

David J. Donovan, Southern Nevada Water Authority, Las Vegas Nevada
 Rei Arai, Department of Geological Sciences and Engineering, University of Nevada, Reno
 John W. Bell, Nevada Bureau of Mines and Geology, University of Nevada, Reno

Interferometric synthetic aperture radar (InSAR) has become a commonly used tool to detect and measure the magnitude and spatial variation of aquifer-system response, specifically subsidence, in groundwater basins in Nevada. Previous work has included InSAR studies of Las Vegas, which has a well-documented history of water-level changes and subsidence. The purpose of this study was to extend InSAR studies from Las Vegas to the north to Ely, Nevada in order to evaluate on a reconnaissance level the present groundwater system response to pumping in 35 hydrographic basins. These data will form a baseline for the period 1992 to 2007.

More than 100 interferometric pairs were processed using ERS and Envisat data from the WInSAR and GeoEarthscope archives covering the time period 1992-2007. The best results were obtained with pairs with a baseline separation (orbital position) of less than 200 meters

Each interferometric pair was produced from descending ERS and Envisat SAR data provided by a European Space Agency Category-1 Data Grant and from data in the WInSAR and GeoEarthscope archives.

The processed pairs were used in this presentation. The area shown in detail are: 1) Las Vegas Valley, 2) Cave Valley, 3) The Muddy Springs Area, 4) Southern Steptoe Valley and 5) Central Railroad Valley.

