FRESNO COUNTY PUBLIC HEALTH LABORATORY

1221 Fulton Mall, Fresno CA 93721 P.O. Box 11867 Fresno, CA 93775
Phone: (559)445-3407 Alt. Phone: (559)445-3387 Fax: (559)445-3540
ELAP Certification Number: 1868 James J. Spolsdoff, Laboratory Director

Lab Number	Account #	Date Received	Date Collected	Time Collected	Collector/Inspector
0706-08144	18212	6/1/2007	5/30/2007	11:05 AM	Jenifer McPhetridge

Ken Schmidt & Associates
600 W. Shaw Ste. #250
Fresno,CA 93704

Attn: Ken Schmidt

SystemType: 02
Sample Type: Routine
Water Sys #:
Census Tract:
Well Number:
APN:

GENERAL MINERAL, PHYSICAL & INORGANIC CHEMISTRY ANALYSES

Analysis	Stored #	Result	Flag	MCL	DLR	Chemist	Date Analyzed
Arsenic	01002	5.9 µg/L		10 µg/L	2 µg/L	E. Lennon, PHC	6/14/2007
Iron	01045	<100 µg/L		300 µg/L	100 µg/L	S. Stasikonis, PHC	6/7/2007
Manganese	01055	<20 µg/L		50 µg/L	20 µg/L	E. Lennon, PHC	6/14/2007
S.E.C.	00096	240 µmho/cm		900 µmho/cm	20 µmho/cm	K. Lor, PHC	6/1/2007
Fluoride	00951	0.1 mg/L		2.0 mg/L	0.1 mg/L	L. Assadourian	6/1/2007
Nitrate (ion)	71850	4.1 mg/L		45 mg/L	2.0 mg/L	L. Assadourian	6/1/2007
pH	00403	7.02 Std Units				K. Lor, PHC	6/1/2007
TDS	70300	190 mg/L		500 mg/L	1 mg/L	K. Lor, PHC	6/5/2007

MCL = Maximum Contaminant Level
DLR = Detection Level for Reporting
QNS = Quantity Not Sufficient for Analysis
NTP = No Test Performed on Sample
Flag = "High" If Result Exceeds MCL

Director / Chemistry Supervisor / QA Officer

Date Reported: 06/20/2007

FRESNO COUNTY PUBLIC HEALTH LABORATORY

1221 Fulton Mall, Fresno CA 93721 P.O. Box 11867 Fresno, CA 93775
Phone: (559)445-3407 Alt. Phone: (559)445-3357 FAX: (559)445-3500
State of California Laboratory Accreditation Program Certification Number 1888
James J. Spalsbott, Laboratory Director

0706-08144	6/1/2007	5/30/2007	11:05 AM	Jenifer McPhetridge
LabNumber	Date Received	Date Collected	Time Collected	Collector/Inspector

Ken Schmidt & Associates
600 W. Shaw Ste. #250
Fresno,CA 93704

Attn: Ken Schmidt

Account # 18212
System Type 02
Sample Type 01
Water Sys #
Census Tract
Well Number
APN

RADIOLOGICAL TEST RESULTS BY EPA METHOD 900.0

Analysis	Result (pCi/L)	C.E. (± pCi/L)	MCL	Date Prepared	Date Analyzed	Chemist
Gross Alpha	48.0	8.45	15	6/5/2007	7/11/2007	Larissa Asadourian

Analyst:

DateReported: 7/11/2007

FRESNO COUNTY PUBLIC HEALTH LABORATORY

1221 Fulton Mall, Fresno CA 93721 P.O. Box 11867 Fresno, CA 93775
Phone: (559)445-3407 Alt. Phone: (559)445-3297 Fax: (559)445-3560
ELAP Certification Number: 1858 James J. Spoldsdoff, Laboratory Director

Lab Number	Account #	Date Received	Date Collected	Time Collected	Collector/Inspector
0706-08143	18212	6/1/2007	5/30/2007	2:10 PM	Jenifer McPhetridge

Ken Schmidt & Associates
600 W. Shaw Ste. #250
Fresno,CA 93704

Attn: Ken Schmidt

System Type: 02
Sample Type: Routine
Water Sys #:
Census Tract:
Well Number:
APN:

GENERAL MINERAL, PHYSICAL & INORGANIC CHEMISTRY ANALYSES

Analysis	Storet #	Result	Flag	MCL	DLR	Chemist	Date Analyzed
Arsenic	01002	3.3 µg/L		10 µg/L	2 µg/L	E. Lennon, PHC	6/14/2007
Iron	01045	<100 µg/L		300 µg/L	100 µg/L	S. Stasikonis, PHC	6/7/2007
Manganese	01055	<20 µg/L		50 µg/L	20 µg/L	E. Lennon, PHC	6/14/2007
S.E.C.	00095	257 µmho/cm		900 µmho/cm	20 µmho/cm	K. Lor, PHC	6/1/2007
Fluoride	00951	0.1 mg/L		2.0 mg/L	0.1 mg/L	L. Asaadourian	6/1/2007
Nitrate (ion)	71850	23.8 mg/L		45 mg/L	2.0 mg/L	L. Asaadourian	6/1/2007
pH	00403	7.00 Std Units				K. Lor, PHC	6/1/2007
TDS	70300	200 mg/L		500 mg/L	1 mg/L	K. Lor, PHC	6/5/2007

MCL = Maximum Contaminant Level
DLR = Detection Level for Reporting
QNS = Quantity Not Sufficient for Analysis
NTP = No Test Performed on Sample
Flag = "High" if Result Exceeds MCL

Director / Chemistry Supervisor / QA Officer

Date Reported: 06/20/2007

FRESNO COUNTY PUBLIC HEALTH LABORATORY

1221 Fulton Mall, Fresno CA 93721 P.O. Box 11867 Fresno, CA 93775
Phone: (559)445-3407 Alt. Phone: (559)445-3397 FAX: (559)445-2580
State of California Laboratory Accreditation Program Certification Number 1888
James J. Spolsdoff, Laboratory Director

0706-08143	6/1/2007	5/30/2007	2:10 PM	Jenifer McPhetridge
LabNumber	Date Received	Date Collected	Time Collected	Collector/Inspector

Ken Schmidt & Associates
600 W. Shaw Ste. #250
Fresno,CA 93704

Attn: Ken Schmidt

Account #	18212
System Type	02
Sample Type	01
Water Sys #	
Census Tract	
Well Number	
APN	

RADIOLOGICAL TEST RESULTS BY EPA METHOD 900.0

Analysis	Result (pCi/L)	C.E. (± pCi/S)	MCL	Date Prepared	Date Analyzed	Chemist
Gross Alpha	4.0	0.1$	15	6/4/2007	7/6/2007	Larissa Asadoorian

Analyst:

DateReported: 7/6/2007

FRESNO COUNTY PUBLIC HEALTH LABORATORY

1221 Fulton Mall, Fresno CA 93721 P.O. Box 11867 Fresno, CA 93775
Phone: (559)445-3407 AIL Phone: (559)445-3397 Fax: (559)445-3580
ELAP Certification Number: 1869 James J. Spotsdoff, Laboratory Director

Lab Number	Account #	Date Received	Date Collected	Time Collected	Collector/Inspector
0706-08142	18212	6/1/2007	5/30/2007	3:35 PM	Jennifer McPheltridge

System Type: 02
Sample Type: Routine
Water Sys #:
Census Tract
Well Number:
APN:

Ken Schmidt & Associates
800 W. Shaw Ste. #250
Fresno,CA 93704

Attn: Ken Schmidt

GENERAL MINERAL, PHYSICAL & INORGANIC CHEMISTRY ANALYSES

Analysis	Storet #	Result	Flag	MCL	DLR	Chemist	Date Analyzed
Arsenic	01002	2.3 µg/L		10 µg/L	2 µg/L	E. Lennon, PHC	6/14/2007
Iron	01045	<100 µg/L		300 µg/L	100 µg/L	S. Stasikonis, PHC	6/7/2007
Manganese	01055	<20 µg/L		50 µg/L	20 µg/L	E. Lennon, PHC	6/14/2007
S.E.C.	00095	280 µmho/cm		900 µmho/cm	20 µmho/cm	K. Lor, PHC	6/1/2007
Fluoride	00951	<0.1 mg/L		2.0 mg/L	0.1 mg/L	L. Assadourian	6/1/2007
Nitrate (ion)	71850	20.0 mg/L		45 mg/L	2.0 mg/L	L. Assadourian	6/1/2007
pH	00403	6.94 Std Units				K. Lor, PHC	6/1/2007
TDS	70300	230 mg/L		500 mg/L	1 mg/L	K. Lor, PHC	6/5/2007

MCL = Maximum Contaminant Level
DLR = Detection Level for Reporting
QNS = Quantity Not Sufficient for Analysis
NTP = No Test Performed on Sample
Flag = "High" if Result Exceeds MCL

Director / Chemistry Supervisor / QA Officer

Date Reported: 06/20/2007

FRESNO COUNTY PUBLIC HEALTH LABORATORY

1221 Fulton Mall, Fresno CA 93721 P.O. Box 11867 Fresno, CA 93775
Phone: (559)445-3407 Alt. Phone: (559)445-3397 FAX: (559)445-3580
State of California Laboratory Accreditation Program Certification Number 1888
James J. Stoledoff, Laboratory Director

LabNumber	Date Received	Date Collected	Time Collected	Collector/Inspector
0708-08142	8/1/2007	6/30/2007	3:35 PM	Jenifer McPhetridge

Ken Schmidt & Associates
600 W. Shaw Sta. #250
Fresno,CA 93704

Attn: Ken Schmidt

Account # 18212
System Type D2
Sample Type 01
Water Sys #
Census Tract
Well Number
APN

RADIOLOGICAL TEST RESULTS BY EPA METHOD 900.0

Analysis	Result (pCi/L)	C.E. (± pCi/S)	MCL	Date Prepared	Date Analyzed	Chemist
Gross Alpha	6.0	0.17	15	8/4/2007	7/8/2007	Larissa Aesadourian

Analyst:

DateReported: 7/8/2007

FRESNO COUNTY PUBLIC HEALTH LABORATORY

1221 Fulton Mall, Fresno CA 93721 P.O. Box 11867 Fresno, CA 93775
Phone: (559)445-3407 Alt. Phone: (559)445-3397 Fax: (559)445-3560
ELAP Certification Number: 1888 James J. Spoledoff, Laboratory Director

0708-06141	19212	6/1/2007	5/30/2007	11:39 AM	Jenifer McPhetridge
Lab Number	Account #	Date Received	Date Collected	Time Collected	Collector/Inspector

Ken Schmidt & Associates
600 W. Shaw Ste. #250
Fresno,CA 93704

Attn: Ken Schmidt

System Type: 02
Sample Type: Routine
Water Sys #:
Census Tract:
Well Number:
APN:

GENERAL MINERAL, PHYSICAL & INORGANIC CHEMISTRY ANALYSES

Analysis	Storet #	Result	Flag	MCL	DLR	Chemist	Date Analyzed
Arsenic	01002	9.2 µg/L		10 µg/L	2 µg/L	E. Lennon, PHC	6/14/2007
Iron	01045	<100 µg/L		300 µg/L	100 µg/L	S. Staalkonis, PHC	6/7/2007
Manganese	01055	<20 µg/L		50 µg/L	20 µg/L	E. Lennon, PHC	6/14/2007
S.E.C.	00095	270 µmho/cm		900 µmho/cm	20 µmho/cm	K. Lor, PHC	6/1/2007
Fluoride	00951	0.1 mg/L		2.0 mg/L	0.1 mg/L	L. Assadourian	6/1/2007
Nitrate (ion)	71850	6.1 mg/L		45 mg/L	2.0 mg/L	L. Assadourian	6/1/2007
pH	00403	6.95 Std Units				K. Lor, PHC	6/1/2007
TDS	70300	190 mg/L		500 mg/L	1 mg/L	K. Lor, PHC	6/5/2007

MCL = Maximum Contaminant Level
DLR = Detection Level for Reporting
QNS = Quantity Not Sufficient for Analysis
NTP = No Test Performed on Sample
Flag = "High" if Result Exceeds MCL

Director / Chemistry Supervisor / QA Officer

Date Reported: 06/20/2007

FRESNO COUNTY PUBLIC HEALTH LABORATORY

1221 Fulton Mall, Fresno CA 93721 P.O. Box 11867 Fresno, CA 93775
Phone: (559)445-3407 Alt. Phone: (559)445-3397 FAX: (559)445-3580
State of California Laboratory Accreditation Program Certification Number 1680
James J. Spotaloff, Laboratory Director

LabNumber	Date Received	Date Collected	Time Collected	Collector/Inspector
0706-08141	6/1/2007	5/30/2007	11:39 AM	Jenifer McPhetridge

Account # 18212
System Type 02
Sample Type 01
Water Sys #
Census Tract
Well Number
APN

Ken Schmidt & Associates
600 W. Shaw Ste. #250
Fresno,CA 93704

Attn: Ken Schmidt

RADIOLOGICAL TEST RESULTS BY EPA METHOD 900.0

Analysis	Result (pCi/L)	C.E. (± pCi/S)	MCL	Date Prepared	Date Analyzed	Chemist
Gross Alpha	89.0	0.59	15	6/4/2007	7/6/2007	Larissa Assadourian

Analyst:

DateReported: 7/6/2007

FRESNO COUNTY PUBLIC HEALTH LABORATORY

1221 Fulton Mall, Fresno CA 93721 P.O. Box 11867 Fresno, CA 93775
Phone: (559)445-3407 Alt. Phone: (559)445-3397 Fax: (559)445-3580
ELAP Certification Number: 1686 James J. Spaisdoll, Laboratory Director

0706-08140	18212	6/1/2007	5/30/2007	12:45 PM	Jenifer McPhetridge
Lab Number	Account #	Date Received	Date Collected	Time Collected	Collector/Inspector

Ken Schmidt & Associates
600 W. Shaw Ste. #250
Fresno,CA 93704

Attn: Ken Schmidt

System Type: 02
Sample Type: Routine
Water Sys #:
Census Tract:
Well Number:
APN:

GENERAL MINERAL, PHYSICAL & INORGANIC CHEMISTRY ANALYSES

Analysis	Storet #	Result	Flag	MCL	DLR	Chemist	Date Analyzed
Arsenic	01002	12.2 µg/L	High	10 µg/L	2 µg/L	E. Lennon, PHC	6/14/2007
Iron	01045	<100 µg/L		300 µg/L	100 µg/L	S. Stasikonis, PHC	6/7/2007
Manganese	01055	24 µg/L		50 µg/L	20 µg/L	E. Lennon, PHC	6/14/2007
S.E.C.	00095	1130 µmho/cm	High	900 µmho/cm	20 µmho/cm	K. Lor, PHC	6/1/2007
Fluoride	00951	<0.1 mg/L		2.0 mg/L	0.1 mg/L	L. Assadourian	6/1/2007
pH	00403	8.71 Std Units				K. Lor, PHC	6/1/2007
TDS	70300	1060 mg/L	High	500 mg/L	1 mg/L	K. Lor, PHC	6/5/2007
Nitrate (ion)	71850	<2.0 mg/L		45 mg/L	2.0 mg/L	L. Assadourian	6/1/2007

MCL = Maximum Contaminant Level
DLR = Detection Level for Reporting
QNS = Quantity Not Sufficient for Analysis
NTP = No Test Performed on Sample
Flag = "High" If Result Exceeds MCL

Director / Chemistry Supervisor / QA Officer

Date Reported: 06/20/2007

FRESNO COUNTY PUBLIC HEALTH LABORATORY

1221 Fulton Mall, Fresno CA 93721 P.O. Box 11867 Fresno, CA 93775
Phone: (559)445-3407 AIL Phone (559)445-3397 FAX: (559)445-3560
State of California Laboratory Accreditation Program Certification Number 1550
James J. Spaletuff, Laboratory Director

0706-08140	6/1/2007	5/30/2007	12:45 PM	Jenifer McPhetridge
LabNumber	Date Received	Date Collected	Time Collected	Collector/Inspector

Account # 18212
System Type 02
Sample Type 01
Water Sys #
Census Tract
Well Number
APN

Ken Schmidt & Associates
600 W. Shaw Ste. #250
Fresno,CA 93704

Attn: Ken Schmidt

RADIOLOGICAL TEST RESULTS BY EPA METHOD 900.0

Analysis	Result (pCi/L)	C.E. (± pCi/9)	MCL	Date Prepared	Date Analyzed	Chemist
Gross Alpha	4.0	0.22	15	6/4/2007	7/6/2007	Larissa Assadourian

Analyst:

DateReported: 7/6/2007

FRESNO COUNTY PUBLIC HEALTH LABORATORY

1221 Fulton Mall, Fresno CA 93721 P.O. Box 11867 Fresno, CA 93775
Phone: (559)445-3407 Alt. Phone: (559)445-3397 Fax: (559)445-3560
ELAP Certification Number: 1686 James J. Spolsdoff, Laboratory Director

0706-08139	18212	6/1/2007	5/30/2007	12:15 PM	Jenifer McPhetridge
Lab Number	Account #	Date Received	Date Collected	Time Collected	Collector/Inspector

SystemType: 02

Sample Type: Routine

Water Sys #:

Census Tract:

Well Number:

APN:

Ken Schmidt & Associates
600 W. Shaw Ste. #250
Fresno,CA 93704

Attn: Ken Schmidt

GENERAL MINERAL, PHYSICAL & INORGANIC CHEMISTRY ANALYSES

Analysis	Storet #	Result	Flag	MCL	DLR	Chemist	Date Analyzed
Arsenic	01002	2.2 µg/L		10 µg/L	2 µg/L	E. Lennon, PHC	6/14/2007
Iron	01045	<100 µg/L		300 µg/L	100 µg/L	S. Stasikonis, PHC	6/7/2007
Manganese	01055	<20 µg/L		50 µg/L	20 µg/L	E. Lennon, PHC	6/14/2007
S.E.C.	00095	1050 µmho/cm	High	900 µmho/cm	20 µmho/cm	K. Lor, PHC	6/1/2007
Fluoride	00951	<0.1 mg/L		2.0 mg/L	0.1 mg/L	L. Asesdourian	6/1/2007
Nitrate (ion)	71850	13.3 mg/L		45 mg/L	2.0 mg/L	L. Asesdourian	6/1/2007
pH	00403	8.69 Std Units				K. Lor, PHC	6/1/2007
TDS	70300	1030 mg/L	High	500 mg/L	1 mg/L	K. Lor, PHC	6/5/2007

MCL = Maximum Contaminent Level
DLR = Detection Level for Reporting
QNS = Quantity Not Sufficient for Analysis
NTP = No Test Performed on Sample
Flag = "High" If Result Exceeds MCL

Director / Chemistry Supervisor / QA Officer

Date Reported: 06/20/2007

FRESNO COUNTY PUBLIC HEALTH LABORATORY

1221 Fulton Mall, Fresno CA 93721 P.O. Box 11867 Fresno, CA 93775
Phone: (559)445-3407 Alt. Phone: (559)445-3397 FAX: (559)445-3580
State of California Laboratory Accreditation Program Certification Number 1858
James J. Spoladoff, Laboratory Director

LabNumber	Date Received	Date Collected	Time Collected	Collector/Inspector
0706-08139	6/1/2007	5/30/2007	12:15 PM	Jenifer McPheridge

Account # 18212
System Type 02
Sample Type 01
Water Sys #
Census Tract
Well Number
APN

Ken Schmidt & Associates
900 W. Shaw Ste. #250
Fresno,CA 93704

Attn: Ken Schmidt

RADIOLOGICAL TEST RESULTS BY EPA METHOD 900.0

Analysis	Result (pCi/L)	C.E. (± pCi/L)	MCL	Date Prepared	Date Analyzed	Chemist
Gross Alpha	7.5	0.25	15	6/4/2007	7/6/2007	Larissa Asadourian

Analyst: _____

DateReported: 7/6/2007

FRESNO COUNTY PUBLIC HEALTH LABORATORY

1221 Fulton Mall, Fresno CA 93721 P.O. Box 11867 Fresno, CA 93775
Phone: (559)445-3407 Alt. Phone: (559)445-3397 Fax: (559)445-3580
ELAP Certification Number: 1898 James J. Spolsdoff, Laboratory Director

0706-08138	16212	6/1/2007	5/30/2007	2:45 PM	Jenifer McPhetridge
Lab Number	Account #	Date Received	Date Collected	Time Collected	Collector/Inspector

Ken Schmidt & Associates
600 W. Shaw Ste. #250
Fresno,CA 93704

Attn: Ken Schmidt

System Type: 02
Sample Type: Routine
Water Sys #:
Census Tract:
Well Number:
APN:

GENERAL MINERAL, PHYSICAL & INORGANIC CHEMISTRY ANALYSES

Analysis	Storet #	Result	Flag	MCL	DLR	Chemist	Date Analyzed
Arsenic	01002	<2 µg/L		10 µg/L	2 µg/L	E. Lennon, PHC	6/14/2007
Iron	01045	<100 µg/L		300 µg/L	100 µg/L	S. Stasikonis, PHC	6/7/2007
Manganese	01055	<20 µg/L		50 µg/L	20 µg/L	E. Lennon, PHC	6/14/2007
S.E.C.	00095	289 µmho/cm		900 µmho/cm	20 µmho/cm	K. Lor, PHC	6/1/2007
Fluoride	00951	<0.1 mg/L		2.0 mg/L	0.1 mg/L	L. Assadourian	6/1/2007
Nitrate (Ion)	71850	29.5 mg/L		45 mg/L	2.0 mg/L	L. Assadourian	6/1/2007
pH	00403	8.64 Std Units				K. Lor, PHC	6/1/2007
TDS	70300	210 mg/L		500 mg/L	1 mg/L	K. Lor, PHC	6/5/2007

MCL = Maximum Contaminant Level
DLR = Detection Level for Reporting
QNS = Quantity Not Sufficient for Analysis
NTP = No Test Performed on Sample
Flag = "High" if Result Exceeds MCL

Director / Chemistry Supervisor / QA Officer

Date Reported: 06/20/2007

FRESNO COUNTY PUBLIC HEALTH LABORATORY

1221 Fulton Mall, Fresno CA 93721 P.O. Box 11867 Fresno, CA 93775
Phone: (559)445-3407 Alt. Phone: (559)445-3337 FAX: (559)445-3580
State of California Laboratory Accreditation Program Certification Number 1888
James J. Spolsdoff, Laboratory Director

0705-06138	6/1/2007	5/30/2007	2:45 PM	Jenifer McPhetridge
LabNumber	Date Received	Date Collected	Time Collected	Collector/Inspector

Ken Schmidt & Associates
600 W. Shaw Ste. #250
Fresno,CA 93704

Attn: Ken Schmidt

Account # 16212
System Type 02
Sample Type 07
Water Sys #
Census Tract
Well Number
APN

RADIOLOGICAL TEST RESULTS BY EPA METHOD 900.0

Analysis	Result (pCi/L)	C.E. (± pCi/S)	MCL	Date Prepared	Date Analyzed	Chemist
Gross Alpha	2.0	0.14	15	6/4/2007	7/6/2007	Larissa Asadourian

Analyst: _____

Date Reported: 7/6/2007

FRESNO COUNTY PUBLIC HEALTH LABORATORY

1221 Fulton Mall, Fresno CA 93721 P.O. Box 11867 Fresno, CA 93775
Phone: (559)445-3407 Alt. Phone: (559)445-3397 Fax: (559)445-3560
ELAP Certification Number: 1696 James J. Spaisdoll, Laboratory Director

0706-08137	18212	6/1/2007	5/30/2007	1:30 PM	Jenifer McPhetridge
Lab Number	Account #	Date Received	Date Collected	Time Collected	Collector/Inspector

Ken Schmidt & Associates
600 W. Shaw Ste. #250
Fresno,CA 93704

Attn: Ken Schmidt

System Type: 02
Sample Type: Routine
Water Sys #:
Census Tract:
Well Number:
APN:

GENERAL MINERAL, PHYSICAL & INORGANIC CHEMISTRY ANALYSES

Analysis	Storet #	Result	Flag	MCL	DLR	Chemist	Date Analyzed
Arsenic	01002	4.2 µg/L		10 µg/L	2 µg/L	E. Lennon, PHC	6/14/2007
Iron	01045	<100 µg/L		300 µg/L	100 µg/L	S. Staelkonis, PHC	6/7/2007
Manganese	01055	<20 µg/L		50 µg/L	20 µg/L	E. Lennon, PHC	6/14/2007
S.E.C.	00095	1100 µmho/cm	High	900 µmho/cm	20 µmho/cm	K. Lor, PHC	6/1/2007
Fluoride	00951	<0.1 mg/L		2.0 mg/L	0.1 mg/L	L. Assadourian	6/1/2007
Nitrate (ion)	71850	10.1 mg/L		45 mg/L	2.0 mg/L	L. Assadourian	6/1/2007
pH	00403	6.97 Std Units				K. Lor, PHC	6/1/2007
TDS	70300	1100 mg/L	High	500 mg/L	1 mg/L	K. Lor, PHC	6/5/2007

MCL = Maximum Contaminant Level
DLR = Detection Level for Reporting
QNS = Quantity Not Sufficient for Analysis
NTP = No Test Performed on Sample
Flag = "High" If Result Exceeds MCL

Director / Chemistry Supervisor / QA Officer

Date Reported: 06/20/2007

FRESNO COUNTY PUBLIC HEALTH LABORATORY

1221 Fulton Mall, Fresno CA 93721 P.O. Box 11867 Fresno, CA 93775
Phone: (559)445-3407 Alt. Phone: (559)445-3397 FAX: (559)445-3560
State of California Laboratory Accreditation Program Certification Number 1668
James J. Spotyoff, Laboratory Director

LabNumber	Date Received	Date Collected	Time Collected	Collector/Inspector
0706-0813T	6/1/2007	5/30/2007	1:30 PM	Jenifer McPhetridge

Account # 19212
System Type 02
Sample Type 01
Water Sys #
Census Tract
Well Number
APN

Ken Schmidt & Associates
600 W. Shaw Ste. #250
Fresno,CA 93704

Attn: Ken Schmidt

RADIOLOGICAL TEST RESULTS BY EPA METHOD 900.0

Analysis	Result (pCi/L)	C.E. (± pCi/S)	MCL	Date Prepared	Date Analyzed	Chemist
Gross Alpha	4.0	0.21	15	6/4/2007	7/6/2007	Larissa Assadourian

Analyst:

DateReported: 7/6/2007

FRESNO COUNTY PUBLIC HEALTH LABORATORY

1221 Fulton Mall, Fresno CA 93721 P.O. Box 11867 Fresno, CA 93775
Phone: (559)445-3407 Alt. Phone: (559)445-3397 Fax: (559)445-3580
ELAP Certification Number: 1686 James J. Spaisdoff, Laboratory Director

0710-14883	18212	10/1/2007	9/27/2007	10:20 AM	Jenifer McPhetridge
Lab Number	Account #	Date Received	Date Collected	Time Collected	Collector/Inspector

Ken Schmidt & Associates
600 W. Shaw Sts. #250
Fresno,CA 93704

Attn: Ken Schmidt

System Type: 99
Sample Type: Other
Water Sys #:
Census Tract:
Well Number:
APN:

GENERAL MINERAL, PHYSICAL & INORGANIC CHEMISTRY ANALYSES

Analysis	Storet #	Result	Flag	MCL	DLR	Chemist	Date Analyzed
Arsenic	01002	<2 µg/L		10 µg/L	2 µg/L	M. Ickes, PHC	10/17/2007
Iron	01045	<100 µg/L		300 µg/L	100 µg/L	L. Assadourian	10/2/2007
Manganese	01055	<20 µg/L		50 µg/L	20 µg/L	M. Ickes, PHC	10/17/2007
S.E.C.	00095	525 µmho/cm		900 µmho/cm	20 µmho/cm	K. Lor, PHC	10/2/2007
Fluoride	00951	0.2 mg/L		2.0 mg/L	0.1 mg/L	L. Assadourian	10/2/2007
Nitrate (as N)	71850	19.9 mg/L		45 mg/L	2.0 mg/L	L. Assadourian	10/2/2007
pH	00403	8.34 Std Units				K. Lor, PHC	10/2/2007
TDS	70300	320 mg/L		500 mg/L	1 mg/L	K. Lor, PHC	10/3/2007

MCL = Maximum Contaminant Level
DLR = Detection Level for Reporting
AL = Action Level
QNS = Quantity Not Sufficient for Analysis
NTP = No Test Performed on Sample
Flag = 'High' if Result Exceeds MCL

Director / Chemistry Supervisor / QA Officer

Date Reported: 10/19/2007

FRESNO COUNTY PUBLIC HEALTH LABORATORY

1221 Fulton Mall, Fresno CA 93721 P.O. Box 11867 Fresno, CA 93775
Phone: (559)445-3407 Alt. Phone: (559)445-3357 FAX: (559)445-3560
State of California Laboratory Accreditation Program Certification Number 1888
James J. Spoladoff, Laboratory Director

0710-14883	10/1/2007	9/27/2007	10:20 AM	Jenifer McPhetridge
LabNumber	Date Received	Date Collected	Time Collected	Collector/Inspector

Ken Schmidt & Associates
600 W. Shaw Ste. #250
Fresno,CA 93704

Attn: Ken Schmidt

Account # 18212
System Type 99
Sample Type 99
Water Sys #
Census Tract
Well Number
APN

RADIOLOGICAL TEST RESULTS BY EPA METHOD 900.0

Analysis	Result (pCi/L)	C.E. (± pCi/S)	MCL	Date Prepared	Date Analyzed	Chemist
Gross Alpha	<1	0.14	15	10/2/2007	10/26/2007	Sal Balzano

Analyst:

DateReported: 10/26/2007

FRESNO COUNTY PUBLIC HEALTH LABORATORY

1221 Fulton Mall, Fresno CA 93721 P.O. Box 11867 Fresno, CA 93775
Phone: (559)445-3407 Alt. Phone: (559)445-3397 Fax: (559)445-3580
ELAP Certification Number: 1486 James J. Spaletta, Laboratory Director

0710-14884	18212	10/1/2007	9/27/2007	10:30 AM	Jenifer McPhetridge
Lab Number	Account #	Date Received	Date Collected	Time Collected	Collector/Inspector

Ken Schmidt & Associates
600 W. Shaw Ste. #250
Fresno,CA 93704

Attn: Ken Schmidt

System Type: 99
Sample Type: Other
Water Sys #:
Census Tract:
Well Number:
APN:

GENERAL MINERAL, PHYSICAL & INORGANIC CHEMISTRY ANALYSES

Analysis	Storet #	Result	Flag	MCL	DLR	Chemist	Date Analyzed
Arsenic	01002	<2 µg/L		10 µg/L	2 µg/L	M. Ickes, PHC	10/17/2007
Iron	01045	<100 µg/L		300 µg/L	100 µg/L	L. Assadourian	10/2/2007
Manganese	01055	<20 µg/L		50 µg/L	20 µg/L	M. Ickes, PHC	10/17/2007
S.E.C.	00095	586 µmho/cm		900 µmho/cm	20 µmho/cm	K. Lor, PHC	10/2/2007
Fluoride	00951	0.1 mg/L		2.0 mg/L	0.1 mg/L	L. Assadourian	10/2/2007
Nitrate (ion)	71850	17.2 mg/L		45 mg/L	2.0 mg/L	L. Assadourian	10/2/2007
pH	00403	7.01 Std Units				K. Lor, PHC	10/2/2007
TDS	70300	350 mg/L		500 mg/L	1 mg/L	K. Lor, PHC	10/3/2007

MCL = Maximum Contaminant Level
DLR = Detection Level for Reporting
AL = Action Level
QNS = Quantity Not Sufficient for Analysis
NTP = No Test Performed on Sample
Flag = "High" If Result Exceeds MCL

L L Levine
Director / Chemistry Supervisor / QA Officer

Date Reported: 10/19/2007

FRESNO COUNTY PUBLIC HEALTH LABORATORY

1221 Fulton Mall, Fresno CA 93721 P.O. Box 11867 Fresno, CA 93775
Phone: (559)445-3407 Alt. Phone: (559)445-3397 FAX: (559)445-3540
State of California Laboratory Accreditation Program Certification Number 1868
James J. Spotskoff, Laboratory Director

LabNumber	Date Received	Date Collected	Time Collected	Collector/Inspector
0710-14884	10/1/2007	9/27/2007	10:30 AM	Jenifer McPhetridge

Account # 19212
System Type 99
Sample Type 99
Water Sys #
Census Tract
Well Number
APN

Ken Schmidt & Associates
600 W. Shaw Ste. #250
Fresno,CA 93704

Attn: Ken Schmidt

RADIOLOGICAL TEST RESULTS BY EPA METHOD 900.0

Analysis	Result (pCi/L)	C.E. (± pCi/L)	MCL	Date Prepared	Date Analyzed	Chemist
Gross Alpha	1.4	0.15	15	10/2/2007	10/25/2007	Sal Balzano

Analyst: S. Balzano

DateReported: 10/25/2007

FRESNO COUNTY PUBLIC HEALTH LABORATORY

1221 Fulton Mall, Fresno CA 93721 P.O. Box 11867 Fresno, CA 93775
Phone: (559)445-3407 Alt. Phone: (559)445-3397 Fax: (559)445-3560
ELAP Certification Number: 1686 James J. Spolsdoff, Laboratory Director

0710-14885	18212	10/1/2007	9/27/2007	10:40 AM	Jenifer McPheteridge
Lab Number	Account #	Date Received	Date Collected	Time Collected	Collector/Inspector

Ken Schmidt & Associates
600 W. Shaw Ste. #250
Fresno,CA 93704

Attn: Ken Schmidt

System Type: 99
Sample Type: Other
Water Sys #:
Census Tract:
Well Number:
APN:

GENERAL MINERAL, PHYSICAL & INORGANIC CHEMISTRY ANALYSES

Analysis	Storet #	Result	Flag	MCL	DLR	Chemist	Date Analyzed
Arsenic	01002	<2 µg/L		10 µg/L	2 µg/L	M. Ickes, PHC	10/17/2007
Iron	01045	<100 µg/L		300 µg/L	100 µg/L	L. Assadourian	10/2/2007
Manganese	01055	<20 µg/L		50 µg/L	20 µg/L	M. Ickes, PHC	10/17/2007
S.E.C.	00095	508 µmho/cm		900 µmho/cm	20 µmho/cm	K. Lor, PHC	10/2/2007
Fluoride	00951	0.1 mg/L		2.0 mg/L	0.1 mg/L	L. Assadourian	10/2/2007
Nitrate (ion)	71850	20.4 mg/L		45 mg/L	2.0 mg/L	L. Assadourian	10/2/2007
pH	00403	7.19 Std Units				K. Lor, PHC	10/2/2007
TDS	70300	310 mg/L		500 mg/L	1 mg/L	K. Lor, PHC	10/3/2007

MCL = Maximum Contaminant Level
DLR = Detection Level for Reporting
AL = Action Level
QNS = Quantity Not Sufficient for Analysis
NTP = No Test Performed on Sample
Flag = "High" If Result Exceeds MCL

L. L. Lorenzo
Director / Chemistry Supervisor / QA Officer

Date Reported: 10/19/2007

FRESNO COUNTY PUBLIC HEALTH LABORATORY

1221 Fulton Mall, Fresno CA 93721 P.O. Box 11867 Fresno, CA 93775
Phone: (559)445-3407 Alt. Phone: (559)445-3357 FAX: (559)445-3580
State of California Laboratory Accreditation Program Certification Number 1828
James J. Spoledoff, Laboratory Director

0710-14886	10/1/2007	9/27/2007	10:40 AM	Jenifer McPhetridge
LabNumber	Date Received	Date Collected	Time Collected	Collector/Inspector

Ken Schmidt & Associates
600 W. Shaw Ste. #250
Fresno,CA 93704

Attn: Ken Schmidt

Account # 18212
System Type 99
Sample Type 99
Water Sys #
Census Tract
Well Number
APN

RADIOLOGICAL TEST RESULTS BY EPA METHOD 900.0

Analysis	Result (pCi/L)	C.E. (± pCi/L)	MCL	Date Prepared	Date Analyzed	Chemist
Gross Alpha	<1	0.13	15	10/2/2007	10/25/2007	Sal Balzano

Analyst: S. Balzano

Date Reported: 10/25/2007

FRESNO COUNTY PUBLIC HEALTH LABORATORY

1221 Fulton Mall, Fresno CA 93721 P.O. Box 11867 Fresno, CA 93775
Phone: (559)445-3407 Alt. Phone: (559)445-3397 Fax: (559)445-3680
ELAP Certification Number: 1888 James J. Spolsdoff, Laboratory Director

0710-14888	18212	10/1/2007	9/27/2007	10:59 AM	Jenifer McPhetridge
Lab Number	Account #	Date Received	Date Collected	Time Collected	Collector/Inspector

Ken Schmidt & Associates
600 W. Shaw Ste. #250
Fresno,CA 93704

Attn: Ken Schmidt

SystemType: 98
Sample Type: Other
Water Sys #:
Census Tract:
Well Number:
APN:

GENERAL MINERAL, PHYSICAL & INORGANIC CHEMISTRY ANALYSES

Analysis	Storet #	Result	Flag	MCL	DLR	Chemist	Date Analyzed
Arsenic	01002	6.2 µg/L		10 µg/L	2 µg/L	M. Ickes, PHC	10/17/2007
Iron	01045	<100 µg/L		300 µg/L	100 µg/L	L. Assadourian	10/2/2007
Manganese	01055	<20 µg/L		50 µg/L	20 µg/L	M. Ickes, PHC	10/17/2007
S.E.C.	00095	398 µmho/cm		900 µmho/cm	20 µmho/cm	K. Lor, PHC	10/2/2007
Fluoride	00951	0.1 mg/L		2.0 mg/L	0.1 mg/L	L. Assadourian	10/2/2007
Nitrate (ion)	71950	4.8 mg/L		45 mg/L	2.0 mg/L	L. Assadourian	10/2/2007
pH	00403	7.28 Std Units				K. Lor, PHC	10/2/2007
TDS	70300	240 mg/L		500 mg/L	1 mg/L	K. Lor, PHC	10/3/2007

MCL = Maximum Contaminant Level
DLR = Detection Level for Reporting
AL = Action Level
QNS = Quantity Not Sufficient for Analysis
NTP = No Test Performed on Sample
Flag = "High" if Result Exceeds MCL

Director / Chemistry Supervisor / QA Officer

Date Reported: 10/19/2007

FRESNO COUNTY PUBLIC HEALTH LABORATORY

1221 Fulton Mall, Fresno CA 93721 P.O. Box 11867 Fresno, CA 93775
Phone: (559)445-3407 Alt. Phone: (559)445-3387 FAX: (559)445-3560
State of California Laboratory Accreditation Program Certification Number 1868
James J. Spoisdoff, Laboratory Director

0710-14686	10/1/2007	9/27/2007	10:59 AM	Jenifer McPhetridge
LabNumber	Date Received	Date Collected	Time Collected	Collector/Inspector

Ken Schmidt & Associates
800 W. Shaw Ste. #250
Fresno,CA 93704

Attn: Ken Schmidt

Account # 18212
System Type 98
Sample Type 98
Water Sys #
Census Tract
Well Number
APN

RADIOLOGICAL TEST RESULTS BY EPA METHOD 900.0

Analysis	Result (pCi/L)	C.E. (± pCi/S)	MCL	Date Prepared	Date Analyzed	Chemist
Gross Alpha	1.3	0.15	15	10/2/2007	10/25/2007	Sal Balzano

Analyst:

DateReported: 10/26/2007

FRESNO COUNTY PUBLIC HEALTH LABORATORY

1221 Fulton Mall, Fresno CA 93721 P.O. Box 11867 Fresno, CA 93775
Phone: (559)445-3407 Alt. Phone: (559)445-3397 Fax: (559)445-3590
ELAP Certification Number: 1888 James J. Spoladoff, Laboratory Director

0710-14887	18212	10/1/2007	9/27/2007	11:20 AM	Jenifer McPhetridge
Lab Number	Account #	Date Received	Date Collected	Time Collected	Collector/Inspector

Ken Schmidt & Associates
600 W. Shaw Ste. #250
Fresno,CA 93704

Attn: Ken Schmidt

System Type: 99
Sample Type: Other
Water Sys #:
Census Tract:
Well Number:
APN:

GENERAL MINERAL, PHYSICAL & INORGANIC CHEMISTRY ANALYSES

Analysis	Storet #	Result	Flag	MCL	DLR	Chemist	Date Analyzed
Arsenic	01002	4.7 µg/L		10 µg/L	2 µg/L	M. Ickes, PHC	10/17/2007
Iron	01045	<100 µg/L		300 µg/L	100 µg/L	L. Assadourian	10/2/2007
Manganese	01055	<20 µg/L		50 µg/L	20 µg/L	M. Ickes, PHC	10/17/2007
S.E.C.	00095	445 µmho/cm		900 µmho/cm	20 µmho/cm	K. Lor, PHC	10/2/2007
Fluoride	00951	0.2 mg/L		2.0 mg/L	0.1 mg/L	L. Assadourian	10/2/2007
Nitrate (ion)	71850	10.4 mg/L		45 mg/L	2.0 mg/L	L. Assadourian	10/2/2007
pH	00403	7.26 Std Units				K. Lor, PHC	10/2/2007
TDS	70300	270 mg/L		500 mg/L	1 mg/L	K. Lor, PHC	10/3/2007

MCL = Maximum Contaminant Level
DLR = Detection Level for Reporting
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QNS = Quantity Not Sufficient for Analysis
NTP = No Test Performed on Sample
Flag = "High" If Result Exceeds MCL

Director / Chemistry Supervisor / QA Officer

Date Reported: 10/19/2007

FRESNO COUNTY PUBLIC HEALTH LABORATORY

1221 Fulton Mall, Fresno CA 93721 P.O. Box 11867 Fresno, CA 93775
Phone: (559)445-3407 AIL Phone: (559)445-3397 FAX: (559)448-3569
State of California Laboratory Accreditation Program Certification Number 1664
James J. Spaletta, Laboratory Director

0710-14837	10/1/2007	9/27/2007	11:20 AM	Jenifer McPhetridge
LabNumber	Date Received	Date Collected	Time Collected	Collector/Inspector

Account # 18212
System Type 99
Sample Type 99
Water Sys #
Census Tract
Well Number
APN

Ken Schmidt & Associates
600 W. Shaw Sta. #250
Fresno,CA 93704

Attn: Ken Schmidt

RADIOLOGICAL TEST RESULTS BY EPA METHOD 900.0

Analysis	Result (pCi/L)	C.E. (± pCi/L)	MCL	Date Prepared	Date Analyzed	Chemist
Gross Alpha	<1	0.13	15	10/2/2007	10/25/2007	Larissa Assadourian

Analyst: S Ghukasyan

DateReported: 10/25/2007

DRINKING WATER ANALYSES RESULTS REPORT
FOR SAMPLES FROM 20010101 THRU 20060222
WITHIN CO COUNTY: 33 MADERA

SYSTEM NO: 2010012 NAME: HILLVIEW WATER CO OAKHURST COUNTY: MADERA
SOURCE NO: 004 NAME: WELL 12 -SOURCE- 2010012-004 CLASS: GWP STATUS: AC

CHEMICAL IDENTIFICATION / CONSTITUENT IDENTIFICATION	SAMPLE DATE		RESULT	*	MCL	PHG (MCLG)	DLR		UNITS
02 SECONDARY/GT									
01140 BICARBONATE ALKALINITY	09/04/2002		122.0000	*					MG/L
01140 BICARBONATE ALKALINITY	06/28/2005		129.0000	*					MG/L
01915 CALCIUM	09/04/2002		27.0000	*					MG/L
01915 CALCIUM	06/28/2006		27.0000	*					MG/L
01919 CARBONATE ALKALINITY	09/04/2002	<	3.0000	*					MG/L
01919 CARBONATE ALKALINITY	06/28/2005	<	3.0000	*					MG/L
01940 CHLORIDE	09/04/2002		11.0000		500.0000		500.0000		MG/L
01940 CHLORIDE	06/28/2005		11.5000		500.0000		500.0000		MG/L
01951 COLOR	09/04/2002	<	5.0000		15.0000		15.0000		UNITS
01951 COLOR	06/28/2005	<	5.0000		15.0000		15.0000		UNITS
01915 COPPER	09/04/2002	<	50.0000		1,300.0000		50.0000	1,000.0000	UG/L
01915 COPPER	06/28/2005	<	50.0000		1,300.0000		50.0000	1,000.0000	UG/L
04941 FOAMING AGENTS (MBAS)	09/04/2002	<	.0050		500.0000		500.0000		UG/L
04941 FOAMING AGENTS (MBAS)	06/28/2005		.0050		.5000		.5000		MG/L
01919 HARDNESS (TOTAL) AS CACO3	09/04/2002		171.0000	*					MG/L
01919 HARDNESS (TOTAL) AS CACO3	06/28/2006		171.0000	*					MG/L
71830 HYDROXIDE ALKALINITY	09/04/2002	<	.0000	*					MG/L
71830 HYDROX. OF ALKALINITY	06/28/2005	<	.0000	*					MG/L
01045 IRON	09/04/2002	<	100.0000		300.0000		100.0000	300.0000	UG/L
01045 IRON	06/28/2005		100.0000		300.0000		100.0000	300.0000	UG/L
71870 MERCURY	09/04/2002		.1000	*					UG/L

NOTE1: * RESULT IS EQUAL TO OR GREATER THAN MDLR
NOTE2: .000 - RESULT WAS REPORTED AS NON-DETECTED BELOW MDL

DRINKING WATER ANALYSES RESULTS REPORT

ALL SAMPLES FOR ALL CHAPTER 15 CONSTITUENTS - ALL RESULTS

FOR SAMPLE DATE RANGE OF 20010101 THRU 20060222

REPORT OF COUNTY: 20 MADERA

SYSTEM NO. 2010012 NAME: [illegible] WATER CO RAYMOND COUNTY: MADERA

SOURCE NO. 004 NAME: WELL 04 PSCODE: 2010012-004 CLASS: [illegible] STATUS: AR

GROUP: INORGANICS

CONSTITUENT IDENTIFICATION	SAMPLE DATE		RESULT *	MCL	DLR	TRIGGER	UNITS
00927 MAGNESIUM	06/28/2005		11.0000 *	----------	----------	----------	MG/L
01055 MANGANESE	09/04/2002	<	20.0000	50.0000	20.0000	50.0000	UG/L
01055 MANGANESE	06/28/2005		27.0000	50.0000	20.0000	50.0000	UG/L
00086 ODOR THRESHOLD @ 60 C	09/04/2002		.0000	3.0000	1.0000	3.0000	TON
00086 ODOR THRESHOLD @ 60 C	06/28/2005		.0000	3.0000	1.0000	3.0000	TON
00403 PH, LABORATORY	09/04/2002		6.9000 *	----------	------		
00403 PH, LABORATORY	06/28/2005		7.1000 *				
01077 SILVER	09/04/2002	<	10.0000	100.0000	10.0000	100.0000	UG/L
01077 SILVER	06/28/2005	<	10.0000	100.0000	10.0000	100.0000	UG/L
00929 SODIUM	09/04/2002		33.0000 *	----------	----------	----------	MG/L
00929 SODIUM	06/28/2005		34.0000 *	----------	----------	----------	MG/L
00095 SPECIFIC CONDUCTANCE	09/04/2002		340.0000	2,200.0000	----------	1,600.0000	US
00095 SPECIFIC CONDUCTANCE	06/28/2005		370.0000	2,200.0000	----------	1,600.0000	US
00945 SULFATE	09/04/2002		7.5000	500.0000	500.0000	600.0000	MG/L
00945 SULFATE	06/28/2005		7.4000	500.0000	500.0000	600.0000	MG/L
70300 TOTAL DISSOLVED SOLIDS	09/04/2002		220.0000	1,500.0000	---------	1,000.0000	MG/L
70300 TOTAL DISSOLVED SOLIDS	06/28/2005		229.0000	1,500.0000		1,000.0000	MG/L
82079 TURBIDITY, LABORATORY	09/04/2002		.1000	5.0000		5.0000	NTU
82079 TURBIDITY, LABORATORY	06/28/2005		.0000	5.0000	...	5.0000	NTU
01092 ZINC	09/04/2002		740.0000	5,000.0000	50.0000	5,000.0000	UG/L
01092 ZINC	06/28/2005		250.0000	5,000.0000	50.0000	5,000.0000	UG/L

