GEOLOGIC LOG OF DRILL HOLE NO. MW-10-94

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Right, East of Eastside Bypass
BEGUN: 4/18/10 FINISHED: 4/18/10
WATER LEVEL DEPTH AND ELEVATION: NA
DATE WATER LEVEL WAS MEASURED: NA

PROJECT: San Joaquin River Restoration Program
COORDINATES: N 2,305,418.5 E 6,099,812.0 (NAGD83)
TOTAL DEPTH: 31.1 ft.

STATE: California
GROUND SURFACE ELEVATION: 101.6 ft. (NAVD88)
T.O.C ELEVATION: 103.9 ft. (NAVD88)
HOLE LOGGED BY: A. Warren
REVIEWED BY: J. Vauk

ALL MEASUREMENTS ARE IN FEET FROM THE GROUND SURFACE.

PURPOSE OF HOLE:
To recover core, collect data to determine geologic and hydrologic site conditions, and install a groundwater monitoring well.

LOCATION:
Reach 4B1, river right, about 1 mile east from the center of the Eastside Bypass, about 1.5 miles north of the intersection of W. El Nido Road and the Eastside Bypass.

DRILLED BY:
PN-Regional Drill Crew
Jerry Hansen, Driller
Cody Kelly, Helper
Ken Kreitz, Helper

DRILL RIG:
Central Mining Equipment 75 drill rig (CME-75)

DRILLING & SAMPLING METHODS:
Drill hole MW-10-94 was advanced using hollow stem flight augers with a continuous dry core sampling system (FADC) from the ground surface to a total depth of 31.1 feet. FADC uses 7-5/8-inch O.D., 4-1/4-inch I.D. hollow stem augers, with a 5-foot-long, 3-inch I.D. split sample barrel.

Interval Method
0.0 to 31.1 ft. - FADC

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
0.0 to 31.1 ft. smooth drilling, soft

CAVING CONDITIONS:
None

DRILL FLUID, RETURN AND COLOR:
0.0 to 13.6 ft. None
13.6 to 31.1 ft. Water, no return

WATER LEVEL:
Not measured

REASON FOR HOLE TERMINATION:
The hole was terminated upon successful completion to the target depth.

HOLE COMPLETION:
Well Casing: +2.3 to 9.8 ft. (T.O.C. El. 103.9 ft.)
Dual U-pack Screen: 9.8 to 24.8 ft. (Slotted 0.010-inch)
Well Screen Filter Pack: 2/12 Sand Filter Pack: 9.2 to 31.1 ft. (#3 Sand)
Sump: 24.8 to 26.8 ft. (2-inch blank PVC with cap)
Bentonite Seal: 2.0 to 9.2 ft.
Well Completion: Steel surface casing with locking top, square 6-inches-wide and 5-foot-long.

DEPTH	% CORE RECOVERY	% SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION / ELEVATION	VISUAL CLASSIFICATION / ELEVATION	GEOLOGIC UNIT SYMBOL
	68										s(ML)	Fill
											97.0	
5	93	34.6	29.2	63.8	36.2	0.0	28.2	10.7	22.6	s(CL) 94.6	s(CL) 94.6	Qal
		45.8	16.4	62.2	37.8	0.0	25.1	9.0	19.2	s(CL) 93.6	SC 93.0	
10	100										SP/SC 91.5	
											(CL)s 89.8	
											(CL/ML)s	

0.0 to 4.6 feet
FILL (Fill)

0.0 to 4.6 ft.: SANDY SILT, s(ML): About 65% fines with low plasticity, no toughness, rapid dilatancy; about 35% fine sand; maximum size: fine sand; dry to moist, brown; soft to moderately firm consistency; high organic content; fill; highly disturbed.

4.6 to 31.1 feet
QUATERNARY ALLUVIUM (Qal)

4.6 to 7.0 ft.: SANDY LEAN CLAY, s(CL): About 60% fines with medium plasticity; about 40% fine sand; maximum size: fine sand; moist, brown; moderately firm consistency.

Laboratory Data Interval
6.0 to 7.0 ft.

7.0 to 8.6 ft.: CLAYEY SAND, SC: About 85% fine sand; about 15% fines with medium plasticity; maximum size: fine sand; moist, brown; moderately firm consistency; homogeneous.

Laboratory Data Interval
7.0 to 8.0 ft.

8.6 to 10.1 ft.: POORLY GRADED SAND WITH CLAY, SP/SC: About 90% fine sand; about 10% fines with medium plasticity; maximum size: fine sand; wet, brown; moderately soft consistency; loose, saturated with water.

10.1 to 11.8 ft.: LEAN CLAY WITH SAND, (CL)s: About 85% fines with medium plasticity, low toughness, and slow dilatancy; about 15% fine to coarse sand; maximum size: coarse sand; moist, brown; firm consistency; white calcium carbonate veins throughout.

11.8 to 13.4 ft.: SILTY CLAY WITH SAND, (CL/ML)s: About 85% fines with low to medium plasticity, low toughness, rapid dilatancy; about 15% fine sand; maximum size: fine sand; moist, brown; moderately firm consistency.

Laboratory Data Interval
12.0 to 13.0 ft.

13.4 to 15.0 ft.: SILT WITH SAND, (ML)s: About 80% fines with low plasticity and toughness, rapid dilatancy; about 20% fine sand; maximum size: fine sand; moist, brown; moderately firm consistency.

Laboratory Data Interval
14.0 to 15.0 ft.

15.0 to 16.2 ft.: SILTY SAND, SM: About 60% fine sand; about 40% non-plastic to low plasticity fines; moist, brown; moderately soft to moderately firm consistency.

16.2 to 17.5 ft.: FAT CLAY, CH: About 90% fines with medium to high plasticity, high toughness, no dilatancy; about 10% fine sand; maximum size: fine sand; moist, brown; very firm consistency; some silt.

COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-plastic
NR = No Recovery
NA = Not applicable
I.D. = inner diameter
RM = River Mile
O.D. = outer diameter
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

RECLAMATION
Managing Water in the West

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-94

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Right, East of Eastside Bypass
BEGUN: 4/18/10 FINISHED: 4/18/10
WATER LEVEL DEPTH AND ELEVATION: NA
DATE WATER LEVEL WAS MEASURED: NA

PROJECT: San Joaquin River Restoration Program
COORDINATES: N 2,305,418.5 E 6,099,812.0 (NAGD83)
TOTAL DEPTH: 31.1 ft.

STATE: California
GROUND SURFACE ELEVATION: 101.6 ft. (NAVD88)
T.O.C ELEVATION: 103.9 ft. (NAVD88)
HOLE LOGGED BY: A. Warren
REVIEWED BY: J. Vauk

NOTES	DEPTH	% CORE RECOVERY	LABORATORY DATA: % SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION / ELEVATION	VISUAL CLASSIFICATION / ELEVATION	GEOLOGIC UNIT SYMBOL	CLASSIFICATION AND PHYSICAL CONDITION
		100	63.4	20.5	83.9	16.1	0.0	30.8	13.0	24.7	(CL)s 88.6	(CL/ML)s 88.2		**17.5 to 19.6 ft.: SANDY SILT, s(ML):** About 70% non-plastic to low plasticity fines with no toughness and rapid dilatancy; about 30% fine sand; maximum size: fine sand; moist, brown; firm consistency.
														Laboratory Data Interval 17.5 to 18.5 ft.
			64.3	15.5	79.8	20.2	0.0	26.2	4.7	26.4	(CL-ML)s 86.6	(ML)s 86.6		**19.6 to 21.9 ft.: CLAYEY SILTY SAND, SC/SM:** About 55% fine sand; about 45% fines with medium plasticity and slow dilatancy; maximum size: fine sand; moist, olive brown and brown to reddish brown; moderately firm consistency.
15														**21.9 to 24.7 ft.: SILTY SAND, SM:** About 75% fine sand; about 25% non-plastic to low plasticity fines with rapid dilatancy; maximum size: fine sand; wet, brown; moderately soft consistency; loose, trace of black organic material.
												SM 85.4		Laboratory Data Interval 22.6 to 23.6 ft.
		100												**24.7 to 25.8 ft.: POORLY GRADED SAND WITH SILT, SP/SM:** About 90% fine sand; about 10% non-plastic fines; maximum size: fine sand; wet, reddish brown to brown; soft consistency.
												CH 84.1		**25.8 to 31.1 ft.: POORLY GRADED SAND, SP:** About 95% fine sand; about 5% fines; wet, brown; soft consistency; homogenous.
			45.4	22.0	67.4	32.6	0.0	24.5	6.2	16.7	s(CL-ML) 83.1	s(ML) 82.0	Qal	Laboratory Data Interval 27.6 to 28.6 ft.
20														**T.D.= 31.1 ft.**
		100										SC/SM 79.7		
			51.7	14.0	65.7	34.3	0.0	NP	NP	22.0	s(ML) 78.0	SM		
		80												

COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-plastic
NR = No Recovery
NA = Not applicable
I.D. = inner diameter
RM = River Mile
O.D. = outer diameter
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

RECLAMATION Managing Water in the West

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-94

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Right, East of Eastside Bypass
BEGUN: 4/18/10 FINISHED: 4/18/10
WATER LEVEL DEPTH AND ELEVATION: NA
DATE WATER LEVEL WAS MEASURED: NA

PROJECT: San Joaquin River Restoration Program
COORDINATES: N 2,305,418.5 E 6,099,812.0 (NAGD83)
TOTAL DEPTH: 31.1 ft.

STATE: California
GROUND SURFACE ELEVATION: 101.6 ft. (NAVD88)
T.O.C ELEVATION: 103.9 ft. (NAVD88)
HOLE LOGGED BY: A. Warren
REVIEWED BY: J. Vauk

NOTES	DEPTH	% CORE RECOVERY	LABORATORY DATA: % SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION / ELEVATION	VISUAL CLASSIFICATION / ELEVATION	GEOLOGIC UNIT SYMBOL	CLASSIFICATION AND PHYSICAL CONDITION
	25	80										SM 76.9		
												SP/SM 75.8		
			11.6	5.3	16.9	83.1	0.0	NP	NP	20.8	SM 73.0	SP	Qal	
	30	72										70.5		

BOTTOM OF HOLE

COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-plastic
NR = No Recovery
NA = Not applicable
I.D. = inner diameter
RM = River Mile

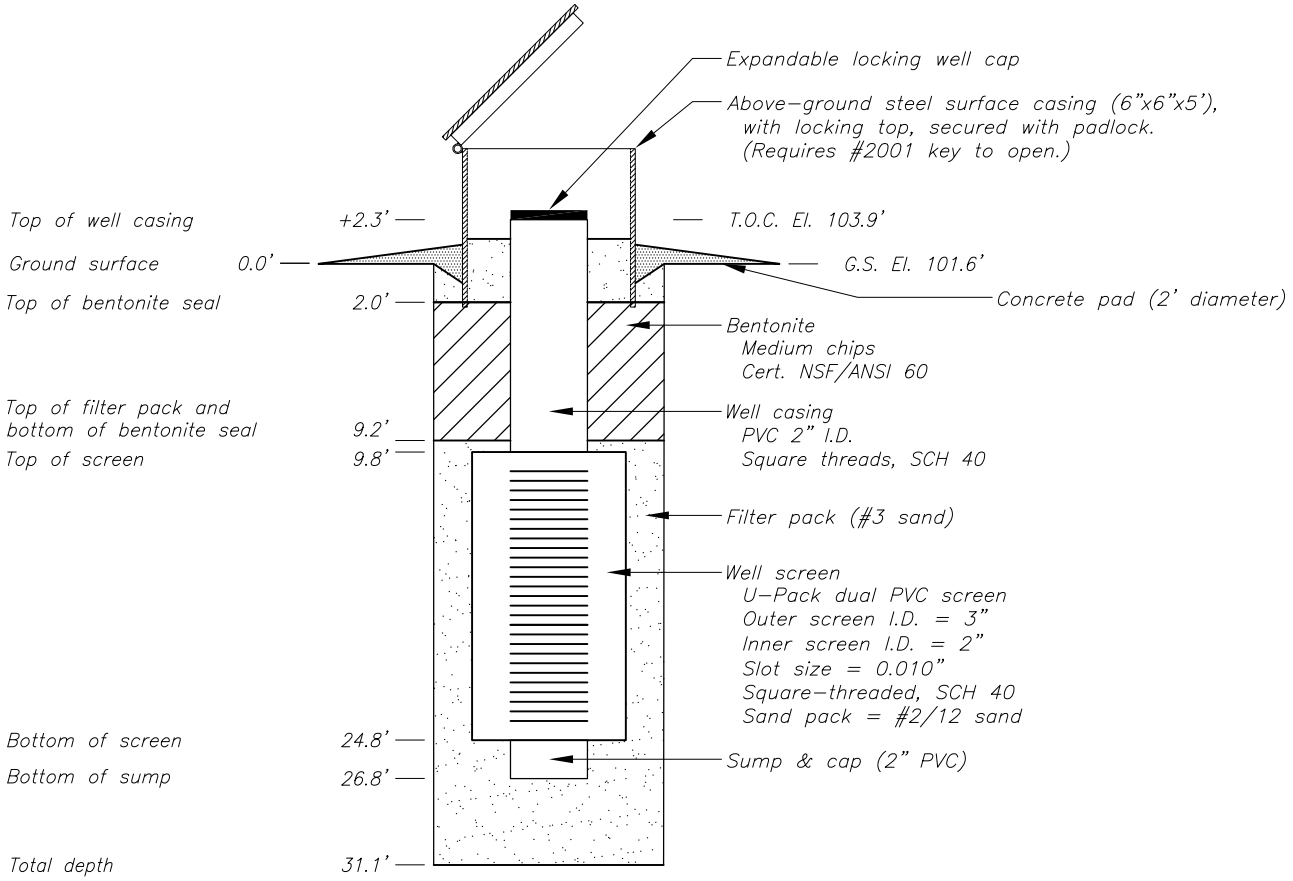
O.D. = outer diameter
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

RECLAMATION
Managing Water in the West

PROJECT DATABASE: SJRRP.GPJ
REPORT: SJRRP DRILL HOLE

MW–10–94	GEOLOGIST: A. WARREN
WELL COMPLETION DIAGRAM	DRILLER: G. HANSEN
DATE COMPLETED: 4/18/2010	HELPER: C. KELLY, K. KREITZ
TOP OF WELL CASING COORDINATES: N2305418.5 E6099812.0 (NAD83) ELEVATION 103.9' (NAVD88) GROUND SURFACE ELEVATION 101.6' (NAVD88)	



NOT TO SCALE

NOTES:
T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, El. = Elevation
#3 Sand backfills the well above the top of the bentonite seal.

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-95

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Left, west of Eastside Bypass
BEGUN: 4/14/10 FINISHED: 4/14/10
WATER LEVEL DEPTH AND ELEVATION: 9.1 ft. (El. 89.9 ft.)
DATE WATER LEVEL WAS MEASURED: 4/14/2010

PROJECT: San Joaquin River Restoration Program
COORDINATES: N 2,299,724.2 E 6,095,316.0 (NAGD83)
TOTAL DEPTH: 31.1 ft.

STATE: California
GROUND SURFACE ELEVATION: 99.0 ft. (NAVD88)
T.O.C ELEVATION: 101.7 ft. (NAVD88)
HOLE LOGGED BY: A. Warren
REVIEWED BY: J. Vauk

NOTES

ALL MEASUREMENTS ARE IN FEET FROM THE GROUND SURFACE.

PURPOSE OF HOLE:
To recover core, collect data to determine geologic and hydrologic site conditions, and install a groundwater monitoring well.

LOCATION:
Reach 4B1, RM 167, river right, about 1.4 miles southwest of the center of the SJR, about 2,800 feet west from the center of the Eastside Bypass, about 3,600 feet northwest of the intersection of W. El Nido Road and the center of the Eastside Bypass.

DRILLED BY:
PN-Regional Drill Crew
Jerry Hansen, Driller
Cody Kelly, Helper
Ken Kreitz, Helper

DRILL RIG:
Central Mining Equipment 75 drill rig (CME-75)

DRILLING & SAMPLING METHODS:
Drill hole MW-10-95 was advanced using hollow stem flight augers with a continuous dry core sampling system (FADC) from the ground surface to a total depth of 31.1 feet. FADC uses 7-5/8-inch O.D., 4-1/4-inch I.D. hollow stem augers, with a 5-foot-long, 3-inch I.D. split sample barrel.

Interval Method
0.0 to 31.1 ft. - FADC

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
0.0 to 8.6 ft. smooth drilling, soft
8.6 to 13.6 ft. soft, wet
13.6 to 23.6 ft. moderately soft
23.6 to 31.1 ft. firm

CAVING CONDITIONS:
None

DRILL FLUID, RETURN AND COLOR:
0.0 to 13.6 ft. None
13.6 to 31.1 ft. Water, no return

WATER LEVEL:
9.1 ft. b.g.s. on 4/14/2010

REASON FOR HOLE TERMINATION:
The hole was terminated upon successful completion to the target depth.

HOLE COMPLETION:
Well Casing: +2.7 to 13.0 ft. (T.O.C. El. 101.7 ft.)
Dual U-pack Screen: 13.0 to 28.0 ft. (Slotted 0.010-inch)
Well Screen Filter Pack: 2/12 Sand
Filter Pack: 12.5 to 31.1 ft. (#3 Sand)
Sump: 28.0 to 30.0 ft. (2-inch blank

DEPTH	% CORE RECOVERY	% SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION / ELEVATION	VISUAL CLASSIFICATION / ELEVATION	GEOLOGIC UNIT SYMBOL
	100										OL / 96.6	
		29.1	57.9	87.0	13.0	0.0	69.3	51.8	28.8	CH / 95.0	CH / 94.8	
5	93	47.2	19.4	66.6	33.4	0.0	25.2	8.7	19.0	s(CL) / 92.0	s(CL) / 90.6	Qal
10		45.4	27.2	72.6	27.4	0.0	28.1	13.5	23.0	(CL)s / 88.6	s(CL) / 87.9	
	100										SC	

0.0 to 31.1 feet
QUATERNARY ALLUVIUM (Qal)

0.0 to 2.4 ft.: ORGANIC CLAY, OL: About 90% fines with medium plasticity, medium toughness, and rapid dilatancy; about 10% fine sand; maximum size: fine sand; moist, dark brown, organic odor; moderately firm consistency; high organic content.

2.4 to 4.2 ft.: FAT CLAY, CH: About 95% fines with high plasticity and toughness, no dilatancy; about 5% fine sand; maximum size: fine sand; moist, dark brown; very firm consistency; fine olive brown stratification.

Laboratory Data Interval
3.0 to 4.0 ft.

4.2 to 8.4 ft.: SANDY LEAN CLAY, s(CL): About 55% fines with medium plasticity and toughness; about 45% fine sand; maximum size: fine sand; moist, olive brown; firm consistency; clay balls up to 1-inch-diameter.

Laboratory Data Interval
6.0 to 7.0 ft.

8.4 to 11.1 ft.: SANDY LEAN CLAY, s(CL): About 70% fines with low plasticity; about 30% fine to medium sand; maximum size: medium sand; moist to wet, olive brown; moderately firm consistency; layered, light to moderate cemented claystone layers throughout unit.

Laboratory Data Interval
9.4 to 10.4 ft.

11.1 to 15.7 ft.: CLAYEY SAND, SC: About 80% fine sand; about 20% fines with medium plasticity; maximum size: fine sand; wet, olive brown marbled with reddish brown; firm consistency.

15.7 to 20.6 ft.: FAT CLAY, CH: About 90% fines with high plasticity and toughness, no dilatancy; about 10% fine sand; maximum size: fine sand; moist, olive brown; moderately firm consistency.

Laboratory Data Interval
17.0 to 18.0 ft.

20.6 to 22.3 ft.: SILTY CLAYEY SAND, SC/SM: About 70% fine sand; about 30% fines with low plasticity and medium toughness; maximum size: fine sand; moist, olive brown, moderately firm consistency, homogeneous.

22.3 to 23.6 ft.: SILTY SAND, SM: About 80% fine sand containing mica; about 20% fines with low plasticity, no toughness, and rapid dilatancy; maximum size: fine sand; moist to wet, olive brown to reddish brown; moderately soft consistency.

23.6 to 26.5 ft.: SANDY LEAN CLAY, s(CL): About 65% fines with low plasticity; about 35% fine sand; maximum size: fine sand; moist to wet, olive brown to reddish brown; moderately soft consistency.

Laboratory Data Interval
23.6 to 24.6 ft.

COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-plastic
NR = No Recovery
NA = Not applicable
I.D. = inner diameter
RM = River Mile
O.D. = outer diameter
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

RECLAMATION
Managing Water in the West

PROJECT DATABASE: SJRRP.GPJ
REPORT: SJRRP DRILL HOLE

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-95

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Left, west of Eastside Bypass
BEGUN: 4/14/10 FINISHED: 4/14/10
WATER LEVEL DEPTH AND ELEVATION: 9.1 ft. (El. 89.9 ft.)
DATE WATER LEVEL WAS MEASURED: 4/14/2010

PROJECT: San Joaquin River Restoration Program
COORDINATES: N 2,299,724.2 E 6,095,316.0 (NAGD83)
TOTAL DEPTH: 31.1 ft.

STATE: California
GROUND SURFACE ELEVATION: 99.0 ft. (NAVD88)
T.O.C ELEVATION: 101.7 ft. (NAVD88)
HOLE LOGGED BY: A. Warren
REVIEWED BY: J. Vauk

NOTES	DEPTH	% CORE RECOVERY	LABORATORY DATA: % SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION / ELEVATION	VISUAL CLASSIFICATION / ELEVATION	GEOLOGIC UNIT SYMBOL	CLASSIFICATION AND PHYSICAL CONDITION
PVC with cap) Bentonite Seal: 2.0 to 12.5 ft. Well Completion: Steel surface casing with locking top, square 6-inches-wide and 5-foot-long.	15	100										SC 83.3		**26.5 to 28.6 ft.: <u>POORLY GRADED SAND WITH SILT, SP/SM</u>:** About 90% fine sand; about 10% fines with low plasticity; maximum size: fine sand; moist to wet, tan; moderately soft consistency. **28.6 to 31.1 ft.: <u>SILTY SAND, SM</u>:** About 85% fine to medium sand; about 15% fines with low plasticity; maximum size: medium sand; wet, tan; soft consistency. <u>Laboratory Data Interval</u> 28.6 to 31.1 ft. **T.D.= 31.1 ft.**
			37.3	43.6	80.9	19.1	0.0	35.5	21.9	18.9	(CL)s 81.0	CH	Qal	
	20	100										78.4 SC/SM 76.7 SM 75.4		

COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-plastic
NR = No Recovery
NA = Not applicable
I.D. = inner diameter
RM = River Mile

O.D. = outer diameter
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

RECLAMATION
Managing Water in the West

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-95

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Left, west of Eastside Bypass
BEGUN: 4/14/10 FINISHED: 4/14/10
WATER LEVEL DEPTH AND ELEVATION: 9.1 ft. (El. 89.9 ft.)
DATE WATER LEVEL WAS MEASURED: 4/14/2010

PROJECT: San Joaquin River Restoration Program
COORDINATES: N 2,299,724.2 E 6,095,316.0 (NAGD83)
TOTAL DEPTH: 31.1 ft.