The map shows ground movement in 2005 and 2007, in previously described areas. Note the hydrograph scale (0 to 200 feet) is much greater than the other hydrographs depicted. Localized and small scale LOS decreases (apparent land surface uplift) and LOS increases (apparent land declines) continue to be observed. In this image, the largest LOS increase and is a known land surface decline and is located between the SNMR and Deer Springs wells, described in Bell et al (2002) as the Northwest Subsidence Bowl. The historic land surface changes are best documented in Bell (1981) Bell et al. (2002) and Bell et al. (2008). The well labeled W006 is at the historic main well field. Hydrographs show large seasonal water level change and annual rises in water levels. The more remote and smaller areas of production in eastern Nevada were the focus of this investigation.

The preliminary interferogram show LOS shortening for 5/27/2005 to 3/3/2006 and nearby LOS increase and localized lack of good phase coherence in vegetated areas in and near the playa. This interferogram, in general, has good phase coherence. Our current working hypothesis is that this is shrink and swell of the playa.

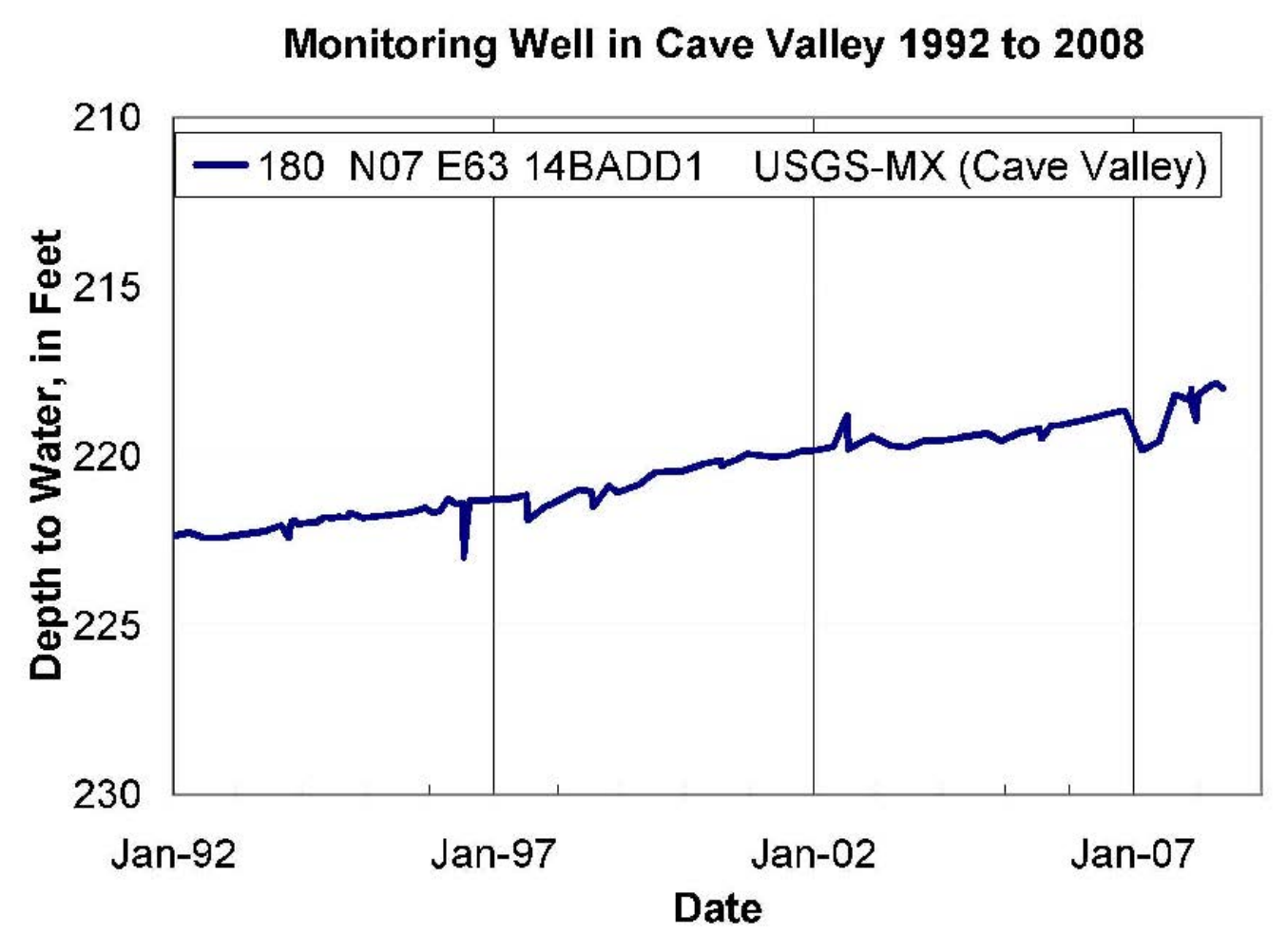
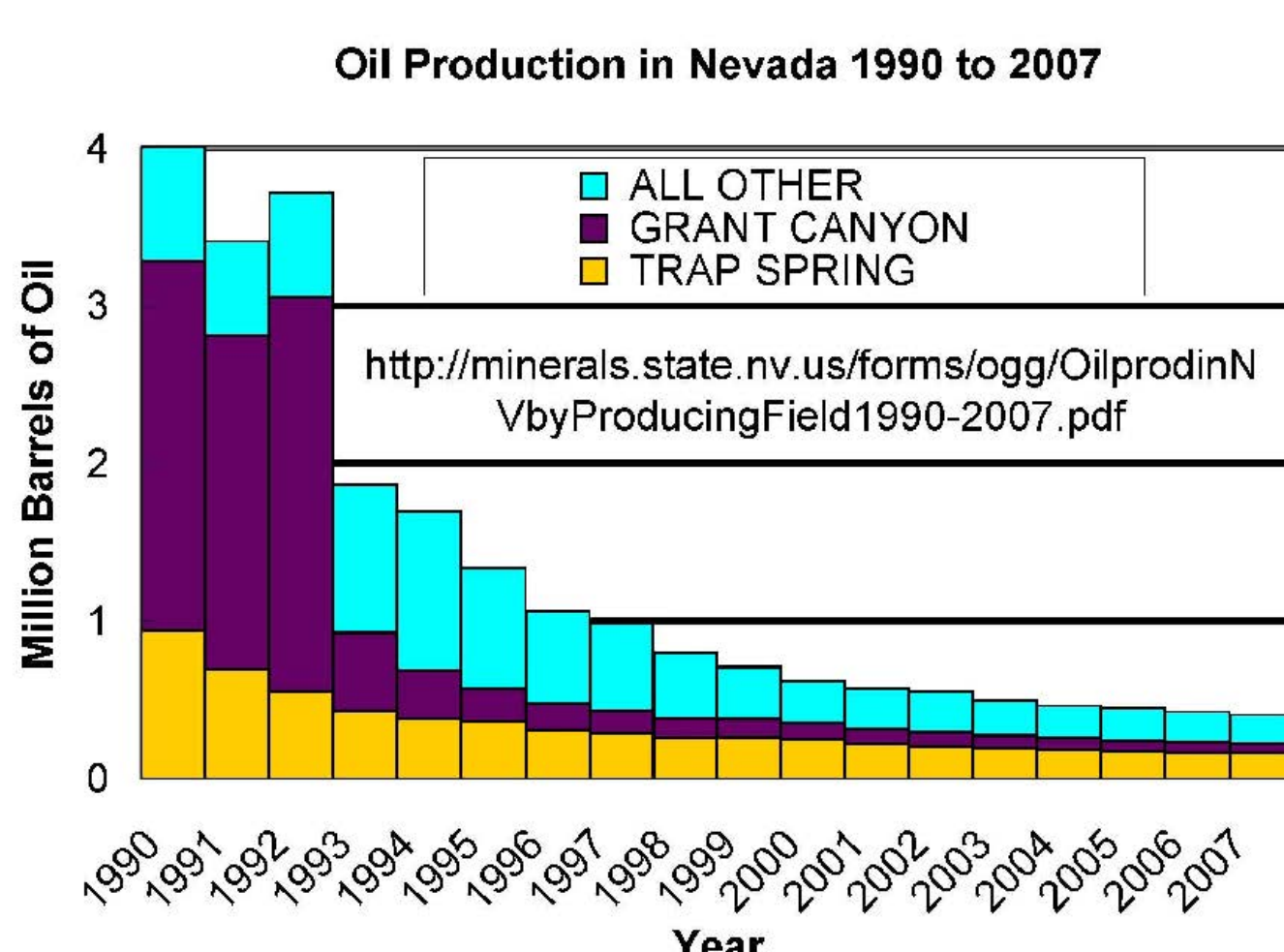
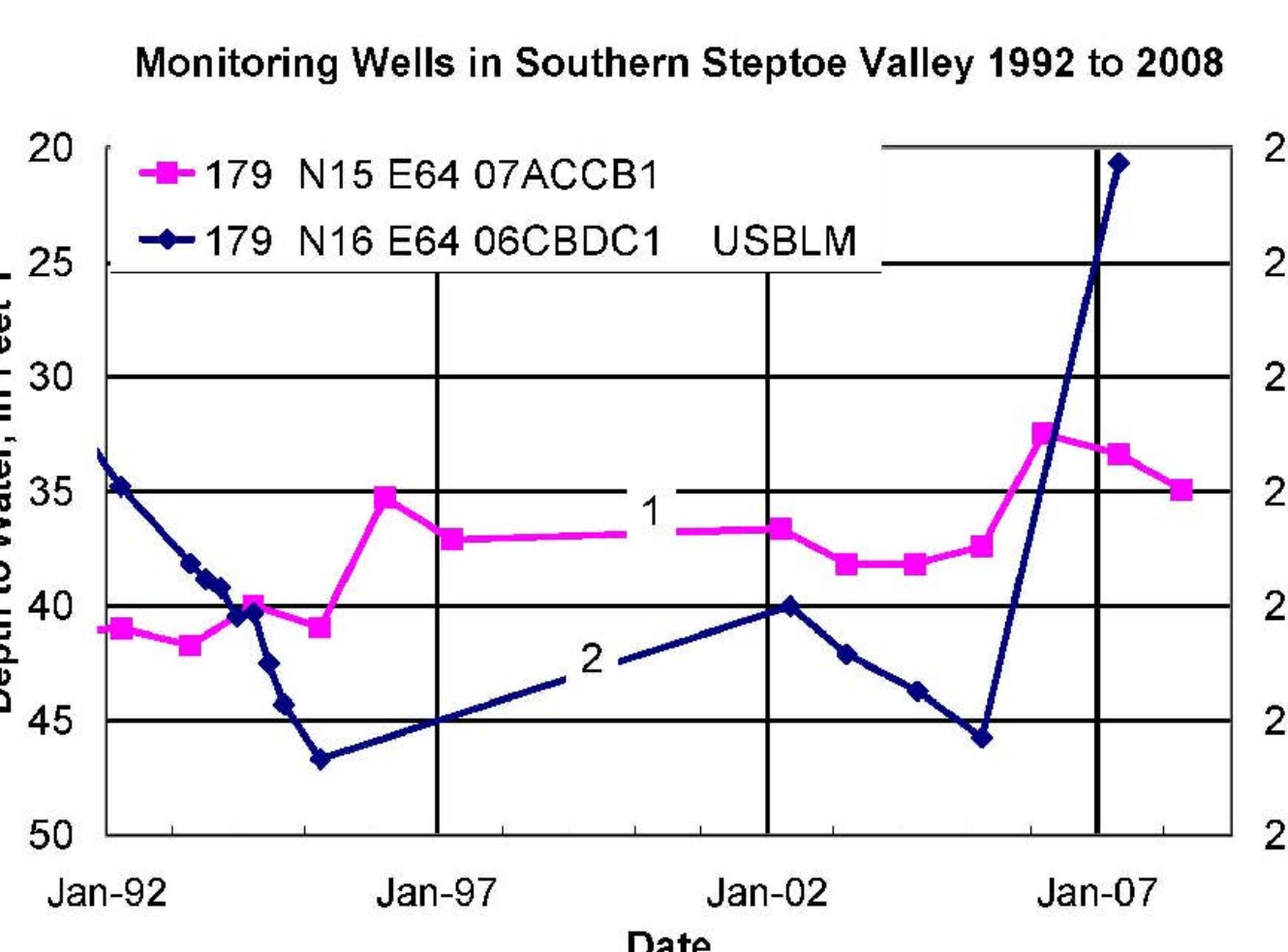
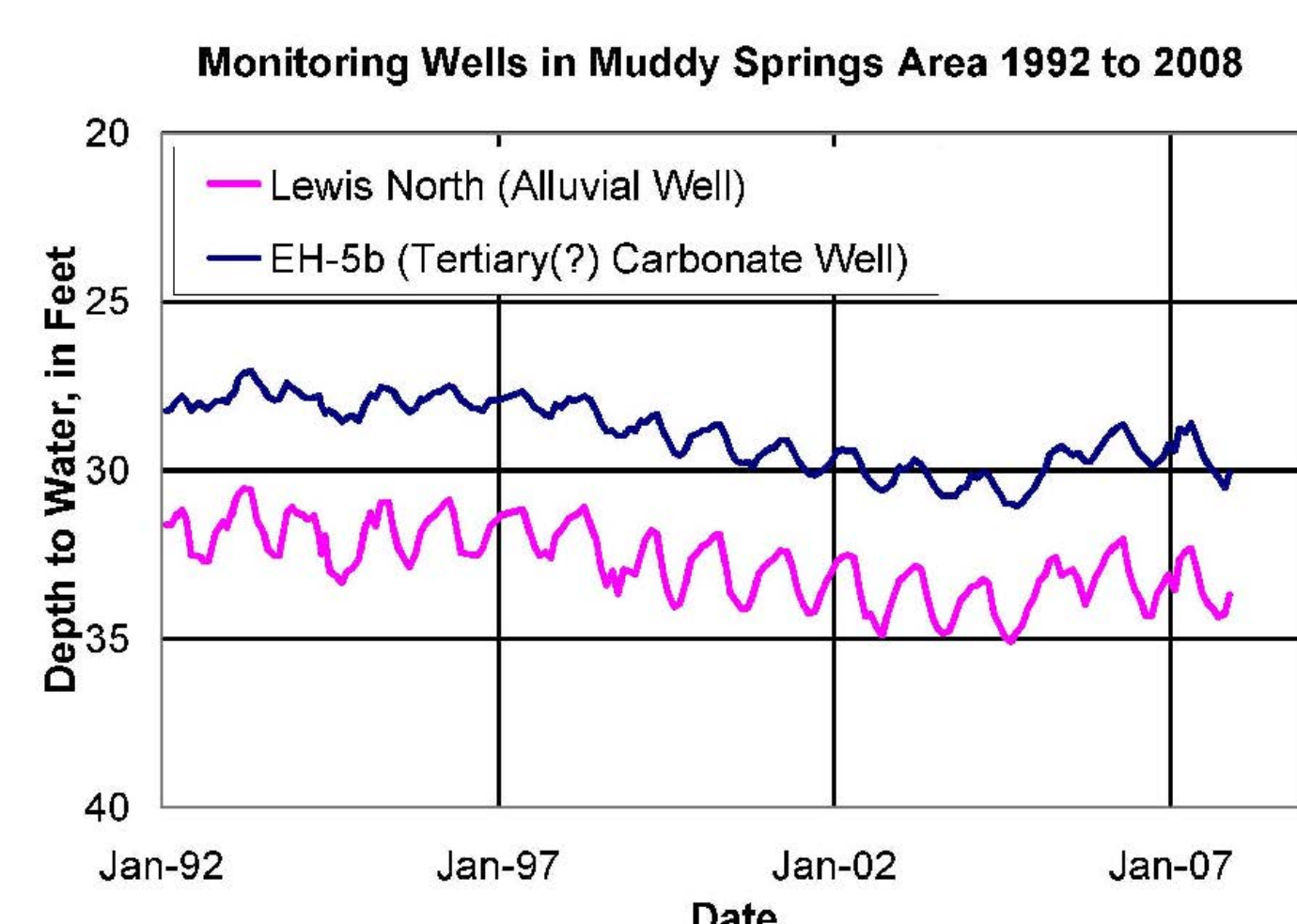
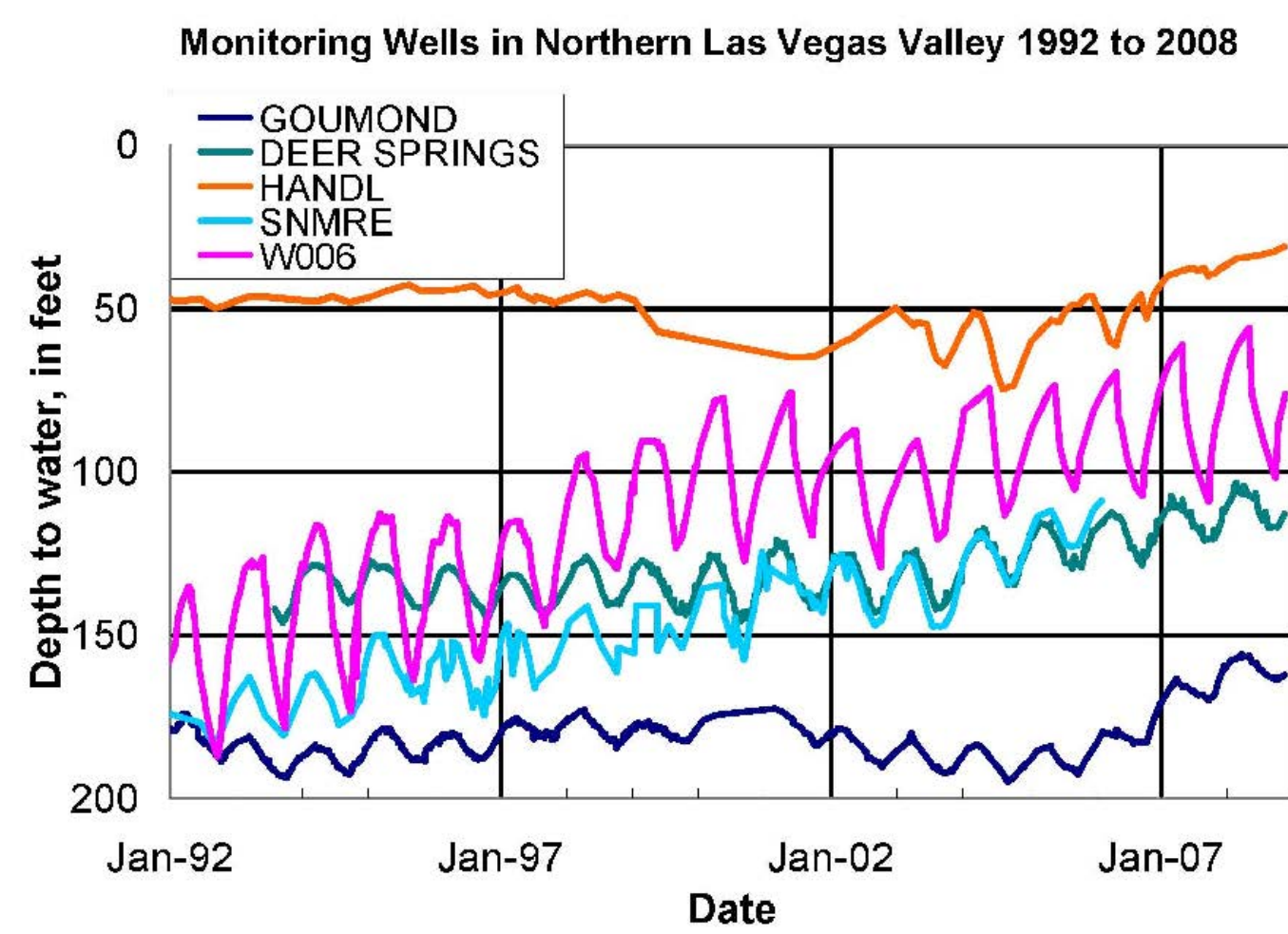
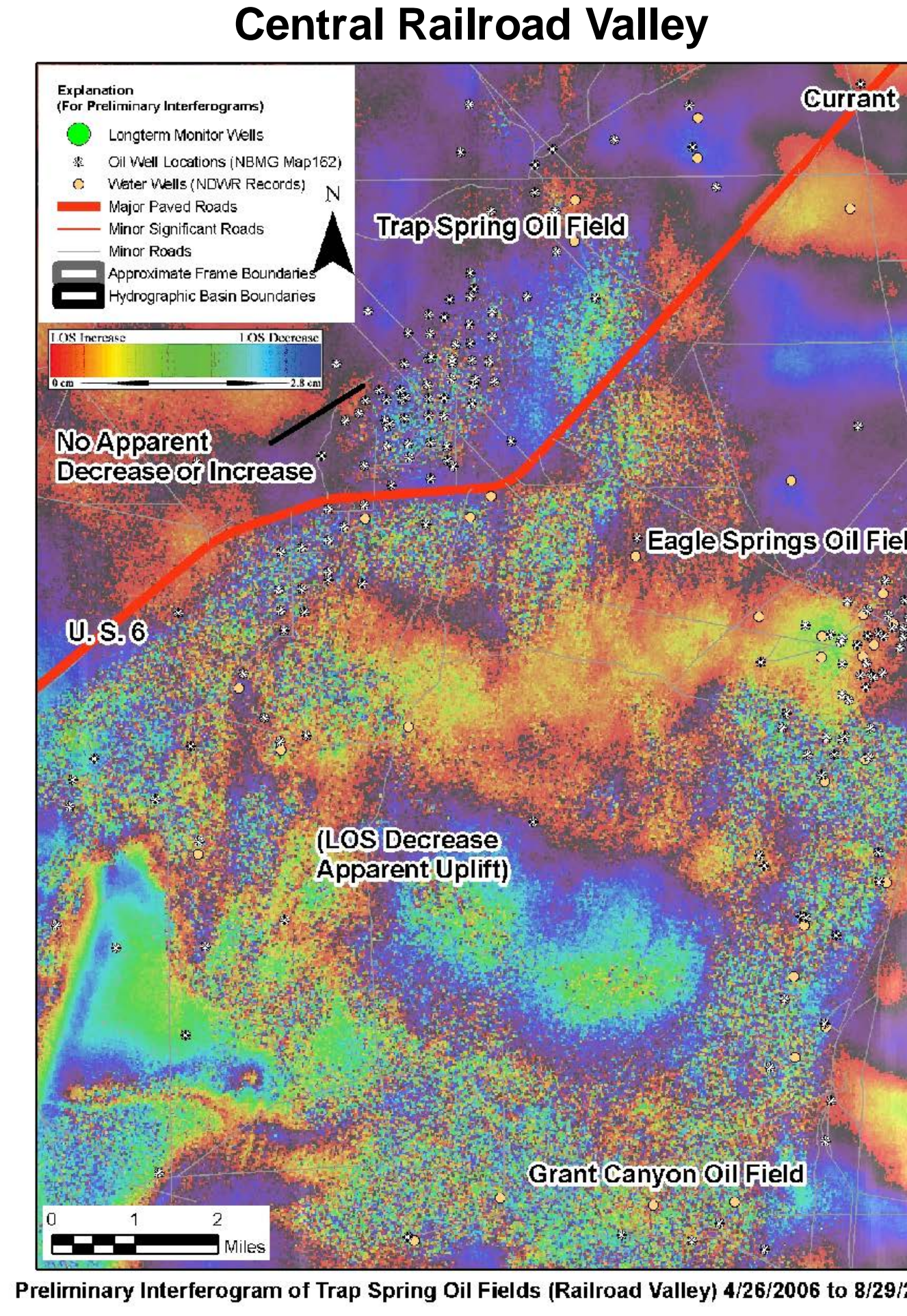
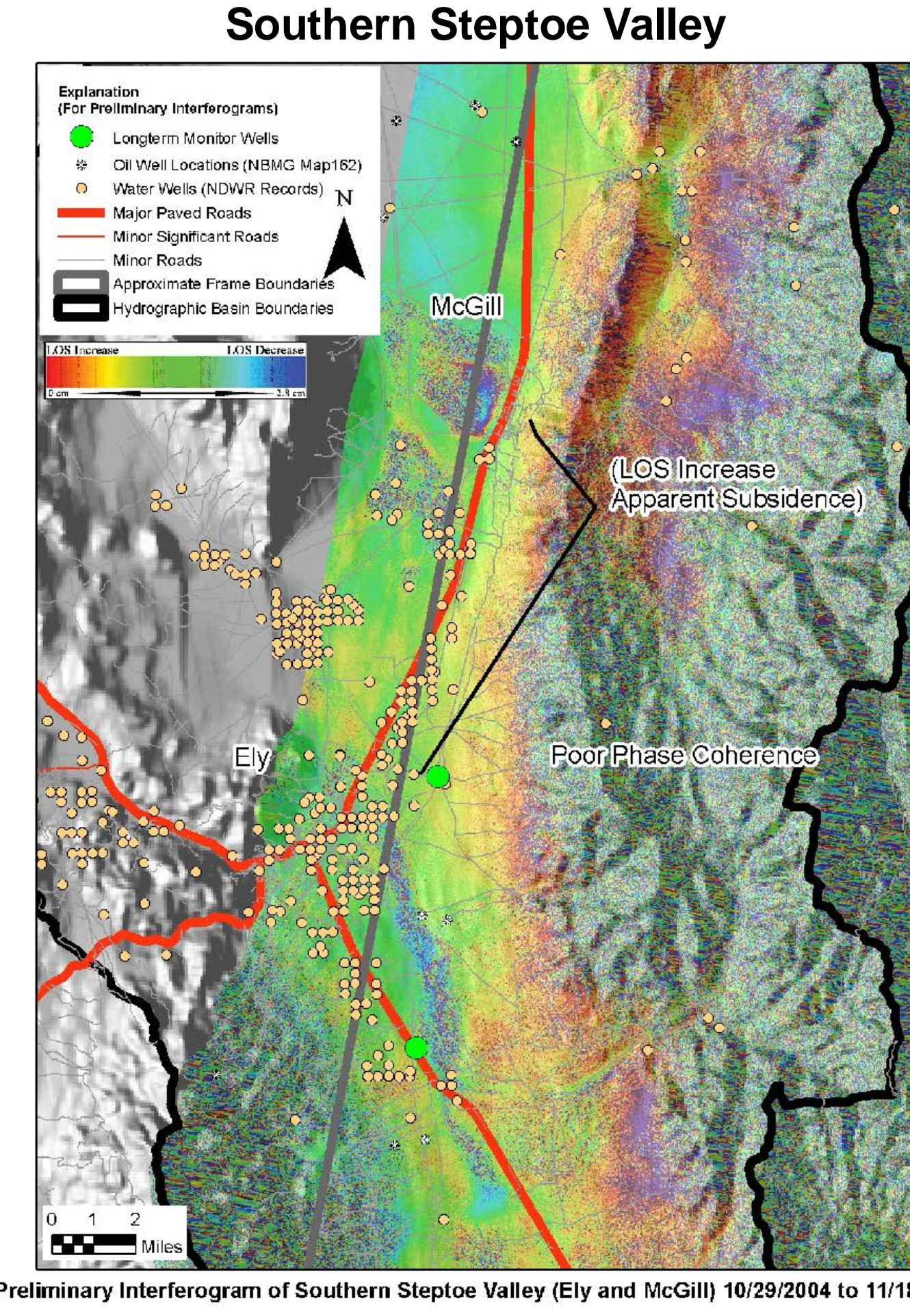
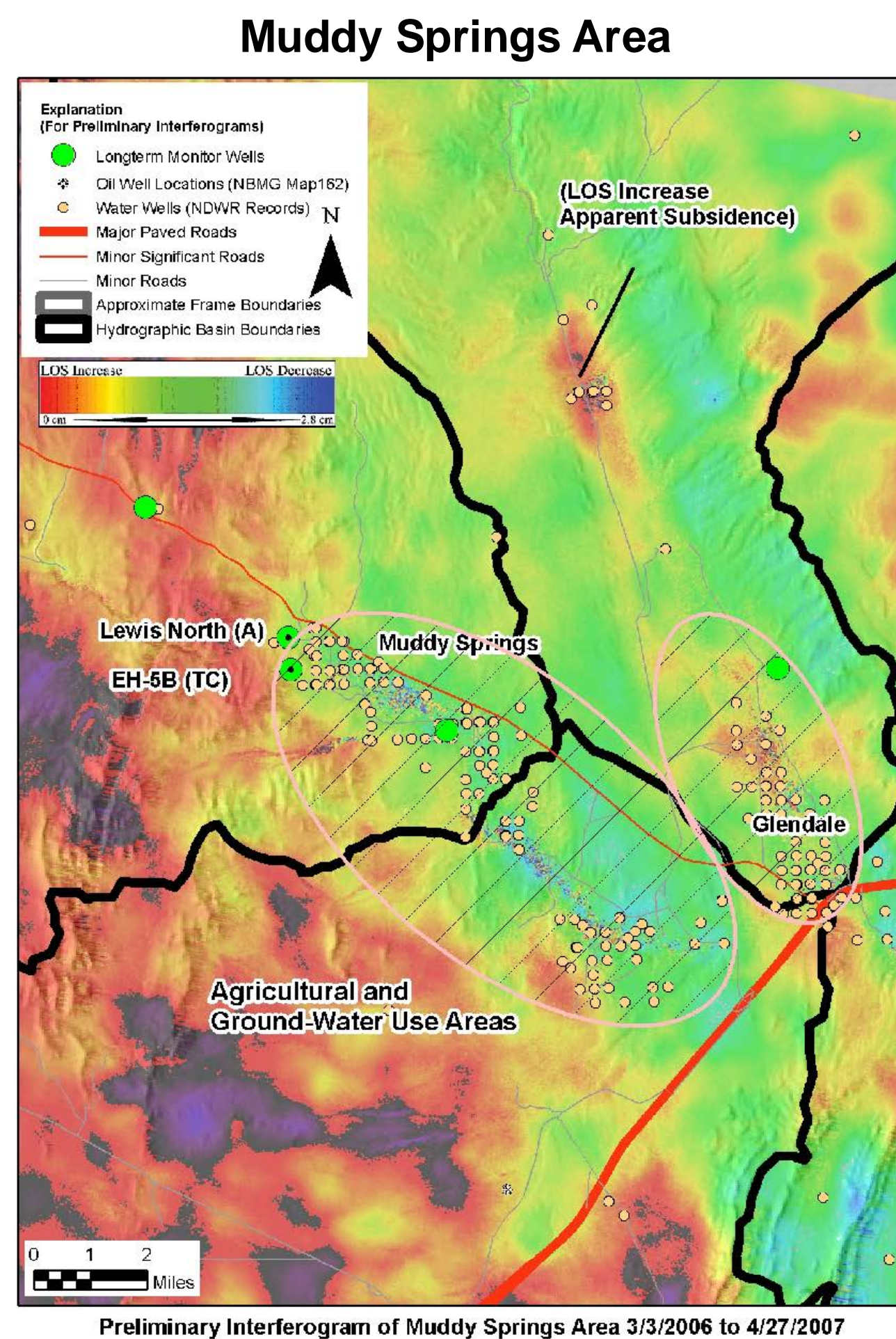
