United States Election Assistance Commission
Election Data Collection Grant Program

Precinct Results Best Practices

Office of Minnesota Secretary of State Mark Ritchie

June 30, 2009

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1. Introduction

This report was prepared using funding provided by the United States Election Assistance Commission (EAC). Investigation of precinct results best practices is one of a number of topics authorized under the EAC's Election Data Collection Grant Program, which was created for the purpose of learning from states' experiences with the Federal elections of November, 2008. The grant announcement specifically emphasized the importance of improving precinct-level reporting results. From page two of the announcement:

> The EAC is soliciting proposals from States to improve the collection of data at the precinct-level for the November 2008 Federal elections. In general, a precinct is defined as an administrative division of a county or municipality to which voters have been assigned by their residing address for voting.

Minnesota's current method of reporting precinct level election results is a time-tested system that works well for both the OSS and its customers. The system has been in use in its current form since about 2000 and has reported precinct-level results for every federal, state and county level race since that time. Since 2004, the system has been used to report nearly every race statewide at the precinct level, including municipal and school district races.

Consumers of election data reported by this system includes election administrators at all levels of government within the state as well as other government officials, candidates, the media and the general public. Since the 2000 presidential election, election results have been available to the public and media in near real time via the Internet. Data is entered or uploaded by the counties and then aggregated and reformatted for public and media use at 5 minute intervals.

2. Minnesota's Election Systems

Minnesota administers elections following a centralized model in which the State defines the procedures, formats, and systems counties use to collect, record, and submit election data to the State. The State has developed several web-based software applications for elections officials to use for managing elections and voter registration data.

Prior to system upgrades performed under the EAC grant program, these systems were available for use by state and county elections officials. As part of the EAC grant program, access to the SVRS application was extended to certain municipal users for the purpose of entering and managing absentee ballot activities.

Minnesota's Election System Software

Minnesota's election system software currently consists of the five applications described below. All five of these applications were developed and are maintained by an in-house staff of software development professionals.

- **Statewide Voter Registration System (SVRS).** Manages voter registrations, precinct and district management, election roster generation, county absentee ballot and UOCAVA administration and voting history. SVRS is accessed by state and county level users. Municipalities can also use the system for the purpose of administering absentee voting.
- **Statewide Voter Registration System View Only (SVRS View).** Provides read-only access of SVRS data to municipal and school district users via a separate system. Voter registration data is extracted from SVRS but all non-public information is removed.
- **Election Reporting System (ERS).** Manages all election activities, including candidate filing, data exports for ballot and voting equipment programming, election results reporting via the web, results file generation, and election administration. The system is capable of reporting all races in the state at the precinct level. ERS is also capable of reporting precinct caucuses and manages recounts and post-election audits.
- **PollFinder.** Provides public web lookup of polling place and districts by voter address for any precinct in the State. It also provides information on upcoming elections, offices, and candidates on the ballot, using a combination of SVRS and ERS data.
- **CaucusFinder.** Provides public web lookup of caucus location by voter address for any precinct or party in the State, using location data submitted by political parties.

This Precinct Results Best Practices document references SVRS, ERS, and the Pollfinder as the key systems involved in precinct-level election data.

Minnesota's Election Management Processes

Figure 1 below illustrates the key processes and external stakeholders associated with Minnesota's election management systems.

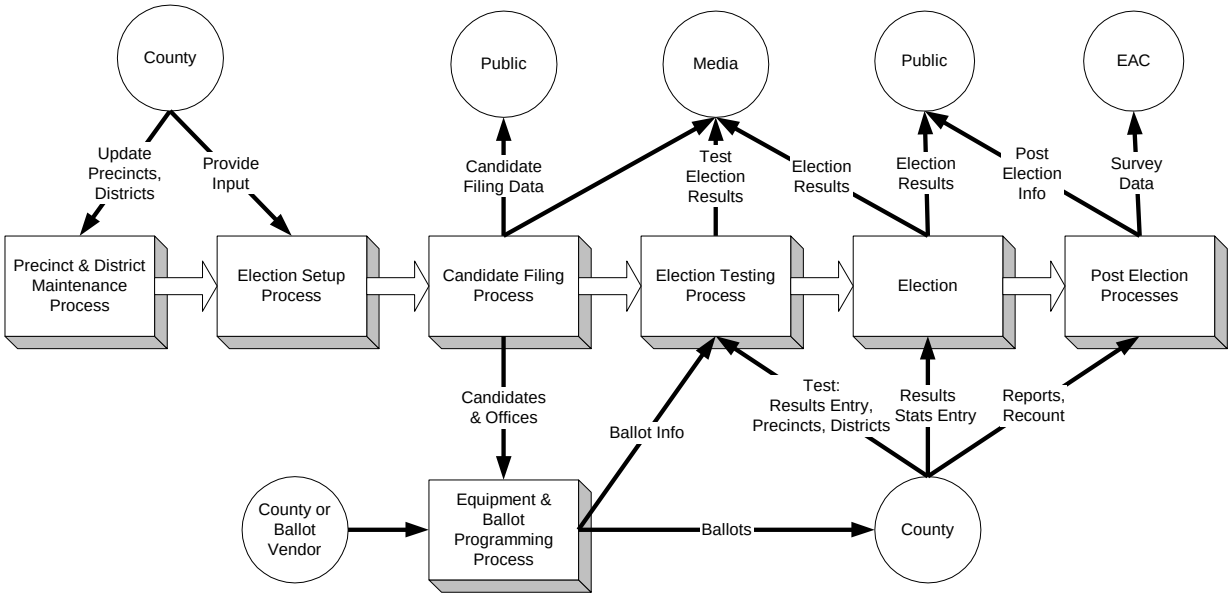


Figure 1: Minnesota Elections Systems Processes

Election Management Processes

Processes identified in Figure 1:

- **Precinct and District Maintenance Process.** Involves the creation and maintenance of precincts in the state, and associated districts. Counties update address ranges and link them to correct precincts and school districts.
- **Election Setup Process.** The Election Setup Process identifies key election information such as date of election, type of election and jurisdictions involved, and initializes system data structures for the election.
- **Candidate Filing Process.** Involves the identification of offices in the election, filing of candidates for offices, ordering of offices and candidates on the ballot, expansion of candidates and offices for multi-county local races, and export of the races, ballot questions and candidate information for the purpose of equipment and ballot programming.
- **Election Testing Process** Successful reporting on election night requires that the process has been thoroughly tested, and that offices, ballot questions and candidates are reported correctly and the information on county ballots exactly match the data in the state system. During this testing, counties upload or enter results from their logic and accuracy testing or manual testing process. The media participates during testing by downloading election results files created by the system and verifying their analysis systems.
- **Election.** Prior to an election, the system is zeroed and locked until the polls close on election night. Results are uploaded or manually entered by counties on election night. Pubic results and media files are created at regular intervals (typically every 5 minutes).
- **Post Election Processes.** After the election, counties and the OSS verify results, audit and canvass results, and conduct recounts if necessary.

Elections Stakeholders

Elections stakeholders identified in Figure 1:

Counties

County and local election officials are responsible for identifying offices, administering and entering candidate filings for offices, verifying ballot completeness and accuracy, testing ballots and uploading test election results, administering the actual election and entering results and statistics for that election, and then being actively involved in the post election processes and audits required to ascertain the final results of the election.

The Public

The general public and citizens of the state have a vested interest in the success and verification of the fairness and accuracy of the election data.

The Media

The media has been a major consumer of election data since Minnesota first began real-time election results reporting in 1988. The OSS has used this partnership to reach Minnesota voters. The OSS and the media assist each other in the following ways:

- OSS meets with the media prior to each election to establish reporting needs for each major election.
- The media provides OSS with its preferred data formats. Current formats include semi-colon delimited text files, and a format for use primarily in television media, known as the Associated Press (AP) format.
- On election nights, OSS maintains a media status page, used to alert the media to any possible reporting issues that might arise.

The Voting Equipment programming and ballot printing Vendor

When counties contract their election programming and ballot printing, the vendor functions as an agent of the county auditor. The vendor receives an export of race and candidate data from OSS (ERS output), or directly from the county auditor and uses the data to program voting equipment and produce ballots returned to the auditor. Vendor software used for programming the equipment is proprietary.

The Office of the Secretary of State (OSS)

The OSS is the owner of all processes related to precinct results reporting. The OSS manages election activities, develops software and systems to support the process and process stakeholders, and is ultimately responsible for conducting fair and accurate elections.

The Election Assistance Commission (EAC)

The EAC is a consumer of election data including precinct level-data. The EAC has a strong interest in collecting precinct-level data for the purpose of analyzing the effectiveness of voting procedures used across the nation. EAC survey requirements can have a significant influence on system design.

Principles

Minnesota's system incorporates several overarching principles that greatly improve the accuracy, consistency, and automated processing capabilities of precinct-level data. These principles are identified below:

- **Collect information as close to the source as possible**. Information that is translated or that goes through many transitions is prone to error, incompleteness, and being untimely.

- **Collect information via system-defined input forms to ensure completeness and uniformity.** Systems can define and enforce constraints, such as limiting offices to the appropriate jurisdiction, in order to reduce errors.
- **Use electronic interfaces whenever possible.** Human entry or re-entry of data is an opportunity for error. Data accuracy can be improved by defining interfaces and transferring data electronically between voter registration systems and reporting systems, ballot vendor systems, and media reporting systems.
- **Finalize system data as early as possible in the process.** Information such as the number of precincts in an election, names and codes of precincts, offices in an election and so on are all defined prior to ballot generation and the actual election. System set up and testing, including external interfaces such as ballot vendors and media, are all improved by finalizing data as early as possible in the process.
- **Identify data and reporting standards and enforce them over time.** Identifying appropriate data formats and creating systems to process that data reduces the complexity of system input logic and improves data quality. For example, Minnesota identified election data upload formats many years ago and requires that vendors provide electronic uploads of election results in this format.

Complete precinct-level information

In order to input and control election data so that precinct-level information is ultimately collected and available, Minnesota's system need to collect and maintain many data entities including these:

- Precincts and districts, including school district information
- Polling places associated with precincts
- Address ranges in Minnesota
- Election information (election type, date)
- Offices in an election, including office code or identifiers, and associated data (term, vote-for)
- Candidates in an office, including codes, and generic candidates such as write-ins
- Ballot questions or referendums, including codes
- Election results (per candidate, per precinct or reporting district, in a specific office)
- Election statistics (per precinct or reporting district)

3. Minnesota's Election System Details

Election Systems

The systems involved in Minnesota's elections have been designed to provide precinct-level data reporting. Figure 2 below shows the systems and interfaces related to precinct-level data collection.

