

**Basin Management Objective
Butte County
Sub-Inventory Unit – LLANO SECO**

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Description of the Llano Seco Sub-Inventory Unit –

The Llano Seco Sub-Inventory Unit (SIU) covers an area of about 18,400 acres in the southwestern portion of the West Butte Inventory Unit. It is bordered by the M&T and Angel Slough SIUs to the north, Durham Dayton and Western Canal SIUs to the east, Glenn County to the south, and the Sacramento River to the west. This SIU corresponds roughly to the water service area associated with Rancho Llano Seco. Land uses within the Llano Seco SIU consist of a mixture of row crops, grain, pasture and native riparian supported by both surface water and groundwater. In a normal year, about 6% of the Llano Seco SIU is in summer agricultural production supported by groundwater.

Management Objective –

Observe and maintain the current and future groundwater surface elevation at a level which will provide an economical and adequate water supply to this area's crops and homes. This basin management objective is intended to be flexible to future land and water uses in this relatively undeveloped portion of Butte County. We began monitoring a well, located fairly close to the Sacramento River for water levels and water quality in 2008 which should give us an even better understanding of groundwater levels and quality in this area of Butte County.

Geologic Formations Identified In Sub-Inventory Unit –

Geologic formations in the Llano Seco SIU, from youngest (shallowest) to oldest (deepest), include:

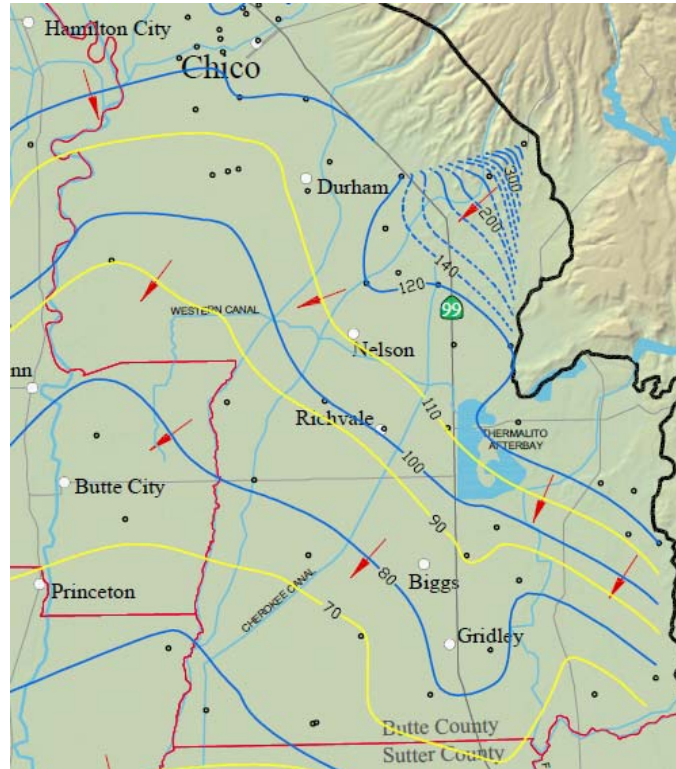
- Quaternary Alluvium
- Basin Deposits
- Tehama Formation
- Tuscan Unit C (Upper Tuscan)

Fresh Water-bearing Units. In the Sacramento Valley Region of Butte County, fresh groundwater-bearing units include, from youngest (shallowest) to oldest (deepest), the Modesto, Riverbank, Laguna, Tehama and Tuscan Formations. Those included in the Llano Seco SIU are:

- Tehama Formation
- Tuscan Unit C (Upper Tuscan)

Groundwater Flow in the Llano Seco Sub-Inventory Unit –

The below figure is a cropped segment of a map prepared by DWR Northern District. It shows the groundwater elevation contours in your sub-inventory unit with arrows indicating the direction of groundwater movement. This graphic indicates that the regional pattern of spring groundwater movement in the Llano Seco SIU is in a south-to-southwesterly direction, at a gradient of about 2 feet per mile, toward the Sacramento River and Angel Slough.



Arrows show the direction of groundwater movement.

2009 Groundwater contours were constructed using groundwater level measurements taken by the Department of Water Resources and Local Cooperators between March 1st and March 20th, 2009. Groundwater contours are based on groundwater level measurements taken from wells constructed within the middle portion of the aquifer system (100 to 400 feet deep). This portion of the aquifer supplies approximately 70% of all domestic, agricultural and municipal wells. Blue contour lines represent 20 foot intervals and yellow contour lines represent 10 foot intervals. Full size contour maps are included in the annual Groundwater Status Report posted on the Department of Water and Resource Conservation website.

