Basin Management Objective
Butte County
Sub Area – CHICO URBAN AREA
Calendar Year - 2006

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Aquifer Systems Identified In Sub Area:
Alluvial Aquifer System (Modesto Formation)
Upper Tuscan (Formation Unit C) Aquifer System
Lower Tuscan (Formation Unit B) Aquifer System

Management Objective –

Basin Management Objectives for the Chico Urban Area shall maintain groundwater levels adequate to sustain municipal, agricultural and domestic use and the quality of streams and groundwater dependent vegetation. These groundwater levels shall reflect the natural seasonality of the groundwater systems. This purpose shall be met in each of the Chico Urban Area's three aquifers, generally described as alluvial, Upper Tuscan Formation, and Lower Tuscan Formation.

Basin Management Objectives for the Chico Urban Area shall maintain water levels adequate to assure good water quality.

Basin Management Objectives for the Chico Urban Area shall maintain water levels sufficient to prevent inelastic land subsidence.

Location of Basin Management Objective Key Wells:

Groundwater Levels – See Attached map of monitoring wells
Groundwater Quality – Not included, under development for adoption in 2007
Land Subsidence – See Attached map of monitoring wells

Groundwater Level Monitoring Network(s):

Department of Water Resources (spring and fall)
Butte County Department of Water and Resource Conservation (summer)
California Water Service (Chico)

Groundwater Quality Network(s):

No groundwater quality information in the Chico Urban Area was provided in the BMO Development Packet. However, significant groundwater quality monitoring is ongoing within the urban area to track nitrate contamination and toxic plumes, including the Butte County Nitrate Compliance Program and the Department of Toxic Substances Control program for monitoring toxic plumes. California Water Service monitors water quality constituents important for drinking water supply.

The Chico Urban Area will work with Butte County to review current groundwater quality monitoring data from the Nitrate Compliance Program and Department of Toxic Substances Control Program. The goal of the analysis is to provide a summary "big picture" understanding of the current status of groundwater quality in the Chico Urban Area. The group will work with the County to monitor appropriate wells to determine if groundwater extraction is affecting migration of contaminants. California Water Service will review its well network to identify appropriate wells to monitor for migration of nitrate and toxic contaminants from the alluvial aquifer system into the Lower Tuscan Formation.

Land Subsidence Monitoring Network(s):

Department of Water Resources
Butte County Department of Water and Resource Conservation

Monitoring Frequency:

Groundwater Levels:
Department of Water Resources - semiannually (fall and spring).
Butte County Department of Water and Resource Conservation – July and August in accordance with Chapter 33 of the Butte County Code.
California Water Service – Monthly

Land Subsidence:
Department of Water Resources – Continuously

Groundwater Quality:
California Water Service – Monthly
Butte County Nitrate Compliance Program – Annually
Department of Toxic Substances Control – Unknown

Well Numbering System(s):

<u>Groundwater Levels</u>:
Department of Water Resources (State Well Numbering System). Butte County Department of Water and Resource Conservation (State Well Numbering System).

<u>Land Subsidence:</u>
Department of Water Resources (State Well Numbering System)

Water Quality:
Butte County Nitrate Compliance Program – Annual
Department of Toxic Substances Control – unknown
California Water Service (State Well Numbering System).

Basin Management Objective Key Wells and Compliance Methodology for Groundwater Levels.

The Chico Urban Area sub-unit will use two approaches in monitoring groundwater levels. Two of the three monitoring wells in a triple-completion Bureau of Reclamation monitoring well will be used to monitor water levels in the Upper Tuscan and the Lower Tuscan. The e-log for this well shows it to be screened in these aquifers. There are currently no monitoring wells identified to monitor water levels in the alluvial aquifer. The group will work to identify an appropriate well to monitor that aquifer.

In addition to monitoring specific aquifers, the Chico Urban Area group has identified six California Water Service production wells to monitor for the continued health of the municipal and industrial (M & I) water supply. While these wells will not provide information about the specific aquifers underlying the Chico Urban Area since they are not screened in a single aquifer, the information will help track whether municipal supply is being sustained, as called for in the BMO objectives.

The group is provisionally selecting the wells and adopting alert levels. Data for each well still needs to be reviewed and verified, in order to understand which aquifer the well is drawing from, including the possibility that it is drawing from multiple aquifers. For example, most California Water Service production wells are screened in multiple aquifers. During the remainder of 2006, the group will work with Butte County to obtain the following information for each selected well.

Criteria used for selecting monitoring wells:

- Wells Screening depth in single aquifer
- Has well log, including soil logging, mud logging, gamma, resistivity, screen levels, spontaneous potential, total depth, width and type of casing, purpose of water use
- Long-term monitoring
- Has water quality data
- Within Chico Urban Area sub unit with distribution across area
- Representative of three aquifers
- Location and elevation previously surveyed
- Accessible

The BMOs for groundwater levels for 2006 are set using average spring and fall groundwater levels for the two levels of the Bureau of Reclamation Monitoring and spring groundwater levels for the six Cal Water Production wells. A stage 1 alert is equal to the average water level for each measurement minus one standard deviation,

with a stage 2 alert consisting of two consecutive years of stage 1. A stage 3 alert consists of the average minus two standard deviations, or when groundwater levels fall one standard deviation below the mean for a third year. The group will continue work in 2006 to develop further groundwater level BMOs based on average fall readings.

SPRING

Well ID	Well Type	Aquifer	Stage 1 & 2 Alerts**		Stage 3 Alerts**	
			Elev. (ft)	Depth (ft)	Elev. (ft)	Depth (ft)
22N01E26L02M	M&I Production	Composite	132	72	127	77
22N01E16H01M	M&I Production	Composite	135	48	128	55
22N02E18N01M	M&I Production	Composite	128	130	124	134
22N01E23K03M	M&I Production	Composite	130	82	123	89
22N02E31Q01M	M&I Production	Composite	125	90	120	95
22N01E34G01M	M&I Production	Composite	129	52	119	62
22N01E28J01M	M&I Production	Composite	122	148	117	153
22N01E28J003M	Monitoring	Tuscan C	138	38	131	45
22N01E28J005M	Monitoring	Tuscan B	137	39	131	45
Stage 3 will also be reached at three consecutive years of Stage 1/Stage 2 levels.						

* - See Staff Report for description of method.
** - See attached hydrographs.

FALL

Well ID	Well Type	Aquifer	Stage 1 & 2 Alerts**		Stage 3 Alerts**	
			Elev. (ft)	Depth (ft)	Elev. (ft)	Depth (ft)
22N01E28J003M	Monitoring	Tuscan C	131	45	124	52
22N01E28J005M	Monitoring	Tuscan B	124	52	116	60
Stage 3 will also be reached at three consecutive years of Stage 1/Stage 2 levels.						