STATE: California
GROUND SURFACE ELEVATION: 99.0 ft. (NAVD88)
T.O.C ELEVATION: 101.7 ft. (NAVD88)
HOLE LOGGED BY: A. Warren
REVIEWED BY: J. Vauk

NOTES	DEPTH	% CORE RECOVERY	LABORATORY DATA: % SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION / ELEVATION	VISUAL CLASSIFICATION / ELEVATION	GEOLOGIC UNIT SYMBOL	CLASSIFICATION AND PHYSICAL CONDITION
	25	86	48.7	16.5	65.2	34.8	0.0	26.2	8.7	22.7	s(CL) 74.4	s(CL) 72.5		
												SP/SM 70.4	Qal	
	30	72	14.0	4.2	18.2	81.8	0.0	NP	NP	18.0	SM 67.9	SM 67.9		

BOTTOM OF HOLE

COMMENTS:

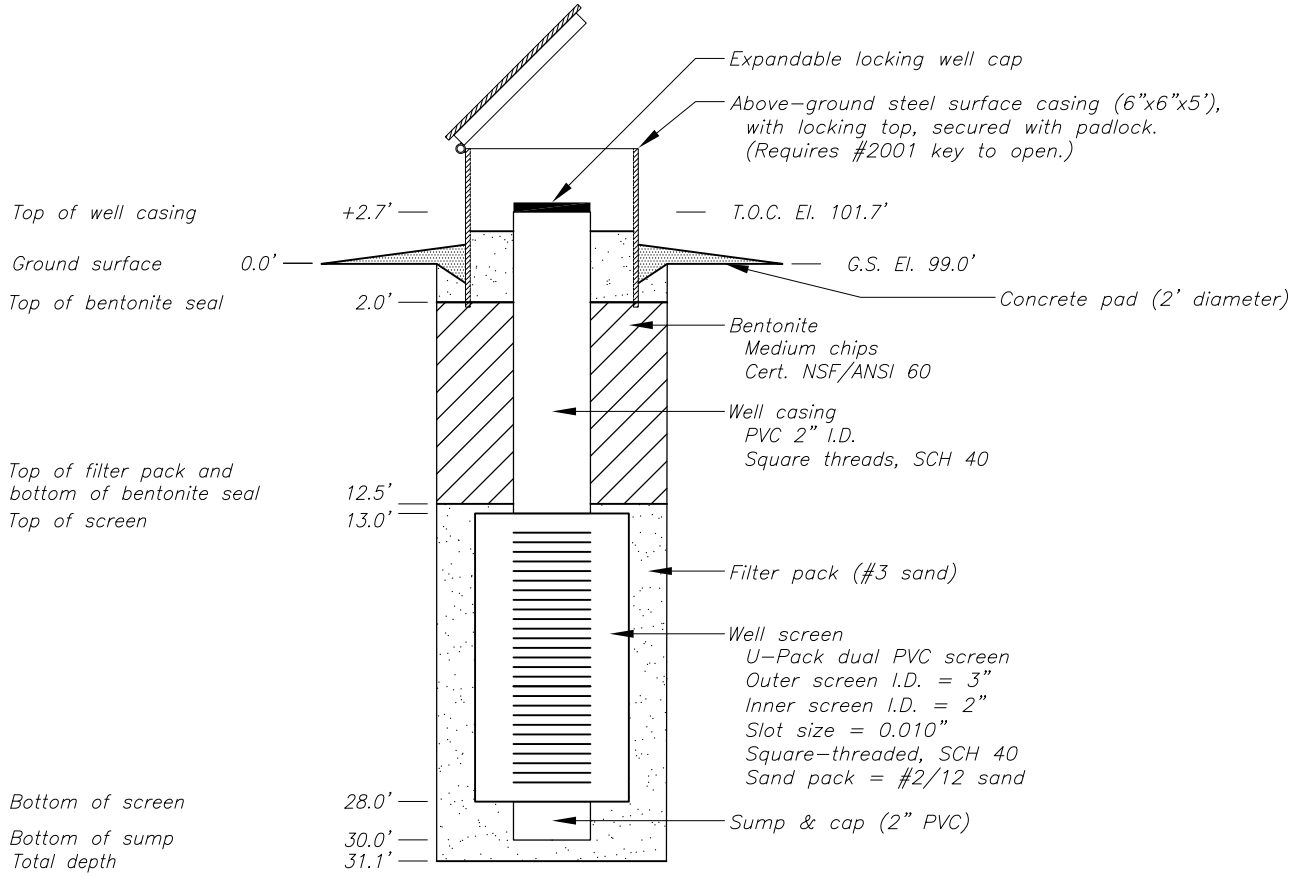
FADC = Flight Auger Dry Core
NP = Non-plastic
NR = No Recovery
NA = Not applicable
I.D. = inner diameter
RM = River Mile

O.D. = outer diameter
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

RECLAMATION
Managing Water in the West

MW–10–95	GEOLOGIST: A. WARREN
WELL COMPLETION DIAGRAM	DRILLER: G. HANSEN
DATE COMPLETED: 4/14/2010	HELPER: C. KELLY, K. KREITZ
TOP OF WELL CASING COORDINATES: N2299724.2 E6095316.0 (NAD83) ELEVATION 101.7' (NAVD88) GROUND SURFACE ELEVATION 99.0' (NAVD88)	



NOT TO SCALE

NOTES:
T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, El. = Elevation
#3 Sand backfills the well above the top of the bentonite seal.

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-96

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Right, RM 167
BEGUN: 4/15/10 FINISHED: 4/15/10
WATER LEVEL DEPTH AND ELEVATION: NA
DATE WATER LEVEL WAS MEASURED: NA

PROJECT: San Joaquin River Restoration Program
COORDINATES: N 2,296,689.5 E 6,093,377.6 (NAGD83)
TOTAL DEPTH: 31.4 ft.

STATE: California
GROUND SURFACE ELEVATION: 100.4 ft. (NAVD88)
T.O.C ELEVATION: 103.0 ft. (NAVD88)
HOLE LOGGED BY: A. Warren
REVIEWED BY: J. Vauk

NOTES	DEPTH	% CORE RECOVERY	LABORATORY DATA: % SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION / ELEVATION	VISUAL CLASSIFICATION / ELEVATION	GEOLOGIC UNIT SYMBOL	CLASSIFICATION AND PHYSICAL CONDITION
ALL MEASUREMENTS ARE IN FEET FROM THE GROUND SURFACE. **PURPOSE OF HOLE:** To recover core, collect data to determine geologic and hydrologic site conditions, and install a groundwater monitoring well. **LOCATION:** Reach 4B1, RM 167, river right, about 1 mile northwest of the intersection of SJR and Indiana Avenue, 1.1 miles west from the center of the Eastside Bypass. **DRILLED BY:** PN-Regional Drill Crew Jerry Hansen, Driller Cody Kelly, Helper Ken Kreitz, Helper **DRILL RIG:** Central Mining Equipment 75 drill rig (CME-75) **DRILLING & SAMPLING METHODS:** Drill hole MW-10-96 was advanced using hollow stem flight augers with a continuous dry core sampling system (FADC) from the ground surface to a total depth of 31.4 feet. FADC uses 7-5/8-inch O.D., 4-1/4-inch I.D. hollow stem augers, with a 5-foot-long, 3-inch I.D. split sample barrel. Interval Method 0.0 to 31.4 ft. - FADC **DRILLING CONDITIONS AND DRILLER'S COMMENTS:** 0.0 to 4.3 ft. smooth drilling, soft 4.3 to 8.9 ft. soft, wet, moved sampler out to 0.2 ft. 8.9 to 13.9 ft. moderately firm, wet 13.9 to 18.9 ft. firm 18.9 to 23.9 ft. moderately firm 23.9 to 31.4 ft. soft **CAVING CONDITIONS:** None **DRILL FLUID, RETURN AND COLOR:** 0.0 to 8.9 ft. None 8.9 to 31.4 ft. Water, no return **WATER LEVEL:** Not measured **REASON FOR HOLE TERMINATION:** The hole was terminated upon successful completion to the target depth. **HOLE COMPLETION:** Well Casing: +2.6 to 10.0 ft. (T.O.C. El. 103.0 ft.) Dual U-pack Screen: 10.0 to 25.0 ft. (Slotted 0.010-inch) Well Screen Filter Pack: 2/12 Sand Filter Pack: 9.5 to 31.4 ft. (#3 Sand) Sump: 25.0 to 27.0 ft. (2-inch blank PVC with cap)	5 10	51 100 96	50.0	9.5	59.5	40.5	0.0	NP	NP	22.6	s(ML) 89.4	s(CL) 97.4 CL 95.1 (CL)s 92.1 SM 90.0	Qal	***0.0 to 31.4 feet*** ***QUATERNARY ALLUVIUM (Qal)*** **0.0 to 3.0 ft.: <u>SANDY LEAN CLAY, s(CL)</u>:** About 70% fines with medium plasticity; about 30% fine sand; maximum size: fine sand; moist, dark brown. **3.0 to 5.3 ft.: <u>LEAN CLAY, CL</u>:** About 95% fines with medium plasticity and toughness; about 5% fine sand; maximum size: fine sand; moist, dark brown; moderately firm consistency; bottom contact is gradual. **5.3 to 8.3 ft.: <u>LEAN CLAY WITH SAND, (CL)s:</u>** About 85% fines with low plasticity and toughness; about 15% fine sand; maximum size: fine sand; moist, olive brown with dark brown mottling; moderately firm consistency; soil becomes less firm with depth. **8.3 to 10.4 ft.: <u>SILTY SAND, SM</u>:** About 65% fine sand containing mica; about 35% fines with low plasticity and toughness; maximum size: fine sand; wet, olive brown with reddish brown oxidation; moderately firm consistency; artificial plasticity from mica. **10.4 to 14.5 ft.: <u>SILTY SAND, SM</u>:** About 80% fine to medium sand; about 20% non-plastic fines; maximum size: medium sand; wet, olive brown with reddish brown oxidation layers; soft consistency; interbedded layers of SP, SM, and s(ML) from 0.05- to 0.3-foot-thick. <u>Laboratory Data Interval</u> 10.0 to 11.0 ft. 12.9 to 13.9 ft. **14.5 to 16.2 ft.: <u>No Recovery - POORLY GRADED SAND WITH SILT, SP/SM</u>:** Description based on soil recovered in the shoe and drilling conditions. **16.2 to 21.9 ft.: <u>POORLY GRADED SAND, SP:</u>** About 95% fine to medium sand; about 5% non-plastic fines; maximum size: medium sand; wet, gray; soft consistency, homogeneous. <u>Laboratory Data Interval</u> 18.9 to 20.9 ft. **21.9 to 22.9 ft.: <u>SANDY LEAN CLAY, s(CL)</u>:** About 55% fines with medium plasticity and toughness; about 45% fine sand; maximum size: fine sand; moist, dark gray; hydrogen sulfide odor; very firm consistency. **22.9 to 25.4 ft.: <u>CLAYEY SAND, SC</u>:** About 85% fine sand; about 15% fines with low plasticity; maximum size: fine sand; moist, dark gray; moderately firm consistency. <u>Laboratory Data Interval</u> 23.9 to 24.9 ft. **25.4 to 30.4 ft.: <u>SANDY LEAN CLAY, s(CL)</u>:** About 70% fines with low plasticity and toughness; about 30% fine (powdery) sand; maximum size: fine sand; moist, dark gray with some chocolate brown marbling; moderately firm consistency; silt content and sand increases with depth. <u>Laboratory Data Interval</u>

COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-plastic
NR = No Recovery
NA = Not applicable
I.D. = inner diameter
RM = River Mile
O.D. = outer diameter
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

RECLAMATION
Managing Water in the West

PROJECT DATABASE: SJRRP.GPJ
REPORT: SJRRP DRILL HOLE

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-96

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Right, RM 167
BEGUN: 4/15/10 FINISHED: 4/15/10
WATER LEVEL DEPTH AND ELEVATION: NA
DATE WATER LEVEL WAS MEASURED: NA

PROJECT: San Joaquin River Restoration Program
COORDINATES: N 2,296,689.5 E 6,093,377.6 (NAGD83)
TOTAL DEPTH: 31.4 ft.

STATE: California
GROUND SURFACE ELEVATION: 100.4 ft. (NAVD88)
T.O.C ELEVATION: 103.0 ft. (NAVD88)
HOLE LOGGED BY: A. Warren
REVIEWED BY: J. Vauk

NOTES	DEPTH	% CORE RECOVERY	LABORATORY DATA: % SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION / ELEVATION	VISUAL CLASSIFICATION / ELEVATION	GEOLOGIC UNIT SYMBOL	CLASSIFICATION AND PHYSICAL CONDITION
Bentonite Seal: 2.0 to 9.5 ft. Well Completion: Steel surface casing with locking top, square 6-inches-wide and 5-foot-long.		96										SM		25.0 to 26.0 ft.
			11.3	4.3	15.6	84.4	0.0	NP	NP	16.9	SM 86.7			**30.4 to 31.4 ft.: FAT CLAY, CH:** About 95% fines with high plasticity and toughness, no dilatancy; about 5% fine sand; maximum size: fine sand; moist, chocolate brown; very firm consistency.
												85.9		**T.D.= 31.4 ft.**
	15											SP/SM		
												84.2		
		0												
													Qal	
												SP		
	20		9.2	3.6	12.8	87.2	0.0	NP	NP	23.2	SM 79.7			
		100										78.5		
												s(CL)		
												77.5		
												SC		

COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-plastic
NR = No Recovery
NA = Not applicable
I.D. = inner diameter
RM = River Mile
O.D. = outer diameter
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

RECLAMATION
Managing Water in the West

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-96

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Right, RM 167
BEGUN: 4/15/10 FINISHED: 4/15/10
WATER LEVEL DEPTH AND ELEVATION: NA
DATE WATER LEVEL WAS MEASURED: NA

PROJECT: San Joaquin River Restoration Program
COORDINATES: N 2,296,689.5 E 6,093,377.6 (NAGD83)
TOTAL DEPTH: 31.4 ft.

STATE: California
GROUND SURFACE ELEVATION: 100.4 ft. (NAVD88)
T.O.C ELEVATION: 103.0 ft. (NAVD88)
HOLE LOGGED BY: A. Warren
REVIEWED BY: J. Vauk

NOTES	DEPTH	% CORE RECOVERY	LABORATORY DATA: % SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION / ELEVATION	VISUAL CLASSIFICATION / ELEVATION	GEOLOGIC UNIT SYMBOL	CLASSIFICATION AND PHYSICAL CONDITION
			23.2	14.1	37.3	62.7	0.0	25.2	10.7	12.7	SC 75.5	SC 75.0		
	25		33.7	25.6	59.3	40.7	0.0	31.3	15.0	15.8	s(CL) 74.4	s(CL) 70.0	Qal	
		100												
	30	100										CH 69.0		

BOTTOM OF HOLE

COMMENTS:

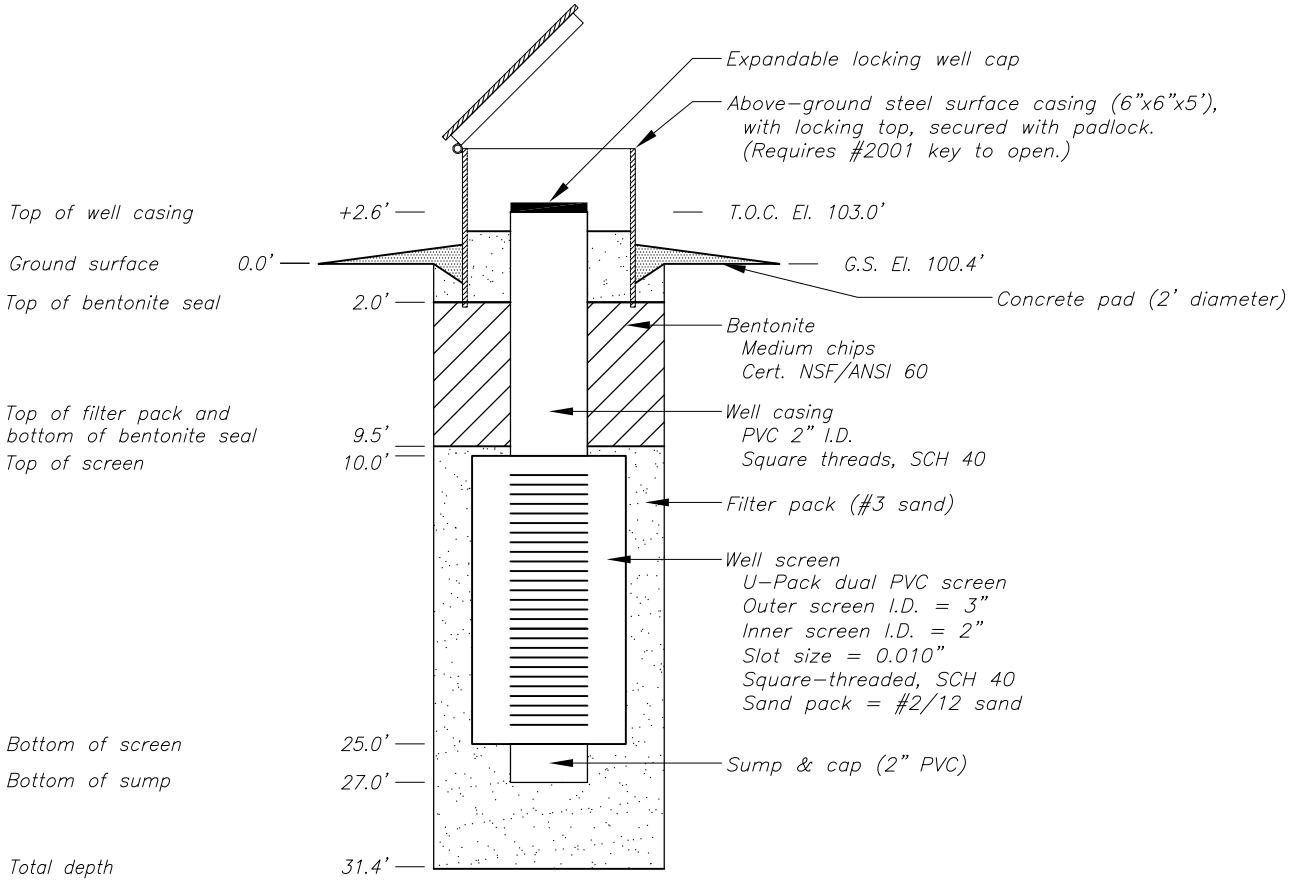
FADC = Flight Auger Dry Core
NP = Non-plastic
NR = No Recovery
NA = Not applicable
I.D. = inner diameter
RM = River Mile
O.D. = outer diameter
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

RECLAMATION
Managing Water in the West

REPORT: SJRRP DRILL HOLE PROJECT DATABASE: SJRRP.GPJ

MW–10–96	GEOLOGIST: A. WARREN
WELL COMPLETION DIAGRAM	DRILLER: G. HANSEN
DATE COMPLETED: 4/15/2010	HELPER: C. KELLY, K. KREITZ
TOP OF WELL CASING COORDINATES: N2296689.5 E6093377.6 (NAD83) ELEVATION 103.0' (NAVD88) GROUND SURFACE ELEVATION 100.4' (NAVD88)	



NOT TO SCALE

NOTES:
T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, El. = Elevation
#3 Sand backfills the well above the top of the bentonite seal.

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-97

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River right, RM 167
BEGUN: 4/16/10 FINISHED: 4/16/10
WATER LEVEL DEPTH AND ELEVATION: NA
DATE WATER LEVEL WAS MEASURED: NA

PROJECT: San Joaquin River Restoration Program
COORDINATES: N 2,294,443.5 E 6,091,007.0 (NAGD83)
TOTAL DEPTH: 29.3 ft.

STATE: California
GROUND SURFACE ELEVATION: 101.2 ft. (NAVD88)
T.O.C ELEVATION: 103.7 ft. (NAVD88)
HOLE LOGGED BY: A. Warren
REVIEWED BY: J. Vauk

NOTES	DEPTH	% CORE RECOVERY	LABORATORY DATA: % SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION / ELEVATION	VISUAL CLASSIFICATION / ELEVATION	GEOLOGIC UNIT SYMBOL	CLASSIFICATION AND PHYSICAL CONDITION
ALL MEASUREMENTS ARE IN FEET FROM THE GROUND SURFACE. **PURPOSE OF HOLE:** To recover core, collect data to determine geologic and hydrologic site conditions, and install a groundwater monitoring well. **LOCATION:** Reach 4B1, RM 167, river right, about 180 feet northeast from the center of the SJR, about 1.1 miles west from the intersection of Indiana Avenue and the SJR. **DRILLED BY:** PN-Regional Drill Crew Jerry Hansen, Driller Cody Kelly, Helper Ken Kreitz, Helper **DRILL RIG:** Central Mining Equipment 75 drill rig (CME-75) **DRILLING & SAMPLING METHODS:** Drill hole MW-10-97 was advanced using hollow stem flight augers with a continuous dry core sampling system (FADC) from the ground surface to a total depth of 29.3 feet. FADC uses 7-5/8-inch O.D., 4-1/4-inch I.D. hollow stem augers, with a 5-foot-long, 3-inch I.D. split sample barrel. Interval Method 0.0 to 29.3 ft. - FADC **DRILLING CONDITIONS AND DRILLER'S COMMENTS:** 0.0 to 29.3 ft. smooth drilling, soft **CAVING CONDITIONS:** None **DRILL FLUID, RETURN AND COLOR:** 0.0 to 9.3 ft. None 9.3 to 29.3 ft. Water, no return **WATER LEVEL:** Not measured **REASON FOR HOLE TERMINATION:** The hole was terminated upon successful completion to the target depth. **HOLE COMPLETION:** Well Casing: +2.5 to 10.0 ft. (T.O.C. El. 103.7 ft.) Dual U-pack Screen: 10.0 to 25.0 ft. (Slotted 0.010-inch) Well Screen Filter Pack: 2/12 Sand Filter Pack: 5.5 to 29.3 ft. (#3 Sand) Sump: 25.0 to 27.0 ft. (2-inch blank PVC with cap) Bentonite Seal: 2.0 to 5.5 ft. Well Completion: Steel surface casing with locking top, square 6-inches-wide and 5-foot-long.	5 10	88 68 0	26.9 6.9	23.4 0.0	50.3 6.9	49.7 93.1	0.0 0.0	26.2 NP	8.0 NP	13.0 26.5	s(CL) 97.2 SP-SM 91.9	SC 97.2 SP 96.9 SP/SM 91.9 No Rec 86.9 SP/SM	Fill Qal	***0.0 to 4.0 feet*** ***FILL (Fill)*** **0.0 to 4.0 ft.: CLAYEY SAND, SC:** About 65% fine sand; about 35% fines with low plasticity; maximum size: fine sand; moist, dark brown; moderately soft consistency; disturbed fill. Laboratory Data Interval 3.0 to 4.0 ft. ***4.0 to 29.3 feet*** ***QUATERNARY ALLUVIUM (Qal)*** **4.0 to 4.3 ft.: POORLY GRADED SAND, SP :** About 95% fine sand; about 5% non-plastic fines; maximum size: fine sand; dry, tan; soft consistency. **4.3 to 9.3 ft.: POORLY GRADED SAND WITH SILT, SP/SM :**About 90% fine sand; about 10% non-plastic fines; maximum size: fine sand; dry, tan; soft consistency; stratified with reddish brown oxidation layers. Laboratory Data Interval 8.3 to 9.3 ft. **9.3 to 14.3 ft.: No Recovery:** **14.3 to 19.3 ft.: No Recovery - POORLY GRADED SAND WITH SILT, SP/SM:** Description based on soil recovered in shoe and drilling conditions. **19.3 to 24.3 ft.: SANDY LEAN CLAY, s(CL):** About 65% fines with medium plasticity; about 35% fine to coarse, hard, sub-angular sand; maximum size: coarse sand; wet to moist, dark olive; soft consistency. **24.3 to 29.3 ft.: SILTY CLAY, CL/ML:** About 90% fines with low plasticity and toughness, rapid dilatancy; about 10% fine sand; maximum size: fine sand; wet to moist, olive brown, strong reaction with HCl; firm consistency; abundant calcium carbonate veins, clay balls some greater than 1-inch in diameter. Laboratory Data Interval 27.0 to 28.0 ft. **T.D.= 29.3 ft.**

COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-plastic
NR = No Recovery
NA = Not applicable
I.D. = inner diameter
RM = River Mile
O.D. = outer diameter
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

RECLAMATION
Managing Water in the West

PROJECT DATABASE: SJRRP.GPJ
REPORT: SJRRP DRILL HOLE

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-97

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River right, RM 167
BEGUN: 4/16/10 FINISHED: 4/16/10
WATER LEVEL DEPTH AND ELEVATION: NA
DATE WATER LEVEL WAS MEASURED: NA

PROJECT: San Joaquin River Restoration Program
COORDINATES: N 2,294,443.5 E 6,091,007.0 (NAGD83)
TOTAL DEPTH: 29.3 ft.