BMO Key Wells Selected for Groundwater Level Monitoring –

SPRING

Well ID	Aquifer System	Well Type	Stage 1 & 2 Alert Elev. (ft)	Stage 3 Alert Elev. (ft)
20N01E18L01M	Lower Tuscan	Monitoring	107.7	105.2
20N01E18L02M	Upper Tuscan	Monitoring	102.9	100.2
20N01E18L03M	Alluvial	Monitoring	103.6	101.5
21N01W35K02M	Alluvial	Irrigation	92.5	78.5

FALL

Well ID	Aquifer System	Well Type	Stage 1 & 2 Alert Elev. (ft)	Stage 3 Alert Elev. (ft)
20N01E18L01M	Lower Tuscan	Monitoring	99.4	94.1
20N01E18L02M	Upper Tuscan	Monitoring	99.3	96.3
20N01E18L03M	Alluvial	Monitoring	101.2	98.5
21N01W35K02M	Alluvial	Irrigation	95.1	93.1

Well ID	Aquifer System	Well Type	Total Depth (ft)	Top Perf (ft)	Bottom Perf (ft)	Geologic Formation at Top Perf.	Geologic Formation at Bottom Perf.	Aquifer Type
20N01E18L01M	Lower Tuscan	Monitoring	1000	767	894	Tuscan B	Tuscan B	Confined
20N01E18L02M	Upper Tuscan	Monitoring	581	509	562	Tuscan C	Tuscan C	Confined
20N01E18L03M	Alluvial	Monitoring	173	99	109	Basin Dep/Tuscan C	Tuscan C	Semi-Confined
21N01W35K02M	Alluvial	Irrigation	270	75	270	Basin Deposits	Tuscan C	Semi-Confined

BMO Key Wells Selected for Groundwater Quality Monitoring–

Butte County Department of Water and Resource staff began sampling ph, temperature and EC on a well located in the Llano Seco Sub Area in August 2008. When sufficient data has been collected for analysis, that information will be presented in this BMO.

BMO Key Well(s) Selected for Land Subsidence Monitoring–

Land Subsidence is continuously monitored by the Department of Water Resources and Butte County Water and Resource Conservation at the closest extensometers in the Western Canal Water District and M&T Ranch sub-inventory units.

Butte County staff participated in the Sacramento Valley Height Modernization Project during March 2008 as a means to enhance the subsidence monitoring program in the county and the region. This cooperative project between the Department of Water Resources (DWR), the Bureau of Reclamation and local County agencies helped to establish baseline ground elevations in Butte County and other portions of the valley. Land elevations were measured using Global Positioning System (GPS) survey equipment and survey monuments located on an approximate three to five mile grid. Re-observations are to be done in approximately three

years, and will give measurements to compare against the baseline data in order to determine whether or not any subsidence has occurred.

BMO Alert Stage Definitions and Compliance Methodologies–

The Llano Seco Sub-Inventory Unit will use the following guidelines in the management of the groundwater resources. The groundwater level and land subsidence management objectives are intended to trigger predetermined voluntary Ground Water Management Actions, as defined in the accompanying Cover Report, to remedy declining ground water levels that are not recovering to compliance levels for each index well.

Groundwater Levels –

The Butte Basin Groundwater model uses the historical hydrology (e.g. precipitation pattern, stream inflows) from October 1970 through October 1999 in the base case simulation. Using historical hydrology allows for the assessment of water resources conditions based on a known range of hydrology, from wet to critical. Each hydrograph for the BMO process shows the static groundwater elevation measurements from the time period of 1970 to 2006, or as many recent years of data available for each selected key wells. The measurements taken during this 36 year window reflect periods of drought and recovery, as well as wet years. These methodologies will apply for both Spring and Fall analysis.

- A. For wells that have a period of record dating back to at least 1970, the subcommittee suggests that the range of measurements from the first year through 2006 be used in calculating Alert Stages 1 and 2 and the Historic Low will be used as the Alert Stage 3. Once the range is defined for each well, 20% of that range will be calculated and added to the Historic Low to establish Alert Stages 1 and 2. The measurements plotted after 2006 are for reference purposes only, and are not included in the calculation of the range.
- B. In the instances where the period of record does not date back to 1970, the Historic Low before 2006 will be used for Alert Stages 1 and 2, and the Historical Low minus the range of measurements shall be used for Alert Stage 3. The measurements plotted after 2006 are for reference purposes only, and are not included in the calculation of the range.