* - See Staff Report for description of method.
** - See attached hydrographs.

Basin Management Objective Key Wells and Compliance Methodology for Groundwater Quality.

Wells and compliance methodology cannot be selected until information on groundwater quality monitoring is evaluated as described in the section **Groundwater Quality Network** above.

Basin Management Objective Key Wells and Compliance Methodology for Land Subsidence.

State Well Number 22N01E35E01M
Maximum annual inelastic land subsidence shall not exceed 0.01 feet over a five-year period.

BMO Alert Stage Definitions:

Groundwater Levels:

Stage 1: The first year that spring or fall groundwater levels fall below one standard deviation below the mean spring or fall groundwater level established for the well but still above two standard deviations below the mean spring or fall level for the well.

Stage 2: Stage 2 is reached if spring or fall groundwater levels, for a second consecutive year, remain below one standard deviation below the mean spring or fall groundwater level of the well but still above two standard deviations below the mean spring or fall level for the well.

Stage 3: Stage 3 is reached if the spring groundwater levels fall two standard deviations below the mean spring or fall level for the well or if mean spring or fall groundwater levels for the well remain one standard deviation below the mean for three or more consecutive years.

Groundwater Quality:

Further information and evaluation are needed to establish Groundwater Quality alert stages so they will be determined during 2006, for submittal in February of 2007.

Land Subsidence:

Stage 1: When the annual elastic subsidence exceeds the average annual elastic subsidence measured over the period of record of the extensometer.
Stage 2: When the annual elastic subsidence exceeds the maximum recorded elastic subsidence over the period of record for the extensometer.
Stage 3: When inelastic subsidence occurs.

BMO Compliance Evaluation Procedure:

Compliance with the BMO will be determined by the Butte County Water Commission's Technical Advisory Committee following the spring and fall measurement periods. The groundwater surface elevation at each monitoring well will be compared against the corresponding compliance graph and stage definition criteria to determine if the groundwater surface elevations are above or below specific alert trigger levels. The Technical Advisory Committee of the Butte County Water Commission will perform this evaluation and report the results of the evaluation to the Butte County Water Advisory Committee and Water Commission.

Ground Water Management Actions:

Stage 1: Groundwater management actions to be undertaken following a Stage 1 noncompliance shall be informational. The Butte County Water Advisory Committee (WAC) and Water Commission (WC) will be advised of the noncompliance. At the recommendation of the Water Advisory Committee and the Water Commission public notification of the noncompliance may be initiated.

Stage 2: Groundwater management actions to be undertaken following a Stage 2 noncompliance shall be investigational. Upon identification of the Stage 2 noncompliance the noncompliance will be reported to the WAC and the WC. Following review and concurrence, the WAC shall direct the TAC to initiate an investigation to determine the cause(s) of the noncompliance and make recommendations as how to correct the noncompliance. The TAC shall report their findings and recommendations back to the WAC and WC within 30 days.

Stage 3: Groundwater management actions to be undertaken following a Stage 3 noncompliance shall be actionable. Upon identification of the Stage 3 noncompliance, the noncompliance will be reported to the WAC and the WC. Following review and concurrence, the WAC shall direct the TAC to initiate an investigation to determine the cause(s) of the noncompliance and make recommendations as how to correct the noncompliance. The TAC shall report back their findings and recommendations back to the WAC and WC within 30 days. The WAC will then work with the locals in the sub area to implement needed water management activities necessary to correct the problem. Such water management activities shall include, but not limited to, voluntary water conservation measures, redistribution of groundwater extraction, reduction of groundwater extraction, or other measure(s) identified and approved by the WAC, WC, and the Butte County Board of Supervisors.

Future Monitoring Recommendations:

Efforts will be made to identify several domestic wells that could be added to the existing monitoring well network in sub-area to allow development of management objectives for the alluvial aquifer system. Efforts will also be made to identify more wells in all aquifers which meet the criteria developed.

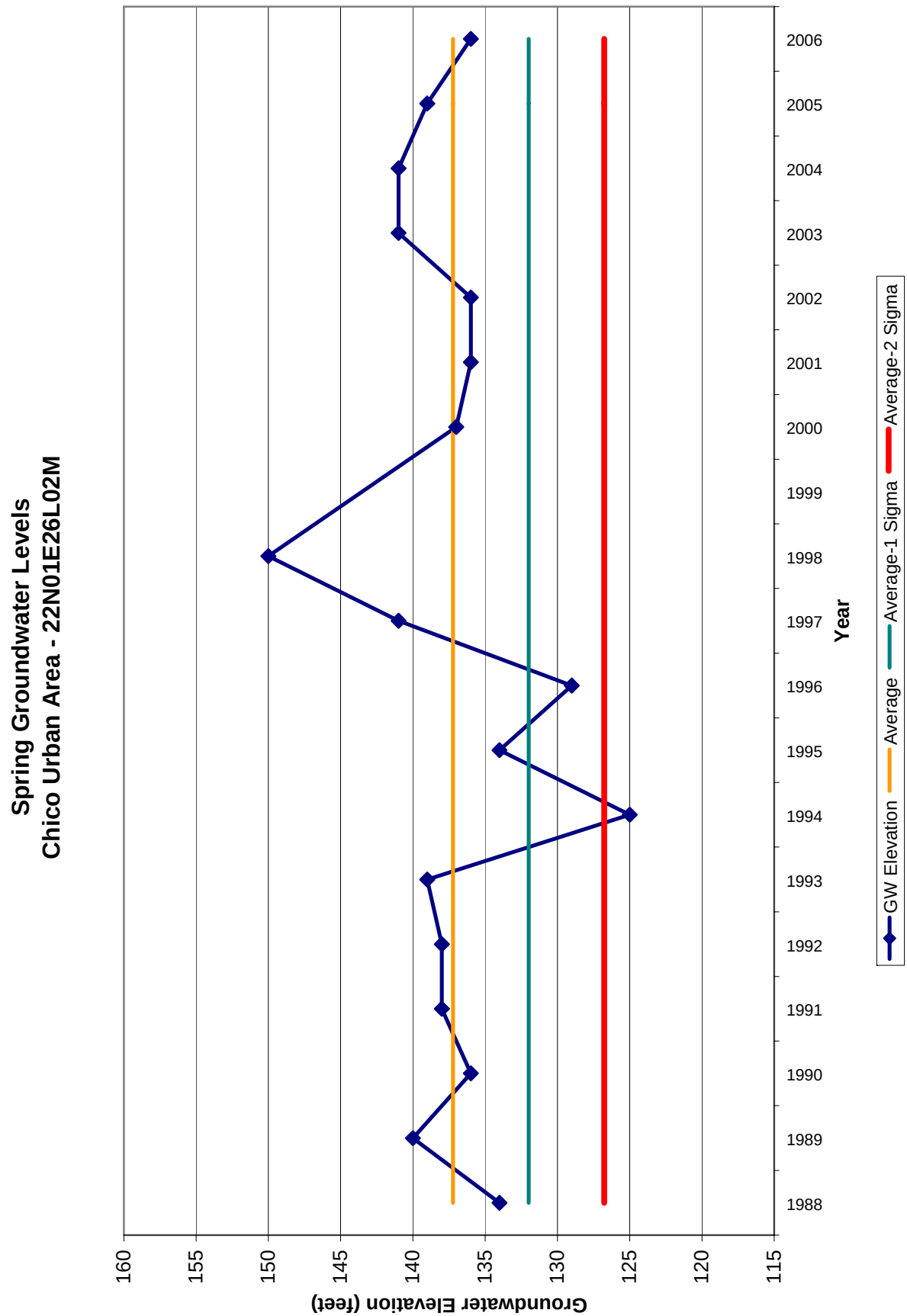
Without the water quality component this document is not complete. The Chico Urban Area Sub basin team needs the support of State and County water monitoring agencies to collect and evaluate the extensive information that exists about water quality in the Chico Urban Area. Without an understanding of the nature of these data, alert stages cannot be set.