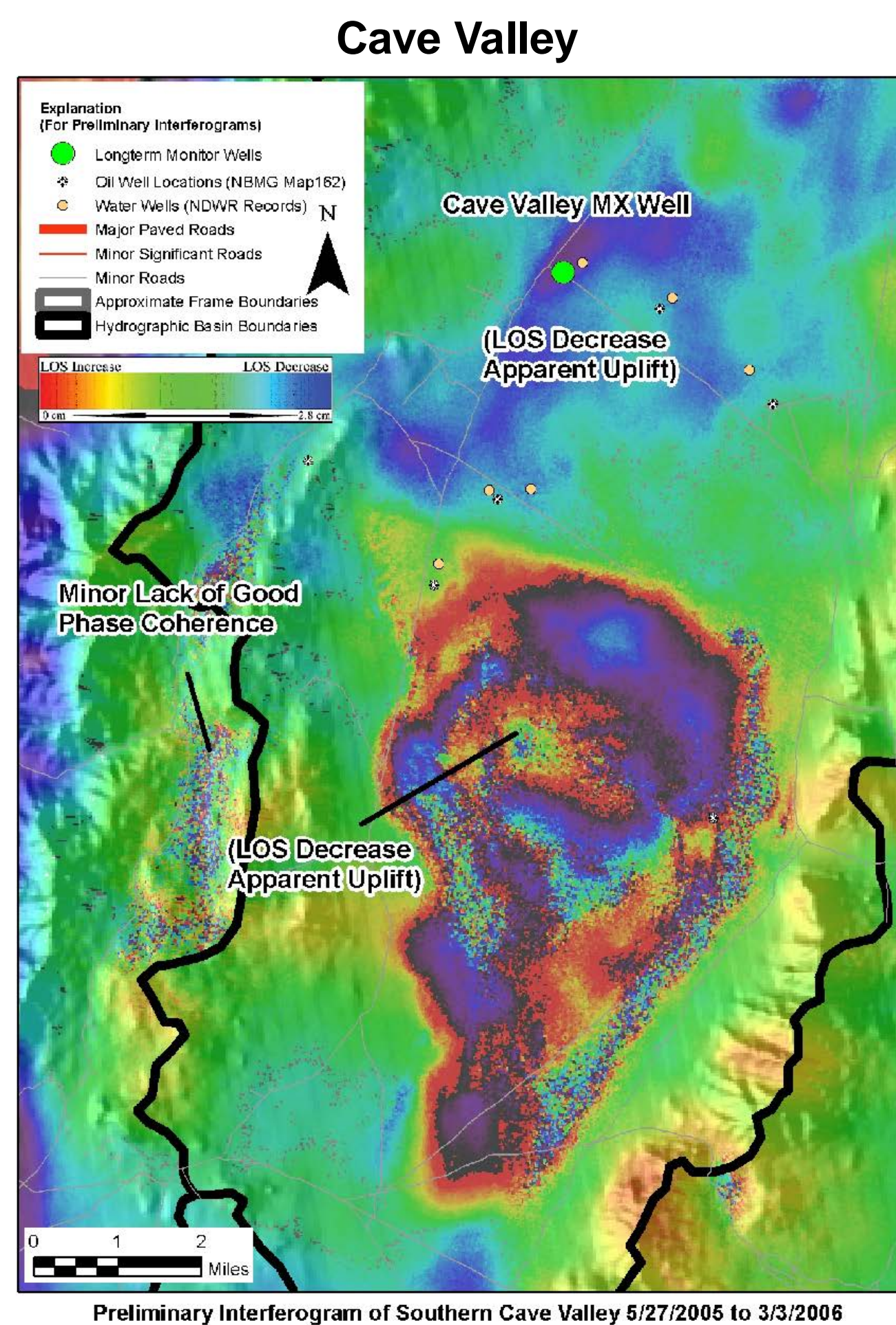
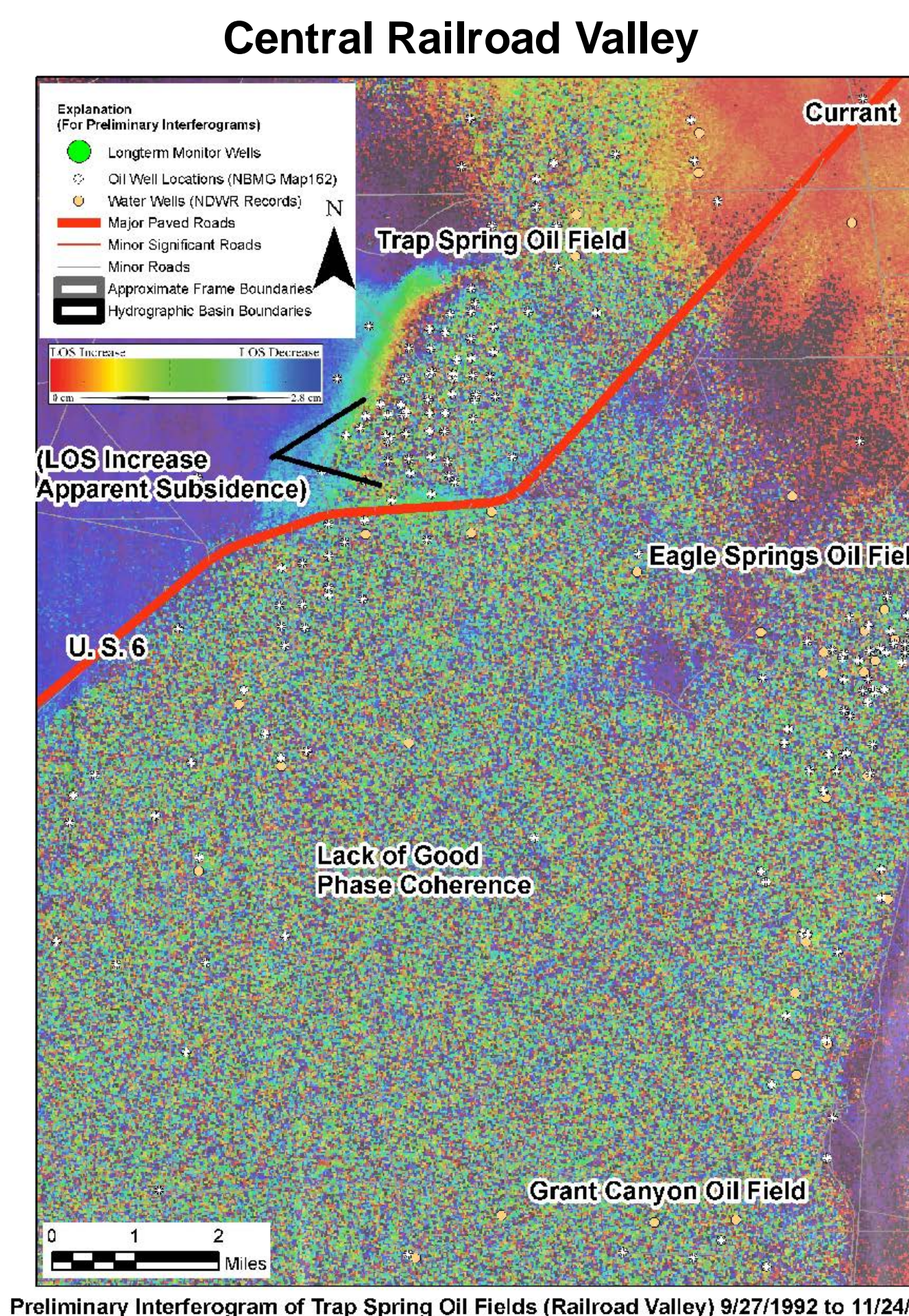
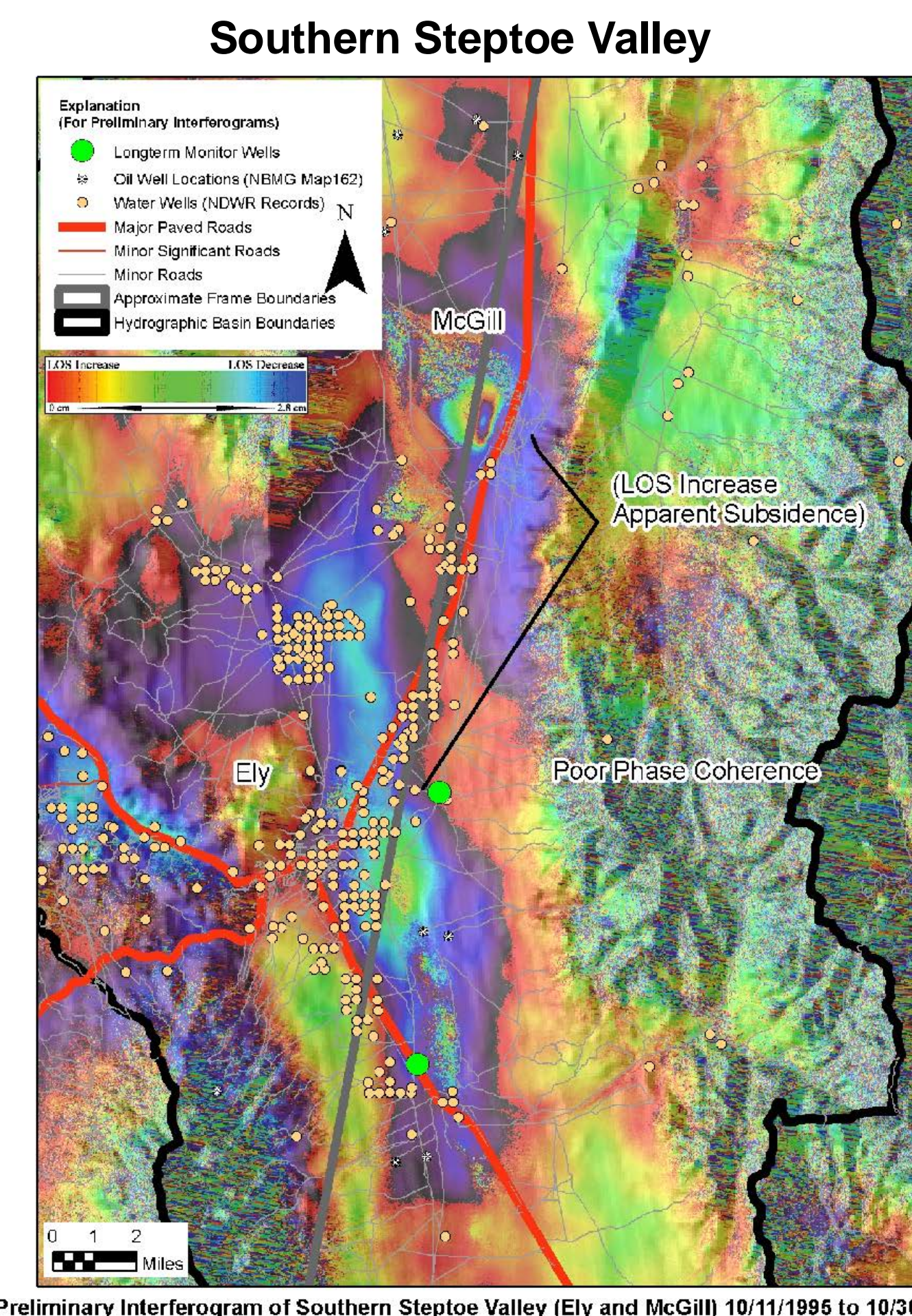
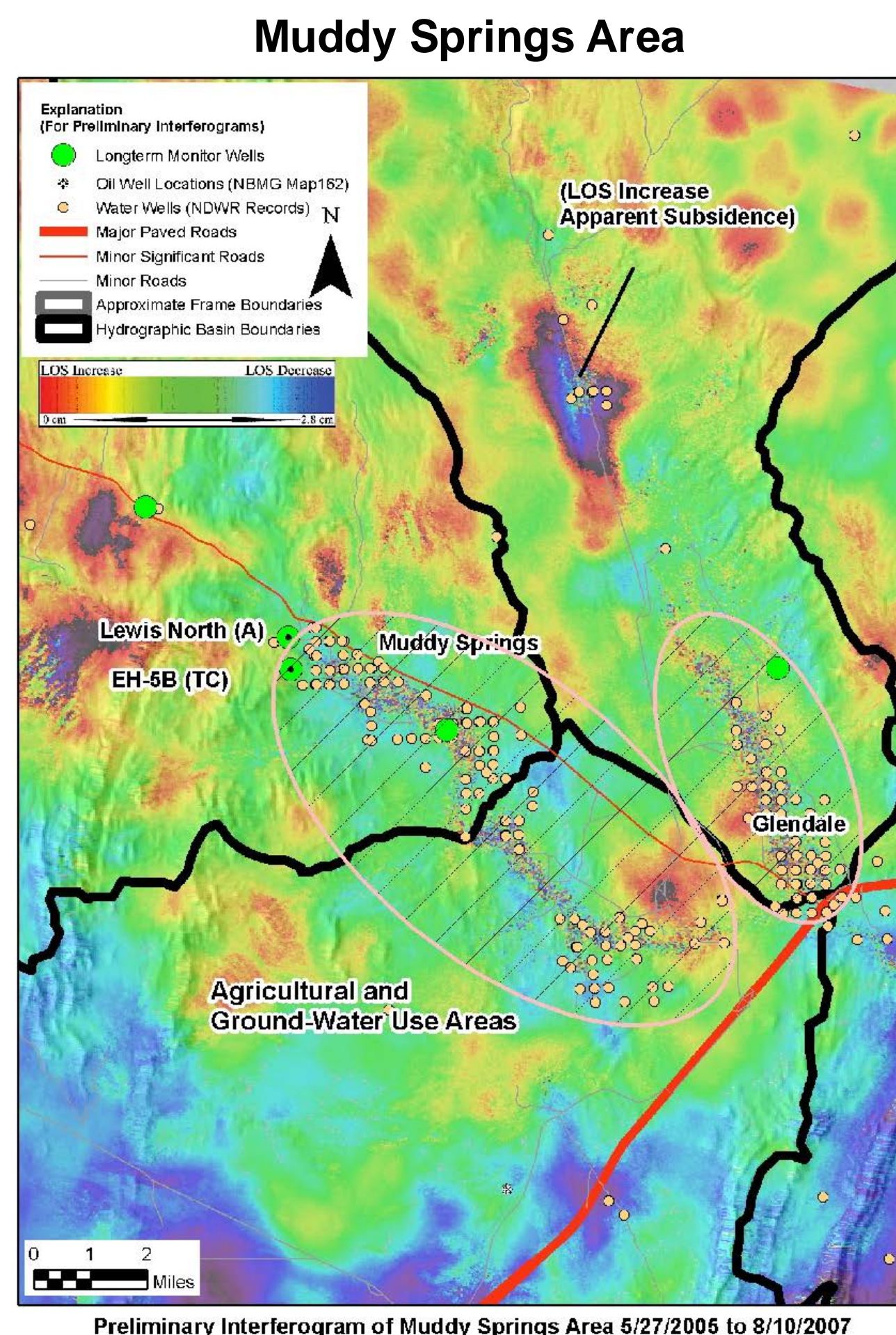
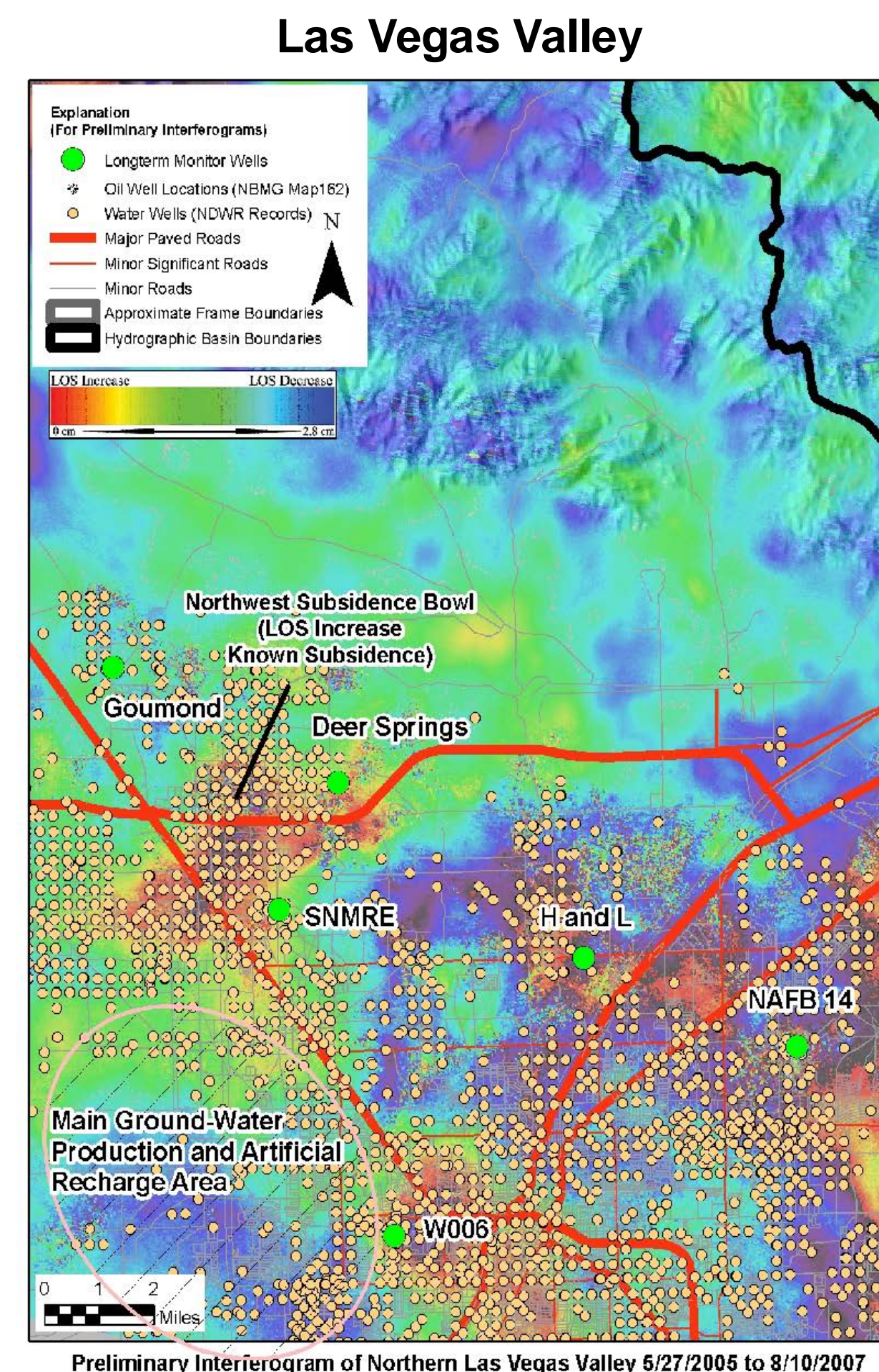
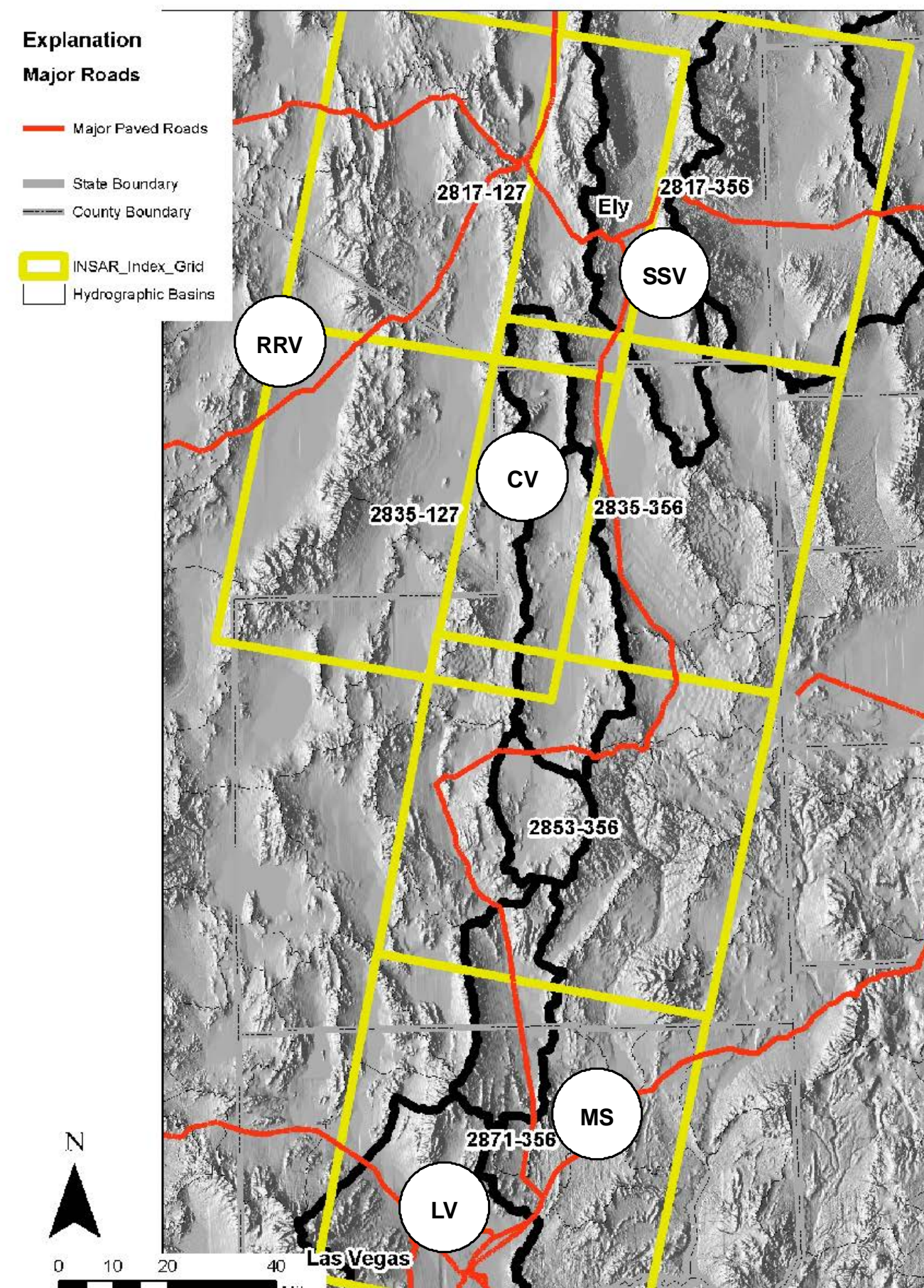
No observed land surface changes were observed despite ground-water production in and near the Muddy Springs Area of about 8.7 Cubic-hm/yr (7,000 acre-ft/yr) in the areas indicated along the Muddy River corridor. A transient but non seasonal LOS increase signal was observed in adjacent Meadow Valley Wash at a gravel quarry with a temporary water right for 711 acre-ft/yr, issued in 2004. On the 5/27/2007 to 9/10/2007 image and to much lesser extent on the 3/3/2006 to 4/27/2007 image and may or may not be ground-water production related.