Groundwater Quality –

The data results for the measured constituents of temperature, pH and electrical conductivity in the selected domestic well within the SIU will be summarized once sufficient data has been collected.

Land Subsidence –

Land Subsidence will be monitored at the closest extensometers located in the M&T and Western Canal sub inventory units. Maximum annual inelastic land subsidence shall not exceed 0.01 feet per year.

Stage 1: is reached when the annual elastic subsidence exceeds the average annual elastic subsidence measured over the period of record of the extensometer.

Stage 2: is reached when the annual elastic subsidence exceeds the maximum recorded elastic subsidence over the period of record for the extensometer.

Stage 3: is when inelastic subsidence is detected. Inelastic subsidence shall be detected by comparing reading from the extensometer taken on March 1 of each year against previous March 1 measurements.

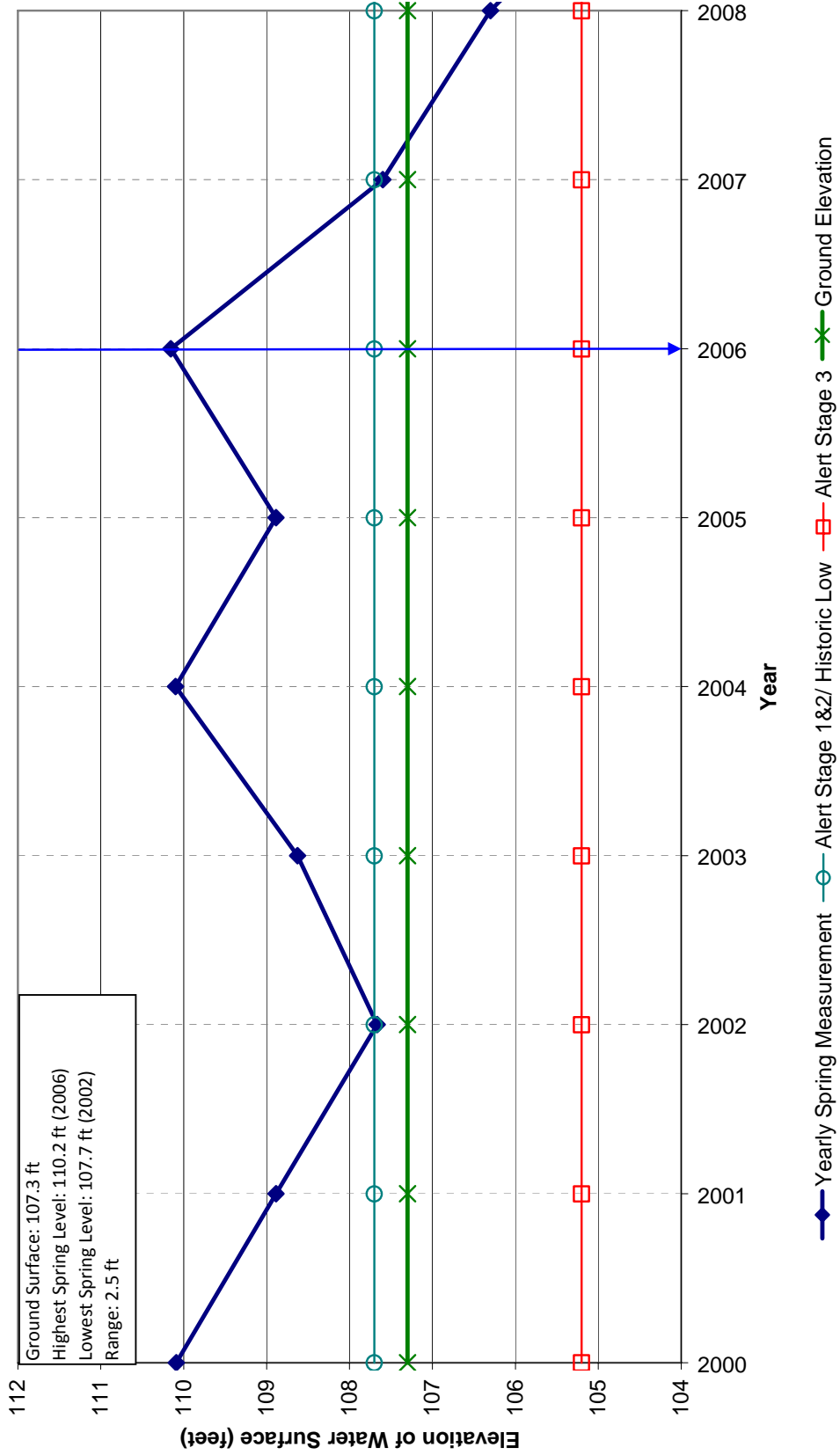
Future Monitoring Recommendations –

Two additional wells located within the SIU will be added to the monitoring network in 2009. Once both wells have been assigned State Well Numbers and measurements taken, that data will be available for review from the BMO Information Center. Groundwater elevation and water quality trend monitoring data will be presented in this BMO once enough years of data have been collected for analyzation.