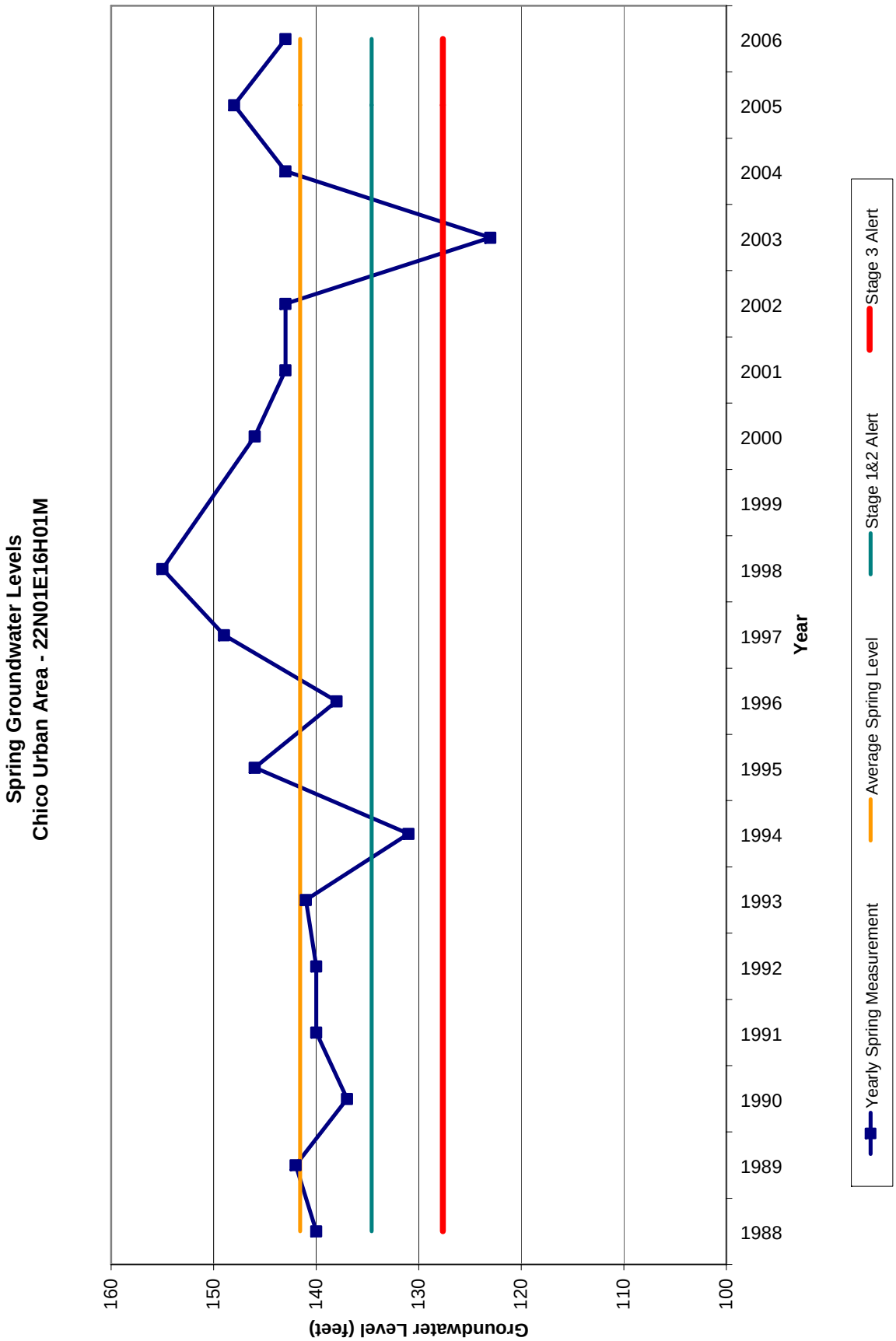
A very deep monitoring well will be established to assess vertical pressure gradients and to monitor for saltwater intrusion from the aquifer underlying the Lower Tuscan.