STATE: California
GROUND SURFACE ELEVATION: 101.2 ft. (NAVD88)
T.O.C ELEVATION: 103.7 ft. (NAVD88)
HOLE LOGGED BY: A. Warren
REVIEWED BY: J. Vauk

NOTES	DEPTH	% CORE RECOVERY	LABORATORY DATA: % SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION / ELEVATION	VISUAL CLASSIFICATION / ELEVATION	GEOLOGIC UNIT SYMBOL	CLASSIFICATION AND PHYSICAL CONDITION
		0										SP/SM		
												81.9		
	20	22										s(CL)	Qal	
												76.9		
	25	100										CL/ML		
			50.4	39.7	90.1	9.9	0.0	37.2	18.4	28.7	CL 73.2			
												71.9		

BOTTOM OF HOLE

COMMENTS:

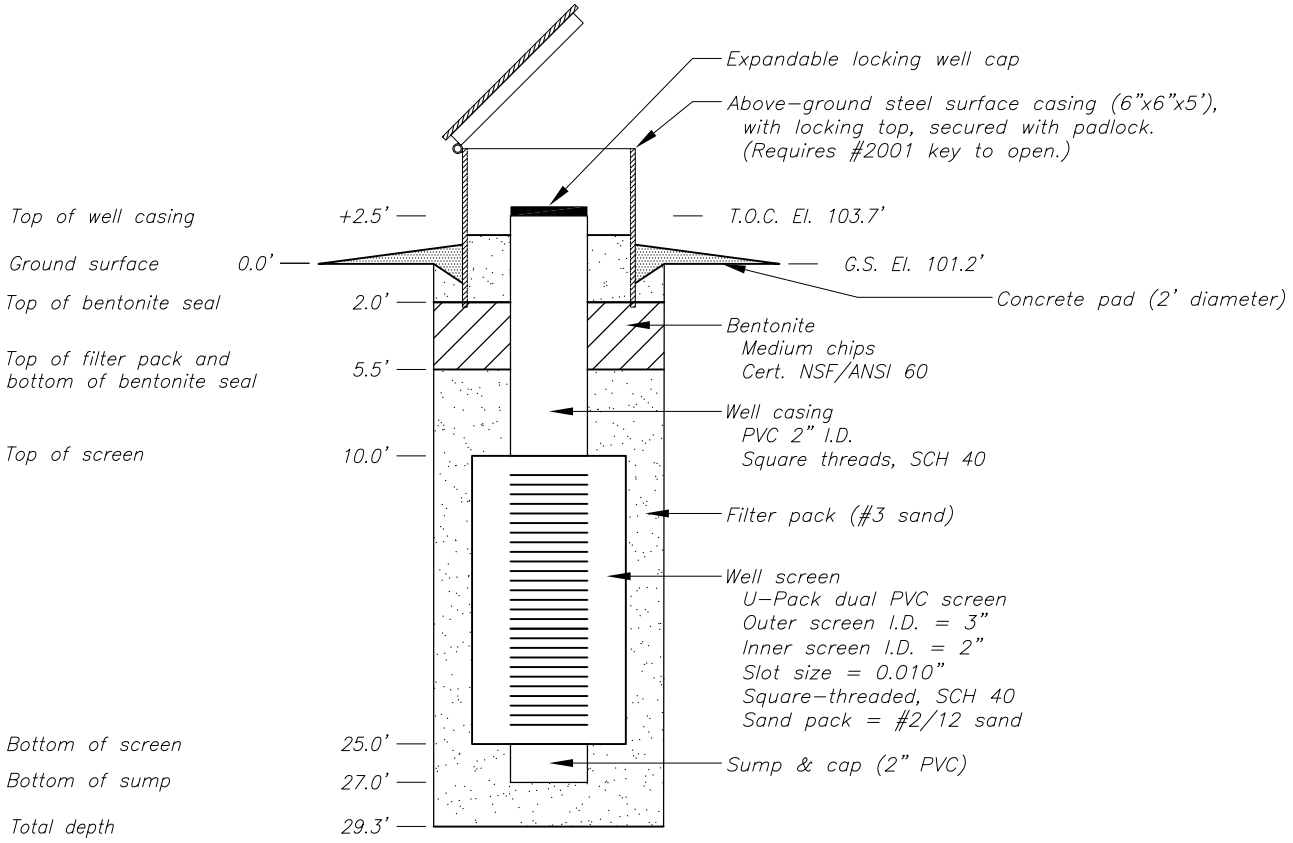
FADC = Flight Auger Dry Core
NP = Non-plastic
NR = No Recovery
NA = Not applicable
I.D. = inner diameter
RM = River Mile
O.D. = outer diameter
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

RECLAMATION
Managing Water in the West

PROJECT DATABASE: SJRRP.GPJ
REPORT: SJRRP DRILL HOLE

MW–10–97	GEOLOGIST: A. WARREN
WELL COMPLETION DIAGRAM	DRILLER: G. HANSEN
DATE COMPLETED: 4/16/2010	HELPER: C. KELLY, K. KREITZ
TOP OF WELL CASING COORDINATES: N2294443.5 E6091007.0 (NAD83) ELEVATION 103.7' (NAVD88) GROUND SURFACE ELEVATION 101.2' (NAVD88)	



NOT TO SCALE

NOTES:
T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, El. = Elevation
#3 Sand backfills the well above the top of the bentonite seal.

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-98

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Left, RM 167
BEGUN: 3/31/10 FINISHED: 3/31/10
WATER LEVEL DEPTH AND ELEVATION: NA
DATE WATER LEVEL WAS MEASURED: NA

PROJECT: San Joaquin River Restoration Program
COORDINATES: N 2,293,516.2 E 6,091,162.9 (NAGD83)
TOTAL DEPTH: 31.2 ft.

STATE: California
GROUND SURFACE ELEVATION: 102.2 ft. (NAVD88)
T.O.C ELEVATION: 105.1 ft. (NAVD88)
HOLE LOGGED BY: J. Vauk
REVIEWED BY: A. Warren

NOTES	DEPTH	% CORE RECOVERY	LABORATORY DATA: % SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION / ELEVATION	VISUAL CLASSIFICATION / ELEVATION	GEOLOGIC UNIT SYMBOL	CLASSIFICATION AND PHYSICAL CONDITION
ALL MEASUREMENTS ARE IN FEET FROM THE GROUND SURFACE. **PURPOSE OF HOLE:** To recover core, collect data to determine geologic and hydrologic site conditions, and install a groundwater monitoring well. **LOCATION:** Reach 4B1, RM 167, river left, about 160 feet south from the center of the SJR, about 1 mile west of the intersection of Indian Road and the SJR. **DRILLED BY:** PN-Regional Drill Crew Jerry Hansen, Driller Cody Kelly, Helper Ken Kreitz, Helper **DRILL RIG:** Central Mining Equipment 75 drill rig (CME-75) **DRILLING & SAMPLING METHODS:** Drill hole MW-10-98 was advanced using hollow stem flight augers with a continuous dry core sampling system (FADC) from the ground surface to a total depth of 31.2 feet. FADC uses 7-5/8-inch O.D., 4-1/4-inch I.D. hollow stem augers, with a 5-foot-long, 3-inch I.D. split sample barrel. Interval Method 0.0 to 31.2 ft. - FADC **DRILLING CONDITIONS AND DRILLER'S COMMENTS:** 0.0 to 8.7 ft. smooth drilling, very soft 8.7 to 31.2 ft. soft, wet to very wet **CAVING CONDITIONS:** None **DRILL FLUID, RETURN AND COLOR:** 0.0 to 8.7 ft. None 8.7 to 31.2 ft. Water, no return **WATER LEVEL:** Not measured **REASON FOR HOLE TERMINATION:** The hole was terminated upon successful completion to the target depth. **HOLE COMPLETION:** Well Casing: +2.9 to 9.0 ft. (T.O.C. El. 105.1 ft.) Dual U-pack Screen: 9.0 to 24.0 ft. (Slotted 0.010-inch) Well Screen Filter Pack: 2/12 Sand Filter Pack: 8.4 to 26.0 ft. (#3 Sand) Sump: 24.0 to 26.0 ft. (2-inch blank PVC with cap) Bottom Backfill: 26.0 to 31.2 ft. (Bentonite) Bentonite Seal: 1.0 to 8.4 ft. Well Completion: Steel surface	5 10 15	57 100 100 34 0	39.9 40.9 6.2	12.4 18.0 1.5	52.3 58.9 7.7	47.7 41.1 92.3	0.0 0.0 0.0	NP NP NP	NP NP NP	21.5 25.8 24.2	s(ML) 95.7 s(ML) 89.2 SP-SM 83.7	s(CL) 98.8 CL 98.0 s(ML) 95.6 CL 94.8 s(CL/ML) 89.0 SM 83.5 SM	Fill Qal	***0.0 to 3.4 feet*** ***FILL (Fill)*** **0.0 to 3.4 ft.: SANDY LEAN CLAY, s(CL):** About 60% fine sand; about 40% fines with medium plasticity, toughness and dry strength, slow dilatancy; maximum size: fine sand; dry, medium brown, no reaction to HCl; soft consistency; organics; fill embankment material. ***3.4 to 31.2 feet*** ***QUATERNARY ALLUVIUM (Qal)*** **3.4 to 4.2 ft.: LEAN CLAY, CL:** About 90% fines with medium to high plasticity, medium toughness and dry strength, no dilatancy; about 10% fine sand; maximum size: fine sand; moist, dark brown, no reaction to HCl; soft consistency. **4.2 to 6.6 ft.: SANDY SILT, s(ML):** About 65% non-plastic fines with rapid dilatancy; about 35% fine sand; maximum size: fine sand; moist, light brown, no reaction to HCl; soft consistency. Laboratory Data Interval 4.3 to 6.5 ft. **6.6 to 7.4 ft.: LEAN CLAY, CL:** About 90% fines with medium plasticity, toughness and dry strength, no dilatancy; about 10% fine sand; maximum size: fine sand; moist, dark brown, no reaction to HCl; firm consistency. **7.4 to 13.2 ft.: SANDY SILTY CLAY, s(CL/ML):** About 60% fines with medium plasticity, low toughness, medium dry strength, rapid dilatancy; about 40% fine sand; maximum size: fine sand; moist, brown, no reaction to HCl; soft consistency. Laboratory Data Interval 8.0 to 13.0 ft. **13.2 to 18.7 ft.: SITLY SAND, SM:** About 70% fine to medium sand; about 30% non-plastic fines with rapid dilatancy; maximum size: medium sand; wet, greenish brown, no reaction to HCl; soft consistency; black organic material encountered at bottom of depth interval, material was recovered disturbed by drilling action. Laboratory Data Interval 13.5 to 18.5 ft. **18.7 to 23.7 ft.: No Recovery - SILTY SAND, SM:** Description based on drilling action. **23.7 to 24.1 ft.: SILTY SAND, SM:** About 75% fine to medium sand; about 25% non-plastic fines with rapid dilatancy; maximum size: medium sand; wet, gray, no reaction to HCl; soft consistency. Laboratory Data Interval 23.8 to 24.0 ft. **24.1 to 28.7 ft.: SANDY LEAN CLAY, s(CL):** About 65 to 70% fines with medium to high plasticity, medium toughness and dry strength, no to slow dilatancy; about 30 to 35% fine to medium sand; maximum size: medium sand; moist, greenish brown, no reaction to HCl; firm consistency.

COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-plastic
NR = No Recovery
NA = Not applicable
I.D. = inner diameter
RM = River Mile
O.D. = outer diameter
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

RECLAMATION
Managing Water in the West

PROJECT DATABASE: SJRRP.GPJ
REPORT: SJRRP DRILL HOLE

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-98

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Left, RM 167
BEGUN: 3/31/10 FINISHED: 3/31/10
WATER LEVEL DEPTH AND ELEVATION: NA
DATE WATER LEVEL WAS MEASURED: NA

PROJECT: San Joaquin River Restoration Program
COORDINATES: N 2,293,516.2 E 6,091,162.9 (NAGD83)
TOTAL DEPTH: 31.2 ft.

STATE: California
GROUND SURFACE ELEVATION: 102.2 ft. (NAVD88)
T.O.C ELEVATION: 105.1 ft. (NAVD88)
HOLE LOGGED BY: J. Vauk
REVIEWED BY: A. Warren

NOTES	DEPTH	% CORE RECOVERY	LABORATORY DATA: % SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION / ELEVATION	VISUAL CLASSIFICATION / ELEVATION	GEOLOGIC UNIT SYMBOL	CLASSIFICATION AND PHYSICAL CONDITION
casing with locking top, square 6-inches-wide and 5-foot-long.	0	0										SM 78.5		Laboratory Data Interval 24.3 to 26.7 ft.
			11.9	9.0	20.9	79.1	0.0	NP	NP	19.2	SM 78.2	SM 78.1		**28.7 to 31.2 ft.: LEAN CLAY, CL:** About 90% fines with high plasticity, toughness and dry strength, no dilatancy; about 10% fine sand; maximum size: fine sand; greenish brown, no reaction to HCl; firm consistency.
	25	100	27.1	39.4	66.5	33.5	0.0	32.6	18.3	21.7	s(CL) 75.5	s(CL) 73.5	Qal	**T.D. = 31.2 ft.**
	30	100										CL 71.0		

BOTTOM OF HOLE

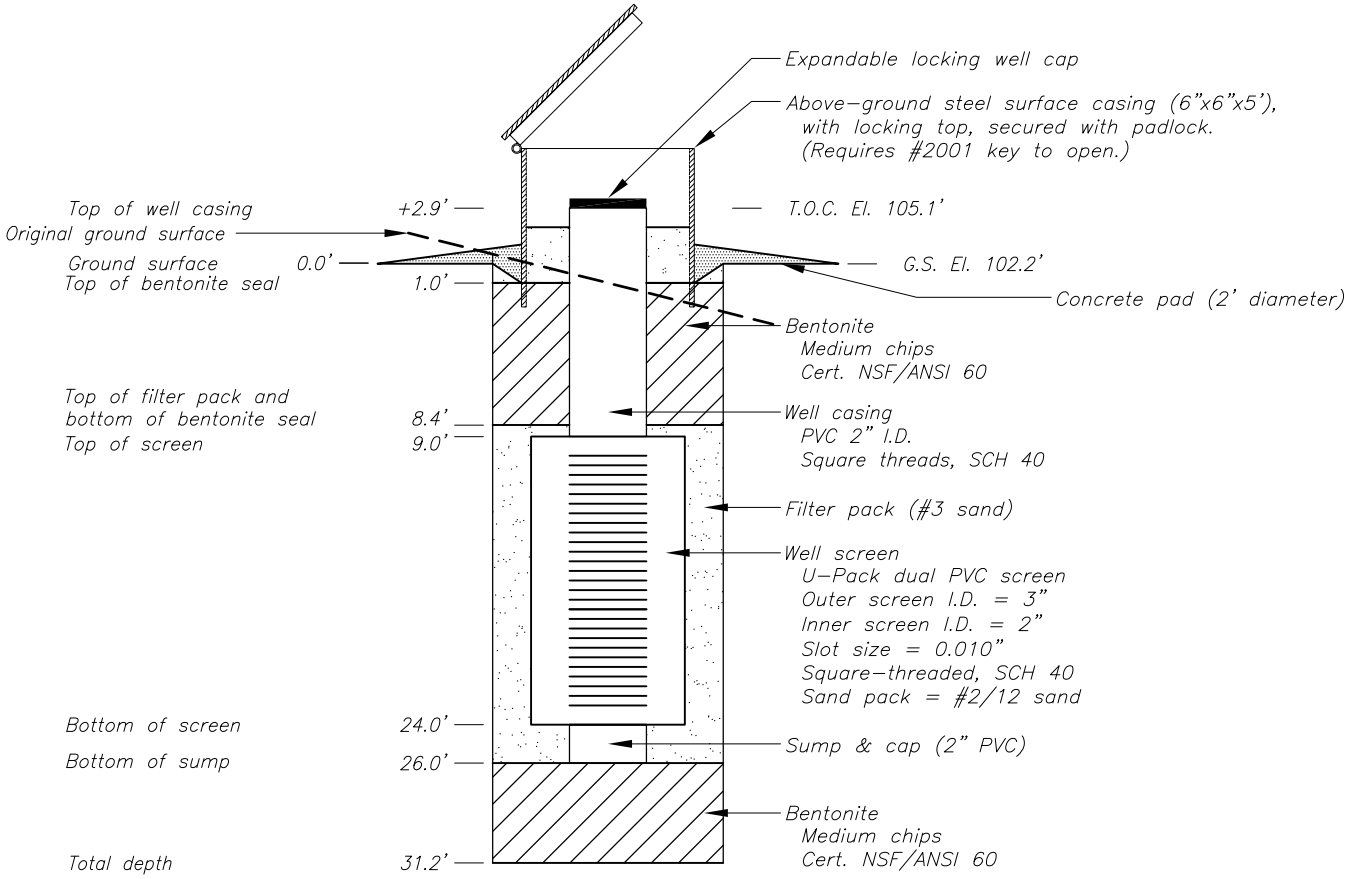
COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-plastic
NR = No Recovery
NA = Not applicable
I.D. = inner diameter
RM = River Mile
O.D. = outer diameter
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

RECLAMATION Managing Water in the West

MW–10–98	GEOLOGIST: J. VAUK
WELL COMPLETION DIAGRAM	DRILLER: G. HANSEN
DATE COMPLETED: 3/31/2010	HELPER: C. KELLY, K. KREITZ
TOP OF WELL CASING COORDINATES: N2293516.2 E6091162.9 (NAD83) ELEVATION 105.1' (NAVD88) GROUND SURFACE ELEVATION 102.2' (NAVD88)	



NOT TO SCALE

NOTES:
T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, El. = Elevation
#3 Sand backfills the well above the top of the bentonite seal.

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-99

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Left, RM 167
BEGUN: 4/1/10 FINISHED: 4/1/10
WATER LEVEL DEPTH AND ELEVATION: 7.2 ft. (El. 97.1 ft.)
DATE WATER LEVEL WAS MEASURED: 4/2/2010

PROJECT: San Joaquin River Restoration Program
COORDINATES: N 2,292,632.1 E 6,090,051.8 (NAGD83)
TOTAL DEPTH: 28.7 ft.

STATE: California
GROUND SURFACE ELEVATION: 104.3 ft. (NAVD88)
T.O.C ELEVATION: 107.1 ft. (NAVD88)
HOLE LOGGED BY: J. Vauk
REVIEWED BY: A. Warren

ALL MEASUREMENTS ARE IN FEET FROM THE GROUND SURFACE.

PURPOSE OF HOLE:
To recover core, collect data to determine geologic and hydrologic site conditions, and install a groundwater monitoring well.

LOCATION:
Reach 4B1, RM 167, river left, about 1,420 feet southwest of the center of the SJR, about 1.2 miles west of the intersection of Indiana Avenue and the SJR.

DRILLED BY:
PN-Regional Drill Crew
Jerry Hansen, Driller
Cody Kelly, Helper
Ken Kreitz, Helper

DRILL RIG:
Central Mining Equipment 75 drill rig (CME-75)

DRILLING & SAMPLING METHODS:
Drill hole MW-10-99 was advanced using hollow stem flight augers with a continuous dry core sampling system (FADC) from the ground surface to a total depth of 28.7 feet. FADC uses 7-5/8-inch O.D., 4-1/4-inch I.D. hollow stem augers, with a 5-foot-long, 3-inch I.D. split sample barrel.

Interval Method
0.0 to 28.7 ft. - FADC

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
0.0 to 3.7 ft. smooth drilling, soft
3.7 to 18.7 ft. very wet, add water
18.7 to 23.7 ft. moved sampler out to 0.4 ft.
23.7 to 27.6 ft. refusal, moved sampler in 0.2 ft.
27.6 to 28.7 ft. firm

CAVING CONDITIONS:
None

DRILL FLUID, RETURN AND COLOR:
0.0 to 3.7 ft. None
3.7 to 28.7 ft. Water, no return

WATER LEVEL:
7.2 ft. b.g.s. on 4/2/2010

REASON FOR HOLE TERMINATION:
The hole was terminated upon successful completion to the target depth.

DEPTH	% CORE RECOVERY	% SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION	ELEVATION	VISUAL CLASSIFICATION	ELEVATION	GEOLOGIC UNIT SYMBOL
	81	30.6	27.7	58.3	41.7	0.0	34.9	15.4	17.9	s(CL)	99.8	(CL/ML)s	99.4	
5	34	40.9	28.5	69.4	30.6	0.0	27.7	10.8	19.5	s(CL)	95.8	s(CL)	95.6	Qal
	88											(CL/ML)s	95.3	
												CL		

0.0 to 28.7 feet
QUATERNARY ALLUVIUM (Qal)

0.0 to 4.9 ft.: SILTY CLAY WITH SAND, (CL/ML)s: About 80% fines with high plasticity, low toughness, very high dry strength, no dilatancy; about 20% fine sand; maximum size: fine sand; dry, dark brown, strong reaction to HCl; soft consistency.

Laboratory Data Interval
1.0 to 4.5 ft.

4.9 to 8.7 ft.: SANDY LEAN CLAY, s(CL): About 70% fines with medium plasticity and toughness, very high dry strength, no dilatancy; about 30% fine sand; maximum size: fine sand; moist, light brown, strong reaction to HCl; soft consistency.

Laboratory Data Interval
5.5 to 8.5 ft.

8.7 to 9.0 ft.: SILTY CLAY WITH SAND, (CL/ML)s: About 85% fines with medium plasticity and toughness, very high dry strength, no dilatancy; about 15% fine sand; maximum size: fine sand; wet, light brown, strong reaction to HCl; soft consistency.