IO INORGANIC

NOTE: * = RESULT IS EQUAL TO OR GREATER THAN TRIGGER

NOTE: .000 RESULT WAS REPORTED AS NOT DETECTED EXCEPT FOR PH

DRINKING WATER ANALYSES RESULTS REPORT

ALL SAMPLES FOR ALL CHAPTER 15 CONSTITUENTS - ALL RESULTS

FOR SAMPLE DATE RANGE OF 20010101 THRU 20051231

REPORT OF COUNTY: 20 MADERA

SYSTEM NO: 2010002 NAME: ALLUVIEW WATER CO-RAYMOND COUNTY: MADERA

SOURCE NO: 004 NAME: WELL 02 PSCODE: 2010002-004 CLASS: GTDP STATUS: AR

GROUP IDENTIFICATION CONSTITUENT IDENTIFICATION	SAMPLE DATE		RESULT *	MCL	DLR	TRIGGER	UNITS
01105 ALUMINUM	09/04/2002	<	50.0000	1,000.0000	50.0000	200.0000	UG/L
01105 ALUMINUM	06/28/2005	<	50.0000	1,000.0000	50.0000	200.0000	UG/L
01097 ANTIMONY	09/04/2002	<	5.0000 *	5.0000	6.0000	5.0000	UG/L
01097 ANTIMONY	06/28/2005	<	5.0000 *	5.0000	6.0000	5.0000	UG/L
01002 ARSENIC	09/04/2002		2.2500	50.0000	2.0000	5.0000	UG/L
01002 ARSENIC	06/28/2005		5.1000 *	50.0000	2.0000	5.0000	UG/L
81855 ASBESTOS	07/19/2001		.0000	7.0000	.2000	7.0000	MFL
01007 BARIUM	09/04/2002		216.0000	1,000.0000	100.0000	1,000.0000	UG/L
01007 BARIUM	06/28/2005		130.0000	1,000.0000	100.0000	1,000.0000	UG/L
01012 BERYLLIUM	09/04/2002	<	1.0000	4.0000	1.0000	4.0000	UG/L
01012 BERYLLIUM	06/28/2005	<	1.0000	4.0000	1.0000	4.0000	UG/L
01027 CADMIUM	09/04/2002	<	1.0000	5.0000	1.0000	5.0000	UG/L
01027 CADMIUM	06/28/2005	<	1.0000	5.0000	1.0000	5.0000	UG/L
01034 CHROMIUM (TOTAL)	09/04/2002	<	10.0000	50.0000	10.0000	50.0000	UG/L
01034 CHROMIUM (TOTAL)	06/28/2005	<	1.0000	50.0000	10.0000	50.0000	UG/L
00951 FLUORIDE (F) (NATURAL-SOURCE)	09/04/2002	<	.1000	1.7000	.1000	2.0000	MG/L
01051 LEAD	09/04/2002	<	5.0000	----------	5.0000	15.0000	UG/L
01051 LEAD	06/28/2005	<	5.0000	----------	5.0000	15.0000	UG/L
71900 MERCURY	09/04/2002	<	.2000	2.0000	1.0000	2.0000	UG/L
71900 MERCURY	06/28/2005	<	.2000	2.0000	1.0000	2.0000	UG/L
01067 NICKEL	09/04/2002	<	10.0000	100.0000	10.0000	100.0000	UG/L
01067 NICKEL	06/28/2005	<	10.0000	100.0000	10.0000	100.0000	UG/L
01147 SELENIUM	09/04/2002	<	5.0000	50.0000	5.0000	50.0000	UG/L

NOTE: * = RESULT IS EQUAL TO OR GREATER THAN TRIGGER

NOTE: < = RESULT WAS REPORTED AS NON-DETECTED EXCEPT FOR RAD

DRINKING WATER ANALYSES RESULTS REPORT
ALL SAMPLES FOR ALL CHEMICAL CONSTITUENTS - ALL RESULTS
FOR SAMPLE DATE RANGE OF 20010101 THRU 20060222
REPORT OF [illegible] 20 MADERA

SYSTEM NO: 2010012 NAME: [illegible] COUNTY: MADERA
SOURCE NO: 004 NAME: WELL [illegible] PSCODE: 2010012-004 CLASS: [illegible] STATUS: AR

GROUP IDENTIFICATION / CONSTITUENT IDENTIFICATION	SAMPLE DATE		RESULT *	MCL	DLR	TRIGGER	UNIT
01147 SELENIUM	06/23/2005	<	[illegible]	50.0000	5.0000	50.0000	UG/L
01059 THALLIUM	09/2[illegible]/2002	<	[illegible]	2.0000	1.0000	2.0000	UG/L
01059 THALLIUM	06/23/2005	<	[illegible]	2.0000	1.0000	2.0000	UG/L
NI NITRATE/NITRITE							
71850 NITRATE (AS NO3)	[illegible]/2001		2.4600	45.0000	2.0000	23.0000	MG/L
71850 NITRATE (AS NO3)	[illegible]/2002		4.7000	45.0000	2.0000	23.0000	MG/L
71850 NITRATE (AS NO3)	03/21/2004		12.2000	45.0000	2.0000	23.0000	MG/L
71850 NITRATE (AS NO3)	06/20/2005		11.4000	45.0000	2.0000	23.0000	MG/L
00620 NITRITE (AS N)	07/19/2001	<	400.0000	1,000.0000	400.0000	500.0000	UG/L
00620 NITRITE (AS N)	09/04/2003	<	[illegible]	1,000.0000	400.0000	500.0000	UG/L
00620 NITRITE (AS N)	09/2[illegible]/2004	<	400.0000	1,000.0000	400.0000	500.0000	UG/L
00620 NITRITE (AS N)	06/23/2005	<	400.0000	1,000.0000	400.0000	500.0000	UG/L
RADIOLOGICAL							
01501 GROSS ALPHA	02/12/2001		[illegible]	15.0000	1.0000	5.0000	PCI/L
01501 GROSS ALPHA	05/14/2001		1.2000	15.0000	1.0000	[illegible]	PCI/L
01501 GROSS ALPHA	08/14/2001		2.3000	15.0000	1.0000	5.0000	PCI/L
01501 GROSS ALPHA	11/12/2001		1.0000	15.0000	1.0000	5.0000	PCI/L
01501 GROSS ALPHA	06/28/2005		7.1000 *	15.0000	3.0000	5.0000	PCI/L
01502 GROSS ALPHA COUNTING ERROR	02/12/2001		.1200 *	----------			PCI/L
01502 GROSS ALPHA COUNTING ERROR	05/14/2001		.1100 *				PCI/L
01502 GROSS ALPHA COUNTING ERROR	08/14/2001		.1100 *				PCI/L

NOTE: * = RESULT IS EQUAL TO OR GREATER THAN TRIGGER
NOTE2: .000 RESULT WAS REPORTED AS NON-DETECTED EXCEPT FOR RAD

CHEMICAL WATER ANALYSES RESULTS REPORT
ALL SAMPLES FOR ALL CHEMICAL IN CONSTITUENTS - ALL RESULTS
FOR SAMPLE DATE RANGE OF 20010101 THRU 20060222
REPORT BY COUNTY: 20 MADERA

SYSTEM NO. [illegible] NAME: [illegible] WATER CO-RAYMOND COUNTY: MADERA
SOURCE NO. 004 NAME: WELL [illegible] PSCODE: [illegible]-004 CLASS: [illegible] STATUS: AR

GROUP IDENTIFICATION / CONSTITUENT IDENTIFICATION	SAMPLE DATE		RESULT *	MCL	DLR	TRIGGER	UNIT
01502 GROSS ALPHA COUNTING ERROR	11/13/2001		[illegible] *	----------	----------	----------	PCI/L
01502 GROSS ALPHA COUNTING ERROR	06/28/2005		.1500 *	[illegible]	[illegible]		PCI/L
28012 URANIUM (PCI/L)	02/12/2001		2.0000	20.0000	2.0000	20.0000	PCI/L
28012 URANIUM (PCI/L)	05/14/2001		1.5000	20.0000	2.0000	20.0000	PCI/L
28012 URANIUM (PCI/L)	06/14/2001		2.5000	20.0000	2.0000	20.0000	PCI/L
28012 URANIUM (PCI/L)	11/12/2001		2.0000	20.0000	2.0000	20.0000	PCI/L
28012 URANIUM (PCI/L)	06/28/2005		6.4000	20.0000	2.0000	20.0000	PCI/L
A-028 URANIUM COUNTING ERROR	02/12/2001		.2200 *	----------	----------	----------	PCI/L
A-028 URANIUM COUNTING ERROR	05/14/2001		.1455 *	----------	----------	----------	PCI/L
A-028 URANIUM COUNTING ERROR	06/14/2001		[illegible] *	----------	----------	----------	PCI/L
A-028 URANIUM COUNTING ERROR	11/12/2001		[illegible] *	----------	----------	----------	PCI/L
A-028 URANIUM COUNTING ERROR	06/28/2005		[illegible] *	----------	----------	----------	PCI/L
REGULATED VOC							
34030 BENZENE	07/15/2001	<	.5000 *	1.0000	.5000	.5000	UG/L
32102 CARBON TETRACHLORIDE	07/15/2001	<	.5000 *	.5000	.5000	.5000	UG/L
[illegible] [illegible]-1,2-DICHLOROETHYLENE	07/[illegible]/2001	<	.5000 *	6.0000	.5000	.5000	UG/L
[illegible] DICHLOROMETHANE	07/[illegible]/2001	<	.5000 *	5.0000	.5000	.5000	UG/L
[illegible] ETHYLBENZENE	[illegible]/2001	<	.5000 *	700.0000	.5000	.5000	UG/L
46491 METHYL TERT BUTYL ETHER (MTBE)	[illegible]/2001	<	3.0000	5.0000	1.5000	3.0000	UG/L
46491 METHYL TERT BUTYL ETHER (MTBE)	12/27/2001	<	3.0000	5.0000	1.5000	3.0000	UG/L
34301 MONOCHLOROBENZENE	07/13/2001	<	.5000 *	70.0000	.5000	.5000	UG/L
77128 STYRENE	07/13/2001	<	.5000 *	100.0000	.5000	.5000	UG/L

NOTE 1: * = RESULT IS EQUAL TO OR GREATER THAN TRIGGER
NOTE 2: .000 = RESULT WAS REPORTED AS NON-DETECTED EXCEPT FOR RAD

DATE: 01/06/06 STATE OF CALIFORNIA PAGE
RPT: [illegible] DRINKING WATER PROGRAM

DRINKING WATER ANALYSES RESULTS REPORT
ALL SAMPLES FOR SELECTED CONSTITUENTS - ALL RESULTS
FOR SAMPLE DATE RANGE OF [illegible] THRU [illegible]
REPORT BY COUNTY: 20 - MADERA

SYSTEM NO: [illegible] NAME: HILLVIEW WATER CO RAYMOND COUNTY: MADERA
SOURCE NO. 004 NAME: WELL 05 PSCODE: [illegible] 004 CLASS: [illegible] STATUS: AR

GROUP IDENTIFICATION / CONSTITUENT IDENTIFICATION	SAMPLE DATE	RESULT *	MCL	DLR	TRIGGER	UNITS
IO INORGANIC						
01002 ARSENIC	[illegible]	5.0000	50.0000	2.0000	5.0000	UG/L
01002 ARSENIC	[illegible]	7.2000	50.0000	2.0000	5.0000	UG/L
01002 ARSENIC	[illegible]	5.1000 *	50.0000	2.0000	5.0000	UG/L
RA RADIO ACTIVE						
28012 URANIUM (PCI/L)	[illegible]	.7700	20.0000	1.0000	20.0000	PCI/L
28012 URANIUM (PCI/L)	[illegible]	1.0000	20.0000	1.0000	20.0000	PCI/L
28012 URANIUM (PCI/L)	[illegible]	1.5000	20.0000	1.0000	20.0000	PCI/L
28012 URANIUM (PCI/L)	[illegible]	[illegible]	20.0000	1.0000	20.0000	PCI/L
28012 URANIUM (PCI/L)	[illegible]	[illegible]	20.0000	1.0000	20.0000	PCI/L
28012 URANIUM (PCI/L)	[illegible]	[illegible]	20.0000	1.0000	20.0000	PCI/L

NOTES: * RESULT IS EQUAL TO OR GREATER THAN THE MCL
NOTES: .000 = RESULT WAS REPORTED AS NON DETECTED EXCEPT FOR RAD

DATE: 03/23/06 | STATE OF CALIFORNIA | PAGE: 1
PGM: P-040/2-C | DRINKING WATER PROGRAM

DRINKING WATER ANALYSES RESULTS REPORT
ALL SAMPLES FOR ALL CHAPTER 15 CONSTITUENTS ALL RESULTS
FOR SAMPLE DATE RANGE OF 20020101 THRU 20060323
REPORT BY COUNTY: 20 MADERA

SYSTEM NO. 2010012 NAME: AG [illegible] WATER CO-RAYMOND | COUNTY: MADERA
SOURCE NO. 007 NAME: WELL 05 | PSCODE: 2010012-007 CLASS: [illegible] STATUS: AP

GROUP IDENTIFICATION / CONSTITUENT IDENTIFICATION	SAMPLE DATE		RESULT *	MCL	DLR	TRIGGER	UNIT
GP [illegible]							
00440 BICARBONATE ALKALINITY	09/04/2002		96.0000 *	----------	----------	----------	MG/L
00440 BICARBONATE ALKALINITY	06/29/2005		101.0000 *	-	----------	----------	MG/L
00916 CALCIUM	09/04/2002		72.0000 *		----------	----------	MG/L
00916 CALCIUM	06/29/2005		128.0000 *	----	----------	----------	MG/L
00445 CARBONATE ALKALINITY	09/04/2002	<	3.0000 *	------	----	----------	MG/L
00445 CARBONATE ALKALINITY	06/29/2005	<	3.0000 *	---------		----------	MG/L
00940 CHLORIDE	09/04/2002		12.6000	250.0000	--	500.0000	MG/L
00940 CHLORIDE	06/29/2005		12.5000	250.0000	------	500.0000	MG/L
00081 COLOR	09/04/2002	<	5.0000	15.0000	----------	15.0000	UNITS
00081 COLOR	06/29/2005		25.0000 *	15.0000	----------	15.0000	UNITS
01042 COPPER	09/04/2002	<	50.0000	1,000.0000	50.0000	1,000.0000	UG/L
01042 COPPER	06/29/2005	<	50.0000	1,000.0000	50.0000	1,000.0000	UG/L
38260 FOAMING AGENTS (MBAS)	09/04/2002	<	.0000	500.0000	----------	500.0000	UG/L
38260 FOAMING AGENTS (MBAS)	06/29/2005		.0500	.5000	--------	.5000	MG/L
00900 HARDNESS (TOTAL, AS CACO3)	09/04/2002		332.0000 *	-----	--	----------	MG/L
00900 HARDNESS (TOTAL, AS CACO3)	06/29/2005		446.0000 *	--------		----------	MG/L
71830 HYDROXIDE ALKALINITY	09/04/2002	<	.5000 *	----------	--	---	MG/L
71830 HYDROXIDE ALKALINITY	06/29/2005	<	.5000 *	----------	-------		MG/L
01045 IRON	09/04/2002	<	100.0000	300.0000	100.0000	300.0000	UG/L
01045 IRON	06/29/2005		2,100.0000 *	300.0000	100.0000	300.0000	UG/L
00927 MAGNESIUM	09/04/2002		31.0000 *	---	----------	----------	MG/L

NOTES: * = RESULT IS EQUAL TO OR GREATER THAN TRIGGER
NOTES: < = RESULT WAS REPORTED AS NOT DETECTED EXCEPT FOR RAD

DRINKING WATER ANALYSES REPORT
ALL SAMPLES FOR ALL SOURCES IN CONSTITUENTS - ALL RESULTS
FOR SAMPLE DATE RANGE OF [illegible] THRU [illegible]
REPORT OF COUNTY: 20 MADERA

SYSTEM NO: [illegible] NAME: [illegible] COUNTY: MADERA
SOURCE NO: [illegible] NAME: WELL [illegible] PSCODE: [illegible] CLASS: [illegible] STATUS: AG

GROUP IDENTIFICATION / CONSTITUENT IDENTIFICATION	SAMPLE DATE		RESULT *	MCL	DLR	TRIGGER	UNIT
[illegible] MAGNESIUM	[illegible]/2005		[illegible] *	[illegible]			MG/L
[illegible] MANGANESE	[illegible]/2002	<	[illegible]	50.0000	[illegible]	50.0000	UG/L
[illegible] MANGANESE	[illegible]/2005	<	[illegible]	50.0000	[illegible]	50.0000	UG/L
[illegible] ODOR THRESHOLD @ 60 C	[illegible]/2002		[illegible]	3.0000	1.0000	3.0000	TON
[illegible] ODOR THRESHOLD @ 60 C	[illegible]/2005		[illegible]	3.0000	1.0000	3.0000	TON
[illegible] PH LABORATORY	[illegible]/2002		[illegible] *	----------	----------	[illegible]	
[illegible] PH LABORATORY	[illegible]/2005		[illegible] *	----------	----------	----------	
[illegible] SILVER	[illegible]/2002	<	10.0000	100.0000	10.0000	100.0000	UG/L
[illegible] SILVER	[illegible]/2005	<	10.0000	100.0000	[illegible]	100.0000	UG/L
[illegible] SODIUM	[illegible]/2002		[illegible] *	[illegible]		[illegible]	MG/L
[illegible] SODIUM	[illegible]/2005		[illegible] *	[illegible]			MG/L
[illegible] SPECIFIC CONDUCTANCE	[illegible]/2002		[illegible]	2,200.0000		1,600.0000	US
[illegible] SPECIFIC CONDUCTANCE	[illegible]/2005		[illegible]	[illegible]	[illegible]	1,600.0000	US
[illegible] SULFATE	[illegible]/2002		[illegible]	[illegible]	[illegible]	[illegible]	MG/L
[illegible] SULFATE	[illegible]/2005		[illegible]	[illegible]	[illegible]	[illegible]	MG/L
[illegible] TOTAL DISSOLVED SOLIDS	[illegible]/2002		[illegible]	[illegible]	----------	1,000.0000	MG/L
[illegible] TOTAL DISSOLVED SOLIDS	[illegible]/2005		[illegible]	[illegible]	----------	1,000.0000	MG/L
[illegible] TURBIDITY, LABORATORY	[illegible]/2002		[illegible]	[illegible]	----------	5.0000	NTU
[illegible] TURBIDITY, LABORATORY	[illegible]/2005		[illegible] *	[illegible]	----------	5.0000	NTU
[illegible] ZINC	[illegible]/2002		[illegible]	5,000.0000	[illegible]	[illegible]	UG/L
[illegible] ZINC	[illegible]/2005		[illegible]	5,000.0000	[illegible]	[illegible]	UG/L

[illegible]

NOTE: * = RESULT IS EQUAL TO OR GREATER THAN [illegible]
NOTE: [illegible] RESULT WAS [illegible] AS NON-DETECTED [illegible]

DRINKING WATER ANALYSES RESULTS REPORT
ALL SAMPLES FOR ALL CHAPTER 15 CONSTITUENTS - ALL RESULTS
FOR SAMPLE DATE RANGE OF [illegible] THRU [illegible]
REPORT BY COUNTY: [illegible]

SYSTEM NO: [illegible] NAME: HILLVIEW WATER CO OAKHURST COUNTY: MADERA
SOURCE NO: 007 NAME: WELL 05 PSCODE: [illegible] CLASS: [illegible] STATUS: AS

GROUP IDENTIFICATION / CONSTITUENT IDENTIFICATION	SAMPLE DATE		RESULT *	MCL	DLR	TRIGGER	UNIT
01147 SELENIUM	06/28/2005	<	5.0000	50.0000	5.0000	50.0000	UG/L
01059 THALLIUM	09/0[illegible]/2002	<	1.0000	2.0000	1.0000	2.0000	UG/L
01059 THALLIUM	06/28/2005	<	1.0000	2.0000	1.0000	2.0000	UG/L
02 NITRATE/NITRITE							
71850 NITRATE (AS NO3)	05/02/2001		16.[illegible]	45.0000	2.0000	23.0000	MG/L
71850 NITRATE (AS NO3)	0[illegible]/19/2001		19.2[illegible]	45.0000	2.0000	23.0000	MG/L
71850 NITRATE (AS NO3)	10/11/2001		20.[illegible]	45.0000	2.0000	23.0000	MG/L
71850 NITRATE (AS NO3)	0[illegible]/0[illegible]/2002		15.2000	45.0000	2.0000	23.0000	MG/L
71850 NITRATE (AS NO3)	09/04/2002		15.0000	45.0000	2.0000	23.0000	MG/L
71850 NITRATE (AS NO3)	12/19/2002		14.9000	45.0000	2.0000	23.0000	MG/L
71850 NITRATE (AS NO3)	[illegible]		16.9000	45.0000	2.0000	23.0000	MG/L
71850 NITRATE (AS NO3)	[illegible]		25.[illegible] *	45.0000	2.0000	23.0000	MG/L
00620 NITRITE (AS N)	[illegible]	<	400.0000	1,000.0000	400.0000	500.0000	UG/L
00620 NITRITE (AS N)	[illegible]	<	400.0000	1,000.0000	400.0000	500.0000	UG/L
00620 NITRITE (AS N)	[illegible]	<	400.0000	1,000.0000	400.0000	500.0000	UG/L
00620 NITRITE (AS N)	[illegible]/2005	<	400.0000	1,000.0000	400.0000	500.0000	UG/L
04 RADIOLOGICAL							
01501 GROSS ALPHA	02/12/2001		16.0000 *	15.0000	3.0000	5.0000	PCI/L
01501 GROSS ALPHA	05/14/2001		16.0000 *	15.0000	3.0000	5.0000	PCI/L
01501 GROSS ALPHA	08/14/2001		19.0000 *	15.0000	3.0000	5.0000	PCI/L
01501 GROSS ALPHA	11/12/2001		[illegible] *	15.0000	3.0000	[illegible]	PCI/L

NOTE1: * RESULT IS EQUAL TO OR GREATER THAN TRIGGER
NOTE2: [illegible] = RESULT WAS REPORTED AS NON DETECTED EXCEPT FOR RAD

DRINKING WATER ANALYSES RESULTS REPORT
ALL SAMPLES FOR ALL CHAPTER 15 CONSTITUENTS - ALL RESULTS
FOR SAMPLE DATE RANGE OF [illegible] THRU [illegible]
REPORT BY COUNTY: 20 MADERA

SYSTEM NO: [illegible] NAME: HILLVIEW WATER CO RAYMOND COUNTY: MADERA
SOURCE NO: [illegible] NAME: WELL [illegible] PSCODE: [illegible] CLASS: CTGP STATUS: AR

GROUP IDENTIFICATION / CONSTITUENT IDENTIFICATION	SAMPLE DATE		RESULT	*	MCL	DLR	TRIGGER	UNIT
01501 GROSS ALPHA	06/[illegible]/2005		7.5000	*	15.0000	3.0000	3.0000	PCI/L
01502 GROSS ALPHA COUNTING ERROR	02/[illegible]/2001		.2500	*	----------	----------	----------	PCI/L
01502 GROSS ALPHA COUNTING ERROR	0[illegible]/[illegible]/2001		.2200	*	----------	----------	----------	PCI/L
01502 GROSS ALPHA COUNTING ERROR	[illegible]/[illegible]/2001		.2400	*	----------	----------	----------	PCI/L
01502 GROSS ALPHA COUNTING ERROR	[illegible]/[illegible]/2001		.2200	*	----------	----------		PCI/L
01502 GROSS ALPHA COUNTING ERROR	[illegible]/28/2005		.[illegible]00	*				PCI/L
28012 URANIUM (PCI/L)	02/12/2001		14.0000		20.0000	1.0000	[illegible]	PCI/L
28012 URANIUM (PCI/L)	05/16/2001		11.2000		20.0000	1.0000	[illegible]	PCI/L
28012 URANIUM (PCI/L)	08/14/2001		14.[illegible]		20.0000	1.0000	[illegible]	PCI/L
28012 URANIUM (PCI/L)	11/[illegible]/2001		[illegible]		20.0000	1.0000	10.0000	PCI/L
28012 URANIUM (PCI/L)	06/28/200[illegible]		6.[illegible]		20.0000	1.0000	10.0000	PCI/L
A-028 URANIUM COUNTING ERROR	02/[illegible]/[illegible]		.[illegible]	*	----------	----------	----------	PCI/L
A-028 URANIUM COUNTING ERROR	05/[illegible]/[illegible]		.[illegible]	*	----------	----------	----------	PCI/L
A-028 URANIUM COUNTING ERROR	08/[illegible]/[illegible]		.[illegible]	*	----------	----------	----------	PCI/L
A-028 URANIUM COUNTING ERROR	11/[illegible]/[illegible]		.[illegible]	*	----------	----------		PCI/L
A-028 URANIUM COUNTING ERROR	06/2[illegible]/200[illegible]		.[illegible]	*				PCI/L
[illegible] REGULATED VOC								
34030 BENZENE	0[illegible]/[illegible]/2001	<	.5000	*	1.0000	.5000	.5000	UG/L
32102 CARBON TETRACHLORIDE	0[illegible]/[illegible]/2001	<	.5000	*	.5000	.5000	.5000	UG/L
77093 CIS-1,2-DICHLOROETHYLENE	0[illegible]/[illegible]/2001	<	.5000	*	6.0000	.5000	.5000	UG/L
34423 DICHLOROMETHANE	0[illegible]/[illegible]/2001	<	.5000	*	5.0000	.5000	.5000	UG/L
34371 ETHYLBENZENE	0[illegible]/[illegible]/2001	<	.5000	*	700.0000	.5000	.5000	UG/L

NOTES: * RESULT IS EQUAL TO OR GREATER THAN TRIGGER
NOTES: .000 < RESULT WAS REPORTED AS NON-DETECTED EXCEPT FOR RAD

DRINKING WATER ANALYSES RESULTS REPORT

ALL SAMPLES FOR SELECTED CONSTITUENTS - ALL RESULTS

FOR SAMPLE DATE RANGE OF [illegible] THRU [illegible]

REPORT BY COUNTY: 20 - MADERA

SYSTEM NO: [illegible] NAME: HILLVIEW WATER COMPANY COUNTY: MADERA

SOURCE NO: [illegible] NAME: WELL 05 PSCODE: [illegible] CLASS: [illegible] STATUS: AR

GROUP IDENTIFICATION / CONSTITUENT IDENTIFICATION	SAMPLE DATE	RESULT *	MCL	DLR	TRIGGER	UNIT
IO INORGANIC						
01002 ARSENIC	08/06/1999	6.0000 *	50.0000	2.0000	5.0000	UG/L
01002 ARSENIC	09/04/2002	14.4000 *	50.0000	2.0000	5.0000	UG/L
01002 ARSENIC	06/20/2005	14.0000 *	50.0000	2.0000	5.0000	UG/L
RA RADIOLOGICAL						
28012 URANIUM (PCI/L)	[illegible]	[illegible]	20.0000	1.0000	10.0000	PCI/L
28012 URANIUM (PCI/L)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	PCI/L
28012 URANIUM (PCI/L)	05/14/[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	PCI/L
28012 URANIUM (PCI/L)	05/[illegible]	14.[illegible]	[illegible]	2.0000	20.0000	PCI/L
28012 URANIUM (PCI/L)	11/22/2004	15.[illegible]	[illegible]	2.0000	20.0000	PCI/L
28012 URANIUM (PCI/L)	[illegible]/2005	[illegible]	[illegible]	2.0000	20.0000	PCI/L

NOTE1 * - RESULT IS EQUAL TO OR GREATER THAN TRIGGER

NOTE2 [illegible] - RESULT WAS REPORTED AS NOT DETECTED EXCEPT FOR RAD

[illegible]
[illegible]
[illegible]

STATE OF CALIFORNIA
DRINKING WATER PROGRAM

DRINKING WATER ANALYSES RESULTS REPORT
ALL SAMPLES FOR ALL CHAPTER 15 CONSTITUENTS - ALL RESULTS
FOR SAMPLE DATE RANGE OF 20010101 THRU 20060222
REPORT OF COUNTY: 20 MADERA

SYSTEM NO: 2010013 NAME: HILLVIEW WATER CO-RAYMOND   COUNTY: MADERA
SOURCE NO: 002 NAME: RAYMOND WELL 02   PSCODE: 2010013-002   CLASS: [illegible]   STATUS: [illegible]

GROUP IDENTIFICATION / CONSTITUENT IDENTIFICATION	SAMPLE DATE		RESULT	MCL	DLR	TRIGGER	UNIT
GP SECONDARY/GP							
00440 BICARBONATE ALKALINITY	09/04/2002		149.0000 *				MG/L
00440 BICARBONATE ALKALINITY	06/28/2005		156.0000 *				MG/L
00916 CALCIUM	09/04/2002		56.0000 *				MG/L
00916 CALCIUM	06/28/2005		42.0000 *				MG/L
00445 CARBONATE ALKALINITY	09/04/2002	<	1.0000 *				MG/L
00445 CARBONATE ALKALINITY	06/28/2005	<	1.0000 *				MG/L
00940 CHLORIDE	09/04/2002		15.5000	600.0000		500.0000	MG/L
00940 CHLORIDE	06/28/2005		15.7000	600.0000		500.0000	MG/L
00081 COLOR	09/04/2002	<	5.0000	15.0000		15.0000	UNITS
00081 COLOR	06/28/2005	<	5.0000	15.0000		15.0000	UNITS
01042 COPPER	09/04/2002	<	50.0000	1,000.0000	50.0000	1,000.0000	UG/L
01042 COPPER	06/28/2005	<	50.0000	1,000.0000	50.0000	1,000.0000	UG/L
38260 FOAMING AGENTS (MBAS)	09/04/2002	<	[illegible]	500.0000		500.0000	UG/L
38260 FOAMING AGENTS (MBAS)	06/28/2005		[illegible]	.5000		[illegible]	MG/L
00900 HARDNESS (TOTAL) AS CACO3	09/04/2002		15[illegible] *				MG/L
00900 HARDNESS (TOTAL) AS CACO3	06/28/2005		156.[illegible] *				MG/L
71830 HYDROXIDE ALKALINITY	09/04/2002	<	[illegible] *				MG/L
71830 HYDROXIDE ALKALINITY	06/28/2005	<	.5000 *				MG/L
01045 IRON	[illegible]	<	100.0000	300.0000	100.0000	300.0000	UG/L
01045 IRON	[illegible]	<	100.0000	300.0000	100.0000	300.0000	UG/L

NOTE1. * RESULT IS EQUAL TO OR GREATER THAN TRIGGER
NOTE2. .000 RESULT WAS REPORTED AS NON-DETECTED EXCEPT FOR RAD

VALIDATED WATER ANALYSIS DIVISION REPORT
ALL SAMPLES FOR ALL CHAPTER 15 CONSTITUENTS - ALL RESULTS
FOR SAMPLE DATE RANGE OF 01/01/2001 THRU 12/31/2005
REPORT OF COUNTY: 32 MADERA

SYSTEM NO. 2010012 NAME: RIVERVIEW WATER CO RAINBOW COUNTY: MADERA
SOURCE NO: 002 NAME: RAYMOND WELL 07 ACCESS: 20100012 002 CHAR: CHEM STATUS: AR

GROUP CODE/IDENTIFICATION / CONSTITUENT IDENTIFICATION	SAMPLE DATE		RESULT	*	MCL	DLR	NOTIFIER	UNIT
0[illegible] ARSENIC	09/04/2002		15.0000	*	----------	--	--------	UG/L
0[illegible] ARSENIC	06/20/2005		10.1000	*	----------	----	--------	UG/L
01002 ARSENIC	09/04/2002	<	10.1000		50.0000	10.0000	50.0000	UG/L
01002 ARSENIC	06/20/2005		60.0000		50.0000	10.0000	50.0000	UG/L
01067 NICKEL (AS NI)	09/04/2002		.0000		1.0000	1.0000	1.0000	MG/L
01067 NICKEL (AS NI)	06/20/2005		.0000		1.0000	1.0000	1.0000	MG/L
00403 PH [illegible]	09/04/2002		7.2000	*	----------	----------	----------	
00403 PH, [illegible]	06/20/2005		7.1000	*	-	----------	----------	
01077 SILVER	09/04/2002	<	10.0000		100.0000	10.0000	100.0000	UG/L
01077 SILVER	06/20/2005	<	10.0000		100.0000	10.0000	100.0000	UG/L
00929 SODIUM	09/04/2002		60.0000	*	----------		----------	MG/L
00929 SODIUM	06/20/2005		70.0000	*	----------	-	-----	MG/L
00095 SPECIFIC CONDUCTANCE	09/04/2002		650.0000		1,600.0000	----- -	1,600.0000	US
00095 SPECIFIC CONDUCTANCE	06/20/2005		500.0000		1,600.0000	----------	1,600.0000	US
00945 SULFATE	09/04/2002		32.0000		600.0000	500.0000	600.0000	MG/L
00945 SULFATE	06/20/2005		34.2000		600.0000	500.0000	600.0000	MG/L
70300 TOTAL DISSOLVED SOLIDS	09/04/2002		370.0000		1,000.0000	----------	1,000.0000	MG/L
70300 TOTAL DISSOLVED SOLIDS	06/20/2005		372.0000		1,000.0000	----------	1,000.0000	MG/L
82079 TURBIDITY, LABORATORY	09/04/2002		.1000		5.0000	--------	5.0000	NTU
82079 TURBIDITY, LABORATORY	06/20/2005		.4000		5.0000	- -	5.0000	NTU
01092 ZINC	09/04/2002		100.0000		5,000.0000	50.0000	5,000.0000	UG/L
01092 ZINC	06/20/2005		101.0000		5,000.0000	50.0000	5,000.0000	UG/L

NOTE1: * = RESULT IS EQUAL TO OR GREATER THAN TRIGGER
NOTE2: .1000 = RESULT WAS REPORTED AS NON-DETECTED EXCEPT FOR DAU

DRINKING WATER ANALYSES RESULTS REPORT
ALL SAMPLES FOR ALL CHAPTER 15 CONSTITUENTS - ALL RESULTS
FOR SAMPLE DATE RANGE OF 20010101 THRU 20051231
REPORT OF COUNTY: 20 MADERA

SYSTEM NO: 2010012 NAME: HILLVIEW WATER CO-EASTWOOD COUNTY: MADERA
SOURCE NO: 002 NAME: EASTSIDE WELL #2 PSOURCE: 2010012-002 CLASS: COM STATUS: AC

GROUP IDENTIFICATION / CONSTITUENT IDENTIFICATION	SAMPLE DATE		RESULT *	MCL	DLR	NOTIFICATION	UNIT
10 INORGANIC							
01105 ALUMINUM	03/04/2002	<	50.0000	1,000.0000	50.0000	200.0000	UG/L
01105 ALUMINUM	06/20/2002	<	50.0000	1,000.0000	50.0000	200.0000	UG/L
01051 ANTIMONY	03/04/2002	<	6.0000 *	6.0000	6.0000	6.0060	UG/L
01051 ANTIMONY	06/20/2002	<	6.0000 *	6.0000	6.0000	6.0060	UG/L
01002 ARSENIC	03/04/2002		10.0000 *	50.0000	2.0000	4.0000	UG/L
01002 ARSENIC	06/20/2002		10.0000 *	50.0000	2.0000	4.0000	UG/L
01100 ASBESTOS	02/19/2001		.0000	7.0000	.2000	7.0000	MFL
01007 BARIUM	03/04/2002	<	100.0000	1,000.0000	100.0000	1,000.0000	UG/L
01007 BARIUM	06/20/2002	<	100.0000	1,000.0000	100.0000	1,000.0000	UG/L
01027 BERYLLIUM	03/04/2002	<	1.0000	4.0000	1.0000	4.0000	UG/L
01012 BERYLLIUM	06/20/2002	<	1.0000	4.0000	1.0000	4.0000	UG/L
01027 CADMIUM	03/04/2002	<	1.0000	5.0000	1.0000	5.0000	UG/L
01027 CADMIUM	06/20/2002	<	1.0000	5.0000	1.0000	5.0000	UG/L
01034 CHROMIUM (TOTAL)	03/04/2002	<	10.0000	50.0000	10.0000	50.0000	UG/L
01034 CHROMIUM (TOTAL)	06/20/2002	<	10.0000	50.0000	10.0000	50.0000	UG/L
01951 FLUORIDE (F) (NATURAL-SOURCE)	03/04/2002		.1000	2.1000	.1000	1.0000	MG/L
01041 COPPER	03/04/2002	*	0.0000	----------	0.0000	15.0000	UG/L
01041 COPPER	06/20/2002		0.1000	----------	0.0000	15.0000	UG/L
01045 IRON	03/04/2002	<	100.0	0.0000	0.0000	0.0000	UG/L
01052 MANGANESE	06/20/2002	<	0.000	0.0000	0.0000	0.0000	UG/L
01049 LEAD	03/04/2002	<	10.0000	0.0000	5.0000	100.0000	UG/L

NOTE1: * RESULT IS EQUAL TO OR GREATER THAN THRESHOLD
HYPH: .0000 RESULT WAS RECEIVED AS NUMERIC WITH TRAILING HYPHEN FOR QUA

DRINKING WATER ANALYSES RESULTS REPORT
ALL SAMPLES FOR ALL CHAPTER 15 CONSTITUENTS - R.O. B-[illegible]
FOR SAMPLE DATE RANGE OF [illegible] THRU [illegible]
REPORT BY COUNTY: SD MADERA

SYSTEM NO: 2010013 NAME: [illegible] COUNTY: MADERA
SOURCE NO: 002 NAME: [illegible] PERIOD: [illegible] CLASS: COLL STATUS: AC

GROUP IDENTIFICATION / CONSTITUENT IDENTIFICATION	SAMPLE DATE		RESULT *	MCL	DLR	TRIGGER	UNIT
01067 NICKEL	06/28/2005	<	10.0000	100.0000	10.0000	100.0000	UG/L
01147 SELENIUM	03/06/2006	<	5.0000	50.0000	5.0000	50.0000	UG/L
01147 SELENIUM	06/28/2005	<	5.0000	50.0000	5.0000	50.0000	UG/L
01059 THALLIUM	03/06/2006	<	1.0000	2.0000	1.0000	2.0000	UG/L
01059 THALLIUM	06/28/2005	<	1.0000	2.0000	1.0000	2.0000	UG/L
NO3 NITRATE/NITRITE							
71850 NITRATE (AS NO3)	07/19/2001		5.0700	45.0000	2.0000	9.0000	MG/L
71850 NITRATE (AS NO3)	09/06/2005		5.0000	45.0000	2.0000	23.0000	MG/L
71850 NITRATE (AS NO3)	03/21/2006	<	2.0000	45.0000	2.0000	23.0000	MG/L
71850 NITRATE (AS NO3)	06/28/2006		10.7000	45.0000	2.0000	23.0000	MG/L
07630 NITRITE (AS N)	07/19/2001	<	100.0000	1,000.0000	400.0000	500.0000	UG/L
07630 NITRITE (AS N)	09/06/2005	<	100.0000	1,000.0000	400.0000	500.0000	UG/L
07630 NITRITE (AS N)	03/21/2006	<	400.0000	1,000.0000	400.0000	500.0000	UG/L
07630 NITRITE (AS N)	06/28/2006	<	400.0000	1,000.0000	400.0000	500.0000	UG/L
RA RADIOACTIVITY							
01501 GROSS ALPHA	03/13/2001		5.0000	15.0000	3.0000	5.0000	PCI/L
01501 GROSS ALPHA	06/14/2005		14.0000	15.0000	3.0000	5.0000	PCI/L
01501 GROSS ALPHA	08/14/2006		14.0000	15.0000	3.0000	5.0000	PCI/L
01501 GROSS ALPHA	11/10/2005		18.0000	15.0000	3.0000	5.0000	PCI/L
01501 GROSS ALPHA	06/28/2006		9.0000	15.0000	3.0000	5.0000	PCI/L
74030 GROSS ALPHA COUNTING ERROR	03/13/2001		1.7000	----------	----------	----------	PCI/L

NOTE1: * = RESULT IS EQUAL TO OR GREATER THAN TRIGGER
NOTE2: .000 - RESULT WAS ACCEPTED AS NON-DETECTED EXCEPT FOR RAD

DRINKING WATER ANALYSES RESULTS REPORT
ALL SAMPLES FOR ALL CHEMICAL CONSTITUENTS - ALL RESULTS
FOR SAMPLE DATE RANGE OF [illegible] THRU 20060222
REPORT OF COUNTY: 20 MADERA

SYSTEM NO: 2010012 NAME: [illegible] RAYMOND COUNTY: MADERA
SOURCE NO: 002 NAME: RAYMOND WELL 02 PSCODE: 2010012-002 CLASS: [illegible] STATUS: AR

GROUP IDENTIFICATION / CONSTITUENT IDENTIFICATION	SAMPLE DATE		RESULT *	MCL	DLR	TRIGGER	UNIT
01501 GROSS ALPHA COUNTING ERROR	05/14/2001		.[illegible] *	----------	----------	----	PCI/L
01501 GROSS ALPHA COUNTING ERROR	08/14/2001		[illegible] *	----------	----------		PCI/L
01501 GROSS ALPHA COUNTING ERROR	11/13/2001		[illegible] *	----------			PCI/L
01501 GROSS ALPHA COUNTING ERROR	06/28/2005		.[illegible] *				PCI/L
28012 URANIUM (PCI/L)	02/12/2001		21.0000	20.0000	2.0000	20.0000	PCI/L
28012 URANIUM (PCI/L)	05/14/2001		15.0000	20.0000	2.0000	20.0000	PCI/L
28012 URANIUM (PCI/L)	08/14/2001		14.3000	20.0000	2.0000	20.0000	PCI/L
28012 URANIUM (PCI/L)	11/13/2001		13.0000	20.0000	2.0000	20.0000	PCI/L
28012 URANIUM (PCI/L)	06/28/2005		1.7000	20.0000	2.0000	20.0000	PCI/L
A-028 URANIUM COUNTING ERROR	02/12/2001		.5000 *	----------	----------	----------	PCI/L
A-028 URANIUM COUNTING ERROR	05/14/2001		.5500 *	----------	----------	----------	PCI/L
A-028 URANIUM COUNTING ERROR	08/14/2001		.5600 *	----------	----------	----------	PCI/L
A-028 URANIUM COUNTING ERROR	11/13/2001		.6600 *	----------			PCI/L
A-028 URANIUM COUNTING ERROR	06/28/2005		.4400 *				PCI/L
01 REGULATED VOC							
34030 BENZENE	07/19/2001	<	.5000 *	1.0000	.5000	.5000	UG/L
32102 CARBON TETRACHLORIDE	07/19/2001	<	.5000 *	.5000	.5000	.5000	UG/L
77093 CIS-1,2-DICHLOROETHYLENE	07/19/2001	<	.5000 *	6.0000	.5000	.5000	UG/L
34423 DICHLOROMETHANE	07/19/2001	<	.5000 *	5.0000	.5000	.5000	UG/L
34371 ETHYLBENZENE	07/19/2001	<	.5000 *	700.0000	.5000	.5000	UG/L
46491 METHYL-TERT-BUTYL ETHER (MTBE)	07/19/2001	<	3.0000	5.0000	3.0000	3.0000	UG/L
34301 MONOCHLOROBENZENE	07/19/2001	<	.5000 *	70.0000	.5000	.5000	UG/L

NOTES: * = RESULT IS EQUAL TO OR GREATER THAN TRIGGER
NOTES: < = ANALYTE WAS REPORTED AS NON-DETECTED EXCEPT FOR RAD

[illegible]
RUN [illegible] 01/06/05
REPT. [illegible]

STATE OF CALIFORNIA
DRINKING WATER PROGRAM

PAGE [illegible]

DRINKING WATER ANALYSES ALL DATA REPORT
ALL SAMPLES FOR SELECTED CONSTITUENTS - ALL RESULTS
FOR SAMPLE DATE RANGE OF 19960101 THRU [illegible]
REPORT OF COUNTY: 20 MADERA

SYSTEM NO: 2010012 NAME: [illegible] WATER CO-RAYMOND
SOURCE NO. 002 NAME: RAYMOND WELL 02

COUNTY: MADERA
PSCODE: 2010012-002 CLASS: [illegible] STATUS: AR

GROUP IDENTIFICATION CONSTITUENT IDENTIFICATION	SAMPLE DATE	RESULT	MCL	DLR	TRIGGER	UNITS
10 INORGANIC						
01002 ARSENIC	07/10/[illegible]	[illegible] *	50.0000	2.0000	5.0000	UG/L
01002 ARSENIC	06/09/[illegible]	7.0000 *	50.0000	2.0000	5.0000	UG/L
01002 ARSENIC	[illegible]	3.0000	50.0000	2.0000	5.0000	UG/L
01002 ARSENIC	[illegible]	12.0000 *	50.0000	[illegible]	5.0000	UG/L
01002 ARSENIC	[illegible]/2005	12.0000 *	50.0000	[illegible]	5.0000	UG/L
4A RADIOLOGICAL						
28012 URANIUM (PCI/L)	03/30/1999	[illegible]	[illegible]	1.0000	20.0000	PCI/L
28012 URANIUM (PCI/L)	09/25/[illegible]	[illegible]	[illegible]	1.0000	20.0000	PCI/L
28012 URANIUM (PCI/L)	02/12/[illegible]	[illegible]	20.0000	1.0000	20.0000	PCI/L
28012 URANIUM (PCI/L)	05/14/[illegible]	[illegible]	20.0000	1.0000	20.0000	PCI/L
28012 URANIUM (PCI/L)	[illegible]/2001	[illegible]	20.0000	1.0000	20.0000	PCI/L
28012 URANIUM (PCI/L)	[illegible]/2001	16.0000	[illegible]	1.0000	20.0000	PCI/L
28012 URANIUM (PCI/L)	[illegible]/2005	0.7000	[illegible]	1.0000	20.0000	PCI/L

NOTE1. * = RESULT IS EQUAL TO OR GREATER THAN TRIGGER
NOTE2. [illegible] = RESULT WAS REPORTED AS NON DETECTED EXCEPT FOR [illegible]

RAYMOND

DRINKING WATER ANALYSES RESULTS REPORT
ALL SAMPLES FOR ALL CHAPTER 15 CONSTITUENTS - ALL RESULTS
FOR SAMPLE DATE RANGE OF 20010101 THRU 2006[illegible]
REPORT OF COUNTY 20 MADERA

SYSTEM NO. 2010012 NAME: HILLVIEW WATER COMPANY COUNTY: MADERA
SOURCE NO. 006 NAME: WELL 10 PSCODE: 2010012-006 CLASS: [illegible] STATUS: [illegible]