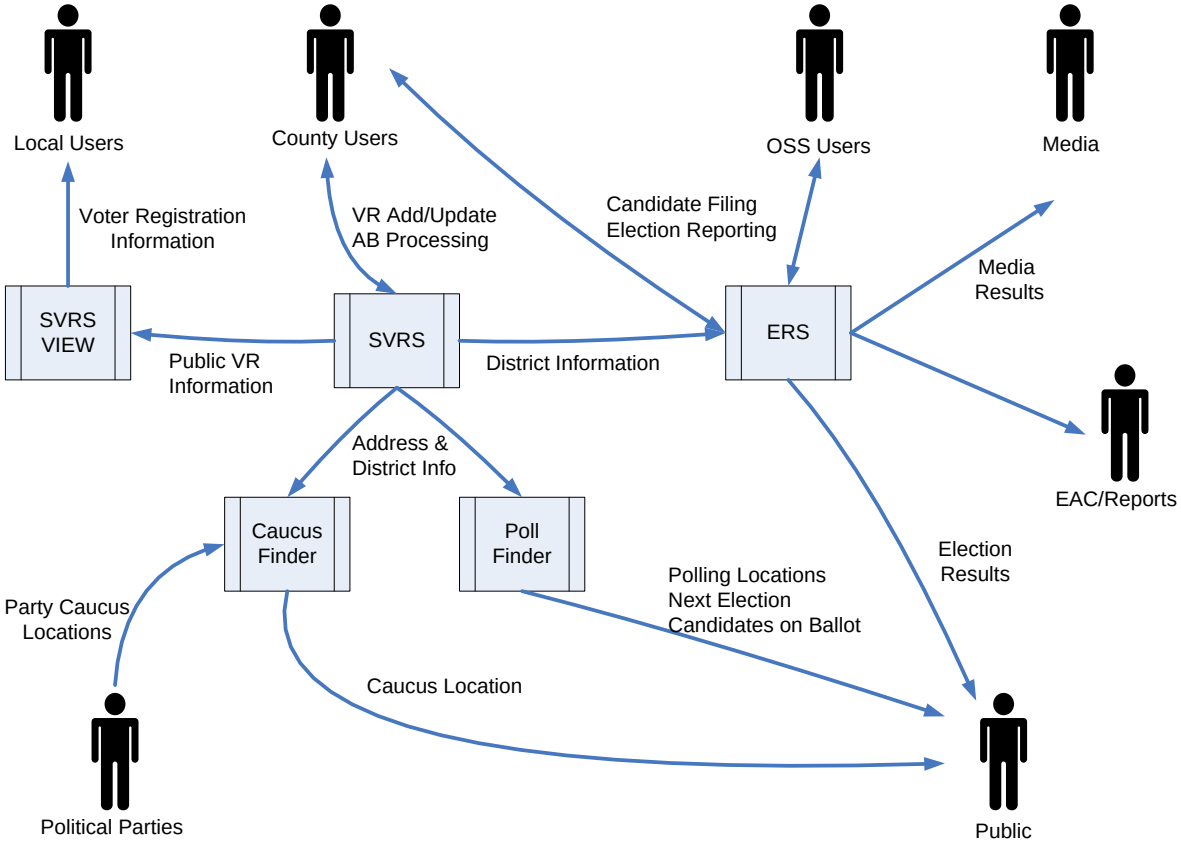


Figure 2: Minnesota Elections Systems

Systems and interface definitions are shown below, in terms of the role of each system in precinct-level election results collection:

Statewide Voter Registration System (SVRS)

SVRS is the master repository of voter registration data, address range data, district information and district relationships. Address ranges (e.g. 1 to 100 Main Street, Hill City) are linked to a specific precinct and school district combination. In Minnesota, each precinct is located in a single municipality, county, state legislative district, county commissioner district, and/or hospital district. SVRS maintains the relationship of precincts to each district type. A precinct can have one or more school districts in it, which is why the address range is linked to a precinct-school district combination.

Offices for an election are created in SVRS and then candidates are entered during the candidate filing period. Office and candidate data is exported on a regular basis to ERS for candidate filing displays and population of election data. As data entry is completed, counties are able to change the order of candidates.

For 2006-2008, candidate filing was moved to SVRS as ERS underwent other changes. As part of the EAC subprojects, ERS upgrades were included to help support candidate and office entry in ERS in 2010.

SVRS Functionality for Precinct Results

SVRS supports the candidate filing process by providing the following functions:

- **Office entry.** Offices are created in SVRS with the expectation that they will persist over time. In this way office holders can be populated in the system and offices can be chosen for an election based on the historical data (a mayor of a city that is elected every 4 years).
- **Office in election.** SVRS provides a function to allow users to select what offices are in a specific election. This is done by appropriate roles and rights. For example, OSS selects statewide, congressional, judicial and state legislative offices while counties select county and municipal or school district offices.
- **Candidate entry.** State or county users can enter candidates for offices in their jurisdictions.
- **Candidate ordering.** SVRS includes a random numbering function for candidate order, but counties can manually enter the candidate order for local offices if necessary.
- **Office Complete.** SVRS provides an “office complete” function to identify an office that has its candidates entered and ordered. This data is used to determine when multi-county race data can be used for non-home county ballots.

Figure 3 below shows the data entry screen for a candidate.

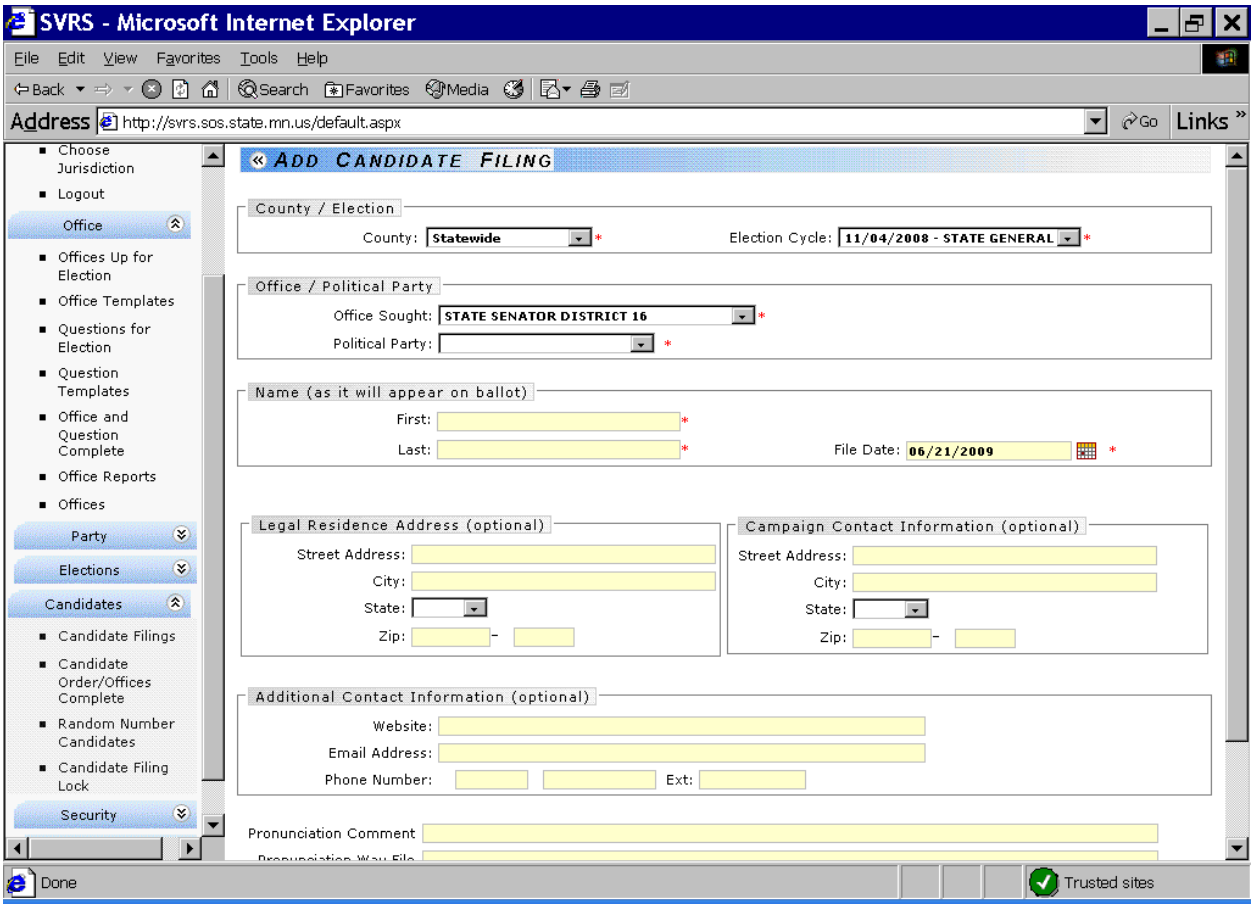


Figure 3: Candidate Data Entry Screen

SVRS Interfaces for Precinct Results

Precinct results information from SVRS is refreshed as follows:

- Election information, polling place data, address range and district data is exported nightly to the Pollfinder database.
- Election and district information, such as precincts, associated districts, and number of registered voters is exported on an as-needed basis to the Election Reporting System.
- A copy of the SVRS Voter registration data, modified to exclude court-ordered protection or data not found on the public information list, is extracted nightly for SVRS View.

Pollfinder

Minnesota maintains an online polling place locator called Pollfinder that provides online information for voters. For any address contained within an SVRS address range, a web user can obtain the following information from Pollfinder:

- The precinct and district information associated with that address
- The next election and polling place
- Maps of districts associated with that precinct

- Maps of how to get to the polling place
- Candidates on the ballot for that precinct for major elections

The Pollfinder application has its own database that is refreshed nightly. SVRS provides the address, district, election and polling place information, while offices and candidates information is obtained from ERS. In addition, Pollfinder can maintain links to sample ballots from counties or ballot vendors. Figure 4 shows a Pollfinder information display screen.

Map data supplied by SVRS is associated with Minnesota districts and then linked to appropriate precincts. Maps are maintained in-house and stored as PDF files.

Representative Pollfinder screens are shown in Figure 44 and Figure 5.