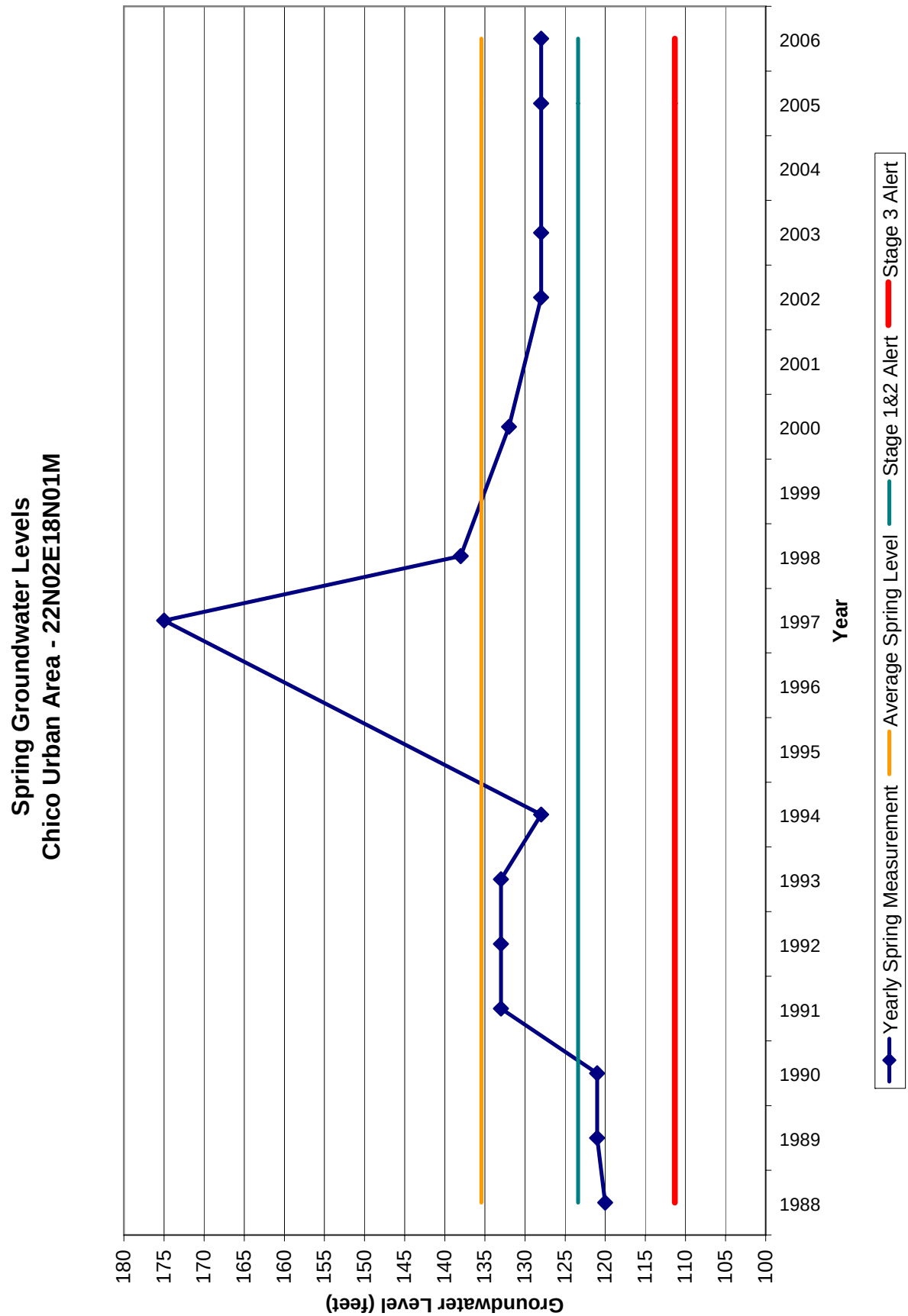
Future monitoring recommendations may be modified once well data have been verified and groundwater quality monitoring data have been compiled.

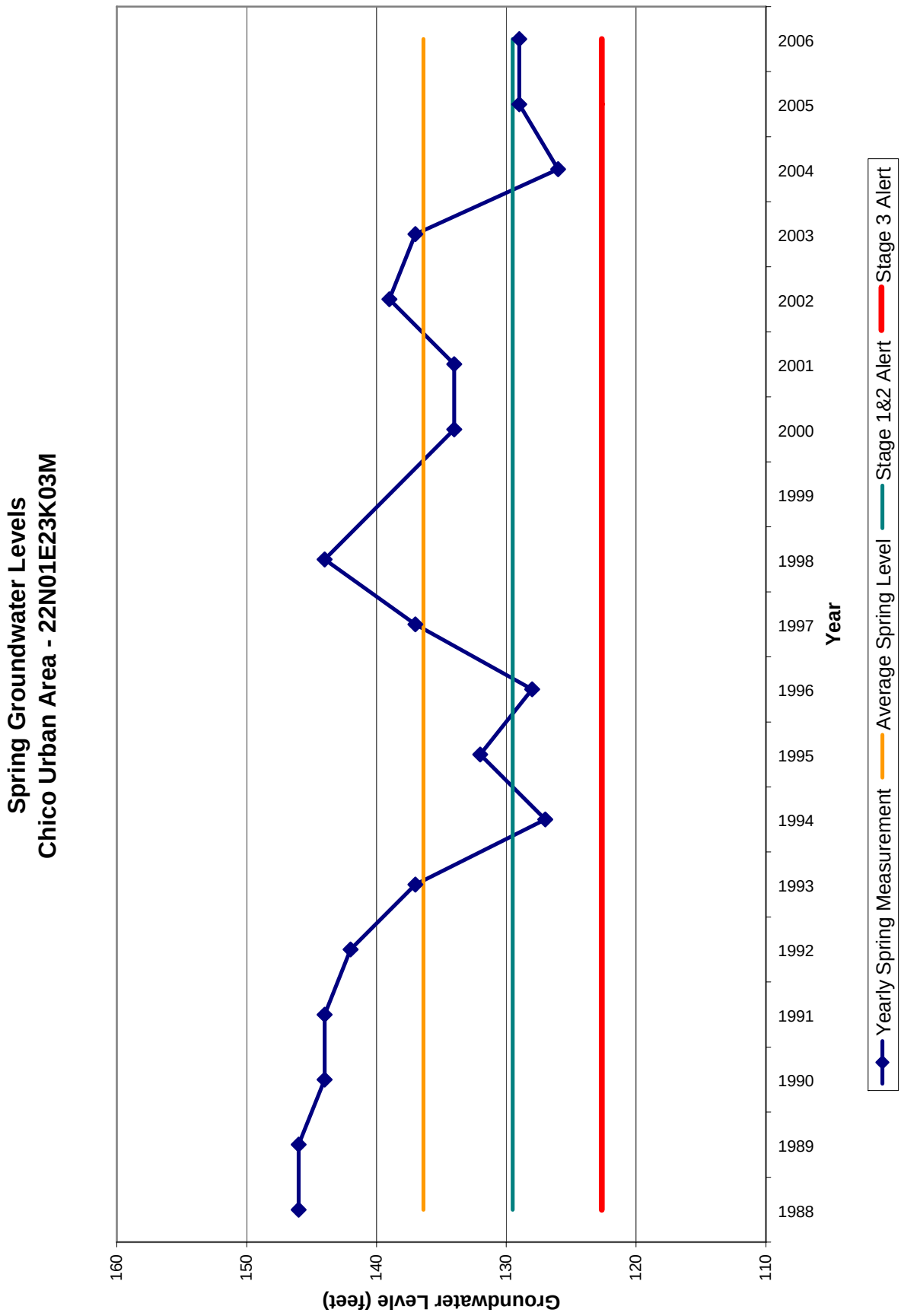
Supporting Data:

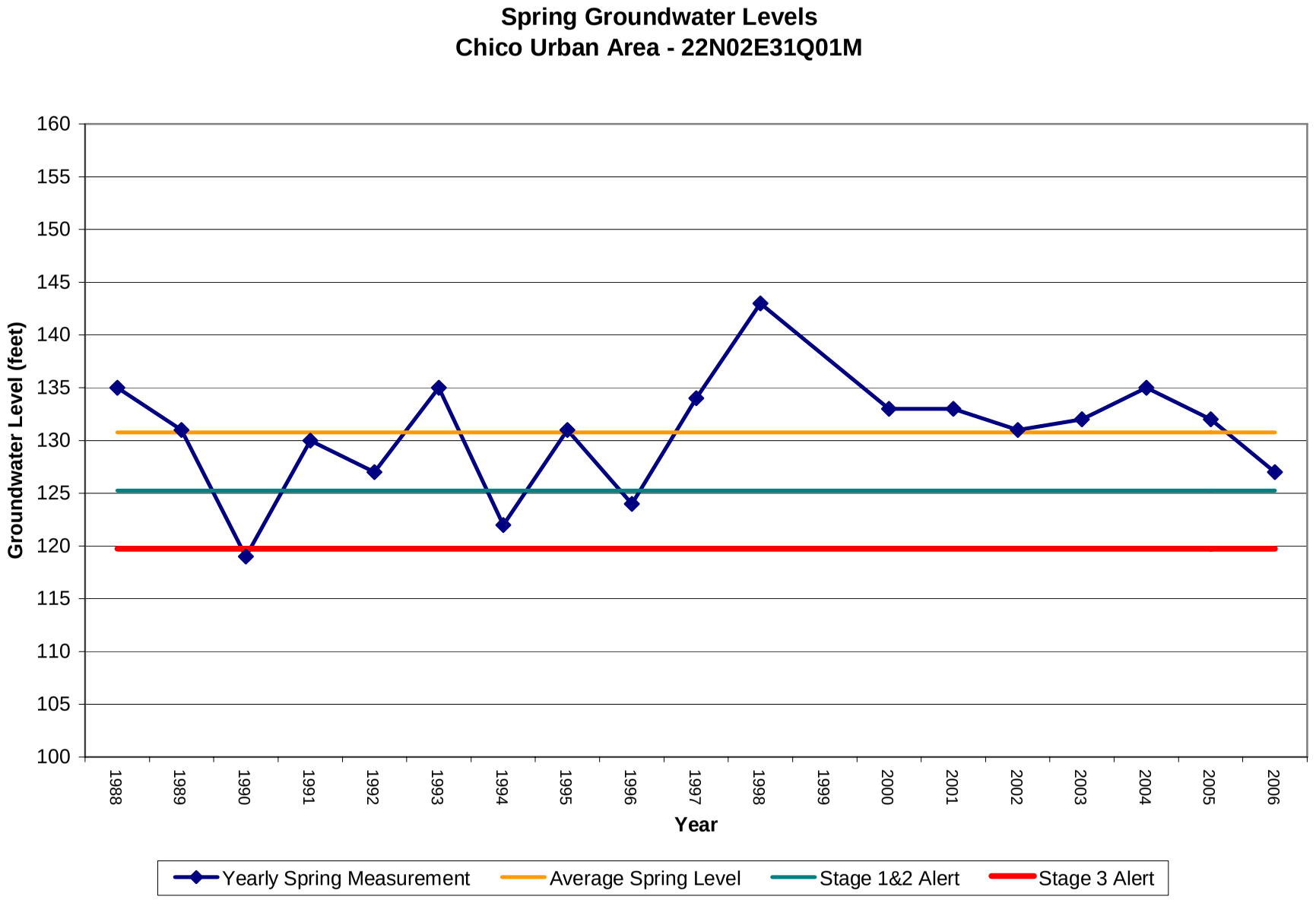
See attached hydrographs
See attached map of existing monitoring wells
See attached map of Sub-Unit Boundaries

