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FIGURE F- 1: CENTRAL ARKANSAS CASE STUDY REGIONAL AREA

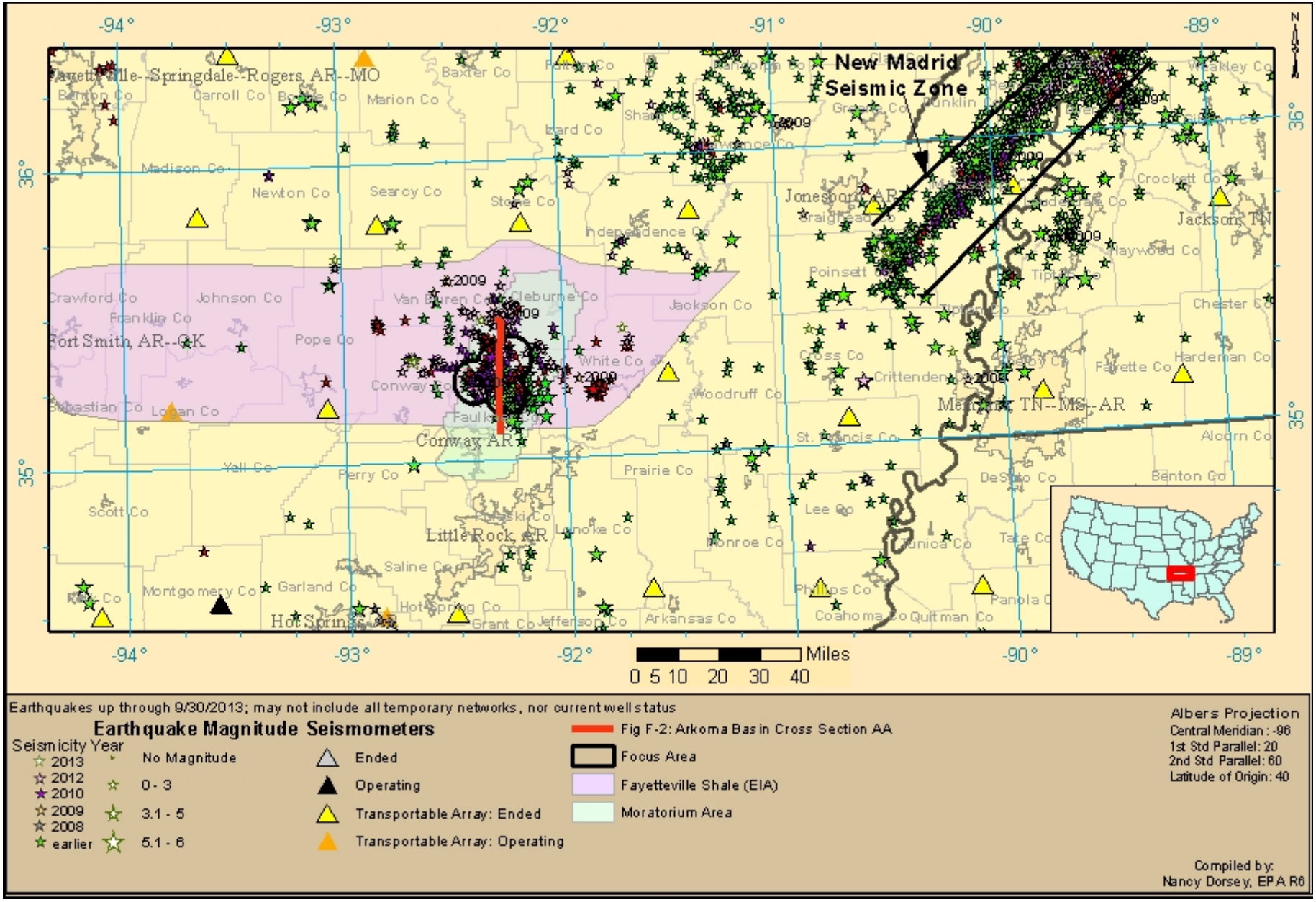
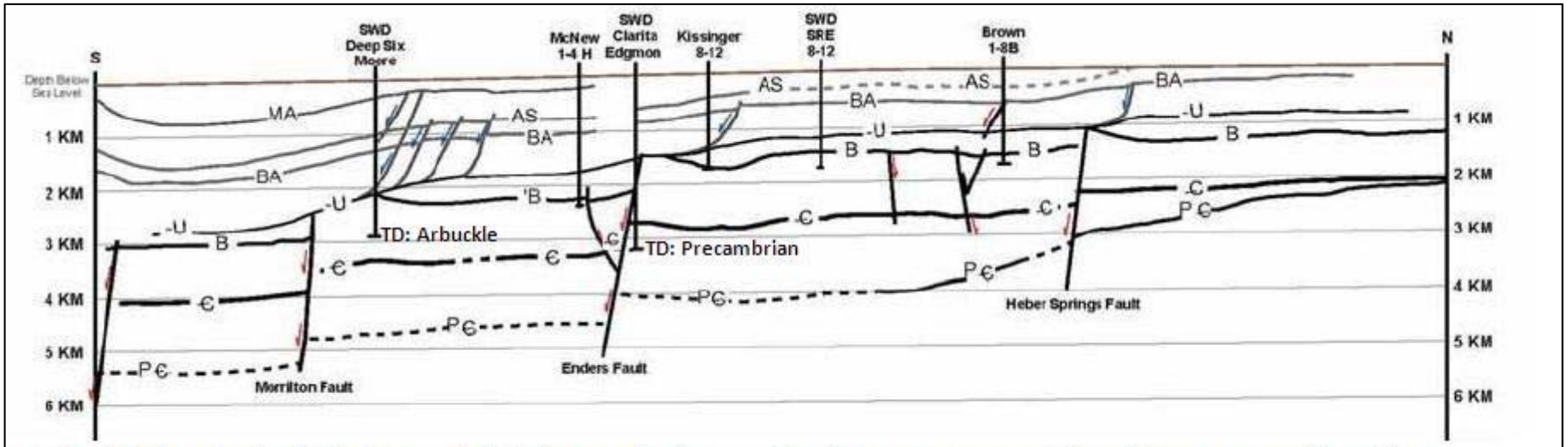
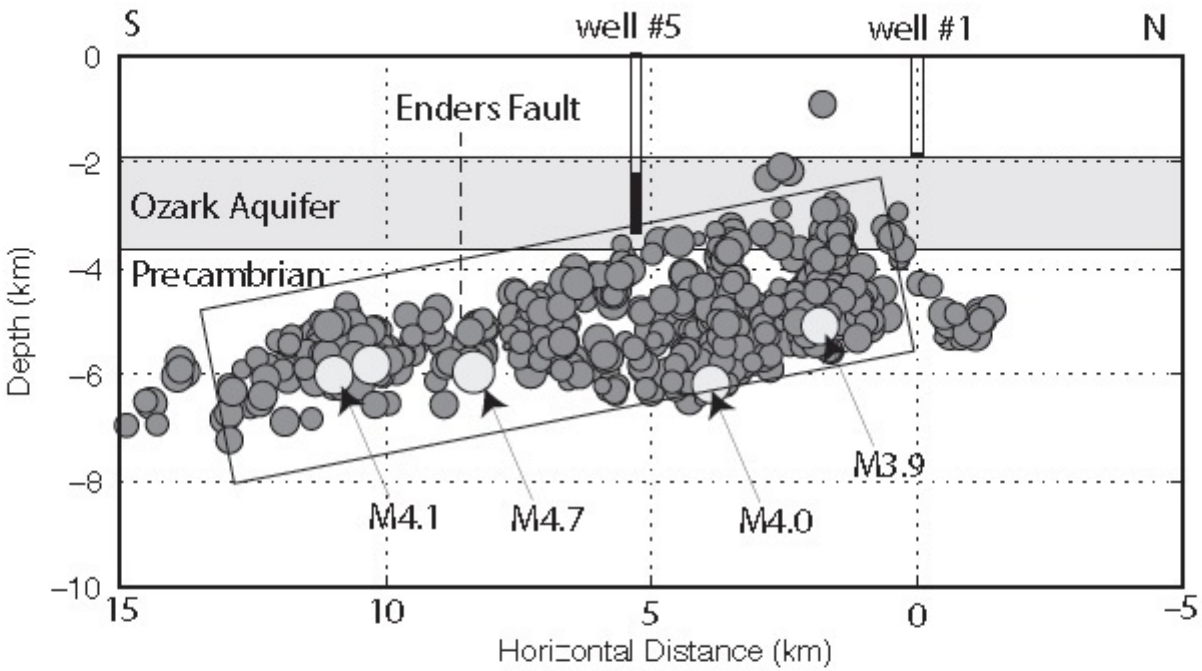


FIGURE F- 2: EAST ARKOMA BASIN STRUCTURAL CROSS-SECTION (WITH PERMISSION)



MA: basal Atoka SS BA: basal Atoka SS unc: Mississippian-Pennsylvanian unconformity B: Boone Fm C: Cambrian reflector Pc: Precambrian reflector
From Ausbrooks Exhibit 23 based on Vanarsdale and Schweig, Subsurface Structure of the Eastern Arkoma Basin, AAPG Bulletin, V. 74, N. 7, p. 1030-1037, 1990.

FIGURE F- 3: CROSS-SECTION OF ACTIVE FAULT PLANE (FIGURE 3 OF HORTON, 2012)

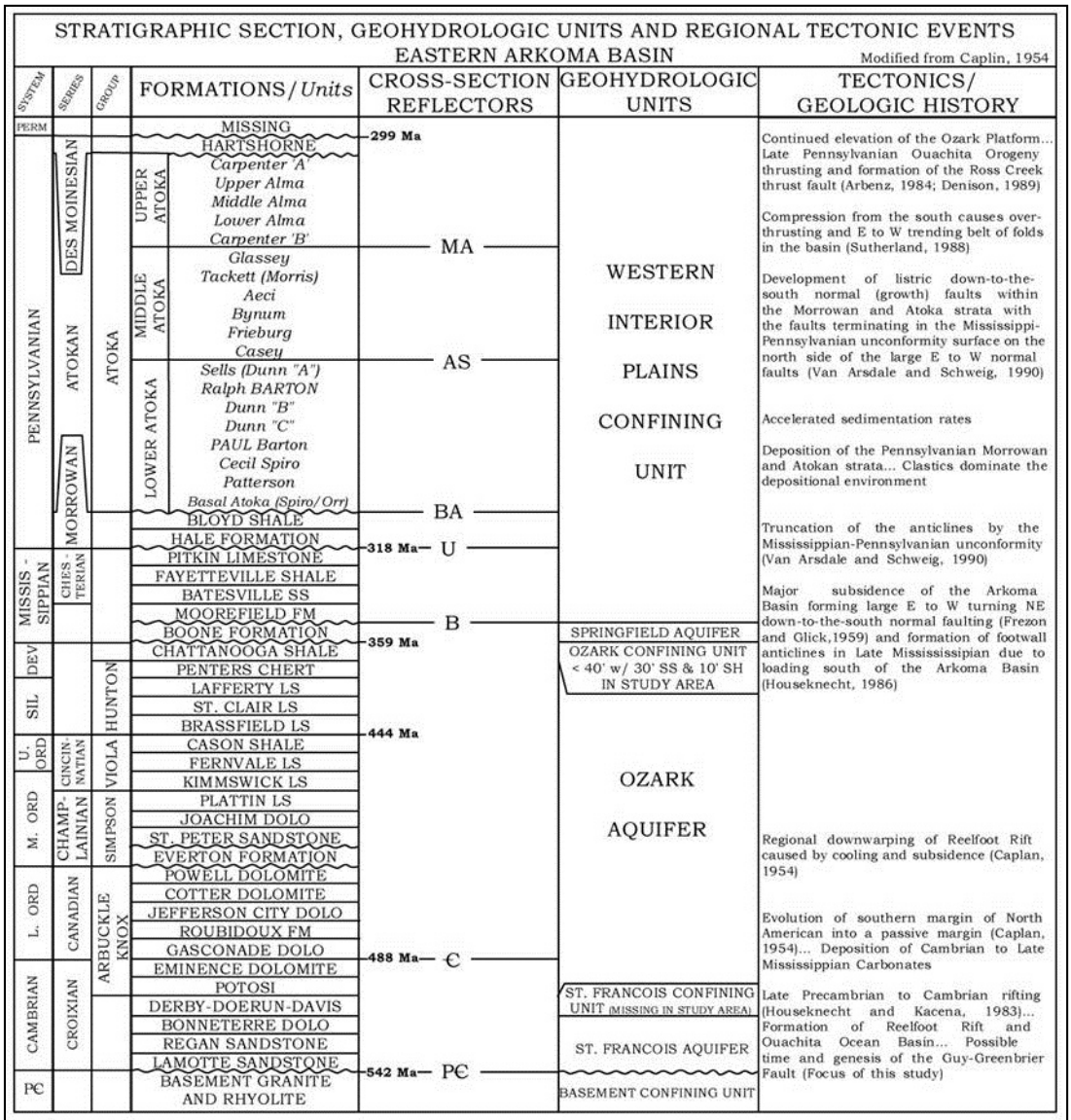


▲ **Figure 3.** Cross-section showing earthquake hypocenters looking N60W. Rectangle is 13 × 3.2 km and dips 11°. Shaded rectangle indicates the approximate vertical extent of the Ozark aquifer with the bottom boundary depth determined in well #5 and the top boundary depth determined in well #1. Solid black portion of each well indicates the interval where fluid is injected. The dashed line indicating the Enders fault is approximate. The larger earthquakes (light gray circles) rupture the deeper portions of the fault.