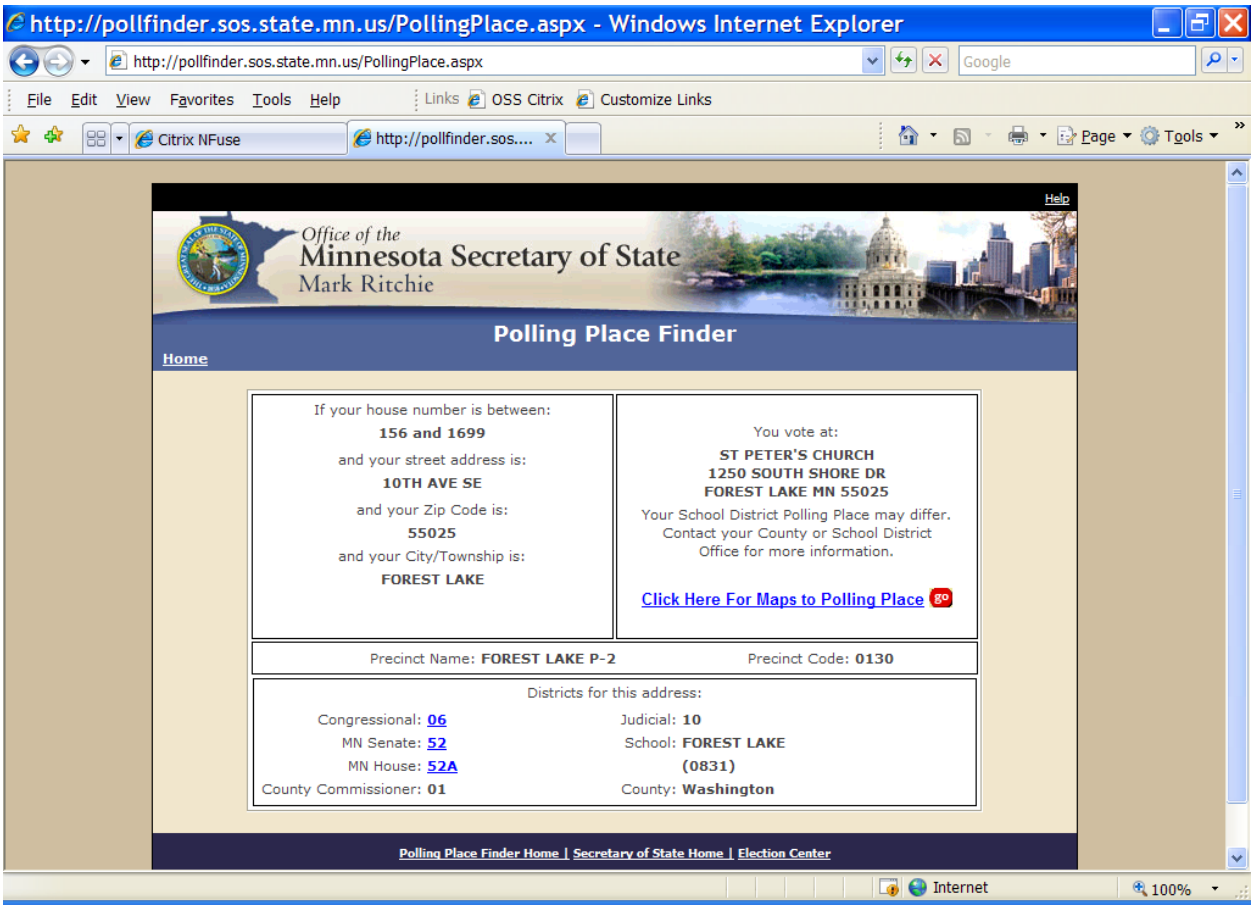


Figure 4: Pollfinder Information Display Screen

The Pollfinder also includes maps of appropriate districts for the address range. In the example above, this address range is in Minnesota House District 52A. Clicking on the “52A” link provides a PDF of this district:

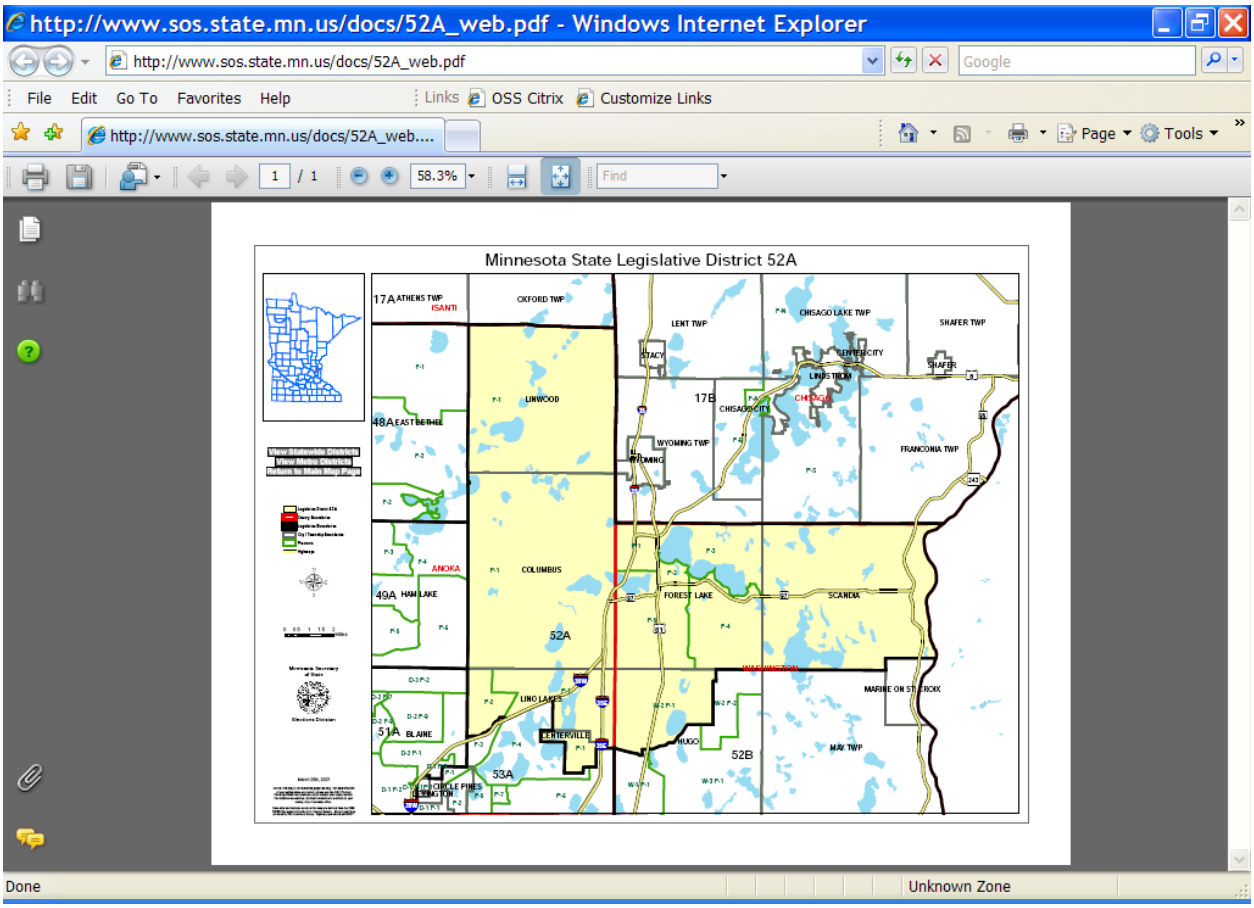


Figure 5: Pollfinder Map Display Screen

SVRS View

SVRS View is a read-only version of SVRS for municipal lookup of voter information. The database is similar to SVRS, but refreshed nightly with non-public data removed (court-ordered protected voters, driver's license numbers). SVRS View is created using SVRS code, but administrative parts are removed during the build process. Existing as a separate application and database improves performance by allowing the use of non-SVRS web servers and database servers.

CaucusFinder

Minnesota's 2008 Caucus Finder was a first-in-the-nation example of providing a single online application to provide caucus locations to voters. The Caucus Finder uses Pollfinder data from SVRS, in addition to the precinct caucus location for major or minor parties, to provide the location and a map to that location of any caucus site in the state for the 2008 Presidential Caucus.

Election Reporting System (ERS)

Minnesota's Election Reporting System (ERS) is comprised of several pieces: Online Candidate Filing information and Election results, which are published on the web for public and media use, and an internal Election Administration system that provides for the creation and maintenance of the election results system including county data entry.

ERS Online Candidate Filing Website

As candidates and offices are entered into SVRS during the candidate filing process, regular exports update the ERS Candidate Filing website for public and media use. Interest in filing data continues to grow every year. The candidate filing website provides online search and viewing of candidate filing data, and media files of candidates and offices. The Candidate Filing search page is shown in Figure 6.

Figure 6: Candidate Filing Web Search

ERS Internal Administrative Functions

During the time leading up to an election, the ERS election results database is rebuilt with new candidates, offices and district information. Counties test the system by manually entering data, or performing file uploads of election results into the system. The manual entry screen is shown in Figure 77.