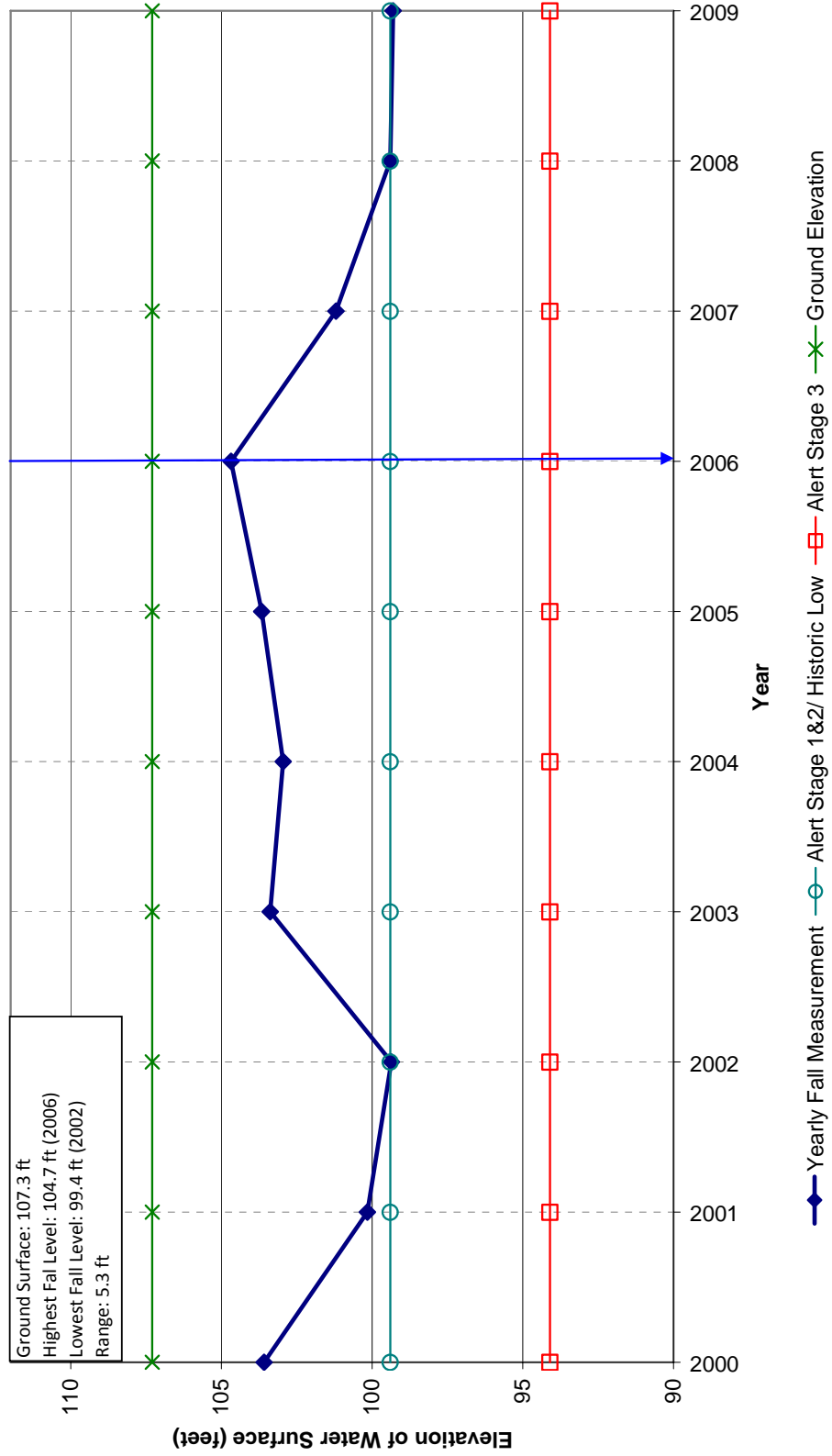
Supporting Data –

Hydrographs depicting yearly spring level measurements, including 2009 data, with established alert