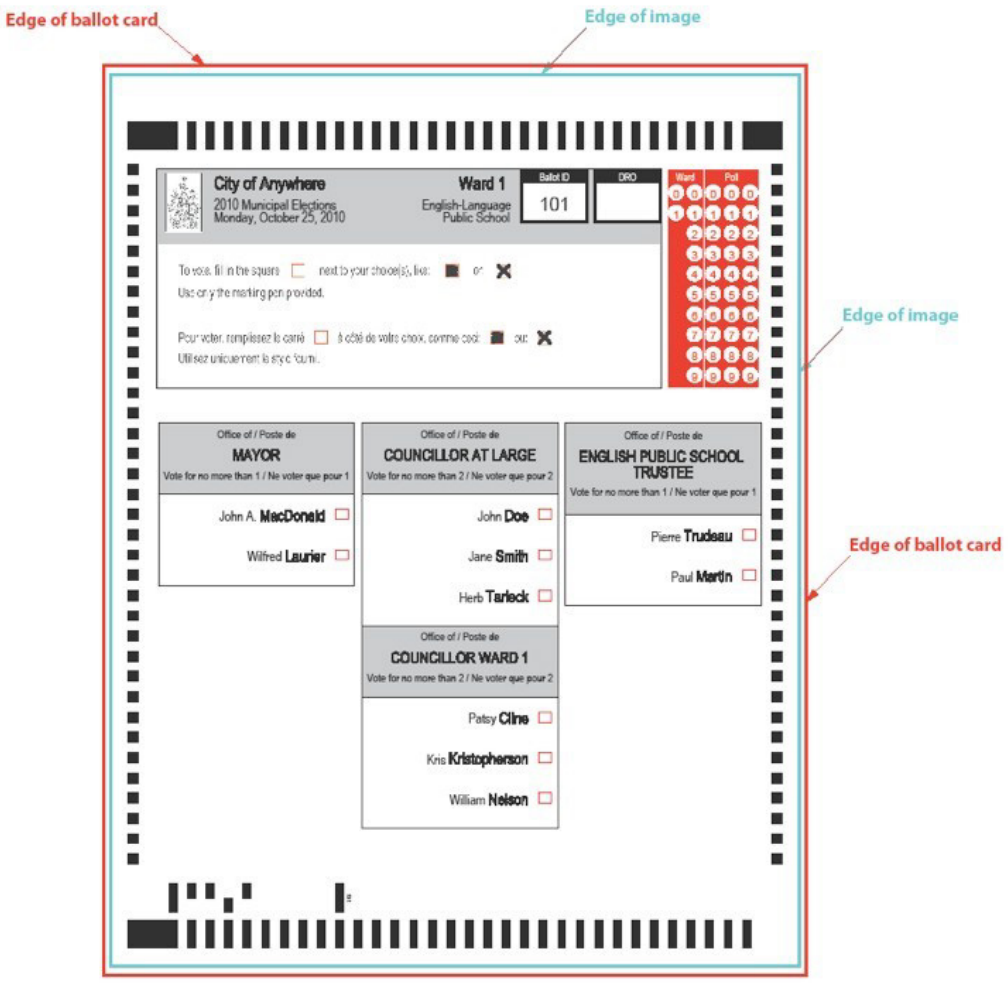

Figure B-9: ImageCast® Ballots Incorrectly Printed.

