Figures

\\ODIN\PROJ\NORTHERNCALIFORNIAWA\SACVALLEYPROP50\FIGURES\MXDS\MODELAPPLICATION\SACFEM\FIG_01_REFINEDGRID.MXD HPERRY 7/26/2011 11:03:03

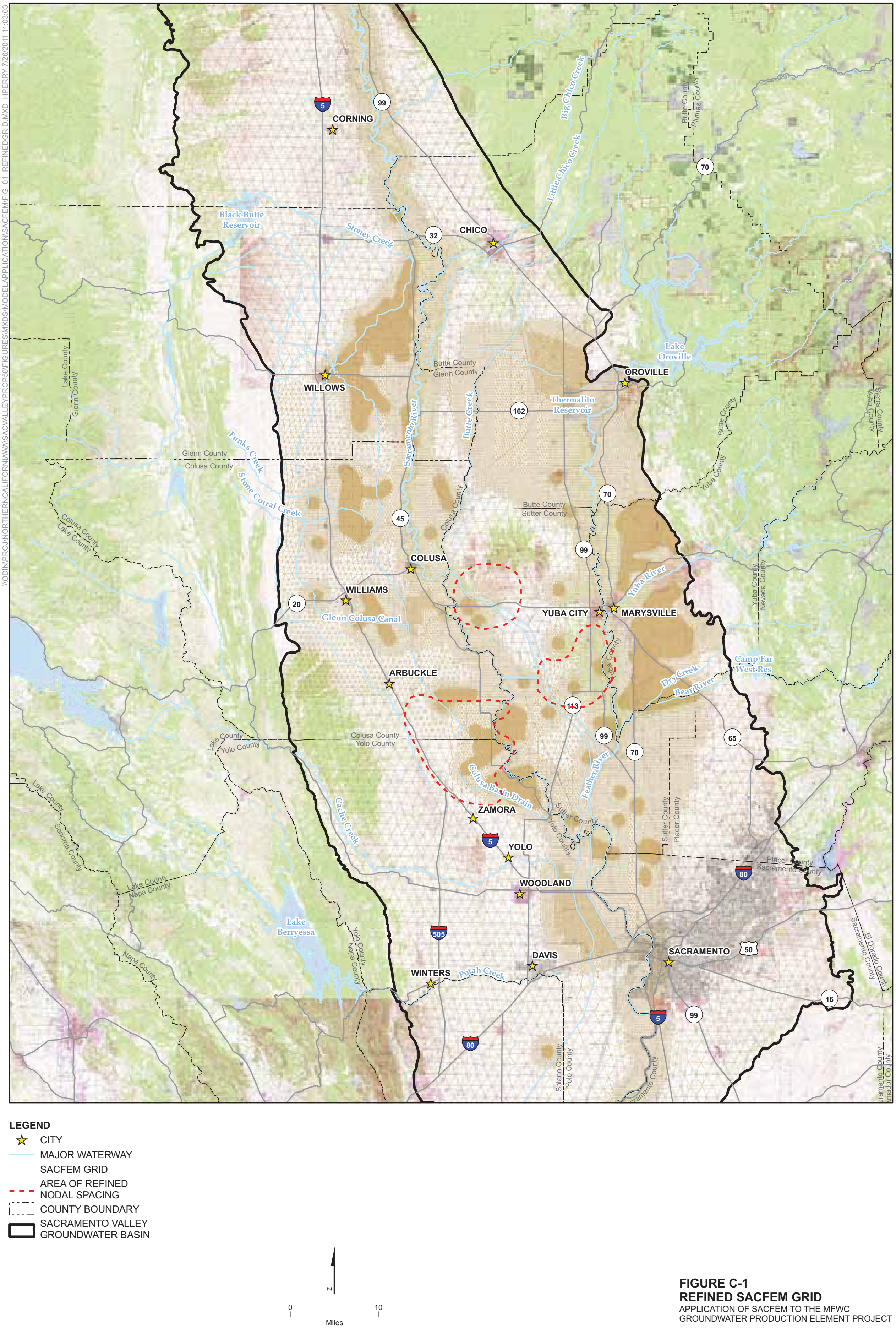


FIGURE C-1
REFINED SACFEM GRID
APPLICATION OF SACFEM TO THE MFWC GROUNDWATER PRODUCTION ELEMENT PROJECT

CH2MHILL

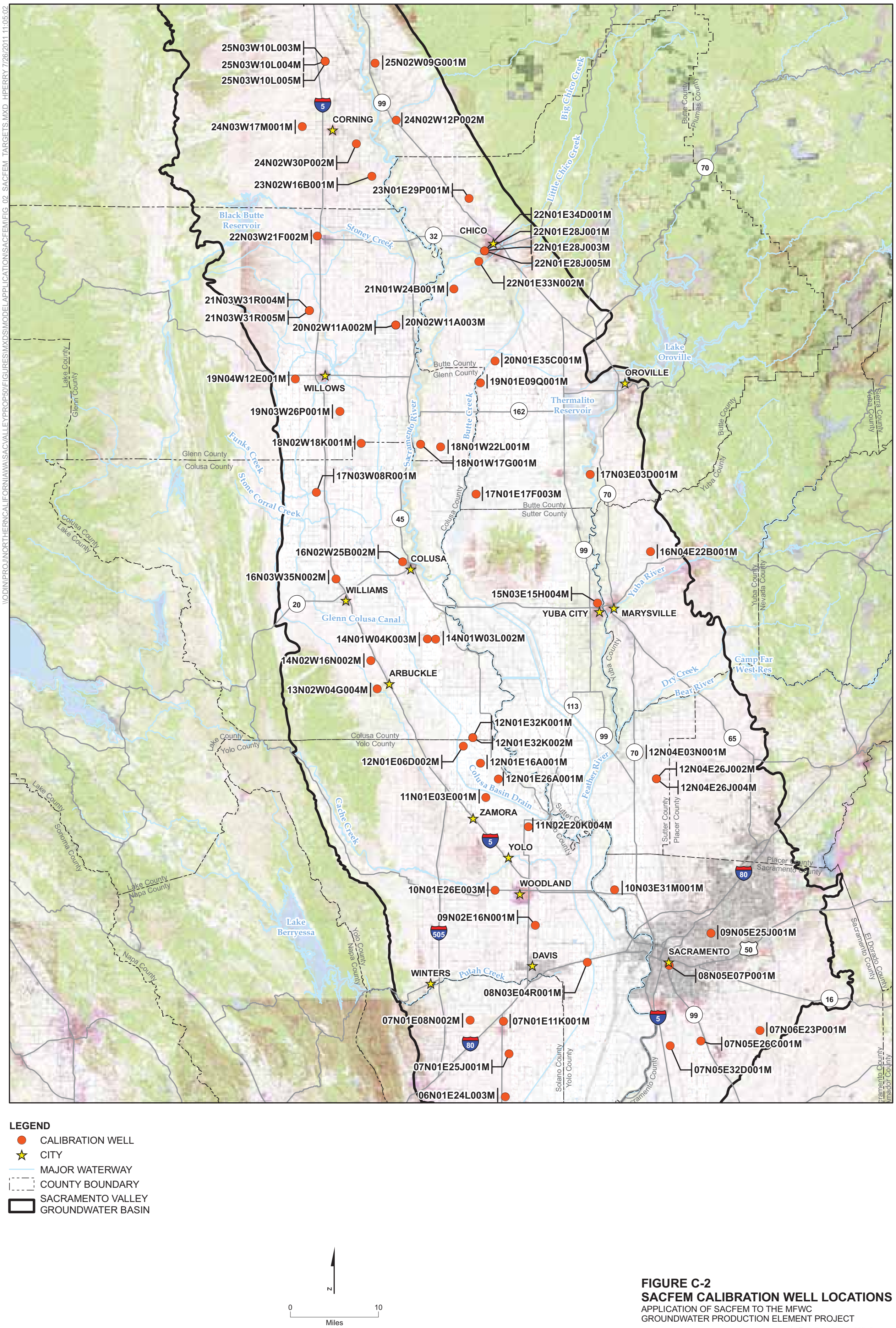
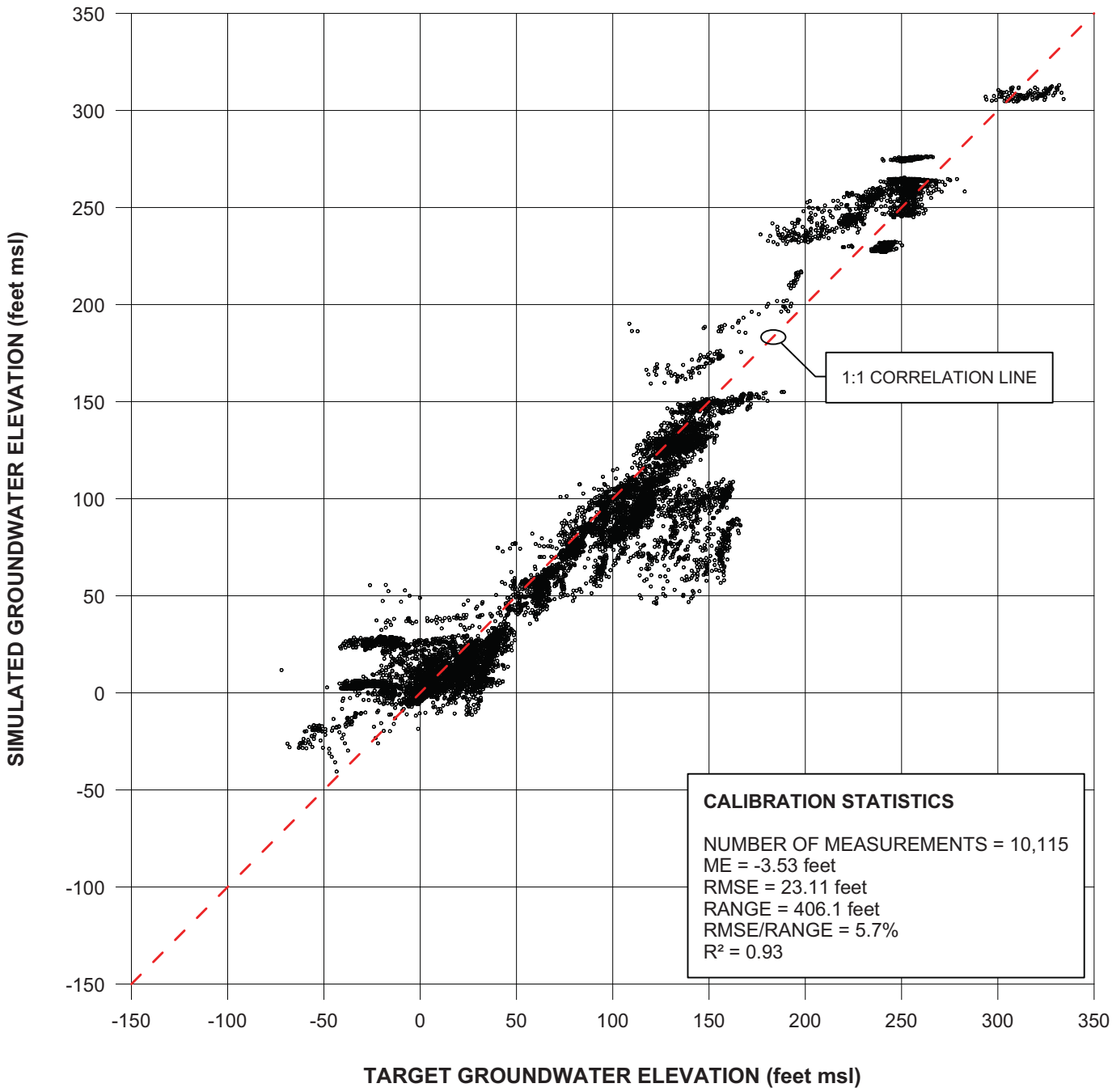