levels for calendar year 2010.

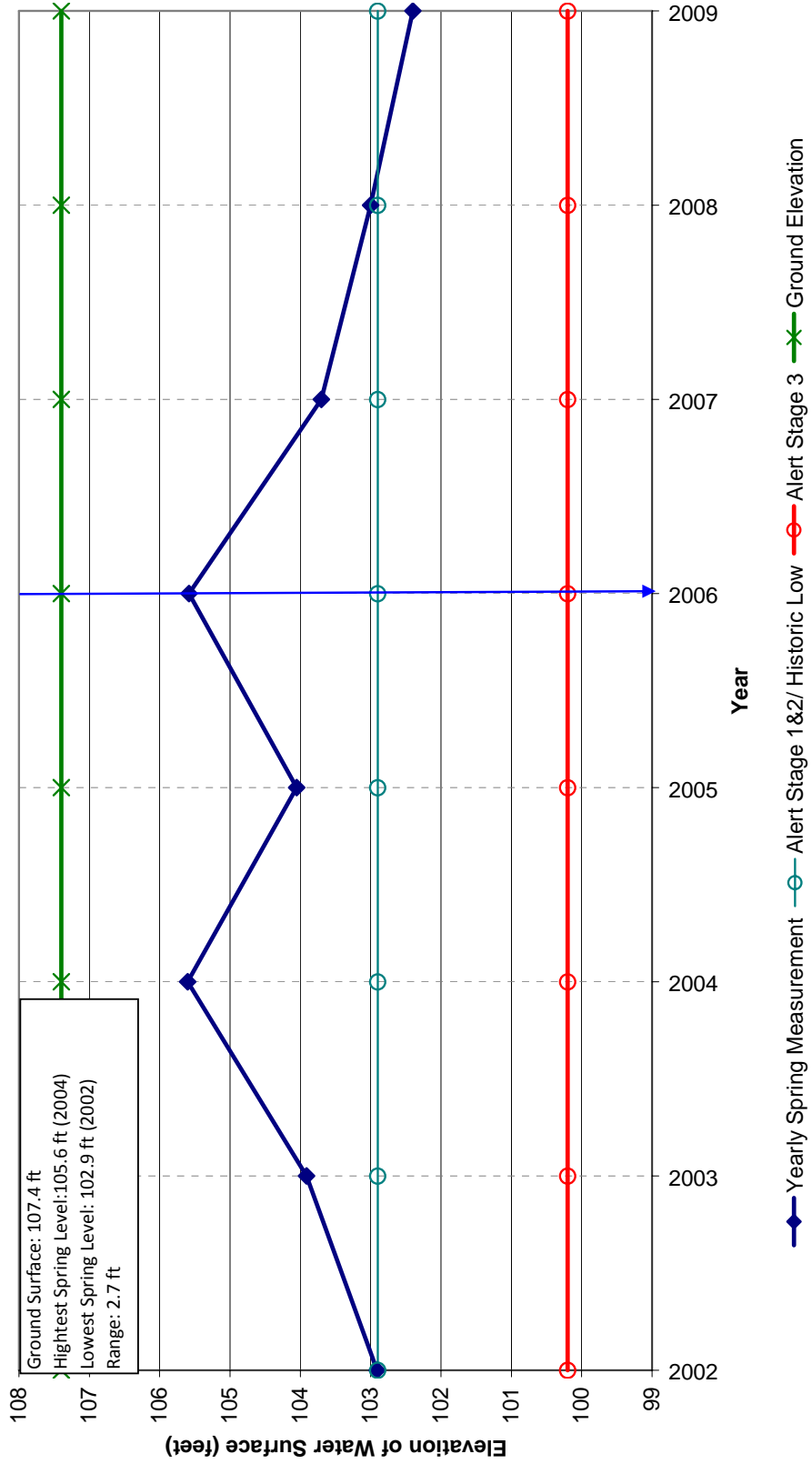
**Spring Groundwater Levels
Llano Seco - 20N01E18L01
Range of Measurements 2000-2006**