9.0 to 11.9 ft.: LEAN CLAY, CL: About 90-95% fines with high plasticity, medium toughness, high dry strength, no dilatancy; about 5-10% fine sand; maximum size: fine sand; moist, medium brown, strong reaction to HCl; firm consistency.

11.9 to 18.7 ft.: INTERBEDDED - LEAN CLAY WITH SAND, (CL)s AND SANDY LEAN CLAY, s(CL): About 60 to 80% fines with high plasticity and toughness, very high dry strength, no dilatancy; about 20 to 40% fine sand; maximum size: fine sand; moist, medium brown, no to weak reaction to HCl; hard consistency; strong reaction to HCl from 13.7 to 17.6 ft; layers are 0.1 to 0.3-foot-thick.

Laboratory Data Interval
12.2 to 18.5 ft.

18.7 to 21.2 ft.: LEAN CLAY, CL: About 95% fines with medium plasticity and toughness, high dry strength, no dilatancy; about 5% fine sand; maximum size: fine sand; moist, dark brown, no reaction to HCl; soft consistency.

Laboratory Data Interval
18.9 to 21.0 ft.

21.2 to 23.6 ft.: FAT CLAY, CH: About 95% fines with high plasticity, medium toughness, very high dry strength, no dilatancy; about 5% fine sand; maximum size: fine sand; medium brown, no reaction to HCl; hard consistency.

Laboratory Data Interval
21.5 to 23.3 ft.

23.6 to 24.9 ft.: SILTY SAND, SM: About 85% fine to medium sand; about 15% fines with low plasticity and toughness, medium dry strength, rapid dilatancy; maximum size: medium sand; wet, light brown, no reaction to HCl; hard consistency.

Laboratory Data Interval
23.9 to 24.7 ft.

COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-plastic
NR = No Recovery
NA = Not applicable
I.D. = inner diameter
RM = River Mile
O.D. = outer diameter
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

RECLAMATION
Managing Water in the West

PROJECT DATABASE: SJRRP.GPJ
REPORT: SJRRP DRILL HOLE

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-99

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Left, RM 167
BEGUN: 4/1/10 FINISHED: 4/1/10
WATER LEVEL DEPTH AND ELEVATION: 7.2 ft. (El. 97.1 ft.)
DATE WATER LEVEL WAS MEASURED: 4/2/2010

PROJECT: San Joaquin River Restoration Program
COORDINATES: N 2,292,632.1 E 6,090,051.8 (NAGD83)
TOTAL DEPTH: 28.7 ft.

STATE: California
GROUND SURFACE ELEVATION: 104.3 ft. (NAVD88)
T.O.C ELEVATION: 107.1 ft. (NAVD88)
HOLE LOGGED BY: J. Vauk
REVIEWED BY: A. Warren

NOTES	DEPTH	% CORE RECOVERY	LABORATORY DATA: % SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION / ELEVATION	VISUAL CLASSIFICATION / ELEVATION	GEOLOGIC UNIT SYMBOL	CLASSIFICATION AND PHYSICAL CONDITION
		88										CL		**24.9 to 27.5 ft.: <u>SANDY LEAN CLAY, s(CL)</u>:** About 60% fines with medium plasticity, toughness and dry strength, slow dilatancy; about 40% fine to medium sand; maximum size: medium sand; moist, brown, no reaction to HCl; firm consistency; greater percentage of medium sand from 26.8 to 27.0 feet.
												92.4		<u>Laboratory Data Interval</u> 25.1 to 27.2 ft.
														27.5 to 28.7 ft.: <u>POORLY GRADED SAND WITH CLAY, SP/SC</u>: About 90% fine to medium sand; about 10% fines with low plasticity and rapid dilatancy; maximum size: medium sand; wet, medium brown, no reaction to HCl; soft consistency.
														T.D.=28.7 ft.
	15		44.8	36.9	81.7	18.3	0.0	33.4	16.3	25.4	(CL)s	(CL)s - s(CL)	Qal	
		100									85.8			
												85.6		
		100	62.3	30.8	93.1	6.9	0.0	33.6	14.3	26.5	CL	CL		

COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-plastic
NR = No Recovery
NA = Not applicable
I.D. = inner diameter
RM = River Mile

O.D. = outer diameter
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

RECLAMATION
Managing Water in the West

REPORT: SJRRP DRILL HOLE
PROJECT DATABASE: SJRRP.GPJ

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-99

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Left, RM 167
BEGUN: 4/1/10 FINISHED: 4/1/10
WATER LEVEL DEPTH AND ELEVATION: 7.2 ft. (El. 97.1 ft.)
DATE WATER LEVEL WAS MEASURED: 4/2/2010

PROJECT: San Joaquin River Restoration Program
COORDINATES: N 2,292,632.1 E 6,090,051.8 (NAGD83)
TOTAL DEPTH: 28.7 ft.

STATE: California
GROUND SURFACE ELEVATION: 104.3 ft. (NAVD88)
T.O.C ELEVATION: 107.1 ft. (NAVD88)
HOLE LOGGED BY: J. Vauk
REVIEWED BY: A. Warren

NOTES	DEPTH	% CORE RECOVERY	LABORATORY DATA: % SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION / ELEVATION	VISUAL CLASSIFICATION / ELEVATION	GEOLOGIC UNIT SYMBOL	CLASSIFICATION AND PHYSICAL CONDITION
											83.3	83.1		
		100												
			47.8	41.6	89.4	10.6	0.0	37.6	19.4	25.0	CL / 81.0	CH / 80.7		
			8.3	6.8	15.1	84.9	0.0	NP	NP	16.3	SM / 79.6	SM / 79.4	Qal	
	25													
		100	31.5	22.2	53.7	46.3	0.0	23.9	9.0	16.4	s(CL) / 77.1	s(CL) / 76.8		
		100										SP/SC / 75.6		

BOTTOM OF HOLE

COMMENTS:

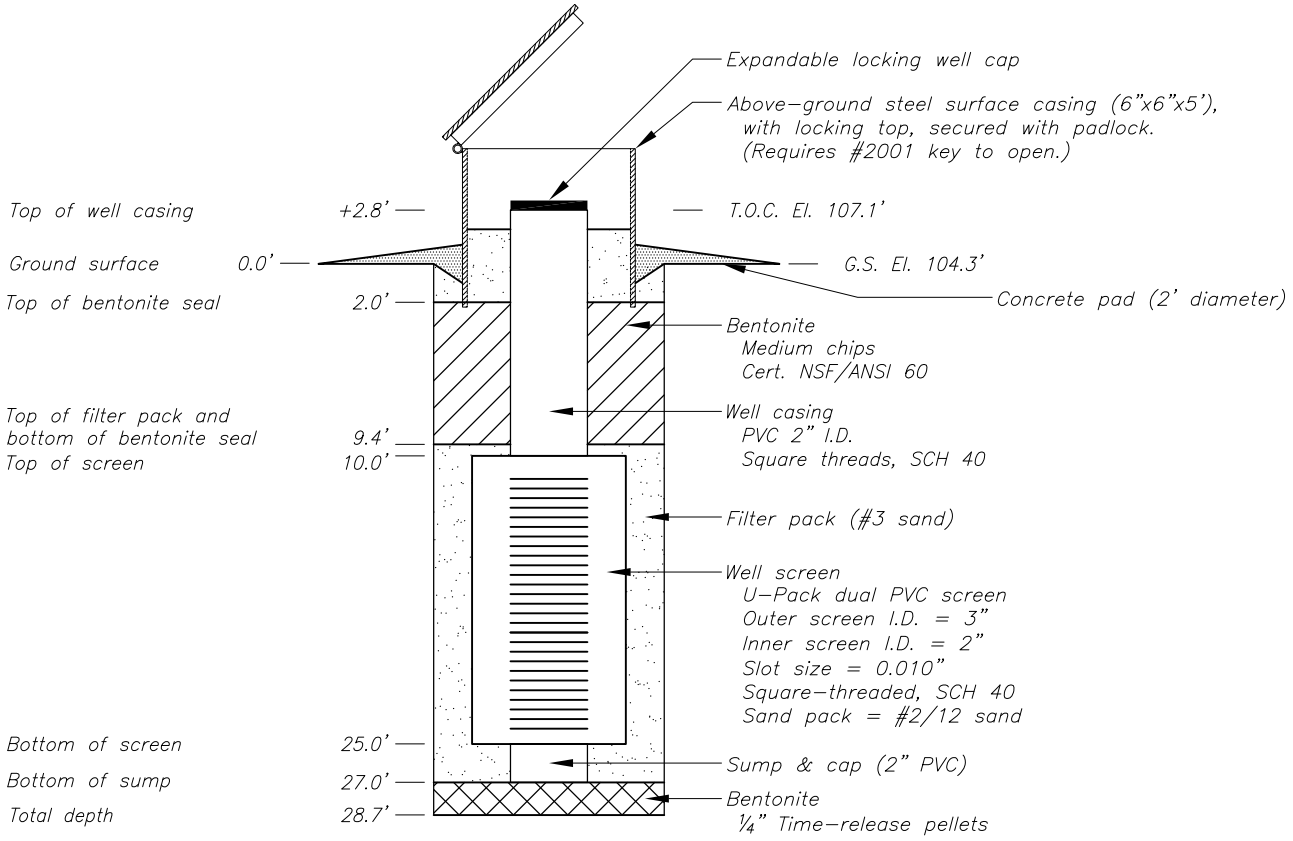
FADC = Flight Auger Dry Core
NP = Non-plastic
NR = No Recovery
NA = Not applicable
I.D. = inner diameter
RM = River Mile
O.D. = outer diameter
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

RECLAMATION
Managing Water in the West

REPORT: SJRRP DRILL HOLE
PROJECT DATABASE: SJRRP.GPJ

MW–10–99	GEOLOGIST: J. VAUK
WELL COMPLETION DIAGRAM	DRILLER: G. HANSEN
DATE COMPLETED: 4/01/2010	HELPER: C. KELLY, K. KREITZ
TOP OF WELL CASING COORDINATES: N2292632.1 E6090051.8 (NAD83) ELEVATION 107.1' (NAVD88) GROUND SURFACE ELEVATION 104.3' (NAVD88)	



NOT TO SCALE

NOTES:
T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, El. = Elevation
#3 Sand backfills the well above the top of the bentonite seal.

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-100

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Left, RM 167
BEGUN: 4/2/10 FINISHED: 4/2/10
WATER LEVEL DEPTH AND ELEVATION: NA
DATE WATER LEVEL WAS MEASURED: NA

PROJECT: San Joaquin River Restoration Program
COORDINATES: N 2,291,486.3 E 6,088,856.0 (NAGD83)
TOTAL DEPTH: 31.7 ft.

STATE: California
GROUND SURFACE ELEVATION: 102.7 ft. (NAVD88)
T.O.C ELEVATION: 105.6 ft. (NAVD88)
HOLE LOGGED BY: J. Vauk
REVIEWED BY: A. Warren

ALL MEASUREMENTS ARE IN FEET FROM THE GROUND SURFACE.

PURPOSE OF HOLE:
To recover core, collect data to determine geologic and hydrologic site conditions, and install a groundwater monitoring well.

LOCATION:
Reach 4B1, RM 167, river left, about 3,070 feet southwest of the center of the SJR, about 1.4 miles west-southwest of the intersection of Indiana Avenue and the SJR.

DRILLED BY:
PN-Regional Drill Crew
Jerry Hansen, Driller
Cody Kelly, Helper
Ken Kreitz, Helper

DRILL RIG:
Central Mining Equipment 75 drill rig (CME-75)

DRILLING & SAMPLING METHODS:
Drill hole MW-10-100 was advanced using hollow stem flight augers with a continuous dry core sampling system (FADC) from the ground surface to a total depth of 31.7 feet. FADC uses 7-5/8-inch O.D., 4-1/4-inch I.D. hollow stem augers, with a 5-foot-long, 3-inch I.D. split sample barrel.

Interval Method
0.0 to 31.7 ft. - FADC

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
0.0 to 14.2 ft. smooth drilling
14.2 to 24.2 ft. moved sampler out to 0.3 ft.
24.2 to 31.7 ft. moved sampler in 0.2 ft.

CAVING CONDITIONS:
Soil caved from the borehole wall from 30.8 to 31.7 ft.

DRILL FLUID, RETURN AND COLOR:
0.0 to 14.2 ft. None
14.2 to 31.7 ft. Water, no return

WATER LEVEL:
Not measured

REASON FOR HOLE TERMINATION:
The hole was terminated upon successful completion to the target depth.

HOLE COMPLETION:
Well Casing: +2.9 to 13.8 ft. (T.O.C. El. 105.6 ft.)
Dual U-pack Screen: 13.8 to 28.8 ft. (Slotted 0.010-inch)
Well Screen Filter Pack: 2/12 Sand
Filter Pack: 12.8 to 30.8 ft. (#3 Sand)
Sump: 28.8 to 30.8 ft. (2-inch blank PVC with cap)

DEPTH	% CORE RECOVERY	% SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION	ELEVATION	VISUAL CLASSIFICATION	ELEVATION	GEOLOGIC UNIT SYMBOL
	45	29.2	27.2	56.4	43.6	0.0	29.7	13.7	15.4	s(CL)	97.8	s(CL)	97.6	
5	76	28.4	26.0	54.4	45.6	0.0	26.0	11.2	16.3	s(CL)	93.7	s(CH)	93.5	
10	76	13.2	6.5	19.7	80.3	0.0	NP	NP	18.2	SM	90.3	SC	90.1	Qal
												(ML)s	89.7	
												SC	88.5	
15	48	5.5	1.0	6.5	93.5	0.0	NP	NP	22.9	SP-SM	86.7	SP/SM	86.5	
												SC	83.0	
												ML	82.7	

0.0 to 31.7 feet
QUATERNARY ALLUVIUM (Qal)

0.0 to 5.1 ft.: SANDY LEAN CLAY, s(CL): About 55% fines with medium plasticity, low toughness, high dry strength, slow dilatancy; about 45% fine sand; maximum size: fine sand; dry, dark brown, no reaction to HCl; soft consistency.

Laboratory Data Interval
2.0 to 4.9 ft.

5.1 to 9.2 ft.: SANDY FAT CLAY, s(CH): About 60% fines with high plasticity and toughness, very high dry strength, no dilatancy; about 40% fine sand; maximum size: fine sand; moist, light orange brown, no reaction to HCl; firm consistency.

Laboratory Data Interval
5.3 to 9.0 ft.

9.2 to 12.6 ft.: CLAYEY SAND, SC: About 55% fine sand with traces of medium sand; about 45% fines with low plasticity, toughness, and dry strength, rapid dilatancy; maximum size: medium sand; wet, light brown.

Laboratory Data Interval
9.5 to 12.4 ft.

12.6 to 13.0 ft.: SILT WITH SAND, (ML)s: About 80% fines with low plasticity and toughness, very high dry strength, rapid dilatancy; about 20% fine sand; maximum size: fine sand; wet, light orange brown, no reaction to HCl; firm consistency.

13.0 to 14.2 ft.: No Recovery - CLAYEY SAND, SC: Description based on drilling conditions; fine grained material at 13.0 feet acts as a plug and SC material pushed out into formation.

14.2 to 16.2 ft.: POORLY GRADED SAND WITH SILT, SP/SM: About 90% fine to medium sand; about 10% non-plastic fines with rapid dilatancy; maximum size: medium sand; wet, light brown, no reaction to HCl; soft consistency; material is recovered disturbed by drilling action.

Laboratory Data Interval
14.5 to 16.0 ft.

16.2 to 19.7 ft.: CLAYEY SAND, SC: About 70% fine sand; about 30% fines with low plasticity and toughness, medium dry strength, slow dilatancy; maximum size: fine sand; moist, medium brown, no reaction to HCl; firm consistency; no recovery from 16.6 to 19.2 feet.

19.7 to 20.0 ft.: SILT, ML: About 90% non-plastic fines with rapid dilatancy; about 10% fine to medium sand; maximum size: medium sand; moist, brown, no reaction to HCl; firm consistency.

20.0 to 23.4 ft.: SILTY SAND, SM: About 80-85% fine to medium sand with traces of coarse sand; about 15-20% non-plastic fines with rapid dilatancy; maximum size: coarse sand; wet, brown, no reaction to HCl; soft consistency; core loss likely.

COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-plastic
NR = No Recovery
NA = Not applicable
I.D. = inner diameter
RM = River Mile
O.D. = outer diameter
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

RECLAMATION
Managing Water in the West

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-100

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Left, RM 167
BEGUN: 4/2/10 FINISHED: 4/2/10
WATER LEVEL DEPTH AND ELEVATION: NA
DATE WATER LEVEL WAS MEASURED: NA

PROJECT: San Joaquin River Restoration Program
COORDINATES: N 2,291,486.3 E 6,088,856.0 (NAGD83)
TOTAL DEPTH: 31.7 ft.

STATE: California
GROUND SURFACE ELEVATION: 102.7 ft. (NAVD88)
T.O.C ELEVATION: 105.6 ft. (NAVD88)
HOLE LOGGED BY: J. Vauk
REVIEWED BY: A. Warren

NOTES	DEPTH	% CORE RECOVERY	LABORATORY DATA: % SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION / ELEVATION	VISUAL CLASSIFICATION / ELEVATION	GEOLOGIC UNIT SYMBOL	CLASSIFICATION AND PHYSICAL CONDITION
Bottom Backfill: 30.8 to 31.7 ft. (soil caved from borehole wall) Bentonite Seal: 2.0 to 12.8 ft. Well Completion: Steel surface casing with locking top, square 6-inches-wide and 5-foot-long.		60	10.8	4.2	15.0	84.5	0.5	NP	NP	18.9	SM 79.5	SM 79.3		Laboratory Data Interval 20.2 to 23.2 ft. **23.4 to 24.2 ft.: SANDY SILT, s(ML):** About 55% non-plastic fines with rapid dilatancy; about 45% fine sand; maximum size: fine sand; wet, light brown, no reaction to HCl; soft to firm consistency. **24.2 to 29.7 ft.: SILTY SAND, SM:** About 85% fine sand; about 15% non-plastic fines with rapid dilatancy; maximum size: fine sand; wet, light brown, no reaction to HCl; soft consistency.
												s(ML) 78.5		
	25	42	15.2	6.2	21.4	77.3	1.3	NP	NP	18.6	SM 73.2	SM 73.0	Qal	Laboratory Data Interval 24.5 to 29.5 ft. **29.7 to 31.7 ft.: SILT WITH SAND, (ML)s:** About 80% non-plastic fines with rapid dilatancy; about 20% fine sand; maximum size: fine sand; wet, light brown, no reaction to HCl; soft consistency. **T.D. = 31.7 ft.**
	30	100										(ML)s 71.0		
											BOTTOM OF HOLE			

COMMENTS:

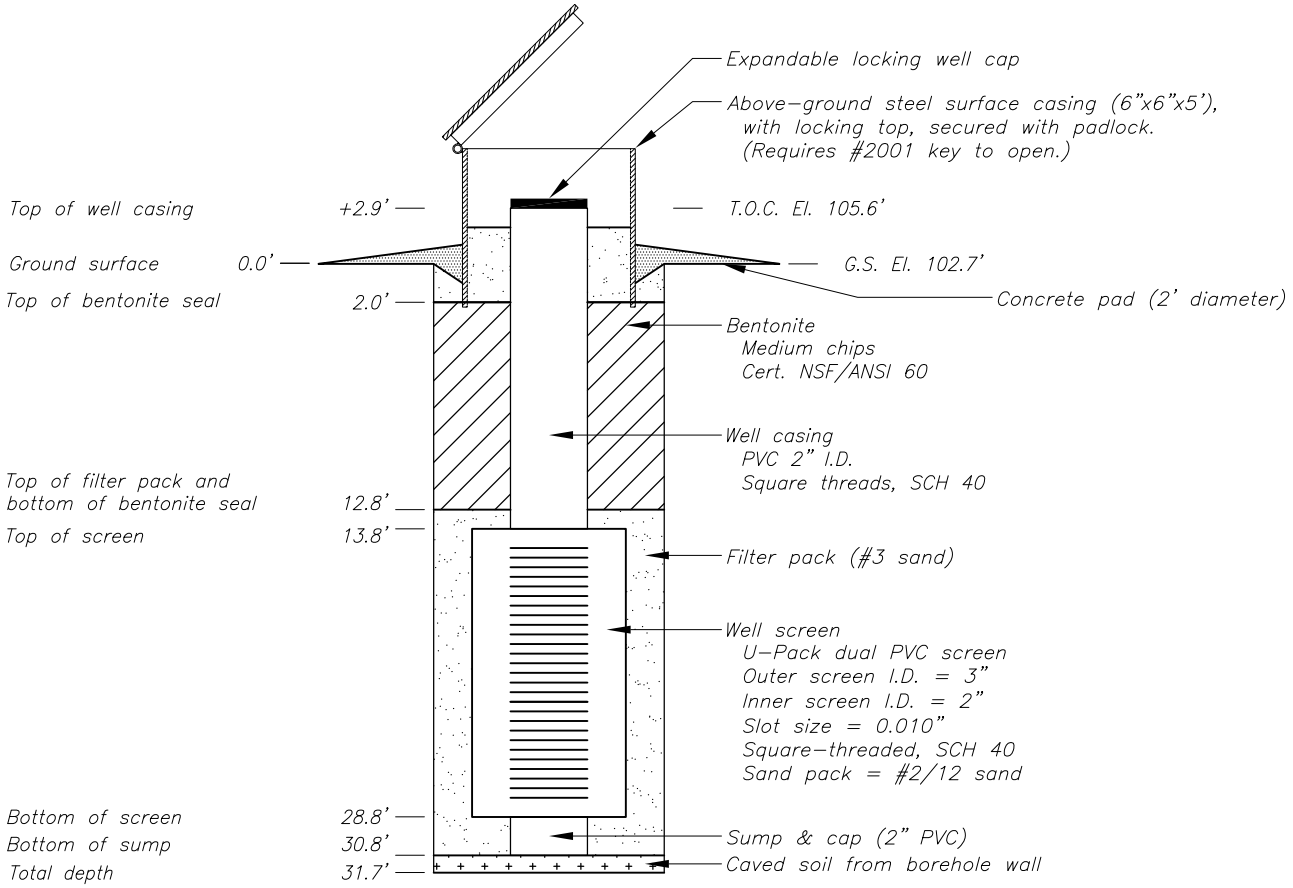
FADC = Flight Auger Dry Core
NP = Non-plastic
NR = No Recovery
NA = Not applicable
I.D. = inner diameter
RM = River Mile

O.D. = outer diameter
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

RECLAMATION
Managing Water in the West

MW–10–100	GEOLOGIST: J. VAUK
WELL COMPLETION DIAGRAM	DRILLER: G. HANSEN
DATE COMPLETED: 4/02/2010	HELPER: C. KELLY, K. KREITZ
TOP OF WELL CASING COORDINATES: N2291486.3 E6088856.0 (NAD83) ELEVATION 105.6' (NAVD88) GROUND SURFACE ELEVATION 102.7' (NAVD88)	



NOT TO SCALE

NOTES:
T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, El. = Elevation
#3 Sand backfills the well above the top of the bentonite seal.