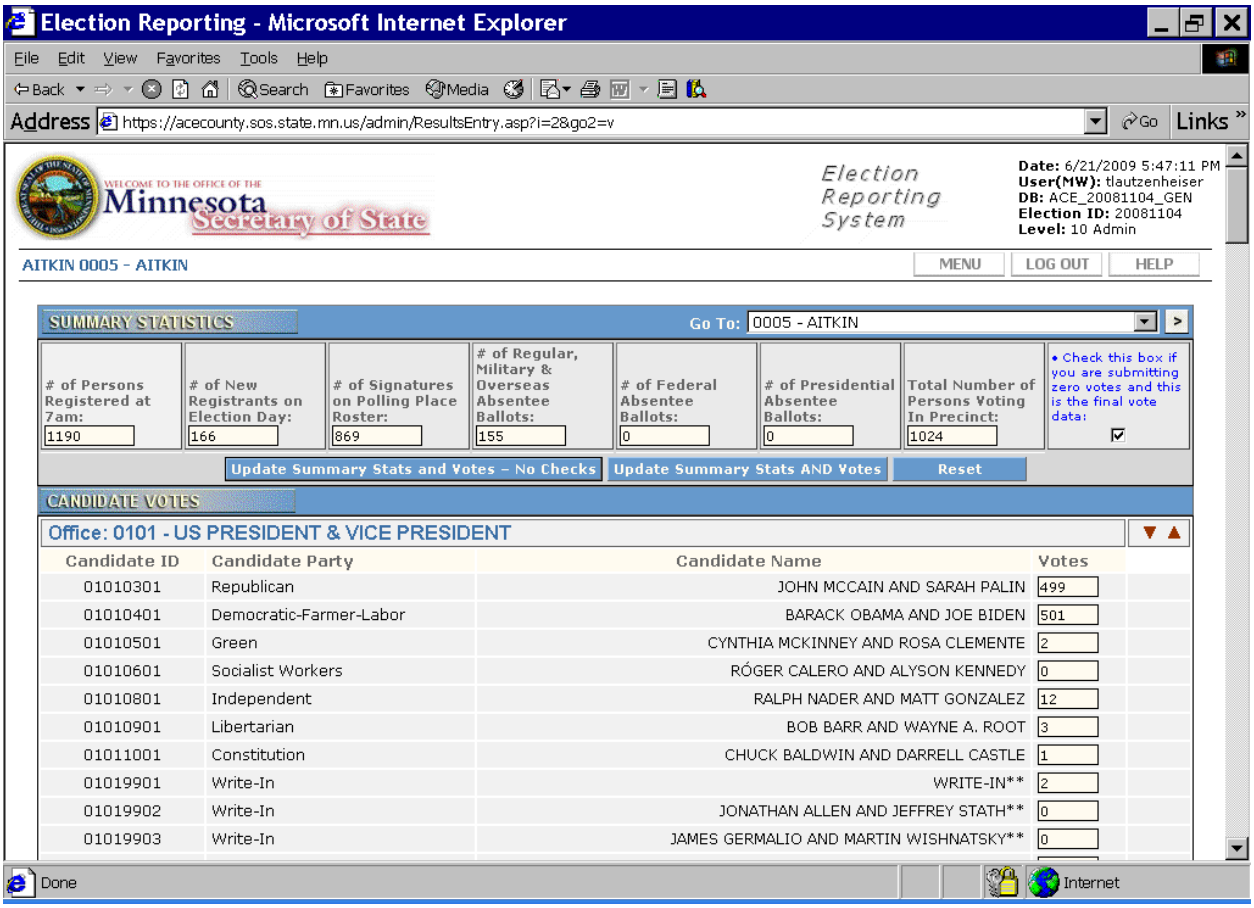
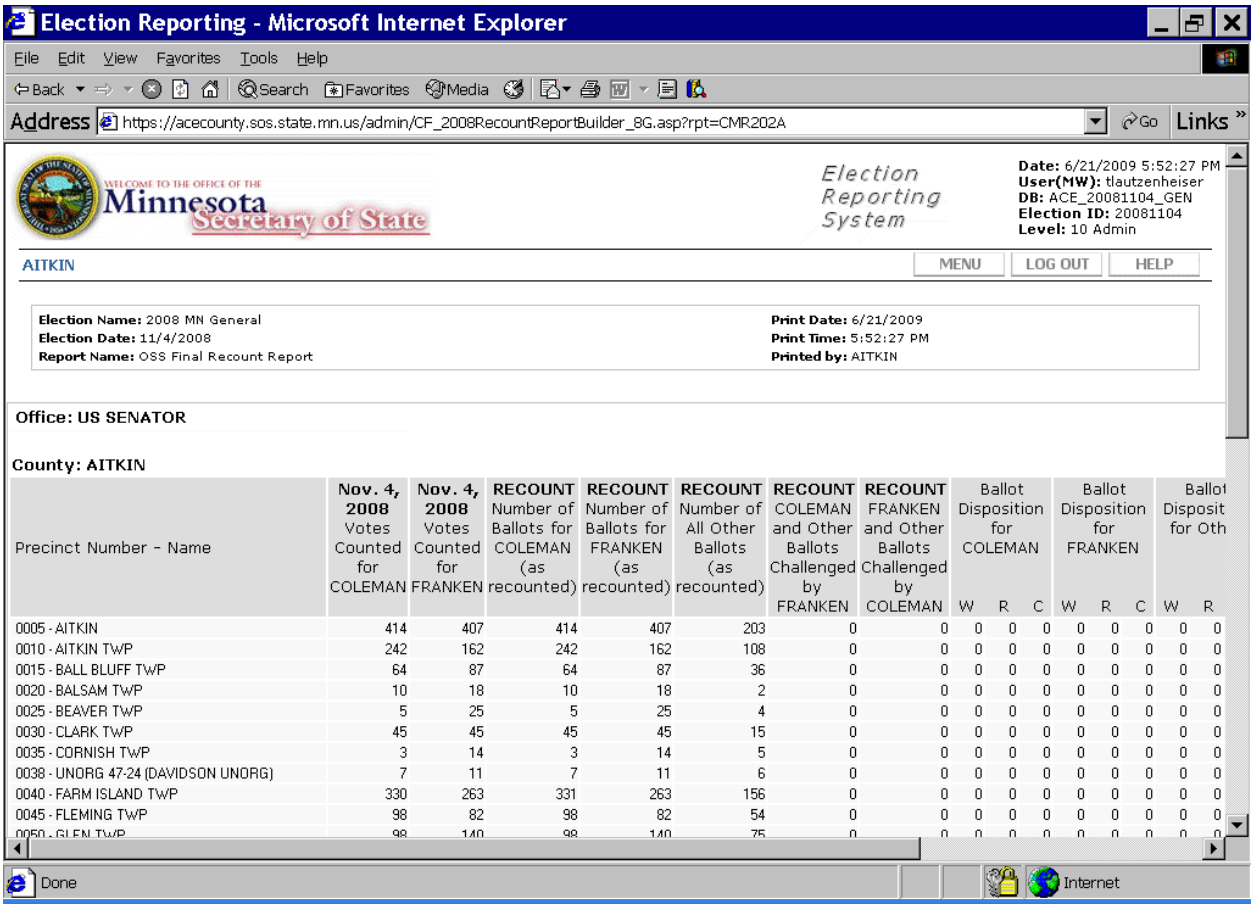


Figure 7: ERS Manual Entry Screen

The ERS Administrative application is the heart of the county and OSS system. Counties can enter equipment data, precinct results and statistics, post-election review audit information, and recount data as well. The recount module was added in 2008 to support the U.S. Senate recount process. An example recount report from ERS is shown in Figure 8.



Precinct Number - Name	Nov. 4, 2008 Votes Counted for COLEMAN	Nov. 4, 2008 Votes Counted for FRANKEN	RECOUNT Number of Ballots for COLEMAN (as recounted)	RECOUNT Number of Ballots for FRANKEN (as recounted)	RECOUNT Number of All Other Ballots (as recounted)	RECOUNT COLEMAN and Other Ballots Challenged by FRANKEN	RECOUNT FRANKEN and Other Ballots Challenged by COLEMAN	Ballot Disposition for COLEMAN			Ballot Disposition for FRANKEN			Ballot Disposit for Oth	
								W	R	C	W	R	C	W	R
0005 - AITKIN	414	407	414	407	203	0	0	0	0	0	0	0	0	0	0
0010 - AITKIN TWP	242	162	242	162	108	0	0	0	0	0	0	0	0	0	0
0015 - BALL BLUFF TWP	64	87	64	87	36	0	0	0	0	0	0	0	0	0	0
0020 - BALSAM TWP	10	18	10	18	2	0	0	0	0	0	0	0	0	0	0
0025 - BEAVER TWP	5	25	5	25	4	0	0	0	0	0	0	0	0	0	0
0030 - CLARK TWP	45	45	45	45	15	0	0	0	0	0	0	0	0	0	0
0035 - CORNISH TWP	3	14	3	14	5	0	0	0	0	0	0	0	0	0	0
0038 - UNORG 47-24 (DAVIDSON UNORG)	7	11	7	11	6	0	0	0	0	0	0	0	0	0	0
0040 - FARM ISLAND TWP	330	263	331	263	156	0	0	0	0	0	0	0	0	0	0
0045 - FLEMING TWP	98	82	98	82	54	0	0	0	0	0	0	0	0	0	0
0050 - GLEN TWP	98	140	98	140	75	0	0	0	0	0	0	0	0	0	0

Figure 8: Example Recount Report

ERS administrative functions that support precinct-level results include:

- **Election rebuild process.** As offices and candidates are added or updated, or precincts or districts change, the election results database needs to be rebuilt. The underlying system is organized around the concept of one entry per candidate/office/precinct reported.
- **Ballot export process.** Candidates and offices can be exported for ballot vendors, with OSS office and candidate numbers to be used for file uploads. The ballot export process helps ensure accurate and complete ballots by providing an electronic transfer for Minnesota ballot vendors.
- **County equipment entry.** Counties enter equipment in ERS, per election and per precinct, which is then used for EAC reports or other analysis.
- **County precinct statistics and results entry.** Counties can manually enter statistics or results for a specific election.
- **County file upload process.** Minnesota's ballot vendors provide a file upload known as the "Minnesota Format." This format, shown below for results upload and statistics upload, provides MCD and School District codes in addition to county, precinct, office and candidate codes, and thereby provides for local data collection.

Data Upload format:

Field:	County	Precinct	MCD	SD	Office	Candidate	Votes
Number of Characters:	2	5	5	6	4	4	6
Example:	62	00105	00101	000101	0211	0101	000023

Statistics Upload format:

Field:	County	Precinct	NA	NA	Stats Type Office Code	NA	Votes
Number of Characters:	2	5	5	6	4	4	6
Example:	62	00105	00000	000000	0001	0000	000023

Statistics codes:

Code	Description
0001	# OF ELECTION DAY REGISTRANTS
0002	# OF FEDERAL ABSENTEE BALLOTS
0003	# OF PERSONS REGISTERED AT 7AM
0004	# OF PRESIDENTIAL ABSENTEE BALLOTS
0005	# OF REGULAR ABSENTEE BALLOTS
0006	# OF SIGNATURES ON ROSTER
0007	TOTAL NUMBER OF PERSONS VOTING

Results files that are uploaded require diagnostics in order to help support troubleshooting during testing. Figure 9 shows the ERS Results File Upload Status screen, and Figure 10 shows the ERS File Upload Diagnostic screen, used to identify issues in file uploads.