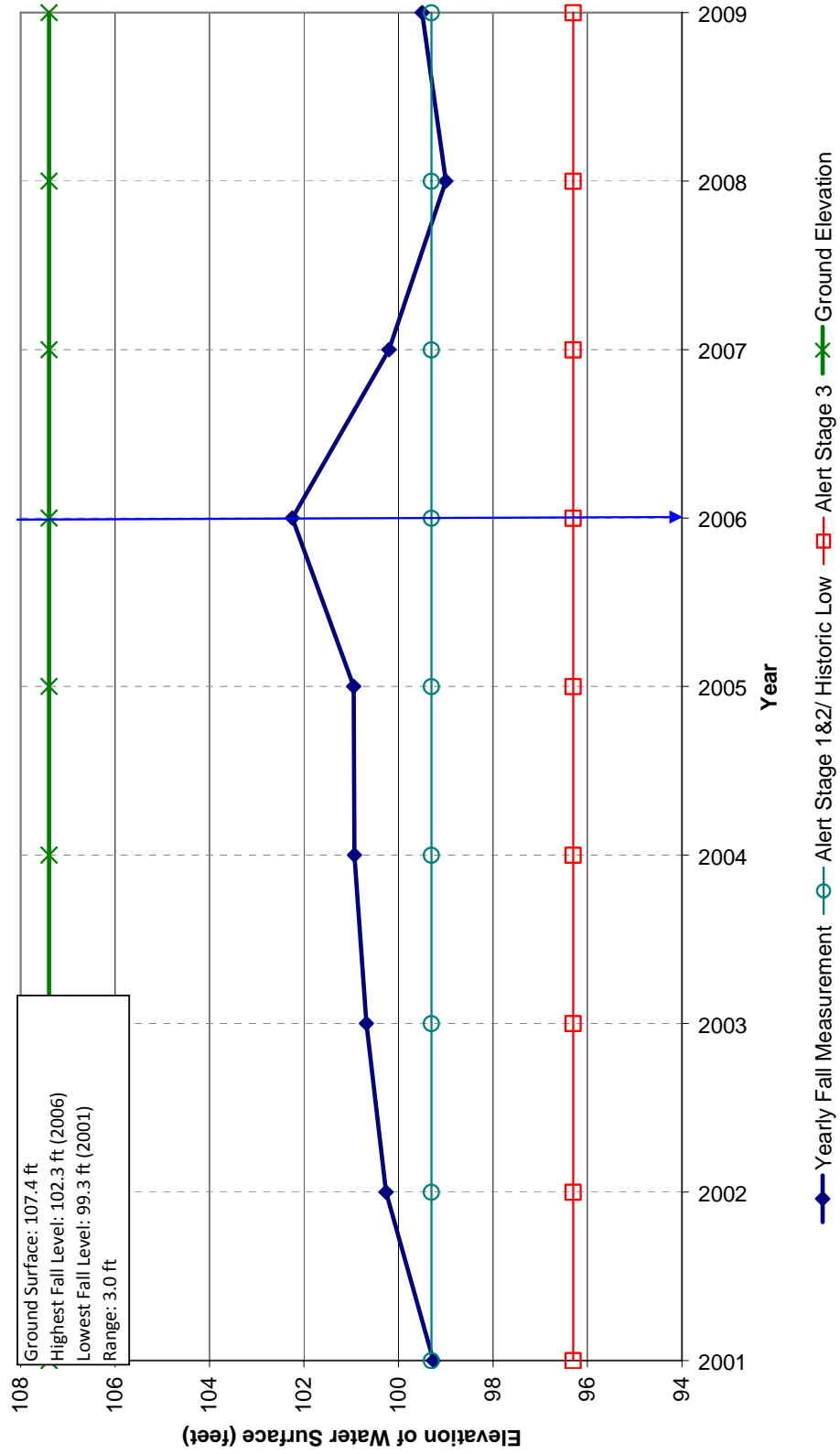
**Fall Groundwater Levels
Llano Seco - 20N01E18L01
Range of Measurements 2000-2006**