FIGURE C-2
SACFEM CALIBRATION WELL LOCATIONS
APPLICATION OF SACFEM TO THE MFWC
GROUNDWATER PRODUCTION ELEMENT PROJECT

CH2MHILL

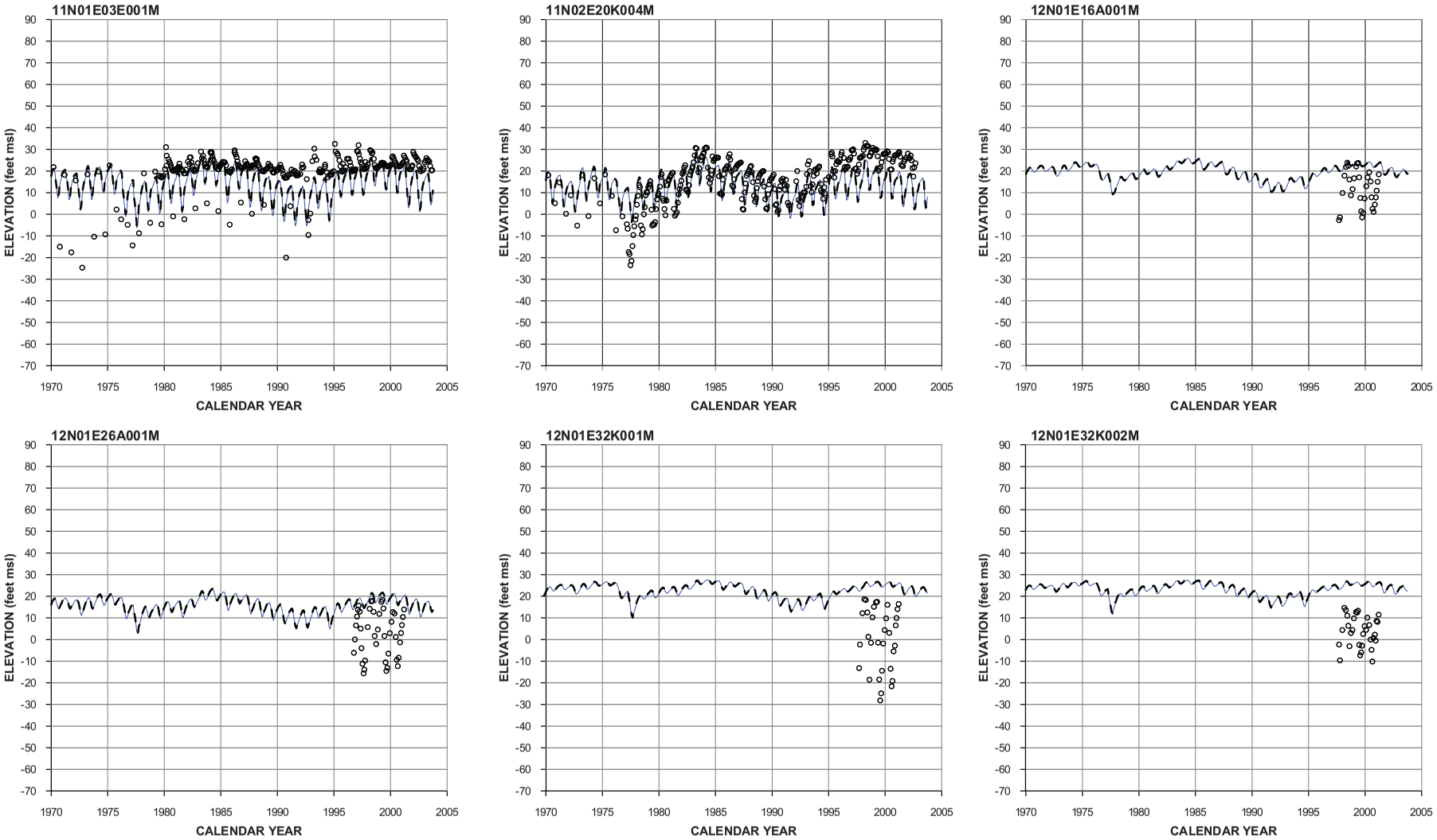


NOTES:

ME = MEAN RESIDUAL ERROR
MSL = MEAN SEA LEVEL
RMSE = ROOT MEAN SQUARE ERROR
RANGE = RANGE IN TARGET GROUNDWATER LEVELS
R^2 = SQUARE OF THE CORRELATION COEFFICIENT

FIGURE C-3
SACFEM - REFINED GRID
CALIBRATION SCATTERGRAM
APPLICATION OF SACFEM TO THE MFWC
GROUNDWATER PRODUCTION ELEMENT PROJECT

CH2MHILL



LEGEND

- MEASURED GROUNDWATER ELEVATION
- SIMULATED DATA - ORIGINAL VERSION OF SACFEM
- SIMULATED DATA - REFINED VERSION OF SACFEM WITH REVISED CACHE CREEK CONCEPTUALIZATION

NOTE:

SEE FIGURE C-2 FOR LOCATION OF CALIBRATION WELLS.

FIGURE C-4 (PAGE 1 OF 2)
SIMULATED AND MEASURED GROUNDWATER ELEVATION VERSUS TIME

APPLICATION OF SACFEM TO THE MFWC GROUNDWATER PRODUCTION ELEMENT PROJECT

CH2MHILL

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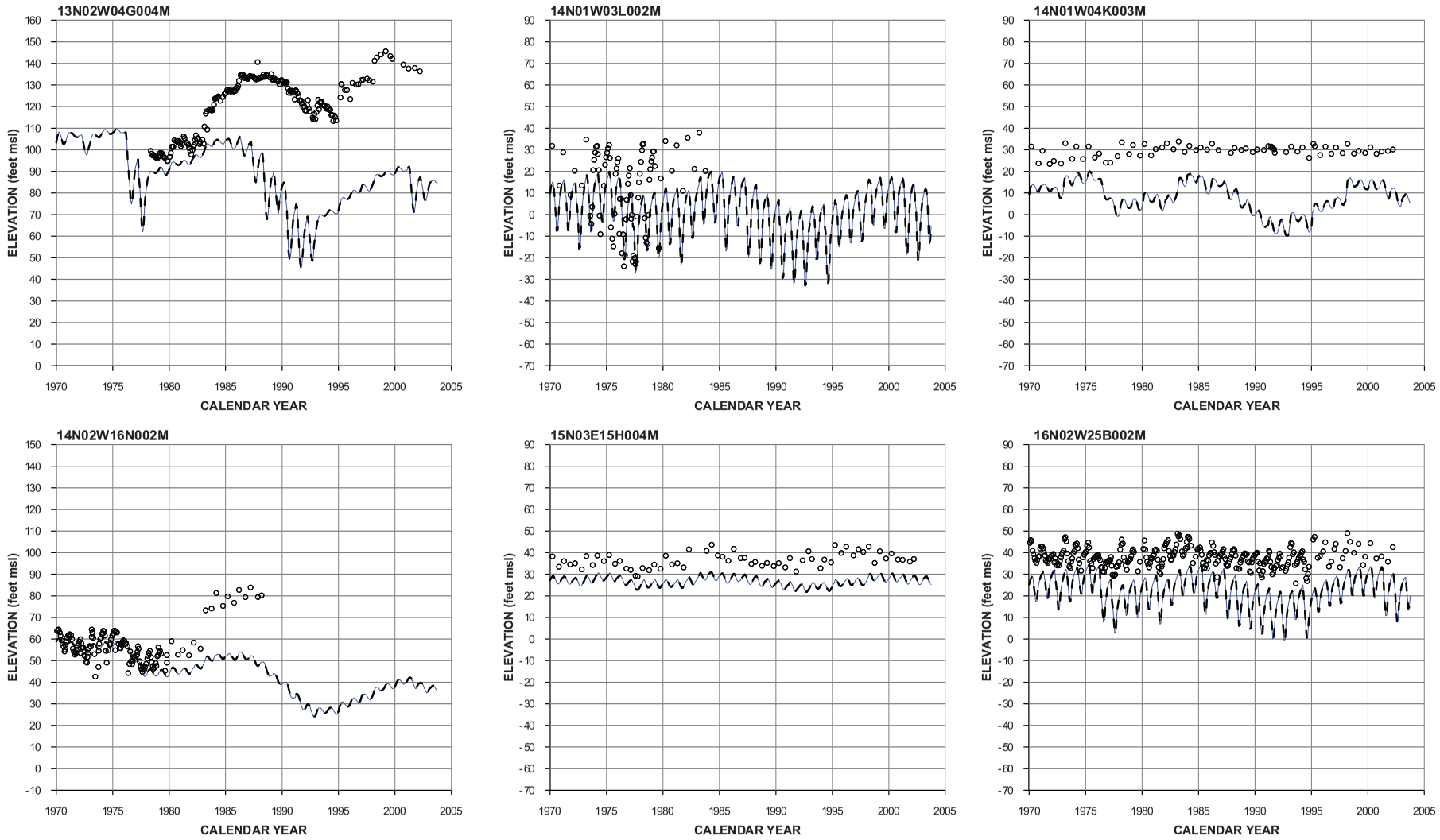

LEGEND

- MEASURED GROUNDWATER ELEVATION
- SIMULATED DATA - ORIGINAL VERSION OF SACFEM
- SIMULATED DATA - REFINED VERSION OF SACFEM WITH REVISED CACHE CREEK CONCEPTUALIZATION

NOTE:

SEE FIGURE C-2 FOR LOCATION OF CALIBRATION WELLS.