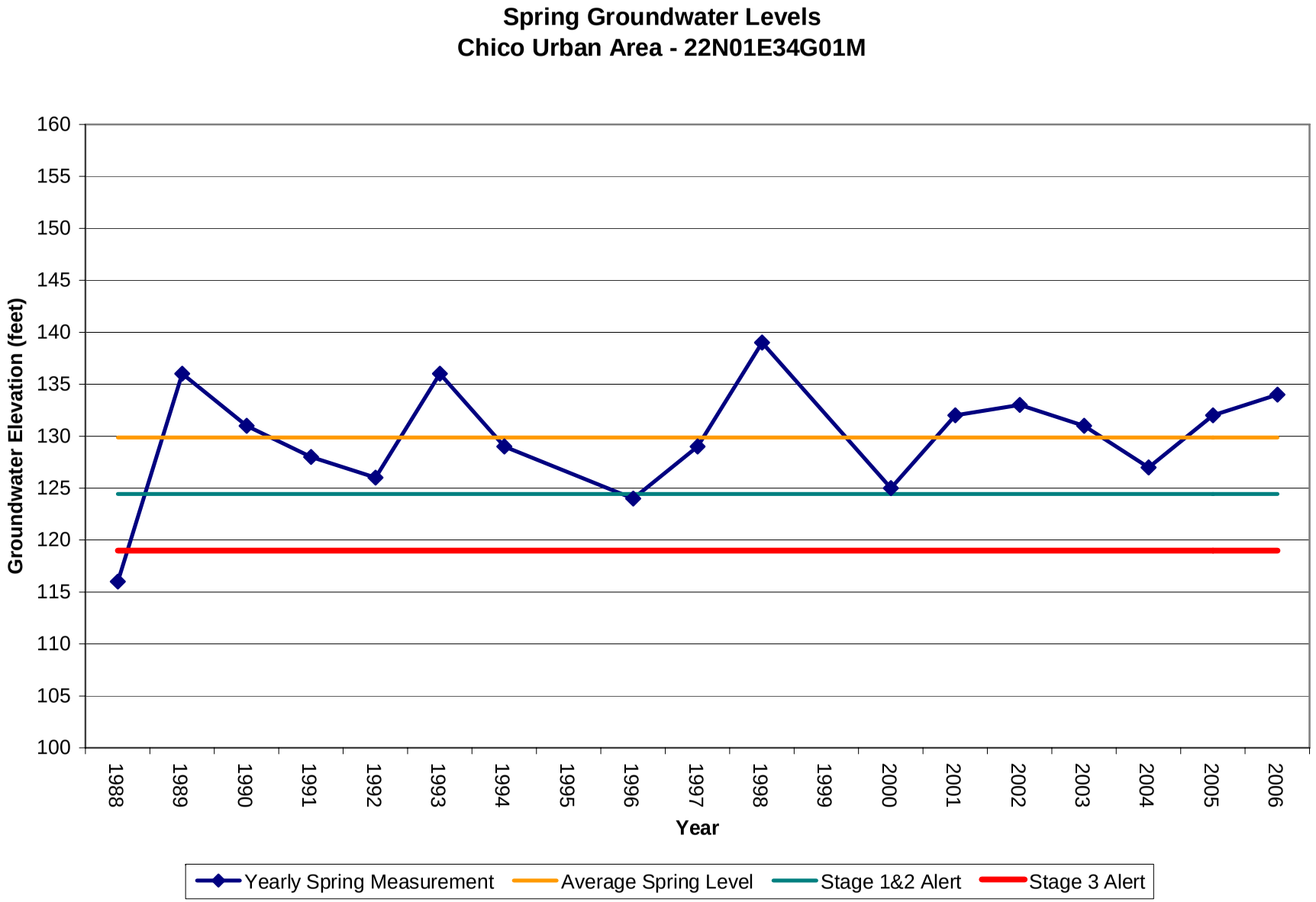

Spring Groundwater Levels
Chico Urban Area - 22N01E26L02M
Groundwater Elevation (feet)
160
155
150
145
140
135
130
125
120
115
Year
2006
2005
2004
2003
2002
2001
2000
1999
1998
1997
1996
1995
1994
1993
1992
1991
1990
1989
1988
GW Elevation
Average
Average-1 Sigma
Average-2 Sigma

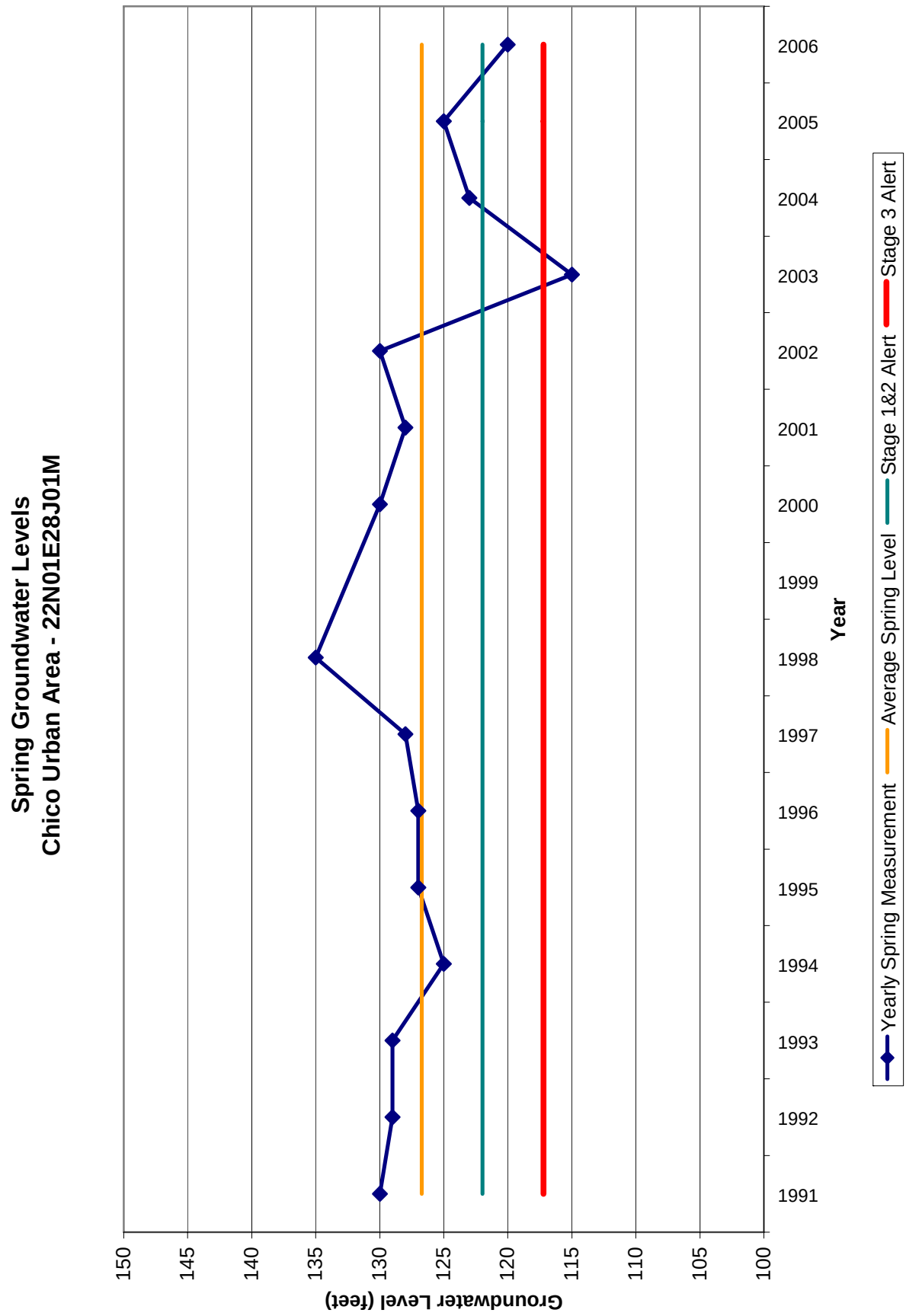

Spring Groundwater Levels
Chico Urban Area - 22N01E16H01M
Groundwater Level (feet)
160
150
140
130
120
110
100
Year
2006
2005
2004
2003
2002
2001
2000
1999
1998
1997
1996
1995
1994
1993
1992
1991
1990
1989
1988
Yearly Spring Measurement
Average Spring Level
Stage 1&2 Alert
Stage 3 Alert