GROUP IDENTIFICATION / CONSTITUENT IDENTIFICATION	SAMPLE DATE		RESULT		MCL	DLR	TRIGGER	UNIT
GP SECONDARY/GP								
00440 BICARBONATE ALKALINITY	09/04/2002		169.0000	*	----------	----------	----------	MG/L
00440 BICARBONATE ALKALINITY	02/28/2005		151.0000	*	----------	----------	----------	MG/L
00916 CALCIUM	09/04/2002		35.0000	*	----------	----------	----------	MG/L
00916 CALCIUM	02/28/2005		31.0000	*	----------	----------	----------	MG/L
00445 CARBONATE ALKALINITY	09/04/2002	<	2.0000	*	----------	----------	----------	MG/L
00445 CARBONATE ALKALINITY	02/28/2005	<	2.0000	*		----------	----------	MG/L
00940 CHLORIDE	09/04/2002		31.0000		500.0000		500.0000	MG/L
00940 CHLORIDE	02/28/2005		24.1000		500.0000	----------	500.0000	MG/L
00081 COLOR	09/04/2002	<	5.0000		15.0000	----------	15.0000	UNITS
00081 COLOR	02/28/2005	<	5.0000		15.0000	----------	15.0000	UNITS
01042 COPPER	09/04/2002	<	50.0000		1,000.0000	50.0000	1,000.0000	UG/L
01042 COPPER	02/28/2005	<	50.0000		1,000.0000	50.0000	1,000.0000	UG/L
38260 FOAMING AGENTS (MBAS)	09/04/2002	<	.0250		500.0000	----------	500.0000	UG/L
38260 FOAMING AGENTS (MBAS)	02/28/2005		.0430		.5000	----------	.5000	MG/L
00900 HARDNESS (TOTAL) AS CACO3	09/04/2002		130.0000	*		----------	----------	MG/L
00900 HARDNESS (TOTAL) AS CACO3	02/28/2005		135.0000	*			----------	MG/L
71830 HYDROXIDE ALKALINITY	09/04/2002	<	.5000	*	------			MG/L
71830 HYDROXIDE ALKALINITY	02/28/2005	<	.5000	*	----------			MG/L
01045 IRON	09/04/2002	<	100.0000		300.0000	100.0000	300.0000	UG/L
01045 IRON	02/28/2005	<	100.0000		300.0000	100.0000	300.0000	UG/L
00927 MAGNESIUM	09/04/2002		14.0000	*	----------	----------	----------	MG/L

NOTE: * RESULT IS EQUAL TO OR GREATER THAN TRIGGER
NOTE: .000 RESULT WAS REPORTED AS NON-DETECTED EXCEPT FOR RAD

DRINKING WATER MONITORING RESULTS REPORT
ALL SAMPLES FOR ALL CHAPTER 15 CONSTITUENTS - ALL RESULTS
FOR SAMPLE DATE RANGE OF 20010101 THRU 20051231
REPORT OF COUNTY: 19 MADERA

SYSTEM NO: 2200112 NAME: [illegible] CO.-RAYMOND COUNTY: MADERA
SOURCE NO: 005 NAME: WELL 05 /BLOCK: 2010018-006 CLASS: COMM STATUS: AC

GROUP IDENTIFICATION / CONSTITUENT IDENTIFICATION	SAMPLE DATE		RESULT	*	PQL	DLR	TRIGGER	UNIT
00927 MAGNESIUM	06/28/2005		30.0000	*	------	----------	----------	MG/L
01056 MANGANESE	09/06/2005	<	20.0000		50.0000	20.0000	50.0000	UG/L
01055 MANGANESE	06/28/2005	<	20.0000		50.0000	20.0000	50.0000	UG/L
00086 TURBIDITY [illegible]	09/06/2005		.0000		1.0000	1.0000	5.0000	TU
00086 TURBIDITY [illegible]	06/28/2005		.0000		1.0000	1.0000	5.0000	TU
00403 PH, LABORATORY	09/06/2005		8.3000	*	----------		----------	
00403 PH, LABORATORY	06/28/2005		7.7000	*	----------		----------	
01077 SILVER	09/06/2005	<	.0000		10.0000	10.0000	100.0000	UG/L
01077 SILVER	06/28/2005	<	.0000		10.0000	10.0000	100.0000	UG/L
00929 SODIUM	09/06/2005		27.0000	*	----------	----------	---	MG/L
00929 SODIUM	06/28/2005		23.2000	*	---------	----------	---------	MG/L
00940 CHLORIDE CONCENTRATION	09/06/2005		410.0000		2.000 0000	----------	1,000.0000	US
00940 CHLORIDE CONCENTRATION	06/28/2005		440.0000		2.000 0000	----------	1,000.0000	US
00945 SULFATE	09/06/2005		11.0000		500.0000	500.0000	500.0000	MG/L
00945 SULFATE	06/28/2005		13.5701		500.0000	500.0000	500.0000	MG/L
70300 TOTAL DISSOLVED SOLIDS	09/06/2005		340.0000		1,000.0000		1,000.0000	MG/L
70300 TOTAL DISSOLVED SOLIDS	06/28/2005		360.0000		1,000.0000	--	1,000.0000	MG/L
82079 TURBIDITY, LABORATORY	09/06/2005		.1000		1.0000	------	5.0000	NTU
82079 TURBIDITY, LABORATORY	06/28/2005		.5000		1.0000	----------	5.0000	NTU
01092 ZINC	10/06/2005	<	50.0000		5.000 0000	10.0000	5,000.0000	UG/L
01092 ZINC	06/28/2005	<	50.0000		5.000 0000	10.0000	5,000.0000	UG/L

END OF REPORT

NOTE1: * = RESULT IS EQUAL TO OR GREATER THAN TRIGGER
NOTE2: .0000 = RESULT WAS REPORTED AS NON-DETECTED [illegible]

DRINKING WATER ANALYSES RESULTS REPORT
ALL SAMPLES ARE AT CHAPTER 15 CONSTITUENTS ALL RESULTS
FOR SAMPLE DATE RANGE OF 20010101 THRU 20060222
FROM: 0- COUNTY: 20 MADERA

SYSTEM NO: 2010013 OWNER: RIVERVIEW WATER CO ASSOCIATE COUNTY MADERA
SOURCE NO: 005 NAME: WELL 05 PWSTOR 2010013-005 CLASS GW SOURCE: AR

CHEMICAL IDENTIFICATION	SAMPLE DATE		RESULT	MCL	PHG	CRITERIA	UNITS
01116 ALUMINUM	09/04/2002	<	50.0000	1,000.0000	600.0000	200.0000	UG/L
01116 ALUMINUM	06/20/2005	<	50.0000	1,000.0000	600.0000	200.0000	UG/L
01074 ANTIMONY	09/04/2002	<	6.0000 *	6.0000	5.0000	6.0000	UG/L
01074 ANTIMONY	06/20/2005	<	6.0000 *	6.0000	5.0000	6.0000	UG/L
01002 ARSENIC	09/04/2002		3.0000	50.0000	2.0000	5.0000	UG/L
01002 ARSENIC	06/20/2005		3.0000	50.0000	2.0000	5.0000	UG/L
01103 ASBESTOS	07/19/2000		0.00	7.0000	.2000	7.0000	MFL
01010 BARIUM	09/04/2002	=	70.0000	1,000.0000	100.0000	1,000.0000	UG/L
01010 BARIUM	06/20/2005	=	100.0000	1,000.0000	100.0000	1,000.0000	UG/L
01013 BERYLLIUM	09/04/2002	<	1.0000	4.0000	1.0000	4.0000	UG/L
01013 BERYLLIUM	06/20/2005	<	1.0000	4.0000	1.0000	4.0000	UG/L
01027 CADMIUM	09/04/2002	<	1.0000	5.0000	1.0000	5.0000	UG/L
01027 CADMIUM	06/20/2005	<	1.0000	5.0000	1.00	5.0000	UG/L
01034 CHROMIUM (TOTAL)	09/04/2002	<	10.0000	50.0000	10.0000	50.0000	UG/L
01034 CHROMIUM (TOTAL)	06/20/2005	<	10.0000	50.0000	10.0000	50.0000	UG/L
00951 FLUORIDE (F) (NATURAL-SOURCE)	04/06/2005	=	.1000	2.0000	.1000	1.0000	MG/L
01051 LEAD	09/04/2002	<	5.0000	----------	2.0000	15.0000	UG/L
01051 LEAD	06/20/2005	<	5.0000	----------	2.0000	15.0000	UG/L
71900 MERCURY	09/04/2002	<	0.50	2.0000	1.0000	2.0000	UG/L
71900 MERCURY	06/20/2005	<	.5000	2.0000	1.0000	2.0000	UG/L
01062 NICKEL	09/04/2002	<	10.0000	100.0000	13.0000	100.0000	UG/L
01062 NICKEL	06/20/2005	<	10.0000	100.0000	13.0000	100.0000	UG/L
01114 SELENIUM	09/04/2002	<	5.0000	50.0000	5.0000	50.0000	UG/L

NOTE1: * = RESULT IS EQUAL TO OR GREATER THAN CRITERIA
NOTE2: .0000 = RESULT WAS REPORTED AS ZERO EXCEPT FOR RAD

DRINKING WATER ANALYSES RESULTS REPORT

ALL SAMPLES FOR ALL CHAPTER 15 CONSTITUENTS - ALL RESULTS

FOR SAMPLE DATE RANGE OF 20010101 THRU 20060222

REPORT OF COUNTY: 20 MADERA

SYSTEM NO: 2010012 NAME: [illegible] COUNTY: MADERA

SOURCE NO: 006 NAME: WELL [illegible] PSCODE: 2010012-006 CLASS: [illegible] STATUS: AR

GROUP IDENTIFICATION / CONSTITUENT IDENTIFICATION	SAMPLE DATE		RESULT *	MCL	DLR	TRIGGER	UNIT
01147 SELENIUM	06/28/2005		2.0000	50.0000	5.0000	50.0000	UG/L
01059 THALLIUM	09/04/2002	<	1.0000	2.0000	1.0000	2.0000	UG/L
01059 THALLIUM	06/28/2005	<	1.0000	2.0000	1.0000	2.0000	UG/L
07 NITRATE/NITRITE							
71850 NITRATE (AS NO3)	04/[illegible]/2001		28.0000 *	45.0000	2.0000	23.0000	MG/L
71850 NITRATE (AS NO3)	07/19/2001		33.1000 *	45.0000	2.0000	23.0000	MG/L
71850 NITRATE (AS NO3)	10/22/2001		28.6000 *	45.0000	2.0000	23.0000	MG/L
71850 NITRATE (AS NO3)	03/05/2002	<	2.0000	45.0000	2.0000	23.0000	MG/L
71850 NITRATE (AS NO3)	09/04/2002		34.2000 *	45.0000	2.0000	23.0000	MG/L
71850 NITRATE (AS NO3)	12/19/2003		30.0000 *	45.0000	2.0000	23.0000	MG/L
71850 NITRATE (AS NO3)	09/21/2004		26.7000 *	45.0000	2.0000	23.0000	MG/L
71850 NITRATE (AS NO3)	05/25/2005		46.1000 *	45.0000	2.0000	23.0000	MG/L
71850 NITRATE (AS NO3)	07/27/2005		46.7000 *	45.0000	2.0000	23.0000	MG/L
00620 NITRITE (AS N)	07/19/2001	<	400.0000	1,000.0000	400.0000	500.0000	UG/L
00620 NITRITE (AS N)	03/14/2002	<	122.0000	1,000.0000	400.0000	500.0000	UG/L
00620 NITRITE (AS N)	09/21/2004	<	400.0000	1,000.0000	400.0000	500.0000	UG/L
00620 NITRITE (AS N)	07/27/2005	<	400.0000	1,000.0000	400.0000	500.0000	UG/L
0A RADIOLOGICAL							
01501 GROSS ALPHA	[illegible]/2001		5.0000 *	15.0000	3.0000	5.0000	PCI/L
01501 GROSS ALPHA	[illegible]/2001		3.0000	15.0000	3.0000	5.0000	PCI/L
01501 GROSS ALPHA	[illegible]/14/2001		3.0000	15.0000	3.0000	5.0000	PCI/L

LEGEND: * = RESULT IS EQUAL TO OR GREATER THAN TRIGGER

NOTES: [illegible] = RESULT WAS REPORTED AS NON-DETECTED EXCEPT FOR RAD

DRINKING WATER ANALYSES RESULTS REPORT
ALL SAMPLES FOR ALL CHAPTER 15 CONSTITUENTS - ALL RESULTS
FOR SAMPLE DATE RANGE OF 20010101 THRU 2005[illegible]
REPORT OF COUNTY: 20 MADERA

SYSTEM NO: 2010012 NAME: HILLVIEW WATER CO-SAMPSON COUNTY: MADERA
SOURCE NO: 006 NAME: WELL 06 PSCODE: 2010012-006 CLASS: CTGR STATUS: AS

GROUP IDENTIFICATION / CONSTITUENT IDENTIFICATION	SAMPLE DATE		RESULT *	MCL	DLR	TRIGGER	UNITS
01501 GROSS ALPHA	11/13/2001		[illegible]	15.0000	3.0000	[illegible]	PCI/L
01502 GROSS ALPHA COUNTING ERROR	02/13/2001		.1[illegible] *	---	----------	----------	PCI/L
01502 GROSS ALPHA COUNTING ERROR	05/14/2001		.14[illegible] *	-		- - - -	PCI/L
01502 GROSS ALPHA COUNTING ERROR	08/14/2001		.1400 *				PCI/L
01502 GROSS ALPHA COUNTING ERROR	11/13/2001		.1400 *				PCI/L
28012 URANIUM (PCI/L)	02/13/2001		4.0000	20.0000	1.0000	20.0000	PCI/L
28012 URANIUM (PCI/L)	05/14/2001		3.0000	20.0000	1.0000	20.0000	PCI/L
28012 URANIUM (PCI/L)	08/14/2001		1.0000	20.0000	1.0000	20.0000	PCI/L
28012 URANIUM (PCI/L)	11/13/2001		1.0000	20.0000	1.0000	20.0000	PCI/L
A-028 URANIUM COUNTING ERROR	02/13/2001		[illegible] *	----------	----------	----------	PCI/L
A-028 URANIUM COUNTING ERROR	05/14/2001		[illegible] *	----------	----------	----------	PCI/L
A-028 URANIUM COUNTING ERROR	08/14/2001		[illegible] *	- - - - - -	----------	----------	PCI/L
A-028 URANIUM COUNTING ERROR	11/13/2001		.[illegible] *	-	----	----------	PCI/L

REGULATED VOC

GROUP IDENTIFICATION / CONSTITUENT IDENTIFICATION	SAMPLE DATE		RESULT *	MCL	DLR	TRIGGER	UNITS
34030 BENZENE	07/13/2001	<	.5000 *	1.0000	.5000	.5000	UG/L
32102 CARBON TETRACHLORIDE	07/13/2001	<	.5000 *	.5000	.5000	.5000	UG/L
77093 CIS-1,2-DICHLOROETHYLENE	07/13/2001	<	.5000 *	6.0000	.5000	.5000	UG/L
34423 DICHLOROMETHANE	07/13/2001	<	.5000 *	5.0000	.5000	.5000	UG/L
34371 ETHYLBENZENE	07/13/2001	<	.5000 *	700.0000	.5000	.5000	UG/L
46491 METHYL-TERT-BUTYL-ETHER (MTBE)	07/13/2001	<	2.0000	5.0000	3.0000	3.0000	UG/L
34571 PARADICHLOROBENZENE	07/13/2001	<	.5000 *	[illegible]0.0000	.5000	.5000	UG/L
77128 STYRENE	07/13/2001	<	.5000 *	100.0000	.5000	.5000	UG/L

NOTE1: * = RESULT IS EQUAL TO OR GREATER THAN TRIGGER
NOTE2: .000 = RESULT WAS REPORTED AS NON-DETECTED EXCEPT FOR RAD.

DATE: 01/06/06 STATE OF CALIFORNIA PAGE: [illegible]
REPORT: [illegible] DRINKING WATER PROGRAM

DRINKING WATER ANALYSES RESULTS REPORT
ALL SAMPLES FOR SELECTED CONSTITUENTS - ALL RESULTS
FOR SAMPLE DATE RANGE OF 1994[illegible] THRU 2006[illegible]
REPORT OF COUNTY: 20 MADERA

SYSTEM NO: 20[illegible] NAME: HILLVIEW WATER CO-RAYMOND COUNTY: MADERA
SOURCE NO: 006 NAME: WELL 06 PSCODE: 20[illegible]-006 CLASS: [illegible] STATUS: AR

GROUP IDENTIFICATION / CONSTITUENT IDENTIFICATION	SAMPLE DATE	RESULT	MCL	DLR	TRIGGER	UNITS
IO INORGANIC						
01002 ARSENIC	06/06/1999	2.[illegible]	50.0000	2.[illegible]	5.0000	UG/L
01002 ARSENIC	09/04/2002	2.2000	50.0000	2.[illegible]	5.0000	UG/L
01002 ARSENIC	0[illegible]/26/2003	2.1000	50.0000	2.[illegible]	5.0000	UG/L
RA RADIOLOGICAL						
28012 URANIUM (PCI/L)	[illegible]/1997	[illegible]	20.0000	1.0000	20.0000	PCI/L
28012 URANIUM (PCI/L)	[illegible]/1997	[illegible]	20.0000	1.0000	20.0000	PCI/L
28012 URANIUM (PCI/L)	02/[illegible]/2001	[illegible]	20.0000	1.0000	20.0000	PCI/L
28012 URANIUM (PCI/L)	05/[illegible]/2001	[illegible]	20.0000	1.0000	20.0000	PCI/L
28012 URANIUM (PCI/L)	08/[illegible]/2001	[illegible]	20.0000	1.0000	20.0000	PCI/L
28012 URANIUM (PCI/L)	11/[illegible]/2001	[illegible]	20.0000	1.0000	20.0000	PCI/L

NOTES: [illegible] RESULT IS EQUAL TO OR GREATER THAN TRIGGER
NOTES: [illegible] RESULT WAS REPORTED AS [illegible] EXCEPT FOR RAD

DETAILED WATER ANALYSIS RESULTS REPORT
ALL SAMPLES FOR ALL CHAPTER 15 CONSTITUENTS ALL RESULTS
FOR SAMPLE DATE RANGE OF 01/01/01 THRU 12/31/11
MAXIMUM OF COUNTY, 30 MADERA

SYSTEM NO. 2010012 NAME: OAKHURST WATER CO MAYHEW COUNTY: MADERA
SOURCE NO 010 NAME: WELL 10 SOURCE: 2010012-010 CLASS: COMP ACTIVE: AC

GROUP IDENTIFICATION / CONSTITUENT IDENTIFICATION	SAMPLE DATE		RESULT	*	MCL	DLR	TRIGGER	UNIT
UP 2010012-010/G:								
00401 BICARBONATE ALKALINITY	09/04/2002		142.0000	*	----------	----------	----------	MG/
00916 CALCIUM	09/04/2002		16.0000	*	----------	----------	----------	MG/
00445 CARBONATE ALKALINITY	09/04/2002	<	1.0000	*	----------	----------	----------	MG/
00940 CHLORIDE	09/04/2002		10.7000		500.0000		100.0000	MG/L
00081 COLOR	09/04/2002	<	5.0000		15.0000		10.0000	UNITS
01042 COPPER	09/04/2002	<	50.0000		1,000.0000	50.0000	1,000.0000	UG/L
38260 FOAMING AGENTS (MBAS)	09/04/2002	<	.0250		500.0000	----------	500.0000	MG/L
00900 HARDNESS (TOTAL AS CACO3)	09/04/2002		98.0000	*	----------	----------	----------	MG/L
71900 MERCURY (AS HG)	09/04/2002	<	.2000	*	----------	----------	----------	NG/L
01045 IRON	09/04/2002	<	100.0000		300.0000	100.0000	100.0000	UG/L
01046 IRON	06/22/2005		200.0000		300.0000	100.0000	100.0000	UG/L
00927 MAGNESIUM	09/04/2002		7.0000	*	----------	----------	----------	MG/L
01055 MANGANESE	09/04/2002	<	20.0000		50.0000	20.0000	20.0000	UG/L
01055 MANGANESE	06/22/2005		41.0000		50.0000	20.0000	20.0000	UG/L
00936 ODOR THRESHOLD @ 60 C	09/04/2002		.0000		3.0000	1.0000	1.0000	TON
00400 PH, LABORATORY	09/04/2002		8.1000	*	----------	----------	----------	
01077 SILVER	09/04/2002	<	10.0000		100.0000	10.0000	100.0000	UG/L
01077 SILVER	06/22/2005	<	10.0000		100.0000	10.0000	100.0000	UG/L
00929 SODIUM	09/04/2002		41.0000	*	----------	----------	----------	MG/L
00095 SPECIFIC CONDUCTANCE	09/04/2002		320.0000		1,600.0000	----------	1,600.0000	UMH
00945 SULFATE	09/04/2002		9.0000		500.0000	500.0000	500.0000	MG/L

NOTES: * RESULT IS EQUAL TO OR GREATER THAN TRIGGER
NOTES: ### RESULT WAS ANALYZED AT NON-DESIGNATED FACILITY FOR LAB

DRINKING WATER ANALYSES RESULTS REPORT
ALL SAMPLES FOR ALL CHAPTER 15 CONSTITUENTS - ALL SOURCES
FOR SAMPLE DATE RANGE OF [illegible] THRU [illegible]
REPORT BY COUNTY: 20 MADERA

SYSTEM NO. [illegible] NAME: [illegible] WATER CO-[illegible] COUNTY: MADERA
SOURCE NO. [illegible] NAME: WELL [illegible] PSCODE: [illegible]-010 CLASS: [illegible] STATUS: AS

GROUP IDENTIFICATION / CONSTITUENT IDENTIFICATION	SAMPLE DATE		RESULT *	MCL	DLR	TRIGGER	UNIT
[illegible] TOTAL DISSOLVED SOLIDS	[illegible]/2002		100.0000	1,500.0000	---------	[illegible]	MG/L
[illegible] TURBIDITY, LABORATORY	[illegible]/2002		.0500	5.0000	----------	[illegible]	NTU
[illegible] ZINC	[illegible]	<	50.0000	5,000.0000	50.0000	5,000.[illegible]	UG/L
[illegible] ZINC	[illegible]		667.0000	5,000.0000	50.0000	5,000.[illegible]	UG/L
10 INORGANIC							
[illegible] ALUMINUM	[illegible]/2002	<	50.[illegible]	1,000.[illegible]	50.0000	200.0000	UG/L
[illegible] ANTIMONY	[illegible]/2002	<	6.0000	6.[illegible]	6.0000	6.0000	UG/L
[illegible] ARSENIC	[illegible]/2002		[illegible] *	50.[illegible]	[illegible].0000	5.0000	UG/L
[illegible] ASBESTOS	[illegible]		[illegible]	7.[illegible]	.2000	[illegible].0000	MFL
[illegible] BARIUM	[illegible]/2002	<	[illegible]	1,[illegible]	100.0000	1,000.0000	UG/L
[illegible] BERYLLIUM	[illegible]	<	[illegible]	4.[illegible]	1.0000	4.0000	UG/L
[illegible] CADMIUM	[illegible]	<	[illegible]	[illegible]	1.0000	5.0000	UG/L
[illegible] CHROMIUM (TOTAL)	[illegible]	<	[illegible]	[illegible]	10.0000	50.0000	UG/L
[illegible] FLUORIDE (F) (NATURAL-SOURCE)	[illegible]		[illegible]	[illegible]	.1000	[illegible].7000	MG/L
01051 LEAD	[illegible]	<	[illegible]		5.0000	[illegible].0000	UG/L
01051 LEAD	[illegible]/2005		[illegible].[illegible] *	[illegible]	5.[illegible]	[illegible]	UG/L
71900 MERCURY	[illegible]	<	[illegible]	2.0000	[illegible]	[illegible]	UG/L
71900 MERCURY	06/28/2005	<	[illegible]	2.0000	1.[illegible]	[illegible]	UG/L
[illegible] NICKEL	[illegible]/2002	<	[illegible].[illegible]	100.0000	[illegible]	[illegible]	UG/L
[illegible] NICKEL	[illegible]/2005	<	[illegible].0000	100.0000	[illegible]	[illegible]	UG/L
[illegible] SELENIUM	[illegible]/2002	<	5.0000	50.0000	[illegible]	[illegible]	UG/L
[illegible] SELENIUM	[illegible]/2005	<	5.0000	50.0000	[illegible]	[illegible]	UG/L

NOTES: * = RESULT IS EQUAL TO OR GREATER THAN TRIGGER
NOTES: .000 = RESULT WAS REPORTED AS NON DETECTED EXCEPT FOR RAD

DRINKING WATER ANALYSES RESULTS REPORT
ALL SAMPLES FOR ALL CHAPTER 15 CONSTITUENTS - ALL PERIODS
FOR SAMPLE DATE RANGE OF 20010101 THRU 20060000
AIRPORT BY COUNTY: 20 - MADERA

SYSTEM NO: 2010012 NAME: MCCLOUDY WATER CO-RAYMOND COUNTY: MADERA
SOURCE NO: 010 NAME: WELL 10 PSCODE: 2010012 010 CLASS: GTSW STATUS: AR

GROUP IDENTIFICATION / CONSTITUENT IDENTIFICATION	SAMPLE DATE		RESULT		MCL	DLR	REPORTED	UNIT
01045 MANGANESE	08/04/2000	<	1.0000		0.0500	1.0000	1.0000	UG/L
01065 TRICHLOROFLUOROMETHANE (FREON 11)	06/16/2005	*	1.0000		0.1500	1.0000	1.0000	UG/L
31501 SECONDARY (AS SO4)	01/19/2001	<	3.0000		45.0000	3.0000	23.0000	MG/L
31501 SECONDARY (AS SO4)	05/04/2001		3.1000		45.0000	3.0000	23.0000	MG/L
31501 SECONDARY (AS SO4)	09/11/2001	<	3.0000		45.0000	3.0000	23.0000	MG/L
00623 SECONDARY (AS CL)	01/19/2001	<	400.0000		1,000.0000	400.0000	200.0000	MG/L
00620 SECONDARY (AS CL)	05/04/2001	<	400.0000		1,000.0000	400.0000	200.0000	MG/L
00620 SECONDARY (AS CL)	09/11/2001	<	400.0000		1,000.0000	400.0000	200.0000	MG/L
00620 SECONDARY (AS CL)	05/14/2002	<	400.0000		1,000.0000	400.0000	200.0000	MG/L
PA RADIOLOGICAL								
01501 GROSS ALPHA	02/12/2001		5.0000	*	15.0000	3.0000	5.0000	PCI/L
01501 GROSS ALPHA	05/14/2001		50.0000	*	15.0000	3.0000	5.0000	PCI/L
01501 GROSS ALPHA	08/14/2001		36.5000	*	15.0000	3.0000	5.0000	PCI/L
01501 GROSS ALPHA	11/12/2001		30.0000	*	15.0000	3.0000	5.0000	PCI/L
01502 GROSS ALPHA COUNTING ERROR	02/12/2001		.1400	*				PCI/L
01502 GROSS ALPHA COUNTING ERROR	05/14/2001		.1300	*				PCI/L
01502 GROSS ALPHA COUNTING ERROR	08/14/2001		1.0000	*				PCI/L
01502 GROSS ALPHA COUNTING ERROR	11/12/2001		.1500	*				PCI/L
28012 RADIUM 226/228	02/12/2001		6.0000		30.0000	3.0000	[illegible]	PCI/L
28012 RADIUM 226/228	05/14/2001		25.0000	*	30.0000	1.0000	[illegible]	PCI/L

NOTE: * = RESULT IS EQUAL TO OR GREATER THAN DLR/MDL

NOTE: 0000 = ANALYSIS WAS REPORTED AS NON-DETECTED EXCEPT FOR DHS

DRINKING WATER ANALYSES RESULTS REPORT
ALL SAMPLES FOR ALL CHAPTER 15 CONSTITUENTS - ALL RESULTS
FOR SAMPLE DATE RANGE OF 20010101 THRU 20051231
REPORT BY COUNTY: 20 MADERA

SYSTEM NO: 2010013 NAME: HILLVIEW WATER CO RAYMOND COUNTY: MADERA
SOURCE NO: 010 NAME: WELL 10 PSCODE: 2010013-010 CLASS: DTSR STATUS: AR

GROUP IDENTIFICATION / CONSTITUENT IDENTIFICATION	SAMPLE DATE		RESULT *	MCL	DLR	TRIGGER	UNIT
28012 URANIUM (PCI/L)	08/14/2001		27.5000 *	20.0000	2.0000	20.0000	PCI/L
28012 URANIUM (PCI/L)	11/12/2001		35.0000 *	20.0000	2.0000	20.0000	PCI/L
A-028 URANIUM COUNTING ERROR	02/12/2001		.5400 *			[illegible]	PCI/L
A-028 URANIUM COUNTING ERROR	05/14/2001		.7500 *				PCI/L
A-028 URANIUM COUNTING ERROR	08/14/2001		.5500 *				PCI/L
A-028 URANIUM COUNTING ERROR	11/12/2001		.9000 *				PCI/L
01 REGULATED VOC							
34030 BENZENE	07/19/2001	<	.5000	1.0000	.5000	.5000	UG/L
32102 CARBON TETRACHLORIDE	07/19/2001	<	.5000	.5000	.5000	.5000	UG/L
77093 CIS-1,2-DICHLOROETHYLENE	07/19/2001	<	.5000	6.0000	.5000	.5000	UG/L
34423 DICHLOROMETHANE	07/19/2001	<	.5000	5.0000	.5000	.5000	UG/L
34371 ETHYL BENZENE	07/19/2001	<	.5000	300.0000	.5000	.5000	UG/L
46491 METHYL TERT-BUTYL ETHER (MTBE)	07/19/2001	<	3.0000	13.0000	3.0000	3.0000	UG/L
34301 MONOCHLOROBENZENE	07/19/2001	<	.5000	70.0000	.5000	.5000	UG/L
77128 STYRENE	07/19/2001	<	.5000	100.0000	.5000	.5000	UG/L
34475 TETRACHLOROETHYLENE	07/19/2001	<	.5000	5.0000	.5000	.5000	UG/L
34010 TOLUENE	07/19/2001	<	.5000	150.0000	.5000	.5000	UG/L
34546 TRANS-1,2-DICHLOROETHYLENE	07/19/2001	<	.5000	10.0000	.5000	.5000	UG/L
39180 TRICHLOROETHYLENE	07/19/2001	<	.5000	5.0000	.5000	.5000	UG/L
34488 TRICHLOROFLUOROMETHANE	07/19/2001	<	5.0000	150.0000	5.0000	5.0000	UG/L
39175 VINYL CHLORIDE	07/19/2001	<	.5000	.5000	.5000	.5000	UG/L
81551 XYLENES (TOTAL)	07/19/2001	<	.5000	1,750.0000	.5000	.5000	UG/L

NOTE: * = RESULT IS EQUAL TO OR GREATER THAN TRIGGER
NOTE: (<) RESULT WAS REPORTED AS NON-DETECTED EXCEPT FOR RAD

Jan 6/2006
Well 2, 5, 10

DATE: [illegible]
TIME: [illegible]

STATE OF CALIFORNIA
DRINKING WATER PROGRAM

DRINKING WATER ANALYSES RESULTS REPORT
ALL SAMPLES FOR SELECTED CONSTITUENTS - ALL AMOUNTS
FOR SAMPLE DATE RANGE OF [illegible] THRU [illegible]
REPORT OF COUNTY: 20 MADERA

SYSTEM NO. [illegible] NAME: [illegible] WATER [illegible] COUNTY: MADERA
SOURCE NO. [illegible] NAME: [illegible] PSCODE: [illegible] 010 CLASS: [illegible] STATUS: AR

GROUP IDENTIFICATION / CONSTITUENT IDENTIFICATION	SAMPLE DATE	RESULT	MCL	DLR	TRIGGER	UNIT
IO INORGANIC						
01002 ARSENIC	12/20/[illegible]	[illegible]	[illegible]	[illegible]	5.0000	UG/L
01002 ARSENIC	[illegible]	[illegible]	50.0000	[illegible]	[illegible]	UG/L
01002 ARSENIC	[illegible]	[illegible]	50.0000	[illegible]	[illegible]	UG/L
01002 ARSENIC	[illegible]	[illegible]	50.0000	[illegible]	[illegible]	UG/L
RA RADIOLOGICAL						
28012 URANIUM (PCI/L)	[illegible]	[illegible]	20.0000	1.0000	[illegible]	PCI/L
28012 URANIUM (PCI/L)	[illegible]	[illegible]	20.0000	1.0000	[illegible]	PCI/L
28012 URANIUM (PCI/L)	[illegible]	[illegible]	20.0000	[illegible]	20.0000	PCI/L
28012 URANIUM (PCI/L)	05/14/2001	[illegible]	[illegible]	[illegible]	20.0000	PCI/L
28012 URANIUM (PCI/L)	05/14/2001	[illegible]	[illegible]	2.0000	[illegible]	PCI/L
28012 URANIUM (PCI/L)	[illegible]/2001	[illegible]	[illegible]	2.0000	[illegible]	PCI/L

NOTE1: * = RESULT IS EQUAL TO OR GREATER THAN TRIGGER
NOTE2: [illegible] = RESULT WAS REPORTED AS NON-DETECTED EXCEPT FOR RAD

Appendix E
Hillview Water Company
Sierra Lakes Wells Centralized Treatment for Arsenic and Uranium
Task Memorandum Report

Integrated Regional Water Management Plan Volume 2 - Appendices

County of Madera

RMA Director:	Rayburn Beach, PE
County Engineer:	S. Greg Farley, PE
Assistant County Engineer:	Kevin S. Ham, PE

Boyle Engineering Corporation

Project Manager:	Ken Swanson, PE
Project Engineers:	Steve Doe, PhD, PE
	Robert Stoddard, PE
	Betsy Lichti, PE
	Mariana Pascuet

Kenneth D. Schmidt and Associates

Principal:	Ken Schmidt, CHG
Hydrologist:	Cheryl Lassonovitch, PG
GPS/Computer Specialist:	Ori Sartoun
Hydrologic Aide:	Jennifer McPhetridge

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BOYLE 1360 E. Spruce Avenue, Suite 101, Fresno, CA 93720

Table of Contents

Figures

Tables

Appendices

Section 1
Introduction

1.1 Purpose of Task Memorandum

This memorandum satisfies one task associated with the Madera County Integrated Regional Water Management Plan (IRWMP) being developed by Boyle Engineering Corporation (Boyle) in cooperation with Madera County and various other water agencies and citizen groups throughout the County. The Scope of Services for the IRWMP, Study Topic 3: *Water Quality Protection and Improvement*, included a task to provide an analysis of infrastructure or other technologies to improve water quality. After working with the Madera County staff and the various advisory committees, it was determined that an evaluation should be conducted of treatment alternatives to remove uranium and arsenic from drinking water, to evaluate alternatives for private wells, and to demonstrate one application in the Hillview Water Company (HWC) water system, which serves a portion of the community of Oakhurst.

Evaluation of water quality issues in Madera County has identified several contaminants of concern. Two of the more significant are arsenic and uranium. The USEPA has established a lower standard for arsenic in drinking water of 10 µg/L, effective as of January 2006 for all public water systems (those serving 15 or more connections or more than 25 people). The USEPA has also adopted a standard for uranium of 30 µg/L, which is equivalent to the California standard of 20 pCi/L, which is applicable to public water systems. Although these drinking water standards do not apply to individuals using private wells, the standards are a gauge by which to determine of a privately-owned well is producing water that is potable and healthful.

For a public water system, removal of contaminated sources from the domestic water system is the easiest means of compliance. However, this is not always feasible in some water-short areas. Construction of a replacement well may not produce a sufficient quantity of water and may itself violate the same or a different drinking water standard. Hydrogeologic studies may improve the odds of situating a well in an area that will obtain sufficient water meeting drinking water standards.

This memorandum provides information on water treatment alternatives for a public water system, using the HWC Sierra Lakes well field as an example. This memorandum will provide an overview of the water quality of the Sierra Lakes Wells serving the HWC, a description of treatment alternatives for removing arsenic and uranium from the water, and an opinion of probable costs for construction and operation and maintenance of one treatment alternative. Actions that could be taken bring the HWC water system into compliance with the arsenic and uranium water quality standards are presented. These actions or steps can be applied to any public water system facing similar drinking water standard violations.

Homeowners with private wells in areas affected by arsenic and/or uranium also will be faced with decisions to ensure a healthful and potable water supply. It is important for Madera County to notify these homeowners that have individual wells in such areas and of their alternatives. The use of bottled water for drinking and cooking is one common alternative. This report identifies point-

of-use (POU) treatment alternatives that could be implemented by a homeowner or by a small public water system. Types of POU acceptable to the USEPA are identified in this report.

1.2 Background Information

The HWC is a privately owned public utility water system providing water service to residential and commercial customers in the Oakhurst, Coarsegold and Raymond areas of Madera County. HWC is regulated by the California Public Utilities Commission (CPUC), which authorizes customer water rates and establishes standards for water system design and customer service. HWC is comprised of four separate water systems that provide water service to customers in service areas authorized by CPUC, including the Oakhurst-Sierra Lakes, Coarsegold, Goldside, and Raymond systems. Each system has its own water supply facilities that are operated under separate conditional domestic water supply permits from the California Department of Public Health (CDPH), which require compliance with drinking water standards per the Safe Drinking Water Act (SDWA), adopted regulations, and other requirements specified by CDPH. Figure 1-1 shows the location of the HWC-Oakhurst/Sierra Lakes water system and general service area boundaries.

This memorandum will specifically address the water quality issues facing the Sierra Lakes Wells in the Oakhurst-Sierra Lakes water system. The Oakhurst-Sierra Lakes system serves a majority of the residences and businesses in the Oakhurst area, and is comprised of approximately 987 metered service connections serving a population of approximately 2,960. Water for the system is obtained from 10 active and 2 standby hard rock wells. The wells are located in 5 well fields identified as Sierra Lakes, Forest Ridge, Pierce Lakes/Yosemite High School, Junction/West Oak, and Highland View Well Fields. Wells in the Sierra Lakes and Forest Ridge Well Fields produce a majority of the water supply for the water system. The water produced in both of these well fields receives treatment to remove iron and manganese. Water production from the Oakhurst-Sierra Lakes system is summarized in Table 1-1.

The Oakhurst-Sierra Lakes Water System has experienced water shortage conditions in recent years due to insufficient production of water meeting drinking water standards. The HWC received approval from the CPUC in 2004 to implement more restrictive water conservation measures and water rationing in its Oakhurst-Sierra Lakes service area because of the continuing reduction of pumping capacity of wells as a result of inadequate aquifer recharge for the fifth consecutive year. Additional wells are currently under construction.

All of the wells discharge to storage tanks, which feed the distribution system by both by gravity and via booster stations. There are 13 pressure zones within the distribution system served by 18 storage tanks and 11 booster pump stations. A schematic of the water system well and storage facilities is provided in Figure 1-2.

1.2.1 Sierra Lakes Well Field

There are three existing and five newly constructed wells in the Sierra Lakes well field. The existing active wells are designated as the Sierra Lakes Wells 1A, 3 and 4. Production for these three wells was shown previously in Table 1-1. This data shows that the Sierra Lakes Well Field has provided over 70 percent of the total production capacity for the system. CDPH reports that

BOYLE

HILLVIEW WATER COMPANY

CAMP REST / SIERRA LAKES

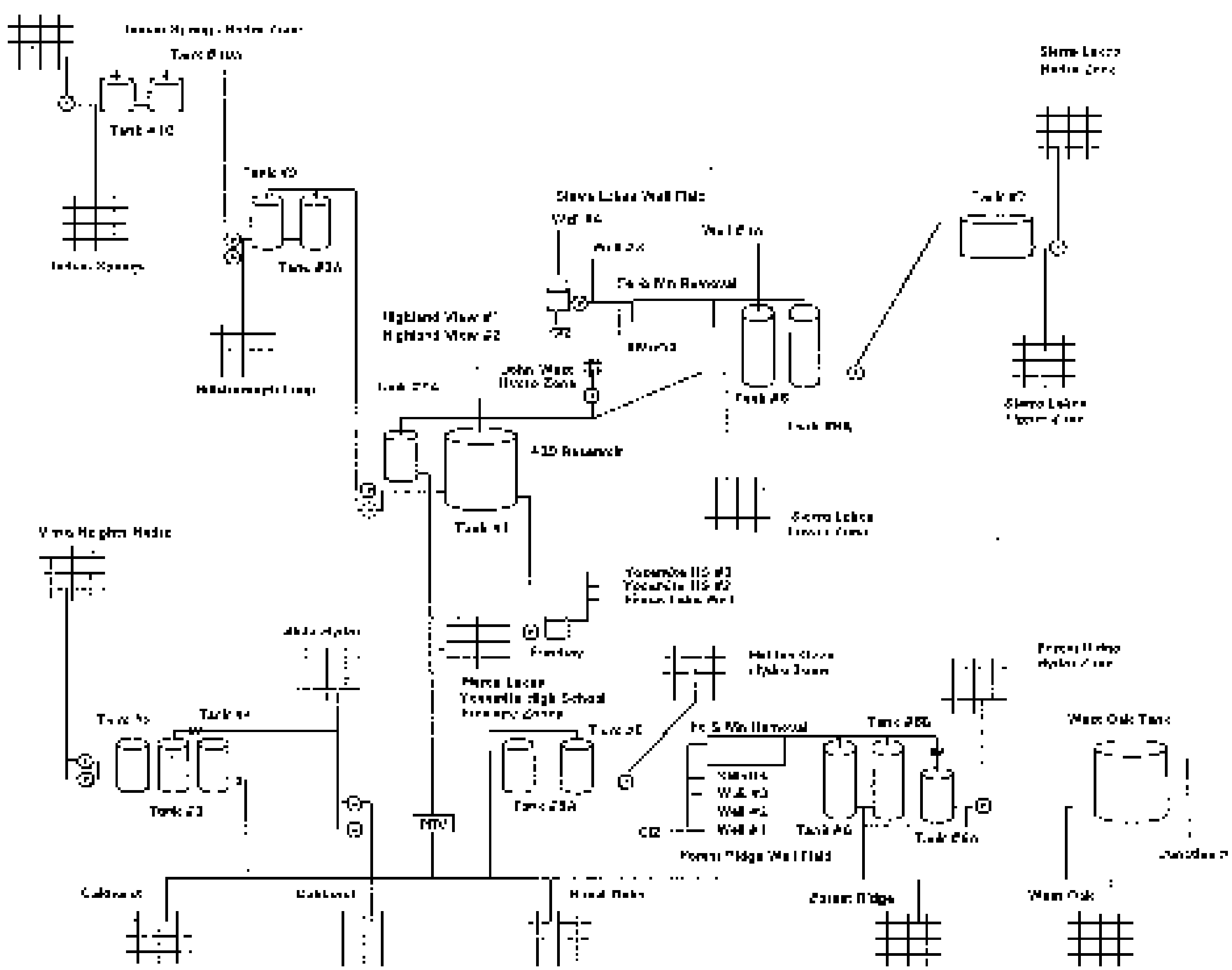
LOCATION MAP & SERVICE AREA

1-1

Table 1-1. Annual Water Production, Oakhurst-Sierra Lakes Water System[1]

Location	Pumping Capacity (gpm)	Annual Water Production Million Gallons (MG) 2001	2002	2003	2004	2005
Sierra Lakes Well Field						
Sierra Lakes Well 1A	200	30.27	41.04	49.05	49.05	49.05
Sierra Lakes Well 3	150	30.13	36.06	41.13	41.13	41.13
Sierra Lakes Well 4	330	38.23	39.09	28.74	28.73	28.73
Well Field Total	***680***	***98.63***	***116.19***	***118.91***	***118.91***	***118.91***
Forest Ridge Well Field (AKA Dillon Wells)						
Forest Ridge Well 1	30	13.09	4.12	3.03	3.03	3.03
Forest Ridge Well 2	135	35.54	26.74	21.32	21.32	21.32
Forest Ridge Well 3	60	9.15	10.25	8.51	8.51	8.51
Forest Ridge Well 4	50	21.21	15.46	13.34	13.34	13.34
Well Field Total	***265***	***78.98***	***56.57***	***46.19***	***46.19***	***46.19***
Highland Well Field						
Highland View Well 1	10	inactive	inactive	1.04	1.04	1.04
Highland View Well 2	22	0	1.01	0.71	0.71	0.71
Well Field Total	***32***	***0***	***1.01***	***1.75***	***1.75***	***1.75***
Pierce Lakes/Yosemite High School Well Field						
Pierce Lakes Well 1	47	3.81	4.25	5.33	5.33	5.33
Yosemite High School Well 2	11	3.10	2.17	2.08	2.08	2.08
Yosemite High School Well 3	25	2.10	1.98	1.68	1.68	1.68
Well Field Total	***115***	***9.04***	***9.41***	***10.83***	***10.83***	***10.83***
System Total Production	**892**	**186.65**	**183.18**	**177.68**	**177.68**	**177.68**
%Sierra Lakes Well Field	**76%**	**53%**	**63%**	**67%**	**67%**	**67%**

[1]Capacity and production figures from CPUC Annual Reports



BOYLE

HILLVIEW WATER COMPANY OAKHURST / SIERRA LAKES	BEC PROJECT NO.	FIGURE
SYSTEM SCHEMATIC	22203.00	1-2

active wells have produced more than 20 million gallons per month during peak production and have averaged about 12 million gallons per month in 2005.

The operation of the three wells is controlled by the water level in the Sierra Lakes storage tanks, Tanks 8 and 8A. All three wells are operated at the same time, with a slight time delay during startup to prevent electrical power overloads. Treatment to remove iron and manganese is provided to Wells 3 and 4, which discharge to a common pipeline entering the treatment facilities. The treated water then discharges to Tank 8A. Well 4 receives additional treatment by dosing with ferric sulfate and then aerated ahead of the iron and manganese removal system to obtain some uranium removal as well. Well 1A has its own direct discharge to Tank 8A, which in turn fills Tank 8. Blending of the water from the three wells provides some additional reduction in the uranium concentration in the water delivered to customers. All three wells have concentrations of arsenic that exceed the federal maximum contaminant level (MCL) of 10 µg/L. Water quality data is presented in Section 2.

Five new wells have been drilled in the Sierra Lakes Well Field, and have been designated as Well 5, Well 6, Well 7, Well 8 and Well 9. The IIWC is seeking permit approval for these wells from CDPH. All of the new wells with the exception of Well 9 are connected to the system and producing water. Well 9 is pending power hookup and is not yet providing water to the system.

Construction information for the existing and new Sierra Lakes wells is shown in Table 1-2. The wells are all hard rock wells, with the casings landed in rock. Combined production from the existing three wells in the well field has been reported to be 680 gpm. The five new wells are anticipated to provide an additional flow of 720 gpm for a combined well field production capacity of 1,400 gpm.

Table 1-2. Sierra Lakes Permitted Well Construction Information

Well No.	Year Drilled	Well Depth (ft)	Casing Dia. (in)	Casing Depth (ft)	Depth to Annular Seal (ft)	Pump Power (HP)	Pump Capacity (gpm)
SL Well 1A	1988	380	8	50	50[1]	25	200
SL Well 3	1980	480	8	57	50	30	150
SL Well 4	1985/1999[2]	400/800	8	50	Unknown[3]	30	330
SL Well 5	2006	1,000	---	---	100		55
SL Well 6	2006	1,407	---	---	100	---	60
SL Well 7	2006	482	---	---	100	---	384
SL Well 8	2006	907	---	---	100	---	171
SL Well 9	2007	1,307	---	---	100	---	50

[1]The seal extends to bedrock.
[2]Well 4 was deepened from 400 feet to 800 feet in 1999.
[3]Sierra Lakes Well 4 has a grouted annular seal, however the Well Drillers Report does not indicate the depth of the seal.

Section 2
Water Quality

2.1 Water Quality Summary & Regulatory Compliance

The Hillview Water Company conducts water quality monitoring of all drinking water sources in accordance with the CDPH regulations specified under Title 22, California Code of Regulations. The samples collected for general mineral, general physical and inorganic chemicals as well as radiological constituents (including uranium and gross alpha) are summarized in Tables 2-1, 2-2, 2-3, 2-4 and 2-5. Data was available for Wells 1A, 3 and 4 over a period of years, as shown in these tables. Data for the new Sierra Lakes Wells 5, 6, 7, and 8 included only a single sample event on February 5, 2007. There is no water quality data available for Well 9.

The data show that the water has low hardness, is moderately aggressive and complies with all secondary drinking water standards (with the exception of Well 4) indicating that the water is generally aesthetically acceptable. The wells have issues with arsenic and uranium compliance, as discussed later.