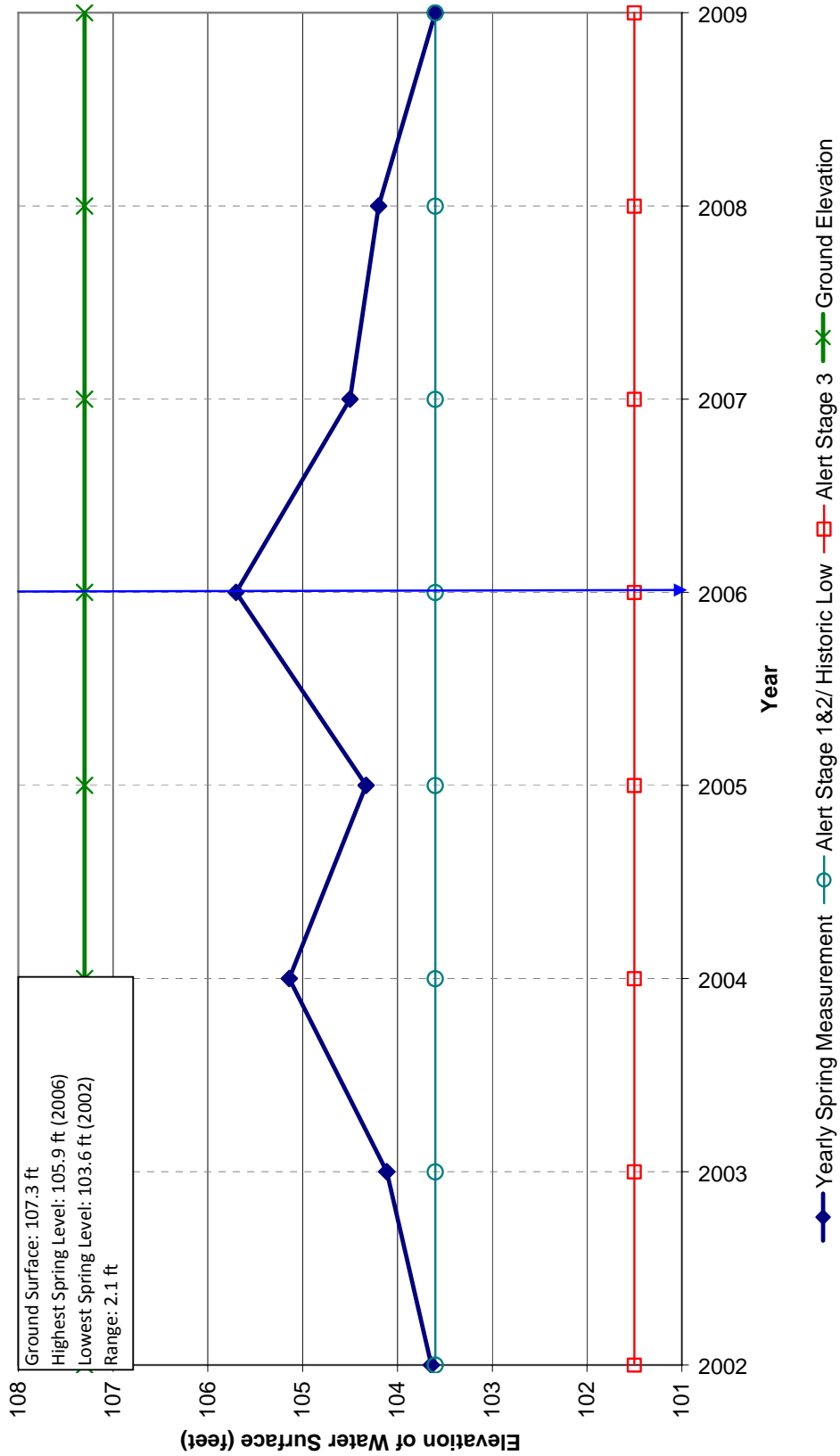
Spring Groundwater Levels
 Llano Seco - 20N01E18L02
 Range of Measurements 2002-2006



**Fall Groundwater Levels
Llano Seco - 20N01E18L02
Range of Measurements 2001-2006**



**Spring Groundwater Levels
Llano Seco - 20N01E18L03
Range of Measurements 2002-2006**



**Fall Groundwater Levels
Llano Seco - 20N01E18L03
Range of Measurements 2001-2006**