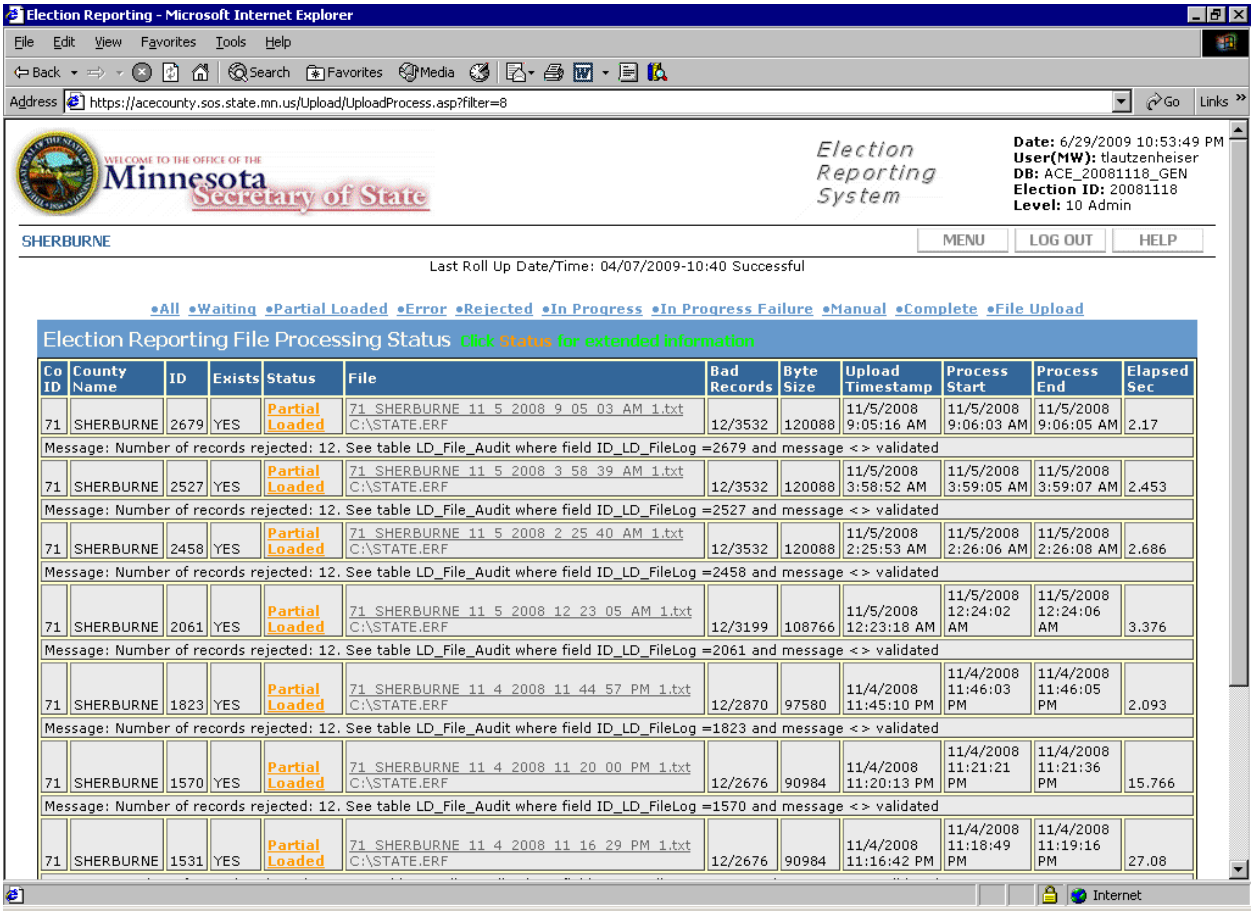
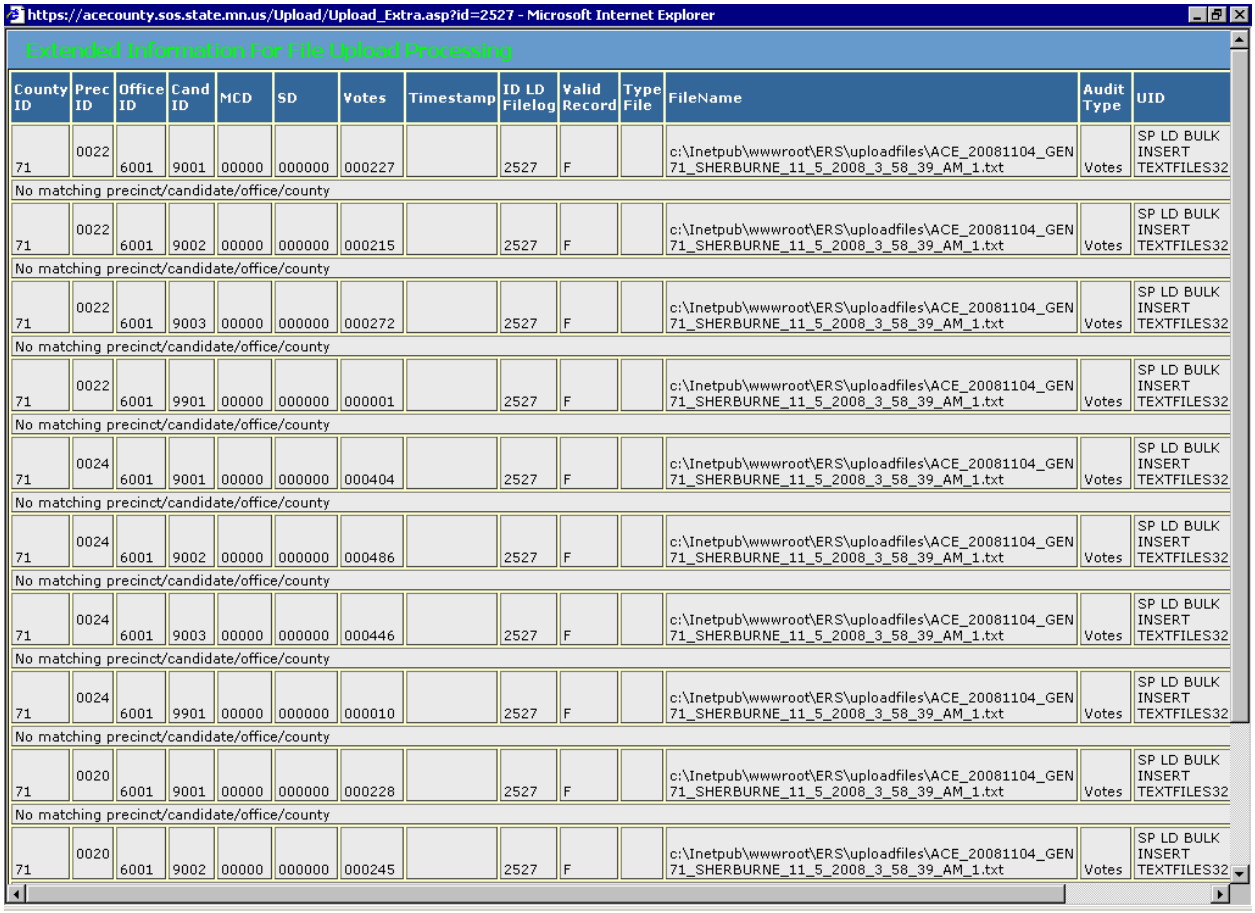


Figure 9: ERS Results File Upload Status



County ID	Prec ID	Office ID	Cand ID	MCD	SD	Votes	Timestamp	ID LD Filelog	Valid Record	Type File	FileName	Audit Type	UID
71	0022	6001	9001	00000	000000	000227		2527	F		c:\Inetpub\wwwroot\ERS\uploadfiles\ACE_20081104_GEN 71_SHERBURNE_11_5_2008_3_58_39_AM_1.txt	Votes	SP LD BULK INSERT TEXTFILES32
No matching precinct/candidate/office/county													
71	0022	6001	9002	00000	000000	000215		2527	F		c:\Inetpub\wwwroot\ERS\uploadfiles\ACE_20081104_GEN 71_SHERBURNE_11_5_2008_3_58_39_AM_1.txt	Votes	SP LD BULK INSERT TEXTFILES32
No matching precinct/candidate/office/county													
71	0022	6001	9003	00000	000000	000272		2527	F		c:\Inetpub\wwwroot\ERS\uploadfiles\ACE_20081104_GEN 71_SHERBURNE_11_5_2008_3_58_39_AM_1.txt	Votes	SP LD BULK INSERT TEXTFILES32
No matching precinct/candidate/office/county													
71	0022	6001	9901	00000	000000	000001		2527	F		c:\Inetpub\wwwroot\ERS\uploadfiles\ACE_20081104_GEN 71_SHERBURNE_11_5_2008_3_58_39_AM_1.txt	Votes	SP LD BULK INSERT TEXTFILES32
No matching precinct/candidate/office/county													
71	0024	6001	9001	00000	000000	000404		2527	F		c:\Inetpub\wwwroot\ERS\uploadfiles\ACE_20081104_GEN 71_SHERBURNE_11_5_2008_3_58_39_AM_1.txt	Votes	SP LD BULK INSERT TEXTFILES32
No matching precinct/candidate/office/county													
71	0024	6001	9002	00000	000000	000486		2527	F		c:\Inetpub\wwwroot\ERS\uploadfiles\ACE_20081104_GEN 71_SHERBURNE_11_5_2008_3_58_39_AM_1.txt	Votes	SP LD BULK INSERT TEXTFILES32
No matching precinct/candidate/office/county													
71	0024	6001	9003	00000	000000	000446		2527	F		c:\Inetpub\wwwroot\ERS\uploadfiles\ACE_20081104_GEN 71_SHERBURNE_11_5_2008_3_58_39_AM_1.txt	Votes	SP LD BULK INSERT TEXTFILES32
No matching precinct/candidate/office/county													
71	0024	6001	9901	00000	000000	000010		2527	F		c:\Inetpub\wwwroot\ERS\uploadfiles\ACE_20081104_GEN 71_SHERBURNE_11_5_2008_3_58_39_AM_1.txt	Votes	SP LD BULK INSERT TEXTFILES32
No matching precinct/candidate/office/county													
71	0020	6001	9001	00000	000000	000228		2527	F		c:\Inetpub\wwwroot\ERS\uploadfiles\ACE_20081104_GEN 71_SHERBURNE_11_5_2008_3_58_39_AM_1.txt	Votes	SP LD BULK INSERT TEXTFILES32
No matching precinct/candidate/office/county													
71	0020	6001	9002	00000	000000	000245		2527	F		c:\Inetpub\wwwroot\ERS\uploadfiles\ACE_20081104_GEN 71_SHERBURNE_11_5_2008_3_58_39_AM_1.txt	Votes	SP LD BULK INSERT TEXTFILES32

Figure 10: ERS Upload Error Diagnostic Screen

- **County Post Election Review process.** Counties are required to choose precincts for a post-election review manual recount. Results from this review process are entered into ERS, and ultimately become the official total.
- **County and OSS Recount process.** ERS provides the ability for counties to enter recounted data and for OSS to identify final disposition of challenged ballots.
- **County Overvote/Undervote entry.** As part of the 2008 EAC Data Collection Grant, ERS was expanded to include manual and automated overvote/undervote data entry.
- **County and OSS verification reports.** ERS provides detailed reports, including county abstracts, which are used to verify the results of the election. An example of an abstract showing state and federal races is shown in Figure 11.