The water produced by Well 4 has elevated levels of iron and manganese that are reduced using a continuously regenerated manganese greensand process. Water from Well 4 is oxidized using liquid sodium hypochlorite, is dosed with ferric sulfate and then aerated ahead of the iron and manganese removal system to obtain some uranium removal. This pretreated water is then blended with the water from Well 3 and passed through the greensand filter. The water produced by Wells 1A and 3 have low to moderate levels of iron and manganese, while the new Wells 5, 6, 7, and 8 had no detection of iron and only low to moderate levels of manganese in the initial samples.

Radiological Quality. The water quality data shows that the water from Well 4 does not comply with the uranium and gross alpha MCLs. Uranium concentrations (shown in Table 2-2) have ranged from non-detectable levels to a high of 205 pCi/L (October 1999). The extensive monitoring conducted on Well 4 shows great variability in uranium from sample to sample and from year to year. Annual averages since 2001 have been in the range of 40 to 90 pCi/L, which exceeds the MCL of 20 pCi/L, which is based on a 4-quarter average of samples. The gross alpha testing of Well 4 (shown in Table 2-4) shows that the water consistently exceeds the gross alpha MCL of 15 pCi/L, which is also intended to be based on a 4-quarter average of samples. Gross alpha concentrations in individual samples have ranged from 14 to 232 pCi/L over the period 1994 to 2005. There was no treated water uranium data available, hence the effectiveness of the aeration treatment to reduce the uranium concentrations could not be determined.

Wells 1A and 3 have also had extensive uranium and gross alpha, presented in Table 2-3. This data shows that Well 1A complies with the uranium and gross alpha MCLs, while Well 3 has had a multiple samples exceeding both MCLs. Based on the last four quarters of 2001, Well 3 would not comply with either the uranium or gross alpha MCLs.

Table 2-1. General Mineral, General Physical and Inorganic Chemical Water Quality

Parameter	Units	MCL Primary (Secondary)	Well 1A 9/4/2002	Well 1A 5/25/2005	Well 3 9/4/2002	Well 3 5/25/2005	Well 4 9/4/2002	Well 4 5/25/2005	Well 5 2/5/2007	Well 6 2/5/2007	Well 7 2/5/2007	Well 8 2/5/2007
Alkalinity, (Total) as CaCO3	mg/L	--							127	129	121	127
Aluminum	ug/L	1000 (200)	<50	<50	<50	<50	<50	55	<50	<50	<50	<50
Antimony	ug/L	6	<6	<6	<6	<6	<6	<6	<6	<6	<6	<6
Arsenic	ug/L	10	16	21.9	15.9	25	32.5	149	11.4	16	15.6	19.3
Barium	ug/L	1000	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Beryllium	ug/L	4	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	mg/L		116	137	112	126	97	56	119	116	65	110
Cadmium	ug/L	5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Calcium	mg/L	--	17	15	3529[2]	26	17	19	21	20	19	25
Carbonate Alkalinity as CaCO3	mg/L	--	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Chloride	mg/L	(500)[1]	14.4	15	16.1	13.5	10.9	11.6	8	9	8.3	10.9
Chromium, Total	ug/L	50	<10	<1	<10	<1	<10	<1	<1	<1	<1	<1
Color, Apparent (Unfiltered)	units	(15)	10	10	<5	5	10	25	<5	<5	<5	<5
Copper	ug/L	1300 (1000)	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Corrosivity (Langelier Saturation Index)	-	—	-0.75[3]	-0.98[3]	-0.56[3]	-0.41[3]	-1.11[3]	-0.56[3]	-0.46[3]	-0.65[3]	-1.33[3]	-0.83[3]
E.C.	umhos/cm	(900)[1]	219	280	310	270	280	250	225	223	224	242
Fluoride (Temp. Depend.)	mg/L	2.0	0.37	0.37	0.3	0.40	0.44	0.40	0.1	0.6	0.5	0.6
Foaming Agents	mg/L	0.5	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250	<0.0250
Hardness, (Total as CaCO3)	mg/L	—	48	100	96	56	86	92	77.5	65.3	81.6	83.6
Hydroxide Alkalinity as CaCO3	mg/L	—	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Iron	ug/L	(300)	180	260	<100	170	310	1900	<100	<100	<100	<100
Lead	ug/L	15	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Magnesium	mg/L	--	2	4	2	<2	3	4	2.2	<2	2.3	2.1
Manganese	ug/L	(50)	40	41	35	35	35	102	29	<20	21	33
MBAS	mg/L	(0.5)	<0.025	<0.025					<0.025	<0.025	<0.025	<0.025
Mercury	ug/L	2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Nickel	ug/L	100	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Nitrate (NO3)	mg/L	45							<2	<2	<2	<2
Nitrite (as N)	ug/L	1000							<400	<400	<400	<400
Odor Threshold @ 60°C	TON	(3)	0	0	0	0	0	[illegible]	Not detected	1	1.4	Not detected
pH, Laboratory	units		7.7	7.2	7.2	6.5	7.1	7.4	7.55	7.42	6.83	7.15
Potassium	mg/L	--							1.2	<1	1.2	1.3
Selenium	ug/L	50	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Silver	ug/L	(100)	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Sodium	mg/L	--	45	38	35	37	27	28	26	29	38	29
Sulfate	mg/L	(250)[1]	14	21.7	13.5	14.3	14.9	47.8	7.3	8	10.4	3.7
TDS	mg/L	(500)[1]	190	205	200	192	190	206	160	170	170	180
Thallium	ug/L	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Turbidity, Laboratory	NTU	5.0	1.5	2.0	0.25	0.9	1.4	1.6	0.50	0.50	0.40	0.50
Zinc	ug/L	(5000)	<50	<50	<50	140	<50	<50	160	250	<50	110

[1]Recommended Level
[2]Possible analytical or data reporting error
[3]Calculated values using AWWA Corrosivity Index Calculator, with assumed temperature of 15°C

Table 2-2. Sierra Lakes Well 4 Uranium Data

1994 - 2000 Data		2001 Data		2002 Data		2003 Data		2004 Data		2005 Data	
Date	Uranium (pCi/L)	Date	Uranium (pCi/L)	Date	Uranium (pCi/L)	Date	Uranium (pCi/L)	Date	Uranium (pCi/L)	Date	Uranium (pCi/L)
2/3/1994	67.4	5/7/2001	93	3/11/2002	90.3	4/15/2003	112	4/19/2004	67	4/26/2005	68.7
2/30/1997	43.05	5/14/2001	89	3/28/2002	82.8	4/29/2003	103	5/10/2004	99	5/11/2005	65
2/27/1997	37.93	5/21/2001	75	4/10/2002	82	5/13/2003	88.5	5/24/2004	81	5/25/2005	80
4/28/1997	75.34	6/4/2001	89.2	4/23/2002	106	5/27/2003	85	6/10/2004	70	6/25/2005	81
5/29/1997	61.4	6/18/2001	72	5/6/2002	60	6/13/2003	70	6/22/2004	52	6/7/2005	80.7
6/27/1997	45.48	7/2/2001	79	5/20/2002	90	6/24/2003	68	7/29/2004	18	6/21/2005	91
7/25/1997	39.75	7/15/2001	81	7/1/2002	60.5	7/7/2003	51	9/15/2004	22	7/21/2005	44.8
9/2/1997	25.19	8/1/2001	59	7/16/2002	24	7/21/2003	30	10/11/2004	29	8/1/2005	24.5
8/23/1999	82	8/13/2001	48	7/29/2002	44	8/18/2003	25	11/8/2004	201	9/6/2005	32
9/20/1999	49	8/28/2001	41	8/12/2002	38	9/10/2003	35			9/22/2005	40
10/23/1999	205	9/7/2001	<1	9/3/2002	41	10/8/2003	49			10/3/2005	33
11/12/1999	201	9/7/2001	40	9/10/2002	58	10/22/2003	61				
2/13/2000	197.09	9/7/2001	<1	9/23/2002	64	11/19/2003	108				
5/13/2000	108	9/7/2001	<1	10/7/2002	52.1						
6/8/2000	105	9/7/2001	<1	10/21/2002	72						
6/23/2000	86	9/8/2001	50	11/6/2002	41						
7/7/2000	68.5	9/8/2001	<1								
7/21/2000	72	9/9/2001	93								
9/21/2000	52	9/10/2001	43								
10/13/2000	55	9/11/2001	16								
10/30/2000	70.5	9/12/2001	40.5								
11/13/2000	58	9/13/2001	36								
		9/15/2001	<1								
		9/15/2001	27								
		9/16/2001	42								
		9/16/2001	<1								
		9/18/2001	<1								
		9/18/2001	26								
		9/19/2001	43								
		9/20/2001	<1								
		9/21/2001	34								
		9/21/2001	<1								
		9/22/2001	30								
		9/22/2001	<1								
		9/23/2001	1								
		9/23/2001	28								
		9/24/2001	2								
		9/24/2001	38								
		9/25/2001	39								
		9/25/2001	2								
		9/26/2001	36								
		9/26/2001	3								
		9/27/2001	3								
		9/27/2001	42								
		10/8/2001	26								
		10/15/2001	35.5								
		10/15/2001	12								
		10/21/2001	42								
		11/4/2001	12								
		11/17/2001	14								
		11/13/2001	15								
		11/15/2001	21								
		11/21/2001	29								
		12/1/2001	20								
		12/11/2001	26								
		12/11/2001	70								

Well 4 Summary

Year	Average Cr (pCi/L)	Range Cr (pCi/L)
1994-2000	89.1	25 - 205
2001	39.1	<1 - 93
2002	61.0	24 - 106
2003	68.1	25 - 112
2004	74.3	22 - 201
2005	52.8	25 - 91

Uranium MCL = 20 pCi/L based on a 4-quarter average

Table 2-3. Sierra Lakes Wells 1A and 3
Gross Alpha & Uranium

Date	Well 1A		Well 3	
	Gross Alpha (pCi/L)	Uranium (pCi/L)	Gross Alpha (pCi/L)	Uranium (pCi/L)
9/26/1989	3.45		10.79	
8/7/1990	6		22	
6/24/1993	6	3	27	27
12/19/1994	8.7		18.8	
1/30/1997	10.5	11.58	9.06	6.65
2/27/1997		3.23		10.37
4/28/1997	15.34	2.96	14.59	12.26
5/29/1997		2.23		11.26
6/27/1997		3.13		11.43
7/25/1997	1.11	1.07	11.39	7.67
9/2/1997		2.02		8.06
1/29/1998		3.34		13.27
2/26/1998	4.4	2.43	15.11	12.46
3/30/1998		2.93		
2/12/2001	7	5	16	17
5/14/2001	11	10	15	12
8/13/2001	6	5	11	11
11/12/2001	7	4	47.5	49.5
9/23/2002	-	185		
5/25/2005	6.3	5.3	6	8
Average	*7.6*	*14.8*	*17.2*	*14.9*

Table 2-4. Sierra Lakes Well 4
Gross Alpha

Date	Gross Alpha (pCi/L)
10/3/1994	49.3
12/19/1994	68.4
1/30/1997	40.62
4/28/1997	57.93
7/25/1997	43.68
2/26/1998	61.13
1/13/2000	232
5/14/2001	90
8/13/2001	49.5
11/12/2001	14
5/25/2005	47.5
Average	*68.6*

Table 2-5. Sierra Lakes Wells 5, 6, 7 & 8[1]
Uranium

Well	Uranium (Lab) (ug/L)	Uranium (Calc'd)[2] (pCi/L)
Well 5	7.4	4.9
Well 6	4	2.7
Well 7	66	44.0
Well 8	16	10.7

[1] For samples collected 2/5/2007

[2] Based on ratio of 0.67 pCi/ug

Ur MCL = 20 pCi/L based on a 4-quarter average
GA MCL = 15 pCi/L based on a 4-quarter average

Table 2-6. Sierra Lakes Wells 1A, 3, and 4 Arsenic Data

Date	Arsenic (ug/L)				
	Well 1A	Well 3	Well 4	New Wells 5, 6, 7, & 8 2/5/2007	
9/7/2001			27		
9/7/2001			<2	Well 5	11.4
9/7/2001			2	Well 6	10.0
9/7/2001			6	Well 7	15.6
9/7/2001			6	Well 8	19.2
9/8/2001			27		
9/8/2001			<2		
9/9/2001			24		
9/10/2001			<2		
9/11/2001			17		
9/12/2001			18		
9/13/2001			20		
9/15/2001			<2		
9/15/2001			26		
9/16/2001			20		
9/18/2001			<2		
9/18/2001			21		
9/19/2001			25		
9/19/2001			<2		
9/20/2001			36		
9/21/2001			24		
9/21/2001			3		
9/22/2001			24		
9/22/2001			<2		
9/23/2001			<2		
9/23/2001			30		
9/24/2001			3		
9/24/2001			38		
9/25/2001			34		
9/25/2001			<2		
9/26/2001			36		
9/26/2001			<2		
9/27/2001			<2		
9/27/2001			40		
10/15/2001			20.9		
10/15/2001			2.02		
10/21/2001			21.3		
11/4/2001			2.08		
11/13/2001			<2		
11/19/2001			<2		
11/25/2001			10.2		
12/11/2001			[redacted]		
9/4/2002	16	15.9	32.8		
5/25/2005	21.9	25	149		
Average	19	20	36		

Only one sample has been collected from the newly constructed Sierra Lakes Wells 5, 6, 7 and 8 for uranium analysis, and no data is available for Well 9 for evaluation. The available samples were analyzed using a mass analysis and showed results of 4 to 66 µg/L of uranium. These values have been converted to radiometric values using the conversion factor used by CDPH of 0.67 pCi/µg. This results in uranium concentrations of about 3 to 44 pCi/L, with only Well 7 exhibiting a level above the 20 pCi/L MCL for uranium. There being only a single sample from each well, and recognizing the variability in water quality from the other wells, leads to the conclusion that any or all of these wells could exhibit increases in uranium concentration above the MCL. HWC provides quarterly notification to customers that the water exceeds the uranium MCL.

Arsenic Quality. The water produced by the wells in the Sierra Lakes Well Field all show elevated levels of arsenic above the federal MCL of 10 µg/L (compliance is calculated over 4 quarters of samples), as shown in Table 2-6. Excluding Well 4, samples from the remaining wells range from 10 to 25 µg/L of arsenic. Extensive monitoring was conducted on Well 4 during the third quarter of 2001, which is tabulated in Table 2-6, with multiple samples taken on some days. This data again shows great variability with samples ranging from nondetectable levels to a high of 370 µg/L. Samples collected on one day could range from nondetectable to levels above 25 µg/L (note the samples collected on September 7, 2001). Some of this data may be indicative of well cycle tests, where testing begins with startup of the well, and continues over a well pumping cycle (i.e., until the well turns off). This demonstrates how the concentrations vary over a typical pumping cycle of the well. No information relative to the time of sample collection is available, hence this study is not able to evaluate variations of arsenic concentration in a pumping cycle. The average of all samples shown for Well 4 is 26 µg/L, with only two samples collected during this period that are exceedingly high – one sample in December 2001 at 370 µg/L, and one sample in May 2005 at 140 µg/L.

Technically, HWC has until the end of 2007 to collect and report an initial arsenic sample for each well under the new federal Arsenic Rule. If any sample exceeds 10 µg/L, then HWC must conduct quarterly monitoring for one year from that well to determine compliance with the MCL.

It has been well documented that iron and manganese treatment using pre-oxidation and greensand filtration can remove arsenic. No treated water arsenic data was available to establish the levels of arsenic removal for the HWC Sierra Lakes Wells iron and manganese treatment as part of this study.

Other Primary Standards. The Sierra Lakes Wells have shown no detectable levels of nitrate, volatile organic chemicals or synthetic organic chemicals, as reported by CDPH in their October 2006 inspection report of the HWC Oakhurst-Sierra Lakes Water System.

2.2 Uranium Health Effects

Uranium is a radioactive element that occurs naturally in varying but small amounts in soil, rocks, water, plants, animals and all human beings. It is the heaviest naturally occurring element, with an atomic number of 92. In its pure form, uranium is a silver-colored heavy metal that is nearly twice as dense as lead. In nature, uranium atoms exist as several isotopes, which are identified by the total number of protons and neutrons in the nucleus: uranium-238, uranium-235, and uranium-234.

The three naturally occurring isotopes of uranium are each radioactive, which means the nuclei spontaneously disintegrate or "decay." Radioactivity emitted from uranium isotopes consists of alpha particles (a collection of two protons and two neutrons) and gamma rays (an electromagnetic energy wave similar to visible light except with higher energy and more penetrating power). The rate at which the nuclei in an isotope sample decay is called activity, which is the number of disintegrations that occur per second. The activity of an isotope sample decreases with time as the atoms disintegrate. Each isotope has its own half-life, which is the time it takes for half of the atoms in a sample of the isotope to decay and the activity of the sample to be proportionately reduced.

When foods and liquids containing uranium are consumed, most of it leaves the body within a few days in feces and never enters the blood. A small portion will get into the blood and will leave the body through urine within a few days. The rest can remain in the bones, kidneys, or other soft tissues. The small amount that goes to the bones may stay there for years. Most people have a very small amounts of uranium, about 1/5,000th of the weight of an aspirin tablet, in their bodies, mainly in their bones.

Exposure to uranium can result in both chemical and radiological toxicity, as described next.

2.2.1 Chemical Toxicity

Uranium, being a naturally occurring heavy metal, is chemically toxic, as are other heavy metals such as lead. The main chemical effect associated with exposure to uranium and its compounds is kidney toxicity. This toxicity can be caused by breathing air containing uranium dusts or by eating substances or drinking water containing uranium, which then enters the bloodstream. Once in the bloodstream, the uranium compounds are filtered by the kidneys, where they can cause damage to the kidney cells. Very high uranium intakes (ranging from about 50 to 150 mg depending on the individual) can cause acute kidney failure and death. At lower intake levels (around 25 to 40 mg), damage can be detected by the presence of protein and dead cells in the urine, but there are no other symptoms. Also, at lower intake levels, there is generally no diminution in kidney function because the kidney repairs itself over a period of several weeks after the uranium exposure has stopped.

Uranium has been identified as a nephrotoxic metal, or kidney toxicant, exerting its toxic effects by chemical action mostly in the proximal tubes of humans and animals[1]. However, uranium is a less potent nephrotoxin than the classical nephrotoxic metals such as cadmium, lead and mercury. Uranium has an affinity for renal proximal tubular cells and interferes with reabsorption of proteins. Uranium-induced renal tubular dysfunction in humans is marked by mild proteinuria, an increase in the excretion of protein in the urine, due to reduced reabsorption in the proximal renal tubules. Proteinuria can also be caused by other physical problems. It is not known if uranium-induced proteinuria is an indicator of the beginning of an adverse effect or whether it is a reversible effect that does not typically result in kidney disease. Based on the uncertainty involved in the ultimate effects, the USEPA has treated this effect as an indicator of an incipient change in kidney function that may lead to adverse effects such as breakdown of kidney tubular function.

[1] USEPA Federal Register, 40 CFR Parts 9, 141, and 142, National Primary Drinking Water Regulations; Radionuclides; Final Rule. December 7, 2000

2.2.2 Radiological Toxicity

Several possible health effects are associated with human exposure to radiation from uranium. Because all uranium isotopes mainly emit alpha particles that have little penetrating ability, the main radiation hazard from uranium occurs when uranium compounds are ingested or inhaled. However, workers in the vicinity of large quantities of uranium in storage or in a processing facility also are exposed to low levels of external radiation from uranium decay products. At the exposure levels typically associated with the handling and processing of uranium, the primary radiation health effect of concern is an increased probability of the exposed individual developing cancer during their lifetime. Cancer cases induced by radiation are generally indistinguishable from other "naturally occurring" cancers and occur years after the exposure takes place. The probability of developing a radiation-induced cancer increases with increasing uranium exposure.

Natural uranium is radioactive but poses little radioactive danger because it gives off very small amounts of radiation. Uranium transforms into another element and gives off radiation. In this way uranium transforms into thorium and gives off a particle called an alpha particle or alpha radiation. Uranium is called the parent, and thorium is called the transformation product. When the transformation product is radioactive, it keeps transforming until a stable product is formed. During these decay processes, the parent uranium, its decay products, and their subsequent decay products each release radiation. Radon and radium are two of these products. Unlike other kinds of radiation, the alpha radiation ordinarily given off by uranium cannot pass through solid objects, such as paper or human skin.

2.2.3 Route of Exposure

The extent of damage from exposure to a uranium compound depends on the solubility of the compound and the route of exposure. In most assessments only inhalation, ingestion, and external radiation are considered. Although absorption of some soluble uranium compounds through the skin is possible, such dermal exposures generally are not significant.

2.2.4 Uranium MCL

Under the Radionuclide Rule the USEPA adopted the MCL of 30 µg/L for uranium in 2000, with an effective date of December 2003. The USEPA believes that 30 µg/L is protective against kidney toxicity and cancer effect, while weighing the high costs for smaller systems to provide treatment and disposal of radioactive wastes.

CDPH has adopted a uranium MCL of 20 pCi/L, which is equivalent to the USEPA mass-based uranium MCL of 30 µg/L using a correlative conversion factor of 0.67 pCi/µg.

2.3 Arsenic Health Effects

Arsenic is a semi-metal element in the periodic table and occurs naturally in rocks and soil, water, air, and plants and animals. It can be further released into the environment through natural activities such as volcanic action, erosion of rocks and forest fires, or through human actions.

Approximately 90 percent of industrial arsenic in the U.S. is currently used as a wood preservative, but arsenic is also used in paints, dyes, metals, drugs, soaps and semi-conductors. High arsenic levels can also come from certain fertilizers and animal feeding operations. Industry practices such as copper smelting, mining and coal burning also contribute to arsenic in our environment.

Arsenic combined with other elements such as oxygen, chlorine and sulfur is called inorganic arsenic. Arsenic combined with carbon and hydrogen is referred to as organic arsenic. Arsenic exists in three common valence states: As(0) (metalloid arsenic, 0 oxidation state), As(III) (trivalent state, such as arsenites), and As(V) (pentavalent state, such as arsenates).

Higher levels of arsenic tend to be found more in groundwater sources than in surface water sources (i.e., lakes and rivers) of drinking water. The demand on groundwater from municipal systems and private drinking water wells may cause water levels to drop and release arsenic from rock formations. Compared to the rest of the United States, western states have more systems with arsenic levels greater than USEPA's standard of 10 parts per billion (ppb).

2.3.1 Arsenic Toxicity

Arsenic-containing compounds vary in toxicity to mammals according to valence state, form (inorganic or organic), physical state (gas, solution, or powder) and factors such as solubility, particle size, rates of absorption and elimination, and presence of impurities. Inorganic arsenic is generally more toxic than organic arsenic. However, animal studies have shown that methyl and phenyl arsenates can produce health effects similar to those produced by inorganic arsenic. The toxicity of arsenite, As(III), is several times greater than that of arsenate, As(V), due to greater cellular uptake.

Until the late 1980s, skin cancer had been the cancer classically associated with arsenic in drinking water. However, more recent studies have demonstrated that exposure to inorganic arsenic in drinking water has also been associated with the development of internal cancers. Studies have linked long-term exposure to inorganic arsenic in drinking water to cancer of the bladder, lungs, skin, kidney, nasal passages, liver, and prostate. Non-cancer effects of ingesting arsenic include gastrointestinal, cardiovascular, hematological (e.g., anemia), pulmonary, neurological, immunological, and reproductive/developmental function. The most common symptoms of inorganic arsenic exposure appear on the skin and include thickening and discoloration of the skin, referred to as keratoses and hyperpigmentation[1]. Other effects include stomach pain, nausea, vomiting, diarrhea, numbness in hands and feet, partial paralysis, and blindness. Short-term exposure to high doses of arsenic can cause other adverse health effects, but such effects are unlikely to occur from U.S. public water supplies that are in compliance with the prior arsenic standard of 50 ppb.

[1] USEPA Federal Register, 40 CFR Parts 9, 141, and 142, National Primary Drinking Water Regulations; Arsenic and Clarifications to Compliance and New Source Contaminants Monitoring; final Rule. January 22, 2001.

2.3.2 Route of Exposure

A person normally takes in small amounts of arsenic in the air, water, and food consumed. The major source of exposure for most people is by eating arsenic-containing food. Exposure to arsenic from air, soil, and water occurs much less frequently. Meat, fish, and poultry account for 80 percent of dietary arsenic intake.

Both arsenate and arsenite are well absorbed by both the oral and inhalation routes. Absorption by the dermal route has not been well characterized but is low compared to the other routes. Once absorbed, arsenates are partially reduced to arsenites, yielding a mixture of As (III) and As(V) in the blood. Most arsenic is promptly excreted in the urine as a mixture of As(III) and As(V), and other reduction compounds.

2.3.3 Arsenic MCL

The USEPA adopted a reduced drinking water standard for arsenic in January 2001 of 10 µg/L. Prior to that date, the MCL had been 50 µg/L. Water systems were required to implement initial monitoring under the new Rule beginning in January 2006. Initial surface water samples were to be collected by December 2007, while groundwater systems have until December 2008. Compliance is based on a quarterly average for systems in which the initial sample exceeds 10 µg/L. California is in the process of adopting a reduced arsenic MCL. (CDPH is still enforcing a 50 µg/L MCL), but in the interim has agreed to assist the USEPA with implementation of the federal MCL of 10 µg/L.

The MCL for arsenic of 10 µg/L in drinking water is based on total arsenic including both organic and inorganic forms.

Section 3
Treatment Alternatives

When alternatives such as developing a new well or simply eliminating a contaminated well (when sufficient supply is available from other sources), public water systems must often rely on treatment to remove a contaminant from groundwater to comply with drinking water standards. This section discusses treatment alternatives for uranium and arsenic removal to comply with the recent federally adopted MCLs.

3.1 Best Available Treatment Technology

Upon promulgation of a drinking water standard, the USEPA provides in the regulations a summary of treatment technologies considered appropriate for removal of the contaminant, identified as Best Available Technology, or BAT. As part of the adopted BATs, the USEPA also identified Small System Compliance Technologies (SSCTs). When considering SSCTs, the USEPA looked at the affordability of the technology (recognizing that per household costs for centralized treatment tend to be higher for smaller system customers) and technical complexity (since many small systems do not have access to well-trained water system operators). The SSCTs represent technologies that are affordable and achieve compliance with the arsenic MCL across the small system size categories (25-500; 500-3,300; 3,301-10,000 people).

The point-of-use (POU) devices are viable options for very small systems, especially those serving fewer than 200 persons, for removal of specific chemical contaminants. The USEPA has identified POU as viable alternatives for some of the BAT technologies identified under the Radionuclide Rule and Arsenic Rule. In California, approval for use of POE (point-of-entry) must be obtained from CDPH on a case by case basis. Use of POU is not currently allowed under California law, but CDPH is working on changing the law to allow it in conformance with the federal rules. Conditions for approval to use POU for compliance with the arsenic MCL will require that the unit be owned and maintained by the public water system. This will require that the water system have access to the unit, which would typically be installed on a kitchen faucet designated for cooking and drinking (i.e., the homeowner would need to agree to allow a utility representative into their home for maintenance and monitoring of the POU device). A monitoring strategy would need to be developed to adequately characterize the condition of all of the POU devices installed in order to identify an appropriate maintenance schedule for replacement of media or membranes.

To obtain approval for use, treatment chemicals added to the water and media or materials that have direct contact with the water should be certified under the NSF/ANSI Standards 60 and 61 for direct and indirect use in potable water systems.

3.1.1 Uranium

The USEPA BATs and SSCTs specified in the Radionuclide Rule for removal of uranium from drinking water, are shown in Table 3-1.

Table 3-1. BAT for Uranium Treatment

Best Available Technology (BAT)	Small System Compliance Technology (SSCT) Criteria (Population-based)
Coagulation/Filtration	All size categories
Ion Exchange	Centralized: All size categories Point-of-Use: All size categories
Lime Softening	501-3,300; 3,301-10,000
Reverse Osmosis	Centralized: 501-3,300; 3,301-10,000 Point-of-Use: All size categories

The USEPA also identified SSCTs to include activated alumina as appropriate for all size categories. Activated alumina was not identified as BAT under the Radionuclide Rule.

3.1.2 Arsenic

The USEPA identified a number of BATs and SSCTs for removal of arsenate, As(V), from drinking water, as shown in Table 3-2.

Table 3-2. BAT for Arsenic[1]

Treatment Technology	Small System Compliance Technology (Population-based)
Activated Alumina	Centralized: All size categories Point-of-Use: All size categories
Coagulation/Filtration	501-3,300; 3,301-10,000
Electrodialysis	501-3,300; 3,301-10,000
Ion Exchange	All size categories
Lime Softening	501-3,300; 3,301-10,000
Oxidation/Filtration[2]	All size categories
Reverse Osmosis	Centralized: 501-3,300; 3,301-10,000 Point-of-Use: All size categories

[1] BATs for Arsenic V. Preoxidation may be required to convert Arsenic III to Arsenic V.
[2] To obtain high removals, iron to arsenic ratio must be at least 20:1.

The USEPA also identified SSCTs to include enhanced coagulation/filtration and enhanced lime softening (pH > 10.5) as appropriate for all size categories; and coagulation-assisted microfiltration for 501-3,300 and 3,301-10,000 population systems. These treatment technologies were not specifically identified as BAT's under the Arsenic Rule.

A treatment option that has developed that was not included by the USEPA as a BAT or SSCT due to insufficient documentation at the time of rule promulgation include iron-based sorbents and other adsorbent materials being developed by industry. These are typically fixed bed contactors with disposable media.

Several of the BAT technologies listed are similar between uranium and arsenic removal. The ability for a particular technology to remove both uranium and arsenic simultaneously to regulatory compliance levels would need to be tested in a pilot study.

It should also be mentioned that alternative solutions to both arsenic and uranium include blending of contaminated sources with those that have lower levels to achieve a blended flow that meets the respective uranium and arsenic MCLs. Eliminating or abandoning sources with the highest concentrations will improve the ability to comply with MCLs in the blended water.

3.2 Treatment Strategies

A brief description of the treatment technologies that are being implemented for removal of uranium and/or arsenic are provided in this section. These treatment technologies can be grouped into three categories: sorption processes, membrane processes and precipitative processes. Tables 3-3 and 3-4 provide a summary of the applicability of these treatment processes for reduction of uranium and arsenic, respectively.

3.2.1 Sorption Processes

3.2.1.1 Ion Exchange

Ion Exchange (IX) processes can be used to remove hardness, radium, nitrate, arsenic, uranium and other contaminants. Ion exchange is a chemical/physical process in which an ion in the feed water is exchanged for an ion on a synthetic resin media. To accomplish this exchange of ions, feed water is continuously passed through a bed of IX media resin beads until the resin is exhausted. Exhaustion occurs when all sites on the resin beads have been filled by contaminant ions (and/or other "competing" ions present in the water). The number of bed volumes that can be treated before exhaustion occurs varies with the resin type and the influent water quality (concentration of contaminant and competing ions). Media is typically regenerated using a concentrated sodium chloride (NaCl) solution, which strips the ions off to be replaced with a chloride ion. Only a few number of bed volumes of regenerant are usually required to regenerate the resin. Regenerant may be reused several times, depending on the concentration of other sorbed contaminants. Once the contaminant concentration becomes too high in the regenerant, the spent solution, or brine, must be treated and/or disposed. Spent brine will have high TDS content as well as high arsenic or uranium concentrations, which may make it unlikely that the solution could be discharged to a wastewater treatment plant. Off-site disposal may be required.

Ion exchange operations have been developed to maximize the removal the exchange capacity of the beds while minimizing the production of waste brine from regeneration. This operation is referred to as "merry-go-round" operation, in which multiple ion exchange beds are used in parallel operation, but in different stages of the treatment and regeneration process. The combined effluent water will meet the target MCLs, but individual beds may be producing water significantly higher or lower than the MCL.

Arsenic. Improved removal of arsenic may be achieved by pre-oxidizing the raw water to convert As(III) to As(V). The strong-base ion exchange resins used for arsenic removal have a relatively high affinity for arsenic in the As(V) form, however competing ions, most notably sulfates and nitrates, play a significant role in efficiency of ion exchange processes.

Uranium. Uranium can be removed by the same processes as arsenic, often using an anion exchange media that is specifically developed to remove uranium preferentially. Up to 95 percent of the uranium can be removed from the source water, with 10,000 to 50,000 bed volumes. Uranium forms a strong bond with the IX media and is not dislodged by competing ions. IX media sites can be taken up by competing ions, shortening the life of the media for uranium removal. Uranium removal IX media can be regenerated onsite, resulting in a liquid waste stream with uranium concentrations. This may be discharged to a local sewer system if the receiving facility is able to accept the levels of salt and uranium in accordance with their wastewater permit. Because of the long life of the uranium IX media (based on bed volumes before exhaustion), media can be disposed of in lieu of being regenerated, and fresh media placed in the vessels, thus eliminating the need for onsite regeneration an the resulting brine waste issues. The solid media residuals must be evaluated as a radioactive material prior to disposal. An example of a disposable IX treatment option is further discussed in Section 4.

NDMA Concerns. Any treatment process using anion exchange media should evaluate the treated water effluent for the formation of NDMA (N-nitrosodimethylamine). NDMA has been found in drinking water supplies in association with disinfected anion exchange treatment. CDPH cautions that the release of nitrosamines from some resins that may be used in drinking water treatment suggest a need for continued vigilance, so that a treatment approach to remove one contaminant does not inadvertently introduce another. NDMA along with other nitrosamines have been demonstrated to cause cancer in laboratory animals CDPH has established a Notification Level of 10 ng/L (0.010 µg/L) for NDMA in drinking water.

3.2.1.2 Activated Alumina

Activated alumina (AA) is a porous, granular material with ion exchange properties, but is considered an adsorption process. AA is used in packed beds to remove contaminants such as fluoride, arsenic, uranium, selenium, silica, and NOM. Removal is achieved by continuously passing water through pressurized beds packed with AA media. Once the adsorption sites are filled, the media must be regenerated. This can be accomplished on-site or the media disposed of and replaced with fresh media. On-site regeneration is accomplished through a sequence of rinsing with regenerant, flushing with water and neutralizing with acid. The regenerant is a strong base, typically sodium hydroxide; the neutralizer is a strong acid, typically sulfuric acid.

A treatment train for arsenic or uranium removal would include pre-oxidation, pH reduction (acid addition), filtration with AA, pH neutralization (with a base), and regeneration.

The use of disposable alumina-based adsorptive media is developing for the treatment of sources with arsenic. These media, commonly referred to as modified AA, contain alumina

in a mixture with other substances such as iron and sulfur, often with greater adsorptive capacities and selectivity for arsenic. Disposal of modified AA disposable media is not expected to exceed any threshold levels, allowing it to be disposed of in a municipal solid waste landfill.

Arsenic. Factors such as source water pH, arsenic oxidation state (As(III) vs. As(V)), competing ions, empty bed contact time, and regeneration have significant effects on the removal efficiency with AA. The selectivity of AA for As(III) is poor. Therefore, preoxidation to convert As(III) to As(V) may be necessary. Research has shown improved arsenic removal at pH in the range of 5.5 to 6.0. Most groundwaters would require pH adjustment using an acid to reduce the pH to this optimal range. Regeneration typically produces a large volume of caustic waste solution - up to 40 bed volumes of waste. In many cases, this waste stream will be classified as a hazardous liquid waste due to the arsenic levels.

Uranium. The use of AA for uranium removal is not designated as a BAT by the USEPA, however it is a SSCT for systems with up to 10,000 customers. The technology does require advanced operator expertise because handling of materials during regeneration and pH adjustment requires an adequately trained operator.

3.2.1.3 Iron-Based Sorbents (Arsenic Only)

Adsorption on iron based sorbents (IBS) is an emerging treatment technique for arsenic removal. Types of IBS currently on the market include iron coated sand, sulfur modified iron, granular ferric hydroxide (GFH) and other proprietary iron based media. Due to limited performance research at the time the Arsenic Rule was promulgated, IBS is not designated as a BAT or a SSCT by the USEPA. It is, however, emerging as a viable treatment technology for small and large system applications.

Typical treatment processes include pre-oxidation of the water to convert As(III) to As(V), then passing the water through a pressure vessel for contact with the IBS media. Competing ions present in the source water, as well as source water pH, will determine the effectiveness of IBS. Phosphate and silica have been shown to compete aggressively with As(V) for adsorptive sites. IBS performs better at lower pH. Any increase in pH during treatment may result in the release of arsenic from the media, resulting in higher levels in the finished water than in the source water.

Most IBS materials are marketed as disposable media, rather than providing onsite regeneration. Exhausted IBS media tested for disposal should not exceed any threshold levels, enabling it to be disposed of in a municipal solid waste landfill. However, testing of the IBS via a short pilot study would be recommended to identify viable disposal options.

3.2.2 Membrane Processes

Membrane separation is a physical process of blocking the passage of chemical constituents in water across the membrane surface. Pressure driven membrane processes are classified by the pore size (and hence the size of particle that can pass through) into four categories (in decreasing size of

pore): microfiltration (MF), ultrafiltration (UF), nanofiltration (NF), and reverse osmosis (RO). MF and UF primarily remove constituents through physical sieving. MF processes for arsenic removal necessitate the use of a coagulation stage to generate floc, and is therefore discussed under Coagulation-Assisted Microfiltration in Section 3.2.3. Reverse osmosis has been found to be able to be used as a stand-alone treatment process for arsenic removal and is further discussed below.

3.2.2.1 Reverse Osmosis

Most RO membranes are made of cellulose acetate or polyamide composites cast into a thin film. Reverse osmosis membranes provide a greater rejection of contaminants than other membranes because they do not rely on the pore size in the membrane, but use osmotic pressure to force the feed water across the membrane. Because of this, they can be used as a stand-alone treatment technology for contaminant removal under most water quality conditions. As an added benefit, RO can also effectively remove other constituents from water, including organic carbon, salts, dissolved minerals and color. RO treatment can also remove constituents that make up alkalinity or hardness (calcium and magnesium), and will lead to a corrosive water. The rejected salts and other constituents are discharged in a concentrated stream, which can make up between 10 and 50 percent of the influent flow depending on the influent water quality (TDS levels especially) and membrane properties.

In order to drive water across the membrane surface against the natural osmotic pressure, feed water must be sufficiently pressurized with a booster pump, which may take significant energy. For drinking water treatment, typical operating pressures are between 100 and 350 psi.

RO performance is adversely affected by the presence of turbidity, iron, manganese, silica, scale-producing compounds and other constituents that can cause membrane fouling. These compounds can produce a scale on the membrane surface that can lead to a decline of contaminant rejection and water recovery. Membrane cleaning can restore treatment performance, but can be difficult and costly. Pretreatment to remove these compounds, as well as particulates that can damage the membrane, is worthwhile and can extend the life of the membrane.

Arsenic. RO membranes are capable of achieving 97 percent removal of As(V) and 92 percent removal of As(III)[3]. Multiple RO units can be applied in series to improve the overall arsenic removal efficiency. Greater recovery can also be achieved by providing RO treatment to the reject stream, which further concentrates rejected water constituents.

Prechlorination to convert As(III) to As(V) may be considered to improve arsenic removal. However, chlorine can damage some polyamide composite membranes.

Uranium. RO treatment can provide over 90 percent rejection of uranium concentrations. Waste stream uranium concentrations will reach 200 to 750 pCi/L[4], depending on the influent concentration and rejection rate.

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[3] USEPA *Arsenic Treatment Technology Evaluation Handbook for Small Systems*, EPA 816-R-03-014, July 2003.

[4] USEPA *A Regulators' Guide to Management of Radioactive Residuals from Drinking Water Treatment Technologies*. EPA 816-R-05-004, July 2005.

3.2.3 Precipitative Processes

3.2.3.1 Coagulation/Filtration

Coagulation/filtration (C/F) is a treatment process by which the physical or chemical properties of dissolved colloidal or suspended matter are altered such that agglomeration is enhanced to an extent that the resulting particles will settle out of solution by gravity or will be removed by filtration. Coagulants are used to change the surface charge properties of solids to allow. The final products are larger particles, or floc, which are more readily filtered or settled under the influence of gravity.

The C/F process has traditionally been used to remove solids from drinking water supplies, such as turbidity from surface water. The coagulants used in the process can render some dissolved species (such as inorganics) insoluble. Metal salt coagulants such as ferric chloride can adsorb other dissolved species.

The major components of a basic C/F facility include chemical feed systems, mixing equipment, basins for rapid mix, flocculation, settling, filter media, sludge handling equipment, and filter backwash and recycling facilities. Settling may not be necessary in situations where the influent concentration is very low.

Arsenic. Preoxidation of As(III) to As(V) improves removal with C/F. Studies show over 95 percent removal of arsenic with ferric sulfate, and between 83 to 90 percent removal with alum coagulation[5]. Higher arsenic removals were seen in the pH range of 5.0 to 8.5 for ferric sulfate, and 5.0 to 7.0 for alum.

Uranium. C/F using iron or alum salts results in 50 to 90 percent uranium removal in a pH range of 6 to 10. The more effective the coagulant used, the higher is the radioactivity in the residual for uranium removal, and can have between 10,000 to 30,000 pCi/L in the residuals[6]. Because of chemical dosage and residuals handling, this technology requires advanced operator expertise for uranium removal.

3.2.3.2 Coagulation Assisted Microfiltration (Arsenic Only)

Coagulation assisted microfiltration uses the same coagulation process described for C/F treatment, but uses a pressurized microfiltration membrane to remove the flocculated particles instead of a gravity media filter. The advantages of microfiltration over conventional filtration include:

- More effective microorganism barrier during coagulation process upsets
- Smaller floc sizes can be removed, allowing lower amounts of coagulants to be used
- Increased total plant capacity (for the footprint)

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[5] USEPA *Technologies and Costs for Removal of Arsenic from Drinking Water*, EPA 815-R-00-028, December 2000.

[6] USEPA *A Regulators' Guide to Management of Radioactive Residuals from Drinking Water Treatment Technologies*, EPA 816-R-05-004, July 2005.

Membranes must be periodically backwashed to remove the solids and restore hydraulic capacity. The backwash water can either be discharged directly to a sewer or thickened and the resultant solids disposed of. The backwash water or solids must be evaluated as a hazardous material.

3.2.3.3 Lime Softening

Lime softening treatment is widely used for reducing hardness (removal of calcium and magnesium ions) in large water treatment systems. Lime softening removes hardness by creating a shift in the carbonate equilibrium. The addition of lime raises the pH of the water. This pH shift converts bicarbonate to carbonate, which results in the precipitation of calcium as calcium carbonate. Softening can result in pH in the range of 9 to 10.5, requiring pH adjustment to return the water to a neutral state. Adjustment of pH using carbon dioxide is common.

The lime softening treatment method is also effective in reducing arsenic and uranium concentrations. The effectiveness of arsenic or uranium removal by lime softening is pH dependent, with higher removals seen at higher pH. Oxidation of As(III) to As(V) will increase the removal efficiencies.

Considerable amounts of sludge are produced in lime softening systems and its disposal can be expensive. Construction of a new lime softening plant for removal of arsenic or uranium would not generally be recommended unless hardness must also be reduced.

3.2.3.4 Oxidation/Filtration (Arsenic Only)

Oxidation/filtration refers to processes that are designed to remove naturally occurring iron and manganese from water. The oxidation process used to remove iron and manganese leads to the formation of hydroxides that remove soluble arsenic by precipitation or adsorption reactions. This process is particularly effective for water with iron concentrations. If insufficient iron is naturally present in the water, additional ferric coagulant may be added to achieve the 20:1 Fe/As ratio for optimal removal.

Substantial arsenic removal has been seen using greensand filtration. The active material in greensand is glauconite, a green, iron-rich clay-like mineral that has ion exchange properties. Glauconite sand is treated with $KMnO_4$ (potassium permanganate) until the sand grains are coated with a layer of manganese oxides. The principle behind arsenic removal using greensand includes oxidation (to convert the As(III) to As(V)), ion exchange, and adsorption.

3.3 Treatability Issues

The arsenic and uranium removal capability of treatment options are impacted by raw water pH, other ions present in the source water that could shorten the treatment removal capacity. Many of these issues were discussed in the preceding description of the treatment processes. Disposal of treatment residuals, such as liquid backwash water or spent solid media, can create a disposal

dilemma because contaminants have been concentrated in these waste streams to levels that might be considered hazardous. These issues are further discussed in this section.

3.3.1 Source Water pH

Generally, most treatment options will have improved removal and longer bed life with lower pH, with the exception of activated alumina and lime softening which require a higher pH for effective removal. Recommended ranges for pH have been shown for some arsenic removal technologies in Table 3-4.

For ion exchange, arsenic removal typically occurs in the range of pH 8 to 9, although the strong-base resins are typically not sensitive to pH in the range of 6.5 to 9. Outside this range, arsenic removal decreases quickly. For some adsorptive media, changes in pH in the source water may result in release of arsenic or uranium from the media. This off-loading of arsenic may result in higher arsenic levels in the effluent than in the source water. For these media, pH must be closely monitored.

3.3.2 Competing Ions

The type and concentration of competing ions present in a particular source water may dictate the applicability of some treatment technologies at a particular site. Ions that have been found to compete for sites on resins and disposable media include:

Chloride	Orthophosphate
Fluoride	pH
Iron	Silica
Manganese	Sulfate
Nitrate	Total Dissolved Solids (TDS)
Nitrite	Total Organic Carbon (TOC)

Specific ions that are of concern for the identified arsenic treatment technologies are shown in Table 3-4, including the acceptable concentrations of these ions in the raw water.

Based on the available information for the Sierra Lakes Wells, it appears that there is water quality data for the majority of these ions, with the exception of orthophosphate, silica and TOC. Treatment is provided for Wells 3 and 4 to remove iron, and treated water iron concentrations are not available. However, depending on the treatment technology selected, elevated levels of iron may be needed to enhance the arsenic removal.

Media typically shows selectivity for ions in the following sequence, but may vary depending on the properties of the specific media:

$$Ur > Sulfate > As(V) > nitrate > carbonate > nitrite > chloride > fluoride$$

When an ion is preferred over arsenic, higher arsenic levels can exist in the effluent than exist in the influent water due to displacement of the As(V) ion with the competing ion. High-TDS/high-sulfate waters have been shown to reduce the efficiency of ion exchange for arsenic removal.

Resins used to absorb uranium have a very high affinity for the uranium ion (creates a strong bond). This chemical bond cannot be broken by the competing ions, as it will with arsenic adsorbed to media. Thus, whereas arsenic may be dislodged and released in the treatment effluent, uranium will not. Due to the strong bond between uranium and the media, these competing will not dislodge the uranium ion, although the IX media bed life might be reduced.

Generally, water from the Sierra Lakes wells has low levels of competing ions, and are not deemed to be a problem in selection of a treatment technology for either uranium or arsenic.

3.3.3 Residuals Disposal

Waste disposal is an important consideration in the treatment selection process. Arsenic and uranium removal technologies produce several different types of waste, including sludges, brine streams, backwash slurries and spent media. The different waste streams for each treatment technology for both uranium and arsenic removal treatment were identified in Tables 3-3 and 3-4. These wastes have the potential for being classified as radioactive (for uranium) and hazardous (for arsenic) and can pose disposal problems. The characteristics of the residuals can be affected by:

- The concentration of the contaminant in the source water (uranium/arsenic)
- Frequency of resin/media/membrane replacement
- How efficient the treatment process is at removing uranium/arsenic
- Frequency of regeneration (for ion exchange and activated alumina)
- Frequency of filter backwash (for treatment processes using granular media filters or membranes)

Treating water with high levels of arsenic or uranium will concentrate the contaminant in the waste stream. Other constituents present in the source water will also become concentrated. Parameters that can impact disposal alternatives include the following:

- High or low pH
- High Total Suspended Solids (TSS)
- High Total Dissolved Solids (TDS)
- High concentrations of heavy metals
- High concentrations of competing ions, such as fluoride, sulfate and chloride
- Radionuclides and daughter products

Several statutes govern the disposal of wastes, including the Resource Conservation and Recovery Act (RCRA); Clean Water Act (CWA); and the Nuclear Regulatory Commission (NRC). RCRA specifies that a person who generates a solid waste must characterize the waste and determine if the waste is hazardous. The CWA, enforced by the Regional Water Quality Control Board (RWQCB), establishes regulations for disposal of wastes to a water of the state (requiring an NPDES permit) or to a wastewater treatment plant. The NRC establishes licensing requirements under the Atomic Energy Act, regulating uranium as a "source material."