Horton, S. P., 2012, Disposal of Hydrofracking-waste fluid by injection into subsurface aquifers triggers earthquake swarm in Central Arkansas with potential for damaging earthquakes: Seismological Research Letters, v. 83, p. 250-260, doi: 10.1785/gssrl.83.2.250.

Wells: 1 = SRE 8-12 1-17; 5 = Edgmon 1

FIGURE F- 4: STRATIGRAPHIC AND HYDROLOGIC COLUMN OF THE ARKOMA BASIN (AUSBROOKS AND HORTON, 2013)



Ausbrooks, S. M. and S. Horton, 2013 Disposal of Hydrofracking-Waste Fluid by Injection into Subsurface Aquifers Triggers Earthquake Swarm in Central Arkansas with Potential for Damage Earthquakes: Ground Water Protection Council 2013 Proceedings, Day 2, http://www.gwpc.org/sites/default/files/event-sessions/Ausbrooks_Scott.pdf

FIGURE F- 5: CENTRAL ARKANSAS HISTORIC AREA SEISMICITY IN FOCUS AREA THROUGH 9/30/2013

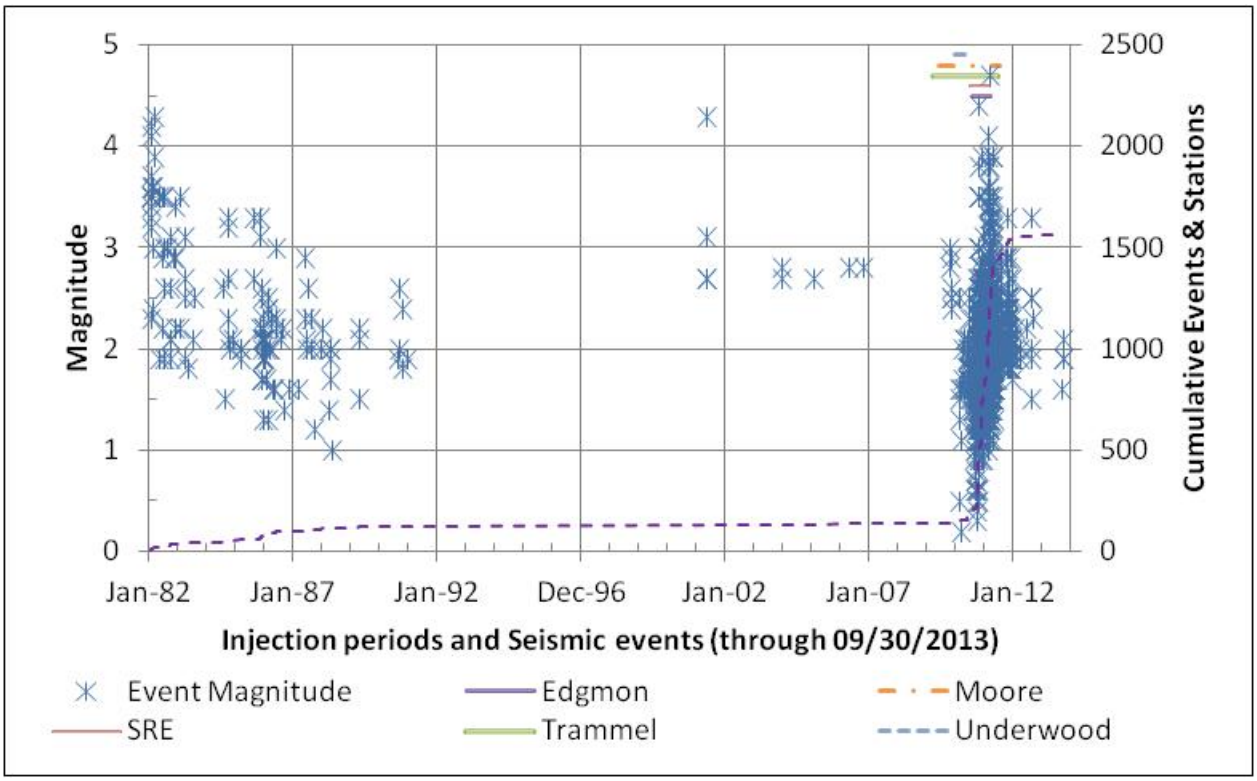


FIGURE F- 6: COMPOSITE FOCUS AREA SEISMICITY MAP

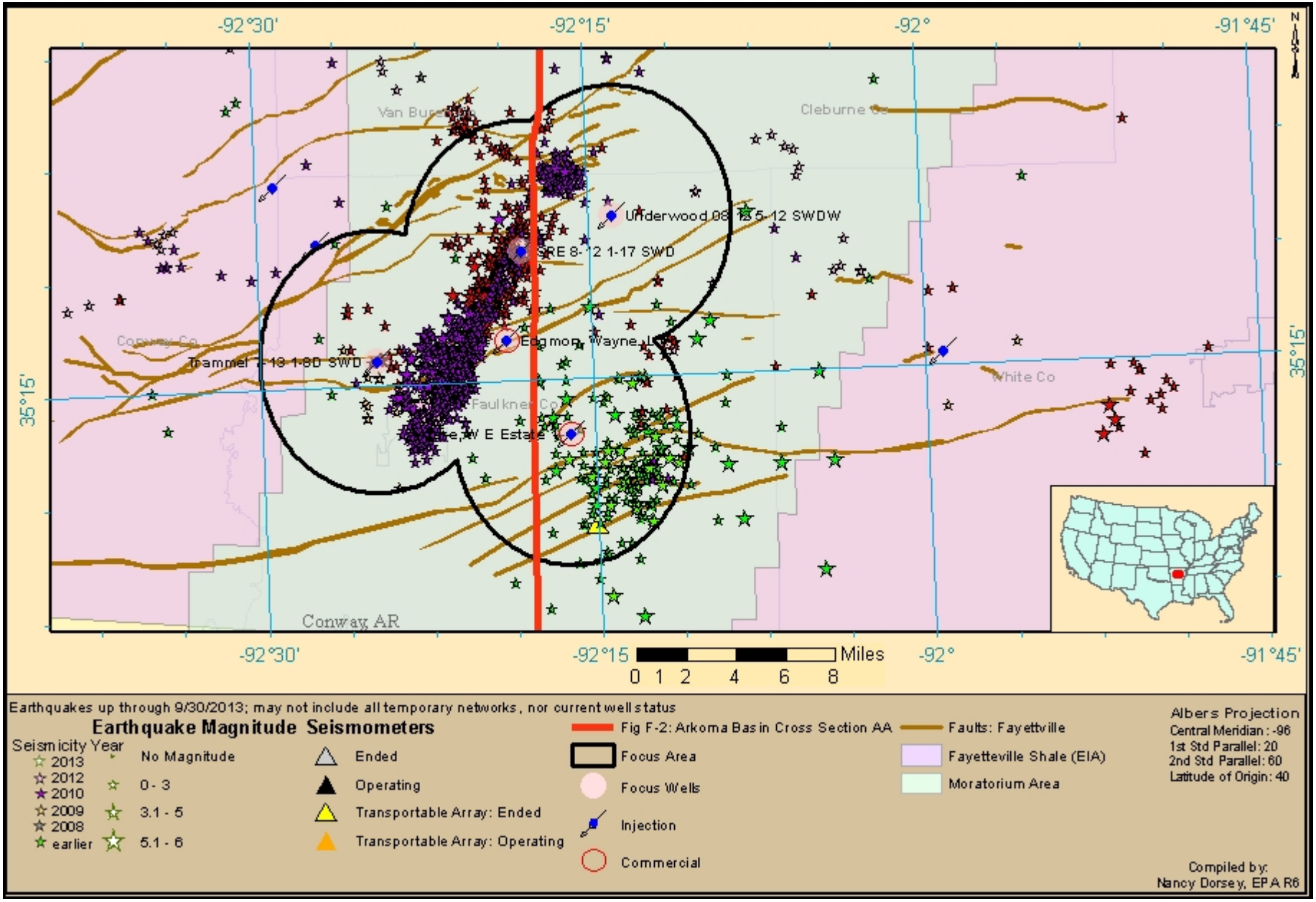
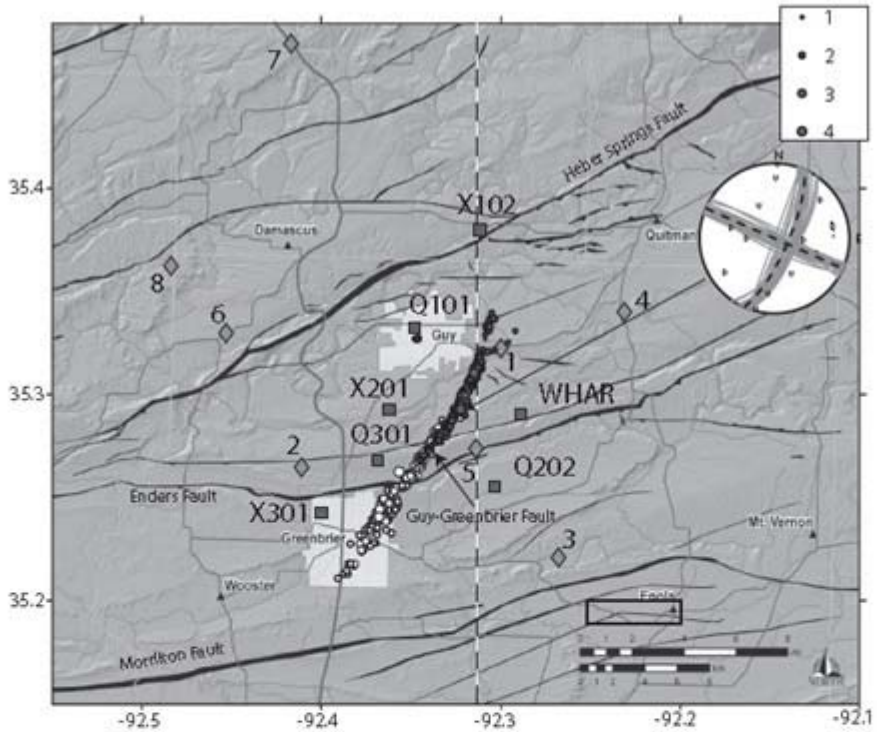


FIGURE F- 7: SEISMOMETER DEPLOYMENT AND ACTIVE FAULT TRACE (HORTON, 2012)



▲ **Figure 2.** Seismic stations (black squares), UIC wells (gray diamonds, Table 1), earthquakes (dark gray filled circles) between 1 October 2010 and 15 February 2011, and earthquakes (white filled circles) between 02/16/11 and 03/08/11. Named faults penetrate to the Precambrian basement (faults from AGS and AOGC). Earthquakes were located using HypoEllipse (Lahr 1999) and the velocity model of Chiu *et al.* (1994), then relocated using hypoDD (Waldhauser 2001) with the same velocity model. Inset: First-motion focal mechanism for **M** 4.0 earthquake on 11 October 2010 is consistent with right-lateral strike-slip on a NE oriented fault. North/south dashed line coincides with the geologic cross-section in Figure 4.

Horton, S. P., 2012, Disposal of Hydrofracking-waste fluid by injection into subsurface aquifers triggers earthquake swarm in Central Arkansas with potential for damaging earthquakes: Seismological Research Letters, v. 83, p. 250-260, doi: 10.1785/gssrl.83.2.250.