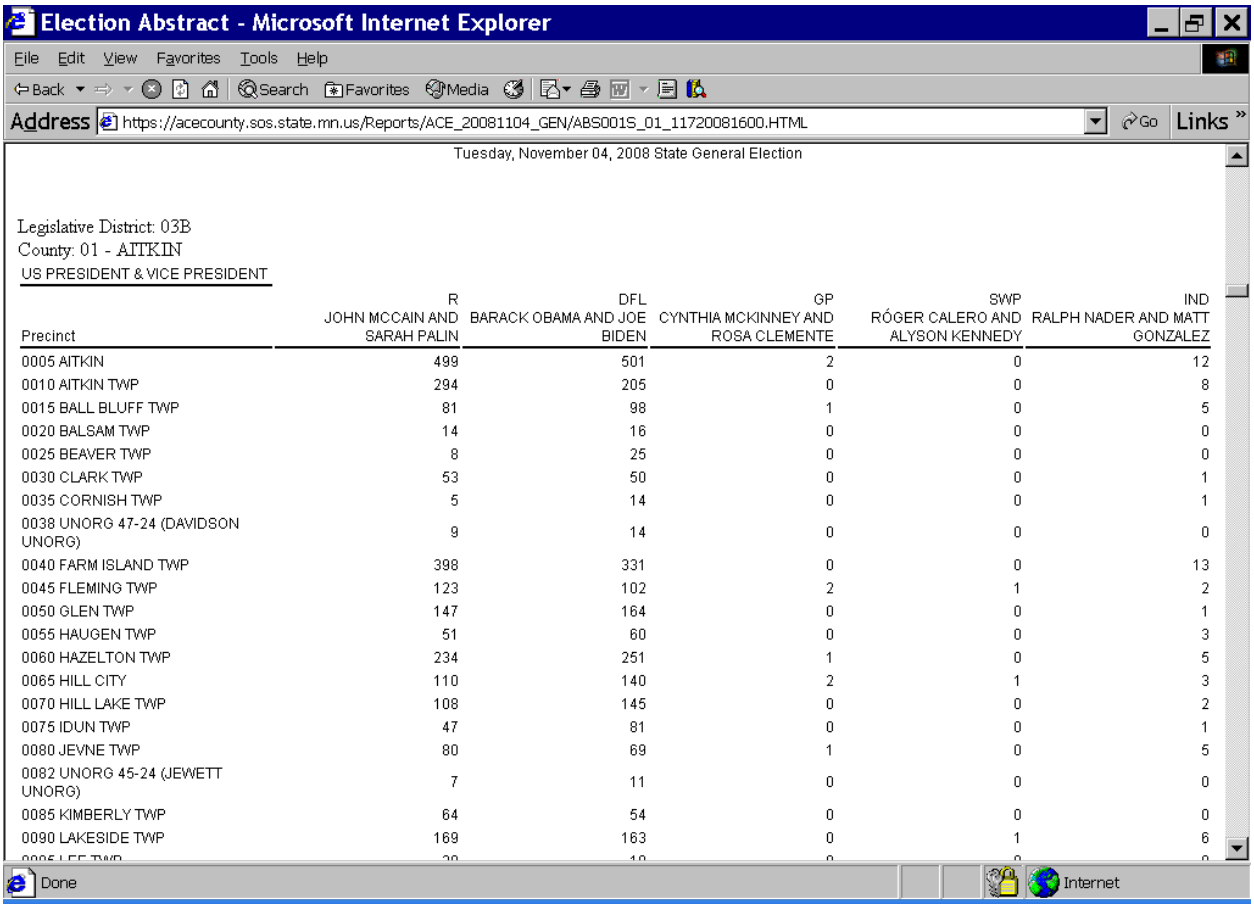


Figure 11: Example Election Abstract

ERS Election Results Reporting

ERS provides online real-time precinct results for public and media use. As counties enter data into the administrative application, data is constantly aggregated and moved from the admin database to presentation databases. Public and media interest in election results has grown substantially over the past nine years (since ERS data was available on the internet). The architecture for the ERS Results presentation included 3 database servers and 15 web servers on election night in 2008.

A few sample screens of the 2008 election follow.