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-102

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Right
BEGUN: 4/27/10 FINISHED: 4/27/10
WATER LEVEL DEPTH AND ELEVATION: NA
DATE WATER LEVEL WAS MEASURED: NA

PROJECT: San Joaquin River Restoration Program
COORDINATES: N 2,313,919.5 E 6,070,042.5 (NAGD83)
TOTAL DEPTH: 31.1 ft.

STATE: California
GROUND SURFACE ELEVATION: 95.7 ft. (NAVD88)
T.O.C ELEVATION: 98.4 ft. (NAVD88)
HOLE LOGGED BY: J. Vauk
REVIEWED BY: A. Warren

NOTES	DEPTH	% CORE RECOVERY	LABORATORY DATA: % SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION / ELEVATION	VISUAL CLASSIFICATION / ELEVATION	GEOLOGIC UNIT SYMBOL	CLASSIFICATION AND PHYSICAL CONDITION
ALL MEASUREMENTS ARE IN FEET FROM THE GROUND SURFACE. **PURPOSE OF HOLE:** To recover core, collect data to determine geologic and hydrologic site conditions, and install a groundwater monitoring well. **LOCATION:** Reach 4B1, river right, about 1.4 miles north from the center of the SJR, just south of Sand Slough Road. **DRILLED BY:** PN-Regional Drill Crew Jerry Hansen, Driller Cody Kelly, Helper Ken Kreitz, Helper **DRILL RIG:** Central Mining Equipment 75 drill rig (CME-75) **DRILLING & SAMPLING METHODS:** Drill hole MW-10-102 was advanced using hollow stem flight augers with a continuous dry core sampling system (FADC) from the ground surface to a total depth of 31.1 feet. FADC uses 7-5/8-inch O.D., 4-1/4-inch I.D. hollow stem augers, with a 5-foot-long, 3-inch I.D. split sample barrel. Interval Method 0.0 to 31.1 ft. - FADC **DRILLING CONDITIONS AND DRILLER'S COMMENTS:** 0.0 to 18.6 ft. smooth drilling, soft; wet at 11.7 ft. 18.6 to 31.1 ft. firm **CAVING CONDITIONS:** None **DRILL FLUID, RETURN AND COLOR:** 0.0 to 13.6 ft. None 13.6 to 31.1 ft. Water, no return **WATER LEVEL:** Not measured **REASON FOR HOLE TERMINATION:** The hole was terminated upon successful completion to the target depth. **HOLE COMPLETION:** Well Casing: +2.7 to 14.1 ft. (T.O.C. El. 98.4 ft.) Dual U-pack Screen: 14.1 to 29.1 ft. (Slotted 0.010-inch) Well Screen Filter Pack: 2/12 Sand Filter Pack: 12.0 to 31.1 ft. (#3 Sand) Sump: 29.1 to 31.1 ft. (2-inch blank PVC with cap) Bentonite Seal: 2.0 to 12.0 ft. Well Completion: Steel surface casing with locking top, square 6-inches-wide and 5-foot-long.	5 10 15	74 100 92 66	33.0 56.9 48.9 6.3 41.0	36.5 21.2 20.1 1.6 34.2	69.5 78.1 69.0 7.9 75.2	30.5 21.9 31.0 92.1 24.8	0.0 0.0 0.0 0.0 0.0	34.9 29.4 27.4 NP 35.8	17.3 9.3 7.4 NP 18.4	21.7 20.9 20.2 25.4 21.8	s(CL) 90.4 (CL)s 87.3 s(CL) 84.8 SP-SM 77.2 (CL)s 76.5	(CL)s 90.4 s(CL) 87.3 (CL)s 84.8 SM 84.6 (ML)s 84.0 SP/SM 77.2 (CL)s 76.5	Qal	***0.0 to 31.1 feet*** ***QUATERNARY ALLUVIUM (Qal)*** **0.0 to 5.3 ft.: LEAN CLAY WITH SAND, (CL)s:** About 85% fines with medium plasticity and toughness, very high dry strength, no dilatancy; about 15% fine sand; maximum size: fine sand; moist, dark brown, no to low reaction to HCl; soft consistency; organics present. Laboratory Data Interval 1.0 to 5.3 ft. **5.3 to 8.4 ft.: SANDY LEAN CLAY, s(CL):** About 70% fines with medium plasticity, low toughness, high dry strength, no dilatancy; about 30% fine sand; maximum size: fine sand; wet, brown, no to low reaction to HCl; soft consistency. Laboratory Data Interval 5.3 to 8.4 ft. **8.4 to 10.9 ft.: LEAN CLAY WITH SAND, (CL)s:** About 80% fines with medium plasticity, low toughness, very high dry strength, no dilatancy; about 20% fine sand; maximum size: fine sand; moist, brown, no reaction to HCl; soft consistency. Laboratory Data Interval 8.4 to 10.9 ft. **10.9 to 11.1 ft.: SILTY SAND, SM:** About 60% fine sand; about 40% fines with low plasticity, toughness and dry strength, rapid dilatancy; maximum size: fine sand; wet, light brownish gray, no reaction to HCl; soft consistency. **11.1 to 11.7 ft.: SILT WITH SAND, (ML)s:** About 75% fines with low plasticity, toughness and dry strength, rapid dilatancy; about 25% fine sand; maximum size: fine sand; moist, brown, no reaction to HCl; soft consistency. **11.7 to 18.5 ft.: POORLY GRADED SAND WITH SILT, SP/SM:** About 90% fine to medium sand; about 10% non-plastic fines with rapid dilatancy; maximum size: medium sand; wet, brown with orange brown layers, no reaction to HCl; soft consistency. Laboratory Data Interval 11.7 to 18.5 ft. **18.5 to 19.2 ft.: LEAN CLAY WITH SAND, (CL)s:** About 80% fines with high plasticity, medium toughness, high dry strength, no dilatancy; about 20% fine to medium sand; maximum size: medium sand; wet, brown. Laboratory Data Interval 18.5 to 19.2 ft. **19.2 to 21.6 ft.: POORLY GRADED SAND, SP:** About 95% fine to medium sand; about 5% non-plastic fines; maximum size: medium sand; wet, brown, no reaction to HCl; firm consistency; core loss likely. Laboratory Data Interval 19.2 to 21.6 ft.

COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-plastic
NR = No Recovery
NA = Not applicable
I.D. = inner diameter
RM = River Mile
O.D. = outer diameter
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

RECLAMATION
Managing Water in the West

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-102

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Right
BEGUN: 4/27/10 FINISHED: 4/27/10
WATER LEVEL DEPTH AND ELEVATION: NA
DATE WATER LEVEL WAS MEASURED: NA

PROJECT: San Joaquin River Restoration Program
COORDINATES: N 2,313,919.5 E 6,070,042.5 (NAGD83)
TOTAL DEPTH: 31.1 ft.

STATE: California
GROUND SURFACE ELEVATION: 95.7 ft. (NAVD88)
T.O.C ELEVATION: 98.4 ft. (NAVD88)
HOLE LOGGED BY: J. Vauk
REVIEWED BY: A. Warren

NOTES	DEPTH	% CORE RECOVERY	LABORATORY DATA: % SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION / ELEVATION	VISUAL CLASSIFICATION / ELEVATION	GEOLOGIC UNIT SYMBOL	CLASSIFICATION AND PHYSICAL CONDITION
		66	5.7	2.3	8.0	92.0	0.0	NP	NP	17.0	SP-SM 74.1	SP 74.1		**21.6 to 23.6 ft.: SILTY SAND, SM:** About 70% fine to medium sand; about 30% non-plastic fines with rapid dilatancy; maximum size: medium sand; wet, brown, no reaction to HCl; soft consistency; 0.1 ft. zones with (CL/ML)s.
												SM 72.1		**23.6 to 28.3 ft.: POORLY GRADED SAND WITH SILT, SP/SM:** About 90% fine to medium sand; about 10% non-plastic fines; maximum size: medium sand; wet, brown, no reaction to HCl; soft consistency; small zones of SM.
														Laboratory Data Interval 23.6 to 28.3 ft.
25		32	11.5	3.9	15.4	84.6	0.0	NP	NP	21.9	SM 67.4	SP/SM 67.4	Qal	**28.3 to 28.6 ft.: SANDY LEAN CLAY, s(CL):** About 60% fines with no to low plasticity, low toughness and dry strength; about 40% fine sand; maximum size: fine sand; moist, light brown, no reaction to HCl.
												s(CL) 67.1		**28.6 to 31.1 ft.: POORLY GRADED SAND WITH SILT, SP/SM:** About 90% fine to medium sand; about 10% non-plastic fines; maximum size: medium sand; wet, brown, no reaction to HCl; soft consistency.
30		44										SP/SM 64.6		**T.D.= 31.1 ft.**

BOTTOM OF HOLE

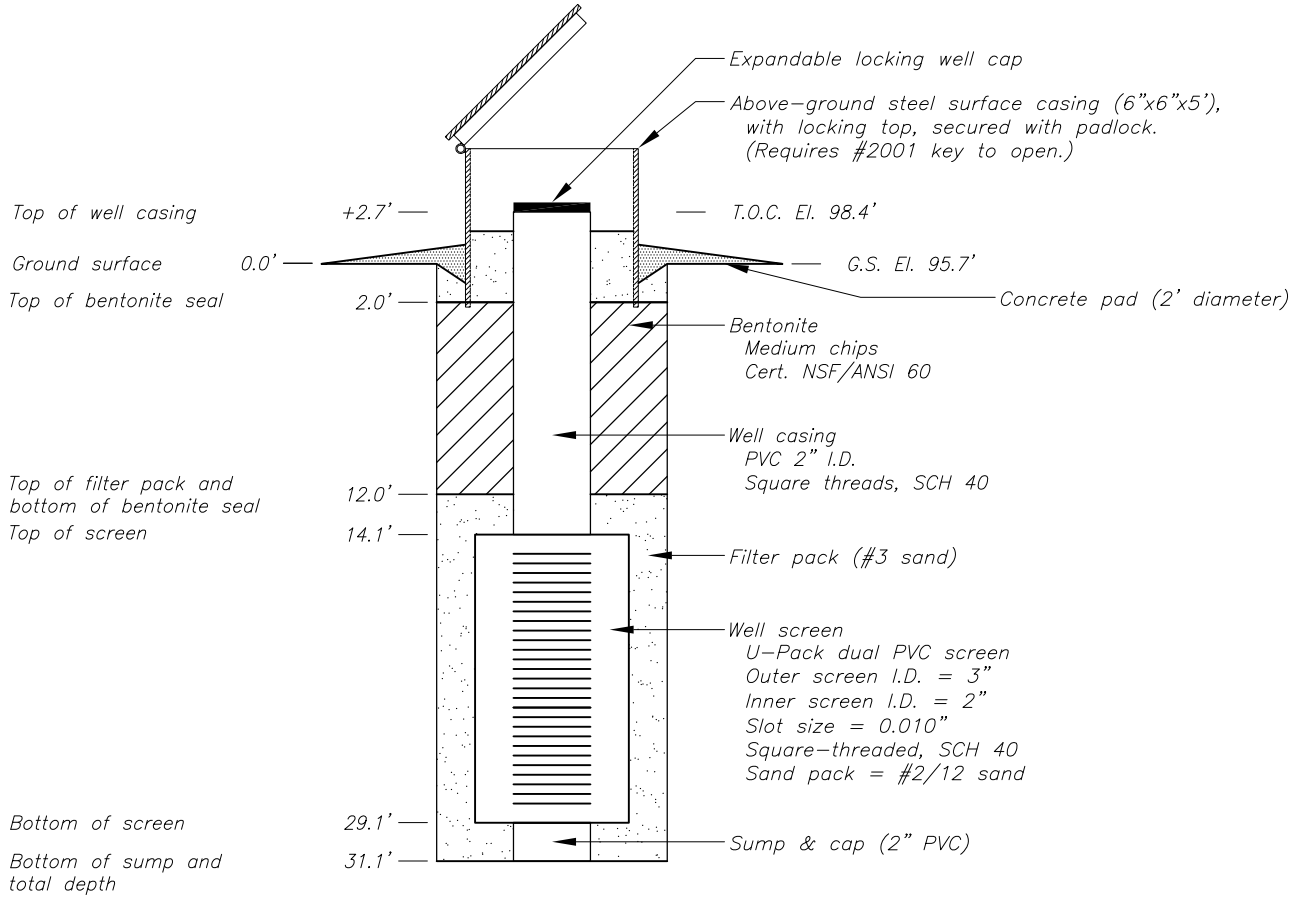
COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-plastic
NR = No Recovery
NA = Not applicable
I.D. = inner diameter
RM = River Mile
O.D. = outer diameter
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

RECLAMATION Managing Water in the West

MW-10-102	GEOLOGIST: J. VAUK
WELL COMPLETION DIAGRAM	DRILLER: G. HANSEN
DATE COMPLETED: 4/27/2010	HELPER: C. KELLY, K. KREITZ
TOP OF WELL CASING COORDINATES: N2313919.5 E6070042.5 (NAD83) ELEVATION 98.4' (NAVD88) GROUND SURFACE ELEVATION 95.7' (NAVD88)	



NOT TO SCALE

NOTES:
T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, El. = Elevation
#3 Sand backfills the well above the top of the bentonite seal.

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-103

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Right
BEGUN: 4/19/10 FINISHED: 4/19/10
WATER LEVEL DEPTH AND ELEVATION: NA
DATE WATER LEVEL WAS MEASURED: NA

PROJECT: San Joaquin River Restoration Program
COORDINATES: N 2,308,736.0 E 6,070,617.2 (NAGD83)
TOTAL DEPTH: 41.3 ft.

STATE: California
GROUND SURFACE ELEVATION: 99.1 ft. (NAVD88)
T.O.C ELEVATION: 101.6 ft. (NAVD88)
HOLE LOGGED BY: A. Warren
REVIEWED BY: J. Vauk

ALL MEASUREMENTS ARE IN FEET FROM THE GROUND SURFACE.

PURPOSE OF HOLE:
To recover core, collect data to determine geologic and hydrologic site conditions, and install a groundwater monitoring well.

LOCATION:
Reach 4B1, river right, about 1,300 feet north from the center of the SJR, just north of Chamberlain Lane.

DRILLED BY:
PN-Regional Drill Crew
Jerry Hansen, Driller
Cody Kelly, Helper
Ken Kreitz, Helper

DRILL RIG:
Central Mining Equipment 75 drill rig (CME-75)

DRILLING & SAMPLING METHODS:
Drill hole MW-10-103 was advanced using hollow stem flight augers with a continuous dry core sampling system (FADC) from the ground surface to a total depth of 41.3 feet. FADC uses 7-5/8-inch O.D., 4-1/4-inch I.D. hollow stem augers, with a 5-foot-long, 3-inch I.D. split sample barrel.

Interval Method
0.0 to 41.3 ft. - FADC

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
0.0 to 23.8 ft. smooth drilling, soft
23.8 to 33.8 ft. firm
33.8 to 41.3 ft. firm

CAVING CONDITIONS:
Soil caved from the borehole wall from 40.8 to 41.3 ft.

DRILL FLUID, RETURN AND COLOR:
0.0 to 18.8 ft. None
18.8 to 41.3 ft. Water, no return

WATER LEVEL:
Not measured

REASON FOR HOLE TERMINATION:
The hole was terminated upon successful completion to the target depth.

HOLE COMPLETION:
Well Casing: +2.5 to 18.8 ft. (T.O.C. El. 101.6 ft.)
Dual U-pack Screen: 18.8 to 38.8 ft. (Slotted 0.010-inch)
Well Screen Filter Pack: 2/12 Sand Filter Pack: 18.2 to 40.8 ft. (#3 Sand)
Sump: 38.8 to 40.8 ft. (2-inch blank PVC with cap)
Bottom Backfill: 40.8 to 41.3 ft. (Soil caved from the borehole wall)
Bentonite Seal: 2.0 to 18.2 ft.
Well Completion: Steel surface

DEPTH	% CORE RECOVERY	% SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION / ELEVATION	VISUAL CLASSIFICATION / ELEVATION	GEOLOGIC UNIT SYMBOL
	55										SM	
											94.9	
5											SM	
	86										92.5	
		58.7	21.8	80.5	19.5	0.0	27.9	11.3	22.5	(CL)s 91.5	(CL)s 91.5	Qal
											SM 90.6	
											SM 89.1	
		69.4	21.5	90.9	9.1	0.0	27.0	6.9	27.1	CL-ML 89.1		
10		42.2	47.1	89.3	10.7	0.0	33.7	14.4	24.6	CL-ML 88.1	(CL/ML)s 88.0	
	80										SP/SM 86.0	
											SM 84.6	
	62										SP	

0.0 to 41.3 feet
QUATERNARY ALLUVIUM (Qal)

0.0 to 4.2 ft.: SILTY SAND WITH ORGANIC FINES, SM: About 70% fine sand; about 30% fines and organics; maximum size: fine sand; dry to moist, dark brown; highly disturbed; several layers of dark brown CH from 2.0 to 4.2 ft.

4.2 to 6.6 ft.: SILTY SAND, SM: About 65% fine sand; about 35% non-plastic fines; maximum size: fine sand; moist, olive brown with reddish brown oxidation streaks; moderately soft consistency.

6.6 to 7.6 ft.: LEAN CLAY WITH SAND, (CL)s: About 80% fines with medium plasticity; about 20% fine sand; maximum size: fine sand; moist, olive brown; moderately firm consistency.

Laboratory Data Interval
6.6 to 7.6 ft.

7.6 to 8.5 ft.: SILTY SAND, SM: About 65% fine sand; about 35% non-plastic fines; maximum size: fine sand; moist, olive brown with reddish brown oxidation streaks; moderately soft consistency.

8.5 to 10.0 ft.: SILTY SAND, SM: About 75% fine sand; about 25% non-plastic fines; maximum size: fine sand; moist to wet, olive brown with reddish brown oxidation; moderately soft consistency; wet and saturated where disturbed by drilling action.

Laboratory Data Interval
9.0 to 10.0 ft.

10.0 to 11.1 ft.: SILTY CLAY WITH SAND, (CL/ML)s: About 85% fines with medium plasticity; about 15% fine sand; maximum size: fine sand; moist, olive brown; moderately firm consistency.

Laboratory Data Interval
10.0 to 11.0 ft.

11.1 to 13.1 ft.: POORLY GRADED SAND WITH SILT, SP/SM: About 90% fine sand; about 10% non-plastic fines; maximum size: fine sand; moist to wet, olive brown with reddish brown oxidation; soft consistency.

13.1 to 14.5 ft.: SILTY SAND, SM: About 85% fine sand; about 15% non-plastic fines; maximum size: fine sand; moist to wet, olive brown with reddish brown oxidation; moderately soft consistency; wet and saturated where disturbed by drilling action.

14.5 to 28.0 ft.: POORLY GRADED SAND, SP: About 100% fine to medium sand; trace of non-plastic fines; wet, brownish gray; soft consistency, homogenous; no recovery from 18.8 to 23.8 ft.

Laboratory Data Interval
15.0 to 16.0 ft.

28.0 to 28.6 ft.: POORLY GRADED SAND WITH SILT, SP/SM: About 90% fine sand; about 10% non-plastic fines; maximum size: fine sand; moist, olive brown to reddish brown; firm consistency.

COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-plastic
NR = No Recovery
NA = Not applicable
I.D. = inner diameter
RM = River Mile
O.D. = outer diameter
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

RECLAMATION
Managing Water in the West

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-103

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Right
BEGUN: 4/19/10 FINISHED: 4/19/10
WATER LEVEL DEPTH AND ELEVATION: NA
DATE WATER LEVEL WAS MEASURED: NA

PROJECT: San Joaquin River Restoration Program
COORDINATES: N 2,308,736.0 E 6,070,617.2 (NAGD83)
TOTAL DEPTH: 41.3 ft.

STATE: California
GROUND SURFACE ELEVATION: 99.1 ft. (NAVD88)
T.O.C ELEVATION: 101.6 ft. (NAVD88)
HOLE LOGGED BY: A. Warren
REVIEWED BY: J. Vauk

NOTES	DEPTH	% CORE RECOVERY	LABORATORY DATA: % SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION / ELEVATION	VISUAL CLASSIFICATION / ELEVATION	GEOLOGIC UNIT SYMBOL	CLASSIFICATION AND PHYSICAL CONDITION
casing with locking top, square 6-inches-wide and 5-foot-long.			3.0	2.3	5.3	94.7	0.0	NP	NP	22.3	SP-SM 83.1	SP	Qal	**28.6 to 28.8 ft.: POORLY GRADED SAND, SP:** About 95% fine sand; about 5% non-plastic fines; maximum size: fine sand; wet, gray; soft consistency.
		62												**28.8 to 34.1 ft.: SILTY SAND, SM:** About 85% fine to medium sand; about 15% non-plastic fines; maximum size: fine sand; wet, gray; moderately soft consistency; layers of fine and medium sand with approximately 1.0 ft. intervals.
														Laboratory Data Interval 29.0 to 30.0 ft.
														34.1 to 37.8 ft.: FAT CLAY, CH: About 95% fines with high plasticity and toughness, no dilatancy; about 5% fine sand; maximum size: fine sand; moist, brown and olive gray mottled; very firm consistency; trace of charcoal fragments and ash tuff from 36.8 to 37.8 ft.
														Laboratory Data Interval 35.0 to 36.0 ft.
	20													**37.8 to 38.7 ft.: CLAYEY SAND, SC:** About 55% fine sand; about 45% fines with high plasticity; maximum size: fine sand; moist, brown with green; very firm consistency; trace charcoal fragments.
		6												**38.7 to 41.3 ft.: LEAN CLAY, CL:** About 90% fines with medium plasticity and toughness, slow to no dilatancy; about 10% fine sand; maximum size: fine sand; moist, olive brown with reddish brown; moderately firm consistency; silty, homogenous.
														Laboratory Data Interval 38.8 to 39.8 ft.
														T.D.= 41.3 ft.
	25													
		40												
												71.1		
												SP/SM 70.5		
												SP 70.3		
		38	14.5	6.6	21.1	78.9	0.0	NP	NP	22.2	SM 69.6	SM		

COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-plastic
NR = No Recovery
NA = Not applicable
I.D. = inner diameter
RM = River Mile
O.D. = outer diameter
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

RECLAMATION Managing Water in the West

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-103

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Right
BEGUN: 4/19/10 FINISHED: 4/19/10
WATER LEVEL DEPTH AND ELEVATION: NA
DATE WATER LEVEL WAS MEASURED: NA

PROJECT: San Joaquin River Restoration Program
COORDINATES: N 2,308,736.0 E 6,070,617.2 (NAGD83)
TOTAL DEPTH: 41.3 ft.