FIGURE C-4 (PAGE 2 OF 2)
SIMULATED AND MEASURED GROUNDWATER ELEVATION VERSUS TIME

APPLICATION OF SACFEM TO THE MFWC GROUNDWATER PRODUCTION ELEMENT PROJECT

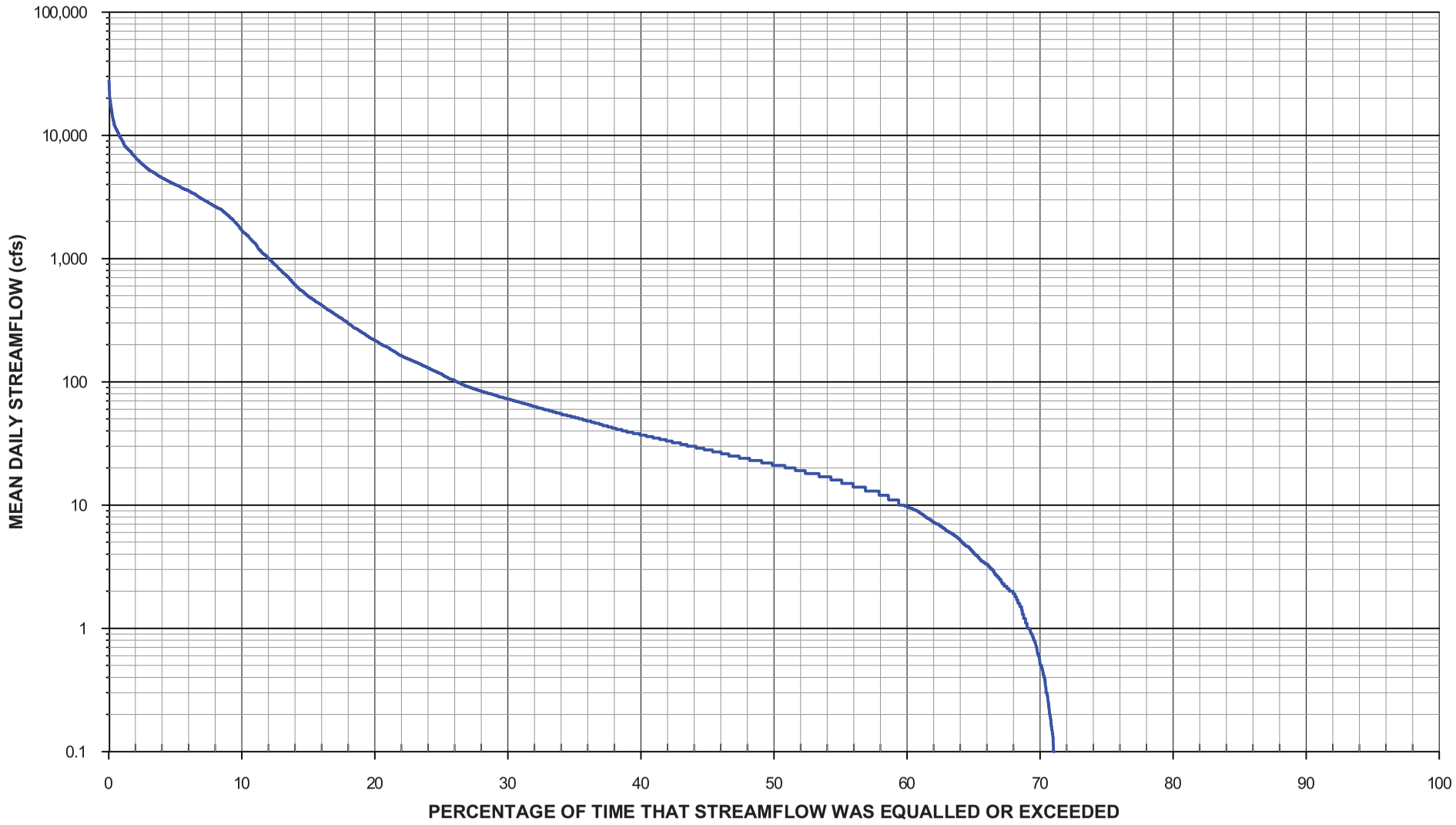

FIGURE C-5
CACHE CREEK
STREAMFLOW EXCEEDANCE PLOT
APPLICATION OF SACFEM TO THE MFWC
GROUNDWATER PRODUCTION ELEMENT PROJECT

NOTES:

1) MEASURED STREAMFLOW AT USGS GAGE No. 11452500, CACHE CREEK AT YOLO, CALIFORNIA
2) EVALUATED PERIOD OF GAGE RECORD: OCTOBER 1969 THROUGH SEPTEMBER 2003

CH2MHILL

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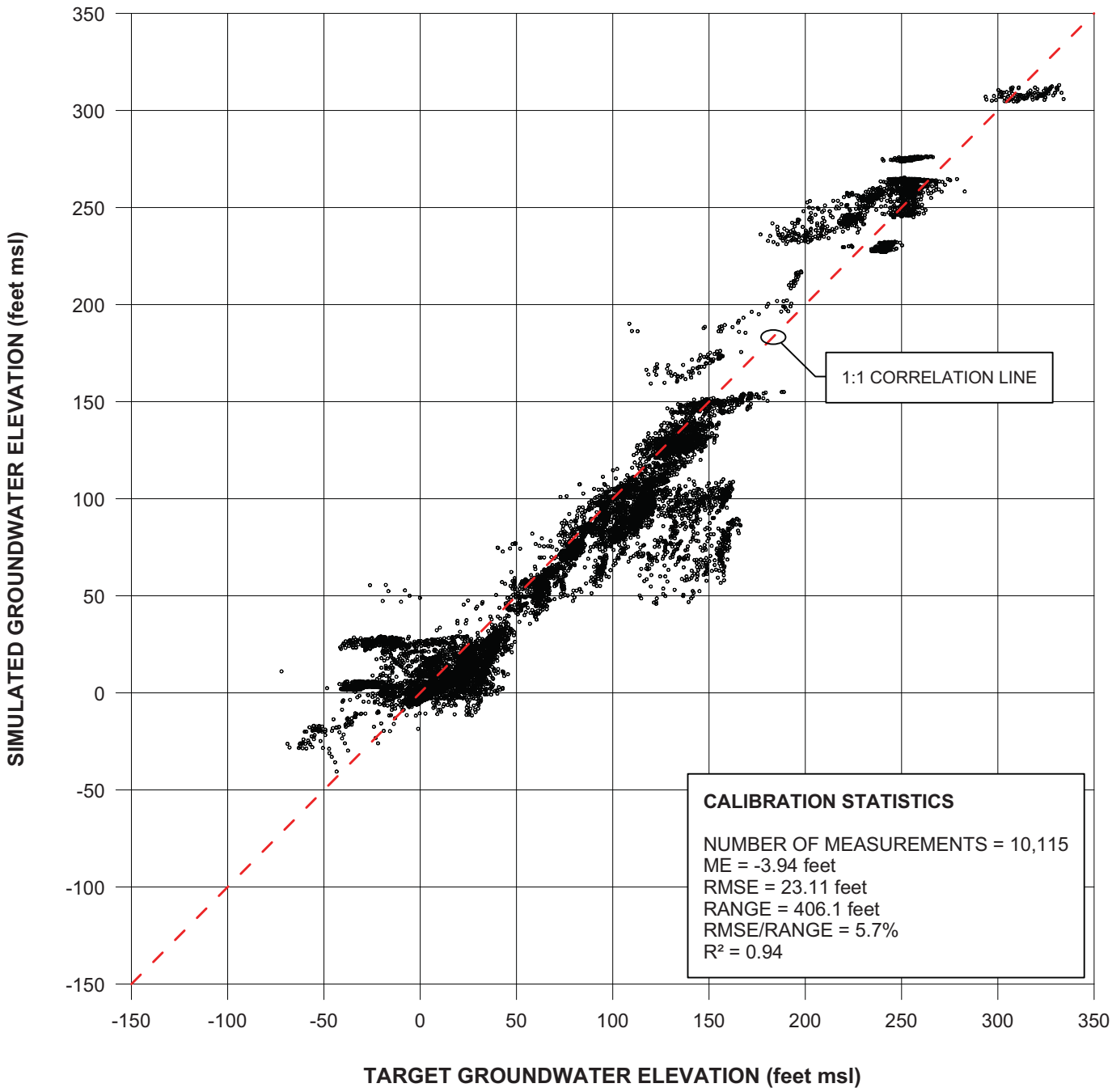
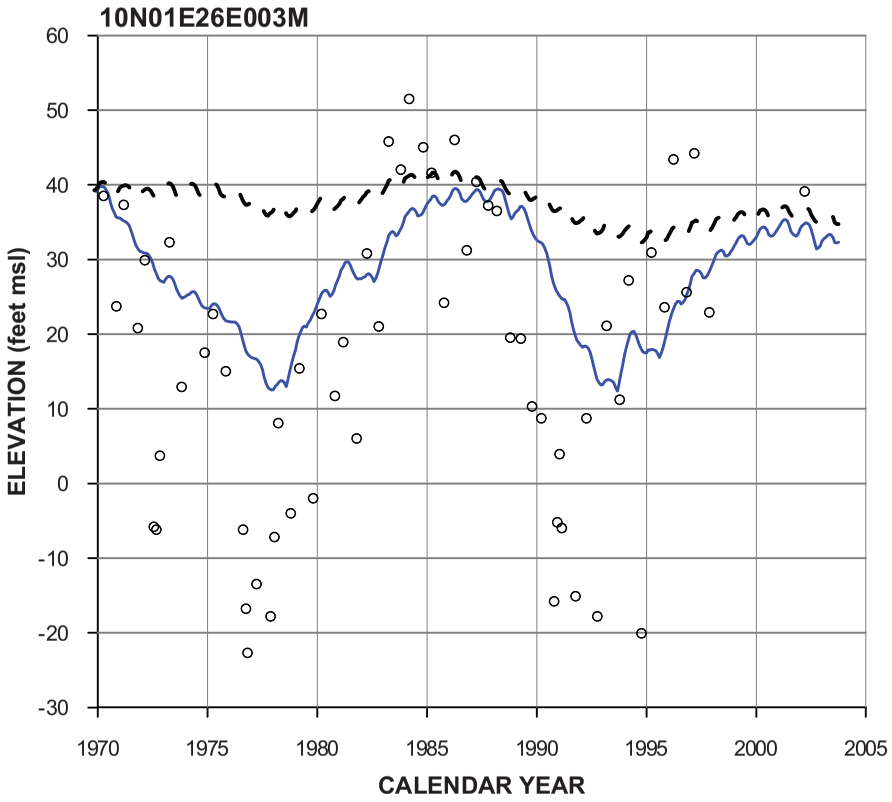