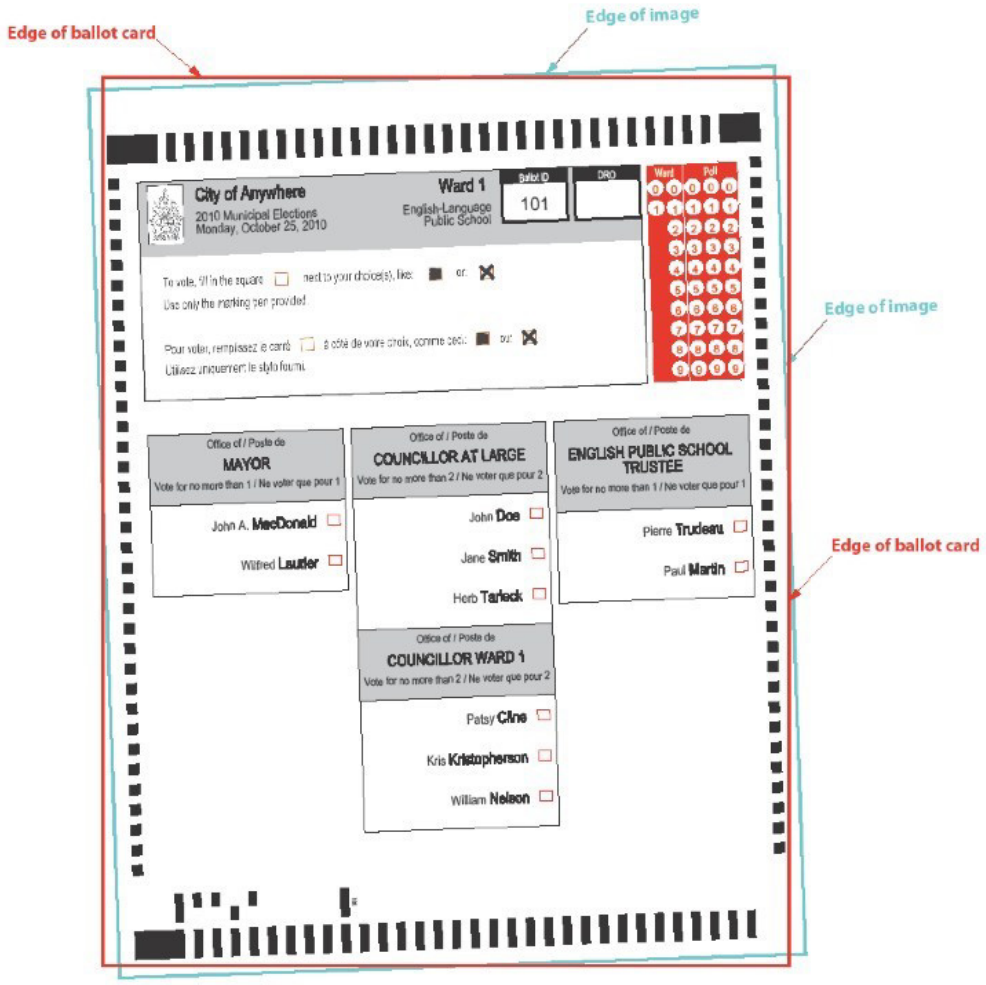

Figure B-10: Printing ImageCast® Ballots - Incorrectly Printed.