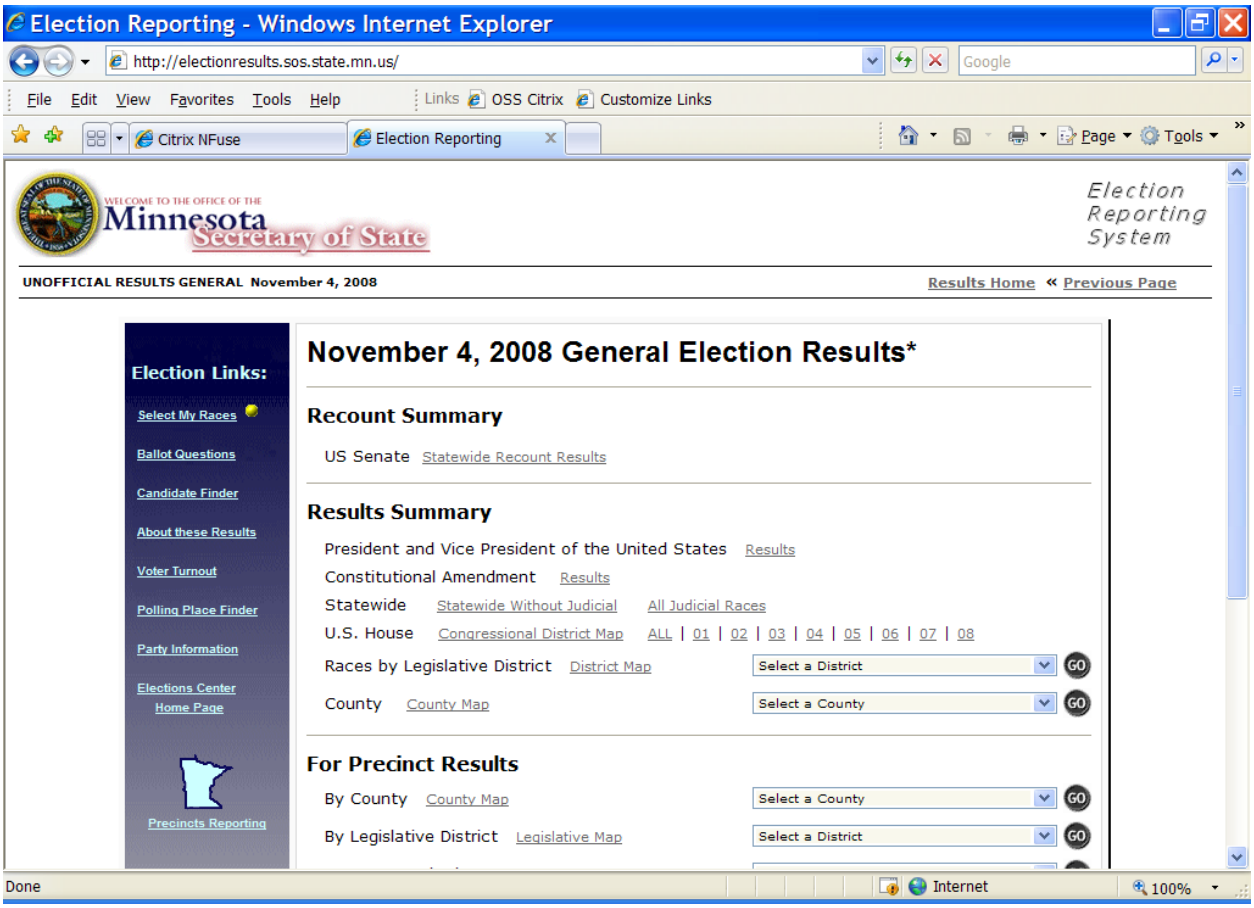


Figure 12: Main Public Results Display

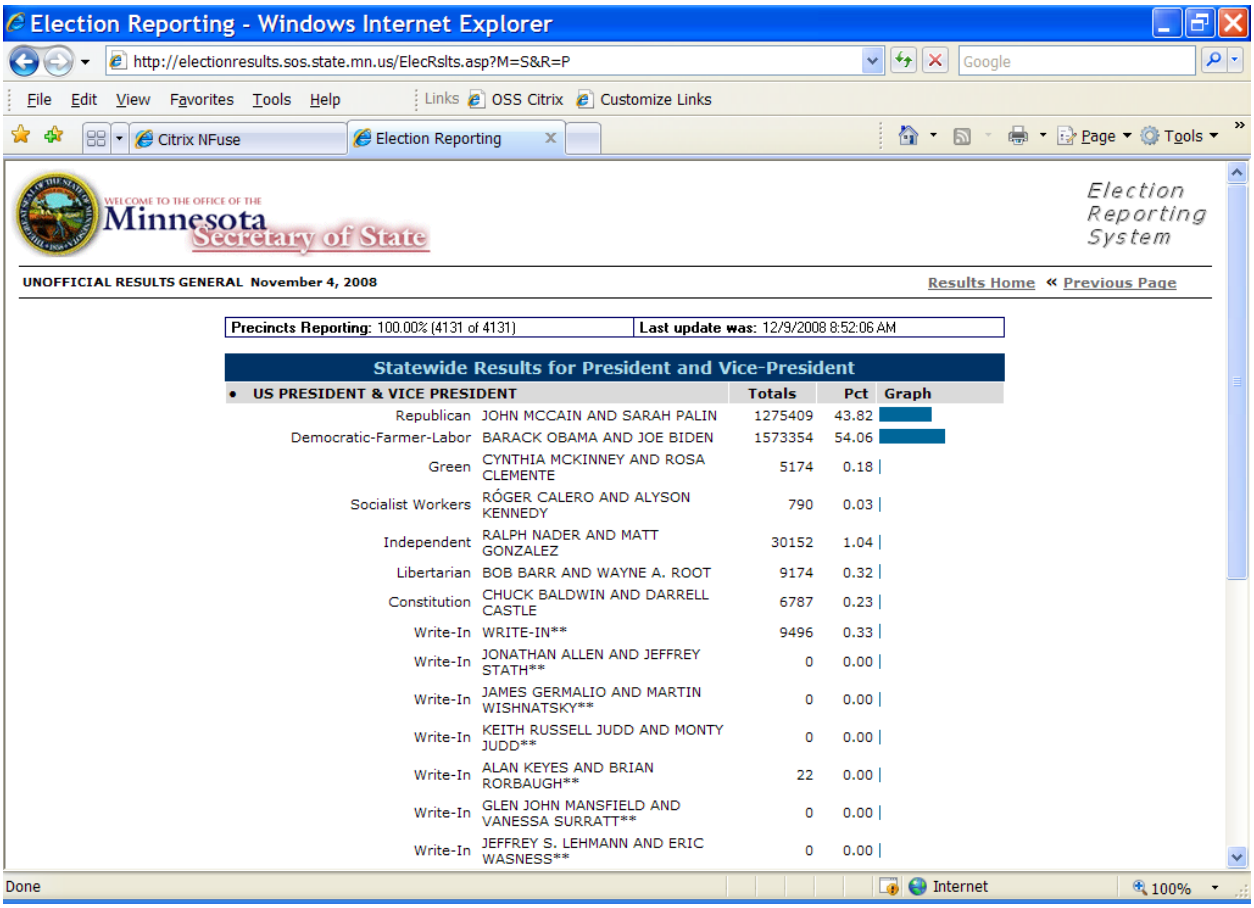


Figure 13: Statewide Totals for President

3. Hennepin County – Bloomington W1-P7 precinct results

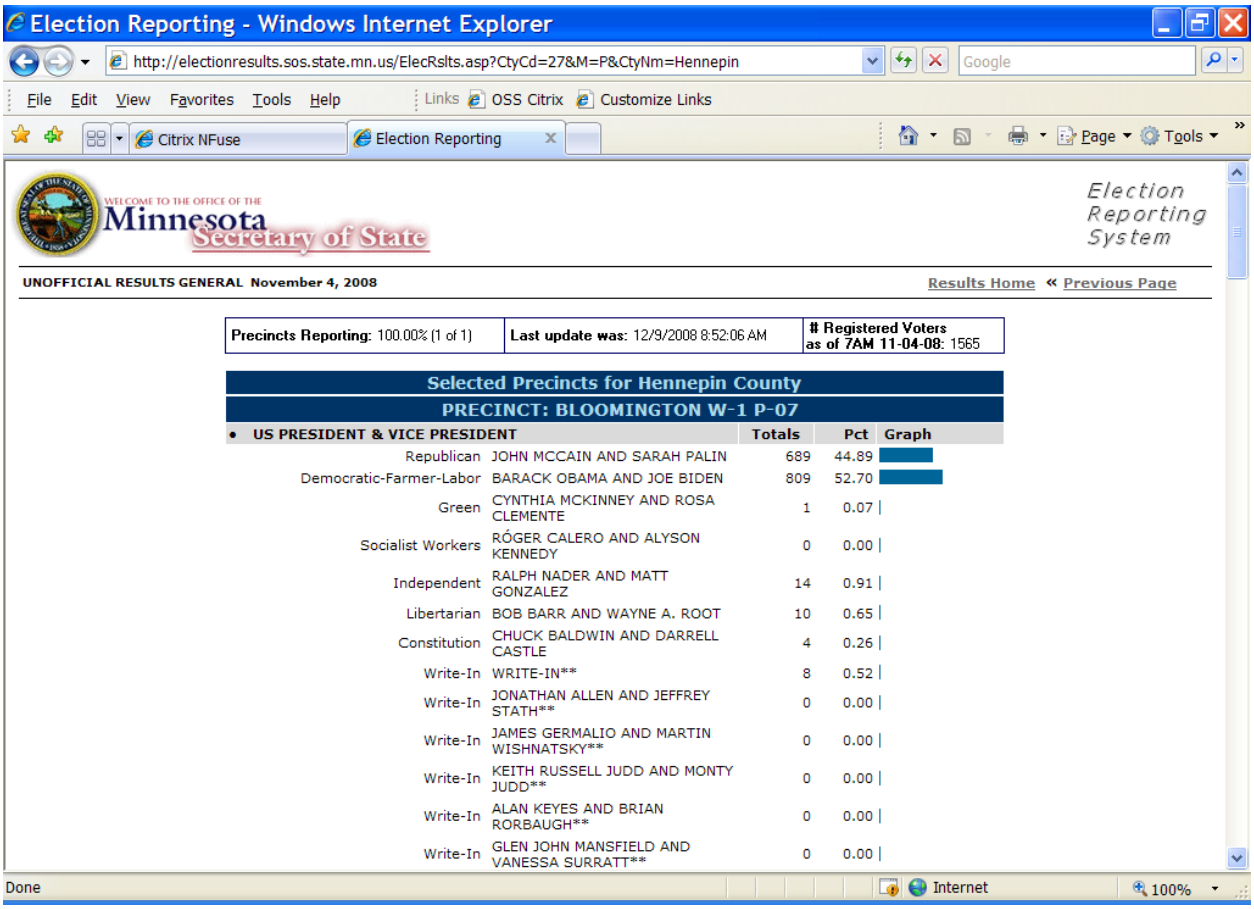


Figure14: Precinct Level Results Web Display

4. County Summary Page

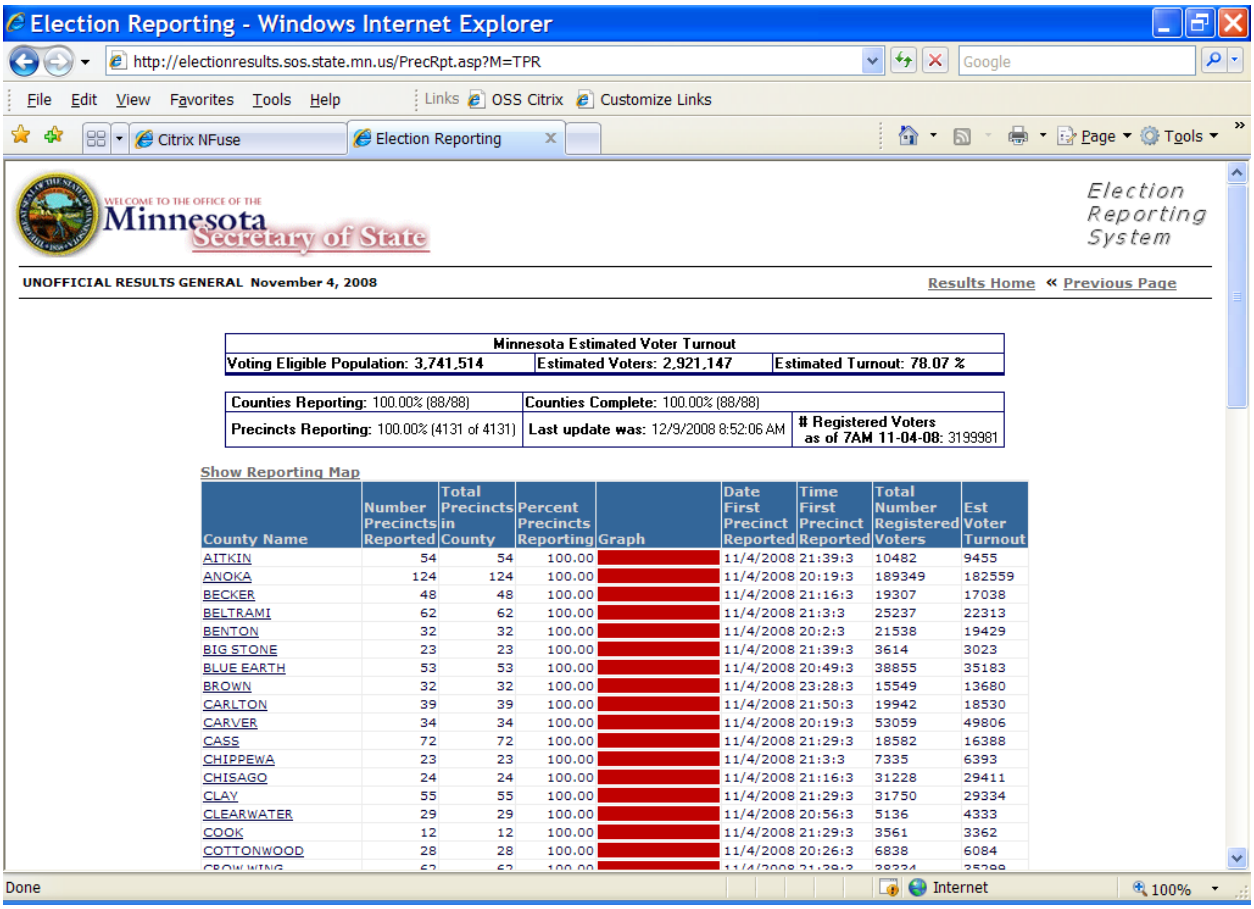
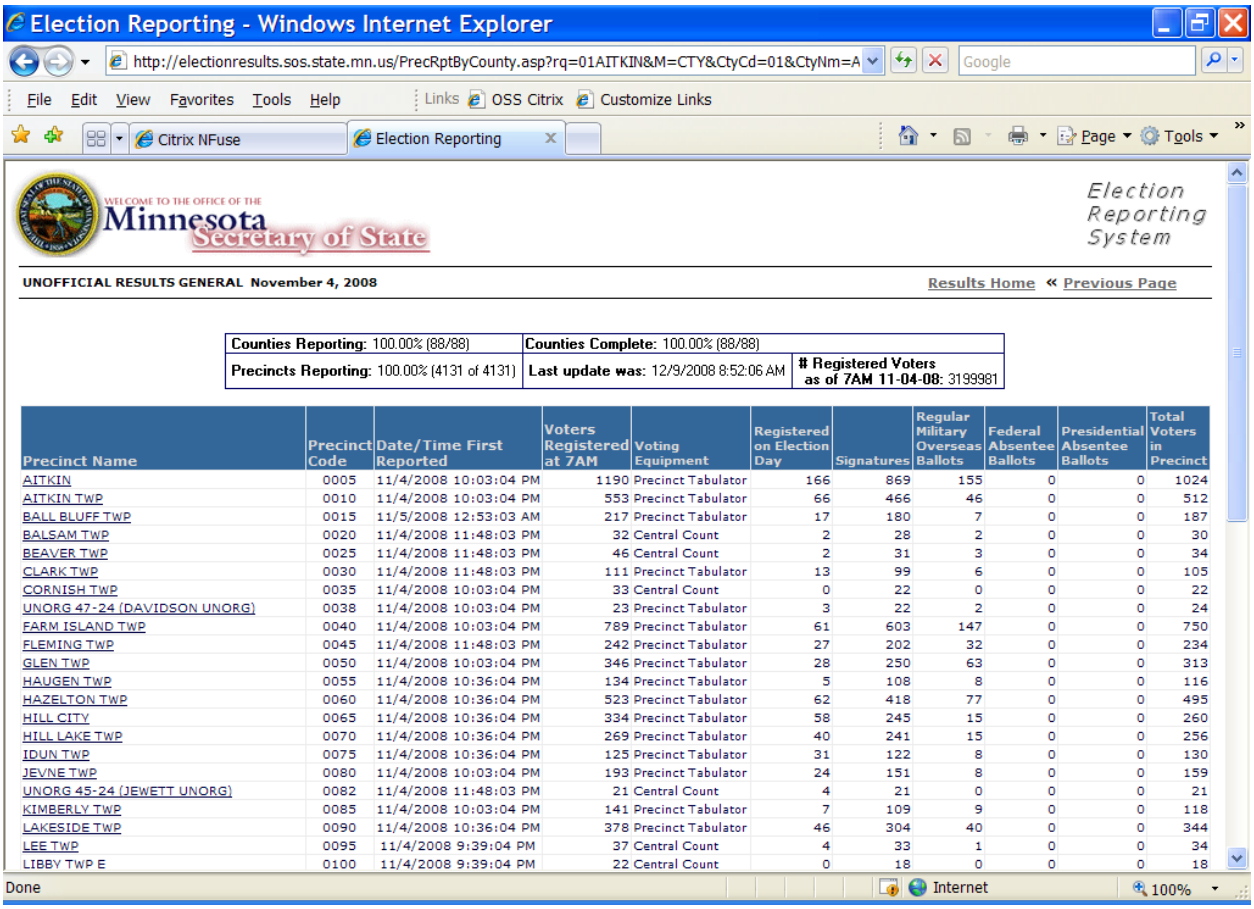