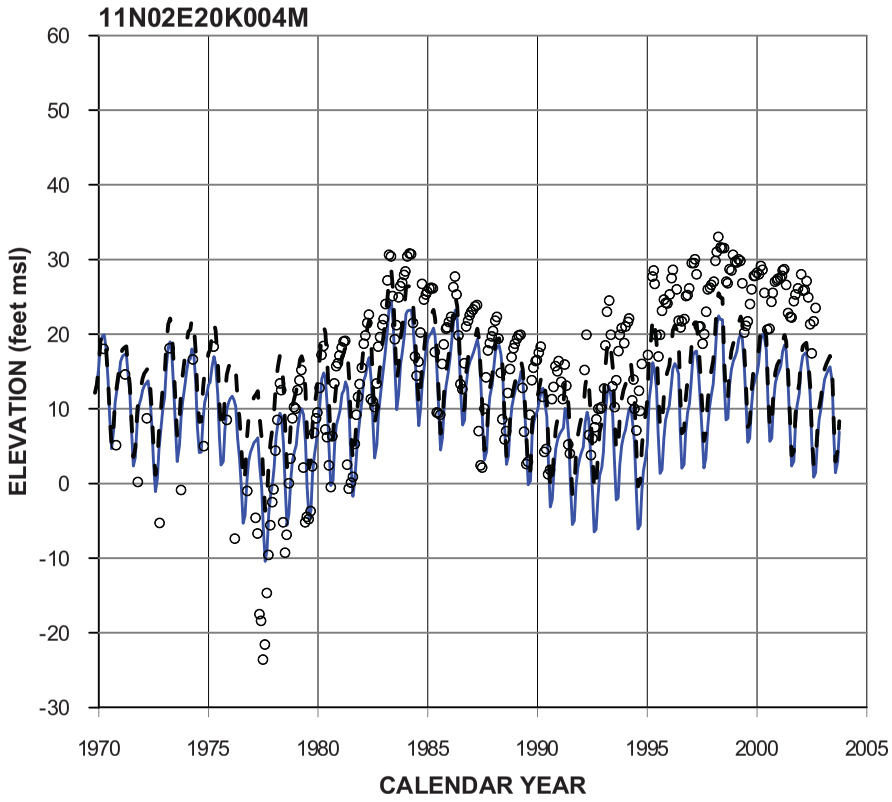
NOTES:

ME = MEAN RESIDUAL ERROR
MSL = MEAN SEA LEVEL
RMSE = ROOT MEAN SQUARE ERROR
RANGE = RANGE IN TARGET GROUNDWATER LEVELS
R^2 = SQUARE OF THE CORRELATION COEFFICIENT

FIGURE C-6
SACFEM CALIBRATION SCATTERGRAM
REFINED CACHE CREEK CONCEPTUALIZATION
APPLICATION OF SACFEM TO THE MFWC
GROUNDWATER PRODUCTION ELEMENT PROJECT

CH2MHILL





LEGEND

- ○ MEASURED GROUNDWATER ELEVATION
- — — SIMULATED DATA - ORIGINAL VERSION OF SACFEM
- ——— SIMULATED DATA - REFINED VERSION OF SACFEM WITH REVISED CACHE CREEK CONCEPTUALIZATION

FIGURE C-7
SIMULATED AND MEASURED GROUNDWATER ELEVATION VERSUS TIME

APPLICATION OF SACFEM TO THE MFWC GROUNDWATER PRODUCTION ELEMENT PROJECT

NOTE:

SEE FIGURE C-2 FOR LOCATION OF CALIBRATION WELLS.

CH2MHILL

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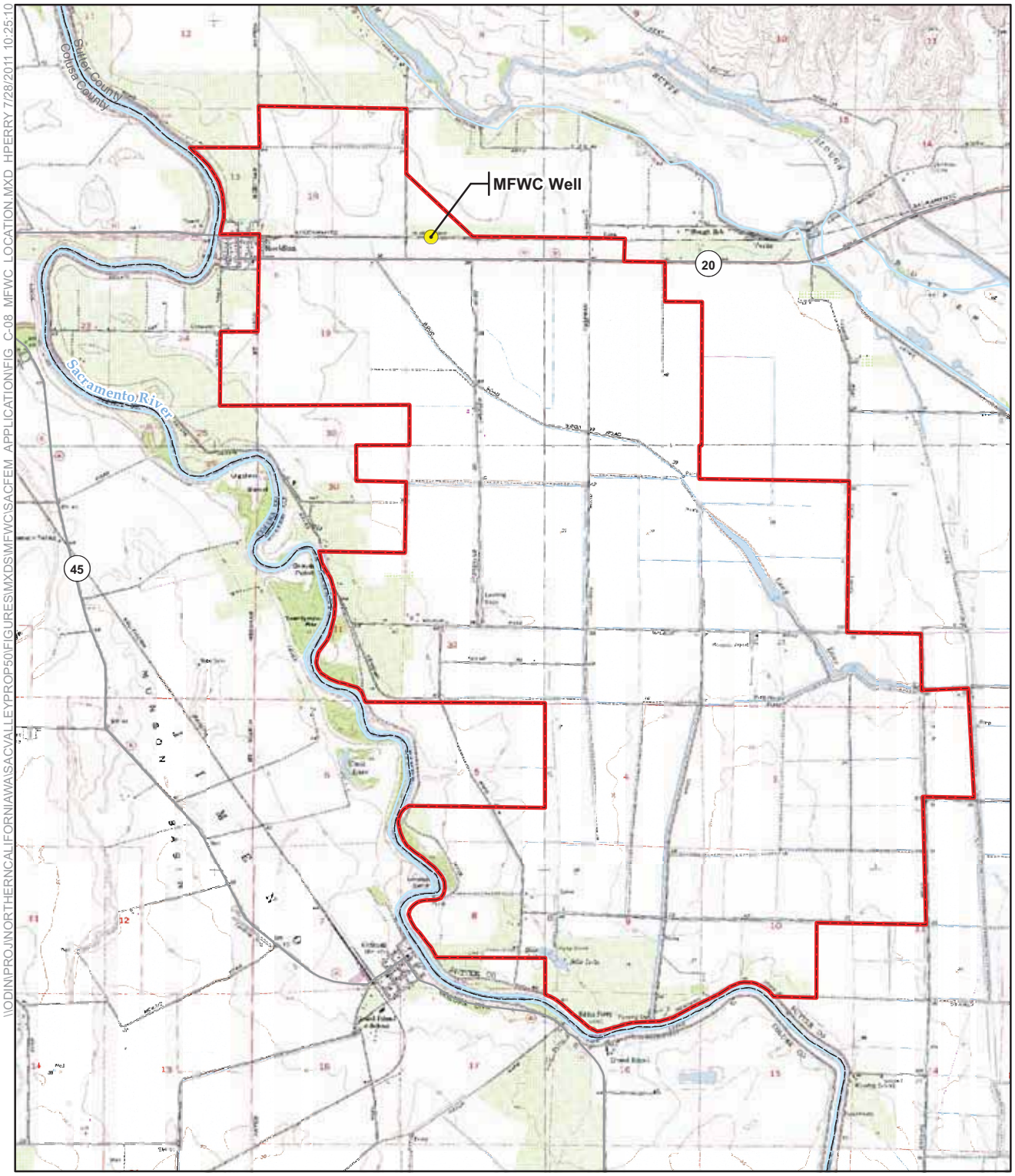