STATE: California
GROUND SURFACE ELEVATION: 99.1 ft. (NAVD88)
T.O.C ELEVATION: 101.6 ft. (NAVD88)
HOLE LOGGED BY: A. Warren
REVIEWED BY: J. Vauk

NOTES	DEPTH	% CORE RECOVERY	LABORATORY DATA: % SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION / ELEVATION	VISUAL CLASSIFICATION / ELEVATION	GEOLOGIC UNIT SYMBOL	CLASSIFICATION AND PHYSICAL CONDITION
		38										SM		
												65.0		
	35		35.5	53.6	89.1	10.9	0.0	50.3	35.0	21.4	CH	CH	Qal	
											63.1			
		100										61.3		
												SC		
												60.4		
			56.5	41.7	98.2	1.8	0.0	54.8	33.9	30.8	CH			
											59.3			
	40	100										CL		
												57.8		

BOTTOM OF HOLE

COMMENTS:

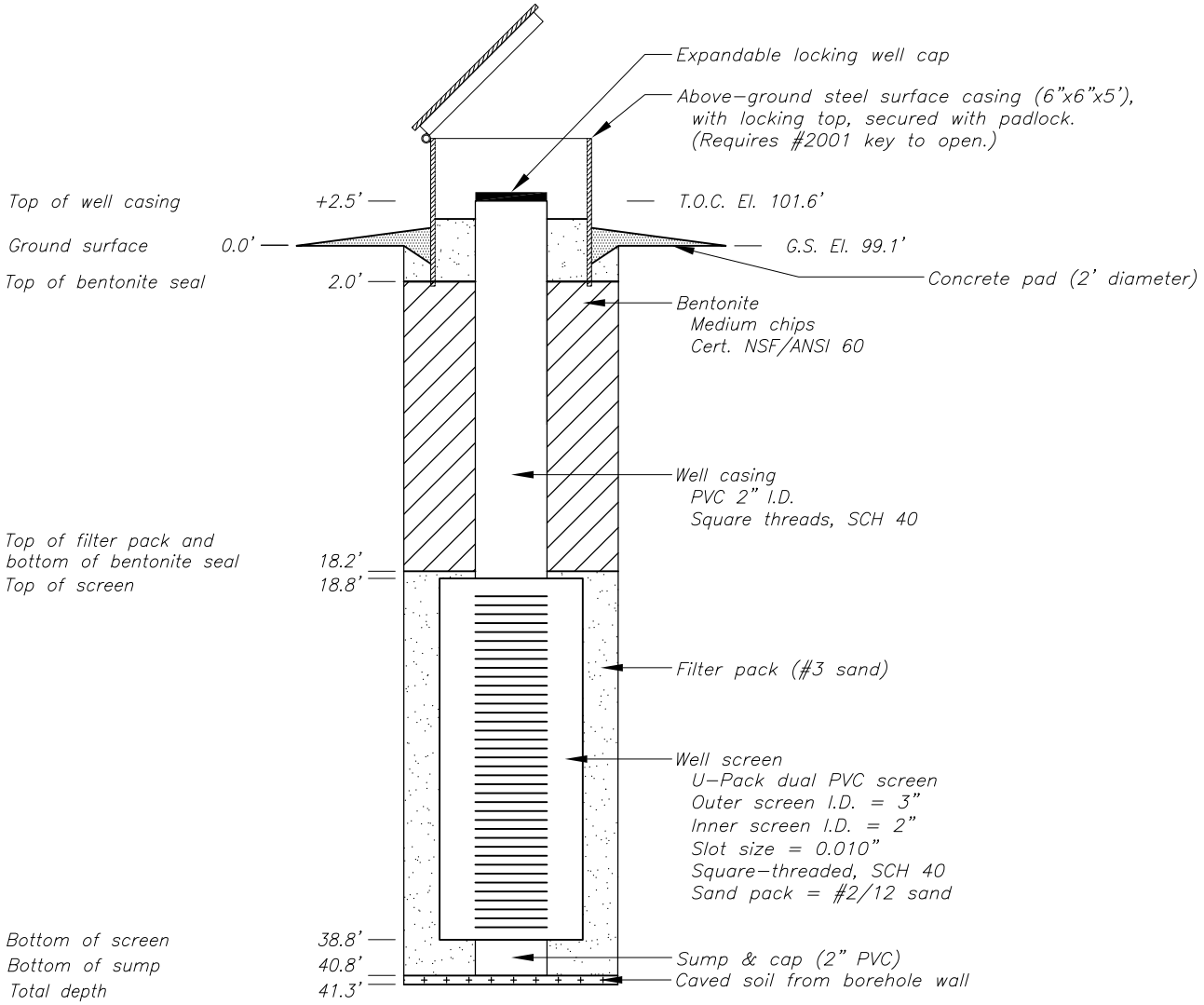
FADC = Flight Auger Dry Core
NP = Non-plastic
NR = No Recovery
NA = Not applicable
I.D. = inner diameter
RM = River Mile

O.D. = outer diameter
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

RECLAMATION
Managing Water in the West

MW–10–103	GEOLOGIST: A. WARREN
WELL COMPLETION DIAGRAM	DRILLER: G. HANSEN
DATE COMPLETED: 4/19/2010	HELPER: C. KELLY, K. KREITZ
TOP OF WELL CASING COORDINATES: N2308736.0 E6070617.2 (NAD83) ELEVATION 101.6' (NAVD88) GROUND SURFACE ELEVATION 99.1' (NAVD88)	



NOT TO SCALE

NOTES:
T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, El. = Elevation
#3 Sand backfills the well above the top of the bentonite seal.

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-105

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Left
BEGUN: 4/27/10 FINISHED: 4/27/10
WATER LEVEL DEPTH AND ELEVATION: NA
DATE WATER LEVEL WAS MEASURED: NA

PROJECT: San Joaquin River Restoration Program
COORDINATES: N 2,303,597.9 E 6,069,923.7 (NAGD83)
TOTAL DEPTH: 31.1 ft.

STATE: California
GROUND SURFACE ELEVATION: 96.7 ft. (NAVD88)
T.O.C ELEVATION: 99.3 ft. (NAVD88)
HOLE LOGGED BY: J. Vauk
REVIEWED BY: A. Warren

ALL MEASUREMENTS ARE IN FEET FROM THE GROUND SURFACE.

PURPOSE OF HOLE:
To recover core, collect data to determine geologic and hydrologic site conditions, and install a groundwater monitoring well.

LOCATION:
Reach 4B1, river left, about 185 feet south from the center of the SJR, about 1.2 miles east of intersection of Turner Island Road and the SJR.

DRILLED BY:
PN-Regional Drill Crew
Jerry Hansen, Driller
Cody Kelly, Helper
Ken Kreitz, Helper

DRILL RIG:
Central Mining Equipment 75 drill rig (CME-75)

DRILLING & SAMPLING METHODS:
Drill hole MW-10-105 was advanced using hollow stem flight augers with a continuous dry core sampling system (FADC) from the ground surface to a total depth of 31.2 feet. FADC uses 7-5/8-inch O.D., 4-1/4-inch I.D. hollow stem augers, with a 5-foot-long, 3-inch I.D. split sample barrel.

Interval Method
0.0 to 31.2 ft. - FADC

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
0.0 to 13.7 ft. smooth drilling, soft
13.7 to 18.7 ft. moderately soft
18.7 to 31.2 ft. slightly firm

CAVING CONDITIONS:
Soil caved from the borehole wall from 28.2 to 31.2 ft.

DRILL FLUID, RETURN AND COLOR:
0.0 to 18.8 ft. None
18.8 to 31.2 ft. Water, no return

WATER LEVEL:
Not measured

REASON FOR HOLE TERMINATION:
The hole was terminated upon successful completion to the target depth.

HOLE COMPLETION:
Well Casing: +2.6 to 14.0 ft. (T.O.C. El. 99.3 ft.)
Dual U-pack Screen: 14.0 to 29.0 ft. (Slotted 0.010-inch)
Well Screen Filter Pack: 2/12 Sand
Filter Pack: 12.2 to 28.2 ft. (#3 Sand)
Sump: 29.0 to 31.0 ft. (2-inch blank PVC with cap)
Bottom Backfill: 28.2 to 31.2 ft. (Soil caved from the borehole wall)
Bentonite Seal: 2.0 to 14.0 ft.

DEPTH	% CORE RECOVERY	% SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION / ELEVATION	VISUAL CLASSIFICATION / ELEVATION	GEOLOGIC UNIT SYMBOL
	100										SC 93.8	
											(CL/ML)s 92.7	
5	100	32.3	41.2	73.5	26.5	0.0	40.8	26.5	18.4	(CL)s 87.8	(CL)s 87.8	
10	100	19.8	23.4	43.2	56.5	0.3	26.7	12.9	15.4	SC 85.5	s(CL) 85.5	Qal
											SC 85.1	
		5.5	2.2	7.7	92.3	0.0	NP	NP	18.8	SP-SM 83.8	SM 83.8	
		5.4	2.1	7.5	92.5	0.0	NP	NP	26.8	SP-SM 82.0	SP/SM 82.0	
15	26										SM 81.7	
											ML 78.0	

0.0 to 31.2 feet
QUATERNARY ALLUVIUM (Qal)

0.0 to 2.9 ft.: CLAYEY SAND, SC: About 80% fine sand; about 20% fines with medium plasticity, low toughness and dry strength, no dilatancy; maximum size: fine sand; dry, dark brown, strong reaction with HCl; soft to firm consistency; organics in top 2 feet.

2.9 to 4.0 ft.: SILTY CLAY WITH SAND, (CL/ML)s: About 75% fines with low plasticity, toughness, and dry strength, rapid dilatancy; about 25% fine sand; maximum size: fine sand; moist, dark brown, no to weak reaction to HCl.

4.0 to 8.9 ft.: LEAN CLAY WITH SAND, (CL)s: About 80% fines with medium plasticity, toughness, and dry strength, no dilatancy; about 20% fine sand; maximum size: fine sand; moist, dark brown, no to weak reaction to HCl.

Laboratory Data Interval
4.0 to 8.9 ft.

8.9 to 11.2 ft.: SANDY LEAN CLAY, s(CL): About 55% fines with medium plasticity, toughness, and dry strength, no dilatancy; about 45% fine to medium sand (mostly fine); maximum size: medium sand.

Laboratory Data Interval
8.9 to 11.2 ft.

11.2 to 11.6 ft.: CLAYEY SAND, SC: About 60% fine to medium sand; about 40% fines with low plasticity, medium toughness and dry strength, rapid dilatancy; maximum size: medium sand; wet, brown.

11.6 to 12.9 ft.: SILTY SAND, SM: About 85% fine to medium sand; about 15% non-plastic fines with rapid dilatancy; maximum size: medium sand; wet, gray, no reaction to HCl; soft consistency.

Laboratory Data Interval
11.6 to 12.9 ft.

12.9 to 14.7 ft.: POORLY GRADED SAND WITH SILT, SP/SM: About 90% fine to medium sand; about 10% non-plastic fines with rapid dilatancy; maximum size: medium sand; wet, gray, no reaction to HCl; soft consistency.

Laboratory Data Interval
12.9 to 14.7 ft.

14.7 to 15.0 ft.: SILTY SAND, SM: About 80% fine to medium sand; about 20% non-plastic fines; maximum size: medium sand; wet, grayish brown, no reaction to HCl; soft consistency.

15.0 to 18.7 ft.: No Recovery - SILT, ML: Description based on drilling conditions.

18.7 to 21.3 ft.: POORLY GRADED SAND WITH SILT, SP/SM: About 90% fine to medium sand; about 10% non-plastic fines; maximum size: medium sand; wet, gray, no reaction to HCl; soft consistency.

Laboratory Data Interval
18.7 to 21.3 ft.

COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-plastic
NR = No Recovery
NA = Not applicable
I.D. = inner diameter
RM = River Mile
O.D. = outer diameter
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

RECLAMATION
Managing Water in the West

PROJECT DATABASE: SJRRP.GPJ
REPORT: SJRRP DRILL HOLE

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-105

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Left
BEGUN: 4/27/10 FINISHED: 4/27/10
WATER LEVEL DEPTH AND ELEVATION: NA
DATE WATER LEVEL WAS MEASURED: NA

PROJECT: San Joaquin River Restoration Program
COORDINATES: N 2,303,597.9 E 6,069,923.7 (NAGD83)
TOTAL DEPTH: 31.1 ft.

STATE: California
GROUND SURFACE ELEVATION: 96.7 ft. (NAVD88)
T.O.C ELEVATION: 99.3 ft. (NAVD88)
HOLE LOGGED BY: J. Vauk
REVIEWED BY: A. Warren

NOTES	DEPTH	% CORE RECOVERY	LABORATORY DATA: % SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION / ELEVATION	VISUAL CLASSIFICATION / ELEVATION	GEOLOGIC UNIT SYMBOL	CLASSIFICATION AND PHYSICAL CONDITION
Well Completion: Steel surface casing with locking top, square 6-inches-wide and 5-foot-long.		68	5.2	1.7	6.9	91.5	1.6	NP	NP	22.2	SP-SM 75.4	SP/SM 75.4		**21.3 to 21.4 ft.: SILT WITH SAND, (ML)s:** About 85% non-plastic fines with rapid dilatancy; about 15% fine sand; maximum size: fine sand; wet, gray, no reaction to HCl..
												(ML)s 75.3		**21.4 to 28.6 ft.: POORLY GRADED SAND WITH SILT, SP/SM:** About 90% fine to medium sand; about 10% non-plastic fines; maximum size: medium sand; wet, gray; no reaction to HCl; soft consistency.
			10.7	3.6	14.3	85.7	0.0	NP	NP	19.2	SM 73.0			Laboratory Data Interval 21.4 to 23.7 ft. 23.7 to 28.6 ft.
	25	42	8.0	1.6	9.6	88.7	1.7	NP	NP	18.6	SP-SM 68.1	SP/SM 68.1	Qal	**28.6 to 28.7 ft.: SILTY SAND, SM:** About 70% fine to medium sand; about 30% non-plastic fines with rapid dilatancy; maximum size: medium sand; wet, gray, no reaction to HCl; soft consistency. **28.7 to 31.2 ft.: No Recovery - POORLY GRADED SAND WITH SILT, SP/SM:** Description based on drilling conditions.
	30	0										SM 68.0 SP/SM 65.5		**T.D.= 31.2 ft.**

BOTTOM OF HOLE

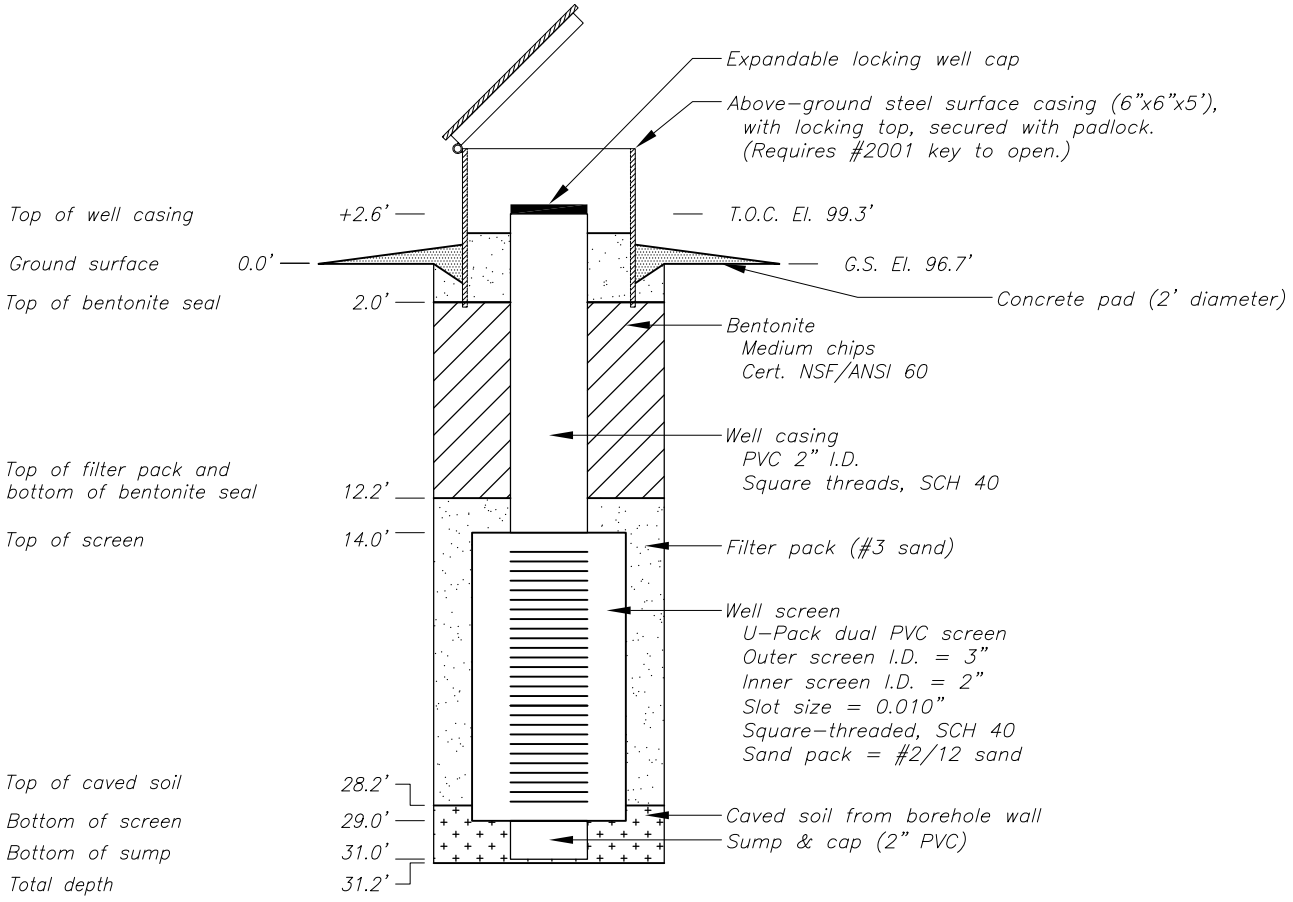
COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-plastic
NR = No Recovery
NA = Not applicable
I.D. = inner diameter
RM = River Mile
O.D. = outer diameter
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

RECLAMATION
Managing Water in the West

MW–10–105	GEOLOGIST: J. VAUK
WELL COMPLETION DIAGRAM	DRILLER: G. HANSEN
DATE COMPLETED: 4/30/2010	HELPER: C. KELLY, K. KREITZ
TOP OF WELL CASING COORDINATES: N2303597.9 E6069923.7 (NAD83) ELEVATION 99.3' (NAVD88) GROUND SURFACE ELEVATION 96.7' (NAVD88)	



NOT TO SCALE

NOTES:
T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, El. = Elevation
#3 Sand backfills the well above the top of the bentonite seal.

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-107

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Left
BEGUN: 4/29/10 FINISHED: 4/29/10
WATER LEVEL DEPTH AND ELEVATION: NA
DATE WATER LEVEL WAS MEASURED: NA

PROJECT: San Joaquin River Restoration Program
COORDINATES: N 2,298,351.8 E 6,064,543.0 (NAGD83)
TOTAL DEPTH: 31.4 ft.

STATE: California
GROUND SURFACE ELEVATION: 96.0 ft. (NAVD88)
T.O.C ELEVATION: 98.9 ft. (NAVD88)
HOLE LOGGED BY: J. Vauk
REVIEWED BY: A. Warren

ALL MEASUREMENTS ARE IN FEET FROM THE GROUND SURFACE.

PURPOSE OF HOLE:
To recover core, collect data to determine geologic and hydrologic site conditions, and install a groundwater monitoring well.

LOCATION:
Reach 4B1, river left, about 1.1 miles south from the center of the SJR, about 165 feet east of the intersection of Turner Island Road and Palazzo Road.

DRILLED BY:
PN-Regional Drill Crew
Jerry Hansen, Driller
Cody Kelly, Helper
Ken Kreitz, Helper

DRILL RIG:
Central Mining Equipment 75 drill rig (CME-75)

DRILLING & SAMPLING METHODS:
Drill hole MW-10-107 was advanced using hollow stem flight augers with a continuous dry core sampling system (FADC) from the ground surface to a total depth of 31.4 feet. FADC uses 7-5/8-inch O.D., 4-1/4-inch I.D. hollow stem augers, with a 5-foot-long, 3-inch I.D. split sample barrel.

Interval Method
0.0 to 31.4 ft. - FADC

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
0.0 to 13.9 ft. smooth drilling, soft
13.9 to 31.4 ft. moderately soft, wet at 13.9 feet

CAVING CONDITIONS:
Soil caved from the borehole wall from 30.5 to 31.4 ft.

DRILL FLUID, RETURN AND COLOR:
0.0 to 18.9 ft. None
18.9 to 31.4 ft. Water, no return

WATER LEVEL:
Not measured

REASON FOR HOLE TERMINATION:
The hole was terminated upon successful completion to the target depth.

HOLE COMPLETION:
Well Casing: +2.9 to 14.1 ft. (T.O.C. El. 98.9 ft.)
Dual U-pack Screen: 14.1 to 29.1 ft. (Slotted 0.010-inch)
Well Screen Filter Pack: 2/12 Sand Filter Pack: 12.5 to 30.5 ft. (#3 Sand)
Sump: 29.1 to 31.1 ft. (2-inch blank PVC with cap)
Bottom Backfill: 30.5 to 31.4 ft. (soil caved from the borehole wall)

DEPTH	% CORE RECOVERY	% SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION	ELEVATION	VISUAL CLASSIFICATION	ELEVATION	GEOLOGIC UNIT SYMBOL
5	50	26.1	25.2	51.3	48.7	0.0	27.4	11.2	10.9	s(CL)	90.1	s(CL)	90.1	
10	91	31.8	23.6	55.4	44.2	0.4	29.0	11.5	16.1	s(CL)	85.8	s(CL)	85.8	Qal
	100	25.6	13.6	39.2	60.5	0.3	25.1	5.8	23.1	SC-SM	82.8	SC	82.8	
		11.7	3.1	14.8	85.2	0.0	NP	NP	21.0	SM	81.7	SP/SM	81.7	
15	64	12.8	1.1	13.9	86.1	0.0	NP	NP	24.0	SM	77.1	ML SM (ML)s SP/SM ML SP/SM (CL/ML)s SM	81.5 81.1 80.8 80.6 80.5 80.3 80.2 77.1	

0.0 to 31.4 feet
QUATERNARY ALLUVIUM (Qal)

0.0 to 5.9 ft.: SANDY LEAN CLAY, s(CL): About 55% fines with medium plasticity and toughness, high dry strength, rapid dilatancy; about 45% fine sand; maximum size: fine sand; dry, dark brown, strong reaction to HCl; soft consistency; organics.

Laboratory Data Interval
1.0 to 5.9 ft.

5.9 to 10.2 ft.: SANDY LEAN CLAY, s(CL): About 50% fines with medium plasticity and toughness, high dry strength, rapid dilatancy; about 50% fine sand; maximum size: fine sand; medium brown, no reaction to HCl; firm consistency.

Laboratory Data Interval
5.9 to 10.2 ft.

10.2 to 13.2 ft.: CLAYEY SAND, SC: About 55-65% fine sand; about 35-45% fines with low plasticity, toughness, and dry strength, rapid dilatancy; maximum size: fine sand; moist, medium brown, no reaction to HCl; frim consistency; greater percentage of sand with depth.

Laboratory Data Interval
10.2 to 13.2 ft.

13.2 to 14.3 ft.: POORLY GRADED SAND WITH SILT, SP/SM: About 90% fine to medium sand; about 10% non-plastic fines; maximum size: medium sand; moist, grayish brown, no reaction to HCl; soft consistency.

Laboratory Data Interval
13.2 to 14.3 ft.

14.3 to 14.5 ft.: SILT, ML: About 90% fines with no to low plasticity, toughness, and dry strength, slow dilatancy; about 10% fine sand; maximum size: fine sand; moist, gray, no reaction to HCl; soft consistency.