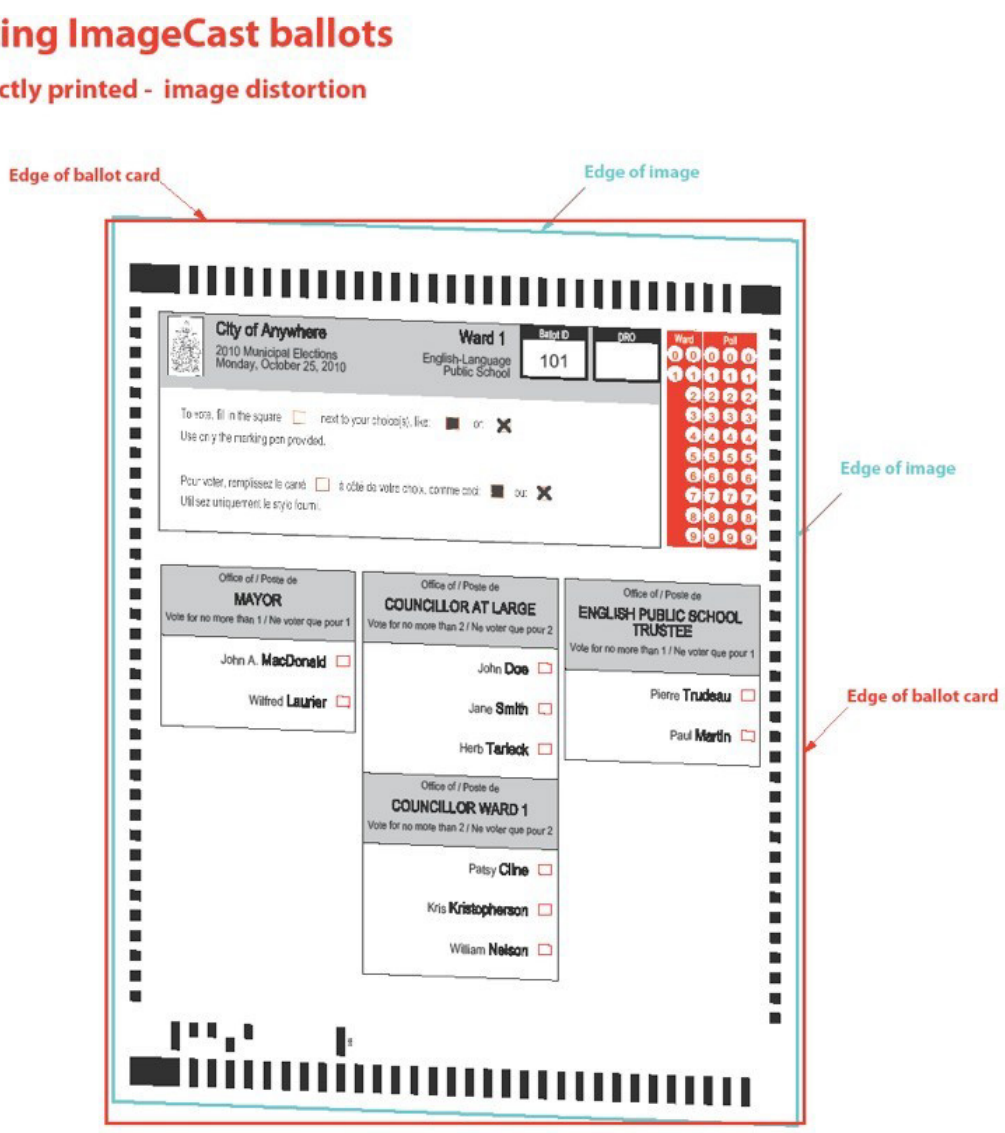

Figure B-11: ImageCast® Ballots Incorrectly Printed - Image Distortion.

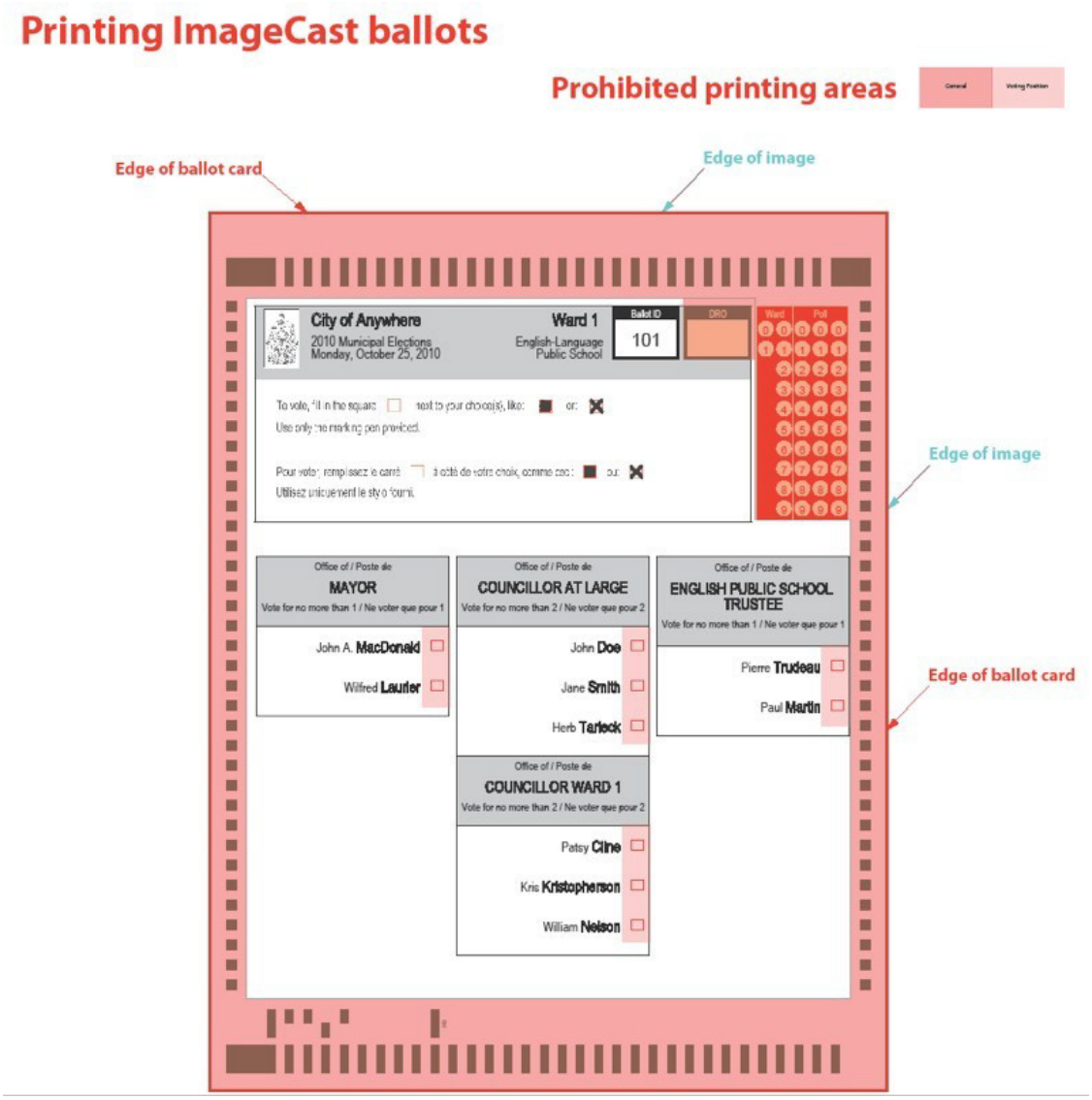

Figure B-12: Definition of Main Ballot Areas.