LEGEND

- PROPOSED WELL LOCATION
- MAJOR WATERWAY
- COUNTY BOUNDARY
- MFWC DISTRICT BOUNDARY

N

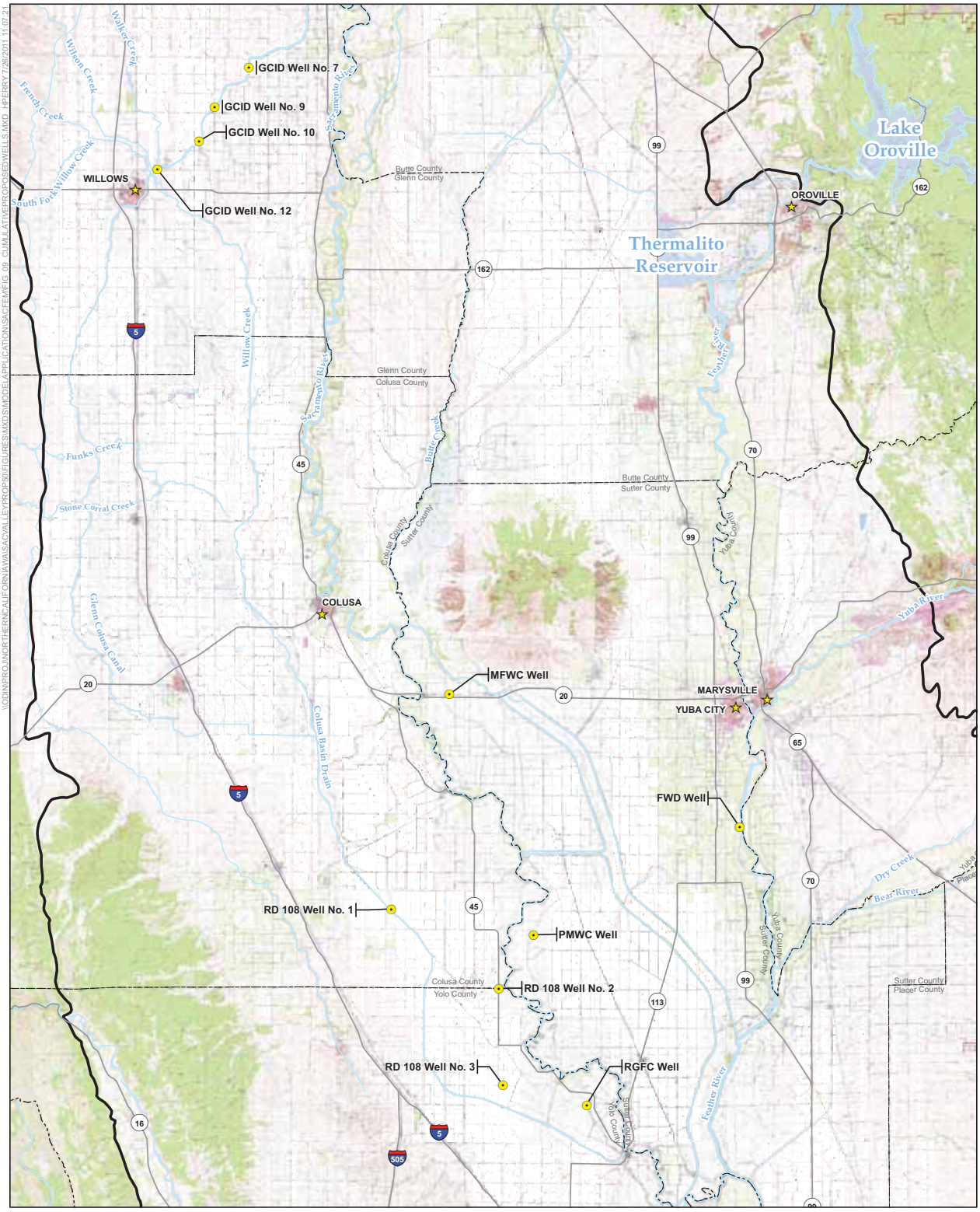
0 1

Miles

FIGURE C-8
LOCATION OF PROPOSED PRODUCTION WELL
APPLICATION OF SACFEM TO THE MFWC GROUNDWATER PRODUCTION ELEMENT PROJECT

CH2MHILL

\\ODIN\PROJ\NORTHERNCALIFORNIAWA\SACVALLEYPROP50\FIGURES\MXDS\MFWC\SACFEM APPLICATION\FIG C-08 MFWC LOCATION.MXD HPERRY 7/28/2011 10:25:10



LEGEND

- PROPOSED WELL LOCATION
- CITY
- MAJOR WATERWAY
- COUNTY BOUNDARY
- SACRAMENTO VALLEY GROUNDWATER BASIN

NOTES:
FWD = FEATHER WATER DISTRICT
GCID = GLENN-COLUSA IRRIGATION DISTRICT
PMWC = PELGER MUTUAL WATER COMPANY
RD 108 = RECLAMATION DISTRICT 108
RGFC = RIVER GARDEN FARMS COMPANY

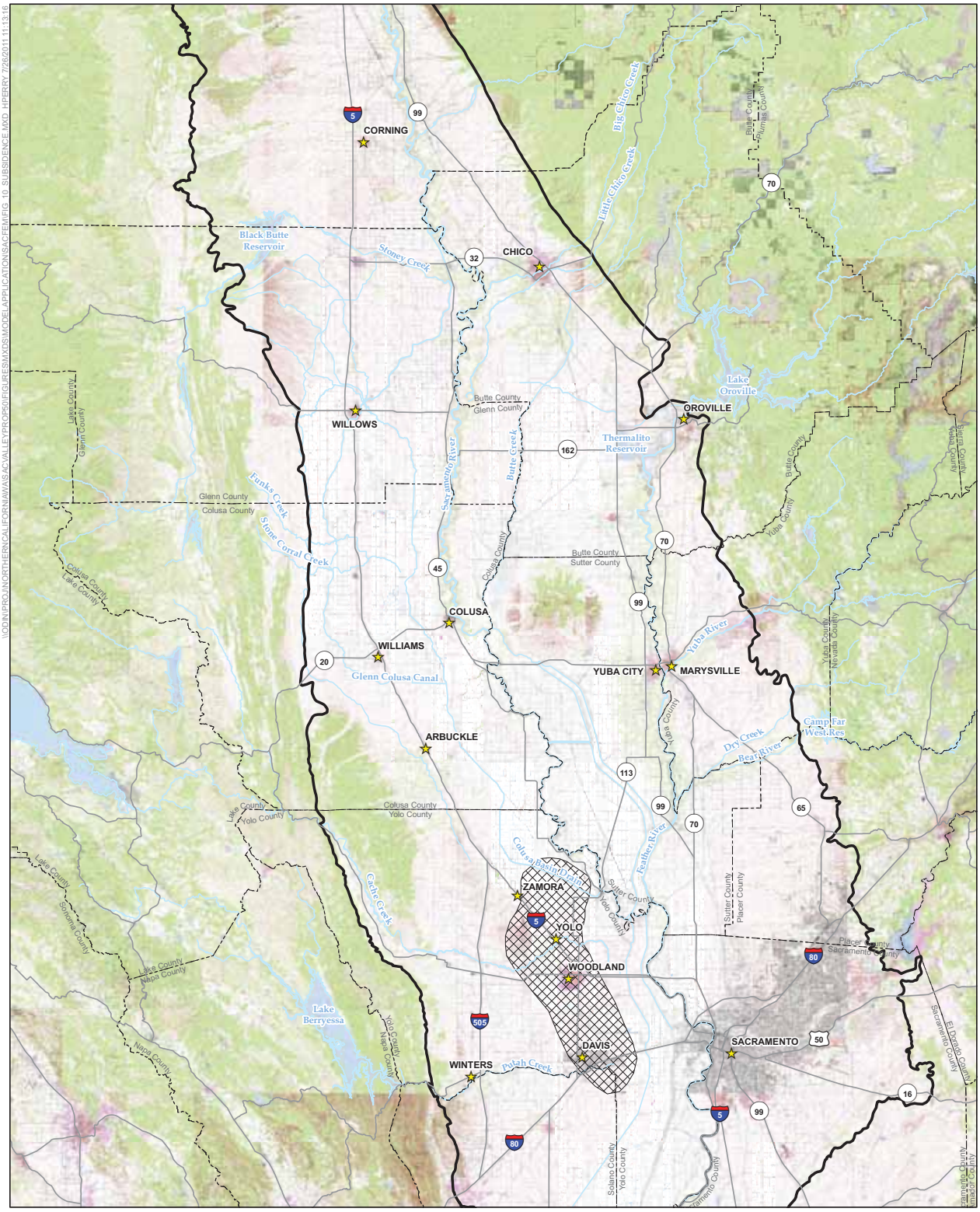
N

0 5
Miles

FIGURE C-9
CUMULATIVE SIMULATION
PROPOSED PRODUCTION WELL LOCATIONS
APPLICATION OF SACFEM TO THE MFWC
GROUNDWATER PRODUCTION ELEMENT PROJECT

CH2MHILL

\\ODIN\PROJ\NORTHERNCALIFORNIA\WASACVALLEY\PROP50\FIGURES\MXD\SIMODELAPPLICATION\SACFEMFIG 09_CUMULATIVEPROPOSEDWELLS.MXD HPERRY 7/28/2011 11:07:21



LEGEND

- CITY
- MAJOR WATERWAY
- COUNTY BOUNDARY
- SACRAMENTO VALLEY GROUNDWATER BASIN
- AREA OF LAND SUBSIDENCE GREATER THAN 1 FOOT

Source: Bertoldi, 1991

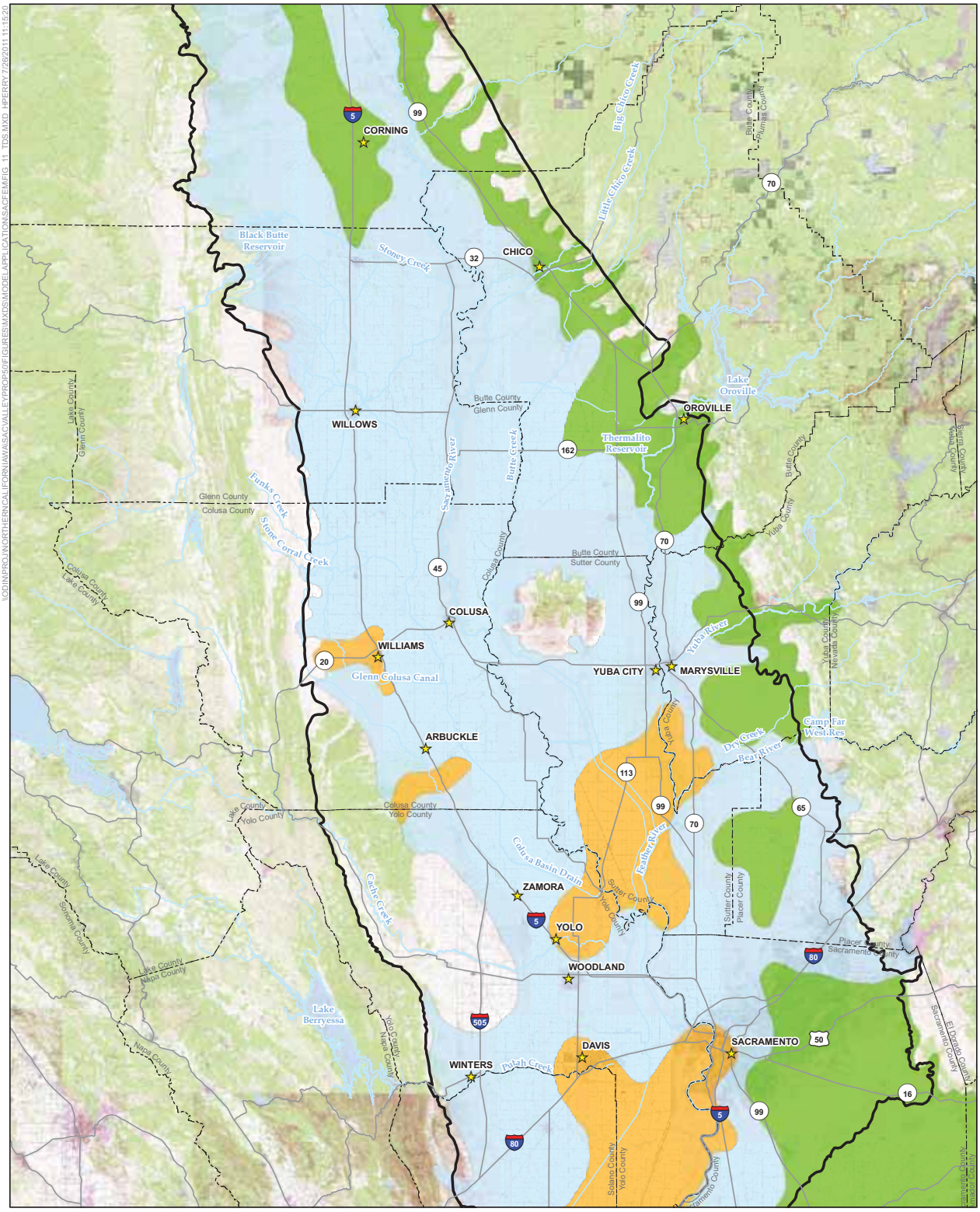
N

0 10
Miles

FIGURE C-10
DISTRIBUTION OF LAND SUBSIDENCE
APPLICATION OF SACFEM TO THE MFWC
GROUNDWATER PRODUCTION ELEMENT PROJECT

CH2MHILL

\\ODIN\PROJ\NORTHERN\CALIFORNIA\WASA\CVALLEYPROP50\FIGURES\MXDS\MODELAPPLICATIONS\SACFEM\FIG 10 SUBSIDENCE.MXD HPERRY 7/26/2011 11:13:16