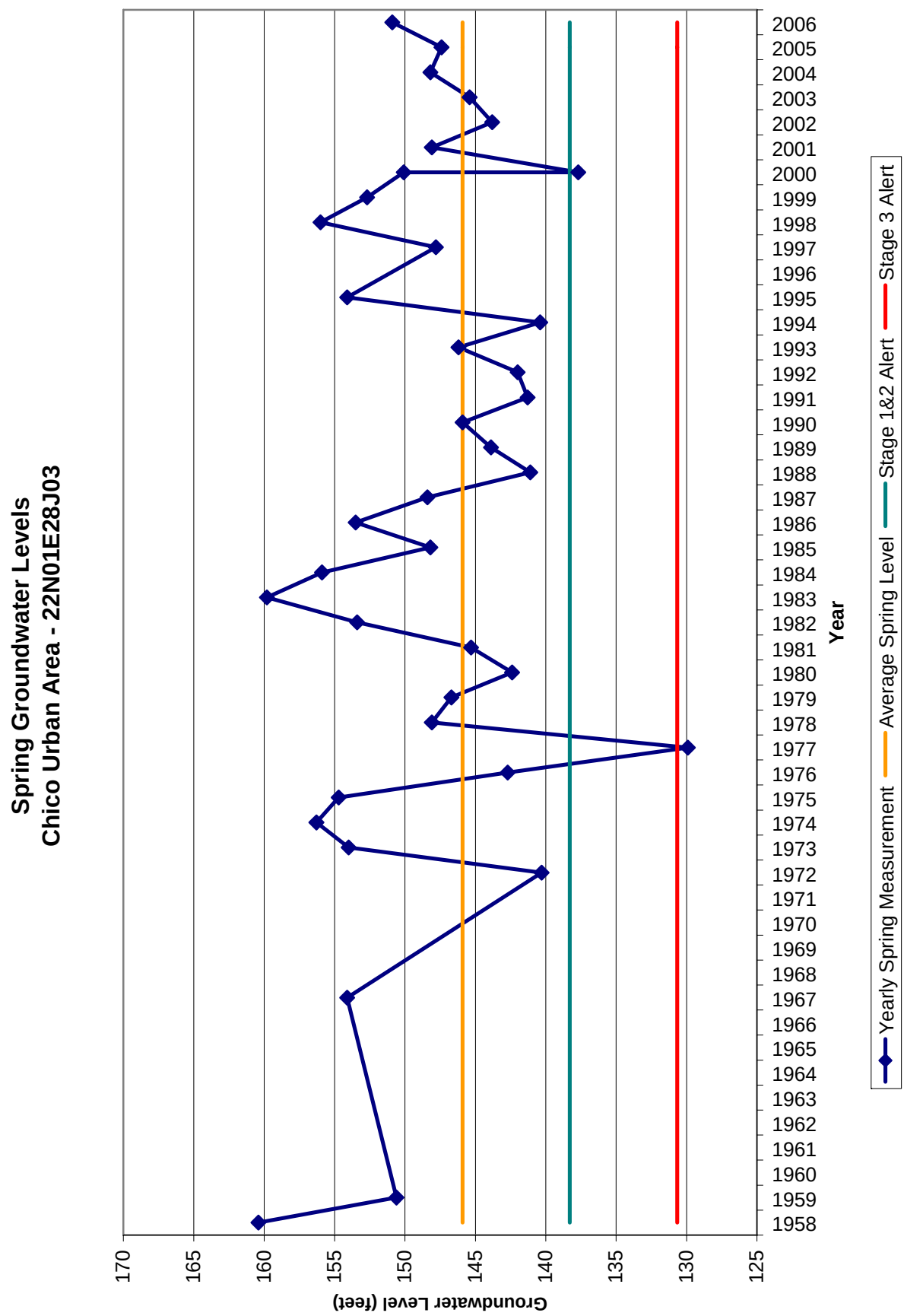

Spring Groundwater Levels
Chico Urban Area - 22N02E18N01M
Groundwater Level (feet)
180
175
170
165
160
155
150
145
140
135
130
125
120
115
110
105
100
Year
2006
2005
2004
2003
2002
2001
2000
1999
1998
1997
1996
1995
1994
1993
1992
1991
1990
1989
1988
Yearly Spring Measurement
Average Spring Level
Stage 1&2 Alert
Stage 3 Alert


Spring Groundwater Levels
Chico Urban Area - 22N01E23K03M
Groundwater Levle (feet)
160
150
140
130
120
110
Year
2006
2005
2004
2003
2002
2001
2000
1999
1998
1997
1996
1995
1994
1993
1992
1991
1990
1989
1988
Yearly Spring Measurement
Average Spring Level
Stage 1&2 Alert
Stage 3 Alert


Spring Groundwater Levels
Chico Urban Area - 22N02E31Q01M
Groundwater Level (feet)
160
155
150
145
140
135
130
125
120
115
110
105
100
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
Year
Yearly Spring Measurement
Average Spring Level
Stage 1&2 Alert
Stage 3 Alert


Spring Groundwater Levels
Chico Urban Area - 22N01E34G01M
Groundwater Elevation (feet)
160
155
150
145
140
135
130
125
120
115
110
105
100
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
Year
Yearly Spring Measurement
Average Spring Level
Stage 1&2 Alert
Stage 3 Alert


Spring Groundwater Levels
Chico Urban Area - 22N01E28J01M
Groundwater Level (feet)
150
145
140
135
130
125
120
115
110
105
100
Year
2006
2005
2004
2003
2002
2001
2000
1999
1998
1997
1996
1995
1994
1993
1992
1991
Yearly Spring Measurement
Average Spring Level
Stage 1&2 Alert
Stage 3 Alert