Small LOS increases with multiple fringes from the 1990's (10/11/1995 to 10/30/1996) were observed, consistent with small scale ground water use. The LOS increases locations to a lesser extent in a 10/29/2004 to 11/18/2005 image. The two maps are shown as are the water level data from the long term monitor wells in the area. Lack of good phase coherence is common in this area, on the later image, and probably vegetation or ground disturbance related.

LOS increases from the 1990's (9/27/1992 to 11/24/1999) were observed in the second largest (in production) oil field in Railroad Valley and Nevada. The Grant Canyon Field, approximately 2.5 miles southeast has larger production. The total oil and water production is known from Davis (2007) and Nevada Department of Minerals (<http://minerals.state.nv.us/>). The shape of the signal appears to be controlled by faults previously mapped by French (1994). The maps showing location of the fringes and the water and oil production summarized by year are also provided. The later (4/26/2006 to 8/29/2007) image in the detailed map, and composite, shows fringes through out the Railroad play but a much reduced LOS signal in the Trap Springs Oil Field.

- 1) This study detected previously described land changes in Las Vegas Valley.
- 2) This study also detected small scale LOS increases (apparent subsidence) and LOS shortening, (apparent uplift) in several areas.
- 3) Additional analysis need to be performed to further describe these and possibly, additional locations.
- 4) No land surface changes were observed in a few locations where known ground-water production was occurring, such as the Muddy Springs Area.

Basin	Frame	Track	Date 1	Date 2	Type
Synoptic	2817	127	10/1/1991	10/26/1996	ERS
Railroad S	2835	127	4/28/2006	8/28/2007	Envisat
Railroad S	2835	127	9/27/1990	1/24/1998	ERS
Railroad S	2835	127	6/23/1991	10/5/1997	ERS
Song	2817	356	4/22/2004	7/21/2005	Envisat
Song	2817	356	10/23/2004	11/18/2005	Envisat
Lake	2836	356	3/3/2008	8/10/2007	Envisat
Lake	2836	356	5/2/2006	3/3/2008	Envisat
Chesapeake	2836	356	11/18/98	11/18/98	ERS
Coyote Spring	2862	356	8/3/2007	8/20/2004	Envisat
Las Vegas	2817	356	9/2/2008	8/16/2009	Envisat
Las Vegas	2817	356	3/3/2000	4/27/2007	Envisat



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