Source: Bertoldi, 1991

LEGEND

- CITY
- MAJOR WATERWAY
- COUNTY BOUNDARY
- SACRAMENTO VALLEY GROUNDWATER BASIN

CONCENTRATION (mg/L)

- < 200
- 200 to 500
- 501 to 1500

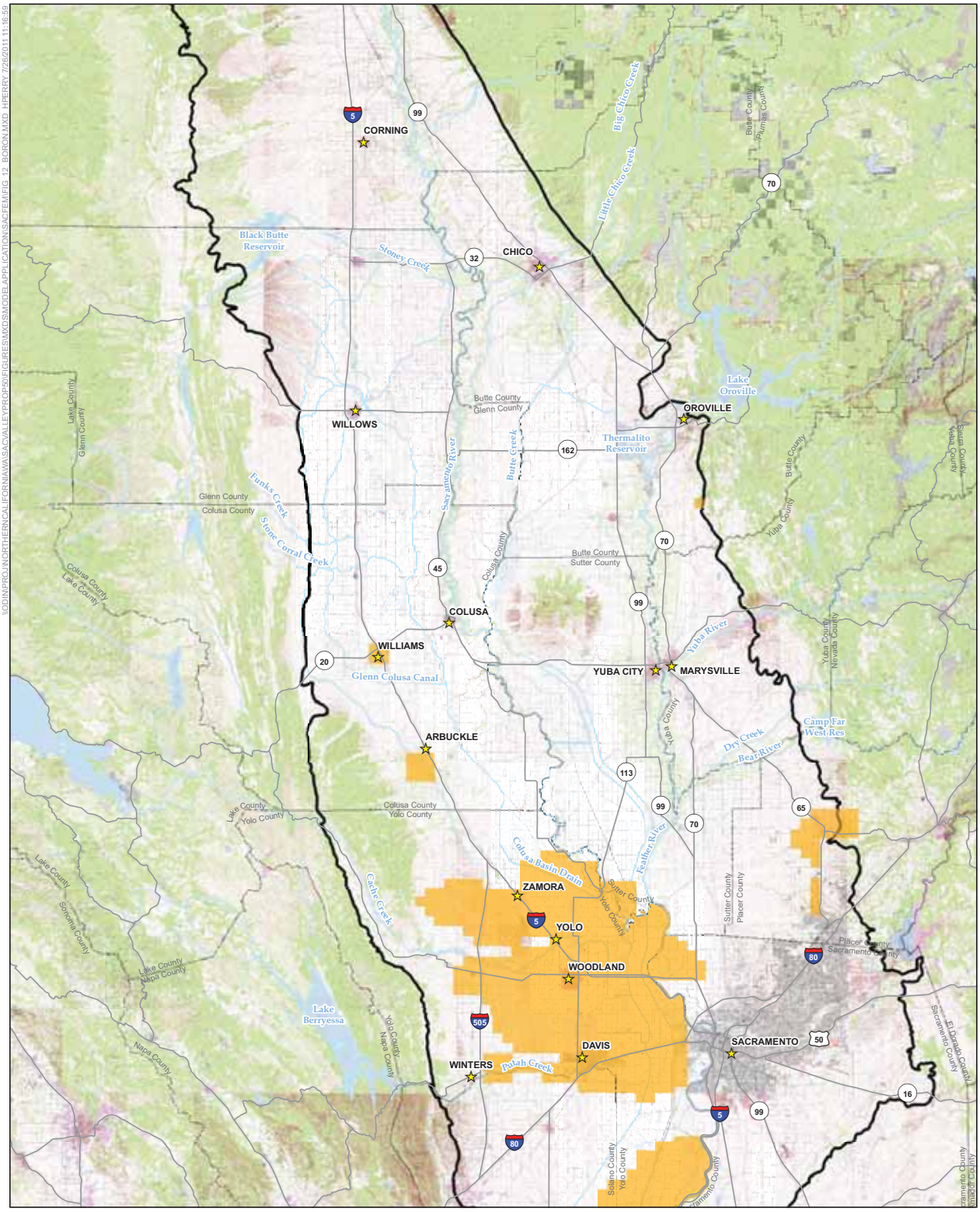
N

0 10
Miles

FIGURE C-11
DISTRIBUTION OF TOTAL DISSOLVED SOLIDS IN GROUNDWATER
APPLICATION OF SACFEM TO THE MFWC GROUNDWATER PRODUCTION ELEMENT PROJECT

CH2MHILL

\\ODIN\PROJ\NORTHERNCALIFORNIA\VAISAC\VALLEYPROP50\FIGURES\MXDS\MODELAPPLICATION\SACFEM\FIG 11 TDS.MXD HPERRY 7/28/2011 11:15:20



LEGEND

- CITY
- MAJOR WATERWAY
- COUNTY BOUNDARY
- SACRAMENTO VALLEY GROUNDWATER BASIN
- AREA WHERE BORON CONCENTRATION IN GROUNDWATER IS GREATER THAN 0.75 mg/L

DATA SOURCES: BERTOLDI, 1976; EVENSON, 1985; FOGELMAN, 1978; FOGELMAN, 1979; AND JOHNSON, 1985.

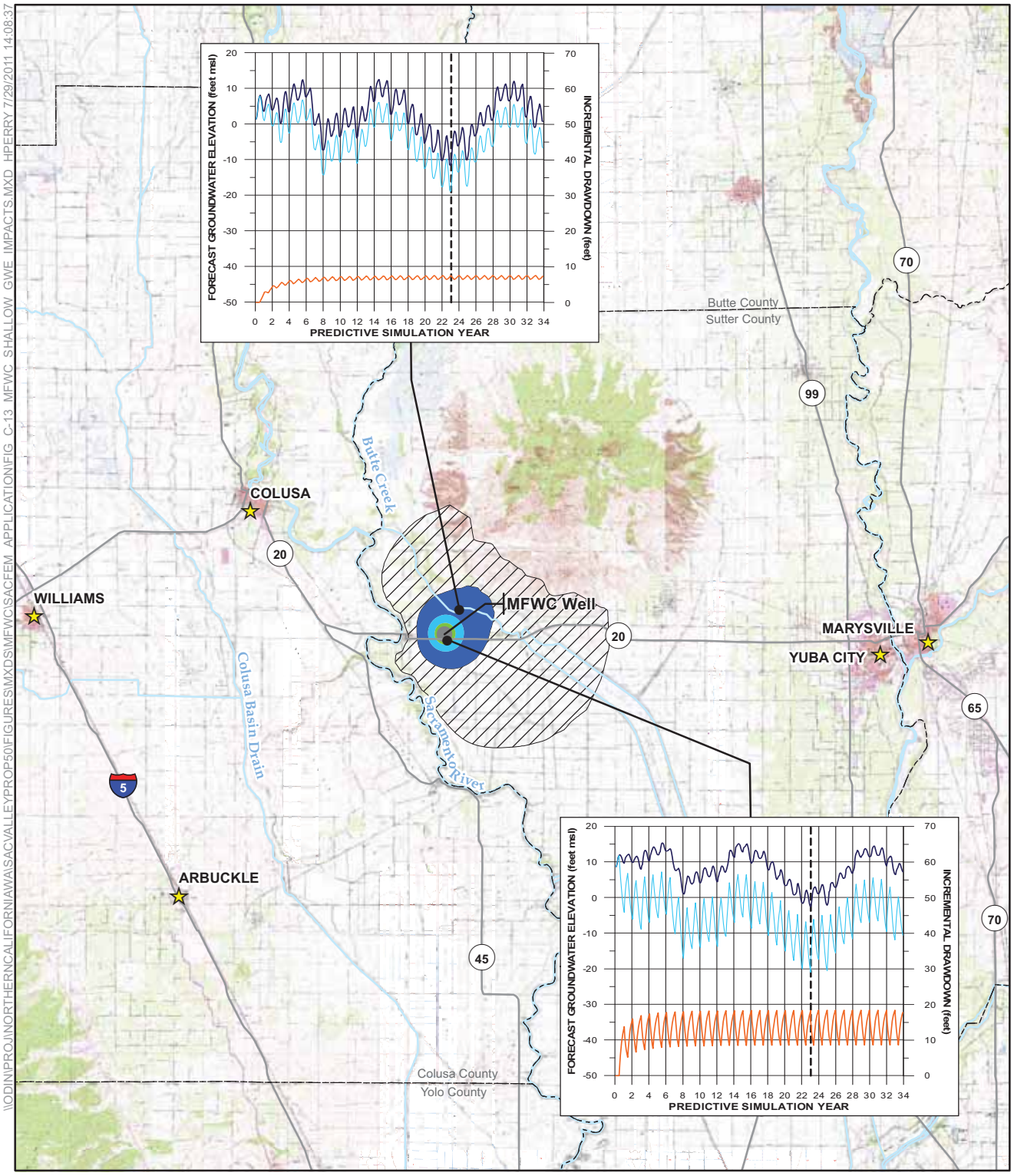
N

0 10
Miles

FIGURE C-12
DISTRIBUTION OF BORON GREATER THAN 0.75 mg/L IN GROUNDWATER
APPLICATION OF SACFEM TO THE MFWC GROUNDWATER PRODUCTION ELEMENT PROJECT

CH2MHILL

\\ODIN\PROJ\NORTHERNCALIFORNIA\WASACVALLEYPROP50\FIGURES\MXDS\MODELAPPLICATIONS\SACFEM\FIG_12_BORON.MXD HPERRY 7/26/2011 11:16:59