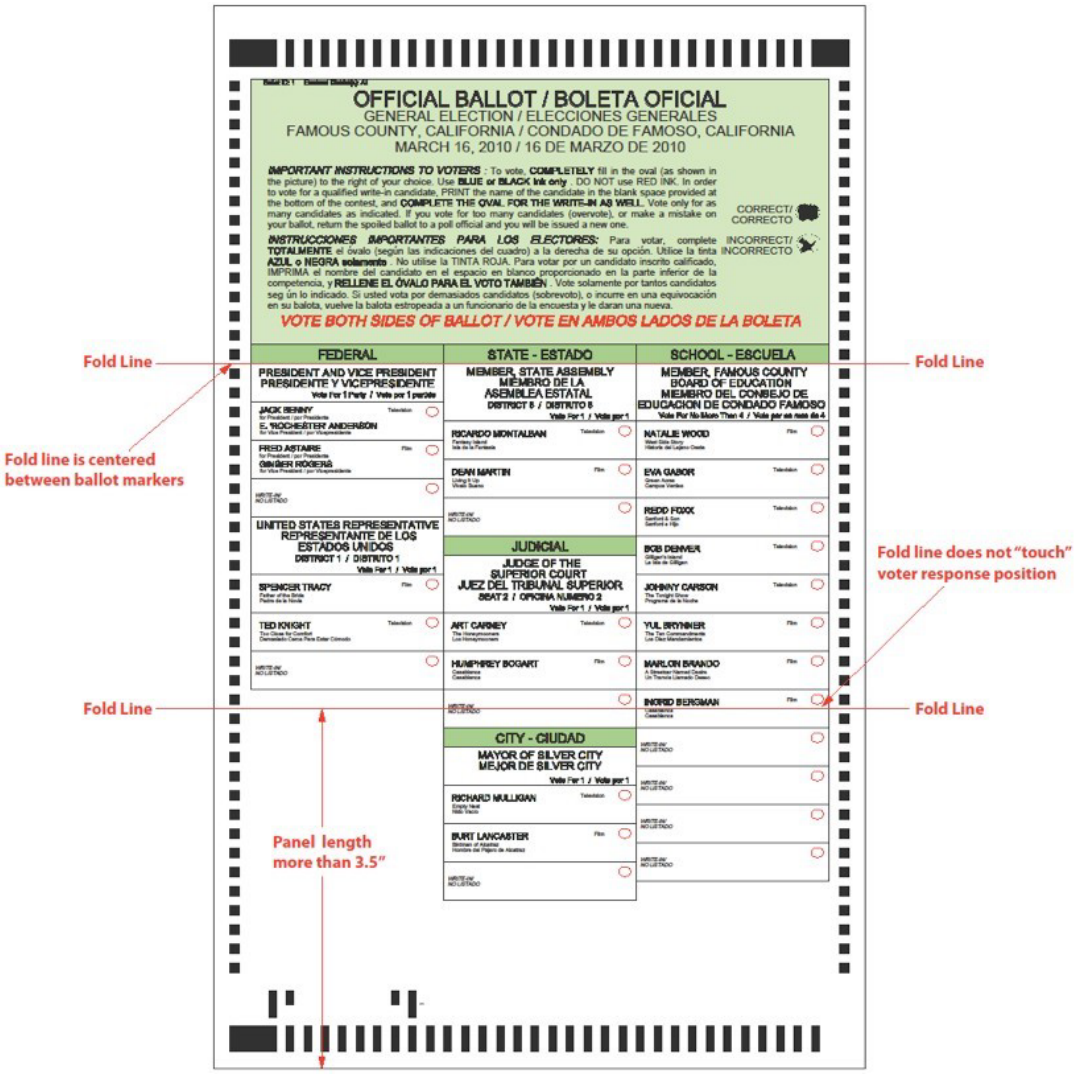

Figure B-13: Example of Fold Line Placement.

REVISION HISTORY

Rev.	Date	Author	Summary
1	03-06-2019	brian.fitzsimmons	Created 5.11-CO branch from trunk

LIST OF FIGURES

LIST OF TABLES

End of Document


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