Table 3-3. Uranium Treatment Technologies Summary Comparison[1]

Treatment Technology	Designation *BAT and/or SSCT?*	Customers Served (SSCTs only)	Source Water Considerations	Operator Skill Required	Types of Residuals							
					Solid			Liquid				
					Spent Resins/ Media	Spent Membranes	Sludge	Brine	Backwash Water	Rinse Water	Acid Neutralization Water	Concentrate
Ion Exchange (IX)	BAT & SSCT	25-10,000	All ground-waters	Intermediate	✓			✓	✓	✓		
POU IX	SSCT	25-10,000	All ground-waters	Basic								
Reverse Osmosis (RO)	BAT & SSCT	501-10,000	Surface waters usually requiring pre-filtration	Advanced		✓						✓
POU RO	SSCT	25-10,000	Surface waters usually requiring prefiltration	Basic								
Lime Softening	BAT & SSCT	501-10,000	All waters	Advanced	✓		✓		✓			
Activated Alumina	SSCT	25-10,000	All ground-waters	Advanced	✓			✓	✓	✓	✓	
Coagulation/Filtration	BAT & SSCT	25-10,000	Wide range of water qualities	Advanced	✓		✓		✓			

[1] Adapted from USEPA *A Regulator's Guide to the Management of Radioactive Residuals from Drinking Water Treatment Technologies*, EPA 816-R-05-004, July 2005

Table 3-4. Arsenic Treatment Technologies Summary Comparison[1]

	Sorption Processes			Membrane Processes	Precipitative Processes				
Factors	Ion Exchange IX	Activated Alumina [A] AA	Iron-Based Sorbents IBS	Reverse Osmosis RO	Enhanced Lime Softening LS	Enhanced Coagulation Filtration CF	Coagulation-Assisted Micro-Filtration CMF	Coagulation Assisted Direct Filtration CADF	Oxidation/ Filtration OxFilt
USEPA BAT? [B]	Yes	Yes	No [C]	Yes	Yes	Yes	No	Yes	Yes
USEPA SSCT? [D]	Yes	Yes	No [C]	Yes	No	No	Yes	Yes	Yes
System Size [D,D]	25-10,000	25-10,000	25-10,000	25-10,000	25-10,000	25-10,000	25-10,000	25-10,000	25-10,000
SSCT for POU [B]	No	Yes	No	Yes	No	No	No	No	No
POU System Size [B,D]	--	25-10,000	25-10,000	25-10,000	25-10,000	25-10,000	25-10,000	25-10,000	25-10,000
Removal Efficiency	95% [E]	95% [E]	Up to 98% [E]	>95% [E]	90% [E]	95% (w/$FeCl_3$) [E] <90% (w/ Alum) [E]	90% [E]	90% [E]	50-90% [E]
Total Water Loss	1-2%	1-2%	1-2%	15-75%	0%	0%	5%	1-2%	1-2%
Pre-Oxidation Required [F]	Yes	Yes	Yes [G]	Likely [H]	Yes	Yes	Yes	Yes	Yes
Optimal Water Quality Conditions	pH 6.5 – 9 [S] <5 mg/L NO_3^- <50 mg/L SO_4^{2-} [J] <500 mg/L TDS [K] <0.3 NTU Turbidity	pH 5.5 – 7 [L] pH 6 – 8.39 [L] <250 mg/L Cl^- [J] <2 mg/L F [L] <360 mg/L SO_4^{2-} [K] <30 mg/L Silica [K] <0.5 mg/L Fe^{+2} [L] <0.05 mg/L Mn^{+2} [L] <1,000 mg/L TDS [K] <4 mg/L TOC [K] <0.3 NTU Turbidity	pH 6 – 8.5 <1 mg/L PO_4^{-3} <0.3 NTU Turbidity	No Particulates	pH 10.5 – 11 [I] <5 mg/L Fe [N]	pH 5.5 – 8.5 [I]	pH 5.5 – 8.5 [P]	pH 5.5 – 8.5 [P]	pH 5.5 – 8.5 <0.3 mg/L Fe Fe:As Ratio > 20:1
Operator Skill Required	High	Low [A]	Low	Medium	High	High	High	High	Medium
Waste Generated	Spent Resin, Spent Brine, Backwash Water	Spent Media, Backwash Water	Spent Media, Backwash Water	Reject Water (Concentrate)	Backwash Water, Sludge (high volume)	Backwash Water, Sludge	Backwash Water, Sludge	Backwash Water, Sludge	Backwash Water, Sludge
Other Considerations	Possible pre & post pH adjustment. Pre-filtration required. Potentially hazardous brine waste. Nitrate peaking. Carbonate peaking affects pH	Possible pre & post pH adjustment. Pre-filtration may be required. Modified AA available	Media may be very expensive. [O] Pre-filtration may be required.	High water loss (15-75% of feed water)	Treated water requires pH adjustment	Possible pre & post pH adjustment	Possible pre & post pH adjustment	Possible pre & post pH adjustment.	None
Centralized Cost	Medium	Medium	Medium	High	Low [Q]	Low [Q]	High	Medium	Medium
POU Cost	--	Medium	Medium	Medium	N/A	N/A	N/A	N/A	N/A

[A] Activated alumina is assumed to operate in a non-regenerated mode.
[B] USEPA, *Implementation Guidance for the Arsenic Rule* (EPA 816K02018), August 2002.
[C] IBS's track record in the US was not established enough to be considered as BAT or SSCT at the time the rule was promulgated.
[D] Affordable for systems with the given number of people served.
[E] USEPA, *Technologies and Costs for Removal of Arsenic from Drinking Water* (EPA 815R00028), December 2000.
[F] Pre-oxidation only required for Arsenic III.
[G] Some iron-based sorbents may catalyze the arsenic III to Arsenic V oxidation and therefore would not require a pre-oxidation step.
[H] RO will remove Arsenic III, but its efficiency is not consistent and pre-oxidation will increase removal efficiency.
[I] AwwaRF, *Implementation of Arsenic Treatment Systems Part 1*, 2002
[J] Kempic, Jeffrey, Teleconference on October 29, 2002.
[K] Wang, et al., *Arsenic Removal from Drinking Water by Ion Exchange and Activated Alumina Plants* (EPA 600R00088), October 2000
[L] AA can be used economically at higher pH, but with a significant decrease in the capacity of the media.
[M] Clifford, Dennis, *Arsenic Treatment Technology Demonstration Drinking Water Assistance Program for Small Systems*, March 2001
[O] With increased domestic use, IBS cost will significantly decrease.
[P] Fields, et al., *Arsenic Removal from Drinking Water by Iron Removal Plants* (EPA 600R00086), August 2000
[Q] costs for enhanced LS and enhanced CF are based on modifications of an existing technology. Most small systems will not have this technology in place

[1] From USEPA *Arsenic Treatment Technology Evaluation Handbook for Small Systems*, EPA 816-R-03-014, July 2003

3.3.3.1 Arsenic Residuals

There are five generally accepted methods for disposal of arsenic waste streams, including (1) landfill disposal; (2) direct discharge to surface waters; (3) indirect discharge to a wastewater treatment plant; (4) land application; and (5) on-site sewerage to a septic system.

Under the RCRA requirements, wastes intended to be disposed in a solid waste landfill, such as dewatered sludge and spent media, must demonstrate that the waste passes both the Paint Filter Liquids Test (PFLT) and the Toxicity Characteristics Leaching Procedure (TCLP) to ensure there is no leaching of high levels of contaminants once in the landfill. The PFLT is used to verify there is no free liquid residual associated with the waste (waste sludges cannot contain free liquid residuals at the time of disposal). If the TCLP extract contains extract contains arsenic or any other contaminant (e.g., chromium) above the Toxicity Characteristic (TC) limit, the waste residuals must be disposed in a designated and licensed hazardous waste landfill. The TC limit for arsenic is 5.0 mg/L. Those liquid waste steams that contain more than 5.0 mg/L of arsenic would therefore be classified as a hazardous waste, and the cost of disposal will be fairly high.

Solid wastes in California must also have a Waste Extraction Test (Ca WET) conducted to determine if the waste is non-hazardous or hazardous. The Ca WET is a more rigorous test than the TCLP. The same limit applies for the Ca WET – no more than 5.0 mg/L of arsenic and/or established TC levels for other contaminants. Residuals that pass the TCLP may have difficulty passing the Ca WET.

One strategy for residuals that may have difficulty passing the Ca WET is to replace the media prior to full exhaustion. The media will have less arsenic or other contaminant loading and may pass Ca WET limits. This reduction in the cost of disposal (by not being classified as hazardous) must be weighed against the higher cost of media for more frequent replacement. It is also possible to mix the waste with other non-hazardous wastes prior to disposal to reduce the contaminant levels.

Liquid waste streams discharged to wastewater treatment plants (indirect discharge), must demonstrate that the liquid residual meets an acceptable level for discharge at that facility. This will be based on the limits established in the wastewater permit issued by the RWQCB, and take into account the background levels of contaminants in the municipal wastewater and local groundwater.

Liquid waste streams from RO POU devices should be suitable for disposal in an on-site sewerage or septic system.

3.3.3.2 Uranium Residuals

The concentrated residual streams generated from radionuclide treatment facilities are called Technologically Enhanced Naturally Occurring Radioactive Materials (TENORM). The concentration of TENORM (and other potential contaminants) in the waste stream, the type

of waste produced (liquid or solid), and federal and state regulations will affect what disposal options are available. The NRC must issue a license to any water system intending to dispose of treatment waste residuals containing uranium and other radionuclides. The NRC may issue a general license, a specific license or deem the residual to be exempt, depending on the amount of uranium present in the material. The NRC can deem the material to be exempt from regulations if the uranium makes up less than 0.05 percent by weight. In California, the CDPH, Division of Food, Drug and Radiation Safety, is responsible for regulating the use of and exposure to radiation. CDPH implements the NRC requirement to issue a license for any radioactive materials, including those waste residuals from a water treatment plant that contain uranium.

Waste generated by these uranium treatment technologies are also removing co-occurring contaminants, and hence the residuals must be tested under the RCRA requirements.

Disposal options will vary depending on the concentration of uranium and any co-contaminants, and whether the residual is a solid or a liquid. Some, but not all, hazardous waste landfills accept TENORM solid wastes. Low Level Radioactive Waste (LLRW) landfills may accept wastes with radionuclide concentrations too high for disposal at a solid or hazardous waste landfill. There are a limited number LLRW landfills in the United States, and none in California. Licensed LLRW disposal facilities are located at Barnwell, South Carolina; Clive, Utah; and Richland, Washington.

Liquid wastes may be able to be discharged to a wastewater treatment plant, depending on the concentration in the residual stream and any limits established in the waste discharge permits issued by the RWQCB.

CDPH has developed the following guidelines for disposal of waste from a treatment system containing uranium;

- Solid Waste Disposal
  - No license needed for possession, transfer and disposal of filter media or other waste if the media contains less than 0.05 percent uranium or thorium by weight
  - A general license is needed if radium concentrations do not exceed 5 pCi/L per gram of media, and the facility does not possess in excess of 15 pounds of total mass at any one time, or in excess of 150 pounds throughout any calendar year.
  - A Specific License is needed if the above criteria are not met.

  The disposal of solid filter media to landfill is governed by California's Solid Waste Board.

- Liquid Waste Disposal
  - Waste from a treatment system can go to the "general environment" if it contains less than 300 pCi/L.

- Waste from a treatment system can go to a sewer system if:

  -- Contains less than 3,000 pCi/L uranium, and the discharge is approved by the Regional Water Quality Control Board.

  --RWQCB approves of the discharge

Section 4
Treatment Implementation

This Section will evaluate the alternatives of treatment for arsenic and uranium using point-of-entry and point-of-use treatment within the home as well as centralized treatment at a public water system wellhead using a disposable media. For the purposes of evaluating treatment for the Sierra Lakes Well Field, in which both arsenic and uranium concentrations exceed drinking water standards in one or more wells, the use of a Water Remediation Technologies (WRT) treatment processes are described. Alternatives for sizing the treatment facilities and preliminary costs estimates for this treatment alternative are discussed.

4.1 Point-of-Use Treatment

Centralized treatment is not always a feasible treatment option, for example, in areas where each home has a private well or where centralized treatment is cost prohibitive. In these instances, point-of-entry (POE) and point-of-use (POU) treatment options may be acceptable treatment alternatives. POE is a means of providing treatment to all of the water entering a home, whereas POU provides treatment at a single faucet. POU is acceptable when treated water is needed only for drinking and cooking. These types of systems may offer ease of installation, simplified operation and generally lower capital cost, but will result in increased monitoring (where owned by a public water system) to ensure that the treatment units are operating properly. The USEPA has identified POU as a viable BAT or SSCT for small systems serving 25 to 10,000 persons. Public water systems wanting to use POU or POE for compliance with a drinking water standard must apply for a variance or an exemption from the standard from the state regulatory agency (CDPH), provide the operation and maintenance of the device, and monitoring of the treated water quality.

Currently, the USEPA has identified POU/POE as a viable compliance technology only under two regulations: the Arsenic Rule and the Radionuclides Rule. Other chemicals pose risks from multiple routes of exposure (including inhalation and dermal adsorption) which makes the use of POU for compliance infeasible. Table 3-1 identified both ion exchange and reverse osmosis POU treatment as BAT for uranium treatment. Table 3-2 identified activated alumina and reverse osmosis POU as BAT for arsenic removal. For water with both arsenic and uranium, it makes sense therefore that RO would be one POU alternative that could remove both contaminants simultaneously.

A number of case studies have been documented for arsenic and other contaminant removal by USEPA in *Point-of-Use or Point-of-Entry Treatment Options for Small Drinking Water Systems*[7], showing varying results. Performance information indicates that all of the devices tested were shown to be capable of removing arsenic to levels below the new MCL with the exception of one that was not effective in removing As(III) (preoxidation to As(V) was recommended).

[7] USEPA, *Point of Use or Point of Entry Treatment Options for Small Drinking Water Systems*, EPA 815-R-06-010, April 2006.

EPA's Environmental Technology Verification (ETV) Program develops testing protocols and verifies the performance of innovative technologies that have the potential to improve protection of human health and the environment. ETV was created to accelerate the entrance of new environmental technologies into the domestic and international marketplace. Under the ETV program, cost-effective treatment technologies can be demonstrated and evaluated under common testing protocol. Under the ETV program, three RO membranes (with and without post-membrane carbon filters) have been tested for removal of a set of contaminants which included organic and inorganic chemicals, as well as overall TDS removal. These were not specifically tested for either arsenic or uranium removal. The summary of these three verification tests are provided in Appendix A.

Demonstration of a particular POU technology via a pilot study is highly recommended for public water systems, especially where multiple contaminants need to be removed.

Homeowners with individual wells that produce water with arsenic and/or uranium should seek the guidance of CDPH in identifying devices certified for specific contaminant removal, or the USEPA ETV program. Water treatment devices sold for residential use in California must be certified by CDPH where a health benefit claim is made (removal of a specific contaminant). Links to web pages for each of these programs are as follows:

USEPA ETV Program: http://www.epa.gov/etv/verifications/verification-index.html

CDPH Certified Water Treatment Devices:
http://www.cdph.ca.gov/ps/ddwem/devices/directory/default.htm

4.2 Fixed-Bed Ion Exchange Treatment

New approaches to treatment have been developed as a result of the reduced arsenic MCL, which is impacting many smaller water systems nation-wide. The use of disposable media has become a viable alternative because of the lower operator skill level required (typically no chemicals are added in the treatment process), and the elimination of onsite regeneration or backwashing to cleanse the media for reuse.

WRT designs, builds, and provides operational support for ammonia, arsenic, radium, uranium and heavy metal removal systems for water and wastewater treatment. The WRT treatment process uses a proprietary adsorptive ion exchange media for removal of uranium (Z-92™ media) and arsenic (Z-33™ media) and has also developed a proprietary media specifically for the concurrent removal of both uranium and arsenic. The process uses a series of two upflow treatment vessels in series configuration. The water is moved through the treatment system using the water pressure generated from the well source(s). No chemicals are added to the water for the uranium or arsenic removal treatment. There is no regeneration of the ion exchange media. The WRT ion exchange process includes only an adsorption phase, with the majority of the contaminant removed in the first vessel. Once the media in the first vessel is spent, the media from the second vessel is rotated to the first vessel and new media is placed in the second vessel. This procedure maximizes the contaminant loading on the media to reduce the overall cost of operation. The treatment media is ANSI/NSF Standard 61 certified for use in drinking water.

Under contractual agreement with the water utility, the spent media is removed by RMD Operations, LLC (a sister company to WRT) and permanently disposed of at a licensed facility. RMD has obtained Radioactive Materials License No. 7542-30, dated April 21, 2006, which was issued by the CDPH Radiologic Health Branch. The license was issued to RMD for the removal of natural uranium from drinking water and its storage and handling. WRT designs, manufactures, and provides the equipment and media used in the facility. The handling and exchange of new media to replace spent media, as well as the shipping and disposal, is handled by RMD. A WRT example process flow diagram and plant schematic for uranium and arsenic removal using a dual tank system are provided in Appendix B.

Advantages of the WRT disposable media system:

- Nothing is added to the water. No chemicals are added in the arsenic and uranium treatment process and nothing is imparted into the water during the treatment process. The water system will want to continue providing disinfection to the treated water.
- No backwash or regeneration cycle required, hence no liquid residuals are generated
- Minimal maintenance and operation consists of routine monitoring and sampling
- No handling of radioactive materials, media or chemicals by utility staff
- Disposal of waste to an NRC-approved site
- Media is NSF/ANSI Standard 61 certified
- Complete package of services provided on a long-term contract basis

WRT has successfully demonstrated the ability of the uranium Z-92™ media and the arsenic Z-33™ media to achieve compliance with the respective MCLs for uranium and arsenic in pilot tests and full-scale treatment applications. One WRT uranium removal system has been approved for a public water system in California by CDPH, which was installed by Bass Lake Water Company. Boyle assisted Bass Lake Water Company with the CEQA compliance and development of an operations plan for the uranium removal system for CDPH permit approval.

Pilot testing for uranium removal shows that significant reduction in uranium is achieved over the course of the study. One study in Brazos, New Mexico, tested water with a source water uranium concentration of about 260 µg/L, with no detection of uranium in the effluent during the 2-month pilot. Another study conducted in Las Cruces, New Mexico, on a source water with about 50 µg/L of uranium showed no detection of uranium during the first month, with a slow increase to 3.3 µg/L at the end of the 3-month study. Uranium concentrations in the effluent will increase more rapidly in sources with competing ions, which take up adsorptive sites on the media. An arsenic pilot study using the WRT Z-33™ ion exchange media was conducted in Rio Rancho, New Mexico, on source water with about 18 µg/L of arsenic. The pilot demonstrated removal to below the MCL of 10 µg/L for the length of the 4-month study. Arsenic concentrations increased over time.

The use of the media for removal of uranium and arsenic concurrently must be piloted to demonstrate adequacy of removal and to determine the actual loading rates for both uranium and arsenic. The life of the media will depend on the arsenic and uranium concentrations, pH and competing ion concentrations and the gallons per day produced through the treatment units. The life of each media charge using the As/U-specific media should be in the range of 1.5 to 2 years and is verified by WRT using loading calculations and water quality monitoring results. Evaluation of the media for change out would be based on the arsenic concentration in the plant effluent.

Water quality samples must be collected and analyzed for parameters that compete for bonding sites on the media. Those of concern for the uranium and arsenic media include sulfate and nitrate. The presence of either of these ions in significant quantities could reduce the useful life of the media and result in early breakthrough of arsenic.

4.2.1 Preliminary Cost Opinions

For the purposes of providing a general estimate of the cost of treatment to remove uranium and arsenic from the Sierra Lakes Wells, WRT has provided capital and operations and maintenance costs to remove both uranium and arsenic in dual stage treatment. Costs are presented for two flow rates for sizing the facilities: 800 gpm and 1,000 gpm (to account for the new flow from Wells 5, 6, 7, 8 and 9), and a maximum of 150 million gallons produced over one year. WRT used the worst-case water quality data for determining the facility size and operation and maintenance costs, which was a uranium concentration of 205 pCi/L (306 µg/L) and an arsenic concentration of 170 µg/L, both derived from Well 4 data (refer to Tables 2-2 and 2-6). As such, these estimates are considered to be conservative, and may actually be lower under design conditions. Operational costs may be significantly reduced during periods of lower contaminant concentrations in the influent water. These are intended to be preliminary budgetary estimates only, and must be confirmed through a pilot study to establish actual loading rates of the two media. Design of full scale facilities would be based on a predesign report in which all of the design parameters are identified.

It is recognized that the blended flow from all of the wells would result in concentrations of arsenic and uranium well below the assumed worst-case water quality levels used for presenting these preliminary cost estimates. Additional water quality testing should be conducted to confirm the concentrations of uranium and arsenic in the new wells (Wells 5, 6, 7, 8 and 9). The final assumed arsenic and uranium concentration to be used for full scale design would be identified in a predesign report, and approved by CDPH.

Additional costs would be incurred to provide for a pilot study and engineering design of the treatment facilities. Pilot study costs for a WRT system would include only the analytical costs for sample collection and analysis. Analytical costs for both arsenic and uranium for the duration of a study (typically 2 to 3 months) would be in the range of $8,000. WRT would provide a written report documenting the pilot study results.

Table 4-1. Preliminary Cost Estimates for Arsenic and Uranium Removal (Hillview Water Company - Sierra Lakes Wells)

Cost Element	Design Flow	
	800 gpm	1000 gpm
Capital	$706,300	$956,000
Annual O & M[1]	$460,200 [2]	$456,200 [3]
20-Year O & M[1]	$9,204,000	$9,124,000
Total 20-Year Cost[1]	$9,910,300	$10,080,000

[1] Includes disposal of media
[2] Based on a cost of $3.07 per 1,000 gallons produced
[3] Based on a cost of $3.04 per 1,000 gallons produced

Design Assumptions: Annual usage of 150 MGY
Uranium concentration of 205 pCi/L (306 µg/L)
Arsenic concentration of 370 µg/L

4.2.2 Contractual Agreements

If treatment is provided by a company such as WRT, which provides operational assistance and spent media disposal services, a contractual agreement is signed to provide the basis of the services to be provided. The WRT agreement will establish a standard of service and media replacement, based on an estimate of the loading rate established during the pilot study. Significant changes in raw water quality (beyond ± 10 percent of annual average) may require renegotiation of the contract.

Section 5
Actions

5.1 Arsenic and Uranium Mitigation Steps

In order to fully comply with the arsenic and uranium MCLs in the Sierra Lakes Wells serving the Hillview Water Company's Oakhurst/Sierra Lakes Water System, the following steps highlight actions that should be taken:

1. Continue to evaluate arsenic and uranium monitoring data from each source, including the new Wells 5, 6, 7, 8 and 9.

2. Determine compliance status of each well based on the results of monitoring (compliance is based on a running annual average of all samples, calculated quarterly)

3. Determine if non-treatment mitigation strategy (such as abandoning sources or providing blending) will resolve both the arsenic and uranium compliance issues.

4. Measure the following water quality parameters from each source to identify the levels of ions that may compete for arsenic and uranium sites on various media:

Arsenic, Total	Nitrite
Arsenate [As(V)]	Orthophosphate
Arsenite [As(III)]	pH
Chloride	Silica
Fluoride	Sulfate
Iron	Total Dissolved Solids (TDS)
Manganese	Total Organic Carbon (TOC)
Nitrate	

5. Determine the treatment evaluation criteria to allow comparison in the treatment selection process. These criteria may include the following:

   a. Existing treatment processes

   b. Target finished water quality concentrations (arsenic, uranium, iron and manganese)

   c. Identify waste disposal options (local sewer system, local landfills, hazardous waste landfills and low level radiation disposal locations)

   d. Land availability for siting new treatment facilities, including treatment vessels, chemical storage and feed facilities, residual holding facilities (tanks or ponds), and a treatment building.

   e. Available labor and their qualifications for operations of new treatment facilities

f. Maximum and average source flow rate

g. Acceptable percent water loss

h. Regulatory requirements

6. Identify appropriate mitigation strategies that will address both arsenic and uranium together to minimize treatment costs. Treatment strategies have been discussed in Sections 3.2 and 3.3 of this Technical Memorandum.

7. Estimate planning-level capital and operations and maintenance (O&M) costs for the identified mitigation strategies. Include costs for both contaminant removal and disposal handling.

8. Evaluate design considerations for the identified mitigation strategies.

9. Select the most viable mitigation strategy based on design considerations, capital costs, O&M costs, land availability and disposal issues.

10. Obtain conceptual approvals from the regulatory agencies for the selected mitigation strategy.

11. Pilot the selected mitigation strategy. The pilot study will demonstrate the suitability of the selected mitigation strategy to reliably reduce arsenic and uranium below MCLs, establish design parameters and operating costs. In many cases, piloting may be performed by the vendor and will result in a guarantee from the vendor that the system will perform as stated.

    Issues to be addressed by the results of a pilot study include:

    a. Anticipated life of the media (bed volumes that can be treated before media is exhausted)

    b. Maximum surface loading rate

    c. Evaluation of residuals (spent media or liquid wastes) and identification of disposal options and associated costs

    d. Evaluation of water quality variables that can lead to process failure, and establishing an upper limit to ensure adequate treatment is provided

12. Develop a Predesign Report that provides final design criteria, equipment sizing, disposal methods, and establishes construction level cost estimates and O&M costs.

13. Prepare construction plans and specifications

14. Implement mitigation strategy

15. Monitor the mitigation strategy in accordance with permit requirements and the Operations Plan to ensure contaminant levels in the delivered water are below MCLs and within anticipated parameters.

Appendix A
USEPA ETV Summaries for POU Reverse Osmosis Treatment

THE ENVIRONMENTAL TECHNOLOGY VERIFICATION PROGRAM

U.S. Environmental Protection Agency

NSF International

ETV Joint Verification Statement

TECHNOLOGY TYPE:	POINT-OF-USE REVERSE OSMOSIS DRINKING WATER TREATMENT SYSTEM	
APPLICATION:	REMOVAL OF MICROBIAL CONTAMINATION AGENTS IN DRINKING WATER	
PRODUCT NAME:	WATTS PREMIER ULTRA 5	
COMPANY:	WATTS PREMIER, INC.	
ADDRESS	1725 WEST WILLIAMS STREET	PHONE: 800-752-5582
	PHOENIX, AZ 85027	FAX: 623-931-0191

NSF International (NSF) manages the Drinking Water Systems (DWS) Center under the U.S. Environmental Protection Agency's (EPA) Environmental Technology Verification (ETV) Program. The DWS Center recently evaluated the performance of the Watts Premier, Inc. Ultra 5 point-of-use (POU) reverse osmosis drinking water treatment system. NSF performed all of the testing activities, and also authored the verification report and this verification statement. The verification report contains a comprehensive description of the test.

EPA created the ETV Program to facilitate the deployment of innovative or improved environmental technologies through performance verification and dissemination of information. The goal of the ETV program is to further environmental protection by accelerating the acceptance and use of improved and more cost-effective technologies. ETV seeks to achieve this goal by providing high-quality, peer-reviewed data on technology performance to those involved in the design, distribution, permitting, purchase, and use of environmental technologies.

ETV works in partnership with recognized standards and testing organizations, stakeholder groups (consisting of buyers, vendor organizations, and permitters), and with the full participation of individual technology developers. The program evaluates the performance of innovative technologies by developing test plans that are responsive to the needs of stakeholders, conducting field or laboratory tests (as appropriate), collecting and analyzing data, and preparing peer reviewed reports. All evaluations are conducted in accordance with rigorous quality assurance protocols to ensure that data of known and adequate quality are generated and that the results are defensible.

ABSTRACT

The Watts Premier Ultra 5 was tested for removal of bacteria and viruses at NSF's Drinking Water Treatment Systems Laboratory. Watts Premier submitted ten units, which were split into two groups of five. One group received 25 days of conditioning prior to challenge testing, while the second group was tested immediately. Due to an incorrectly installed shut-off valve on one of the unconditioned units, only four in this group were tested. Both groups were challenged identically. The challenge organisms were the viruses fr. MS2, and Phi X 174, and the bacteria *Brevundimonas diminuta* and *Hydrogenophaga pseudoflava*. The test units were challenged at two different inlet pressures – 40 and 80 pounds per square inch, gauge (psig). The virus challenges were conducted at three different pH settings (6, 7.5, and 9) with the intent to assess whether pH influenced the performance of the test units. The bacteria challenges were only conducted at pH 7.5.

In most cases, the test units significantly reduced the challenge organisms, with reductions greater than 4.0 $\log_{10}$. The $\log_{10}$ reduction data is shown in Tables 3 through 6. Overall, the performance of the conditioned units was better than that of the unconditioned units. Also, the unconditioned units exhibited wider unit-to-unit performance variation than the conditioned units. The $\log_{10}$ reduction data does not conclusively show that inlet pressure or pH influenced test unit performance.

TECHNOLOGY DESCRIPTION

The following technology description was provided by the manufacturer and has not been verified.

The Watts Premier Ultra 5 is a five-stage POU drinking water treatment system. It employs carbon filtration and reverse osmosis processes to remove contaminants from drinking water. It is sold with a faucet that is installed at the kitchen sink, and the system itself is installed either under the kitchen sink or in another location.

During operation, inlet water first passes through a sediment filter, and then through two carbon block filters. The fourth stage is passage through the reverse osmosis membrane. The portion of the inlet water that passes through the membrane travels to the product water storage tank. When the user opens the faucet, the water leaves the storage tank and travels through a final carbon filter before exiting the faucet. The system is designed to produce approximately 12 gallons of reject water for each gallon of treated water produced.

The test units were evaluated without the carbon filters or sediment filter in place to eliminate the possibility that these filters could temporarily trap a portion of the challenge organisms, causing a positive bias of system performance during testing.

VERIFICATION TESTING DESCRIPTION

Test Site

The testing site was the Drinking Water Treatment Systems Laboratory at NSF in Ann Arbor, Michigan. A description of the test apparatus can be found in the test/quality assurance (QA) plan and verification report. The testing was conducted in September and October of 2003.

Methods and Procedures

The testing methods and procedures are detailed in the *Test/QA Plan for Verification Testing of the Watts Premier Ultra 5 Point-of-Use Reverse Osmosis Drinking Water Treatment System for Removal of Microbial Contamination Agents*. Nine test units were verified for bacteria and virus removal

performance using the bacteriophage viruses fr, MS2, and Phi X 174, and the bacteria *B. diminuta* and *H. pseudoflava*. The challenge organisms were chosen because they are smaller than most other viruses and bacteria, and so provide a conservative estimate of performance.

Watts Premier submitted ten units, which were split into two groups of five according to the performance of each membrane in the manufacturer's quality control testing. One group was conditioned for 25 days prior to challenge testing by operating the units daily using the test water without challenge organisms. The second group was challenged without receiving the 25-day conditioning period. Due to an incorrectly installed shut-off valve on one of the unconditioned units, only four in this group were tested.

The test units were challenged at both 40 and 80 psig inlet pressure. The test water for the bacteria challenges was set to pH 7.5 ± 0.5. The test water for the virus challenges was set at pH 6.0 ± 0.5, 7.5 ± 0.5, and 9.0 ± 0.5. However, it had a low buffering capacity, so the lab technicians had difficulty maintaining the pH within the 9.0 ± 0.5 range. As a result, the pH for the conditioned units pH 9, 80 psig challenge was only 7.9. The test water pH values for all other challenges were within the allowable ranges. These challenge conditions were intended to evaluate whether inlet pressure or pH influences bacteria and virus removal. Table 1 shows the challenge schedule for the conditioned units, while Table 2 shows the schedule for the unconditioned units. The challenge levels ranged from 5.4 to 6.4 $\log_{10}$ for the viruses, and 6.7 to 8.4 $\log_{10}$ for the bacteria.

Table 1. Conditioned Units Challenge Schedule

Day	Challenge Organism(s)	pH (± 0.5 units)	Inlet Pressure (± 3 psig)
1	All Viruses	6.0	40
2	All Viruses	6.0	80
3	All Viruses	7.5	40
4	All Viruses	7.5	80
5	All Viruses	9.0	40
6	All Viruses	9.0	80
7	*H. pseudoflava*	7.5	80
8	*H. pseudoflava*	7.5	40
9	*B. diminuta*	7.5	40
10	*B. diminuta*	7.5	80

Table 2. Unconditioned Units Challenge Schedule

Day	Challenge Organism(s)	pH (± 0.5 units)	Inlet Pressure (± 3 psig)
1	*H. pseudoflava*	7.5	80
2	*H. pseudoflava*	7.5	40
3	*B. diminuta*	7.5	40
4	*B. diminuta*	7.5	80
5	All Viruses	6.0	40
6	All Viruses	6.0	80
7	All Viruses	7.5	40
8	All Viruses	7.5	80
9	All Viruses	9.0	40
10	All Viruses	9.0	80

On each challenge day, the test units were operated for one tank-fill period (approximately six to eight hours). The end of this period was evident through engagement of the system's automatic shutoff mechanism, which causes the flow of reject water to cease. At 40 psig, not all of the shut-off mechanisms engaged after 8 hours of operation due to the low pressure. The storage tanks were nearly full in these instances, so operation of the units was stopped manually.

Influent water samples were collected at the beginning and end of the challenge period. After each test unit ceased operation, the entire contents of the product water storage tank were emptied into a sterile container, and a subsample was collected for microbiological analysis. All samples were enumerated in triplicate. Following each challenge period, the test units were flushed by operating them for one tank-fill period using the test water without challenge organisms.

VERIFICATION OF PERFORMANCE

The bacteria reduction data are presented in Tables 3 and 4, and the virus reduction data in Tables 5 and 6. An examination of the bacteria reduction data shows that for the five conditioned test units, in only one case (unit 4 for *B. diminuta* at pH 7.5, 40 psig) was one of the bacteria species detected in the effluent samples. In contrast, for the unconditioned units, there were 13 cases out of 16 where the challenge bacteria were detected in the effluents.

An evaluation of the virus reduction data shows that overall, the conditioned units performed better than the unconditioned units. The mean $\log_{10}$ reductions and mean $\log_{10}$ effluent counts are shown in the bottom right corner of Tables 5 and 6. A comparison of the mean $\log_{10}$ effluent counts for the unconditioned versus conditioned units shows that the conditioned units performed approximately 0.3 to 1.7 $\log_{10}$ better than the unconditioned units.

The unit-to-unit performance variation for the unconditioned units was wider than for the conditioned units, and the performance of each unconditioned unit also varied more from day-to-day. Also, the unconditioned units had many cases where bacteria reduction performance was less than virus reduction performance. The reasons for these observations are not known, but the data suggest that conditioning the systems improves and/or stabilizes their performance. The data does not conclusively show whether inlet pressure or pH influenced test unit performance.

Table 3. Bacteria Log Reduction Data for Unconditioned Units

pH	Pressure (psig)	Challenge Organisms	$\log_{10}$ Influent Challenge	Geometric Mean $\log_{10}$ Reduction Unit 1	Unit 2	Unit 3	Unit 4
7.5	40	*H. pseudoflava*	6.9	4.4	4.5	2.2	1.3
		B. diminuta	9.2	8.2	3.8	2.9	6.2
7.5	80	*H. pseudoflava*	6.9	4.6	6.6	1.9	3.8
		B. diminuta	8.1	7.5	3.2	4.9	8.1

Table 4. Bacteria Log Reduction Data for Conditioned Units

pH	Pressure (psig)	Challenge Organisms	$\log_{10}$ Influent Challenge	Geometric Mean $\log_{10}$ Reduction Unit 1	Unit 2	Unit 3	Unit 4	Unit 5
7.5	40	*H. pseudoflava*	6.7	6.7	6.7	6.7	6.7	6.7
		B. diminuta	8.9	8.9	8.9	8.9	7.2	8.9
7.5	80	*H. pseudoflava*	6.7	6.7	6.7	6.7	6.7	6.7
		B. diminuta	8.4	8.4	8.4	8.4	8.4	8.4

Table 5. Virus Log Reduction Data for Unconditioned Units

Challenge Conditions Target pH	Actual pH	Pressure (psig)	Challenge Organisms	Log_{10} Influent Challenge	Geometric Mean Log_{10} Reduction Unit 1	Unit 2	Unit 3	Unit 4	Mean[1]	Log_{10} Mean Effluent Count
6.0 ± 0.5	6.5	40	fr	6.2	4.8	3.1	2.9	4.5	3.8	2.5
			MS2	6.1	>6.1[2]	2.0	2.8	4.7	4.0	2.1
			Phi X 174	5.0	5.0	2.4	2.3	>5.0[2]	3.7	1.2
6.0 ± 0.5	6.2	80	fr	5.9	4.2	3.2	3.3	5.9	4.2	1.7
			MS2	5.8	4.5	3.0	3.3	5.8	4.2	1.6
			Phi X 174	4.9	4.6[2]	2.8	2.4	4.9	3.7	1.2
7.5 ± 0.5	7.5	40	fr	5.9	4.0	2.9	4.9	4.4	4.1	1.8
			MS2	5.6	3.8	2.7	5.2	4.3	4.0	1.6
			Phi X 174	5.7	3.7	2.3	5.7[2]	4.3	4.0	1.7
7.5 ± 0.5	7.7	80	fr	5.8	4.6	2.5	4.3	5.5	4.3	1.6
			MS2	5.7	4.4	2.6	4.3	>[illegible][2]	4.2	1.5
			Phi X 174	5.9	4.3	2.5	3.7	5.1	3.9	2.0
9.0 ± 0.5	8.7	40	fr	5.8	4.4	2.9	4.2	4.8	4.1	1.7
			MS2	5.6	4.1	2.7	4.1	4.8	3.9	1.7
			Phi X 174	5.7	3.8	3.6	2.3	4.1	3.5	2.2
9.0 ± 0.5	9.0	80	fr	6.0	4.6	3.2	3.7	5.1	4.2	1.8
			MS2	5.7	4.7	3.4	3.8	5.1	4.3	1.4
			Phi X 174	5.6	4.1	3.5	2.5	4.5	3.9	1.7
				fr mean[3]	4.5	3.0	3.9	5.1	4.1	1.9
				MS2 mean[3]	4.3	2.9	3.9	5.0	4.1	1.7
				Phi X 174 mean[3]	4.3	2.7	3.5	4.7	3.6	1.7

1 The arithmetic mean of all test units for each challenge.
2 Triplicate count had two "non-detect" agar plates.
3 The arithmetic mean for all challenges against each test unit.

Original signed by		*Original signed by*	
E. Timothy Oppelt	*9/17/04*	*Gordon Bellen*	*9/16/04*
E. Timothy Oppelt	Date	Gordon Bellen	Date
Director		Vice President	
National Homeland Security Research Center		Research	
United States Environmental Protection Agency		NSF International	

NOTICE: Verifications are based on an evaluation of technology performance under specific, predetermined criteria and the appropriate quality assurance procedures. EPA and NSF make no expressed or implied warranties as to the performance of the technology and do not certify that a technology will always operate as verified. The end user is solely responsible for complying with any and all applicable federal, state, and local requirements. Mention of corporate names, trade names, or commercial products does not constitute endorsement or recommendation for use of specific products. This report is not a NSF Certification of the specific product mentioned herein.

Availability of Supporting Documents

Copies of the test protocol, the Verification Statement, and the Verification Report (NSF Report # NSF 04/12/EPADWCTR) are available from the following sources (ORD/NCERQA Appendices are not included in the Verification Report. Appendices are available from NSF upon request.):

1. PTV Drinking Water Systems Center Manager (order hard copy)
   NSF International
   P.O. Box 130140
   Ann Arbor, Michigan 48113-0140
2. NSF web site: http://www.nsf.org/etv/etvdws_reports.html and from http://groups.nsf.org/etv/etvdws_project_documents.htm (electronic copy)
3. EPA web site: http://www.epa.gov/etv (electronic copy)

Table 6. Virus Log Reduction Data for Conditioned Units

Challenge Conditions					Geometric Mean Log10 Reduction						
Target pH	Actual pH	Pressure (psig)	Challenge Organisms	Log10 Influent Challenge	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Mean[1]	Log10 Mean Effluent Count
6.5 ± 0.3	6.5	40	fr	5.1	5.6	4.2	4.0	4.8	4.0	4.1	1.0
			MS2	4.8	3.2	3.7	3.8	4.1	3.2	3.6	1.2
			Phi X 174	3.4	3.4	3.4	3.4	3.4	3.4	3.4	0.0
6.5 ± 0.3	6.4	80	fr	5.1	4.6	4.2	4.3	4.7	4.6	4.5	1.6
			MS2	5.0	4.6	4.2	4.2	4.8	4.7	4.5	1.7
			Phi X 174	3.8	3.8	3.8	3.8	3.8	3.8	3.8	0.0
7.5 ± 0.5	7.5	40	fr	6.1	4.2	4.8	4.7	4.8	4.2	4.5	1.9
			MS2	5.2	4.2	4.5	4.8	4.7	4.5	4.5	1.7
			Phi X 174	4.0	3.7	4.0[2]	4.0[2]	4.0	3.7	3.9	0.1
7.5 ± 0.5	7.3	80	fr	6.3	4.8	5.6	5.3	5.3	4.8	5.2	1.1
			MS2	6.1	5.2	5.3	5.6	4.9	5.0	5.2	0.9
			Phi X 174	4.1	4.1	4.1[2]	4.1	4.1	4.1[2]	4.1	0.1
9.0 ± 0.5	8.9	40	fr	5.2	4.4	4.2	4.3	4.3	4.3	4.3	1.9
			MS2	5.8	4.2	4.0	4.2	4.1	4.2	4.1	1.7
			Phi X 174	4.1	4.1	4.1	4.1	4.1	4.1	4.1	0.0
9.0 ± 0.5	7.9[3]	80	fr	6.0	4.4	4.9	4.7	4.7	4.6	4.7	1.3
			MS2	5.9	4.3	5.9	4.8	4.5	4.5	4.9	1.0
			Phi X 174	4.0	4.0	4.0	4.0	4.0	4.0	4.0	0.0
			fr mean[4]		4.5	4.6	4.6	4.8	4.4	4.6	1.5
			MS2 mean[4]		4.3	4.6	4.5	4.5	4.2	4.4	1.4
			Phi X 174 mean[4]		3.9	3.9	3.9	3.9	3.9	3.9	0.0

1 The arithmetic mean of all test units for each challenge.
2 Triplicate sound and two "too-dense" agar plates.
3 See section 5.8.3 of verification report for discussion of pH variance.
4 The arithmetic mean for all challenges against each test unit.

QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

NSF personnel conducted a technical systems audit during testing to ensure that the testing was in compliance with the test plan. NSF also conducted a data quality audit of 100% of the data. Please see the verification report referenced below for more QA/QC information.

THE ENVIRONMENTAL TECHNOLOGY VERIFICATION PROGRAM

U.S. Environmental Protection Agency

NSF International

ETV Joint Verification Statement

TECHNOLOGY TYPE:	POINT-OF-USE DRINKING WATER TREATMENT SYSTEM
APPLICATION:	REMOVAL OF CHEMICAL CONTAMINANTS IN DRINKING WATER
PROJECT NAME:	WATTS PREMIER WP-4V
COMPANY	WATTS PREMIER, INC.
ADDRESS	1725 WEST WILLIAMS DR.
	SUITE C-20
	PHOENIX, AZ 85027
PHONE:	800-752-5582

NSF International (NSF) manages the Drinking Water Systems (DWS) Center under the U.S. Environmental Protection Agency's (EPA) Environmental Technology Verification (ETV) Program. The DWS Center recently evaluated the performance of the Watts Premier WP-4V point-of-use (POU) drinking water treatment system. NSF performed all of the testing activities, and also authored the verification report and this verification statement. The verification report contains a comprehensive description of the test.

EPA created the ETV Program to facilitate the deployment of innovative or improved environmental technologies through performance verification and dissemination of information. The goal of the ETV Program is to further environmental protection by accelerating the acceptance and use of improved and more cost-effective technologies. ETV seeks to achieve this goal by providing high-quality, peer-reviewed data on technology performance to those involved in the design, distribution, permitting, purchase, and use of environmental technologies.

ETV works in partnership with recognized standards and testing organizations, stakeholder groups (consisting of buyers, vendor organizations, and permitters), and with the full participation of individual technology developers. The program evaluates the performance of innovative technologies by developing test plans that are responsive to the needs of stakeholders, conducting field or laboratory tests (as appropriate), collecting and analyzing data, and preparing peer reviewed reports. All evaluations are conducted in accordance with rigorous quality assurance protocols to ensure that data of known and adequate quality are generated and that the results are defensible.

ABSTRACT

The Watts Premier WP-4V POU drinking water treatment system was tested for removal of aldicarb, benzene, cadmium, carbofuran, cesium, chloroform, dichlorvos, dinotephos, fenamiphos, mercury, mevinphos, oxamyl, strontium, and strychnine. The WP-4V employs a reverse osmosis (RO) membrane, a sediment filter, and activated carbon filters to treat drinking water. The system was first tested with only the RO membrane component in place. The target challenge concentration for each chemical for the RO membrane tests was 1 mg/L. Following the RO membrane challenges, the post-membrane carbon filter component was challenged alone with each chemical the RO membrane did not remove to below 50 µg/L. Based on this criterion, the carbon filter was challenged with benzene, chloroform and mercury. The target challenge concentration for the carbon filter tests was the maximum effluent level measured during the RO membrane tests.

A total of 20 RO membrane components were tested, divided into ten pairs. Only one pair of membranes was tested for removal of each chemical. Each RO membrane chemical challenge was conducted over a one-day period. Influent and effluent samples were collected during the operation period, and also the next morning. The post-membrane carbon filter challenges were conducted over a 15-hour duration. Two filters were tested for each chemical challenge, and each pair was only used for one challenge. Influent and effluent samples were collected at the beginning, middle, and end of the challenge period.

The WP-4V as a whole, considering both the RO membrane challenge and post-membrane carbon filter challenge results combined, reduced all of the challenge chemicals 98% or more.

TECHNOLOGY DESCRIPTION

The following technology description was provided by the manufacturer and has not been verified.

The WP-4V is a four-stage POU drinking water treatment system, using sediment filtration, activated carbon filtration, and reverse osmosis. Treated water is stored in a three-gallon storage tank. The WP-4V is certified by NSF to NSF/ANSI Standard 58 – *Reverse Osmosis Drinking Water Treatment Systems*. It has a certified production rate of 9.06 gallons per day.

Incoming water first passes through a sediment filter to remove particulate matter, such as rust and silt, and then through a carbon filter to remove chlorine or other contaminants. The third stage of treatment is the reverse osmosis membrane, which removes a wide variety of inorganic and larger molecular weight organic contaminants, and also protozoan cysts such as cryptosporidium and Giardia. The permeate water is sent to a 3-gallon maximum capacity storage tank. Upon leaving the storage tank, the water passes through a second carbon filter to remove organic chemicals and other taste and odor causing substances before dispensing through the faucet. The pre-membrane carbon and sediment filters were not tested, because they are only designed to remove chlorine and particulate matter to protect the RO membrane.

VERIFICATION TESTING DESCRIPTION

Test Site

The testing site was the Drinking Water Treatment Systems Laboratory at NSF in Ann Arbor, Michigan. A description of the test apparatus can be found in the test/QA plan and verification report. The testing was conducted November 2004 through March 2005.