MAP LEGEND

- 0.25-MILE BUFFER
- LOCATION OF FORECAST GROUNDWATER ELEVATION AND INCREMENTAL DRAWDOWN

INCREMENTAL DRAWDOWN (feet)

- 1 to 5
- 5 to 10
- 10 to 15
- 15 to 20
- 20 to 25
- 25 to 30

HYDROGRAPH LEGEND

- INCREMENTAL DRAWDOWN
- BASELINE SIMULATION GROUNDWATER ELEVATION
- PROJECT SIMULATION GROUNDWATER ELEVATION
- TIME OF INCREMENTAL DRAWDOWN DISPLAYED ON MAP

N

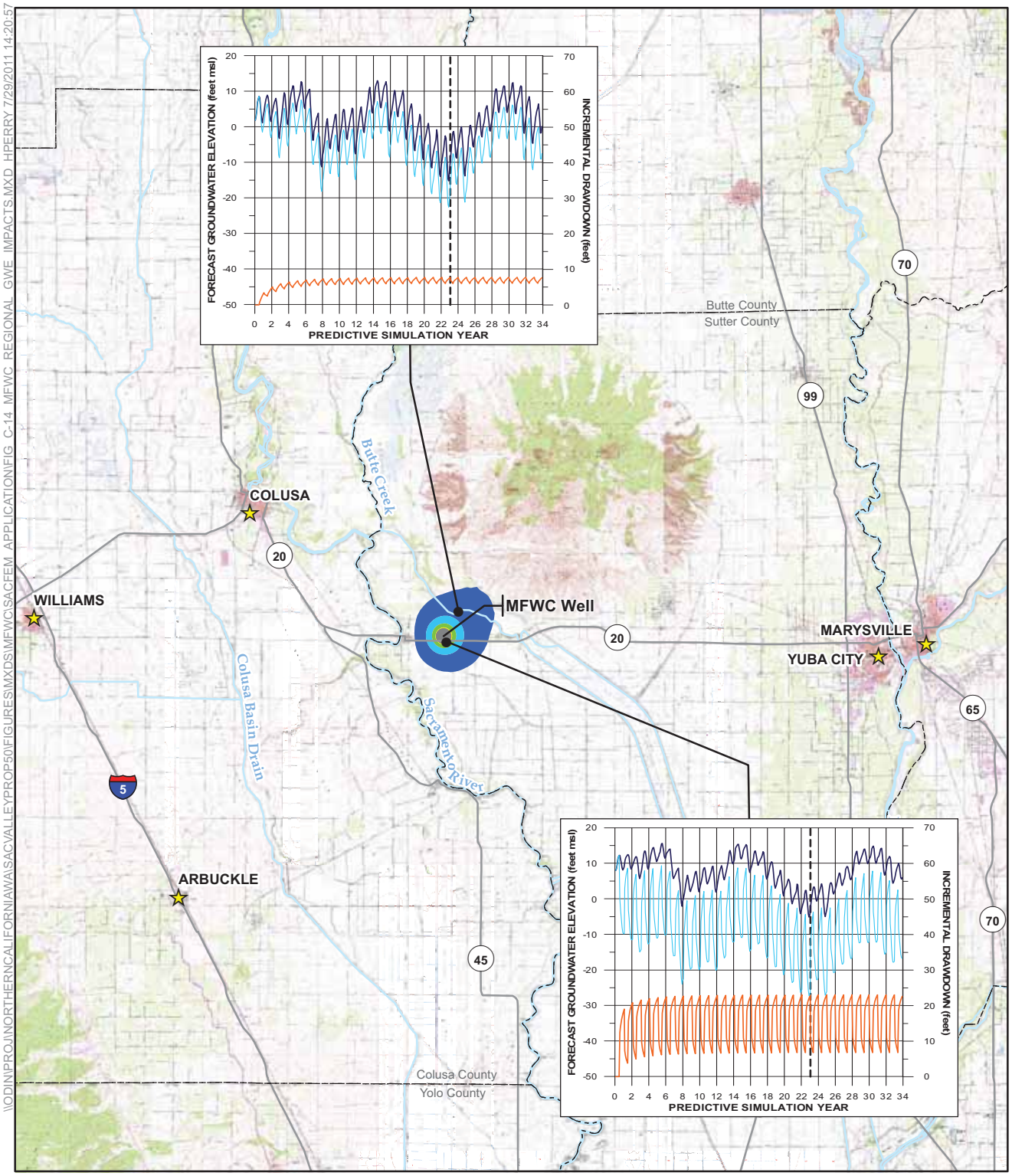
0 5
Miles

NOTE:
SEE TABLE C-2 FOR A DESCRIPTION OF THE PREDICTIVE SIMULATION YEAR.

FIGURE C-13
LOCAL IMPACTS
FORECAST SHALLOW AQUIFER DRAWDOWN
APPLICATION OF SACFEM TO THE MFWC GROUNDWATER PRODUCTION ELEMENT PROJECT

CH2MHILL

\\ODIN\PROJ\NORTHERNCALIFORNIAWA\SACVALLEYPROP50\FIGURES\MXDS\MFWC\SACFEM APPLICATION\FIG C-13 MFWC SHALLOW GWE IMPACTS.MXD HPERRY 7/29/2011 14:08:37



MAP LEGEND

- 0.25-MILE BUFFER LOCATION OF FORECAST GROUNDWATER ELEVATION AND INCREMENTAL DRAWDOWN

INCREMENTAL DRAWDOWN (feet)

- 5 to 10
- 10 to 15
- 15 to 20
- 20 to 25
- 25 to 30

HYDROGRAPH LEGEND

- INCREMENTAL DRAWDOWN
- BASELINE SIMULATION GROUNDWATER ELEVATION
- PROJECT SIMULATION GROUNDWATER ELEVATION
- TIME OF INCREMENTAL DRAWDOWN DISPLAYED ON MAP

N

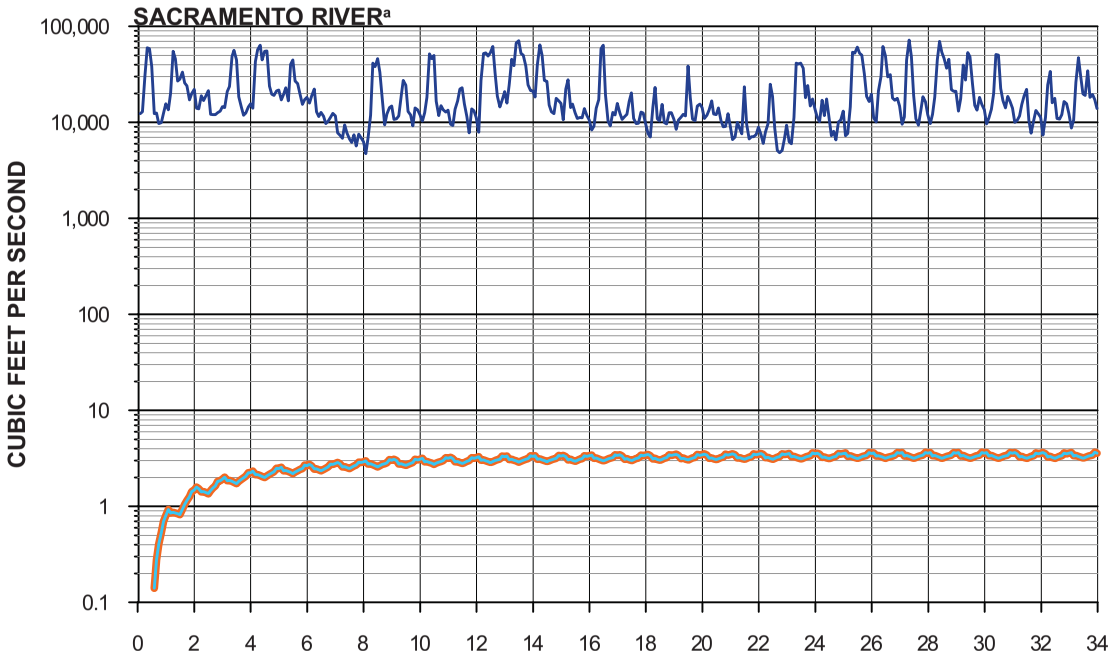
0 5
Miles

NOTE:
SEE TABLE C-2 FOR A DESCRIPTION OF THE PREDICTIVE SIMULATION YEAR.

FIGURE C-14
LOCAL IMPACTS
FORECAST REGIONAL AQUIFER DRAWDOWN
APPLICATION OF SACFEM TO THE MFWC GROUNDWATER PRODUCTION ELEMENT PROJECT

CH2MHILL

\\ODIN\PROJ\NORTHERNCALIFORNIA\WA\SACVALLEYPROP50\FIGURES\MXDS\MFWC\SACFEM APPLICATION\FIG C-14 MFWC REGIONAL GWE IMPACTS.MXD HPERRY 7/29/2011 14:20:57



LEGEND

- MEAN MONTHLY MEASURED STREAMFLOW
- FORECAST STREAMFLOW REDUCTION - UPSTREAM OF GAGE
- FORECAST STREAMFLOW REDUCTION - ENTIRE STREAM