14.5 to 14.9 ft.: SILTY SAND, SM: About 85% fine to medium sand (mostly fine); about 15% non-plastic fines; maximum size: medium sand; wet, brown, no reaction to HCl; soft consistency.

14.9 to 15.2 ft.: SILT WITH SAND, (ML)s: About 75% non-plastic fines with rapid dilatancy; about 25% fine sand; maximum size: fine sand; wet, grayish light brown; soft consistency.

15.2 to 15.4 ft.: POORLY GRADED SAND WITH SILT, SP/SM: About 90% fine to medium sand; about 10% non-plastic fines; maximum size: medium sand; wet, brown, no reaction to HCl; soft consistency.

15.4 to 15.5 ft.: SILT, ML: About 80% non-plastic fines with rapid dilatancy; about 20% fine sand; maximum size: fine sand; wet, light brown, no reaction to HCl; soft consistency.

15.5 to 15.7 ft.: POORLY GRADED SAND WITH SILT, SP/SM: About 90% fine to medium sand; about 10% non-plastic fines; maximum size: medium sand; wet, light brown, no reaction to HCl; soft consistency.

COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-plastic
NR = No Recovery
NA = Not applicable
I.D. = inner diameter
RM = River Mile
O.D. = outer diameter
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

RECLAMATION
Managing Water in the West

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-107

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Left
BEGUN: 4/29/10 FINISHED: 4/29/10
WATER LEVEL DEPTH AND ELEVATION: NA
DATE WATER LEVEL WAS MEASURED: NA

PROJECT: San Joaquin River Restoration Program
COORDINATES: N 2,298,351.8 E 6,064,543.0 (NAGD83)
TOTAL DEPTH: 31.4 ft.

STATE: California
GROUND SURFACE ELEVATION: 96.0 ft. (NAVD88)
T.O.C ELEVATION: 98.9 ft. (NAVD88)
HOLE LOGGED BY: J. Vauk
REVIEWED BY: A. Warren

NOTES	DEPTH	% CORE RECOVERY	LABORATORY DATA: % SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION / ELEVATION	VISUAL CLASSIFICATION / ELEVATION	GEOLOGIC UNIT SYMBOL	CLASSIFICATION AND PHYSICAL CONDITION
Bentonite Seal: 2.0 to 12.5 ft. Well Completion: Steel surface casing with locking top, square 6-inches-wide and 5-foot-long.		60	12.2	1.8	14.0	84.7	1.3	NP	NP	18.2	SM / 72.1	SP/SM / 72.1		**15.7 to 15.8 ft.: SILTY CLAY WITH SAND, (CL/ML)s:** About 85% fines with medium plasticity, low toughness and dry strength, no dilatancy; about 15% fine sand; maximum size: fine sand; wet, light brown, no reaction to HCl. **15.8 to 18.9 ft.: SILTY SAND, SM:** About 85% fine to medium sand; about 15% non-plastic fines; maximum size: medium sand; wet, light brown, no reaction to HCl; soft consistency. Laboratory Data Interval 15.7 to 18.9 ft.
	25	60	8.4	0.9	9.3	89.1	1.6	NP	NP	15.9	SW-SM / 67.1	SP / 67.1	Qal	**18.9 to 23.9 ft.: POORLY GRADED SAND WITH SILT, SP/SM:** About 90% fine to medium sand; about 10% non-plastic fines with rapid dilatancy; maximum size: medium sand; wet, grayish brown, no reaction to HCl; soft consistency. Laboratory Data Interval 18.9 to 23.9 ft. **23.9 to 28.9 ft.: POORLY GRADED SAND, SP:** About 95% fine to medium sand; about 5% non-plastic fines with rapid dilatancy; maximum size: medium sand; wet, gray, no reaction to HCl; soft consistency. Laboratory Data Interval 23.9 to 28.9 ft.
	30	0										No Rec / 64.6		**28.9 to 31.4 ft.: No Recovery.** **T.D.= 31.4 ft.**

BOTTOM OF HOLE

COMMENTS:

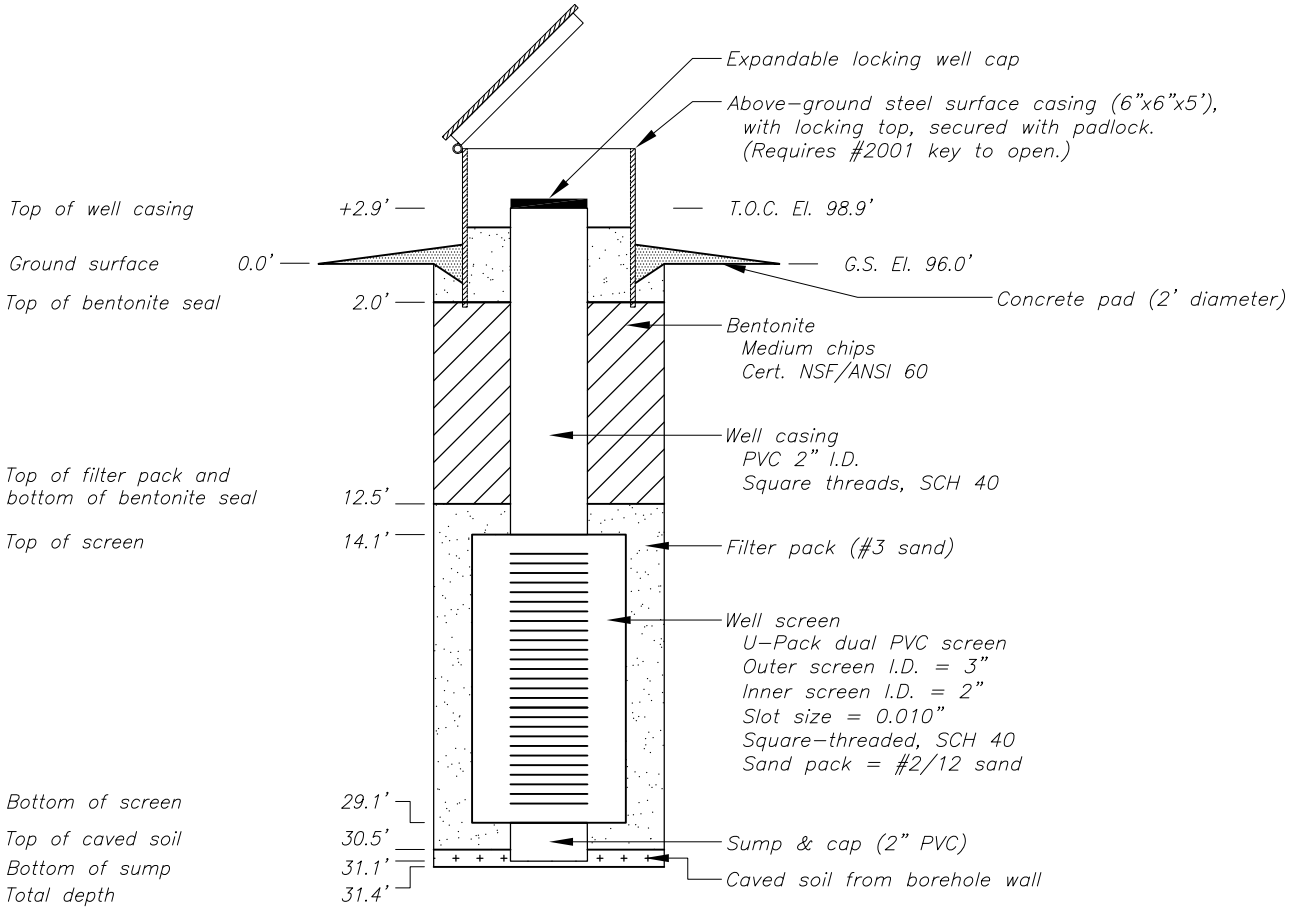
FADC = Flight Auger Dry Core
NP = Non-plastic
NR = No Recovery
NA = Not applicable
I.D. = inner diameter
RM = River Mile

O.D. = outer diameter
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

RECLAMATION
Managing Water in the West

MW–10–107	GEOLOGIST: J. VAUK
WELL COMPLETION DIAGRAM	DRILLER: G. HANSEN
DATE COMPLETED: 4/29/2010	HELPER: C. KELLY, K. KREITZ
TOP OF WELL CASING COORDINATES: N2298351.8 E6064543.0 (NAD83) ELEVATION 98.9' (NAVD88) GROUND SURFACE ELEVATION 96.0' (NAVD88)	



NOT TO SCALE

NOTES:
T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, El. = Elevation
#3 Sand backfills the well above the top of the bentonite seal.

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-106

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Left, Merced County
BEGUN: 11/18/10 FINISHED: 11/18/10
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 8.26 ft. (87.6 ft. - 12/08/2010)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,304,528.3 E 6,065,473.9 NAD83
TOTAL DEPTH: 31.3 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 95.3 ft. NADV88
ANGLE FROM HORIZONTAL: -90°
HOLE LOGGED BY: A. Warren
REVIEWED BY: S. Dalton

NOTES

ALL MEASUREMENTS ARE IN FEET FROM THE GROUND SURFACE

PURPOSE OF HOLE:
To recover core, collect data to determine geologic and hydrologic site conditions, and install a groundwater monitoring well.

LOCATION:
Reach 4B1, River Bank Left, Merced County, on farm road 1,500 feet East of Turner Island Road.

DRILLED BY:
Bureau of Reclamation: PN-Region drill crew:
Gerry Hansen, driller
Chris Peterson, helper
Dennis Read, helper

DRILL RIG:
Truck mounted Central Mining Equipment (CME) 75

DRILLING & SAMPLING METHODS:
The drill hole was advanced using 8-1/4 inch o.d. by 4-1/4 inch i.d. hollow stem flight augers equipped with an 8-1/2 inch o.d. bullet and spade drill bit. Continuous sampling was performed by advancing a 4 inch o.d. by 3-3/8 inch i.d. by 5 feet long split barrel dry core system (FADC). Unless indicated otherwise, the FADC was placed inside the augers and the cutting shoe of the FADC extended 0.2 foot beyond the auger drill bit. A free-spinning adapter was placed at the top of the FADC, so that the FADC did not rotate while advancing the augers.

Interval Method
0.0 to 31.3 ft. FADC

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
0.0 to 3.6 ft. - Moderately soft
18.8 to 22.4 ft. - Very firm

DRILLING FLUID, RETURN AND COLOR:
0.0 to 31.3 ft. - Drilled without fluid

WATER LEVEL FROM TOC:
10.50 ft. on 12/08/2010

REASON FOR HOLE TERMINATION:
The hole was terminated upon successful completion to the target depth.

HOLE COMPLETION:
Well Casing: +3.0 to 8.0 ft. (2-inch blank PVC)
Dual U-pack Screen: 8.0 to 23.0 ft. (2-inch inner screen; 3-inch outer screen; slotted 0.010-inch)
U-Pack Screen Filter Pack: #2/12 Sand
Filter Pack: 7.0 to 25.0 ft. (#3 Sand)
Sump: 23.0 to 25.0 ft. (2-inch blank PVC with slip cap)
Bentonite Seal: 2.0 to 7.0 ft.; 25.0 to 31.3 ft.
Concrete Seal: 0.0 to 2.0 ft.
Well Completion: Steel surface casing with locking top, 6-inch by 6-inch by 5-foot long; 2.0 ft. diameter concrete pad.
Lock: #2001 Masterlock

DEPTH	% CORE RECOVERY	LABORATORY DATA: <0.005	<0.075	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION / El.	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / El.
0											s(CL) 93.8
	97										SM 92.2
		3.1	25.8	71.1	0.0	NP	NP	13.1	SM 90.3		SP-SM 89.7
5											
	69	1.0	5.9	93.1	0.0	NP	NP	13.8	SP-SM 88.3		SP 81.5
10											
	32										
15										Qal	
	0										NR 76.5
		0.0	4.6	95.4	0.0	NP	NP	28.2	SP 75.3		SP

CLASSIFICATION AND PHYSICAL CONDITION

0.0 to 31.3 ft.
QUATERNARY ALLUVIUM - Qal

0.0 to 1.5 ft. SANDY LEAN CLAY, s(CL):
About 65% fines with low plasticity; about 35% fine sand; dry, dark brown; firm; cemented.

1.5 to 3.1 ft. SILTY SAND, SM:
About 60% fine sand; about 40% non plastic fines; dry, brown; loose consistency.

3.1 to 5.6 ft. POORLY GRADED SAND WITH SILT, SP-SM:
About 85-90% fine sand; about 15-10% non plastic fines; dry to moist, tan with reddish brown oxidation; moderately soft; homogenous with few layers.

Lab Data Interval
4.0 to 5.0 ft.

5.6 to 13.8 ft. POORLY GRADED SAND, SP:
About 95-100% fine to medium sand, trace coarse, rounded, hard sand; about 5% to trace fines with low plasticity; moist, tan with reddish brown and gray layers; soft; micaceous and granitic; finely layered.

Note: 7.0 ft.: Wet.

Lab Data Interval
6.0 to 7.0 ft.

Note: 8.3 to 13.8 ft.: Gray, no oxidation.

13.8 to 18.8 ft. NO RECOVERY

18.8 to 20.8 ft. POORLY GRADED SAND, SP:
About 95-100% fine to medium sand, trace coarse, rounded, hard sand; about 5% to trace fines with low plasticity; moist, tan with reddish brown and gray layers; soft; micaceous and granitic; finely layered.

Note: At contact: layer of 1 inch rounded; decomposed (W9) gravel; soft; gray.

Lab Data Interval
19.0 to 20.0 ft.

20.8 to 23.0 ft. POORLY GRADED SAND WITH SILT, SP-SM:
About 90% fine to medium sand; about 10% non plastic fines; wet, gray; soft; clayey layer at 22.0 ft.

Lab Data Interval
21.0 to 22.0 ft.

23.0 to 24.6 ft. SILTY SAND, SM:
About 80% fine to medium sand; about 20% fines with low plasticity; wet, blue to gray; moderately soft; layered.

24.6 to 27.8 ft. LEAN CLAY WITH SAND, (CL)s:
About 75% fines with medium plasticity, medium toughness; about 25% fine sand; moist, gray/green; very firm.

COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-plastic
NR = No Recovery
NA = Not applicable
I.D. = inner diameter
O.D. = outer diameter
G.S. = Ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-106

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Left, Merced County
BEGUN: 11/18/10 FINISHED: 11/18/10
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 8.26 ft. (87.6 ft. - 12/08/2010)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,304,528.3 E 6,065,473.9 NAD83
TOTAL DEPTH: 31.3 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 95.3 ft. NADV88
ANGLE FROM HORIZONTAL: -90°
HOLE LOGGED BY: A. Warren
REVIEWED BY: S. Dalton

NOTES

DEPTH	% CORE RECOVERY	LABORATORY DATA: <0.005	<0.075	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION / El.	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / El.
	67										74.5
		1.5	5.1	93.4	0.0	NP	NP	27.2	SP-SM 73.3		SP-SM
	100										72.3
											SM
25											70.7
	100	43.4	32.0	24.6	0.0	34.7	19.3	21.5	(CL)s 68.8		(CL)s
											67.5
											s(CL)
											66.5
											s(ML)
30	100										65.3
											CL
											64.0

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

Note: 24.6 to 25.2 ft.: 35% sand.

Lab Data Interval
25.5 to 26.5 ft.

27.8 to 28.8 ft. SANDY LEAN CLAY, s(CL):
About 55% fines with medium plasticity; about 45% fine sand; moist, gray-green; firm.

28.8 to 30.0 ft. SILT, (ML):
About 90-95% non plastic fines; about 10-5% fine sand; moist, olive tan; moderately firm; layered; spongey.

30.0 to 31.3 ft. LEAN CLAY, CL:
About 100% fines with medium plasticity, medium toughness; moist, olive tan; firm.

COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-plastic
NR = No Recovery
NA = Not applicable
I.D. = inner diameter
O.D. = outer diameter
G.S. = Ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

San Joaquin River Restoration Program
U.S. Department of Interior, Bureau of Reclamation

MONITORING WELL DEVELOPMENT

Facility/Project Name	County Name	Well Name
SJRRP	Merced	MW-10-106

Facility License, Permit or Monitoring Number	County Code	Wis. Unique Well Number	DNR Well ID Number

1. Can this well be purged dry? Yes ☐ No ☒

2. Well development method
- surged with bailer and bailed ☐ 41
- surged with bailer and pumped ☒ 61
- surged with block and bailed ☐ 42
- surged with block and pumped ☐ 62
- surged with block, bailed and pumped ☐ 70
- compressed air ☐ 20
- bailed only ☐ 10
- pumped only ☐ 51
- pumped slowly ☐ 50
- Other _____ ☐

3. Time spent developing well 30 min.

4. Depth of well (from top of well casisng) 25.4 ft.

5. Inside diameter of well 2 in.

6. Volume of water in filter pack and well casing ___.__ gal.

7. Volume of water removed from well 30 gal.

8. Volume of water added (if any) ___.__ gal.

9. Source of water added _____

10. Analysis performed on water added? (If yes, attach results) ☐ Yes ☐ No

	Before Development	After Development
11. Depth to Water (from top of well casing) a.	10.56 ft.	10.61 ft. (2.95)
Date b. (mm dd yyyy)	12/09/2010	12/08/2010
Time c.	12:08 ☐ a.m. ☒ p.m.	12:35 ☐ a.m. ☐ p.m.
12. Sediment in well bottom	tr. inches	___.__ inches
13. Water clarity	Clear ☐ 10 Turbid ☒ 15 (Describe)	Clear ☐ 20 Turbid ☐ 25 (Describe)

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids	____.__ mg/l	____.__ mg/l
15. COD	____.__ mg/l	____.__ mg/l

16. Well developed by: Name (first, last) and Firm
First Name: Gerry Last Name: Klansen
Firm:

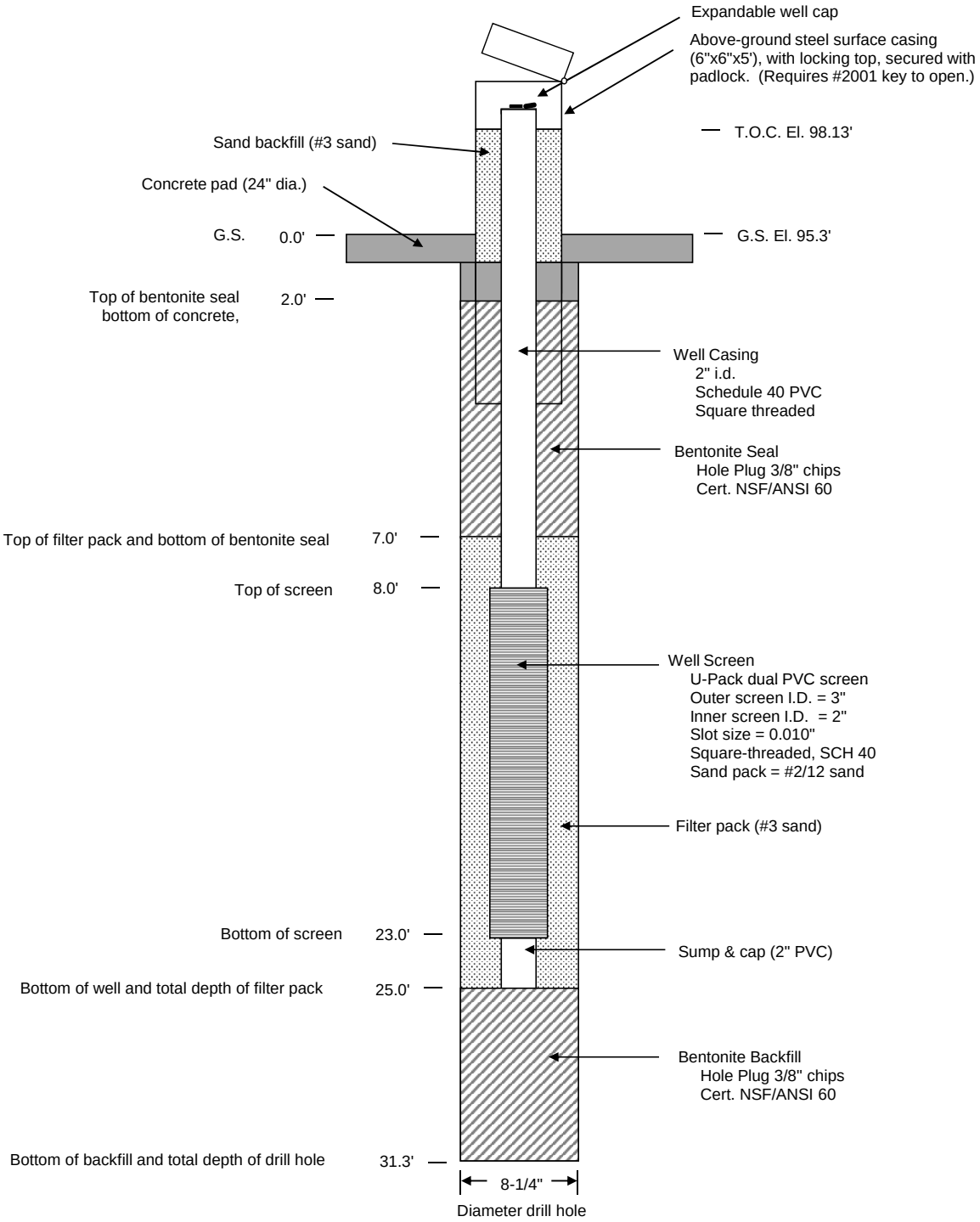
17. Additional comments on development:
1209-1220 - hand bailed 5 gallons - TURBID & SANDY
1222-1233 - pump 25 gallons

Name and Address of Facility Contact /Owner/Responsible Party
First Name: _____ Last Name: _____
Facility/Firm: _____
Street: _____
City/State/Zip: _____

I hereby certify that the above information is true and correct to the best of my knowledge.
Signature: _____
Print Name: _____
Firm: _____

NOTE: See instructions for more information including a list of county codes and well type codes.

MW-10-106	GEOLOGIST: A. Warren
WELL COMPLETION DIAGRAM	DRILLER: G. Hansen
DATE COMPLETED: 11/18/2010	HELPERS: D. Read & C. Peterson
LOCATION: Field east of Turner Island Road T.O.C. COORDINATES: N2304528.33 E6065473.87 (NAD93) EL. 98.13' (NAVD88) G.S. ELEVATION: 95.3' (NAVD88)	



***NOT TO SCALE**

NOTES:

T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, El. = Elevation
Dia. = Diameter NS = Not Surveyed

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-108

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Left, Merced County
BEGUN: 11/15/10 FINISHED: 11/15/10
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 7.14 ft. (89.9 ft. - 12/08/2010)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,304,569.2 E 6,075,776.6 NAD83
TOTAL DEPTH: 31.3 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 97.0 ft. NADV88
ANGLE FROM HORIZONTAL: -90°
HOLE LOGGED BY: A. Warren
REVIEWED BY: S. Dalton

NOTES

ALL MEASUREMENTS ARE IN FEET FROM THE GROUND SURFACE

PURPOSE OF HOLE:
To recover core, collect data to determine geologic and hydrologic site conditions, and install a groundwater monitoring well.