Methods and Procedures

Verification testing followed the procedures and methods detailed in the *Test/QA Plan for Verification Testing of the Watts Premier WP-4Y Point-of-Use Drinking Water Treatment System for Removal of Chemical Contamination Agents*. Because any contamination event would likely be short-lived, the challenge period for each chemical lasted only one day. Long-term performance over the life of the membrane was not evaluated.

The system was first tested with only the RO membrane component in place. A total of 20 RO membranes were challenged with the chemicals in Table 1. The target challenge concentration for each chemical was 1 mg/L. The 20 membrane test units were divided into ten pairs. One pair of systems was tested for removal of each chemical. The reduction of TDS was also measured during the challenges to evaluate whether any organic chemicals damaged the membrane material or membrane seals.

Table 1. Challenge Chemicals

Organic Chemicals	Inorganic Chemicals
Aldicarb	Cadmium Chloride
Benzene	Cesium Chloride (nonradioactive isotope)
Carbofuran	Mercuric Chloride
Chloroform	Strontium Chloride (nonradioactive isotope)
Diazinon	
Dichlorvos	
Fenamiphos	
Methapyrilene	
Oxamyl	
Strychnine	

Each RO membrane chemical challenge was conducted over a one-day period. The systems were operated for six tank-fill periods, and then were allowed to rest overnight. Influent and effluent samples were collected at certain after the 3rd tank fill, after 15 hours of operation, and the next morning after the membranes rested under pressure overnight. During the chloroform, dichlorvos, and fenamiphos challenges, the systems were still in operation for the 3rd tank fill at 15 hours, so the 3rd tank-fill samples were not collected.

Following the RO membrane challenges, the post-membrane carbon filters were challenged with the chemicals that the RO membranes did not remove to below 10 µg/L. The filters were attached to a separate manifold that was of the same design as the manifold in the full RO system. Two carbon filters were tested for each chemical challenge, and each filter was only used for one challenge. The target challenge concentrations were the maximum effluent levels measured during the RO membrane tests.

Prior to testing, each carbon filter was service-conditioned by feeding water containing chloroform to simulate the possible contaminant loading on the carbon halfway through the filter's effective lifespan.

The post-membrane carbon filter challenges were 15 hours in duration. Influent and effluent samples were collected at the beginning, middle, and end of the challenge period. The carbon filters were operated at 0.2 gallons per minute on an operating cycle where the "on" portion was 19 minutes (the time required to empty the system storage tank when full), and the "off" portion was 3 hours and 45 minutes (the time required to fill the storage tank).

VERIFICATION OF PERFORMANCE

The results of the RO membrane challenges are presented in Table 2. The RO membrane treatment process removed 98% or more of all challenge chemicals but mercury, benzene, and chloroform. The membranes removed 44% of mercury, 85% of benzene, and 84% of the chloroform challenge.

The TDS reduction by each membrane component for all challenge tests was 95% or higher. The TDS reduction data does not indicate that any of the membranes or membrane seals were adversely affected by exposure to the challenge chemicals.

The post-membrane carbon filter components were challenged with benzene, chloroform, and mercury.

Table 2. RO Membrane Challenge Data

Chemical	Mean Influent (µg/L)	Mean Effluent (µg/L)	Percent Reduction (%)
Cadmium	910	32	> 96
Chromium	600	11	99
Mercury	1200	670	44
Selenium	920	1	> 99
Silver	1100	10	> 99
Benzene	1100	160	85
Carbofuran	1100	5	> 99
Chloroform	1100	180	84
Dichlorvos	360	10	98
Dinoseb	870	10	99
Pentachlorophenol	1200	11	> 99
Methamidophos	1200	16	99
Oxamyl	1100	4	> 99
Glyphosate	3000	6	> 99

The carbon challenge results are shown below in Table 3. The carbon filter removed 98% or more of all three substances. The RO membrane and carbon challenge data combined shows that the two treatment technologies working in tandem within the WP-4V system removed 98% or more of all challenge chemicals.

Complete descriptions of the verification testing results are included in the verification report.

Table 3. Post-Membrane Carbon Filter Challenge Data

Chemical	Target Influent[1] (µg/L)	Measured Mean Influent (µg/L)	Mean Effluent (µg/L)	Percent Reduction (%)
Benzene	290	300	0.5	> 99
Chloroform	300	300	ND (0.5)	> 99
Mercury	740	760	12	98

(1) Target influent level set at maximum ajacle effluent level from RO challenge.

QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

NSF ETV and QA staff monitored the testing activities to ensure that the testing was in compliance with the test plan. NSF also conducted a data quality audit of 100% of the data. Please see the verification report referenced below for more QA/QC information.

Original signed by Andrew Avel 01/18/06	*Original signed by Robert Ferguson 01/24/06*
Andrew P. Avel Date	Robert Ferguson Date
Acting Director	Vice President
National Homeland Security Research Center	Water Systems
United States Environmental Protection Agency	NSF International

NOTICE: Verifications are based on an evaluation of technology performance under specific, predetermined criteria and the appropriate quality assurance procedures. EPA and NSF make no expressed or implied warranties as to the performance of the technology and do not certify that a technology will always operate as verified. The end-user is solely responsible for complying with any and all applicable federal, state, and local requirements. Mention of corporate names, trade names, or commercial products does not constitute endorsement or recommendation for use of specific products. This report is not an NSF Certification of the specific product mentioned herein.

Availability of Supporting Documents

Copies of the test protocol, the verification statement, and the verification report (NSF report # NSF 04/13c/EPADWCTR) are available from the following sources:

(NOTE: Not all of the appendices are included in the verification report. The appendices are available from NSF upon request.)

1. ETV Drinking Water Systems Center Manager (printed copy)
   NSF International
   P.O. Box 130140
   Ann Arbor, Michigan 48113-0140
2. NSF web site: http://www.nsf.org/business/newtech/news_reports.html, and from http://www.nsf.org/business/newtech/news_project_documents.html (electronic copy)
   EPA web site: http://www.epa.gov/etv (electronic copy)

THE ENVIRONMENTAL TECHNOLOGY VERIFICATION PROGRAM

U.S. Environmental Protection Agency

NSF International

ETV Joint Verification Statement

TECHNOLOGY TYPE:	**POINT-OF-USE DRINKING WATER TREATMENT SYSTEM**
APPLICATION:	**REMOVAL OF MICROBIAL CONTAMINANTS IN DRINKING WATER**
PRODUCT NAME:	WATTS Premier WP-4V
VENDOR:	**WATTS PREMIER**
ADDRESS:	1725 W. 13TH AVENUE SUITE C-20 **PHOENIX, AZ 85027**
PHONE:	800-752-5582
INTERNET	http://www.wattspremier.com

NSF International (NSF) manages the Drinking Water Systems (DWS) Center under the U.S. Environmental Protection Agency's (EPA) Environmental Technology Verification (ETV) Program. The DWS Center recently evaluated the performance of the Watts Premier WP-4V point-of-use (POU) reverse osmosis (RO) drinking water treatment system. NSF performed all of the testing activities and also authored the verification report and this verification statement. The verification report contains a comprehensive description of the test.

EPA created the ETV Program to facilitate the deployment of innovative or improved environmental technologies through performance verification and dissemination of information. The goal of the ETV Program is to further environmental protection by accelerating the acceptance and use of improved and more cost-effective technologies. ETV seeks to achieve this goal by providing high-quality, peer-reviewed data on technology performance to those involved in the design, distribution, permitting, purchase, and use of environmental technologies.

ETV works in partnership with recognized standards and testing organizations, stakeholder groups (consisting of buyers, vendor organizations, and permitters), and with the full participation of individual technology developers. The program evaluates the performance of innovative technologies by developing test plans that are responsive to the needs of stakeholders, conducting field or laboratory tests (as appropriate), collecting and analyzing data, and preparing peer-reviewed reports. All evaluations are conducted in accordance with rigorous quality assurance protocols to ensure that data of known and adequate quality are generated and that the results are defensible.

ABSTRACT

The Watts Premier WP-4V four-stage POU RO system was tested for removal of bacteria and viruses at NSF's Drinking Water Treatment Systems Laboratory. Five systems were challenged with the bacteriophage viruses f2 and MS2, and the bacteria *Brevundimonas diminuta*. The virus challenges were conducted at three different pH settings (6, 7.5, and 9) to assess whether pH influences the performance of the RO membrane. The bacteria challenges were conducted only at pH 7.5.

The challenge concentrations ranged from 3.8 to 5.0 logs for the viruses, and 6.4 to 7.2 logs for the bacteria. The log reductions ranged from 1.5 to 6.4 $\log_{10}$ for *B. diminuta*, with an average of 2.1 $\log_{10}$. The virus log reductions ranged from 1.4 to 3.6 $\log_{10}$ for f2, and 1.2 to 3.7 $\log_{10}$ for MS2. The average virus $\log_{10}$ reductions were 2.5 and 2.7, respectively. The virus challenge data does not indicate that the pH of the challenge water influenced removal by the RO membrane. See Table VS-2 below for the complete log reduction data.

TECHNOLOGY DESCRIPTION

The following technology description was provided by the manufacturer and has not been verified.

The WP-4V is a four-stage POU drinking water treatment system using sediment filtration, activated carbon filtration, and reverse osmosis. Treated water is stored in a three-gallon storage tank. The WP-4V is certified by NSF to NSF/ANSI Standard 58 - *Reverse Osmosis Drinking Water Treatment Systems*. It has a certified production rate of 9.06 gallons per day.

Incoming water first passes through a sediment filter to remove particulate matter, such as rust and silt, and then through a carbon filter to remove chlorine or other contaminants. The third stage of treatment is the reverse osmosis membrane, which removes a wide variety of inorganic and larger molecular weight organic contaminants, and also protozoan cysts such as Cryptosporidium and Giardia. The permeate water is sent to a 3-gallon maximum capacity storage tank. Upon leaving the storage tank, the water passes through a second carbon filter to remove organic chemicals and other taste and odor causing substances before dispensing through the faucet. The pre-membrane carbon and sediment filters were not tested, because they are only designed to remove chlorine and particulate matter to protect the RO membrane.

VERIFICATION TESTING DESCRIPTION

Test Site

The testing site was the Drinking Water Treatment Systems Laboratory at NSF in Ann Arbor, Michigan. A description of the test apparatus can be found in the test/QA plan and verification report. The testing was conducted in June and July of 2005.

Methods and Procedures

The testing methods and procedures are detailed in the Test/QA Plan for Verification Testing of the Watts Premier WP-4V Point-of-Use Drinking Water Treatment System for Removal of Microbial Contamination Agents. Five WP-4V systems were tested for bacteria and virus removal performance using the bacteriophage viruses f2 and MS2, and the bacteria Brevundimonas diminuta. The challenge organisms were chosen because they are smaller than most other viruses and bacteria, and so provide a conservative estimate of performance. NSF also used a genetically engineered strain of B. diminuta. The NSF Microbiology Laboratory inserted into a culture of B. diminuta strain 19146 a gene conferring resistance to the antibiotic kanamycin. This allowed the Microbiology Laboratory to use a growth media

amended with 50 µg/mL of kanamycin to prohibit heterotrophic plate count (HPC) bacteria in the treated water samples from growing along with the kanamycin resistant B. diminuta.

Five systems were evaluated. The systems were installed on a test rig and conditioned according to the vendor's instructions (fill the storage tanks and dispense the contents to a drain three times), and then were conditioned for another five days. Prior to testing, the systems were evaluated for reduction of total dissolved solids (TDS) to ensure that the systems undergoing testing were representative of the expected performance of the system.

The test water for the bacteria challenges was set to pH 7.5 ± 0.5, while the virus challenges were conducted at pH 6.0 ± 0.5, 7.5 ± 0.5, and 9.0 ± 0.5. The challenge schedule is shown in Table VS-1. The virus challenges were conducted at different pH settings to evaluate whether the surface charges of the viruses influenced their removal through electrostatic forces versus mechanical filtration. Viruses have different surface charges, or different strengths of negative or positive charge, depending on their isoelectric point and the pH of the water. The isoelectric point is the pH at which the virus surface is neutrally charged. MS2's isoelectric point is pH 3.9, and f2's is pH 8.9. In solutions above the isoelectric point, the virus is negatively charged. Below the isoelectric point, the virus is positively charged.

Table VS-1. Challenge Schedule

Day	Surrogate Challenge	pH
1	*B. diminuta*	7.5 ± 0.5
2	f2 and MS2	6.0 ± 0.5
3	f2 and MS2	7.5 ± 0.5
4	Kanamycin Resistant *B. diminuta*	7.5 ± 0.5
5	f2 and MS2	9.0 ± 0.5

For each challenge, the systems were operated for one tank-fill period (approximately four to five hours). The end of this period was evident through engagement of each system's automatic shutoff mechanism, which causes the flow of reject water to cease. Influent water samples were collected at the beginning and end of each challenge period. After each system ceased operation, the contents of the product water storage tanks were emptied into sterile containers, and samples were collected for microbiological analysis. All samples were enumerated in triplicate. Following each challenge period, the systems were flushed by operating them for one tank-fill period using water without challenge organisms.

VERIFICATION OF PERFORMANCE

As discussed above, the systems were first subjected to a TDS reduction test to verify that the RO membranes would perform as expected. The observed TDS reduction ranged from 89% to 96%. The certified TDS reduction for the WP-4V is 97%.

The bacteria and virus $\log_{10}$ reduction data is presented in Table VS-2. The $\log_{10}$ reduction of *B. diminuta* ("normal" and kanamycin resistant *B. diminuta* combined) ranged from 1.3 to 6.4, with an average $\log_{10}$ reduction of 3.9. The challenge organisms were detected in the effluent samples for all test units but Unit 2 for the "normal" *B. diminuta* challenge. Since the Unit 2 effluent count for kanamycin resistant *B. diminuta* was 4.3 $\log_{10}$, and all other effluent samples had bacteria counts greater than 4 $\log_{10}$ (data not shown), it is possible that there was a sampling or analytical error associated with the Unit 2 "normal" *B. diminuta* sample. Therefore, that sample was not included in the mean $\log_{10}$ reduction calculation for the bacteria.

The virus challenge data showed similar performance. The $\log_{10}$ reduction of the fr virus ranged from 1.4 to 3.6, with an overall mean of 2.5. The $\log_{10}$ reduction of MS2 ranged from 1.2 to 3.7, with an overall mean of 2.6. A visual comparison of the $\log_{10}$ reductions versus the challenge water pH shows the mean $\log_{10}$ reductions decreasing with increasing pH. However, an examination of the 95% confidence intervals around the means (see verification report for data) shows that the decreases are not statistically significant.

The minimum observed log reductions equal removal of 95% of *B. diminuta*, and 94% of the viruses.

Table VS-2. Bacteria and Virus Log Reduction Data

Target pH	Initial Measured pH	Final Measured pH	Challenge Organisms	Log$_{10}$ Influent Challenge	Geometric Mean Log$_{10}$ Reduction				
					Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Mean
7.0 ± 0.2	7.6	7.8	*B. diminuta*/ Kathmandu	6.4	1.8	8.4*	1.3	1.5	1.6	1.5
7.5 ± 0.2	7.5	7.8	Rosa/and *B. diminuta*	7.2	1.4	2.8	2.6	2.9	3.1	2.4
6.0 ± 0.2	6.1	6.5	fr	5.9	1.8	3.1	3.6	3.4	3.0	2.9
			MS2	5.8	2.1	3.4	3.7	3.6	2.9	3.1
7.5 ± 0.2	7.5	7.7	fr	6.5	1.9	2.7	2.3	3.1	2.8	2.5
			MS2	4.2	1.7	2.4	2.4	3.4	3.2	2.3
9.0 ± 0.2	8.9	9.0	fr	5.0	1.4	2.3	2.1	2.5	2.6	2.1
			MS2	4.6	1.3	3.4	3.0	2.5	3.0	2.7
						Overall Means:			*B. diminuta*	1.9
									fr	2.3
									MS2	2.6

*Number not included in mean log reduction calculation.

QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

NSF provided technical and quality assurance oversight of the verification testing as described in the verification report, including a review of nearly 100% of the data. NSF personnel also conducted a technical systems audit during testing to ensure the testing was in compliance with the test plan. A complete description of the QA/QC procedures is provided in the verification report.

Original signed by Sally Gutierrez 09/11/06

Sally Gutierrez — Date
Director
National Risk Management Research Laboratory
Office of Research and Development
United States Environmental Protection Agency

Original signed by Robert Ferguson 09/23/06

Robert Ferguson — Date
Vice President
Water Systems
NSF International

NOTICE: Verifications are based on an evaluation of technology performance under specific, predetermined criteria and the appropriate quality assurance procedures. EPA and NSF make no expressed or implied warranties as to the performance of the technology and do not certify that a technology will always operate as verified. The end-user is solely responsible for complying with any and all applicable federal, state, and local requirements. Mention of corporate names, trade names, or commercial products does not constitute endorsement or recommendation for use of specific products. This report is not an NSF Certification of the specific product mentioned herein.

Availability of Supporting Documents

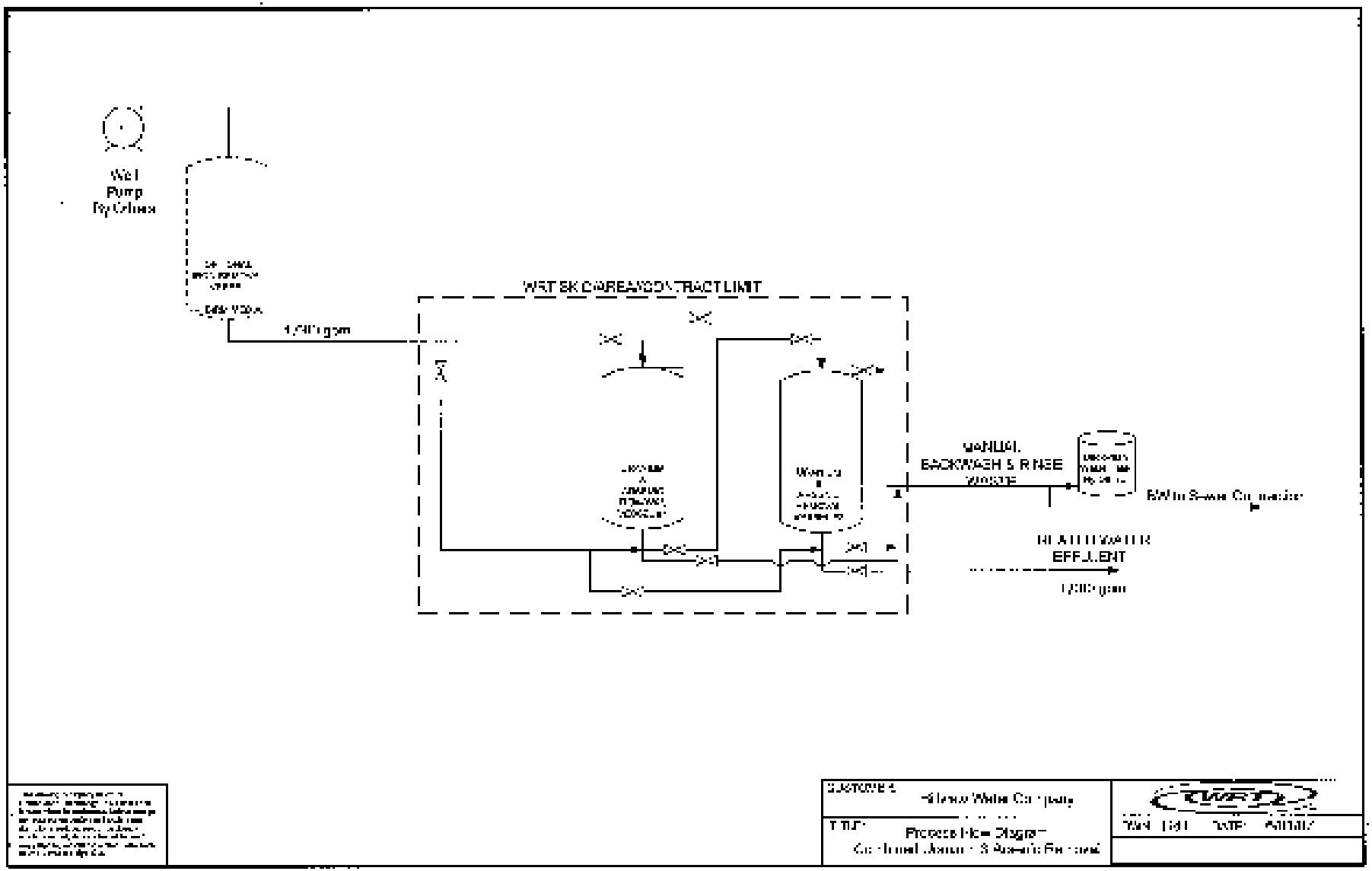
Copies of the test protocol, the verification statement, and the verification report (NSF report # NSF 06/12b/EPADWCTR) are available from the following sources:

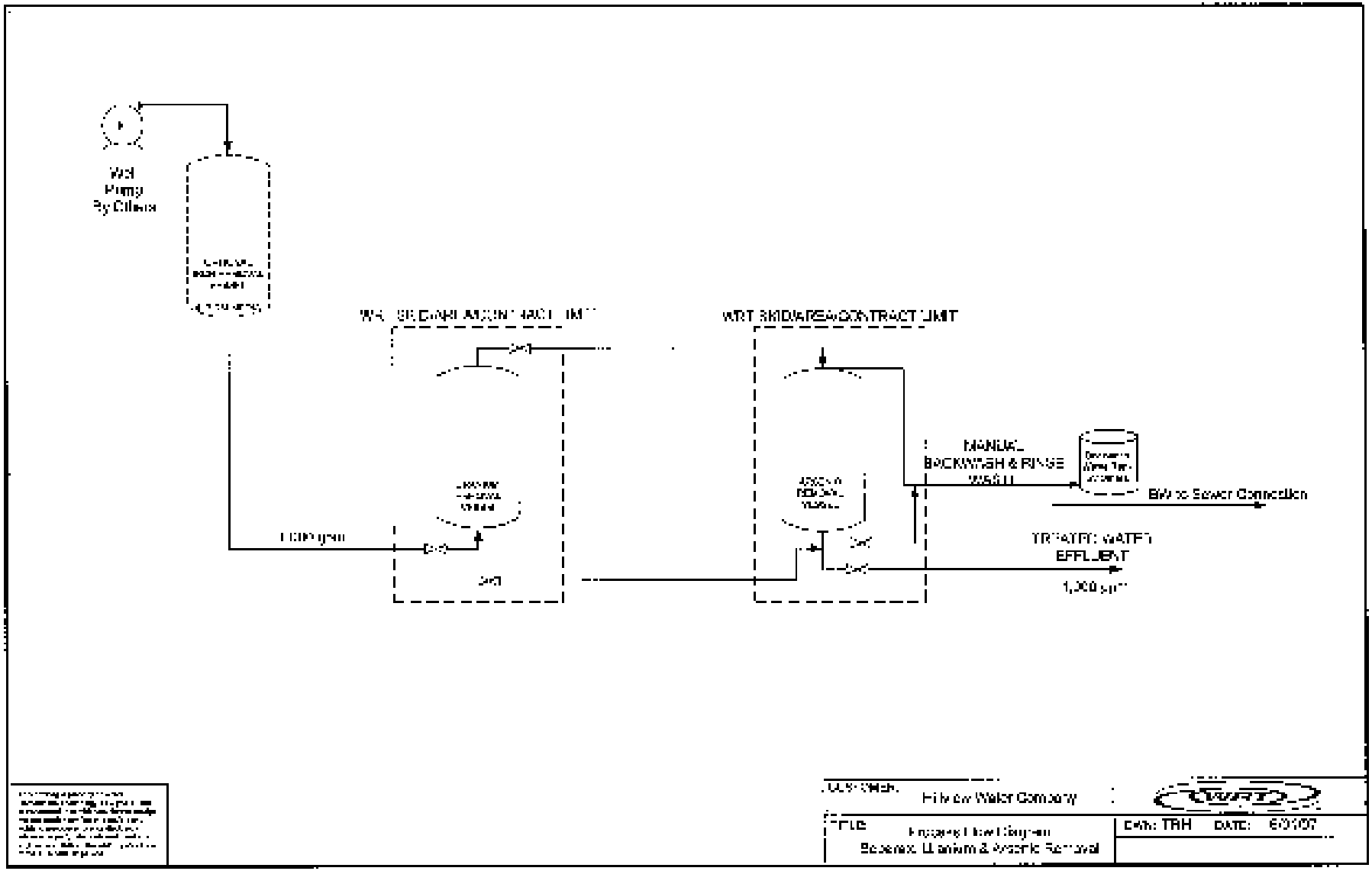
(NOTE: Appendices are not included in the verification report. Appendices are available from NSF upon request.)

1 ETV Drinking Water Systems Center Manager (order hard copy)
NSF International
P.O. Box 130140
Ann Arbor, Michigan 48113-0140

2 Electronic PDF copy
NSF web site: http://www.nsf.org/etv
EPA web site: http://www.epa.gov/etv

Appendix B
WRT Arsenic/Uranium Treatment Process
Flow Diagram and Treatment Plant Schematic


Well
Pump
By Others
WATER CARE AREA CONTRACT LIMIT
MANUAL
BACKWASH & RINSE
BW to Sewer Connection
RECLAIMED WATER
EFFLUENT


Well
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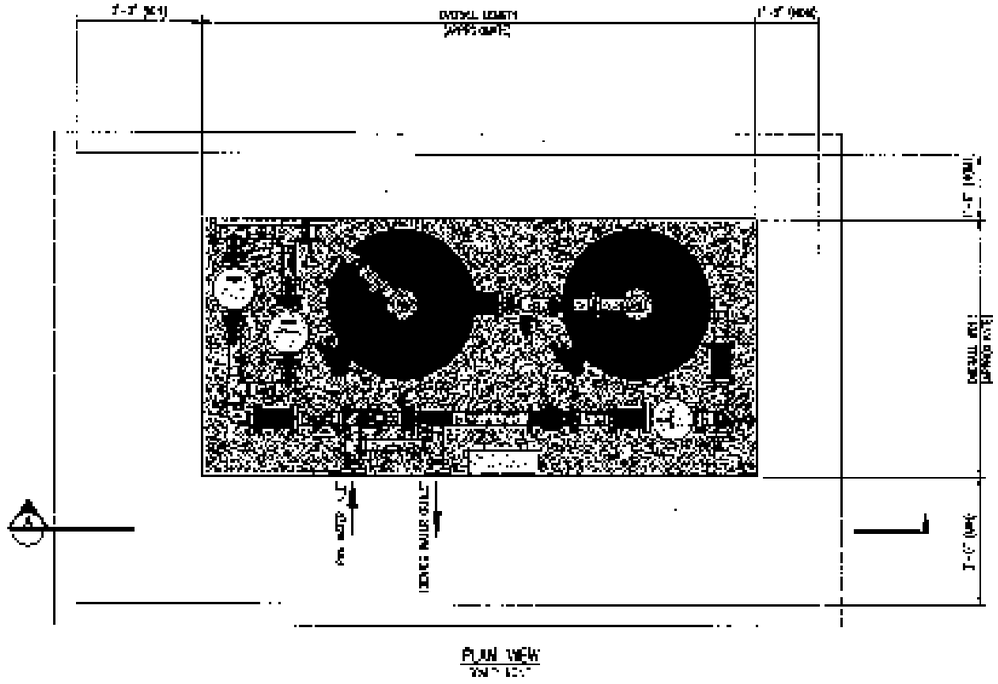
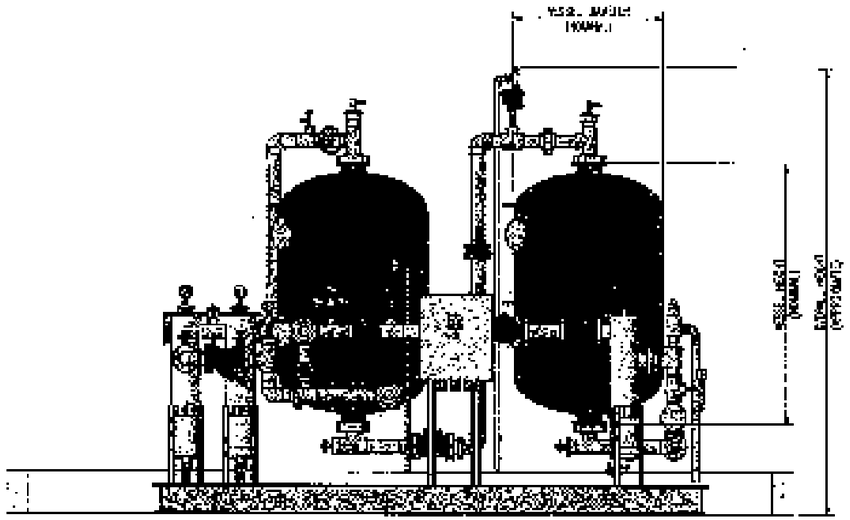


PLAN VIEW



A ELEVATION

NOTES:

DIMENSIONS AND PIPING ORIENTATIONS SHOWN ARE APPROXIMATE.

TYPICAL PRESSURE DROP THROUGH THE SYSTEM IS 15 PSI*
MAXIMUM OPERATING INLET PRESSURE IS 150 PSI
MINIMUM OPERATING INLET PRESSURE IS 40 PSI*
* DOES NOT ACCOUNT FOR ANY LOSSES OR REQUIREMENTS EXTERNAL TO THE WRT® SYSTEM.

ALL PIPING, FITTINGS, GASKETS, HARDWARE, SUPPORTS AND OTHER APPURTENANCES REQUIRED TO CONNECT THE WRT® SYSTEM ARE NOT INCLUDED.

ANY PIPING AND ELECTRICAL WORK NECESSARY FOR THE CUSTOMER / WRT® SYSTEM INTERFACE IS NOT INCLUDED.

DELIVERY TO THE SITE IS PROVIDED BY WRT®.

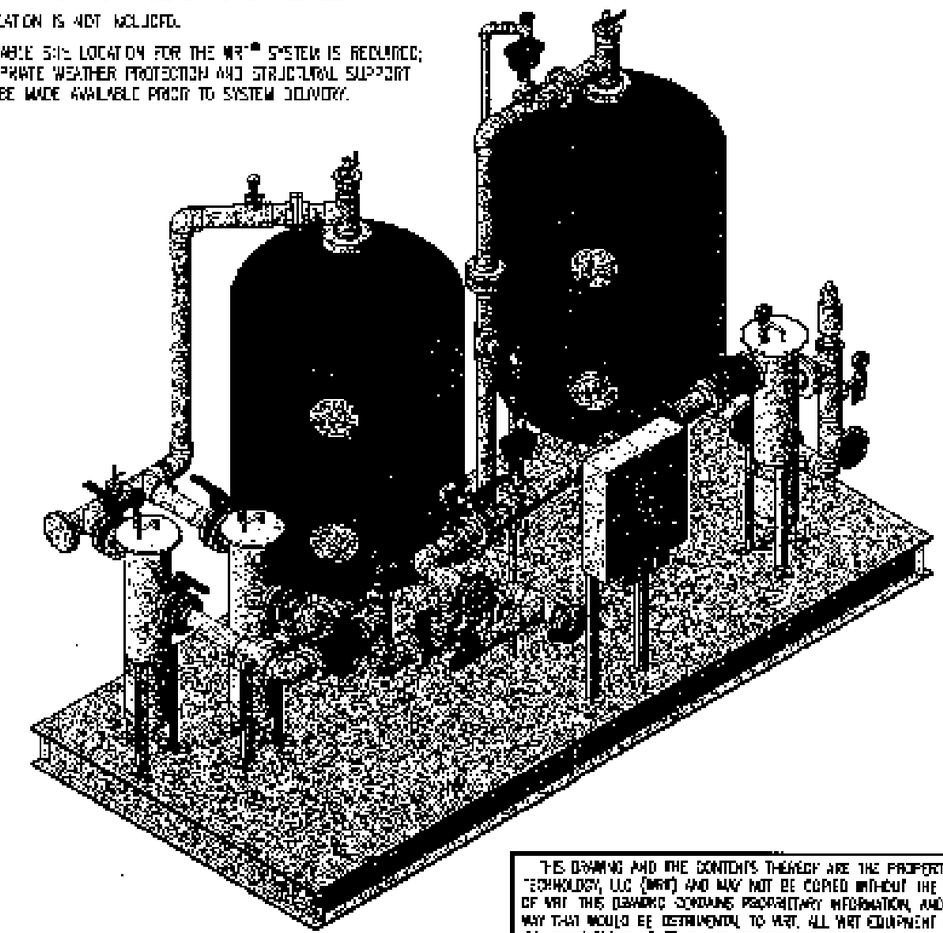
SYSTEM UNLOADING UPON DELIVERY IS NOT INCLUDED.

INSTALLATION IS NOT INCLUDED.

A SUITABLE SITE LOCATION FOR THE WRT® SYSTEM IS REQUIRED; APPROPRIATE WEATHER PROTECTION AND STRUCTURAL SUPPORT MUST BE MADE AVAILABLE PRIOR TO SYSTEM DELIVERY.

REPRESENTATIVE DIMENSIONAL DATA

FLOW RATE (GPM)	VESSEL DIAMETER	VESSEL HEIGHT	OVERALL WIDTH	OVERALL LENGTH	OVERALL HEIGHT	NOMINAL PIPE SIZE	APPROX. SHIPPING WEIGHT	APPROX. OPERATING WEIGHT
10 - 25	24"	72"	5'-6"	11'-0"	10'-2"	2"	3,750 lbs	4,750 lbs
26 - 45	30"	72"	5'-6"	11'-0"	10'-2"	2"	4,750 lbs	6,000 lbs
46 - 65	36"	72"	5' 3"	12' 6"	10'-4"	2"	5,500 lbs	7,250 lbs
66 - 95	42"	72"	6'-2"	13'-0"	10'-6"	3"	8,000 lbs	10,500 lbs
96 - 125	48"	72"	6'-6"	13'-0"	11'-0"	3"	9,000 lbs	12,500 lbs
126 - 210	63"	86"	7'-6	15'-0"	11'-2"	4"	15,000 lbs	20,000 lbs



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WATER REMEDIATION TECHNOLOGY, LLC
WHEAT RIDGE, COLORADO

Z-92™ URANIUM REMOVAL SYSTEM
SKID SYSTEM

TYPICAL LAYOUT

Appendix F
Proposed Groundwater Monitoring Program for Madera County

PROPOSED GROUNDWATER MONITORING PROGRAM FOR MADERA COUNTY

prepared for
Resources Management Agency
County of Madera
Madera, California

by
Kenneth D. Schmidt and Associates
Groundwater Quality Consultants
Fresno, California

January 2008

KENNETH D. SCHMIDT AND ASSOCIATES
GROUNDWATER QUALITY CONSULTANTS
800 WEST SHAW, SUITE 250
FRESNO, CALIFORNIA 93704
TELEPHONE (559) 224-4412

January 4, 2008

Mr. Greg Farley
County Engineer
Madera County RMA
2037 West Cleveland Avenue
Madera, CA 93637

Re: Proposed Groundwater Monitoring
Program for Madera County

Dear Greg:

Submitted herewith is our proposed groundwater monitoring program for Madera County. We appreciate the cooperation of Boyle Engineering Corporation, the Chowchilla Water District, the Root Creek Water District, the Columbia Canal Company, the Gravelly Ford Water District, and the Alisо Water District in providing information for this report.

Sincerely Yours,

Kenneth D. Schmidt
Geologist No. 1578
Certified Hydrogeologist
No. 176

KDS/pe

TABLE OF CONTENTS

Continued:

TABLE OF CONTENTS
(Continued:)

LIST OF ILLUSTRATIONS

PROPOSED GROUNDWATER MONITORING PROGRAM FOR MADERA COUNTY

INTRODUCTION

In this report, existing groundwater monitoring is described, first in the foothills and mountains, then in the valley floor. Data gaps in the monitoring programs in both of these areas are then discussed. Lastly, a groundwater monitoring program is proposed to address these gaps and to supplement the exiting monitoring.

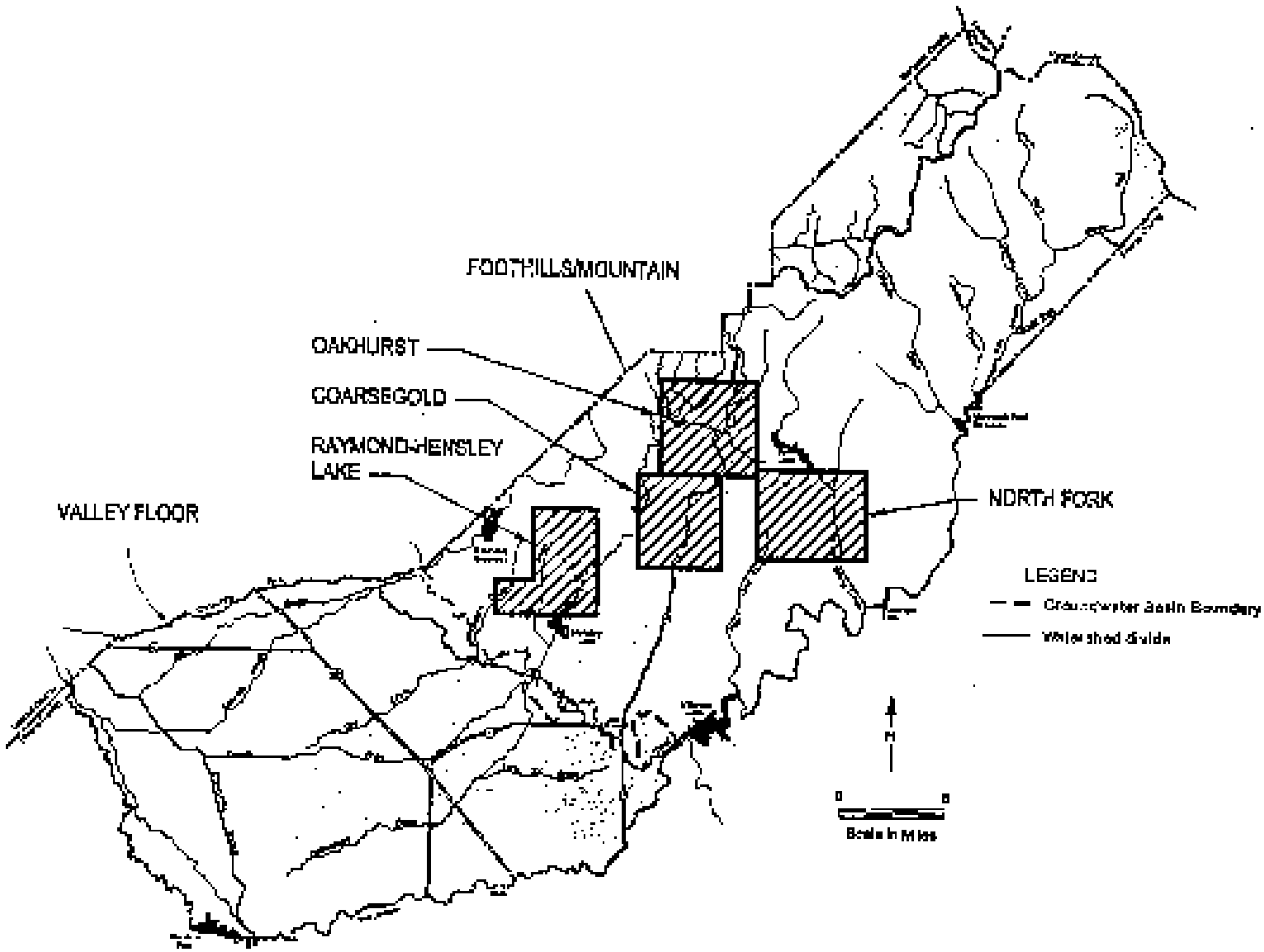
EXISTING MONITORING PROGRAMS

Foothills and Mountains

Figure 1 shows the foothill and mountain part of Madera County, and the locations of four areas were detailed hydrogeologic evaluations have been completed (Oakhurst, North Fork, Coarsegold, and Raymond-Hensley Lake).

Well Completion Reports

Locations of wells, depths, water-producing fracture zones, and airtest yields are all important information that is necessary to conduct hydrogeologic evaluations. Well completion reports for new wells are required to be filed with both Madera County Environmental Health and the California Department of Water Resources (DWR). Unfortunately, the reports in the County files are not readily retrievable. The completion reports in the DWR files are



Basemap from Todd Engineers (2002).

FIGURE 1-LOCATION OF DETAILED STUDY AREAS IN FOOTHILLS AND MOUNTAINS

retrievable and are filed by township, range, and section. The locations of these wells are generally not matched to specific parcels and the well locations are not field checked. Some water well drilling contractors have extensive files of completion reports, but these are considered confidential by most contractors.

Precipitation

Figure 2 shows the locations of precipitation gages in the foothills and mountains of Madera County. In terms of suitability for evaluating groundwater conditions, this network of gages is considered adequate.

Streamflow

Figure 2 also shows streamflow gaging stations in the foothills and mountains. In general, flows for the larger streams, such as the Chowchilla River and Fresno River, are measured, but flows of most smaller streams are not, except for Willow Creek in the North Fork area, Finegold Creek, and Cottonwood Creek near Friant Dam. There are no active streamflow gages in the Coarsegold area. Streamflow, particularly the baseflow, is important in the foothills and mountains for groundwater evaluations. Baseflow represents groundwater discharge to streams, and good examples are the low Fresno River and Coarsegold Creek flows in the early summer. A number of vegetation management programs are underway at some locations, and these can increase streamflow, due to a reduc-

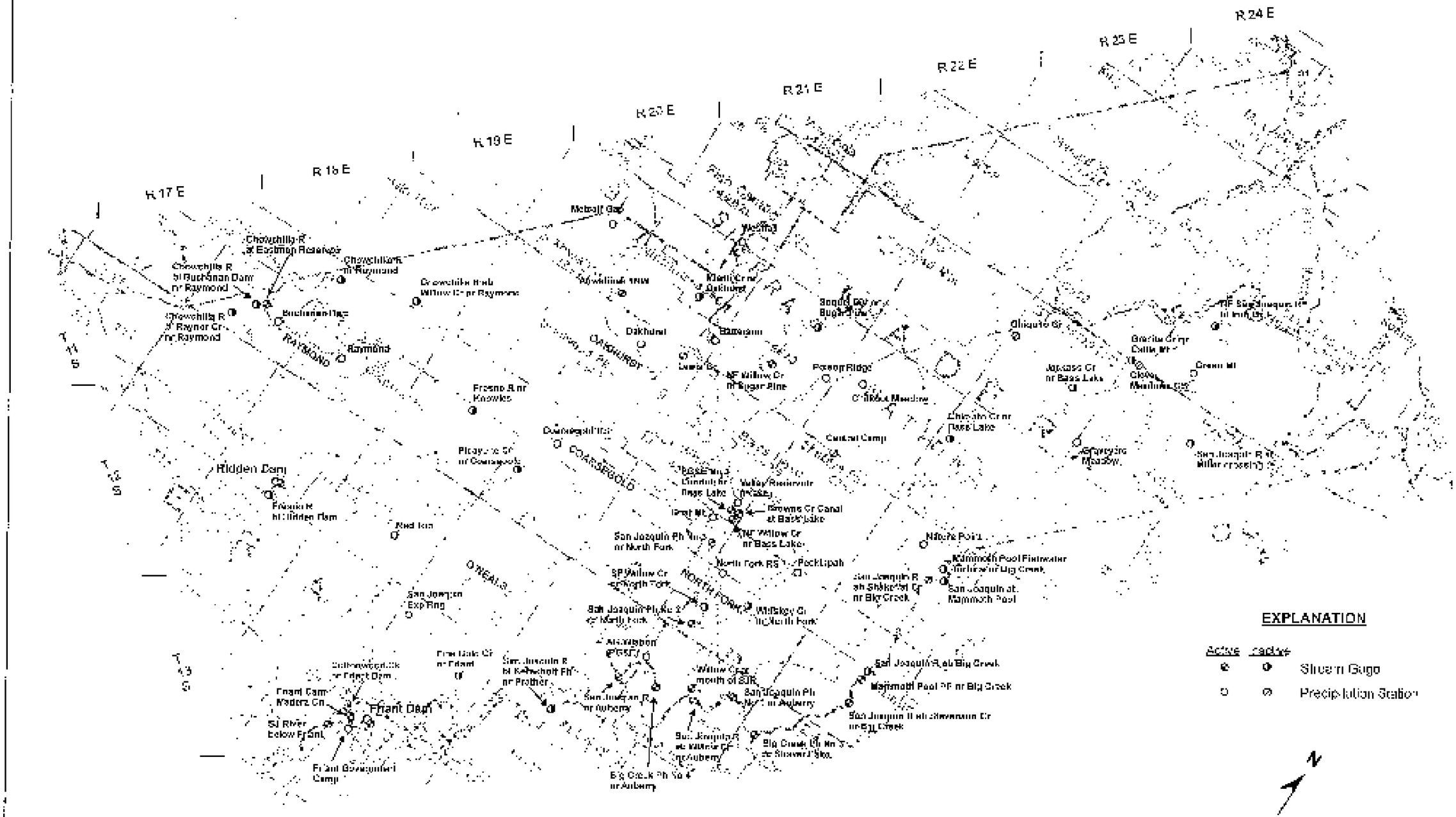


FIGURE 2 - STREAM GAGES AND PRECIPITATION STATIONS IN FOOTHILL AND MOUNTAIN AREA

tion in evapotranspiration. Measurements of streamflow in local areas where such practices have been or are being conducted would be useful.

Pumpage

Pumpage in the foothills and mountains is generally measured only for water system wells. In the areas where detailed hydrogeologic evaluations have been conducted, pumpage of private individual wells was estimated by determining the number of developed lots not connected to water systems and using average water deliveries per connection for water systems. Pumpage information is indicated to be generally suitable for hydrogeologic evaluations.

Water Levels

In general, prior to the detailed hydrogeologic evaluations in the four areas, routine water-level records were primarily limited to those for some water system wells. Some large water systems have excellent water-level records, such as the Yosemite Spring Park Utility and Hillview Water Company. However, many small systems have much less water-level records. Continuous water-level recorders have been maintained for several Chukchansi Casino wells for several years, and these are considered the best records available. As part of the detailed hydrogeologic studies, numerous wells were measured, and the measuring point elevations were determined. This allowed preparation of the first water-level elevation maps to be prepared for the foothill and mountain areas of Madera

County. Also, frequent water-level measurements allowed water-level hydrographs to be prepared and to be compared to precipitation records. There are a number of other water-level measurements that are maintained by water well drillers and pump companies, but for the most part this is not public information.

Groundwater Quality

Prior to the detailed hydrogeologic studies for the four referenced areas, chemical analyses of water samples from wells were primarily limited to wells in moderate to large water systems. As part of the detailed studies, numerous private domestic wells were sampled for determination of key chemcial constituents. This allowed preparation of maps showing groundwater quality problem areas, in many cases for the first time. Identified problems in some areas include high concentrations of total dissolved solids, iron, manganese, uranium, arsenic, and hydrogen sulfide. Also, groundwater of low pH (less than 6) has been identified in some areas. Water from wells in some areas has been treated to remove iron and manganese, and this is common in the Coarsegold area. Probably the most difficult groundwater quality problem in the foothills and mountains is uranium, particularly in parts of the Oakhurst and North Fork areas. Some chemical analyses are available for other private domestic wells, but these are generally not in the public record. Because water system wells with water

quality problems that cannot be readily handled by treatment are often taken out of service and can't be sampled to obtain representative results, time trends for groundwater quality in problem areas have been difficult to determine.

Valley Floor

Figure 3 shows the location of the valley floor part of Madera County and irrigation and water districts and subareas within the area. Todd Engineers (2002) evaluated groundwater conditions in this area for the County AB303 groundwater management plan. More detailed hydrogeologic studies have been conducted in parts of this area, including the Chowchilla Water District, Root Creek Water District, City of Madera, and in the vicinity of the Mendota Pool.