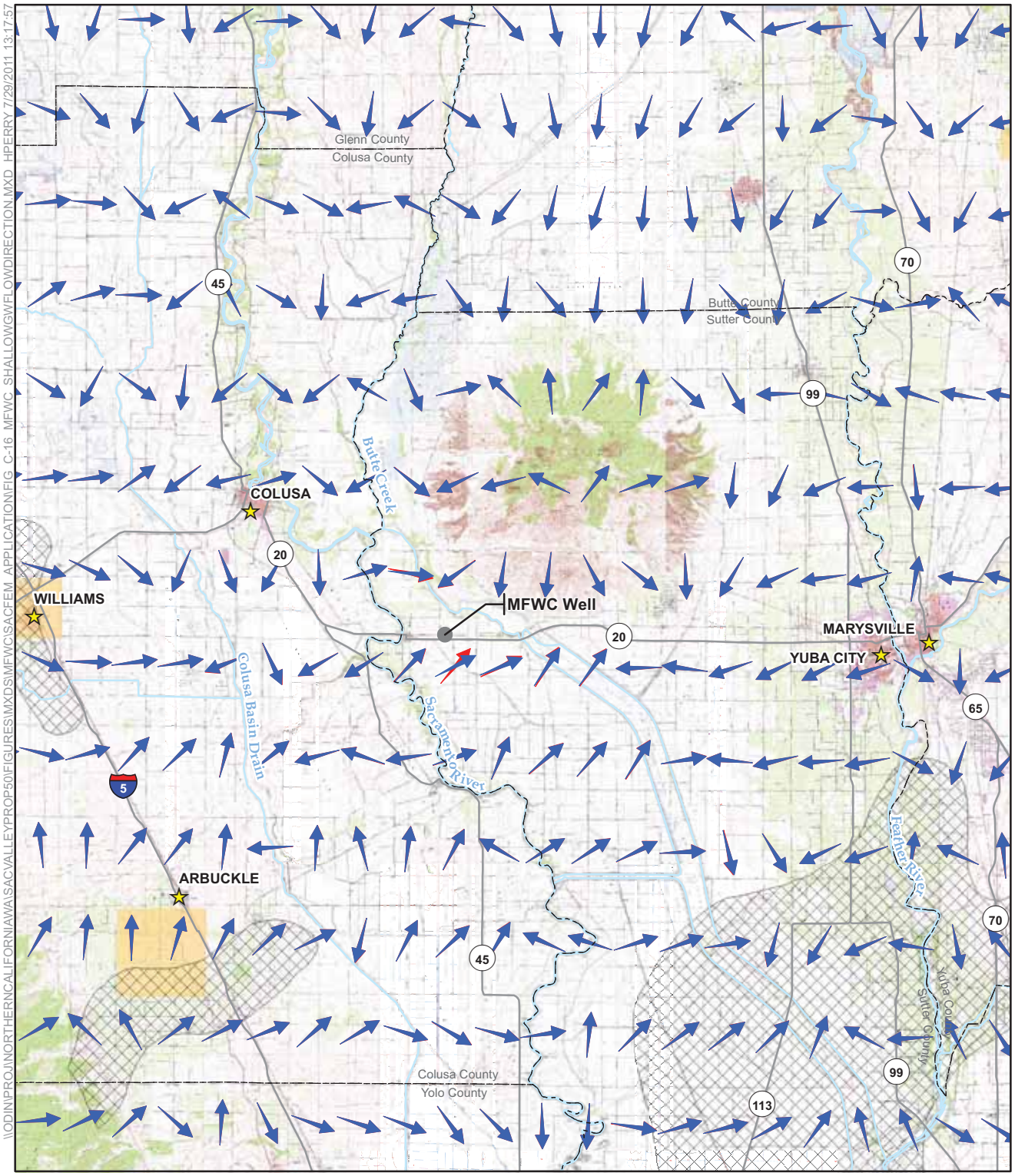
PREDICTIVE SIMULATION YEAR	WATER-YEAR HYDROLOGY	PREDICTIVE SIMULATION YEAR	WATER-YEAR HYDROLOGY
1	1970	18	1987
2	1971	19	1988
3	1972	20	1989
4	1973	21	1990
5	1974	22	1991
6	1975	23	1992
7	1976	24	1993
8	1977	25	1994
9	1978	26	1995
10	1979	27	1996
11	1980	28	1997
12	1981	29	1998
13	1982	30	1999
14	1983	31	2000
15	1984	32	2001
16	1985	33	2002
17	1986	34	2003

[a]MEASURED STREAMFLOW AT USGS GAGE No. 11425500, SACRAMENTO RIVER AT VERONA, CALIFORNIA.

FIGURE C-15
LOCAL IMPACTS
FORECAST STREAM IMPACTS
APPLICATION OF SACFEM TO THE MFWC GROUNDWATER PRODUCTION ELEMENT PROJECT

CH2MHILL

'\\odin\proj\northernCaliforniaWa\SacValleyProp50\Figures\Grapher\SACFEM_APPLICATION\Fig_E-15_RGFC_StreamImpacts.grf



\\ODIN\PROJ\NORTHERNCALIFORNIAWA\SACVALLEYPROP50\FIGURES\MXDS\MFWC\SACFEM APPLICATION\FIG C-16 MFWC SHALLOWGWFLOWDIRECTION.MXD HPERRY 7/29/2011 13:17:57

LEGEND

- 0.25-MILE BUFFER
- CITY
- MAJOR WATERWAY
- COUNTY BOUNDARY
- TDS CONCENTRATION GREATHER THAN 500 mg/L
- BORON CONCENTRATION GREATER THAN 0.75 mg/L
- BASELINE SIMULATION GROUNDWATER FLOW DIRECTION
- PROJECT SIMULATION GROUNDWATER FLOW DIRECTION

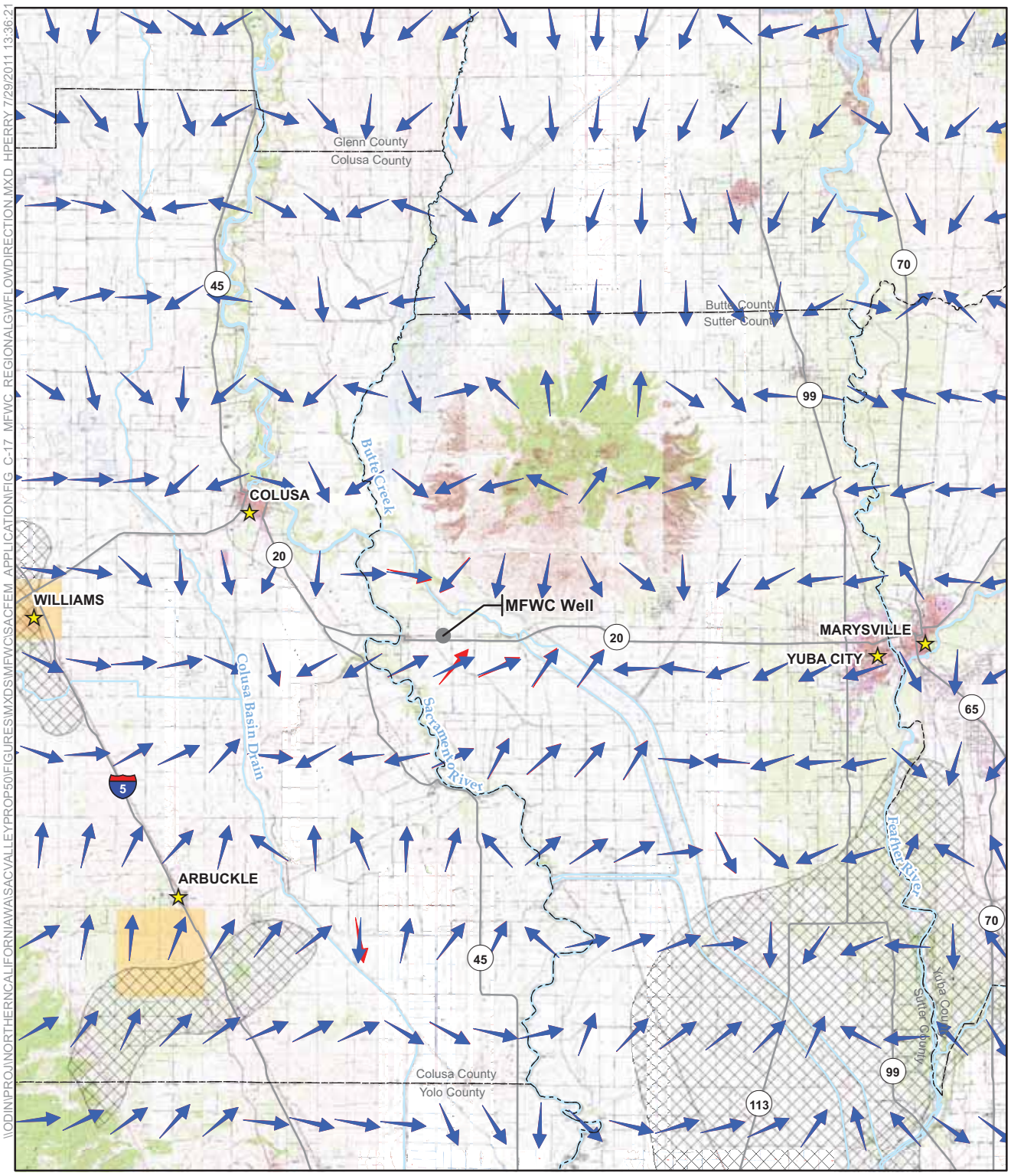
NOTES:
GROUNDWATER FLOW DIRECTIONS SHOWN OCCUR NEAR THE END OF PREDICTIVE SIMULATION YEAR 23 (OCTOBER 1992).
DATA SOURCES: BERTOLDI, 1976; BERTOLDI, 1991; EVENSON, 1985; FOGELMAN, 1978; FOGELMAN, 1979; AND JOHNSON, 1985.

N

0 5
Miles

FIGURE C-16
LOCAL IMPACTS
FORECAST TEMPORARY GROUNDWATER FLOW DIRECTION IN THE SHALLOW AQUIFER
APPLICATION OF SACFEM TO THE MFWC GROUNDWATER PRODUCTION ELEMENT PROJECT

CH2MHILL



LEGEND

- 0.25-MILE BUFFER
- CITY
- MAJOR WATERWAY
- COUNTY BOUNDARY
- TDS CONCENTRATION GREATHER THAN 500 mg/L
- BORON CONCENTRATION GREATER THAN 0.75 mg/L
- BASELINE SIMULATION GROUNDWATER FLOW DIRECTION
- PROJECT SIMULATION GROUNDWATER FLOW DIRECTION

NOTES:
GROUNDWATER FLOW DIRECTIONS SHOWN OCCUR NEAR THE END OF PREDICTIVE SIMULATION YEAR 23 (OCTOBER 1992).
DATA SOURCES: BERTOLDI, 1976; BERTOLDI, 1991; EVENSON, 1985; FOGELMAN, 1978; FOGELMAN, 1979; AND JOHNSON, 1985.

N

0 5
Miles

FIGURE C-17
LOCAL IMPACTS
FORECAST TEMPORARY GROUNDWATER FLOW DIRECTION IN THE REGIONAL AQUIFER
APPLICATION OF SACFEM TO THE MFWC GROUNDWATER PRODUCTION ELEMENT PROJECT

CH2MHILL

\\ODIN\PROJ\NORTHERNCALIFORNIAWA\SACVALLEYPROP50\FIGURES\MXDS\MFWC\SACFEM APPLICATION\FIG C-17 MFWC REGIONALGWFLOWDIRECTION.MXD HPERRY 7/29/2011 13:36:21