Wells 1 = SRE 8-12 1-17; 2 = Trammel 7-13 1-8D; 3=Moore 1-22; 4=Underwood 8-12 5-12; 5 = Edgmon 1

FIGURE F- 8: CENTRAL ARKANSAS COMPOSITE FOCUS AREA SEISMICITY

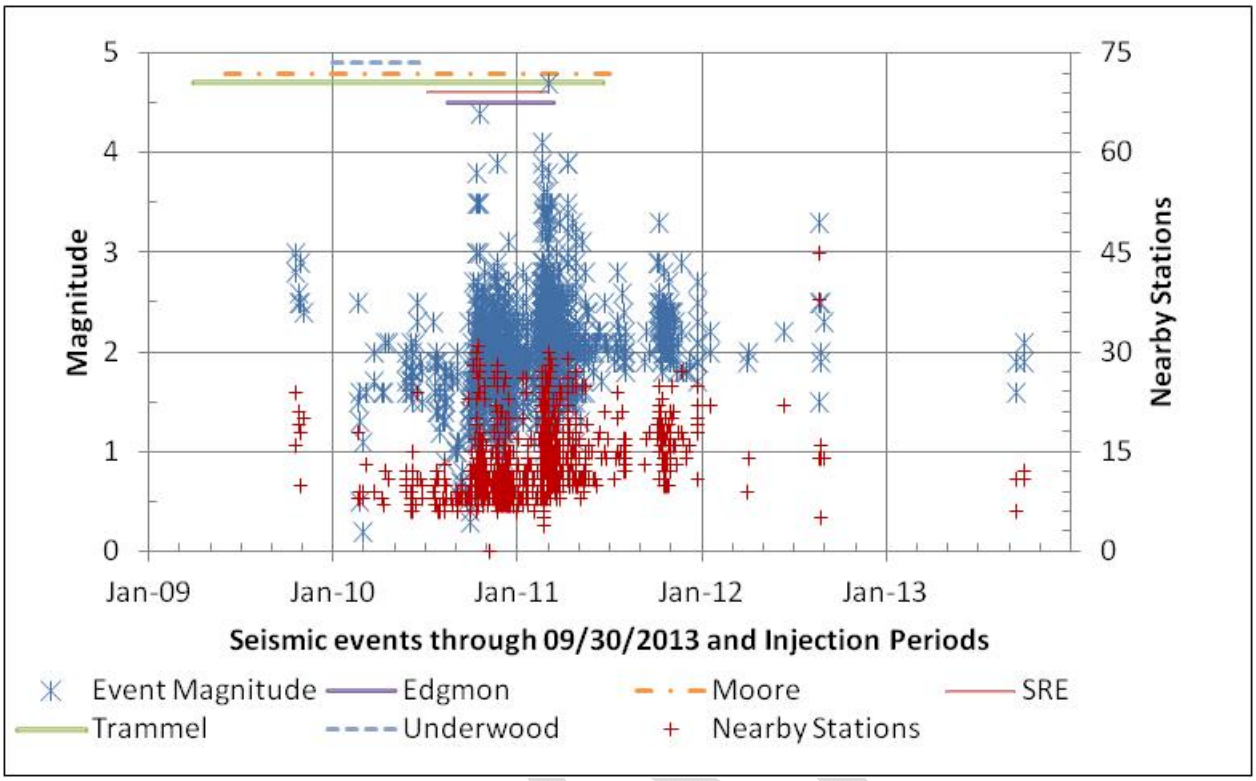


FIGURE F- 9: MOORE ESTATE OPERATIONAL DATA PLOT

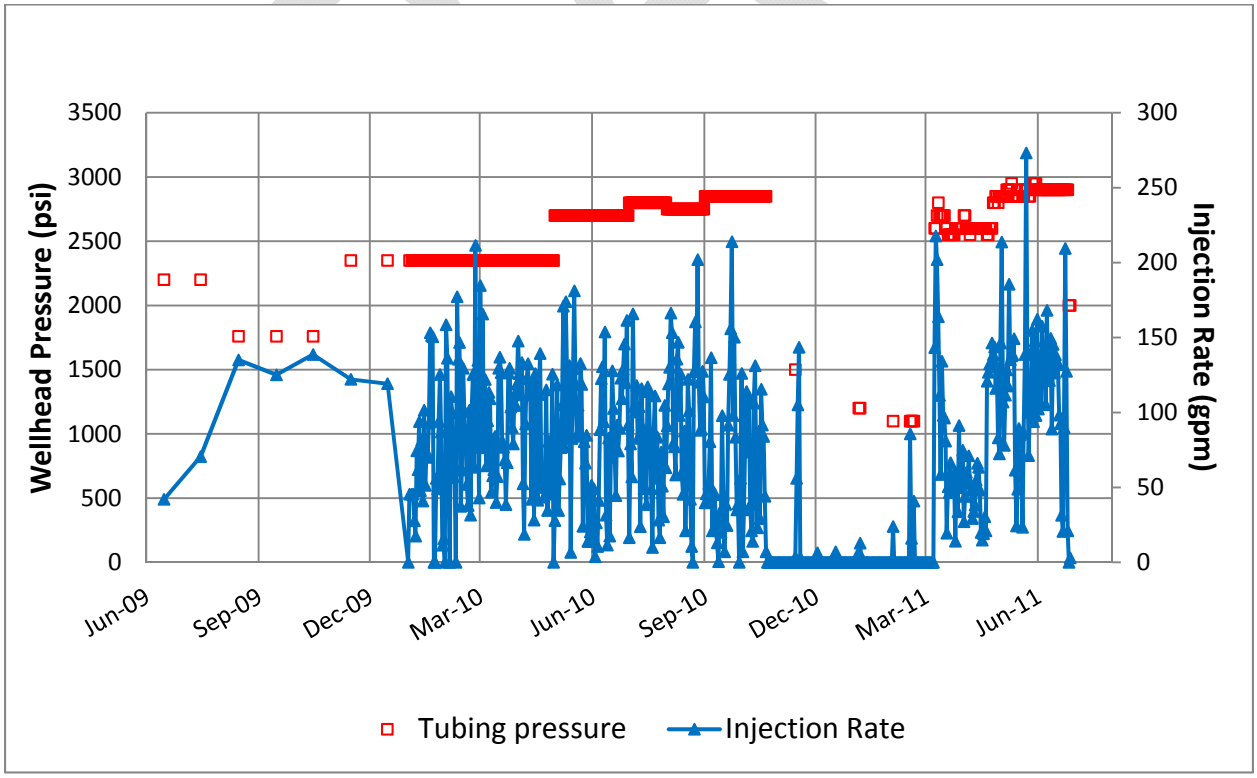


FIGURE F- 10: SRE OPERATING DATA PLOT

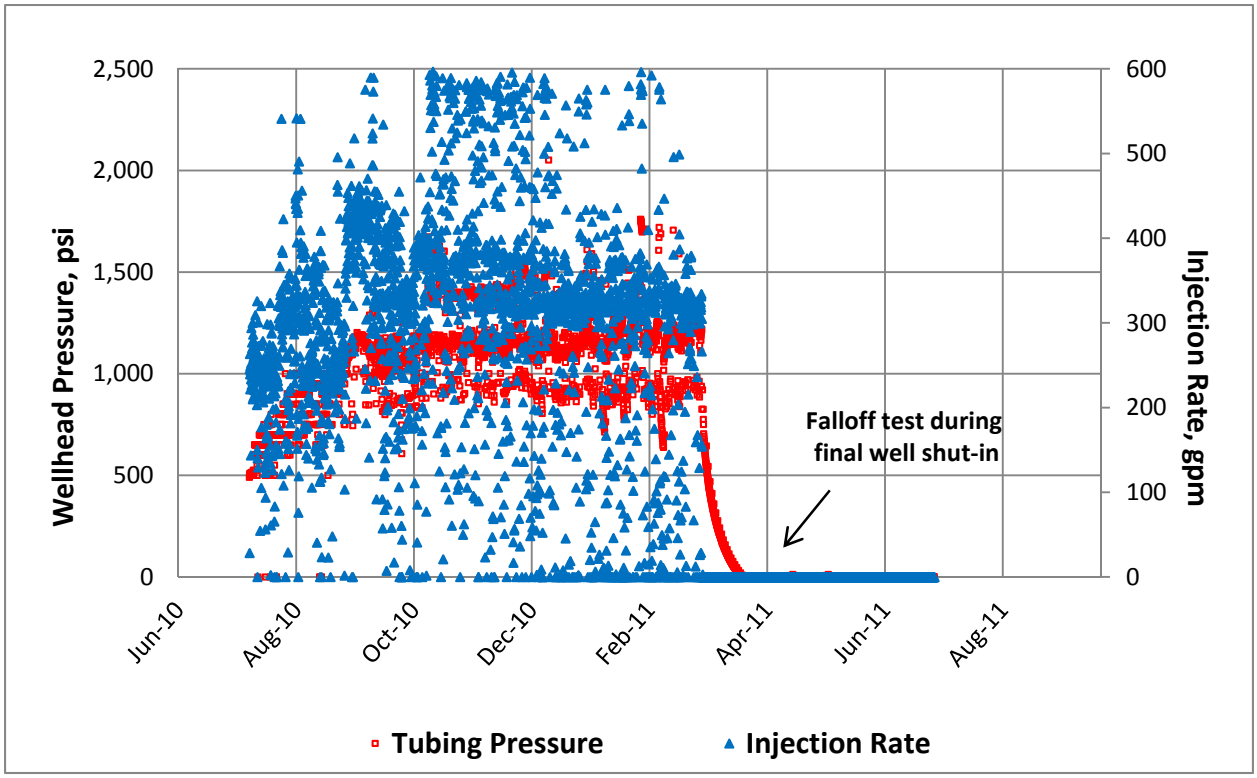


FIGURE F- 11: TRAMMEL OPERATING DATA PLOT

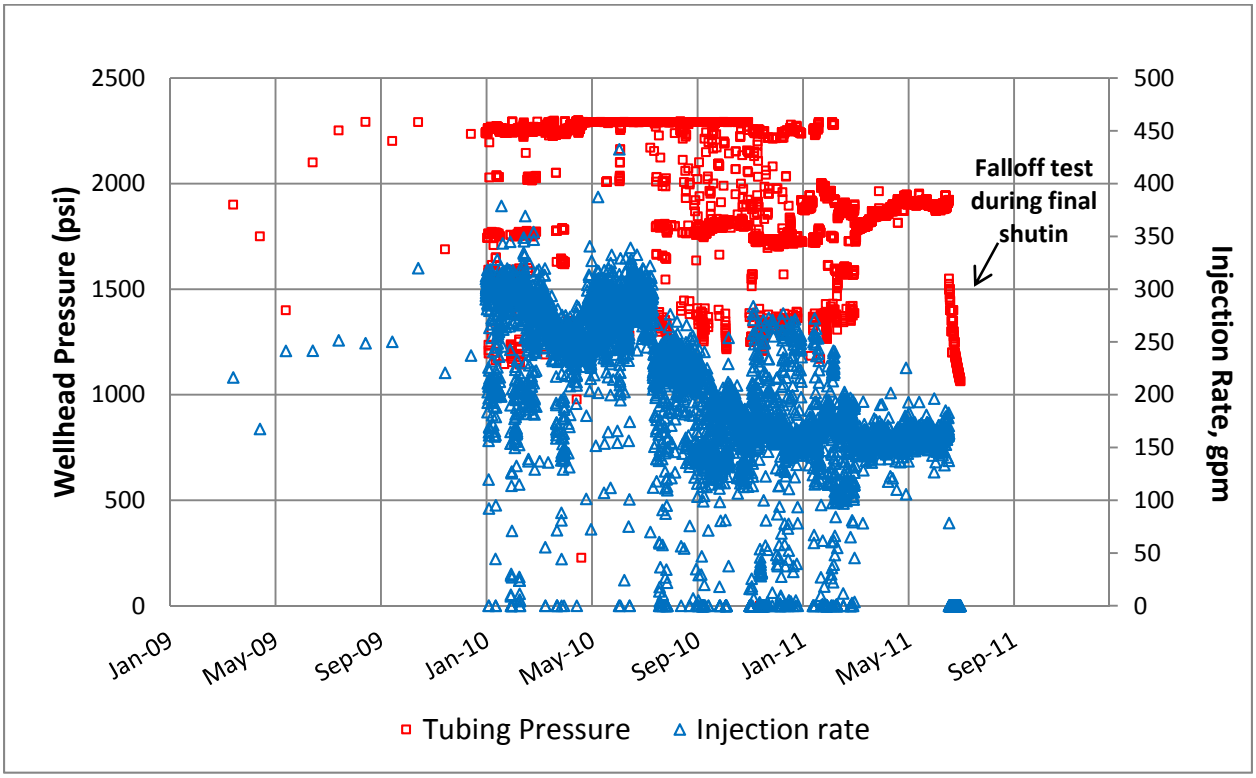