Precipitation

Figure 4 shows locations of precipitation stations in the valley floor part of the County. In general, those stations provide adequate information for groundwater evaluations.

Evaporation and Evapotranspiration

Evaporation from surface water bodies is a component of the water budget. Crop evapotranspiration is one of the largest water budget items for the irrigated part of the valley floor. Records from climatological stations where parameters such as pan evaporation and temperature are measured can be used to estimate evapora-

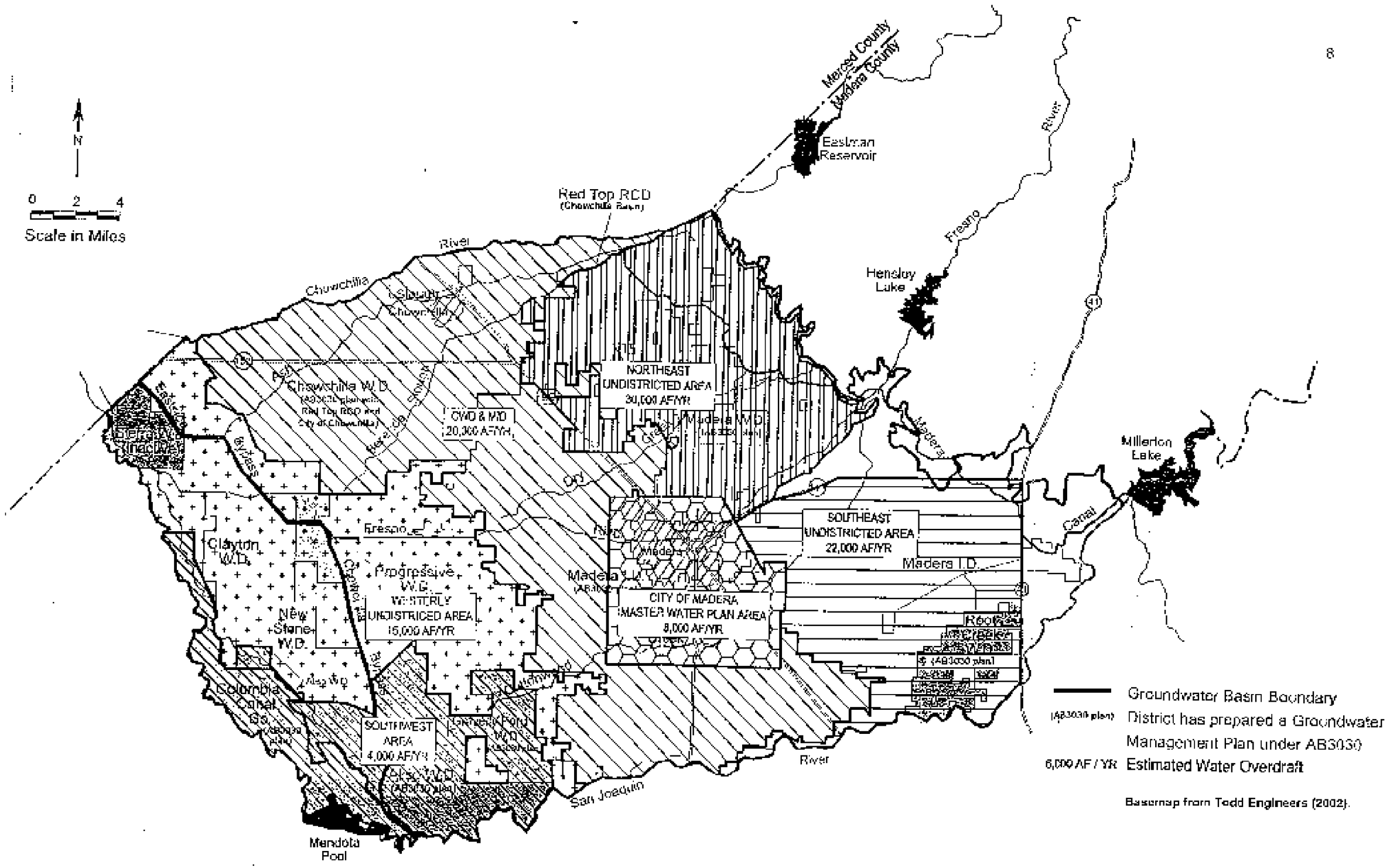


FIGURE 3-LOCATIONS OF WATER DISTRICTS AND SUBAREAS IN VALLEY FLOOR AREA

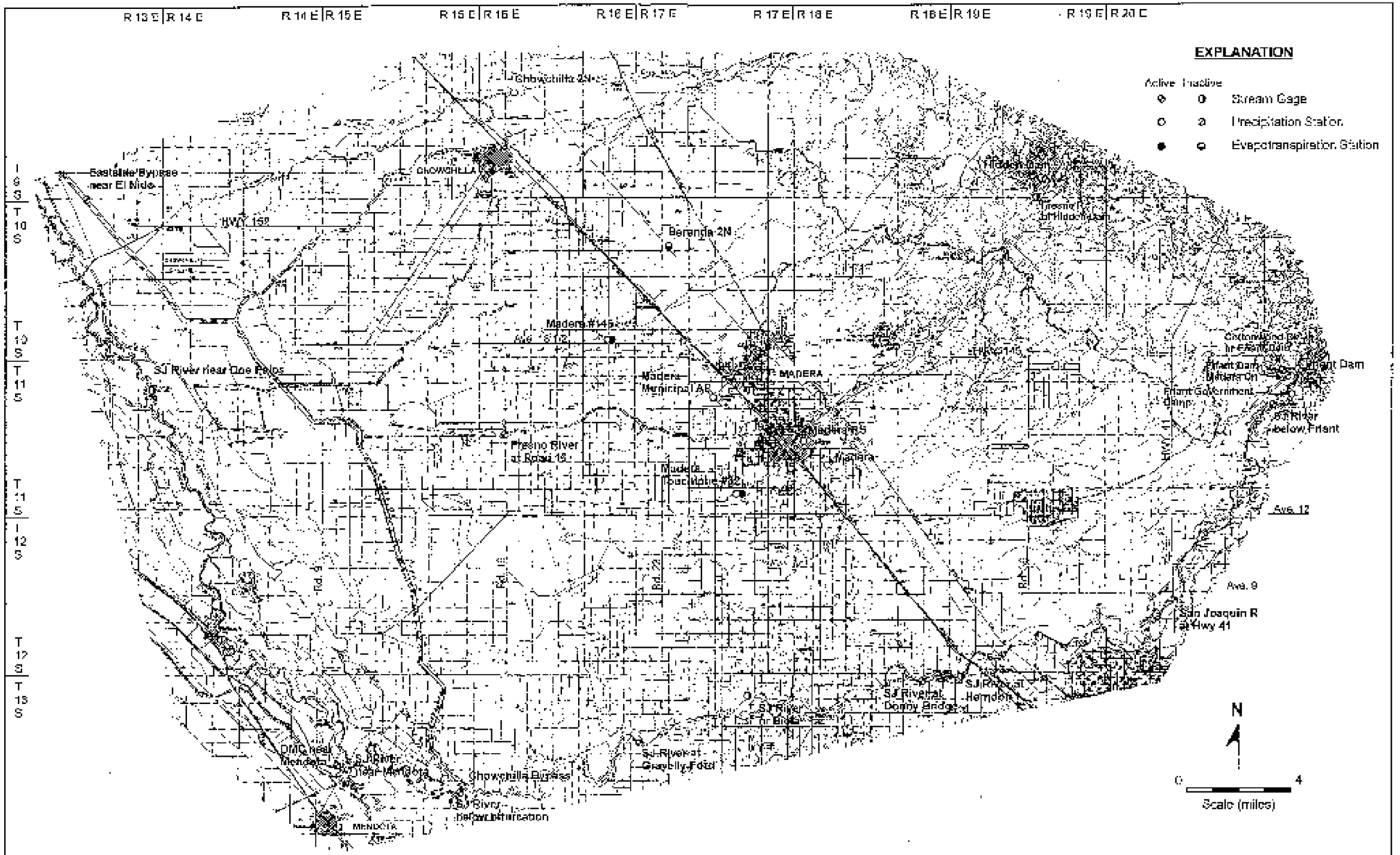


FIGURE 4 - STREAM GAGES AND PRECIPITATION AND EVAPOTRANSPIRATION STATIONS IN VALLEY FLOOR AREA

-tion from free water surfaces and crop evapotranspiration. Locations of these stations in valley floor areas are shown in Figure 4. In terms of groundwater evaluations, these records are considered adequate.

Streamflow

Figure 4 also shows locations of streamgages in or near the valley floor area for the Chowchilla River, Fresno River, and San Joaquin River. The San Joaquin River is gaged below Friant Dam, at the Eastside Bypass, and at Mendota Dam. The Fresno River is gaged below Hidden Dam and at Road 16. The Chowchilla River is gaged below Buchanon Dam (Eastman Lake). In general, downstream flows on the Fresno River and distributaries of the Chowchilla River in Madera County aren't measured, except for diversions for irrigation.

Canal Diversions

Amounts of water diverted from the Madera Canal, the Fresno River, and the Chowchilla River and its distributaries are measured by either the Chowchilla WD or Madera ID. Diversions of San Joaquin River water are measured by the Gravelly Ford Water District, Columbia Canal Company, and private landowners.

Consumptive Use

Periodic crop surveys are normally done in the MID, CWD, Gravelly Ford WD, and Root Creek WD. Crop surveys are not routine-

ly done in undistricted areas. However, the California Department of Water Resources periodically conducts crop surveys in the valley floor area for evaluation of irrigation water use.

Pumpage

Pumpage is one of the largest items in the water budget. In the valley floor area, pumpage for City and other moderate to large water system wells is generally measured by flowmeters. Pumpage is also measured at the Paramount Farms New Columbia Ranch, the Columbia Canal Co., and by some other individual land owners. However, pumpage from most private irrigation wells and private domestic wells is not directly measured. In the past, irrigation well pumpage in the valley floor area has been estimated by agencies such as the U. S. Geological Survey from power consumption records. Pumpage for irrigation can also be estimated from the consumptive use of applied water (based on crop surveys), estimates of the irrigation efficiency, and records of river or canal water use. This is considered a better approach than using power records, but is not as accurate as direct measurements.

Water Levels

Todd Engineers (2002) retrieved electronic water-level records obtained from the California Department of Water Resources for more than 750 wells in the valley floor area. Unfortunately, many of those wells are no longer measured, due to well destruction, water-

level declines, and other factors. A number of Districts routinely measure water levels in the spring and fall and these are provided to the DWR.

Following are the number of wells being measured in or by specific districts in or near the valley floor area:

Madera ID	202
Chowchilla ID	143
Columbia Canal Co.	36
Root Creek WD	18
El Nido ID	10
Aliso WD/Gravely Ford WD	8

MID also measures water levels in 20 other wells in the vicinity of the Madera Ranch water-banking facility. The DWR measures water levels in about 60 other wells in the valley floor area, primarily in undistricted areas. As part of the Mendota Pool Pumpers Group transfer program, a number of wells in the Columbia Canal Co. service area and Aliso WD are measured. As part of this program, continuous water-level recorders are maintained at two compaction recorders near Mendota. There is a total of almost 500 wells that are being measured routinely in the valley floor area. Figure 5 shows the locations of known presently measured wells in the valley floor area.

The DWR, USBR, MID, and CWD prepare water-level elevation maps for all or parts of the valley floor area. The DWR formerly prepared separate maps for the upper and lower aquifers in the west

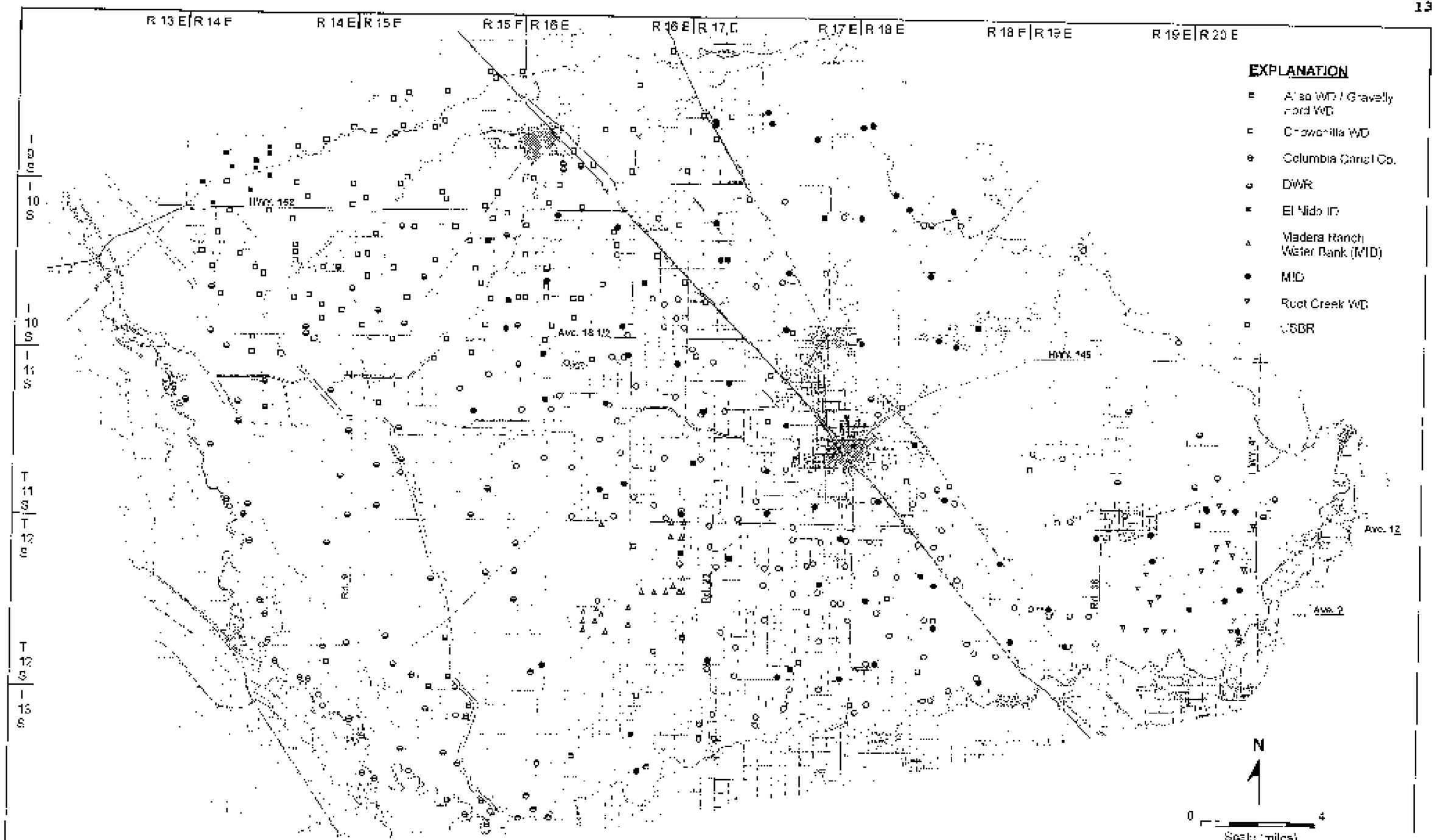


FIGURE 5 - LOCATION OF PRESENTLY MEASURED WELLS IN VALLEY FLOOR AREA

part of the area, but discontinued preparation of the lower aquifer maps in the 1980's. The DWR prepares water-level hydrographs for wells in their network that are available on a website. Unfortunately, water levels in wells throughout much of the valley floor area vary substantially with well depth. Depths and/or perforated intervals for many of the wells being measured aren't available. This complicates interpretation of the water-level records.

Land Subsidence

Land subsidence has been documented in the west part of the valley floor area in Madera County. Historically, most of the subsidence monitoring was done on the west side of the valley in the part of the valley north of the Tulo River. Although land subsidence in the San Joaquin Valley was extensively studied through the mid-1960's, much of this monitoring ceased in the mid or late 1960's, when water from the San Luis Canal became available on the west side of the valley. However, monitoring has been reinstituted for subsidence associated with large-scale pumping near the Mendota Pool, where two compaction recorders have been operational since the early 2000's. The National Geodetic Survey periodically determines land surface elevations along Highway 152. Along Highway 152, most of the subsidence has been east of the Eastside Bypass, where most irrigation wells tap groundwater in the confined aquifer below the Corcoran Clay. Subsidence in this area along Highway 152

has been about three feet during the past 16 years (Al Steele, DWR, San Joaquin District). Subsidence monitoring in the western part of Madera County has been fragmentary, particularly during the past several decades.

Groundwater Quality

Extensive groundwater quality monitoring is required for wells in moderate to large water systems, such as in the Cities of Madera and Chowchilla. This information is in the public record. Less groundwater quality monitoring is required for small water systems. Historically, private individual wells in Madera County weren't required to be sampled for chemical analyses, but in recent years sampling has been required. Additionally, the County has required water assessments in recent years for a number of proposed projects, such as lot splits. As part of these studies, water samples were collected from a number of wells for analyses of major inorganic chemical constituents and potential problem constituents. As part of the Mendota Pool Group program, an extensive groundwater quality monitoring has been undertaken and is underway, including a number of wells in the southwest part of the valley floor area and in adjoining areas in Fresno County. Annual monitoring reports are available for this program that provide and interpret this information.

The Root Creek Water District sampled about 40 wells in the District in 2003, as part of a DWR AB303 project (Provost & Prit-

chard and KDSA, 2004). This sampling was done to provide more information on groundwater quality in and near the area where the Gateway Village development is to be built.

Identified groundwater quality problems in parts of the valley floor area include high concentrations of TDS, nitrate, hydrogen sulfide, manganese, arsenic, uranium, DBCP, slime-producing organisms, and methane gas.

High TDS groundwater has been present west of the San Joaquin River for many decades and has been moving to the east into Madera County. High nitrate concentrations are fairly common in shallow groundwater beneath irrigated area, particularly where sandy soils are present. Hydrogen sulfide has been found in some deeper groundwater in blue-green deposits in the east part of the valley floor area and to the west near the valley trough, where shallow groundwater in the Sierran sands is present under reducing conditions. Manganese, arsenic, and slime-producing organisms are a problem in some of the deeper groundwater, primarily in the east part of the valley floor area. DBCP was found in shallow groundwater south of Madera and west of Highway 99, where there are extensive tracts of vineyards and sandy soils. The DBCP concentrations were mapped by Moore (1995). High uranium concentrations have been found in shallow groundwater at the Howard and Lavina Schools, at the City of Madera WWTF, and several other locations north of the San Joaquin River near Highway 99. Figure

6 and 7 show locations of known groundwater quality problem areas in the valley floor area.

DATA GAPS

Foothills and Mountains

The main data gaps in part of of the foothill and mountains are for 1) accessibility of well completion reports, 2) streamflow, 3) water levels, and 4) groundwater quality.

Well Completion Reports

Completion reports for new wells are filed with the County and DWR, but are either not readily accessible or the locations of a number of wells are not accurate enough for use in hydrogeologic evaluations. In addition, a number of completion reports are being submitted electronically to DWR and these are not being processed and are thus not available

Streamflow

Baseflow measurements are particularly valuable for groundwater evaluations. In the Oakhurst Basin, measurements of streamflow on Miami Creek were discontinued many years ago, and there are no streamflow measurements for China Creek. In the Coarsegold Area, streamflow in Coarsegold Creek has not been measured, and the stream gaging on Picayune Creek was discontinued many years ago. In the Raymond-Hensley Lake area, there are no streamflow measurements for Daulton Creek or Willow Creek. Streamflow measurements

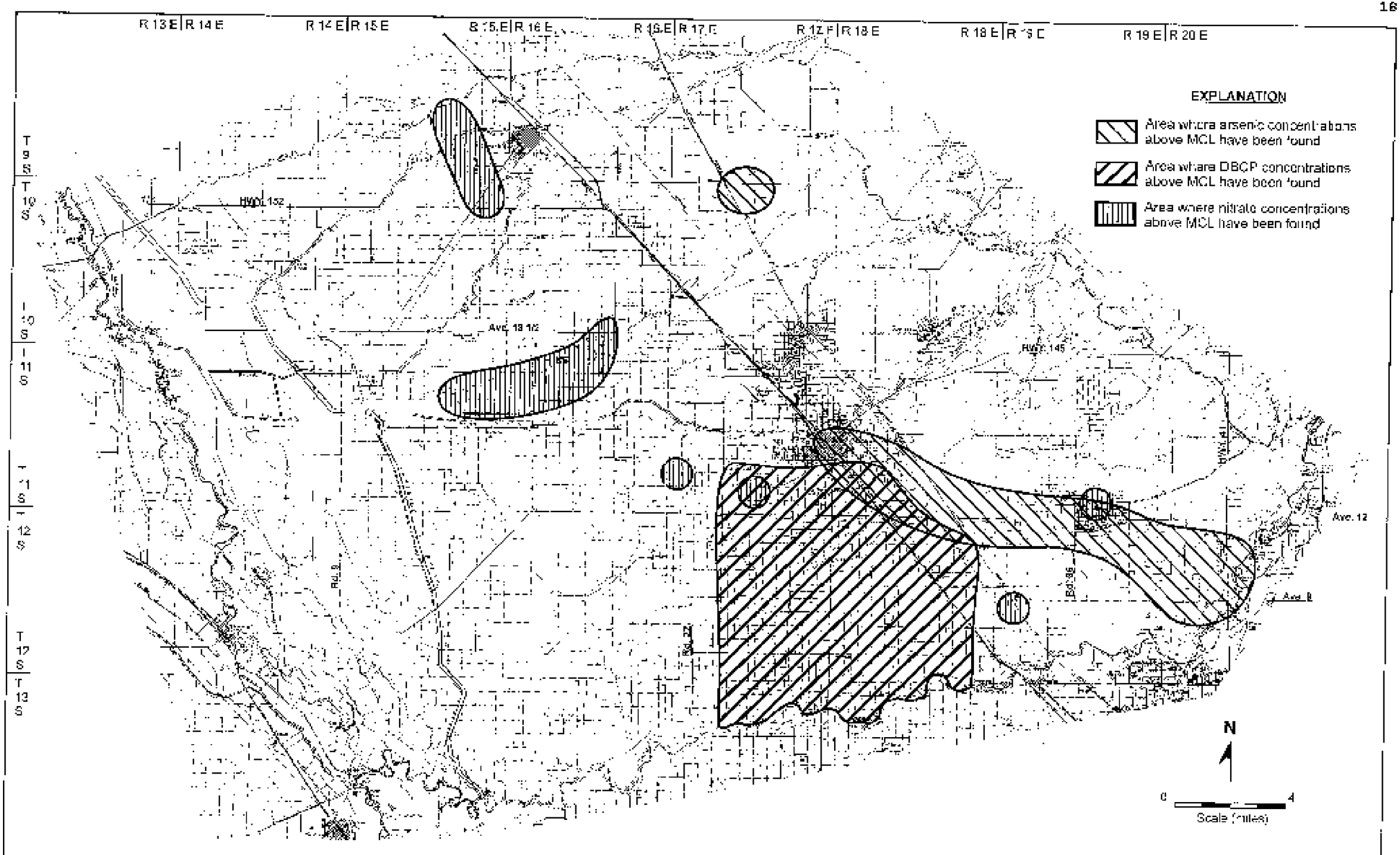


FIGURE 6 - APPROXIMATE LOCATIONS OF KNOWN GROUNDWATER QUALITY PROBLEM AREAS IN VALLEY FLOOR AREA

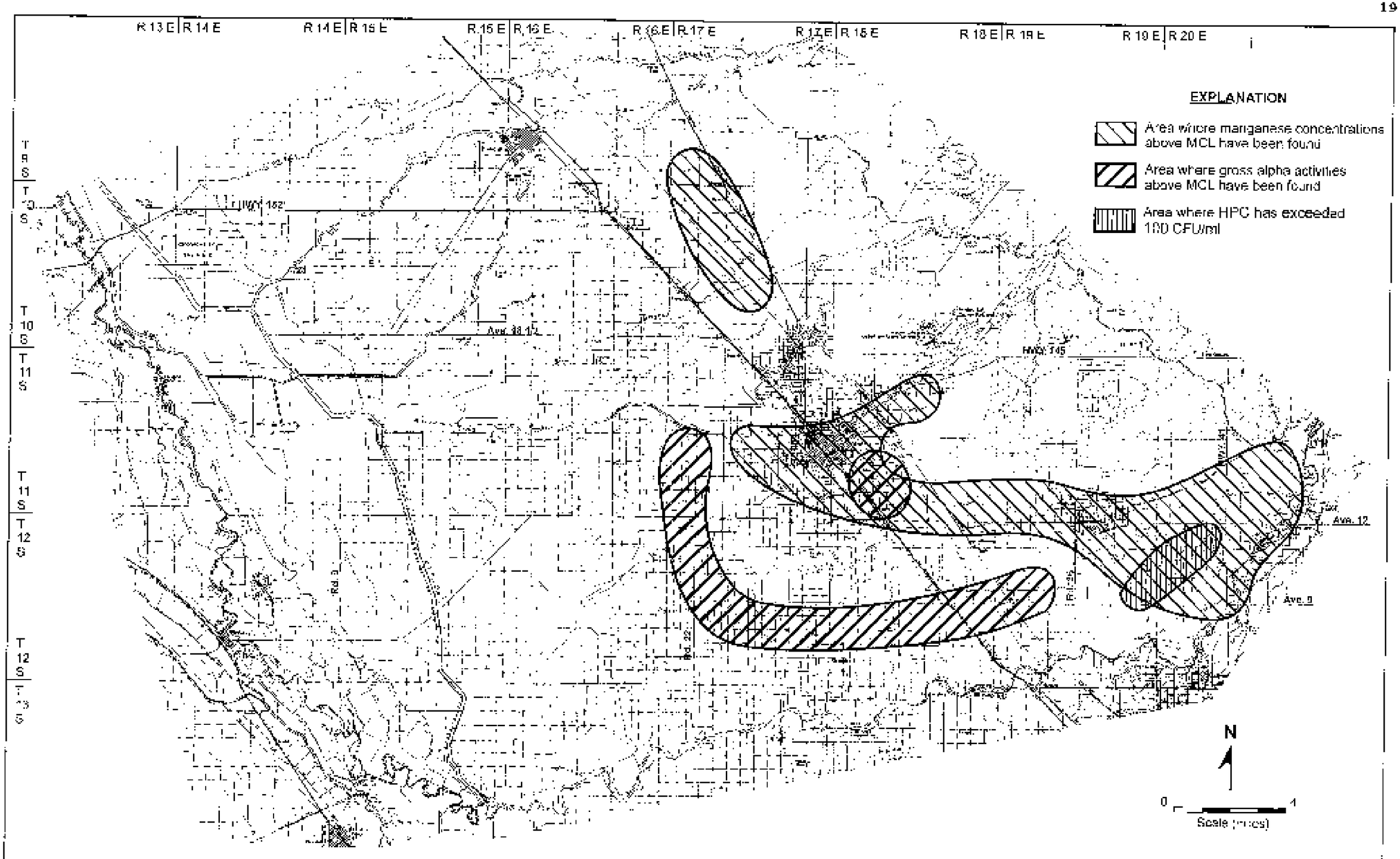


FIGURE 7 - APPROXIMATE LOCATIONS OF KNOWN GROUNDWATER QUALITY PROBLEM AREAS IN VALLEY FLOOR AREA

are also lacking in smaller watersheds where vegetation management has been undertaken in recent years.

Water Levels

Except for some water systems, water levels in wells have generally not been routinely measured, particularly for private domestic wells. Also, water-level maps have not been routinely prepared, nor have water-level hydrographs been maintained, except in a few cases.

Groundwater Quality

In general, the most groundwater quality data are available for wells in relatively large water systems. There has been no sampling required for new private domestic wells, and no routine sampling conducted, except for the wells in water systems and some other private wells. Maps showing groundwater quality problem areas have not been routinely prepared and updated.

Valley Floor

The primary data gaps in the valley floor are for canal flow (spills), pumpage, water levels, land subsidence, and groundwater quality.

Canal Flows

Canal diversions at the head of canals are measured, but flows leaving districts are generally not measured.

Pumpage

Pumpage for most private irrigation, domestic, and industrial wells is not measured. These items are important in preparing water budgets and estimating groundwater overdraft.

Water Levels

The water-level measuring program in the valley floor area is critical in terms of calculating groundwater overdraft. The water-level measurement program has three primary deficiencies: 1) it is not extensive enough in non-Districted areas, particularly in the southeast part of the valley floor area, 2) a number of measured wells are of unknown depth and/or perforated intervals, and 3) a number of measured wells, particularly in the western part of the valley floor area, are composite wells. These wells have water levels that are intermediate between water levels in the upper aquifer (above the Corcoran Clay) and those in the lower aquifer (below this clay). The focus needs to be on developing two separate water-level networks throughout the valley floor part of the County. One would be for relatively shallow wells (i.e., about 250 to 300 feet deep or shallower) and the other for deeper wells (commonly about 500 to 900 feet deep and without shallow perforations). In addition, continuous water-level recorders are recommended at at least one dozen sites in the valley floor area.

Land Subsidence

According to Al Steele of the DWR, there have been more than three feet of subsidence along Highway 152 in the area east of the Eastside Bypass, where there is extensive pumping from the lower aquifer, during the past 16 years. There are no compaction recorders in Madera County to measure compaction associated with land subsidence and no other ongoing routine monitoring program for land subsidence. The only apparent monitoring is periodic surveys of the land surface by the National Geodetic Survey along Highway 152.

Groundwater Quality

Extensive water quality monitoring is required for moderate to large water systems, and an extensive ongoing groundwater quality monitoring program is conducted as part of the Mendota Pool Group pumping program. Some additional well sampling is done by private entities, and most is not in the public record. However, for most private irrigation and industrial wells in the valley floor area, there has been no well sampling where the chemical analyses are in the public record. There is no comprehensive water quality data base for wells in the County other than public supply wells. There has been no routine mapping of groundwater quality problem areas in the valley floor area, and no plotting of time trends for specific problem constituents.

RECOMMENDED ADDITIONAL MONITORING

Foothills and Mountains

Streamflow

In the Oakhurst Basin, it is recommended that the streamgage on Miami Creek be reactivated or replaced and a new streamgage be developed on China Creek, above the confluence with the Fresno River. This work could be done in cooperation with the MID, DWR, or U. S. Geologic Survey. The focus would be to measure baseflow accurately, in addition to amounts of total streamflow each year.

Water Levels

It is recommended that the water-level networks that have been developed for the Oakhurst, North Fork, Coarsegold, and Raymond-Hensley Lake areas in recent years be continued. Also, in areas of concentrated pumping (i.e., water system well fields), continuous water-level measurements are recommended for some wells (such as routinely done at the Chukchansi Casino). On an annual basis, water-level elevations and direction of groundwater flow maps would be prepared for the spring and fall each year, and water-level hydrographs would be updated each year.

Groundwater Quality

New private domestic wells should be sampled and the water analyzed for the major inorganic chemical constituents including nitrate, and for pH, electrical conductivity, iron, manganese, ar-

senic, and alpha activity and the results provided to the County. Water from a number of private wells sampled as part of the detailed studies should be continued to be sampled and analyzed at least every three years. A data base should be developed whereby this information is accessible for use. On a biennial basis (every two years), groundwater quality problem area maps should be updated, based on results of this sampling and results of analyses of water from water system wells. Included would be the following maps:

1. Oakhurst Area: High TDS, nitrate, iron, manganese, and arsenic concentrations and high alpha activities.

2. North Fork Area: High iron, manganese, and arsenic concentrations and high alpha activities.

3. Coarsegold Area: High iron and manganese concentrations and high alpha activities.

4. Raymond and Hensley Lake Areas: High TDS and nitrate concentrations.

Also, for routinely sampled wells where one or more problem constituents are present at elevated levels, water quality hydrographs should be prepared and updated every several years.

Valley Floor

Pumpage

Over the long-term, because of the severe groundwater overdraft, it would be desirable to measure the pumpage from each well in the valley floor area that produces more than about 100 gpm. This is a considerable undertaking, but pumpage is the most important item in the water budget, in terms of groundwater. Until irrigation pumpage is measured, this pumpage can be estimated from other factors, such as crop water demand and canal water and river water use. It is recommended that pumpage in the valley floor area be determined on an annual basis. Also, efforts should be started to have flowmeters installed in as many large-capacity wells as possible, on a volunteer basis.

Consumptive Use

Annual or more frequent crop surveys are needed for the entire valley floor area. This would be done to supplement routine crop surveys that are primarily done in active water districts. Total crop acreages by type would be tabulated and standard DWR consumptive use factors used for each crop in order to calculate the crop consumptive use of applied water.

Consumptive use also needs to be determined in urban and rural residential areas. The extent of irrigated areas can partly be determined from aerial photos. It would be desirable to be able to

compare the total pumpage, surface water use or recharge, and consumptive use in the valley floor area from year to year, and to compare these with groundwater level trends.

Water Levels

The existing network for the valley floor is problematic and needs to be improved and subdivided into at least two depth zones. The network for the shallow zone (or upper aquifer in the western part of the area) would primarily use private domestic wells and shallow irrigation wells (generally less than about 250 to 300 feet deep). The deep zone (lower aquifer in the west part of the valley floor area) would generally be based on measurements for deep City, irrigation, dairy, and industrial wells (generally about 500 to 900 feet deep and without shallow perforations). This improved program would be undertaken in cooperation with DWR, USBR, Cities, active Districts, and others, as necessary.

The goal of this program would be to prepare spring and fall water-level elevation maps for both the shallow and deep groundwater on an annual basis. The direction of groundwater flow would also be shown on these maps. Another important goal in terms of groundwater recharge or water-banking would be to develop a better understanding of the shallowest groundwater, which in a number of situations can't be determined from water-level measurements in water supply wells. This is because such wells often aren't per-

forated near the water level, and tap deeper strata below significant clay layers. Substantial information on the shallowest groundwater is available from soil borings and shallow monitor or observation wells in specific areas, such as at the Madera County Landfill near Fairmead and the City of Madera WWTF. A number of monitor wells have been installed at gasoline leak sites and others are being installed at dairies and other sites. This information should be obtained, compiled, and used to develop maps showing depth to the shallowest groundwater, particularly in areas where it is less than 50 feet deep, or where intentional recharge is practiced.

Water level hydrographs for wells should be periodically prepared for both the shallow and deep zones. Water-level trends and water budget items should be evaluated at least every three years to estimate groundwater overdraft in the valley floor area.

Land Subsidence

Land surface elevations should be measured every several years along some of the major roads in the area west of Highway 99. Recommended east-west roads are: Highway 152, Avenue 18-1/2, Avenue 14, and Avenue 7. Recommended north-south roads are Road 9, Road 16, and Road 23. In cooperation with Cal Trans and the Madera County Road Department, new benchmarks would be established as necessary and the elevations of these re-surveyed at least every

three years. Maps of land subsidence should then be prepared about every three years, and correlated to groundwater pumping in Madera County and in adjoining areas, such as Fresno County.

Groundwater Quality

Water samples should be collected from each new private domestic well for analyses of major inorganic chemical constituents including nitrate, pH, electrical conductivity, TDS, manganese, arsenic, and alpha activity. In areas where vineyards or tree crops were grown prior to 1980, DBCP, EDB, and TCP should also be determined. This group of constituents would be analyzed in water from new domestic wells in or near the DBCP problem area previously described.

Every several years, information from the Cities and other water systems would be obtained and along with other information used to develop updated maps of groundwater quality problem areas, including: high TDS, nitrate, DBCP, alpha activity (uranium), manganese, arsenic concentrations, and high heterotrophic plate counts (indicator of slime-producing organisms). Selected private wells in known areas of groundwater quality problems should be sampled (with the owners approval) on a routine basis (at least annually) in order to determine time trends. This would help determine if the problem is getting better (i.e., such as due to degradation of DBCP), getting worse, or staying the same.

Information on vertical trends in groundwater quality has been obtained in the City of Madera, at Madera Ranchos, Madera Community College, Rolling Hills, Valley Children's Hospital, and at a number of schools. This information is normally derived from test wells done prior to construction of new public supply wells. Because most of this information has been obtained for public entities, it is publically available. Maps should be prepared and updated every few years showing where this information has been obtained and the results should be interpreted and presented in reports on groundwater quality problem areas.

REFERENCES

Kenneth D. Schmidt and Associates, 2005, "Groundwater Conditions in the Oakhurst Basin", prepared for Madera County Resource Management Agency, 90p.

Kenneth D. Schmidt and Associates, 2007, "Groundwater Conditions in the North Fork Area", prepared for Madera County Resource Management Agency, 48p.

Kenneth D. Schmidt and Associates, 2007, "Groundwater Conditions in the Raymond and Daulton Ranch-Hensley Lake Areas", prepared for Madera County Resource Management Agency, 41p.

Kenneth D. Schmidt and Associates, 2008, "Groundwater Conditions in the Coarsegold Basin", prepared for Madera County Resource Management Agency, 74p.

Luhdorff and Scalmanini, Consulting Engineers and Kenneth D. Schmidt and Associates, 2007, "Mendota Pool Group Pumping and Monitoring Program 2006 Annual Report", prepared for San Joaquin River Exchange Contractors Authority, Paramount Farming Company, and Mendota Pool Group.

Moore, K. L., 1995, "An Assessment of the Variance Between the Levels of DBCP in the Groundwater Water in Madera County, Califor-

nia" unpublished Masters Thesis, California State University, Fresno.

Mitten, H. T., LeBlanc, R. A., and G. L. Bertoldi, 1970, "Geology, Hydrology and Quality of Water in the Madera Area, San Joaquin Valley, California", USGS Open File Report 70-228.

Provost and Pritchard Engineering Group and Kenneth D. Schmidt and Associates, 2004, "The Village of Gateway Groundwater Quality Investigation" 15p.

Todd Engineers, 2002, "AB3030 Groundwater Management Plan Madera County", prepared for County of Madera Engineering and General Services, 44p.

Appendix G
Responses to Comments and Questions on Draft IRWMP

County of Madera
Responses to Comments and Questions on
Draft Integrated Regional Water Management Plan

No.	Reference[1]	Comment/Question	Response
Christopher Campbell, Baker Manock & Jensen, 3/20/08			
1.	--	I strongly encourage the County to include development of a water impact fee program in the Conclusions and Recommendations section of the IRWMP.	Language encouraging consideration of a water impact fee program added in Sections 8.4.2 and 9.2.2.3.
Sandra Wright			
2.	--	Suggest that there be a clause adopted for future review and update of the IRWMP through Madera County avenues on an annual basis. My suggestion is to have a specific governing body assigned to the IRWMP for future updates, with oversight and annual review being performed by the assigned county entity (or TAC), who could then have the authority to bring the suggested updates to the Board of Supervisors' attention for adoption as deemed necessary.	Section 1.4.4.4, "Plan Acceptance and Updates" added.
Jeannie Habben, 3/9/08			
3.	P ES-23	First bullet, 7th line … "were" should be "where."	Corrected.
4.	P ES-26	First bullet, 2nd line – comma after "Chowchilla River."	Corrected.
5.	S 9.1.4	"arundo" should be changed to *Arundo donax*.	Corrected.
6.	S 5.1.2.2	Please review and explain this section. Aquifers do not exist in the foothills.	The term "aquifer test" is used to identify the type of pump test described in this section. This term is commonly used by hydrogeologists and the pump testing industry. The use of this term is not intended to imply that aquifers exist in the hardrock areas of the County.
7.	--	There should be a section on "Snow Pack and Recharge" also on "Climate Change and Storage."	These issues will be addressed in the planned update of the Plan as described in Section 1.4.4.4.

[1] "P" refers to the page number in the draft IRWMP.
"S" refers to the section number in the draft IRWMP.

No.	Reference	Comment/Question	Response
8.	--	There should also be a section with more clear recommendations on water conservation for both the foothills and the valley.	Water conservation opportunities for the Valley Floor are discussed in Section 8.1.2. Language added discussing applicability to the Foothills/Mountains area.
9.	S 8.1.3.1	This section suggests the formation of a JPA...but does not mention the JPA already in existence…. The Chowchilla Red Top RCD has a signed JPA with the City of Chowchilla and the Chowchilla Water District.	Existing JPA language added in Section 8.1.3.1.
10.	S 9.2.1.1	The line about "pilot holes" should be removed.	Language modified to reflect recommendation only applies to new "public" supply wells.
11.	--	There should be a section specifically on agriculture and what agriculture is doing to address conservation/water demand, water quality, flood control, etc.	Agricultural water conservation is addressed in Section 8.1.2. Language added regarding Water Management Plans. Additional language regarding agricultural water quality programs added in Section 8.3. Agriculture's role in flood control is mentioned in several areas of the Plan, and future participation is discussed in Section 9.2.2.5.
12.	--	There needs to be a section on governance.	Governance language added in Section 1.4.4.4
13.	--	There should be a subsection on code enforcement.	Additional language added in Section 8.3.
14.	--	Recommendation for the "treated effluent" from the area treatment plants: instead of the sole suggestion of the use on spray fields, this water could be sold (or given) to water trucks for use for dust control on roads and/or for construction and building sites, also for road compaction.	Section 9.2.1.3 states that the Oakhurst and Bass Lake WWTPs use sprayfields for effluent disposal and suggests alternative disposal methods. California law will not allow the use of secondary treated effluent for these purposes. The level of treatment provided by the plants in the County is secondary or lower.
15.	--	Better definitions are needed in the plan in regards to 1) subdivisions and 2) shared wells.	Reference to shared wells has been removed and subdivision language removed or clarified throughout the Plan.
16.	--	Please review the section for the new recommendations in regards to shared wells. According to Ken Schmidt, his five-year-old plan is out of date and the County has a new Well Ordinance. Please refer to the new Well Ordinance when discussing shared wells.	Recommendations related to shared wells have been removed.

No.	Reference	Comment/Question	Response
17.	--	There needs to be a recommendation that discusses the need for or the "recommendation" for stock ponds, ponding basins, or recharge ponds on individual properties in the foothills.	Recommendation language added in Section 9.2.1.2.
18.	S 9.2.1.5	It suggests only "surface water" as a solution to the issue. This needs to be expanded on because that is not the only solution to review. There are many others to be looked into (though some may not be popular) such as: no more development in some areas, or make a proposed development smaller, or pull from other groundwater sources, etc.	Language added in Section 9.2.1.5.
Phillip R. Pierre, 3/10/08			
19.	P ES-13 Water Quality	Arsenic is listed as a "contaminant of concern" for the Foothills and Mountains, however is not listed as one for the Valley Floor. Figure 6-1 identifies arsenic as a "contaminant of concern" for the Valley Floor from data points provided in Table 6-2.	Corrected.
20.	Executive Summary	Overdraft: Figure ES-6 shows SOUTHEAST UNDISTRICTED AREA 22,000 AFY. Ken Schmidt's study identified 22,000 for Southeastern Madera County, <u>including 3,400 within Root Creek Water District</u>.	Changed to "Southeast Area" on Figures ES-6 and 5-7.
Dale Drozen, 3/12/08 and 3/20/08			
21.	--	Before the IRWMP endorses and vigorously supports the water bank system, I think it would be prudent to at least know the rules that will apply and if the water will be exported out of the County.	Recommendation language modified in Section 9.2.2.1. MID has stated publicly that water originating in Madera County will not be exported out of the County, but a thorough review of the Water Bank rules should be conducted.
22.	--	The IRWMP's statements about lot sizes are not based on any verifiable data and should be removed.	Specific lot size language has been removed.

No.	Reference	Comment/Question	Response
23.	--	The water usage documented makes no provision for water being returned to the ground via septic systems in foothill land mountain areas.	The term "water demand" or "water use" refers to the amount of water needed to meet all demands and does not indicate "consumptive use," which includes reduction for water returned to the basin. The amount of water returned to the basin does not affect the calculation of the amount of water needed to meet future demands.
24.	--	Agricultural conservation is barely addressed.	Agricultural water conservation is addressed in Section 8.1.2.1. It must also be noted that the County has very little authority with regard to agricultural water use. The irrigation and water districts have the surface water contracts and the majority of the water rights in the County. In addition, the County currently has no authority to regulate groundwater pumping.
25.	--	Decorative landscaping and lawns are also ignored.	Addressed in Section 8.1.2.2.
26.	--	Potential water exports are not addressed.	Section 6.4.1 includes a summary of Section 13.100 of Madera County Ordinances that addresses export of water.
27.	--	How about adding some kind of plan for annual updates or modifications? How about naming the County Water Advisory Commission to be the body to review and recommend changes to the Board of Supervisors?	See Response No. 2.
28.		Shared wells were discussed and recommended by the hydrologist doing the study yet the Plan recommends not allowing shared wells.	See Response No. 15.
29.		Population numbers appear to have been inflated.	See Tables 2-1 and 2-2. The population of Madera County increased at an annual rate of over 3 percent between 2000 and 2007. The annual rate of growth for the City of Madera is about 3.6 percent and 3.1 percent for the City of Chowchilla. The County's Planning Department projections for the County assume an annual growth rate of 3.85 percent, which may be slightly high but is reasonable when using for planning purposes.

No.	Reference	Comment/Question	Response
30.		We…have been assured…this will be a living document…	See Response No. 2.
31.		The IRWMP uses the creation of a subdivision as a trigger point for certain requirements and or tests. Trigger points should be based on density…	Language with regard to subdivisions has been clarified throughout the document and it has been noted that the number or size of lots in the subdivision that will trigger the requirement will have to be defined in creating any new ordinance or code.
32.		The IRWMP should strongly recommend that an immediate regulation of groundwater pumping from the Madera County aquifer to a level that halts the overdraft….	The County does not have the authority to immediately regulate or halt groundwater pumping. One of the primary purposes of this Plan is to identify programs, projects, and policies that the County can implement that will help address the overdraft problem.
33.		The IRWMP should strongly recommend the privatization of all special districts within the County.	The Plan recommends that the special districts rates be adjusted to make each district self-sufficient and also recommends combining districts where feasible to improve efficiencies in operation and costs. The County has recently shown that privatization is an option that it will consider implementing if the customers of the district will not support rates needed to properly operate the district (MD 95A).
Elissa Brown, 2/26/08 and 3/5/08			
34.	P 1-1 S 1.1	Third paragraph, last sentence. Why only through 2030?	Period of study agreed to by County staff. The year 2030 was only used as a reference point for determining future water demands. The potential programs, projects, and policies are not subject to this planning timeframe.
35.	P 2-1	Madera County is closer than 88 miles from Yosemite National Park.	Language removed.
36.	P 6-1 S 6.1	"Surface Groundwater" has not been defined. Do you mean groundwater, surface water, or shallow groundwater here?	Corrected (groundwater).
37.	P 7-2	Next to last line: *Most project levees are maintained by local agencies such as reclamation and levee districts and* the *Madera County FCWCA.*	Corrected.

No.	Reference	Comment/Question	Response
38.	P 7-7 S 7.1.3.4	Section 7.1.3.4 is not specific enough. You note that *the FCWCA does not have sufficient funding and staff to adequately address flood control planning and maintenance requirements*, but you don't say why. What are the current sources of funds? What are the planning and maintenance requirements? Later on in Chapter 8 you make recommendations about increasing the funding to the FCWCA. You should either repeat those here or refer to them.	Reference to Section 8.1.3 added.
39.	P 7-12 S 7.2.2.2	Second sentence. *Natural obstructions to flood flow include brush,* reeds, *and other vegetation….*	Corrected.
40.	P 7-16	Third sentence. *…to implement flood control planning projects* and would make the County ineligible for FEMA rehabilitation assistance under Public Law 84-99.	Corrected.
41.	P 7-17	First line. *Because the plant is so* invasive…	Corrected.
42.	P 7-17 S 7.3.2	*In conjunction with the eradication of Arundo, the County* has received *a countywide permit…. This* will *allow the County to alter…*	Corrected.
43.	P 7-17 7.3.3	First sentence. "It is reported that some of the levees are in poor shape and badly in need of repair" is too vague. The next sentence "The County needs to restore these levees" is also too vague.	Corrected.
44.	P 8-41	Last paragraph. Please indicate the elevation of the Eastman Reservoir.	Corrected.
45.	P 8-43	First bullet. What fuel break are you referring to?	The Fuel Break Program included construction of many fuel breaks.
46.	P 8-56	Paragraph 2 *…is not considered in this estimation.* In many cases the flow will be into existing rivers and streams which already have conveyance infrastructure associated with them, so costs may not be an issue or may only involve expansion of existing infrastructure. *Cost components must be developed…*	Suggested language added.
47.	P 8-56	Last bullet point. Insert the same sentence before *Infrastructure will have to be….*	Language modified.