Figure 15: County Summary Screen

5. Aitkin County Detailed Summary



Precinct Name	Precinct Code	Date/Time First Reported	Voters Registered at 7AM	Voting Equipment	Registered on Election Day	Signatures	Regular Military Overseas Ballots	Federal Absentee Ballots	Presidential Absentee Ballots	Total Voters in Precinct
AITKIN	0005	11/4/2008 10:03:04 PM	1190	Precinct Tabulator	166	869	155	0	0	1024
AITKIN TWP	0010	11/4/2008 10:03:04 PM	553	Precinct Tabulator	66	466	46	0	0	512
BALL BLUFF TWP	0015	11/5/2008 12:53:03 AM	217	Precinct Tabulator	17	180	7	0	0	187
BALSAM TWP	0020	11/4/2008 11:48:03 PM	32	Central Count	2	28	2	0	0	30
BEAVER TWP	0025	11/4/2008 11:48:03 PM	46	Central Count	2	31	3	0	0	34
CLARK TWP	0030	11/4/2008 11:48:03 PM	111	Precinct Tabulator	13	99	6	0	0	105
CORNISH TWP	0035	11/4/2008 10:03:04 PM	33	Central Count	0	22	0	0	0	22
UNORG 47-24 (DAVIDSON UNORG)	0038	11/4/2008 10:03:04 PM	23	Precinct Tabulator	3	22	2	0	0	24
FARM ISLAND TWP	0040	11/4/2008 10:03:04 PM	789	Precinct Tabulator	61	603	147	0	0	750
FLEMING TWP	0045	11/4/2008 11:48:03 PM	242	Precinct Tabulator	27	202	32	0	0	234
GLEN TWP	0050	11/4/2008 10:03:04 PM	346	Precinct Tabulator	28	250	63	0	0	313
HAUGEN TWP	0055	11/4/2008 10:36:04 PM	134	Precinct Tabulator	5	108	8	0	0	116
HAZELTON TWP	0060	11/4/2008 10:36:04 PM	523	Precinct Tabulator	62	418	77	0	0	495
HILL CITY	0065	11/4/2008 10:36:04 PM	334	Precinct Tabulator	58	245	15	0	0	260
HILL LAKE TWP	0070	11/4/2008 10:36:04 PM	269	Precinct Tabulator	40	241	15	0	0	256
IDUN TWP	0075	11/4/2008 10:36:04 PM	125	Precinct Tabulator	31	122	8	0	0	130
JEVNE TWP	0080	11/4/2008 10:03:04 PM	193	Precinct Tabulator	24	151	8	0	0	159
UNORG 45-24 (JEWETT UNORG)	0082	11/4/2008 11:48:03 PM	21	Central Count	4	21	0	0	0	21
KIMBERLY TWP	0085	11/4/2008 10:03:04 PM	141	Precinct Tabulator	7	109	9	0	0	118
LAKESIDE TWP	0090	11/4/2008 10:36:04 PM	378	Precinct Tabulator	46	304	40	0	0	344
LEE TWP	0095	11/4/2008 9:39:04 PM	37	Central Count	4	33	1	0	0	34
LIBBY TWP E	0100	11/4/2008 9:39:04 PM	22	Central Count	0	18	0	0	0	18

Figure 16: County Detailed Summary Screen

Infrastructure

Minnesota created an extensive web farm and redundant hardware architecture for SVRS deployment in 2004, which was expanded for SVRS View and municipal Absentee Ballot administration during the EAC grant projects. Figure 17 shows a high-level view of Minnesota's architecture:

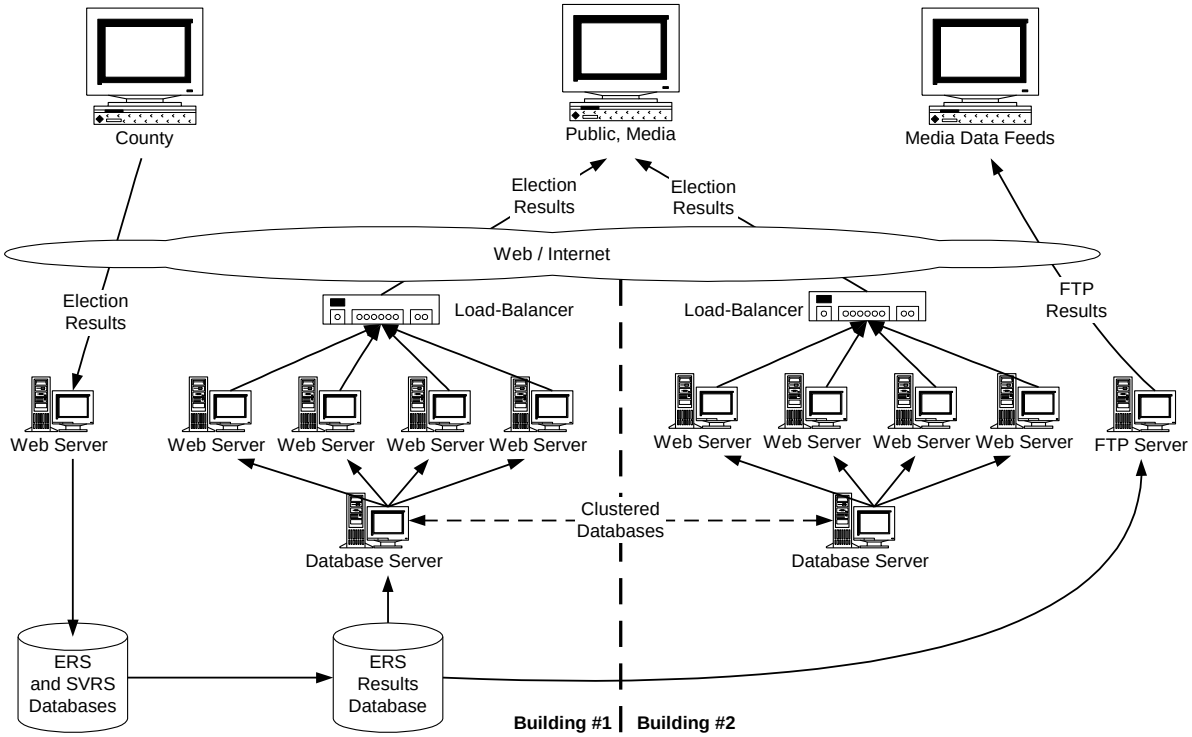


Figure 17: Minnesota Infrastructure

Key factors that help support Minnesota's Precinct Results Best Practices include the following:

- The system is physically located in two different buildings to reduce the likelihood of failure due to power outages or other problems related to a single location. All equipment (switches, firewalls, routers, load balancing appliances, web servers, and database servers) exist in both buildings and can share the load or fail-over if needed.
- Load-balancing appliances distribute the load across any available web servers for an application. These appliances are redundant, so that only one is active at a time.
- Web farm hosts the applications. SVRS is typically deployed on five active web servers; ERS on election night is deployed on 15 web servers and 3 database servers. All web servers are accessible by each load balancer, to ensure maximum availability. Databases are "clustered," meaning that two physical servers are part of a pair in which only one is the master at any one time.
- County ERS web server provides a path for data entry and file uploads which is used only for that purpose on election night.
- ERS and SVRS Databases exist on an internal server, and ERS results data is published to ERS Results Databases at regular intervals on election night. The election results presentation hardware can be increased by scaling up the number of web servers and presentation database servers if needed.

4. Minnesota's Precinct Results Best Practices

Minnesota has built a collection of systems that provides for the entry of offices and candidates, the creation of ballots and election testing, the collection of election results, and distribution of those precinct-level results to a wide variety of consumers. In the evolution of our systems, we have identified certain decisions, designs, processes and techniques that have contributed to our success. These items may be beneficial to others and are shared here with that in mind:

Getting the right data on the ballot

1. Office Entry process:
    a. Allow for input and review of offices by the jurisdiction responsible for the office
    b. Use office templates to ensure consistent naming and office code use in the state
2. Candidate Filing process:
    a. Restrict offices/candidates to the correct jurisdiction to eliminate candidate filing errors
    b. Encourage timely entry of candidates by appropriate jurisdiction, in order to provide timely delivery of candidate filing data to public and media
    c. Encourage complete office and candidate entry, statewide, at all levels (state, federal, county, municipal, school, hospital). Having 100% complete ballot data in the statewide election results system will provide the most complete list of offices and candidates for sample ballots, the best links to candidate web sites for public information, and the most complete results reporting.
3. Ballot Data Exports:
    a. Give data to ballot vendors electronically to eliminate errors and maintain consistency in ballot creation and election reporting
    b. Work with ballot vendors to obtain ballot title and vendor-unique information for ballot data interchange

Vote Tabulation file upload process

1. Election results entry:
    a. Provide for both manual and file upload processes to facilitate access
    b. Track the number of counties with manual vs. electronic (file upload) reporting. Use this data for analysis of post-election changes, and timeliness and accuracy of entry,
    c. Track the time required on major elections to obtain 100% reported status. Use this information to set expectations for media and public in future elections.
    d. The 32 character "Minnesota Format" has provided for complete ballot coverage, for every race in the state is used by those with appropriate software for automated election results upload.
    e. Work with counties to ensure files are generated correctly and the upload process is tested by each county
    f. Use a format that is human-readable to facilitate identifying problems during testing and on election night

g. Consider future enhancements such as XML or EML

h. Ensure that entry or upload processes provide for all races and all levels (federal, state, county, municipal, school) and include cross-county races

2. Election results testing:

a. Provide as large a testing window as possible to ensure statewide county testing and provide ample testing time for jurisdictions busy with other election related duties. Track the test participation by counties and the test coverage of offices and candidates; use this information for pre-election follow-up.

b. Include media personnel in selected test periods to help eliminate problems in media results processing. Provide system-generated 100%

c. Provide several concentrated test windows that simulate election night for internal testing, and encourage statewide county and media participation.

Statistics and Over/Undervote processing

1. Statistics Entry:

d. Allow for precinct statistic entry after results are complete

e. Identify standardized file format for statistics upload

2. Overvote/Undervote processing:

f. Identify file formats to standardize overvote/undervote upload

g. Provide for manual entry and file upload of overvote/undervote data

Election results consumers:

1. Election Officials

a. Provide precinct-level reports for canvassing for Federal, State and County offices.

b. Provide precinct-level reports for canvassing for Municipal, School District and Hospital districts. Note that these jurisdictions oftentimes cross county lines.

c. Provide reports that can be used for verification of all precinct-level data that has been entered or uploaded into the system (results, statistics, over/under votes)

2. Public Web Results:

a. Provide a wide variety of web results, including office totals, county totals, legislative district totals, municipality and school district totals

b. Provide precinct-level results for any precinct in the state

c. Measure response time on public results display

d. Create a data refresh process that minimizes data change window.

e. Track the number of hits and number of visitors to public results for the 24 hour time period starting at 8:00 PM on election night. Use this information as trends over time to predict hardware improvements and infrastructure needs.

3. Media Files:
    a. Identify key media stakeholders and engage in file content discussions and testing schedules
    b. Provide a wide variety of media results files at differing levels; different media outlets have different needs for analysis and reporting
    c. Track FTP site availability and ensure that bandwidth issues are not diminishing media access to results.
    d. Create a mechanism to share system information with media technical representatives on election night.
4. Detailed analysis of election results data:
    a. Collect and provide appropriate data for EAC surveys
    b. Collect data for future detailed analysis, such as incorporating into a data warehouse
5. System Testing
    a. Perform failover tests on all redundant hardware prior to election night
    b. Perform load testing on election results sites prior to election night.
    c. Review entire architecture for bottlenecks prior to election night
    d. Create a disaster recovery plan with secondary and tertiary site alternatives prior to election night
    e. Identify all systems that can be taken offline on election night to reduce bandwidth needs
    f. Create static HTML pages for primary OSS website that include links to the Election Results System. Ensure that these pages are in place on election night.
    g. Test multiple presentation systems to ensure consistent data on all sites
    h. Monitor web server and database server CPU utilization on election night, particularly for presentation hardware. Web server or database server over-utilization will cause delays in presenting results to public and media.
    i. Check internet bandwidth capacity and overall infrastructure throughput for switches, routers, and network. Consider temporarily increasing bandwidth availability for a time period (weeks before and after) around a major election in order to reduce likelihood of network traffic throttling.

Appendix A: Key Terms

Term: Definition

EML: Definition

XML: Definition

Appendix B: Reference Information

Reference Title

website or document information

Reference Title

website or document information