FIGURE F- 12: UNDERWOOD OPERATING DATA PLOT

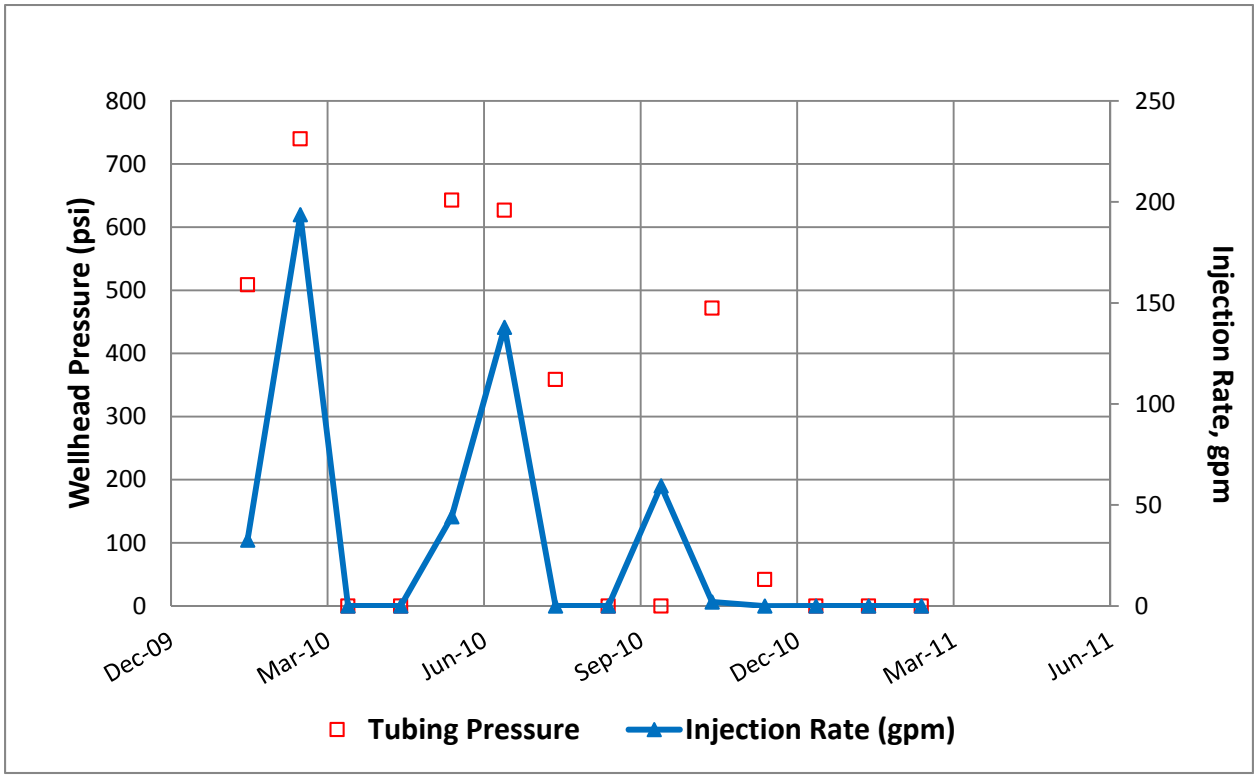


FIGURE F- 13: EDGMON OPERATING DATA PLOT

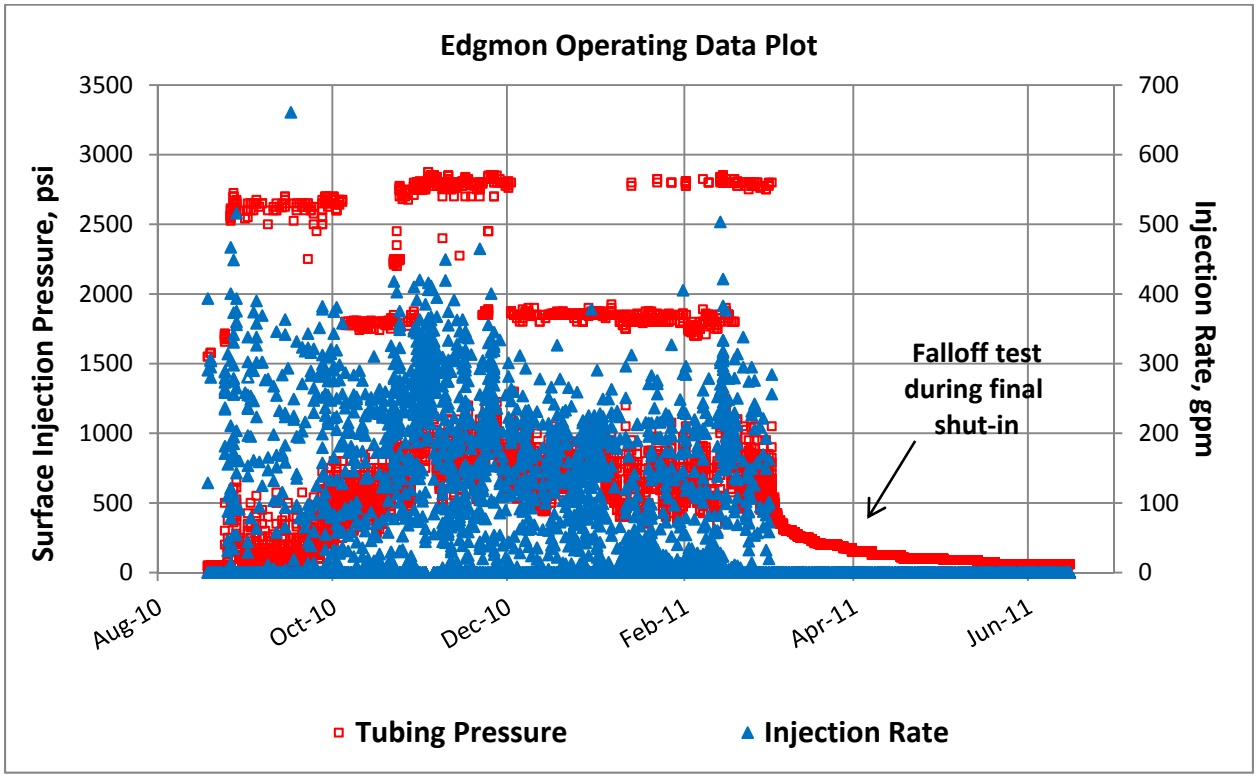


FIGURE F- 14: MOORE ESTATE OPERATING PRESSURE GRADIENT PLOT

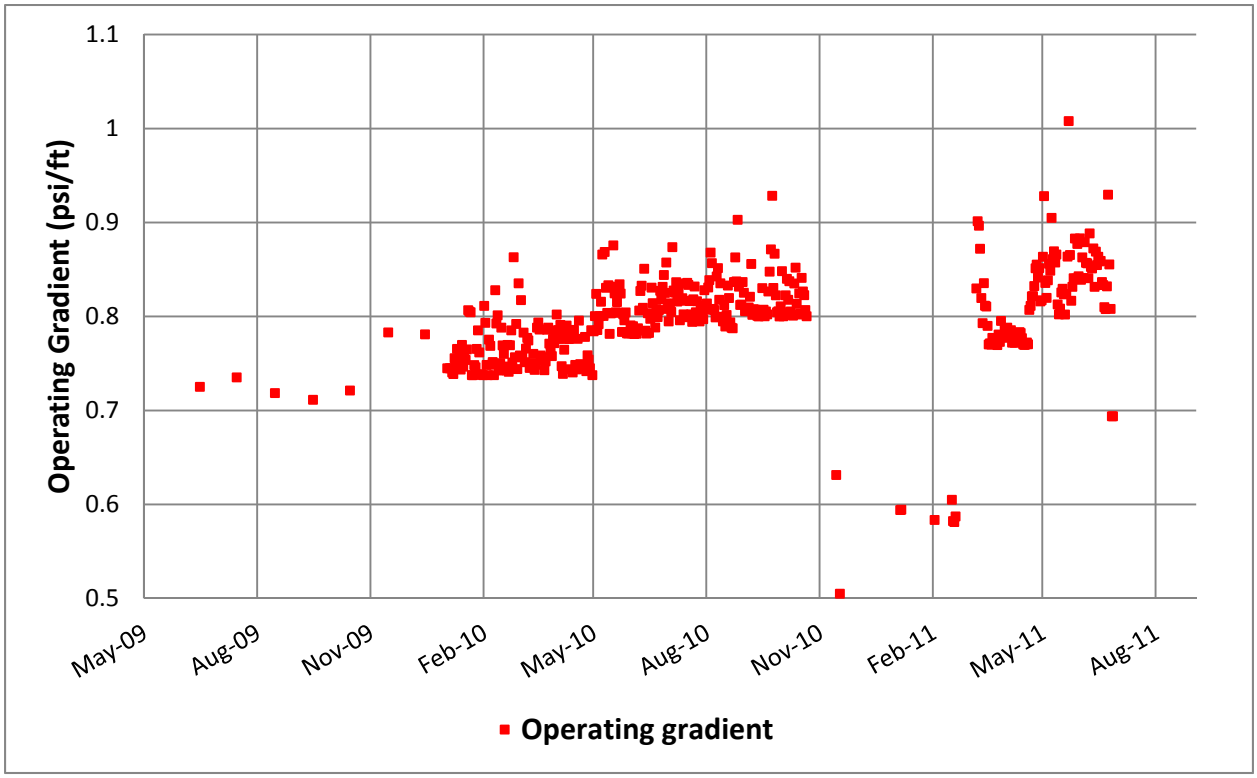


FIGURE F- 15: SRE OPERATING PRESSURE GRADIENT PLOT

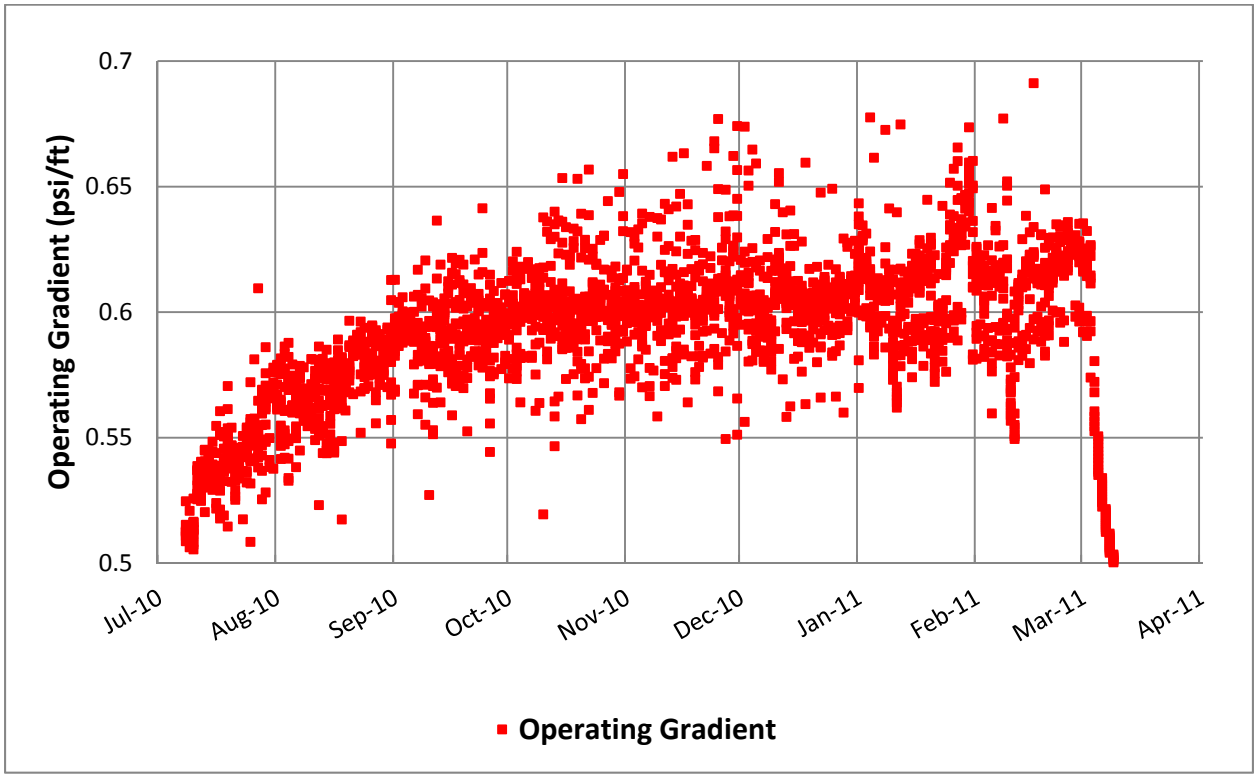


FIGURE F- 16: TRAMMEL OPERATING PRESSURE GRADIENT PLOT

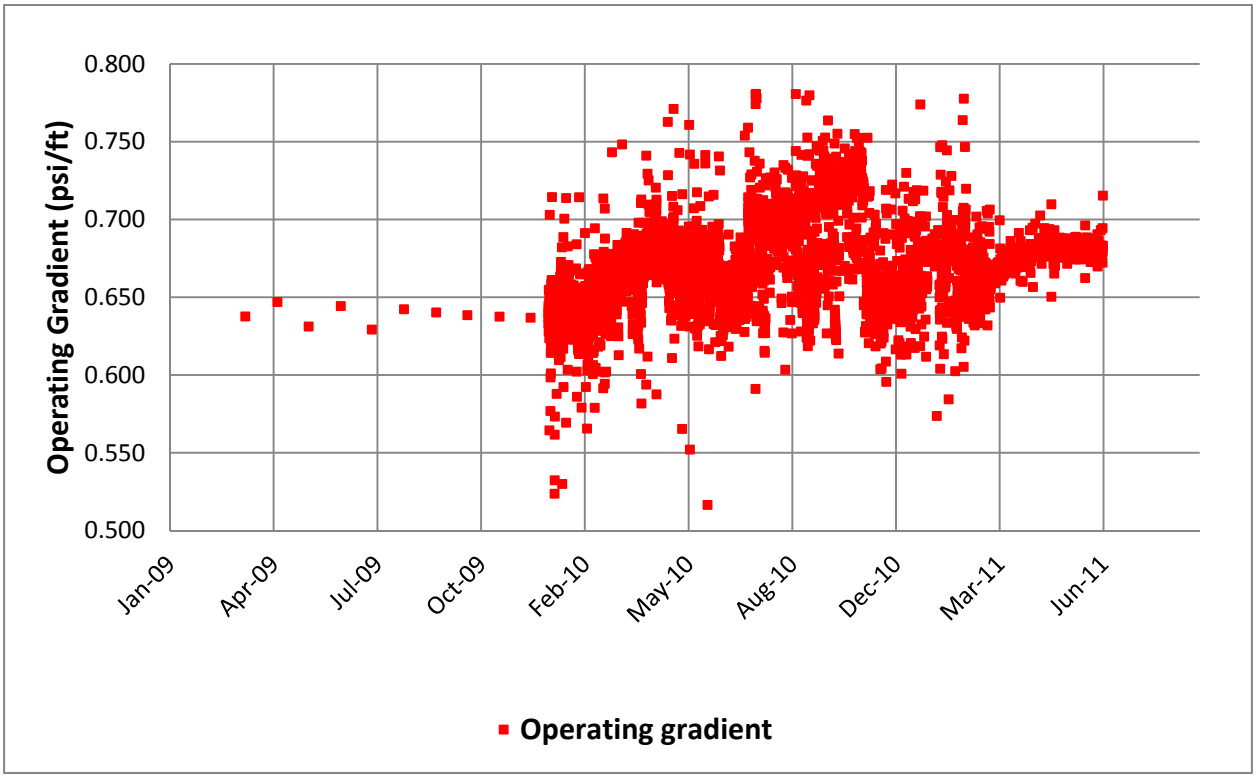