No.	Reference	Comment/Question	Response
48.	P 8-59 S 8.3.1.2	*…it is recommended that a feasibility study be conducted for sewering these areas*. Identify the areas of high density and environmental sensitivity (i.e., near to streams and rivers) that would be the highest priority for this type of feasibility study.	Language modified to include prioritization of areas.
49.	P 8-62 S 8.4.1	Change "could" to "would."	Language modified.
50.	P 8-63	Next to last sentence *…or by transfer of water into the County*, or by reducing evapotranspiration through vegetation management.	Language modified.
51.	P 9-27 S 9.2.2.5	First sentence. *…that deficiencies exist on the Chowchilla River, Ash and Berenda Sloughs*.	Corrected.
Ed McIntyre, 3/19/08 Water Advisory Commission Meeting			
52.		Why was higher County population estimate used versus lower DOF numbers?	DOF projections are lower than historical population growth rates. See Response No. 29.
David Brodie, 3/19/08 Water Advisory Commission Meeting			
53.		Have all water diversions from the San Joaquin River in Madera County been included in the surface water use numbers in the report?	Language added to Table 5-1 indicating the amount of water diverted from the San Joaquin River under Holding Contracts with the USBR is not included.
John Reed, 3/21/08			
54.		There needs to be more emphasis on water usage by agriculture.	See Response Nos. 11 and 24.
55.		There needs to be more study done on the travel of groundwater in the foothills and mountain areas.	Suggested recommendation added to last recommendation in Section 9.2.1.
56.		References to mandatory septic tank pumping schedules need to be removed.	Removed.
57.		All references to requirements for "subdivisions" need to be removed or clarified.	See Response No. 15.
58.		The IRWMP should be heard and updated regularly, by the WAC if not the BOS, for updating and revisions.	See Response No. 2.

No.	Reference	Comment/Question	Response
59.		A study should be recommended to identify additional site for water recharge basins in the valley to provide storage capacity for untapped surface water in winter and spring. Some effort to gain additional water rights to that water from the BOR should be examined.	See second recommendation in Section 9.2.2.5 and third bullet in Section 9.2.2.1.
60.		The County should identify all of its options and opportunities vis a vis the proposed MID water bank, any additional water banks, and other storage possibilities in the foothills and the valley in one document that should be incorporated into the IRWMP. The development of that document should be a recommendation of the report.	Suggested recommendation added to second bullet in Section 9.2.2.1.
61.		A Temperance Dam planning effort should begin immediately to protect and enhance the County's interest and participation in the project should it become a reality. A standing committee should exist (maybe the WAC?) to direct those efforts and monitor the project for the BOS.	Suggested recommendation added to fifth bullet in Section 9.2.2.1.
Dave Merchen, Community Development Director, City of Madera, 3/20/08			
62.	P 3-5	The discussion of MID should briefly note the relationship between the District and the City of Madera.	Added to Section 3.1.1.1.
63.	S 7.2.2.2	Should the role of Freeway 99, as it intersects Cottonwood Creek and Schmidt Creek, be included in this discussion?	Data or information was not identified to enable a discussion of the impact of Freeway 99 on flood control.
64.	S 8.1.1.3.1	The potential benefit/relationship to the City of Madera from/with the water bank project should be defined.	Language added to ninth bullet in Section 8.1.1.3.1.
65.	S 8.1.1.5	The discussion of the Madera Lake Area Groundwater Storage Project should establish the connection between the recharge potential at this location and the direct benefit to the City of Madera as well as the potential of the City of Madera to be a partner in the project.	Language added to last sentence of seventh bullet in Section 9.2.2.1.

No.	Reference	Comment/Question	Response
66.	P 8-35	The discussion regarding use of the Economic Development Reserve should include a recommendation that requires the creation of a definition for eligible projects and how local projects would differ from FCWCA projects, if such as distinction is intended.	Recommendation added to fourth bullet in Section 8.1.3.3.
67.	Pages 8-30, 9-25, etc.	Water metering discussions refer primarily to the Cities' systems. Is there an assumption that urban development which may occur in the County will be metered?	Yes. All new homes constructed since 1992 that are part of a community water system have been metered under State law. The Plan recommends that all community systems in the unincorporated area of the County be metered and billed for water use on a volumetric basis.
68.		Some preliminary discussion occurred between the City of Madera and MID regarding the potential feasibility of modifying the storm drain system to put more storm water into canals and drainage facilities (after filtration) with the intent of getting that water into water bank or other regional recharge facility.	Language added to Section in 8.1.3.2.1.
Susan Larson, 3/20/07			
69.	Chapter 9	Retool the final recommendations to include a water-related requirements checklist that must be applied equally to all subdivisions as baseline criteria for approval of a subdivision.	The Plan can only recommend and cannot require the County implement any suggested water-related recommendations having to do with development. Several recommendations regarding water supply for new development are included in the Plan.
70.	--	We must require certified hydrologists to examine water conditions when determining viability at preplanning for a subdivision as outlined in this report. The language of this must be framed as a requirement, not an option.	Again, the recommendation is made, but the document is a planning document and will not enact any new requirements without further County actions required.
71.	--	Create stronger and more specific language about the required mitigation for subdivisions that might prove through EIRs to adversely impact water availability of surrounding properties. Ensure that it is a requirement, rather than a negotiated option, that concurrent well testing and monitoring is used to determine water viability for a subdivision.	See Response Nos. 69 and 70.

No.	Reference	Comment/Question	Response
72.	--	For public or private water systems serving multiple customers, such as Broadview or Hillview, requirements must be in place to ensure that where they find water to drill for new wells, that it is handled in the same way as a subdivision. More stringent requirements for drilling public wells on private land should be in place.	The County has limited authority with regard to HWC and BTMWC because they are CPUC-regulated water systems.
73.	--	Ensure that subdivisions are required to provide legal information regarding contaminant levels to potential buyers and how they will be mitigated. Ensure that this is a requirement, not a recommendation.	Recommendations regarding enhanced water quality testing and provision of the results to the public are addressed in the Plan. See Section 9.2.1.1, fourth and fifth bullets.
74.	--	Require that subdivisions are required to mitigate higher-than-allowed contaminants, with a viable plan, prior to gaining ok of the subdivision from the planning department and environmental health department. Currently there are only recommendations rather than requirements.	All new public water supply systems are required to prove availability of sufficient water meeting all drinking water requirements prior to being permitted.
75.	--	Ensure that all water-related requirements for subdivisions are applied equally across the County and are not negotiable.	The Plan discusses code enforcement which applies to ensuring equal treatment of all citizens and projects within the County.
76.	--	Require beefed-up EIR requirements for subdivisions regarding water and deny subdivision developments that cannot prove sustainable water supplies.	State law establishes the requirements for CEQA documents including EIRs. The Plan addresses the need for new development to prove sustainable water supplies in Section 8.4.2.
Larry E. Ballew 3/17/08			
77.		It was pointed out numerous times that the leadership and authors did not differentiate between individual homeowner wells, shared wells, small public well systems in comparison to large community well systems.	See Response No. 16. Language regarding the type of well has been clarified throughout the Plan.
78.		There is no ongoing governance, accountability, living document concepts, scientific change allowance, or future voice of the people.	See Response No. 2.

No.	Reference	Comment/Question	Response
79.		No landowner or private individuals shall be required to perform any of the following activities as they relate to private individual wells and private property. 1. Meter any well and pay a pumping fee to any public entity. 2. Prohibit use of shared wells or water storage on or between parcels. 3. Conduct pothole surveys (remove from document). 4. Employ a certified or licensed engineer or hydrologist during planning or drilling of the well(s). 5. Perform pump test beyond the normal driller's blow test. Hour/time designation prohibited. 6. Involuntary water testing. 7. Restrict any water conservation practice, including moisture impoundment of salvaged waters from his or his predecessors' activities. 8. Be prohibited from using historical and scientific practices of vegetation management or improving or conserving water supplies. 9. Consider or plan for offsite water sources. 10. Be prohibited from developing groundwater recharge practices.	The Plan language has been clarified and does not recommend any changes to current County ordinances as they apply to individual wells and/or private property as listed in Items 2 through 10. However, the Plan does suggest that the County investigate the legal and institutional feasibility of requiring metering of groundwater wells and the imposition of a groundwater pump tax or land-based assessment to fund water supply projects. In addition, the Plan recommends the chemical and radiological testing of well water for new wells and upon sale of property. See first paragraph of Section 9.2 for process required for implementation of any recommended programs, projects, or policies.
Bruce Gray, 3/20/08			
80.		Please add a recommendation assigning a committee the responsibility of overseeing this document and through the Board of Supervisors implementing the recommendations to ensure this document does not gather dust like many others.	See Response No. 2.

No.	Reference	Comment/Question	Response
81.	P ES-23/24	MID to pump 9,600 AFY of water from the City of Madera's WWTP and conveyed through MID distribution system. How will the quality of water and the contamination factor be monitored? What effect will these waters, if contaminated, have on the canal and waters being conveyed in the same distribution systems?	The water pumped is groundwater from under the percolation ponds. The water quality will be monitored. Pilot tests and water quality testing have indicated the pumped water will not restrict the current use of water in the canal.
82.		The greatest number of new housing starts will be happening in the Rio Mesa area and, other than mentioning that the greatest average water level decline in Madera includes Madera Ranchos and Rolling Hills, there is no real mention of this area. It looks like the area west of Highway 41 was just forgotten. Where is the study of the Rio Mesa area?	Specific or detailed study of any areas on the Valley Floor was not included in the Work Plan for this study.
83.		There seems to be a push to get the Madera Water Bank going, much more so than any other project in this report. Where are the studies and reports on which you base your recommendations?	The technical studies and the adopted EIR were conducted by MID and/or the previous owners.
84.		Please explain how the Water Bank, which will use runoff and release water from Millerton Lake, will be viable if Temperance Flat dam is built. How can they both be useful?	The two projects complement each other. Temperance Flat Dam will provide additional CVP yield and flood control protection that may make more water available to bank for recovery and use in dry periods.
85.		What will the cost of Temperance Flat dam be and what will the cost of the water to the farmers and the City be?	Costs of construction depend on the site selected and size of dam but range from about $200M to $1.8B. Cost of water to contractors is not available.
86.		There seems to be an incredible amount of water testing that could have brought in dollars for Madera (the one conducting the study). Why were all of the water tests shown in this document done in Fresno and not in Madera?	No State-certified labs are available in Madera County.
87.		Ag water makes up 97% of all water used, but I do not see a proportionate number of recommendations suggested for this water. Why is that? Why were the water consumption records used for ag water usage and not more study into the actual crops being grown?	Cropping pattern information is presented in Table 4-1 along with ag water use in Figure 4-1. See Responses 11 and 24.

No.	Reference	Comment/Question	Response
Don Roberts, Madera Irrigation District, 3/21/08 and 3/24/08			
88.	P ES-9	Second area of greatest water level declines is in the Madera Basin, east of the Santa Fe RR.	Language modified to reflect comment.
89.	P ES-10, 12 etc.	We were previously unaware of the formation of Progressive Water District. It is within the sphere of include of Madera Irrigation District, which was adopted by LAFCO in 1988.	Source of map was the Todd Engineers report, 2002. Progressive Water District identified as "inactive."
90.	P ES-18	Third paragraph. Water balance should be required for new development. Need to define development.	Modified language.
91.	P ES-19	The requirement for a chemical and radiological analysis for all private drinking wells (includes single family or livestock?) Would do what – prohibit use? Require treatment? Or be advisory? Well spacing should include spacing from septic tanks, leachfields, and property lines.	See Section 9.2.1.1, fourth and fifth bullets. Well spacing language modified to include recommendation.
92.	P ES-20	Vegetation management to acquire a water right. This has previously been granted by the State Water Rights Board, but they apparently don't do follow-up to assure the vegetation stays removed.	Any program established by the County would have to include provisions to ensure land is maintained and land use does not change. See Section 8.2.3.
93.	P ES-21	Conveyance of Section 215 water in Madera Canal. The canal capacity is allocated, and conveyance of "County" water may require enlargement of the canal.	See seventh bullet in Valley Floor Recommendations in ES, Section 8.1.1.8, and eighth bullet in Section 9.2.2.1.
94.	P ES-22	Madera Canal/Hidden Dam pumps storage. The 6,000 AF of water would be available for use by MID as a redirection of an existing water supply.	Language modified in ES and Section 9.2.2.1.
95.	P ES-24	The possible exchange of water between MID and the City has not reached any formal discussion level.	Language modified in ES and Section 9.2.2.1.
96.	P ES-25	Define development – includes single-family units?	Language added and clarified.
97.	P ES-27	Countywide groundwater monitoring. How would information be collected and shared?	Details have not been determined, but it is anticipated that it would be a cooperative effort among the various water agencies in the County, and data would be made available to the public.

No.	Reference	Comment/Question	Response
98.	P 3-5	Progressive Water District shown on maps – not referenced anywhere in text. Is it active or inactive?	See Response No. 89.
99.	P 3-6	Big Creek Soquel 10,000 should be 9,400 9,700 See 5-26.	Corrected.
100.	P 3-7	Madera Water District purchases surface water for lands that are within MID.	Corrected.
101.	P 3-26	The City was excluded from the MID groundwater management plan at the City's request. MID does not measure wells within the City of Madera.	Language modified.
102.	P 3-27	MID no longer accepts any new storm water into its system because of water quality concerns and a lack of capacity within the MID system. City storm water may be delivered to growers, but it requires MID to cut back on its water supply at the system head, which often results in unanticipated spilling of District supplies. There is usually a net loss to the MID in water.	Language modified.
103.	P 3-30	MID Recharge Basins. The Pistoresi Pond and the Allende Pond are no longer available for use as recharge basins.	Corrected.
104.	P 5-12	First paragraph. Wording should agree with ES-9.	Language modified. See Response No. 88.
105.	P 5-25	Paragraph 2. The sixth sentence should be deleted (not factual). The remainder of the paragraph needs to be amended in that other riparian rights and appropriative rights can reach several thousand acre-feet in some years. Also, riparian rights quantities can change (increase) with a change in diversion capabilities and cropping patterns and could become more significant in even below-normal water years.	Corrected. Language added.
106.	P 5-26	Big Creek 9,400 AFY, see 3-6 Soquel Should read pre-1914. Ave yield not noted.	Corrected.

No.	Reference	Comment/Question	Response
107.	P 5-27	GFWD has no water rights to the Hensley Lake yield. Section 215 water. The average field of 114,000 AFY seems like an excessive amount. If this number is based on use, often because of pricing, the Class I and Class II uses are reduced accordingly. Also, 215 water doesn't occur annually.	Language corrected and modified to reflect comment.
108.	P 6-32	Would suggest that the code be revised to have a 50-foot distance from property line; that way each adjoining property is impacted equally.	Language added to seventh bullet in Section 9.2.1.1.
109.	P 6-36	Table 6-13, our dictionary is old, but we couldn't find "analytes."	Changed to "analyses."
110.	P 7-12	Last paragraph. We take exception to the statement, *that MID's diversion weir is a significant cause of flooding along the Fresno River.* The weir is designed for a 10,000-cfs flow, which matches the designated channel capacity, and flows up to and exceeding this amount have successfully passed the weir without flooding. The area directly upstream of the weir is desanded on a regular schedule to maintain channel capacity.	Paragraph removed.
111.	P 7-13	The primary cause of flooding on Berenda Creek, Dry Creek, and Cottonwood Creek is the reduced channel capacity as these channels progress to the west. Originally there was a main channel and several overflow areas. Now there are only main channels and, with increasing runoff from the eastern portion of the County, the channel capacities are exceeded during heavy storm events. Current requirements of California Fish & Game restricts the amount of bank clearing that takes place as part of channel maintenance, further inhibiting flood flows.	Language added to reflect comment.
112.	P 7-18	Fresno River. To our knowledge, the USBR has no statutory authority on this channel. The Reclamation Board had this authority and is a State agency. The Fresno River channel improvement went from halfway between Road 21½ and Road 22 westerly to the Bypass near Road 9. No improvements were made upstream of this location.	"USBR" changed to "Central Valley Flood Protection Board" (formerly Reclamation Board). Noted. Description in Plan is taken from "Flood Plain Information, Madera, CA" prepared by USACE, June 1973.

No.	Reference	Comment/Question	Response
113.	P 8-7	Project Benefits. The 23% of the Friant Unit represents a 100% supply of both Class I and Class II supplies. This gives a distortion to the available "pre river restoration" number as the 100% number is not an annual number. An average percentage would be more meaningful.	Language modified to reflect comment.
114.	P 8-9	Paragraph 2. The project will help reduce the need. The words after dry years are optimistic. Paragraph 3. Subject to agreements with MID. Paragraph 4. Also contingent on agreements with MID.	Paragraph 2 language modified. Paragraph 3 language modified. Paragraph 4 language modified.
115.	P 8-11	No signed agreement at this time. Oversight committee formed to protect adjacent lands.	Sentence removed. "Landowners" changed to "lands."
116.	P 8-31 8.1.2.3	Wastewater. Oakhurst has a water? Should be wastewater?	Corrected.
117.	P 8-39	Projects - Water supply from Lewis Creek, Willow Creek, or Bass Lake. MID's Big Creek water flows into Lewis Creek and is not available for use without a contract agreement. MID's Soquel water flows into either Nelder Creek or stays in Willow Creek to Bass Lake, depending on conditions. This water is not available for use without a contract.	Language added to Section 8.2.2.1, first paragraph.
118.	P 8-64	Pump tax or land-based assessments. The constraints of Prop 218 and Prop 13 should be noted.	Language added.
119.	P 8-41	The agreement between MID and the Titan Group, Yosemite Lakes Park, was terminated in the early 1990s.	Language modified to reflect termination of agreement.
120.	P 9-18	Water Supply. It's our understanding that the Fresno River and San Joaquin River water has all been previously appropriated. Black Hawk Reservoir has a permit for livestock watering and recreation use only.	The Plan is discussing a potential study to identify possible surface water supplies, and the mentioned issues would be addressed and verified as part of the study.
121.	P 9-19	See previous applicable comments.	See Response No. 92.
122.	P 9-22	Currently, MID has an Agricultural Use Contract with USBR, and this may limit opportunities in this area.	Language added to reflect comment.

No.	Reference	Comment/Question	Response
123.	P 9-24	Study to increase the capacity of Madera Canal. This is a good idea.	Noted.
124.	P 9-26 9.2.2.3	Balance the development's water supply. This is a good concept.	Noted.
125.	P 9-28	Last paragraph. Should discuss or at least mention limitations imposed by Props 218 and 13.	Language added.
126.	App. F P 10	The Fresno River is gauged at Road 16.	Corrected on page 10 and Figure 4 in Appendix F.
127.	App. F P 23	Cost of these measuring structures and operations is expensive and should be a County cost.	See Response No. 97. Program details have not yet been addressed.
Madera County Farm Bureau and H. Clay Daulton, 3/18/08			
128.	P ES-1	Regarding the comment, *Groundwater of suitable quality for public consumption has been demonstrated to be present in most of the area (Valley floor) at specific depths*. The problem with this statement is there is no mention of how long local water will last under the increasing rates of use and overdraft that are observed.	Noted. The estimation of how long the local water (groundwater) will last is very complex and will vary within the County. This level of effort is beyond the scope of work for this Plan.
129.	ES-15	Water Demand Reduction Measures (for agriculture). For agriculture, this is ongoing due to economics and genetics. Most gains have already been achieved. Do not expect significant future gains of water from this source.	Noted. Discussion of potential agricultural water conservation measures is discussed in several areas of the main report.
130.	ES-18	New development water should not come from existing agricultural accounts.	No recommendation was made regarding new development source of water. Sale, exchange, and/or transfers are subject to various existing regulations.
131.	ES-21	Regarding the comment, *Madera County should exercise its 10,000 shares in the water bank*, but it should declare at the outset its plans for the use of waters it will be eligible to store. And that use, if used to mitigate losses of any kind, should include agriculture in part of a balanced distribution formula.	Language has been modified to read, *The County should evaluate participation in the…*. Evaluation of the Water Bank program and the use of the County's share will be part of the County's investigation process.

No.	Reference	Comment/Question	Response
132.	ES-25	Regarding the comment, *Setting limitations on new agricultural development if water supply is not sufficient to meet demand and/or requiring annexation into an irrigation district as a prerequisite.* A water use per acre limit would be more logical and probably less challengeable in court. Regulations emanating from this advisory should only apply to areas where the water table is declining significantly.	Language modified to reflect comment.
133.	ES-25	Regarding the comment, *Groundwater use or pump tax to fund future water supplies*. Such tax collections are limited to areas only where proposed projects have been identified and engineered and should never go into the county general fund. While mentioned in Chapter 9 in the IRWMP summary/conclusion, the idea that the proposed pump tax should be reserved for water development is not mentioned.	Noted. Language modified to reflect comment in ES, Section 8.4.4, and Section 9.2.2.3.
134.	P 2-14 S 2.6	This section declares timber as being part of the economy. Timber has become a negligible part of the county's economy due to actions of environmental activists.	Language modified.
135.	P 4-8 S 4.1.3	Regarding the comment, *The majority of the water use in the County is for agricultural purposes, with approximately 3% being used for urban and rural use.* Is the agricultural use of natural rainfall water on rangeland included in the 3% calculation for urban use, or not? What is the meaning of rural use in this sentence? Does this 3% urban use include percolated agricultural water and irrigation district urban percolation ponds?	Rainfall on rangeland is not included in urban use. Rural means use of water for household or domestic use in the unincorporated area of the County (water use other than for agriculture). Urban use does not include percolated water, only use for household or domestic purposes.
136.	P 4-10 S 4.2	The retirement of agricultural land locally for the specific purpose of saving surface-delivered water, only to have that water sent or displaced to distant places within or outside the county for the purposes of development of naturally, now parched lands is unacceptable and should be fought.	Agreed. The County has an ordinance prohibiting export of groundwater outside the County. See Table 6-12.

No.	Reference	Comment/Question	Response
137.	P 5-3 S 5.1.1.1	The **subbasins** of lower foothills and Raymond areas do not appear to have been as rigorously studied as other, larger basins and, thus, no regulatory framework for this area should be emplaced prior to studies of equivalent caliber and paid for from the same sources.	Noted.
138.	P 5-19 S 5.1.2.4	Regarding the concluding sentence, *There is little stream flow that originates in the foothills because of low precipitation*. Certainly, there is little stream flow sufficient to help the valley floor development and overdraft problems, but stream flow is a relative term and it is highly important to operation of the open space preserving institution of cattle ranching and to the ecology of the foothills and mountains. Further, the report's assertion that only about a tenth of foothill rainfall makes it into the groundwater is probably not correct for all areas.	Language added to reflect comment.
139.	P 5-25 S 5.2.1.1 & P 5-27 S 5.2.1.3	Franchi Weir, not Fanchi Weir.	Corrected.
140.	P 6-1 S 6.1	Regarding the text description, *The main source of* [groundwater] *chemical* [pollutants] *has been associated with agricultural and industrial uses*. Proportions of blame associated with each chemical pollutant needs to be identified so that agriculture does not receive a disproportion of defamation.	Language modified.
141.	P 6-17 S 6.2	While partially applicable, the comments in 6.2, Surface Water Quality, *Typically, surface water contains microorganisms such as bacteria, viruses, protozoa such as Giardia and Cryptosporidium…,*and further down, in another negative context*, animal…activities,* and finally*, watershed protection to minimize or* ***eliminate*** [emphasis added] *these sources of pollution is essential to public health protection.* All three of the quotations are alarmist, misleading, and the concluding one is just plan irrational!	Language modified to reflect comments.

No.	Reference	Comment/Question	Response
142.	P 7-12 S 7.2.2.2	Regarding commentary on debris during flooding. Culverts need to be adequate in dimension so as not to cause erosion on the emitting end due to fire-hose forces of existing water and roadway overflow due to inadequate sizing. Due to high dumping charges at the Madera County Landfill, along with its distance from many areas needing more immediate access to dumping sites, huge amounts of trash is being illegally dumped on roadsides near culverts and into creeks wherever access is possible.	Language modified to reflect comments.
143.	P 8-5 S 8.1.1.2	Temperance Flat Dam. The commentary in this section is an excellent and commendable treatment on new water and is somewhat refreshing compared with the excessive gloom and doom found throughout most of the rest of the report. When the County adopts this Plan, it is imperative that it actively pursue Temperance Flat Dam with vigor uncharacteristic of most government entities. The same can be said for the other water enhancement projects found in Chapter 8.	Noted.
144.	S 8.1.1.3.1	Species Recovery. Caveats and disclaimers need to be added when mentioning endangered and threatened species.	Noted. No change in language in the eleventh bullet of Section 8.1.1.3.1 discussing species recovery. This is the only discussion of species recovery in the Plan.
145.	P 8-29 S 8.1.2.1	Water Conservation. To paraphrase the paragraph: *[Adoption] by agriculture of modern drip and microsprinklers to conserve water [is recommended]*. There can be no significant commercial irrigated agriculture left that does not use drip or microsprinkler irrigation where applicable.	Agreed, but the mention of this practice is important to encourage those who may not have converted or are planning new agricultural development or conversion of crops.
146.	P 8-35 S 8.1.3.3	Flooding project selection on a first-come/first-served basis is a questionable idea when merit may be a far better method.	Language added.
147.	P 8-41 S 8.2.2.3	Daulton is misspelled as Dalton. The correct spelling is Daulton.	Corrected.

No.	Reference	Comment/Question	Response
148.	P 8-54 S 8.3.3.2	Under *Disadvantages of* [mountain and foothill] *vegetative management: Land ownership patterns in the watershed which may not be suitable for integrated* [watershed] *management*. This observation conveys the idea that an individual owner of several contiguous parcels is subject to greater government regulation than are owners of single parcels.	Section language expanded to clarify the intent.
149.	P 8-61 S 8.4	Under *Other Water Management Measures, Management of all large capacity well pumpages in the valley*. Who will pay for this?	This is not discussed in the Plan and would be determined during the program development and adoption process if pursued.
150.	P 8-61 S 8.4	Regarding the commentary under *Other Water Management Measures, Controls on groundwater pumping*. Who will be the controlling authority? What considerations will be given to temporal priority? Urban vs. agricultural priority?	The mention of controlling groundwater pumping as a means of addressing overdraft does not address all of the issues raised in this comment along with many legal issues. These would have to be addressed in the development of an ordinance or regulation dealing with controls on groundwater.
151.	P 8-62 S 8.4.1	Regarding the commentary under *Land Use Policies, Limitations on new development (agricultural and urban) if the water supply is not sufficient to meet demand*. This is an excellent idea based on a hard fact known for at least 60 years. It should have been implemented as a temporary measure after the first IRWMP committee meeting.	Noted.
152.	P 8-62 S 8.4.2	Water Supply for New Development. This section ignores the fact that the valley floor water table is likely going to be very difficult if not impossible to stabilize and that the stabilization of the valley floor water table should take precedence over all development until it is stabilized.	Noted. The Plan does not recommend a moratorium on new development but tries to identify alternatives for new development to not further impact the existing overdraft while identifying measures and opportunities to help alleviate the existing overdraft.
153.		Rainfall inconsistency: In Chapter 9, there is a comment that rainfall ranges from about 14 inches in the lowest foothill areas. This number, which is correct, is used elsewhere throughout the report. In one place in the report, it is said that the lower foothills receive 13 inches, which is the number of inches stated by Ken Schmidt to be the evapotranspiration use.	Inconsistency not found.

No.	Reference	Comment/Question	Response
154.	Schmidt Report, P 86	Regarding *proposed new well water test requirements*. Does this recommendation mean that a pump must be installed immediately in all new wells to obtain clear water samples, or is water blown from the wells by the pump rig at the time of drilling sufficient for the test?	It is assumed that the comment is in regard to the recommendation that individual fracture zones have water sampled and analyzed in water quality problem areas. This is in the Oakhurst report (Appendix A). This recommendation is only for public supply wells and not individual wells. See Response No. 10.
Taxpayers Association of Madera County, 3/19/08			
155.		There needs to be a water accounting showing the MID water is indeed available for banking.	The purpose of this Plan does not include legal interpolation of MID's right to store various types of water in its groundwater bank. The County will have to address these potential legal issues before deciding whether to participate in the project.
156.	S1.2	The specific goals for the Valley Floor are to enable the County to: (add) • Create an agreement with MID so that MID cannot sell Madera County water outside Madera County or to districts that well water outside the San Joaquin Valley without Madera County's approval and not to sell water under long-term contracts to Madera County developers to be used for commercial, residential, or industrial use without County approval.	The goals for the IRWMP, as stated in Section 1 Introduction, are as outlined in the agreement with DWR for grant funding and the scope of work.
157.	S 3.1.1.6 S 3.3.4.5	Add: Castle and Cooke, a landowner of Root Creek Water District, was approved for development to commercial, residential, and industrial use by Madera County with the understanding that they had an option to purchase new water form outside Madera County. This new water would have a significantly positive impact on the Madera County water supply.	Language added in both referenced sections.

No.	Reference	Comment/Question	Response
158.	S 5.2.1.3	Add: In Rank v. Krug, the trial court found that there was significant water percolation from the San Joaquin River to properties in Madera County that had significant value to those properties. The court also found that there were properties that were riparian to the San Joaquin River as well as properties that had appropriative rights to the San Joaquin River. The water subject to those rights has significant value to Madera County and should be protected.	Language added in Section 5.2.1.3.
159.	Chapter 7	Flood Control Planning. A paragraph should be added about flows created by Freeway 41 that flow into the San Joaquin River. This storm water is a source of potential water pollution.	Language added in first paragraph of Section 6.2 Surface Water Quality.
160.	S 8.1.1.3.3	Add: The Water Supply Enhancement Project EIR, by its terms, only prevents MID from selling, transporting, or exporting "native groundwater" outside the County. EIR at 2.3. Since artificially percolated water is not "native groundwater," this restriction begs the question and, in fact, would not prevent MID from selling water to other water districts or water entities that are selling water to the other water districts or water entities that are selling to the Metropolitan Water District of Southern California (MWD). These sales would have the same effect as selling water directly to MWD and would affect water availability to Madera County.	Legal issue that is not within the purpose of the Plan to comment on.
161.	S 9.2.2.1	Water Supply, second bullet. Add: The County should investigate the following issues prior to purchasing 10,000 shares of the bank's capacity: • Demonstrate availability of Madera Canal capacity for Madera County to carry water that is to be stored in the Water Supply Enhancement Project. • Due to the current direction of groundwater migration to the southwest and the goal of serving more MID constituents, MID should consider placing the 10-percent water bank reserve from the Water Supply Enhancement Project in the Fresno River for percolation.	The issue of the Madera Canal capacity is addressed in the eighth bullet of the noted section and in Section 8.1.1.8. The idea of percolating water in the Fresno River and on nearby lands is addressed in Sections 8.1.1.5 and 8.1.3.2.2 and in the seventh bullet of Section 9.2.2.1.

No.	Reference	Comment/Question	Response
Tony Ward, 3/21/08			
162.		In the unincorporated area of the valley, conversion of grazing land to crops and/or use of native land for agriculture must be controlled the same as dairies. A CUP will provide the mechanization to examine water impacts and the ability to assure water supplies are available through water agencies.	The requirement that conversion of land to agricultural use should require a CUP was not addressed in the Plan. This would require a legal analysis of the proposed requirement and action by the County.
163.		Madera County has not developed a water agency with a water master infrastructure plan. The proposed plan infers the need for such oversight, but does not require the initiation of an Integrated Water Management Plan. The two areas needing a comprehensive master infrastructure water plan are Rio Mesa and the Sierra foothills.	The IRWMP work plan did not include development of area-specific infrastructure plans. This will require a separate study and should be prepared as part of development plans for the areas.
164.		The use of "shall" has little to no importance in justifying controlling ordinances. If the County is to implement a Water Management Plan, it must be supported by legal ordinances.	The IRWMP only presents recommendations and does not implement any programs, policies, or projects. See first paragraph of Section 9.2.
Joe Middleton, 3/19/08			
165.		The draft Plan does not acknowledge or reference the water cycle (hydrological cycle). The draft Plan also fails to recognize Eastern Madera County as a water resource and the effect and relevance of the water cycle in Eastern Madera County on the water resource issues in the County.	The Plan does not mention the phrase "hydrological cycle" but does discuss all facets of the cycle. The water resources of Eastern Madera County and their importance are discussed throughout the Plan.
Larry Wright, 3/20/08			
166.		I was disturbed to see that the IRWMP report didn't address the issue of water conservation by agriculture. I don't buy the argument that farmers have done everything possible to keep their use, and therefore the cost, of their water to an absolute minimum.	See Responses 11 and 24.
Rosemarie Wright, 3/20/08			
167.		When this Plan is passed by the State, it must be recognized as a living document.	See Response No. 2.

No.	Reference	Comment/Question	Response
168.		The County needs to be responsible for creating guidelines—not the State.	It is the intent of the County to use the IRWMP to help in creating "guidelines" so that the State does not step in and do it for the County.
169.		Shared water systems must be allowed.	See Response No. 16.
170.		Chemical testing should not be mandatory for the sale of a property.	Noted. The recommendation in the Plan would require a change in the County ordinance and an action on the part of the County.
171.		Mandate no water is sold outside the County. Create the water bank and use the water in Madera County.	This is the stated position of MID with regard to the Water Bank and use of the banked water.
172.		Recognize that Eastern Madera County has different water needs and conditions than the Valley. Don't lump us all together. Ag water issues affect the Valley, not the mountains.	It is clearly stated in the Plan that there are different hydrogeologic conditions in the Valley Floor and Foothills/Mountains areas of the County and, thus, the division of the County into the two separate areas. Recommendations are specific to the two areas for the most part, but many of the identified potential programs and projects can benefit all regions of the County.
Sandra D. Connolly, 3/19/08			
173.		General comments on the need for the Plan to have definitive and enforceable language with regard to wells for subdivisions and constraints on the Hillview Water Company in the Raymond area.	The IRWMP is a planning document with recommendations. Enactment of any changes to or creation of new County policies or ordinances will require separate action and adoption by the County Board of Supervisors. See Responses 15, 69, 70, and 76.

No.	Reference	Comment/Question	Response
Doug Welch, Chowchilla Water District, 3/18/08			
174.		Figure 4-1 shows a very short time period and implies that water use (ag) in the county is increasing. Why was data for 1998 excluded from Figure 4-1? Agricultural water use may, in fact be increasing, but the data to show that trend have not been used in this Plan.	Estimating future agricultural water use is very difficult due to many unknown factors, such as acreage in production, cropping patterns, water costs (both surface water and groundwater), potential water lost to environmental purposes and regulations, commodity prices, etc. The DWR estimates for countywide cropped acreage and water use were not available beyond 2003 at the time of the analysis. However, it is known through visual observation and discussions with irrigation and water districts that there has been significant development of previously nonirrigated land to permanent crops in undistricted areas of the county since 2003. Based on this knowledge and the trend of increasing acreage and water use shown in recent years' data, it was assumed that agricultural acreage and water use would continue to increase in the near future and then level off due to finite water supplies and developable acreage. The water use assumptions assume that water lost to environmental purposes and regulations would be replaced by developed surface water supplies or additional groundwater pumping, which may not be sustainable in the long run. The 1998 water use number was not used in the trend analysis because it was extremely low due to wet hydrologic conditions that year which would have skewed the trend line upward beyond any reasonable assumption. Further discussion is included in Section 4.2 of the Plan.
175.		Comment regarding the language and numbers used in describing flood releases from Buchanan Dam, the flood capacities of the Chowchilla River and the Berenda and Ash Sloughs, and operation of these facilities during the 2006 flood releases from Buchanan Dam.	Language and numbers corrected in paragraph 3 of Section 7.2.3.

No.	Reference	Comment/Question	Response
Comments and revisions made to the IRWMP included in the motion to accept the IRWMP at the Board of Supervisors meeting, 4/14/08. These revisions supersede the revisions made to the Draft IRWMP as presented above.			
176.	Dave Brodie and Tom Wheeler	Dave Brodie and Tom Wheeler suggested that the IRWMP be reviewed by County staff with an editor's view instead of a policy view to make the document not read like a policy document.	County staff reviewed the document and made changes to the language in Section 8.1.3.3, pages 8-23 and 8-24 and the second bullet of Section 9.2.1.1, page 9-8.
177.	Tom Wheeler	Tom Wheeler discussed the recommendation regarding the use of pilot hole drilling and testing of water from different fracture zones in the foothills/mountains area and whether it should be a recommendation.	After discussion with Ken Schmidt it was concluded to remove the recommendation from the Plan. The recommendation was removed from Section 9.2.1.1.
178.	Tom Wheeler	Tom Wheeler discussed the recommendation in the Plan that states "A chemical and radiological analysis should be required when new wells are constructed or upon sale of any property served by a private well." Tom stated that this is an infringement on private landowner's rights.	After discussion it was concluded to remove the recommendation from the Plan. The recommendation was removed from Section 9.2.1.1 and from page ES-14 of the Executive Summary.
179.	Tom Wheeler	Tom Wheeler noted that the spelling of Wyle Ranch needed correction in the "Groundwater Conditions in the North Fork Area" report.	Corrected.

Public Comment Letters on Draft IRWMP

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March 20, 2008

VIA FACSIMILE & U.S. MAIL

Mr. Greg Farley, County Engineer
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Re: Comments of the Madera County Draft Integrated Regional Water Master Plan

Dear Mr. Farley:

I have reviewed the Madera County draft IRWMP. While Section 8 – Water Resources Management Opportunities and Section 9 Conclusions and Recommendations both discuss means to increase the water supply and reliability within the County, I think what is missing is a discussion of who will accomplish most of these projects, who will pay for them and who will benefit from them.

As the IRWMP discusses in several places, there is a large number of development proposals currently being processed by the County. Some of these are very large and can afford to accomplish all the necessary work to analyze, acquire and deliver water to meet the project needs without contributing to the existing overdraft. Most of the projects are not capable of accomplishing that on their own, however. Given the water situation outlined in the IRWMP, Madera County can only attract and accommodate a diversity of urban and industrial projects that are crucial for the economic development of the County if the County develops a way to provide water to projects for an appropriate development fee.

For instance, industrial development projects provide a tremendous economic benefit to the County per acre foot of water used. The County reasonably will not allow an urban development to consumptively use 100 to several hundred acre feet of water a year without some mitigation but the transaction costs and the availability of water make it extremely difficult to obtain small amounts of water to offset these uses. Really, the only prudent way to obtain those small amounts is to purchase and fallow farm land but the County, again reasonably, has a policy against water deals that impair the primary agricultural industry of the area.

The solution sees to be a County water impact fee program for development under a certain threshold—perhaps 1,000 or even 2,000 AFY or less. Then the County will have a

revenue source to accomplish some of the larger, and more cost effective, projects that will provide significant water benefits without saddling small but meritorious developments with excessive transactional costs to find small amounts of water. I strongly encourage the County to include development of a water impact fee program in the Conclusions and Recommendations section of the IRWMP.

Thank you for your consideration.

Very truly yours,

for

Christopher L. Campbell
BAKER MANOCK & JENSEN, PC

CLC:tlw

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February 28, 2008

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Re: IRWPM for Madera County
Public Comment for Consideration

Mr. Farley,

In review of the Integrated Regional Water Management Plan (IRWMP) for Madera County, I would like to submit the following comment for consideration in the final draft to be adopted by the Madera County Board of Supervisors.

I would like to bring to your attention that in reviewing the Plan and listening to feedback from other interested residents and professionals, I can see where there may be problems in having the current plan draft coincide with the Madera County General Plan, in addition to some included data already being outdated. Since the adoption of this IRWMP is on such a short time frame for finalization even with the granted extension, I would like to suggest that there be a clause adopted for future review and update through Madera County avenues on an annual basis so that these problematic areas need not be addressed within the immediate deadline for adoption by the Board of Supervisors.

My suggestion is to have a specific governing body be assigned to the IRWMP for future updates, with oversight and annual review being performed by the assigned county entity, (or TAC), who could then have the authority to bring the suggested updates to the Board of Supervisors' attention for adoption as deemed necessary.

As the IRWMP will be a key factor for implementation funding in the future, the ability to be flexible with future development of the county should be considered at this stage prior to adoption of the IRWMP as it exists. I feel that the creation of steps to create a governing body and review schedule would be of great assistance in the future of Madera County and success of the IRWMP for funding of water issues.

Thank you for your time and consideration I am sure you will give this matter.

Sincerely,

Sandy Wright

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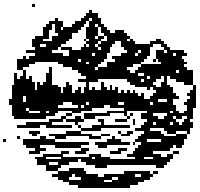

Chowchilla/Fresno River Watershed
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March 21, 2008

Final – Revised version of Recommendations – Integrated Regional Water Management Plan

- Quick Notes: Typos
  Executive Summary: pg. ES-23, Valley Floor, 5th bullet, penultimate line – "were" should be "where"

  Pg. ES-26, 1st bullet, 2nd line, - Comma after "Chowchilla River"

  Chapter 9. Flood Control, 9.1.4 – "arundo" should be changed to *Arundo donax*. Arundo is not a quotable phrase or word; it does exist with a true name as you wrote about it in chapter 7.

- Chapter One – 1.4.3, & 1.4.4. & 1.4.4.1

  This section is not correct in light of all that happened with this project. I realize it has been written as to how the project "should have been" completed based on the guidelines of the grant, but if written in this fashion it again does not take into consideration the true completion and process of the project.

  Possible Alternative to section 1.4.3:
  "The County and Boyle Engineering hired and retained the contract services of a Project Manager (PM) to provide project oversight on its behalf. This PM was responsible for coordinating the activities of the consultants and the Advisory Committees, creating a public awareness of the information being developed as part of the Plan, the issues being raised, and the policies and projects being evaluated as the Plan developed. The PM was also responsible for reporting to the DWR as required in the grants contracts. It was found that these duties were not being fulfilled so they were assumed by Boyle and County staff toward the end of the project."

- Possible Alternative to section 1.4.4 and 1.4.4.1 - Stakeholder Participation
  "The document for this project stated that participation by the public and other County stakeholders was crucial to the development of this plan. The comments, recommendations, support, and endorsement of the local communities for the projects, programs, and policies developed as part of this Plan will facilitate implementation by the County.

  Initially there was a lack of Stakeholder involvement which resulted in the initial implementation of the grant, where the County adopted some changes to the original proposal. Some of these, such as the substitution of Flood Protection for the Recreation

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and Habitat Protection areas were received with good grace by the stakeholders who had worked to develop the original grant proposal. Some of the other changes, such as the expansion of the "region" covered by the Plan to include the valley areas of the County were initially resisted, but eventually received wide support.

The area of greatest disappointment to the original stakeholders was the planning process itself. Originally conceived as an innovative process that induced wide involvement and a great deal of public input, it was greatly curtailed in its implementation. Though this outreach was designed to elicit input from the local communities such that the Plan will be afforded their local knowledge and address their concerns; these "Advisory Committees" were created by invitation; nor did these committees have a great deal of input into the planning process. Reports were made to them periodically on the progress of the plan, but their role as "advisory" was not acknowledged which was the extent of their involvement. Meetings were not widely publicized, and many felt that decision-making in the process was restricted. Though the public process was eventually improved, it never realized the original vision of stakeholder involvement, feedback, and education.

One area of public process that did not end up being implemented was the 'operationalization' of the plan. The plan contains excellent technical information on water conditions throughout the project as well as suggestions for projects to address various water issues. However these projects have not been crafted into an actual implementation plan with a timeline, measurable objectives, and periodic reviews. Particularly, there is no proposal for on-going governance and accountability of the Plan.

***Note; the above is long, but covers the issues with the Stakeholder Participation. If you then go into the 1.4.4." and 1.4.4.2; these will give specific detail with the realization of the above comments.

- Chapter 5 – 5.1.2.2 – Aquifer Characteristics
  Please review and explain this section – Aquifers do not exist in the foothills. I have talked to many who have been working in this area for a long time, and this section is very confusing.

- There should be a section on "Snow Pack and Recharge" also on 'Climate Change and Storage." These are two very important issues especially in the foothills and I see no where that they are addressed.
  1. Snow Pack and Recharge – The Snow Pack in the Sierra Nevada is the only true water storage that we have in the foothills. When the snow pack is deep (which is why you hear the report on the news all winter) we may have a good water supply to last us through the spring and summer. As it slowly melts it recharges the fractures in the foothills that supply our wells. This slow melt is a lot more effective in recharging fractures than rain because of its slow flow system.

  2. Climate Change and Storage – As we go through this time of Climate Change, aka Global Warming, we are not only loosing our snow pack faster than in the past, but more of the precipitation is coming down as rain instead of snow. We may receive the same inches of rain every year, but when it is not snow, we have lost our storage ability for later in the year. If we do not create other ways to store the rain (water that is not frozen now because of the warmer temperatures) then it goes down the hill and out of the area never recharging our wells and fractures (or not as much). Things such as individual

ponding basins or dams need to be addressed to keep some of this water in the foothills. Ponding basins can be used for recharging the fractures/groundwater.

- There also should be a section with more clear recommendations on water conservation for both the foothills and the valley. It is addressed but there is not a clear explanation of "Use vs Need vs Recharge" and how it affects the homeowners in the foothills (recharge of wells) and the homeowners of the valley (overdraft issue).

- 8.1.3.1 Joint Powers Agreement – This section suggests the formation of a JPA with Madera County, the City of Madera, and MID but does not mention the JPA already in existence almost identical to this on the Chowchilla side which is just as important. The Chowchilla Red Top RCD has a signed JPA with the City of Chowchilla and the Chowchilla Water District. This assures their support in any projects to improve or correct any issues with regards to water within the Lower Chowchilla Watershed. Possibly it can further be recommended that Madera County also signs on with this already established JPA.

- Foothill/Mountain Area – section 8.2.1.1 the line about "pilot holes" should be removed. This is a double cost for foothill landowners and is equal to drilling a well twice.

- There should be a section specifically on Farms and Dairies – Agriculture in general. Since this report states that 58% of the water use is agriculture and 38% is just open space, most of this report is written for the other 8% of the population. The other 9% is important, but what is agriculture doing to address all of the issues such as conservation/water demand, water quality, flood control, etc. This could almost be its own chapter. (Another part of your presentation states 97% of the water use is agriculture, most of this report is written for the other 3% of the population; this would make this section even more crucial.)

- Governance: This is not addressed in this plan. There needs to be a section on "How" any of this will be accomplished. Who has the authority to have it reviewed and possibly change things as the county/world changes? Will there be a team or department created to constantly review and revisit issues that need to be so this report after all of its expense and all of its time and trauma does not end up on someone's shelf or under their desk?

  This should be a "Living Document" not locked in stone but up for review possibly as a running item on the Madera County Water Advisory Commission so constituents can address their issues and concerns and they could be reviewed through this plan though not locked in stone based on what is currently written.

  Also, along with Governance should be a sub-section on code enforcement. This is an area lacking in the County, understandable based on funds and not enough personnel, but lacking just the same.

- Possible recommendation for the "treated effluent" from the area treatment plants: instead of the sole suggestion of the use on spray fields, this water could be sold (or given) to water trucks for use for dust control on roads and/or for construction and building sites (new pads or grading) also for road compaction. Why use new water for this, treated water would work well?