Spring Groundwater Levels
Chico Urban Area - 22N01E28J03
Groundwater Level (feet)
170
165
160
155
150
145
140
135
130
125
Year
2006
2005
2004
2003
2002
2001
2000
1999
1998
1997
1996
1995
1994
1993
1992
1991
1990
1989
1988
1987
1986
1985
1984
1983
1982
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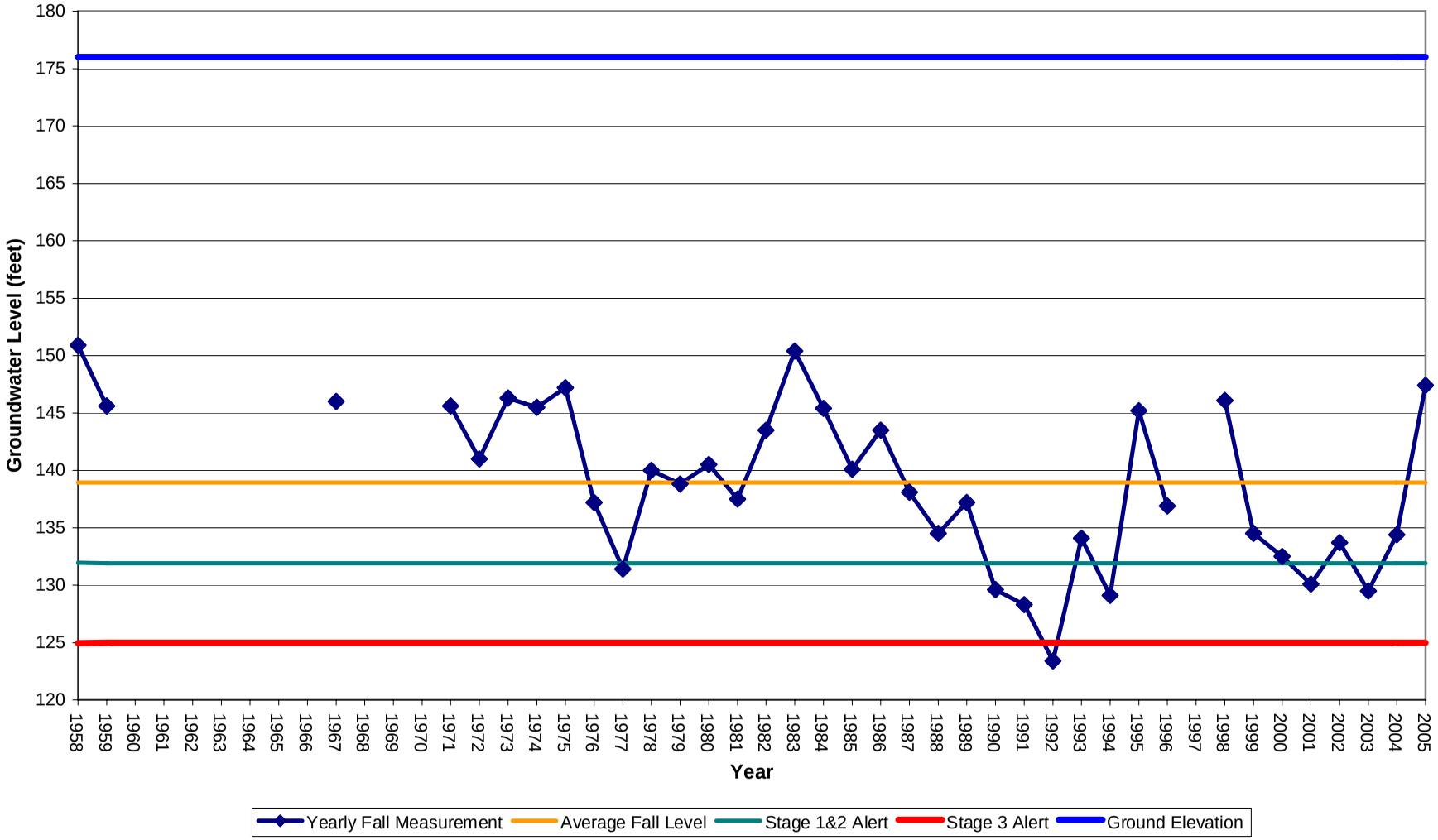
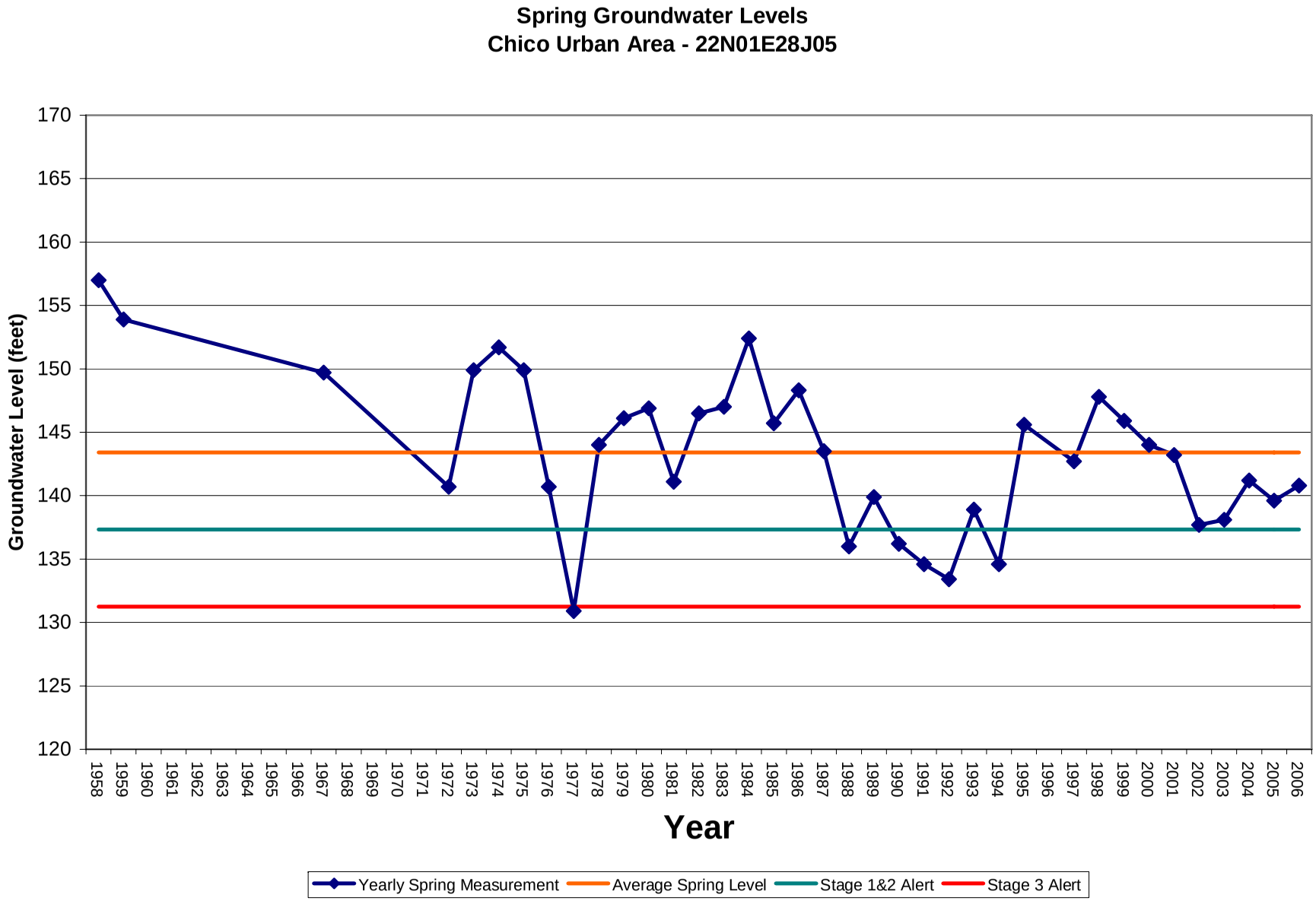
1978
1977
1976
1975
1974
1973
1972
1971
1970
1969
1968
1967
1966
1965
1964
1963
1962
1961
1960
1959
1958
Yearly Spring Measurement
Average Spring Level
Stage 1&2 Alert
Stage 3 Alert

Fall Groundwater Levels
Chico Urban Area - 22N01E28J03




Spring Groundwater Levels
Chico Urban Area - 22N01E28J05
Groundwater Level (feet)
170
165
160
155
150
145
140
135
130
125
120
1958 1959 1960 1961 1962 1963 1964 1965 1966 1967 1968 1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006
Year
Yearly Spring Measurement
Average Spring Level
Stage 1&2 Alert
Stage 3 Alert

Fall Groundwater Levels
Chico Urban Area - 22N01E28J05