FIGURE F- 17: UNDERWOOD OPERATING PRESSURE GRADIENT PLOT

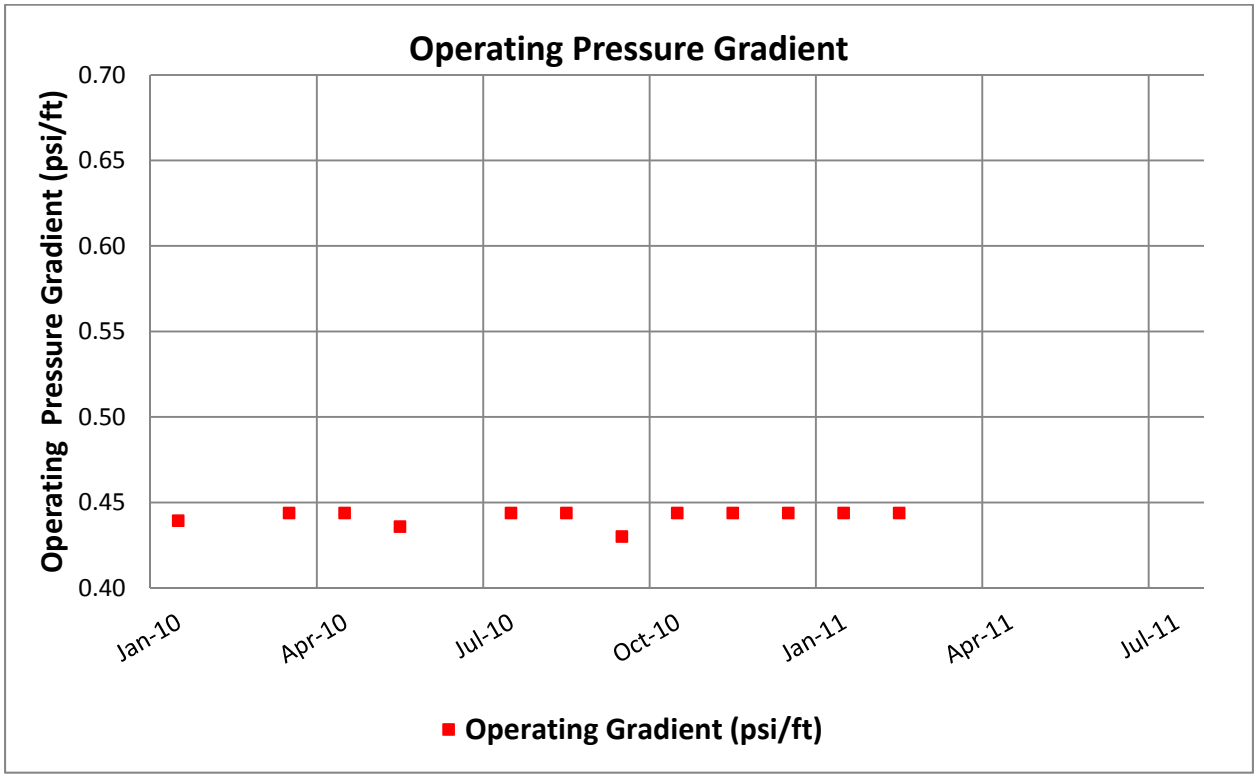


FIGURE F- 18: EDGMON OPERATING PRESSURE GRADIENT PLOT

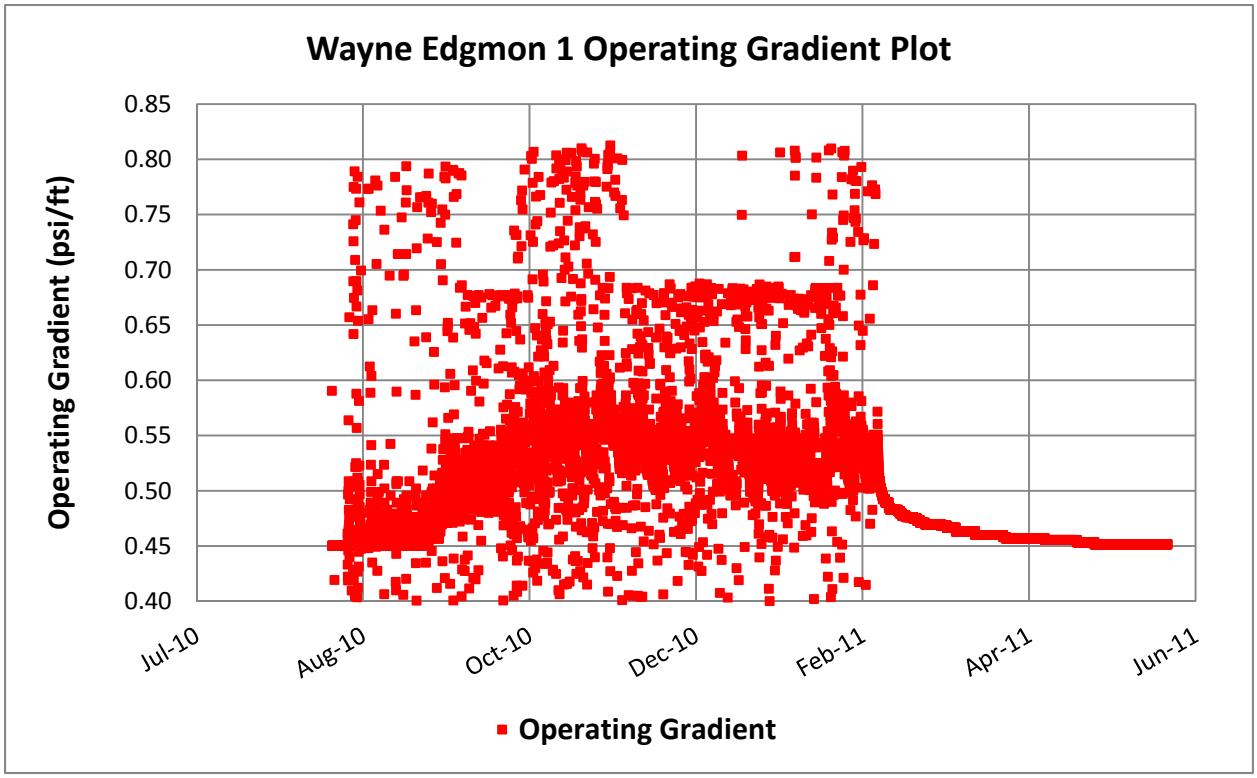


FIGURE F- 19: MOORE ESTATE TANDEM PLOT OF CUMULATIVE EARTHQUAKE EVENTS AND HALL INTEGRAL WITH DERIVATIVE

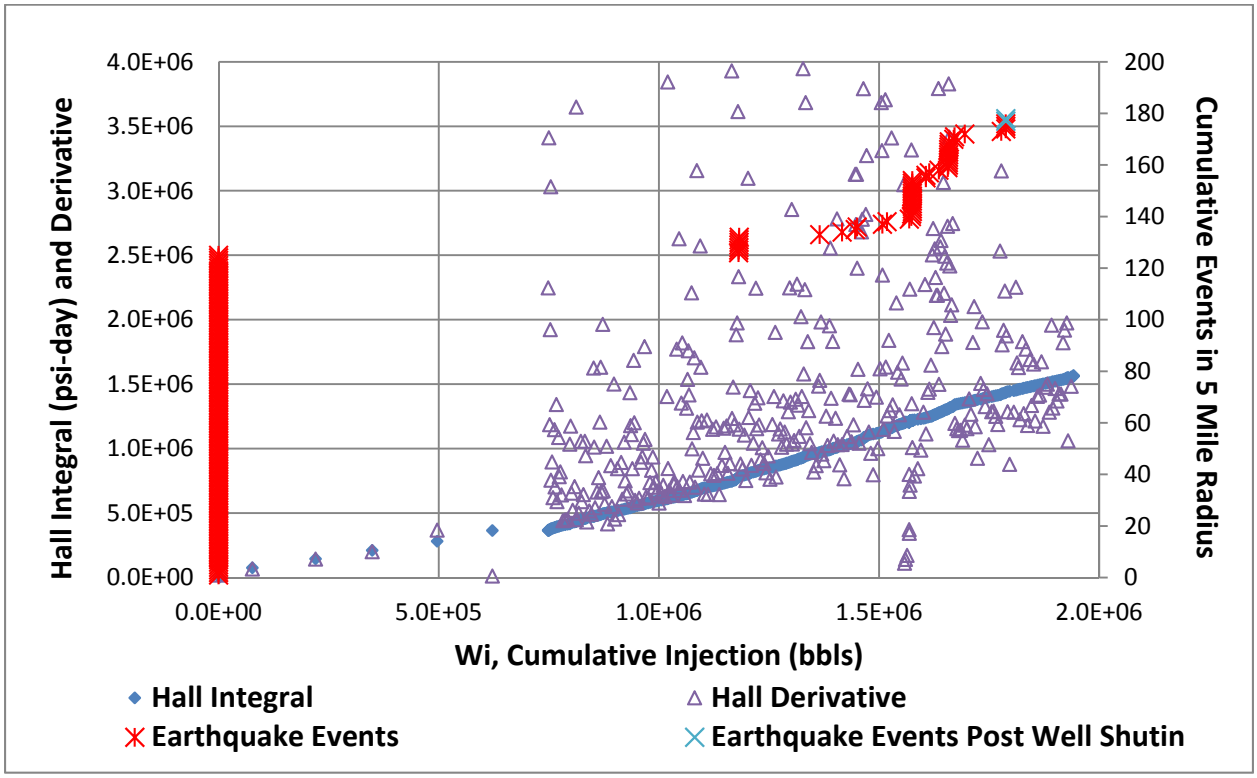


FIGURE F- 20: MOORE ESTATE TANDEM PLOT OF CUMULATIVE EARTHQUAKES SINCE 2010 AND HALL INTEGRAL

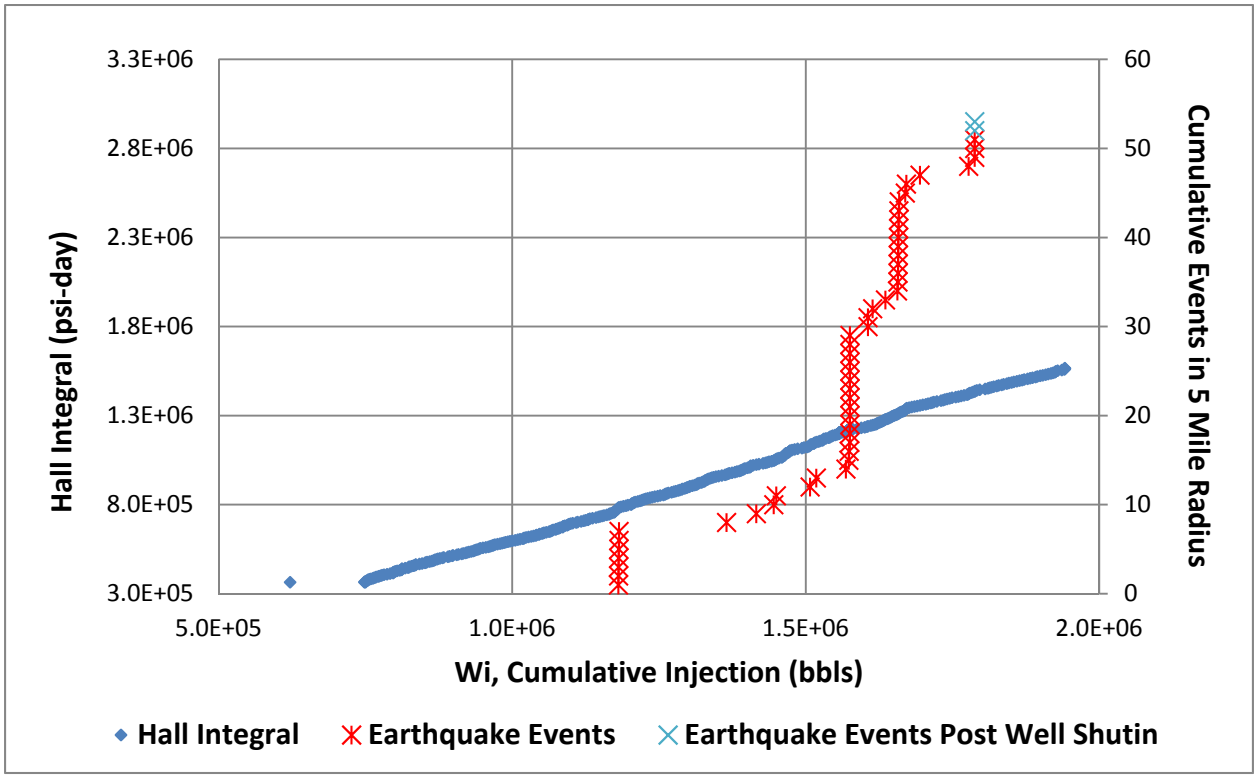


FIGURE F- 21: MOORE ESTATE ZOOMED TANDEM PLOT

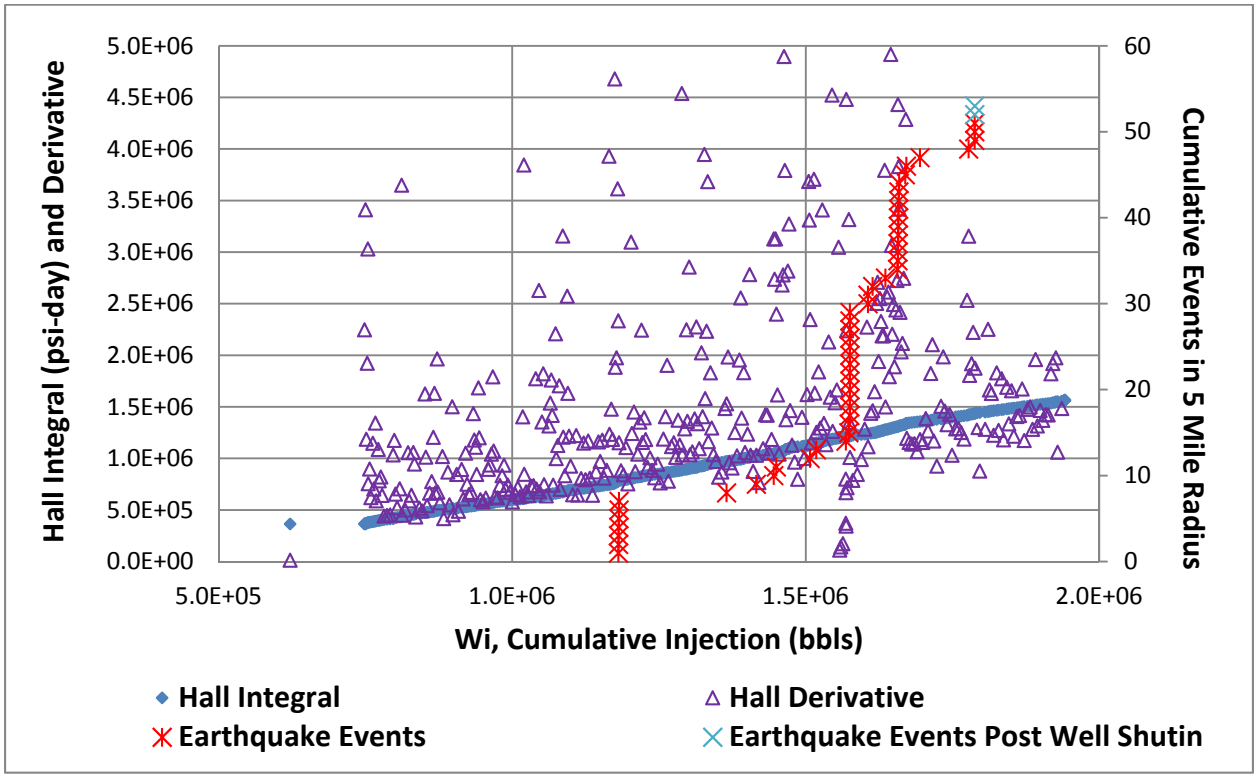


FIGURE F- 22: SRE TANDEM PLOT OF CUMULATIVE EARTHQUAKES AND HALL INTEGRAL WITH DERIVATIVE

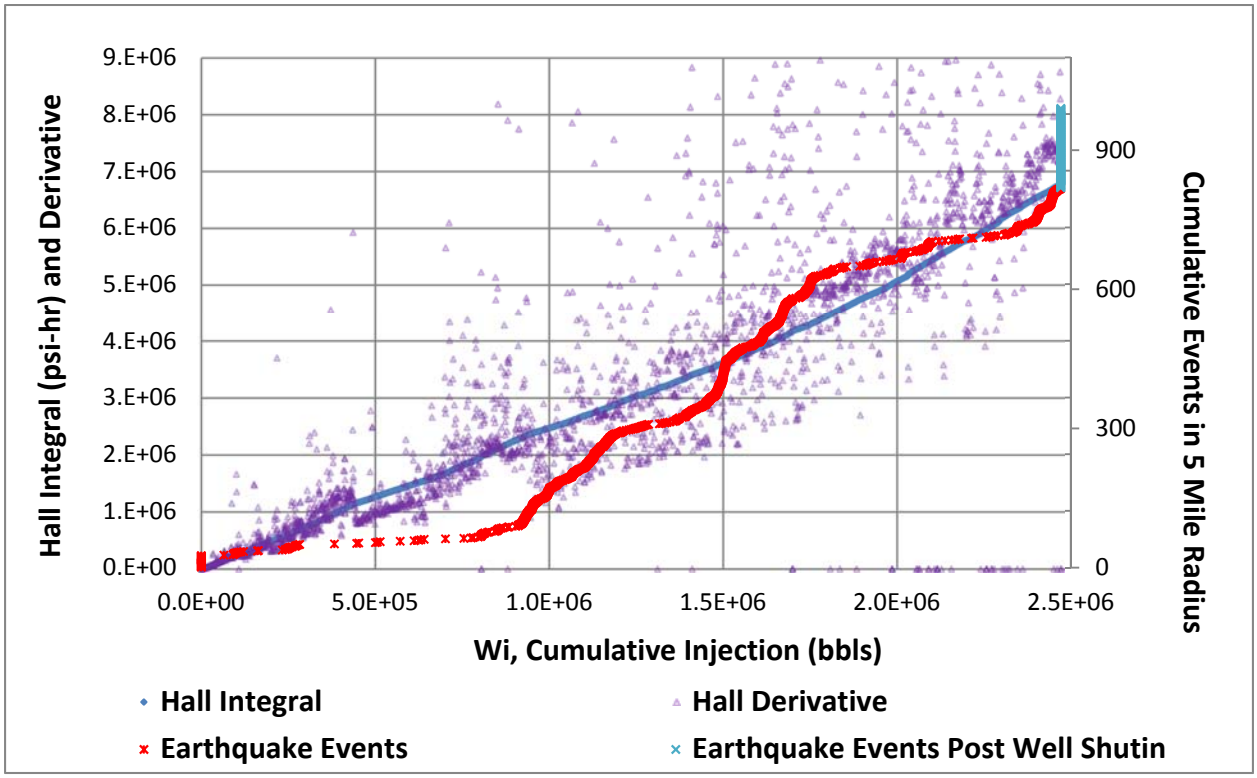


FIGURE F- 23: SRE ZOOMED TANDEM PLOT TO NOVEMBER 21, 2010

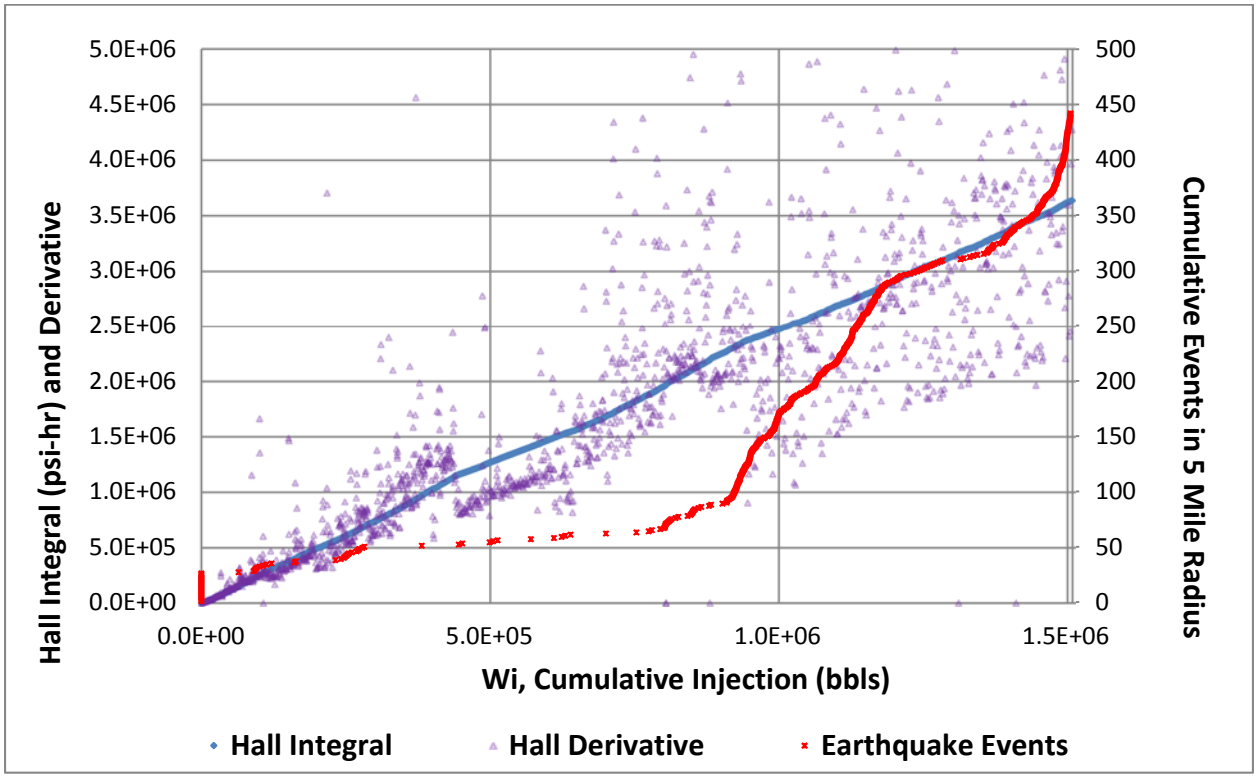


FIGURE F- 24: TRAMMEL TANDEM PLOT OF CUMULATIVE EARTHQUAKE EVENTS AND HALL INTEGRAL WITH DERIVATIVE

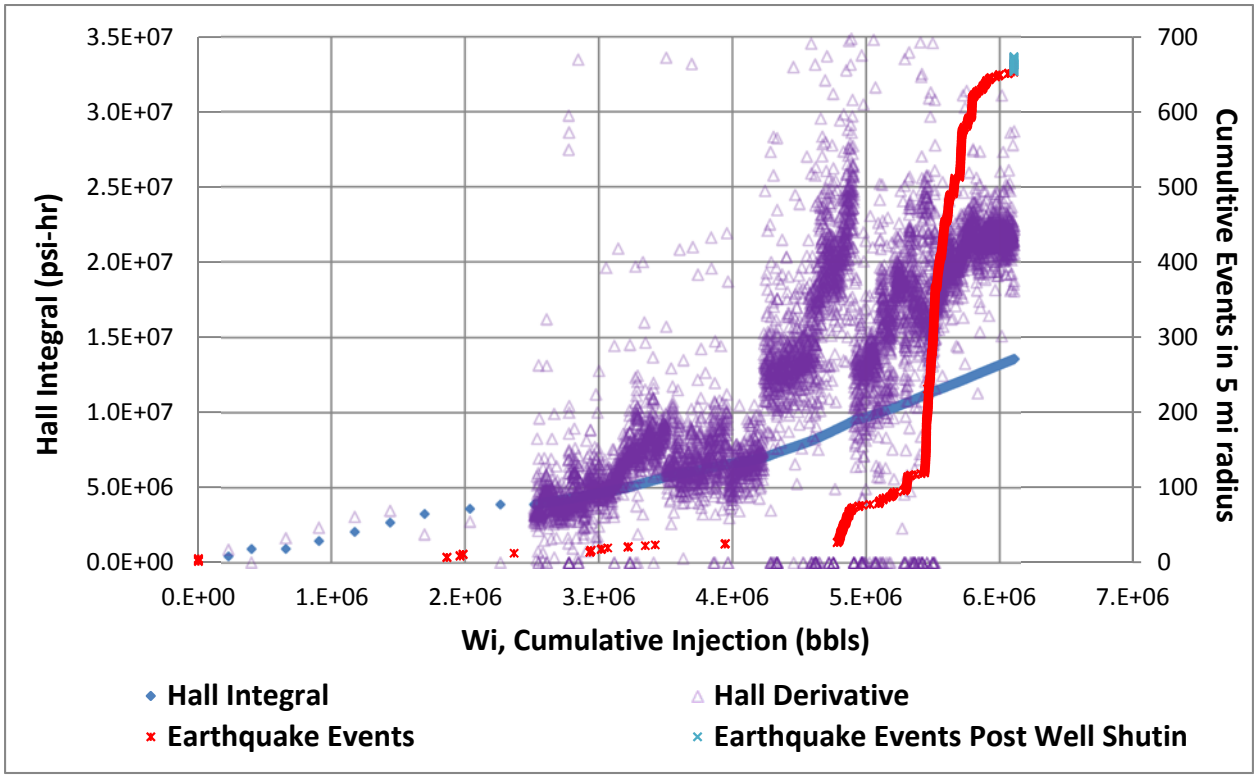


FIGURE F- 25: TRAMMEL TANDEM PLOT OF CUMULATIVE EARTHQUAKES AND HALL INTEGRAL

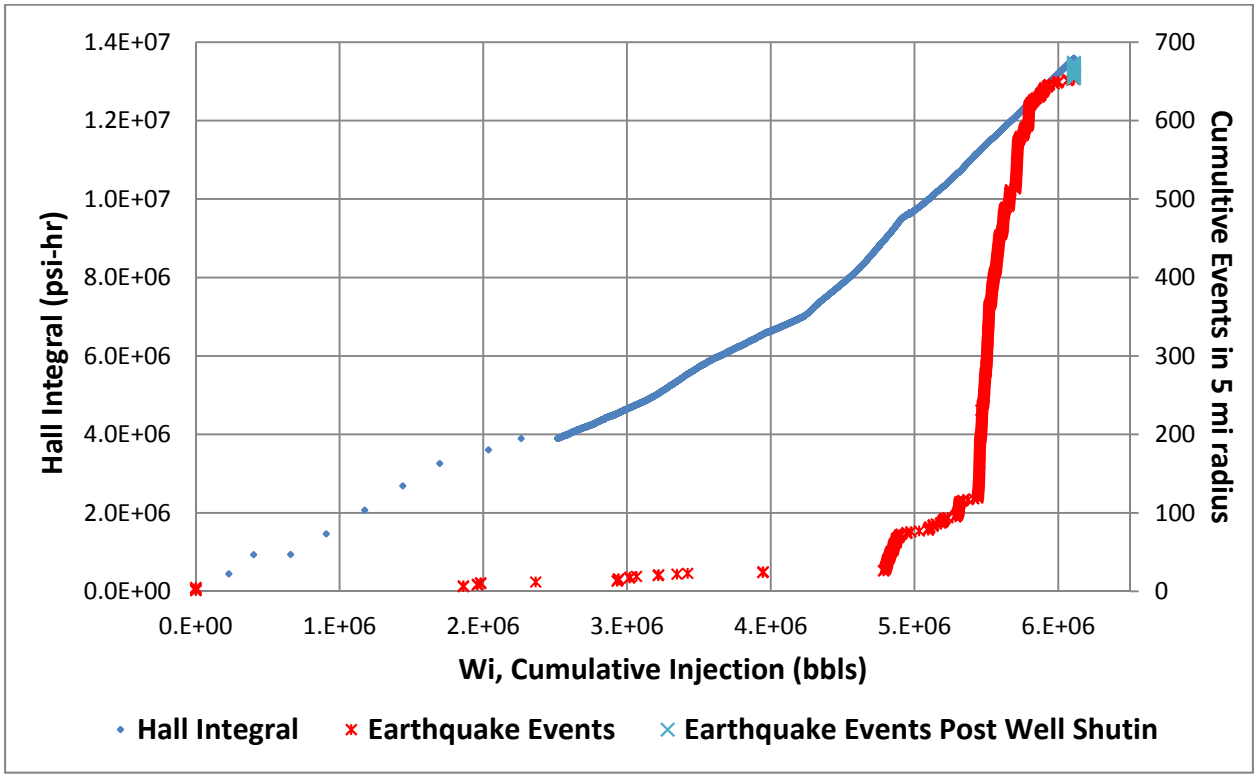


FIGURE F- 26: EDGMON TANDEM PLOT OF CUMULATIVE EARTHQUAKES AND HALL INTEGRAL WITH DERIVATIVE

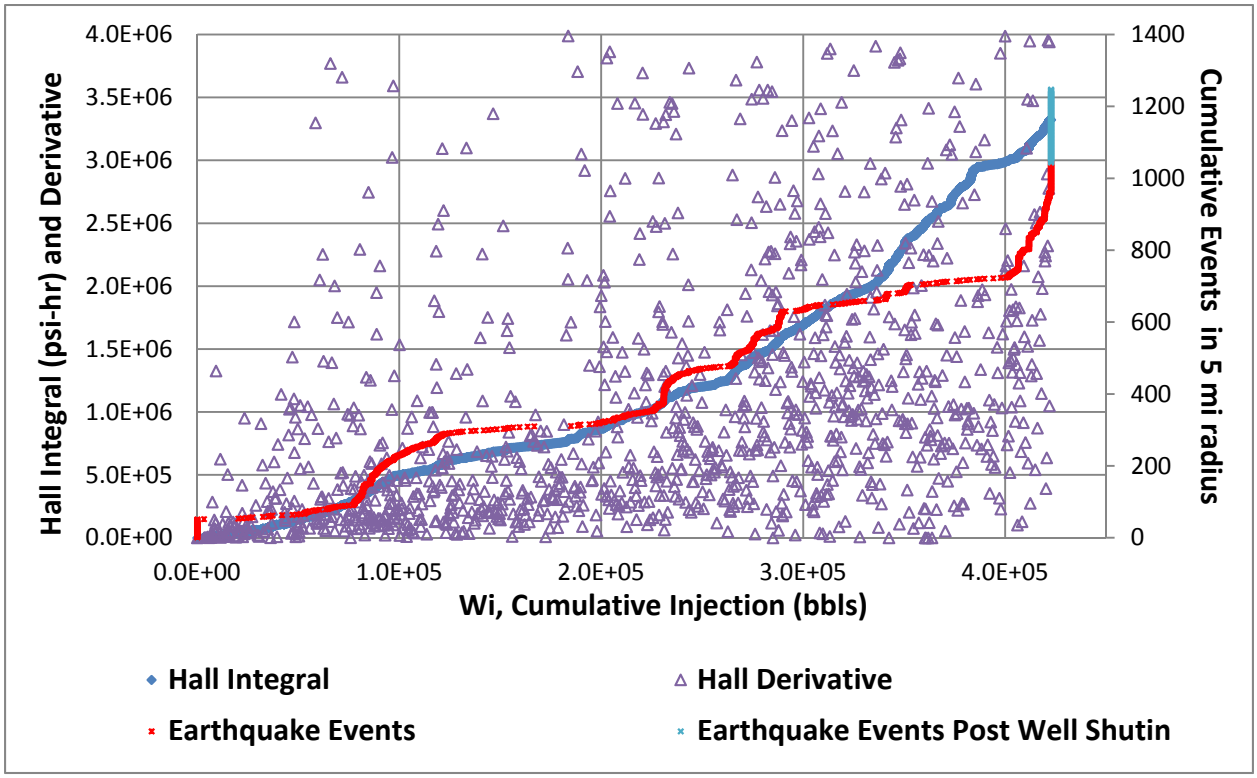


FIGURE F- 27: EDGMON TANDEM PLOT OF CUMULATIVE EARTHQUAKE EVENTS AND HALL INTEGRAL

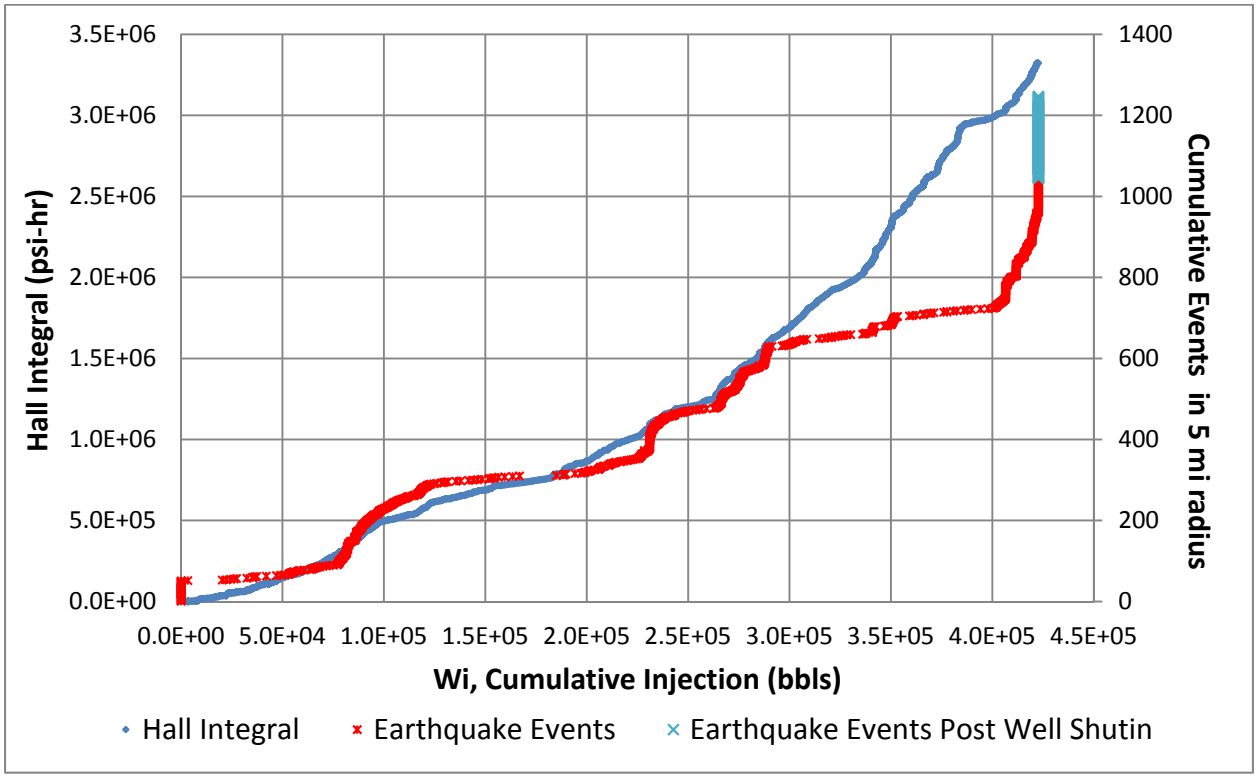


FIGURE F- 28: EDGMON ZOOMED TANDEM PLOT OF EARLY DATA TO DECEMBER 19, 2010

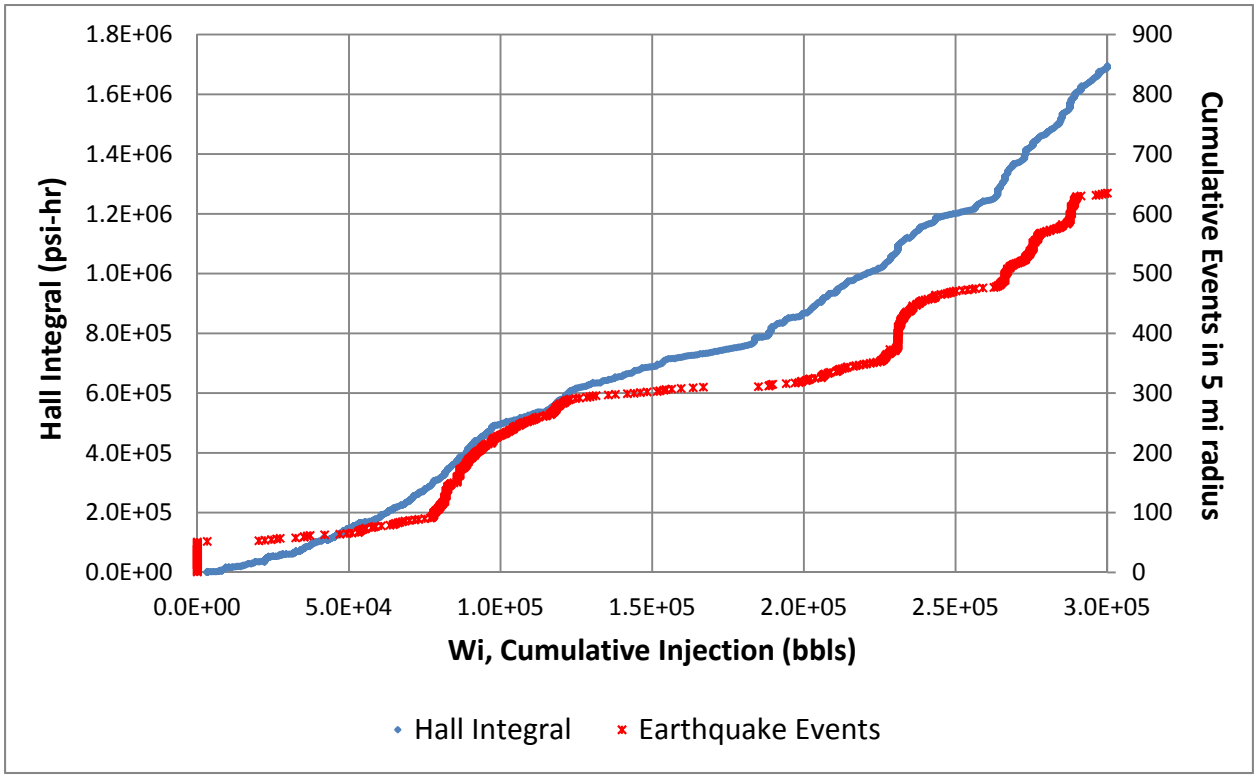


FIGURE F- 29: EDGMON STEP RATE TEST

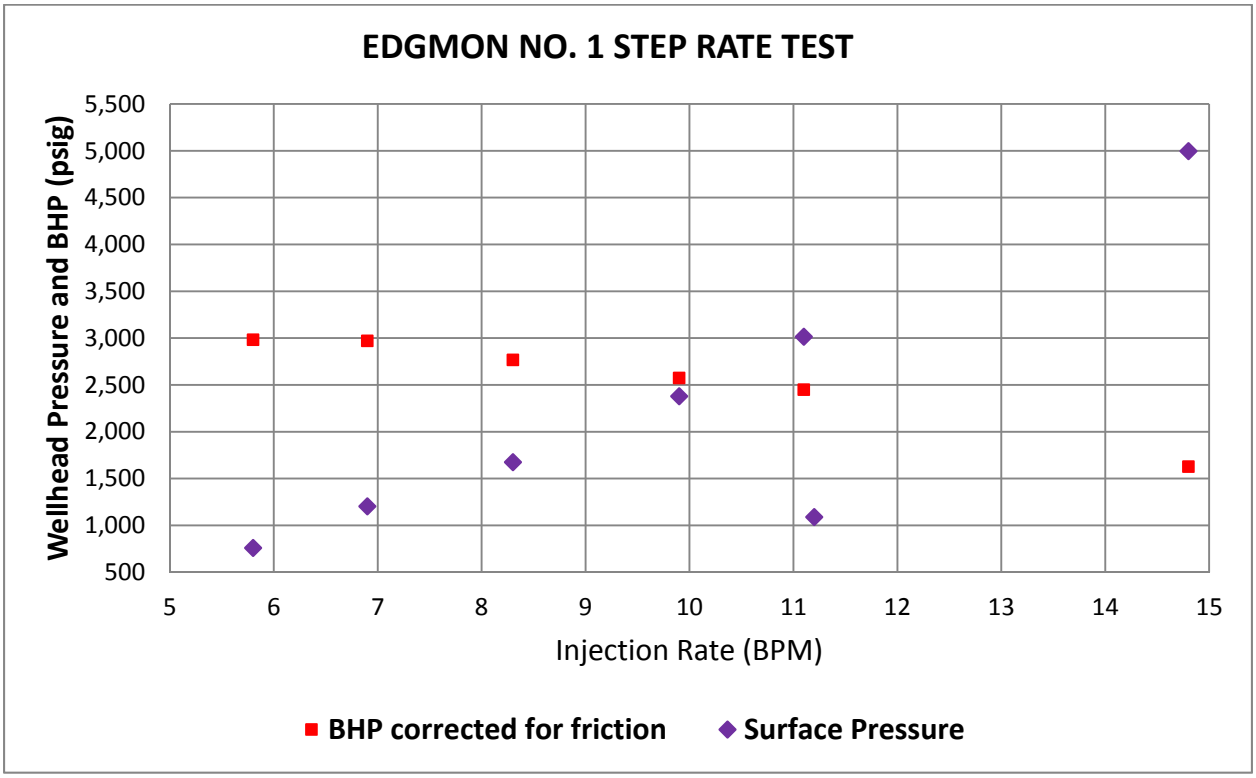


FIGURE F- 30: SRE LOG-LOG PLOT OF PRESSURE FALLOFF DURING FINAL SHUT-IN OF WELL

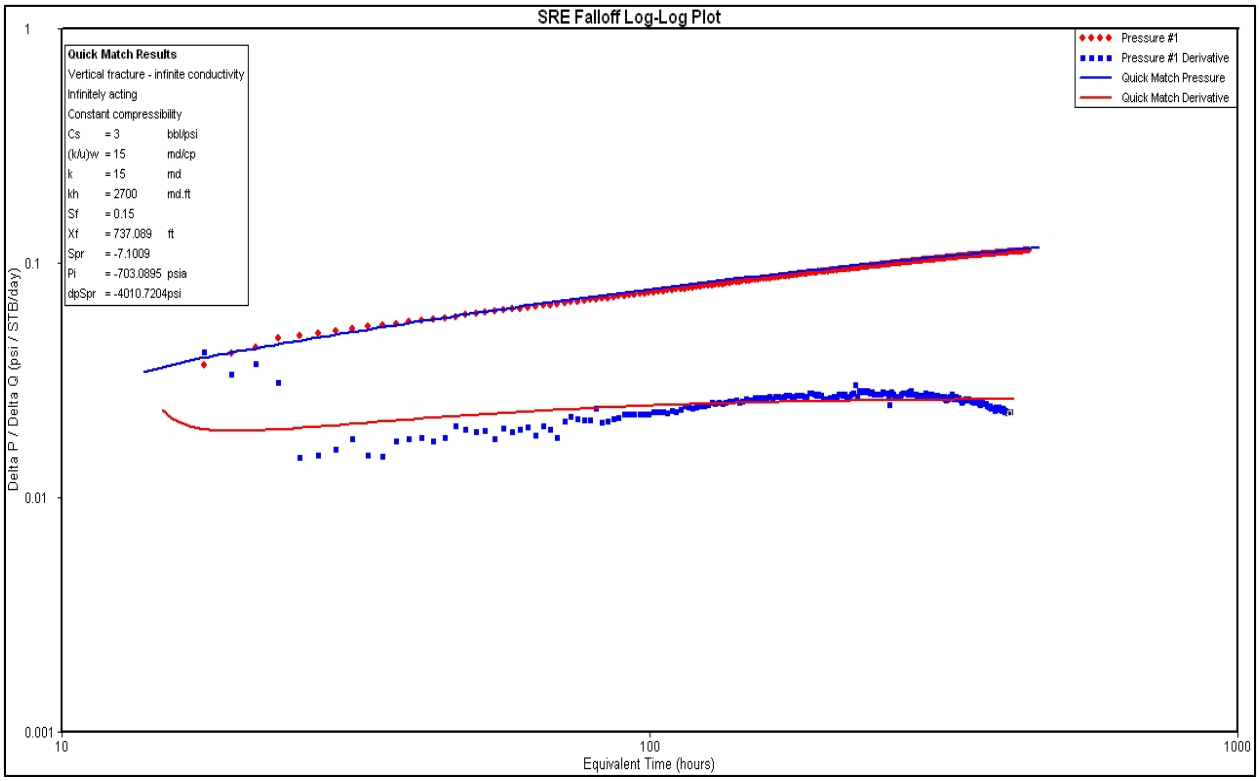


FIGURE F- 31: TRAMMEL LOG-LOG PLOT OF PRESSURE FALLOFF DURING FINAL SHUT-IN OF WELL

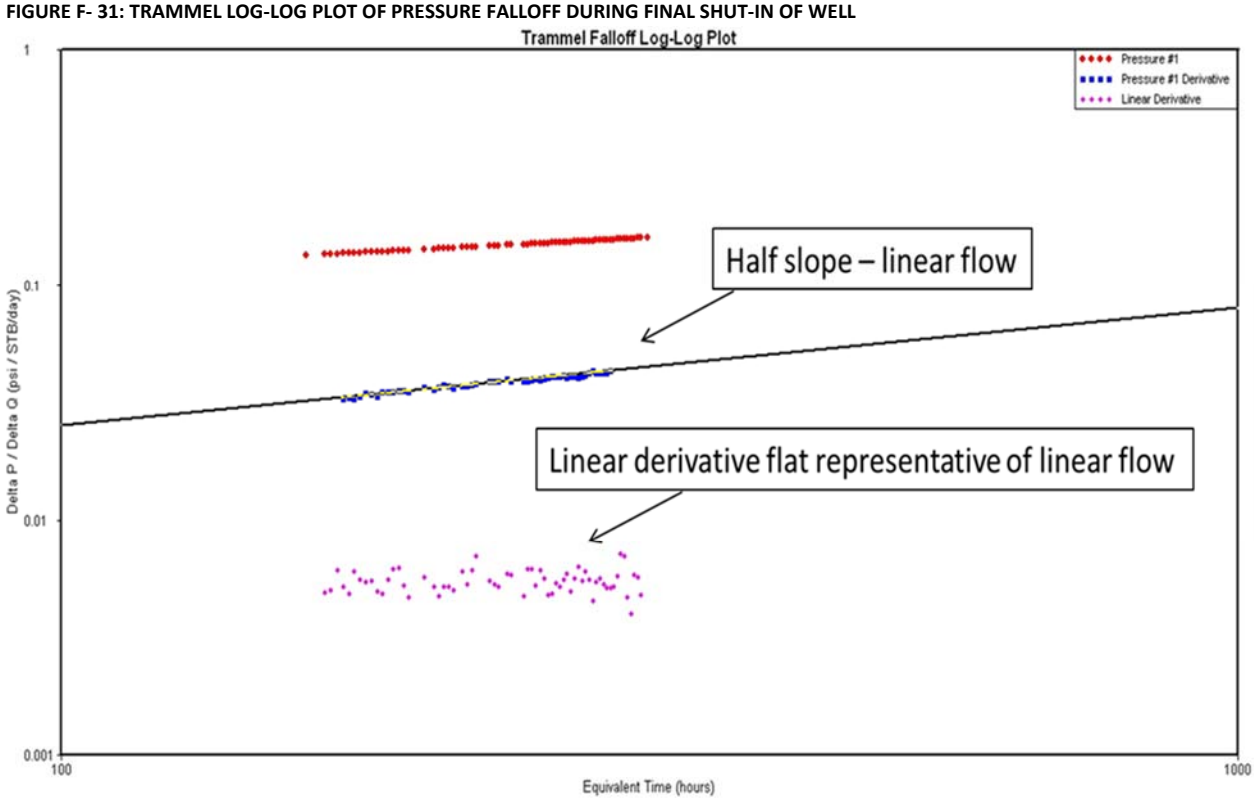
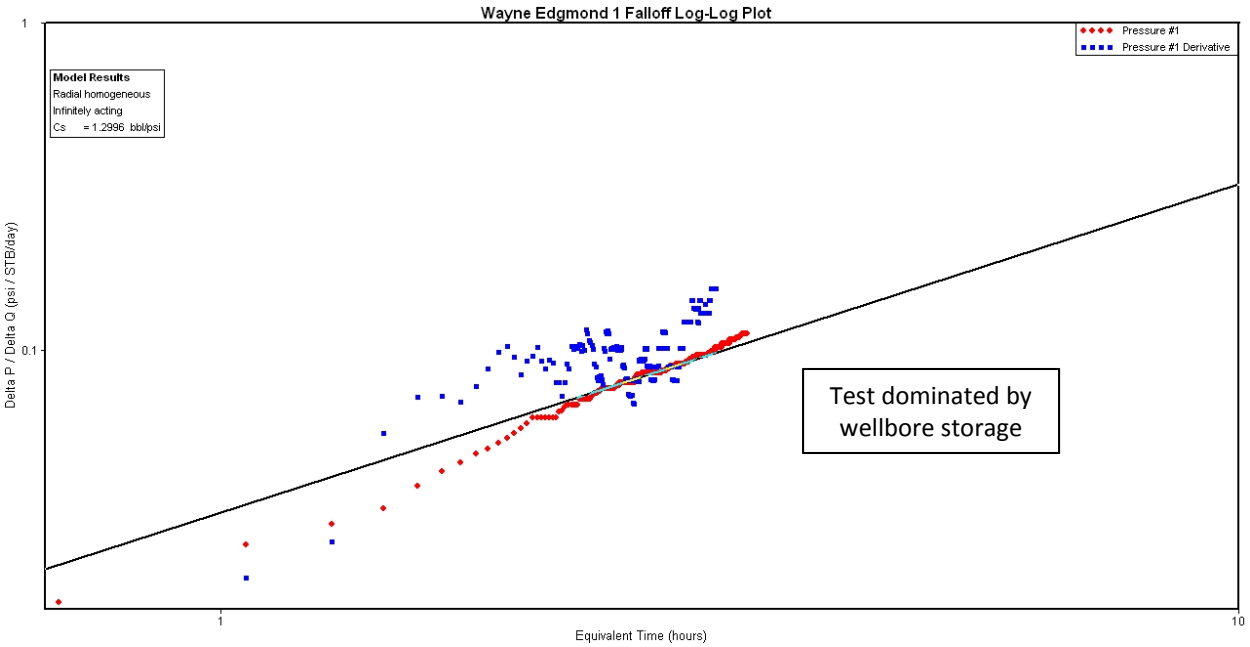



FIGURE F- 32: EDGMON LOG-LOG PLOT OF PRESSURE FALLOFF DURING FINAL SHUT-IN OF WELL