LOCATION:
Reach 4B1, River Bank Left, Merced County, on a farm road about 2 miles East of Turner Island Road.

DRILLED BY:
Bureau of Reclamation: PN Region drill crew:
Gerry Hansen, driller
Chris Peterson, helper
Dennis Read, helper

DRILL RIG:
Truck mounted Central Mining Equipment (CME) 75

DRILLING & SAMPLING METHODS:
The drill hole was advanced using 8-1/4 inch o.d. by 4-1/4 inch i.d. hollow stem flight augers equipped with an 8-1/2 inch o.d. bullet and spade drill bit. Continuous (undisturbed) sampling was performed by advancing a 4 inch o.d. by 3-3/8 inch i.d. by 5 feet long split barrel dry core system (FADC). Unless indicated otherwise, the FADC was placed inside the augers and the cutting shoe of the FADC extended 0.2 foot beyond the auger drill bit. A free-spinning adapter was placed at the top of the FADC, so that the FADC did not rotate while advancing the augers.

Interval Method
0.0 to 31.3 ft. FADC

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
0.0 to 4.3 ft. - Moderately firm
4.3 to 8.8 ft. - Soft
8.8 to 13.8 ft. - Moderately firm
18.8 to 23.8 ft. - Add catcher with nylon, add water

DRILLING FLUID, RETURN AND COLOR:
0.0 to 31.3 ft. - Drilled without fluid

WATER LEVEL FROM TOC:
9.83 ft. on 12/08/2010

REASON FOR HOLE TERMINATION:
The hole was terminated upon successful completion to the target depth.

DEPTH	% CORE RECOVERY	LABORATORY DATA: <0.005	<0.075	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION	El.	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION	El.
												CH	
	79												93.5
												CL	
5													91.6
												(CL/ML)s	90.7
	62												
		79.7	18.1	2.2	0.0	45.3	22.7	30.0	CL	88.5		CH	
													88.1
												(CL)s	
10													86.7
	100	15.2	73.4	11.4	0.0	28.3	7.0	26.1	CL	85.0		CL	
													84.6
		31.8	57.3	10.9	0.0	29.2	13.1	17.7	CL	83.5		CL/ML	
15											Qal		82.1
	100	35.8	51.4	12.8	0.0	31.7	17.3	20.6	CL	80.0		CL	
													78.4
												SP-SC	78.2

CLASSIFICATION AND PHYSICAL CONDITION

0.0 to 31.3 ft.
QUATERNARY ALLUVIUM - Qal

0.0 to 3.5 ft. FAT CLAY, CH:
About 100% fines, with high plasticity, no dilatancy; moist to dry, dark brown; very firm consistency; disturbed at 0.0 to 1.0 ft.

3.5 to 5.4 ft. LEAN CLAY, CL:
About 90% fines with low plasticity; about 10% fine sand; dry to moist, olive brown with trace reddish brown oxidation; moderately firm; thinly bedded CL/CH at 5.4 ft.

5.4 to 6.3 ft. LEAN CLAY WITH SILT AND SAND, (CL/ML)s:
About 80% fines with low plasticity; about 20% fine sand; moist, olive brown with reddish brown; moderately firm.

6.3 to 8.9 ft. FAT CLAY, CH:
About 100% fines with high plasticity, high toughness, no dilatancy; moist, olive brown with reddish brown oxidation; very firm.

Lab Data Interval
7.5 to 8.5 ft.

8.9 to 10.3 ft. LEAN CLAY WITH SAND, (CL)s:
About 85% fines with low plasticity; about 15% fine sand; moist, olive brown with reddish brown; cemented in fine layers.

10.3 to 12.4 ft. LEAN CLAY, CL:
About 90% fines with low plasticity; about 10% fine sand; wet, olive brown; soft and flowing; micaceous.

Lab Data Interval
11.0 to 12.0 ft.

12.4 to 14.9 ft. LEAN CLAY WITH SILT, CL/ML:
About 90-95% fines with low plasticity; about 10-5% fine sand; moist to dry, olive brown; very firm; silty texture.

Lab Data Interval
12.5 to 13.5 ft.

14.9 to 18.6 ft. LEAN CLAY, CL:
About 100% fines with low plasticity, low to medium toughness, no dilatancy; moist, olive brown mottled with dark brown; firm; silty; loses toughness and firmness when worked with water.

Lab Data Interval
16.0 to 17.0 ft.

18.6 to 18.8 ft. POORLY GRADED SAND WITH CLAY, SP-SC:
About 90% fine sand, trace medium sand; about 10% fines with medium plasticity; moist to wet, gray.

Note: 18.6 to 18.7 ft.: Gradual contact.

COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-plastic
NR = No Recovery
NA = Not applicable
I.D. = inner diameter
O.D. = outer diameter
G.S. = Ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-108

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Left, Merced County
BEGUN: 11/15/10 FINISHED: 11/15/10
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 7.14 ft. (89.9 ft. - 12/08/2010)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,304,569.2 E 6,075,776.6 NAD83
TOTAL DEPTH: 31.3 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 97.0 ft. NADV88
ANGLE FROM HORIZONTAL: -90°
HOLE LOGGED BY: A. Warren
REVIEWED BY: S. Dalton

NOTES

HOLE COMPLETION:
Well Casing: +3.0 to 20.0 ft. (2-inch blank PVC)
Dual U-pack Screen: 20.0 to 30.0 ft. (2-inch inner screen; 3-inch outer screen; slotted 0.010-inch)
U-Pack Screen Filter Pack: #2/12 Sand
Filter Pack: 19.0 to 31.3 ft. (#3 Sand)
Sump: 30.0 to 31.3 ft. (2-inch blank PVC with slip cap)
Bentonite Seal: 14.0 to 19.0 ft.
Concrete Seal: 0.0 to 14.0 ft.
Well Completion: Steel surface casing with locking top, 6-inch by 6-inch by 5-foot long; 2.0 ft. diameter concrete pad.
Lock: #2001 Masterlock

DEPTH	% CORE RECOVERY	LABORATORY DATA: <0.005	<0.075	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION / El.	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / El.
	62	1.6	5.1	93.3	0.0	NP	NP	27.9	SP-SM 75.0		SP-SM 73.8
25	88	2.5	12.4	84.6	0.5	NP	NP	22.8	SM 69.0		SM 72.8 / SP-SM 69.6 / SM 69.1
30	36										SP 65.7

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

18.8 to 23.2 ft. POORLY GRADED SAND WITH SILT, SP-SM:
About 90% fine sand; about 10% non plastic fines; wet, gray; moderately soft to soft.

Lab Data Interval
21.0 to 22.0 ft.

23.2 to 24.2 ft. SILTY SAND, SM:
About 80% fine sand; about 20% non plastic fines; wet, olive tan; soft; dilatent.

24.2 to 27.4 ft. POORLY GRADED SAND WITH SILT, SP-SM:
About 90% fine to medium sand, trace coarse; about 10% non plastic fines; wet, olive tan; moderately soft; granitic; oxidized reddish brown band from 27.2 to 27.4 ft.

27.4 to 27.9 ft. SILTY SAND, SM:
About 80% fine sand; about 20% non plastic fines; wet, gray to blue; moderately firm; micaceous.

27.9 to 31.3 ft. POORLY GRADED SAND, SP:
About 95% fine sand; about 5% non plastic fines; wet, gray; soft; 3/4 inch oxidized wood chunks are present.

Lab Data Interval
27.9 to 28.0 ft.

COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-plastic
NR = No Recovery
NA = Not applicable
I.D. = inner diameter
O.D. = outer diameter
G.S. = Ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

San Joaquin River Restoration Program
U.S. Department of Interior, Bureau of Reclamation

MONITORING WELL DEVELOPMENT

Facility/Project Name	County Name	Well Name
SJRRP	Merced	MW-10-108
Facility License, Permit or Monitoring Number	**County Code**	**Wis. Unique Well Number**	**DNR Well ID Number**

1. Can this well be purged dry? Yes ☐ No ☒

2. Well development method
   - surged with bailer and bailed ☐ 41
   - surged with bailer and pumped ☒ 61
   - surged with block and bailed ☐ 42
   - surged with block and pumped ☐ 62
   - surged with block, bailed and pumped ☐ 70
   - compressed air ☐ 20
   - bailed only ☐ 10
   - pumped only ☐ 51
   - pumped slowly ☐ 50
   - Other _____ ☐ 96

3. Time spent developing well ____ min.

4. Depth of well (from top of well casisng) 31.1 ft.

5. Inside diameter of well 2. in.

6. Volume of water in filter pack and well casing ____ gal.

7. Volume of water removed from well 25. gal.

8. Volume of water added (if any) ____ gal.

9. Source of water added _____

10. Analysis performed on water added? (If yes, attach results) ☐ Yes ☐ No

	Before Development	After Development
11. Depth to Water (from top of well casing)	a. 9.83 ft.	8.7 ft. (2.85)
Date	b. 12/08/2010 (m m d d y y y y)	12/08/2010 (m m d d y y y y)
Time	c. 11:27 ☒ a.m. ☐ p.m.	☐ a.m. ☐ p.m.
12. Sediment in well bottom	tr. inches	____ inches
13. Water clarity	Clear ☐ 10 Turbid ☒ 15 (Describe)	Clear ☒ 20 Turbid ☐ 25 (Describe)
14. Total suspended solids	____.__ mg/l	____.__ mg/l
15. COD	____.__ mg/l	____.__ mg/l

Fill in if drilling fluids were used and well is at solid waste facility:

16. Well developed by: Name (first, last) and Firm
First Name: Gerry Last Name: Hansen
Firm:

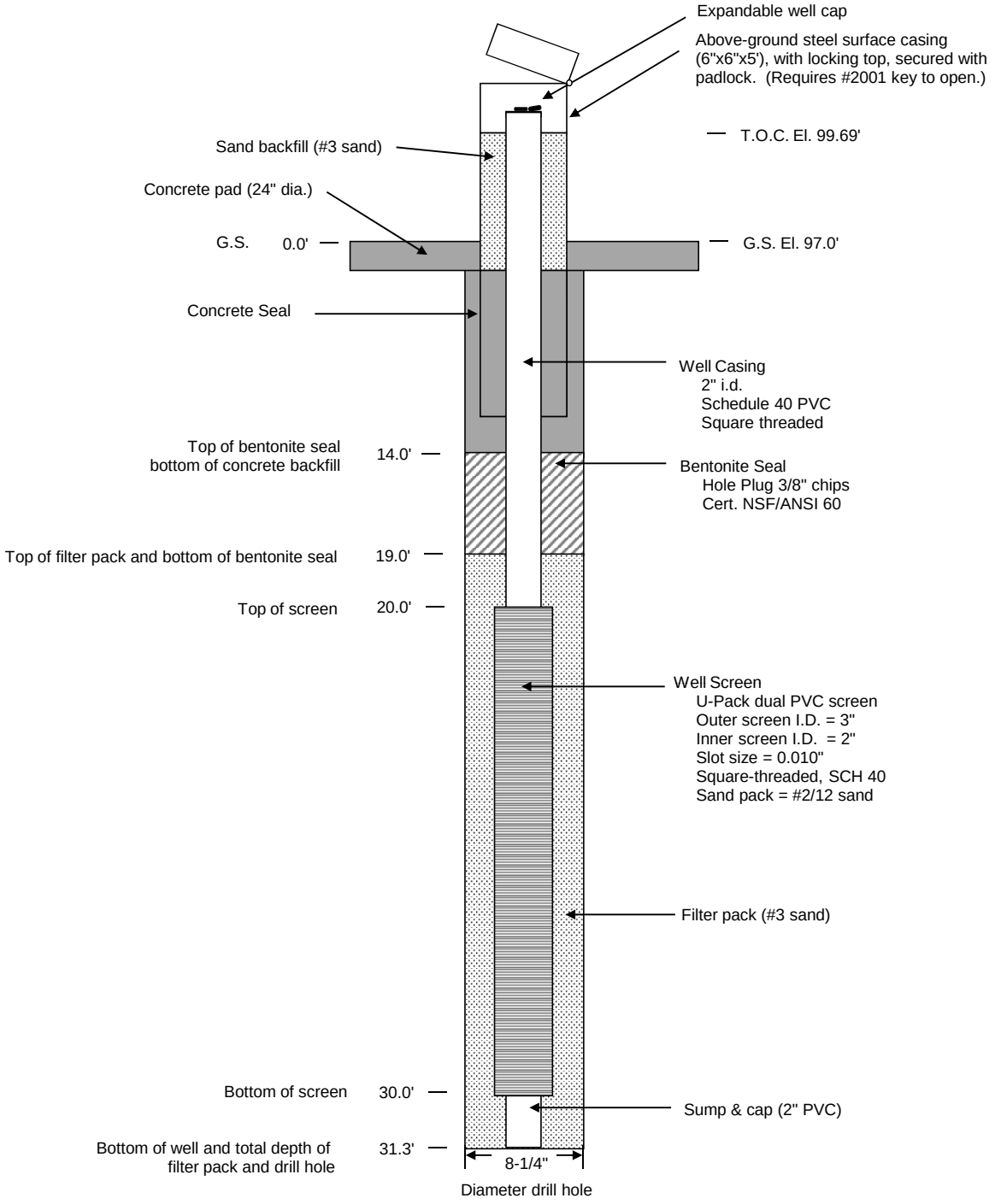
17. Additional comments on development:
1129-1139 - bailed 5 gals by hand
1141-1147 - pumped 20 gals

Name and Address of Facility Contact /Owner/Responsible Party
First Name: _____ Last Name: _____
Facility/Firm: _____
Street: _____
City/State/Zip: _____

I hereby certify that the above information is true and correct to the best of my knowledge.
Signature: _____
Print Name: _____
Firm: _____

NOTE: See instructions for more information including a list of county codes and well type codes.

MW-10-108	GEOLOGIST: A. Warren
WELL COMPLETION DIAGRAM	DRILLER: G. Hansen
DATE COMPLETED: 11/15/2010	HELPERS: D. Read & C. Peterson
LOCATION: Field east of Turner Island Road T.O.C. COORDINATES: N2304569.20 E6075776.63 (NAD93) EL. 99.69' (NAVD88) G.S. ELEVATION: 97.0' (NAVD88)	



***NOT TO SCALE**

NOTES:

T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, El. = Elevation
Dia. = Diameter NS = Not Surveyed

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-109

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Left, Merced County
BEGUN: 11/16/10 FINISHED: 11/16/10
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 6.9 ft. (91.6 ft. - 12/08/2010)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,301,959.1 E 6,075,822.8 NAD83
TOTAL DEPTH: 31.2 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 98.5 ft. NADV88
ANGLE FROM HORIZONTAL: -90°
HOLE LOGGED BY: A. Warren
REVIEWED BY: S. Dalton

NOTES

ALL MEASUREMENTS ARE IN FEET FROM THE GROUND SURFACE

PURPOSE OF HOLE:
To recover core, collect data to determine geologic and hydrologic site conditions, and install a groundwater monitoring well.

LOCATION:
Reach 4B1, River Bank Left, Merced County, on farm road about 2 miles East of Turner Island Road.

DRILLED BY:
Bureau of Reclamation: PN Region drill crew:
Gerry Hansen, driller
Chris Peterson, helper
Dennis Read, helper

DRILL RIG:
Truck mounted Central Mining Equipment (CME) 75

DRILLING & SAMPLING METHODS:
The drill hole was advanced using 8-1/4 inch o.d. by 4-1/4 inch i.d. hollow stem flight augers equipped with an 8-1/2 inch o.d. bullet and spade drill bit. Continuous (undisturbed) sampling was performed by advancing a 4 inch o.d. by 3-3/8 inch i.d. by 5 feet long split barrel dry core system (FADC). Unless indicated otherwise, the FADC was placed inside the augers and the cutting shoe of the FADC extended 0.2 foot beyond the auger drill bit. A free-spinning adapter was placed at the top of the FADC, so that the FADC did not rotate while advancing the augers.

Interval Method
0.0 to 31.2 ft. FADC

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
0.0 to 3.7 ft. - Moderately soft
3.7 to 8.7 ft. - Wet
8.7 to 13.7 ft. - Add catcher and water
21.2 to 23.7 ft. - Add catcher with nylon

DRILLING FLUID, RETURN AND COLOR:
0.0 to 31.2 ft. - Drilled without fluid

WATER LEVEL FROM TOC:
9.67 ft. on 12/08/2010

REASON FOR HOLE TERMINATION:
The hole was terminated upon successful completion to the target depth.

HOLE COMPLETION:
Well Casing: +3.0 to 20.0 ft. (2-inch blank PVC)
Dual U-pack Screen: 20.0 to 30.0 ft. (2-inch inner screen; 3-inch outer screen; slotted 0.010-inch)
U-Pack Screen Filter Pack: #2/12 Sand
Filter Pack: 19.0 to 31.2 ft. (#3 Sand)
Sump: 30.0 to 31.2 ft. (2-inch blank PVC with slip cap)
Bentonite Seal: 2.0 to 19.0 ft.
Concrete Seal: 0.0 to 2.0 ft.
Well Completion: Steel surface casing with locking top, 6-inch by 6-inch by 5-foot long; 2.0 ft. diameter concrete pad.
Lock: #2001 Masterlock

DEPTH	% CORE RECOVERY	LABORATORY DATA: <0.005	<0.075	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION / El.	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / El.
											s(CL) 96.0
	59.46										SC 93.4
5											SM 92.9
	62										
		10.7	65.7	23.6	0.0	NP	NP	25.5	(ML)s 90.5	▼	s(ML) 88.7
10		32.7	60.1	7.2	0.0	32.8	16.6	22.8	CL 87.8		(CL/ML)s 86.5
	100										SC 84.8
15										Qal	CL
	100										81.0
		26.9	47.7	25.4	0.0	31.8	16.3	22.5	(CL)s 80.0		s(CL) 79.8
											s(ML) 78.8

CLASSIFICATION AND PHYSICAL CONDITION

0.0 to 31.2 ft.
QUATERNARY ALLUVIUM - Qal

0.0 to 2.5 ft. SANDY LEAN CLAY, s(CL):
About 60% fines with medium plasticity; about 40% fine sand; organics (leaves, roots, etc.); dry, brown; powdered and loose.

2.5 to 5.1 ft. CLAYEY SAND, SC:
About 55% fine sand; about 45% fines medium plasticity, medium toughness; dry, brown; firm.

5.1 to 5.6 ft. SILTY SAND, SM:
About 70% fine sand; about 30% non plastic fines; moist to wet, brown; moderately soft.

5.6 to 9.8 ft. SANDY SILT, s(ML):
About 65% fines with low plasticity, low toughness; about 35% fine sand; moist to wet, olive brown; moderately soft; flowing.

Lab Data Interval
7.0 to 8.0 ft.

9.8 to 12.0 ft. LEAN CLAY WITH SILT AND SAND, (CL/ML)s:
About 85% fines with low plasticity, no toughness; about 15% fine sand; moist, olive brown; firm.

Lab Data Interval
9.8 to 10.7 ft.

12.0 to 13.7 ft. CLAYEY SAND, SC:
About 60% fine sand; about 40% fines with medium plasticity; moist, olive brown; moderately firm; layered.

13.7 to 17.5 ft. LEAN CLAY, CL:
About 95% fines with medium plasticity, medium toughness, no dilatancy; about 5% fine sand; moist, olive brown; firm.

17.5 to 18.7 ft. SANDY LEAN CLAY, s(CL):
About 65% fines with low plasticity; about 35% fine sand; moist, olive brown with slight reddish brown oxidation; moderately firm.

Lab Data Interval
17.5 to 18.5 ft.

18.7 to 20.2 ft. SANDY SILT, s(ML):
About 55% fines with low plasticity; about 45% fine sand; moist, olive brown with reddish brown; very firm; soft, flowing Silty Sand, SM, interval from 19.7 to 20.2 ft.

20.2 to 21.2 ft. SILTY SAND, SM:
About 70% fine sand; about 30% non plastic fines; moist, dark gray with reddish brown; moderately firm.

21.2 to 28.7 ft. NO RECOVERY

Note: Trace SILTY SAND, SM in shoe: About 80% fine sand; about 20% non plastic fines; wet, gray; soft.

28.7 to 30.3 ft. NO RECOVERY

COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-plastic
NR = No Recovery
NA = Not applicable
I.D. = inner diameter
O.D. = outer diameter
G.S. = Ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-109

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Left, Merced County
BEGUN: 11/16/10 FINISHED: 11/16/10
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 9.61 ft. (91.6 ft. - 12/08/2010)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,301,959.1 E 6,075,822.8 NAD83
TOTAL DEPTH: 31.2 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 98.5 ft. NADV88
ANGLE FROM HORIZONTAL: -90°
HOLE LOGGED BY: A. Warren
REVIEWED BY: S. Dalton

NOTES

DEPTH	% CORE RECOVERY	LABORATORY DATA: <0.005	<0.075	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION / El.	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / El.
	68										NR 78.3
											SM 77.3
	0										
25											
	0										NR
30	36										68.2
		0.0	4.1	95.5	0.4	NP	NP	22.8	SP 67.5		SP 67.3

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

30.3 to 31.2 ft. POORLY GRADED SAND, SP:
About 95% fine sand; about 5% non plastic fines; wet, gray; moderately soft; layered.

Lab Data Interval
30.0 to 31.0 ft.

COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-plastic
NR = No Recovery
NA = Not applicable
I.D. = inner diameter
O.D. = outer diameter
G.S. = Ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

San Joaquin River Restoration Program
U.S. Department of Interior, Bureau of Reclamation

MONITORING WELL DEVELOPMENT

Facility/Project Name	County Name	Well Name
SJRRP	Merced	MW-10-109

Facility License, Permit or Monitoring Number	County Code	Wis. Unique Well Number	DNR Well ID Number

1. Can this well be purged dry? Yes ☐ No ☒

2. Well development method

surged with bailer and bailed	☐ 41
surged with bailer and pumped	☒ 61
surged with block and bailed	☐ 42
surged with block and pumped	☐ 62
surged with block, bailed and pumped	☐ 70
compressed air	☐ 20
bailed only	☐ 10
pumped only	☐ 51
pumped slowly	☐ 50
Other _____	☐

3. Time spent developing well 23 min.

4. Depth of well (from top of well casisng) 21.3 ft.

5. Inside diameter of well 2.00 in.

6. Volume of water in filter pack and well casing ____.__ gal.

7. Volume of water removed from well 25 gal.

8. Volume of water added (if any) ____.__ gal.

9. Source of water added _____

10. Analysis performed on water added? (If yes, attach results) ☐ Yes ☐ No

	Before Development	After Development
11. Depth to Water (from top of well casing)	a. 9.67 ft.	9.71 ft. (2.05)
Date	b. 12/08/2010 (m m d d y y y y)	12/08/2010
Time	c. 10:57 ☐ a.m. ☐ p.m.	11:20 ☒ a.m. ☐ p.m.
12. Sediment in well bottom	___.__ inches	___.__ inches
13. Water clarity	Clear ☐ 10 Turbid ☒ 15 (Describe)	Clear ☒ 20 Turbid ☐ 25 (Describe)
	fine green sand in sump	

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids	____.__ mg/l	____.__ mg/l
15. COD	____.__ mg/l	____.__ mg/l

16. Well developed by: Name (first, last) and Firm
First Name: Gerry Last Name: Hansen
Firm:

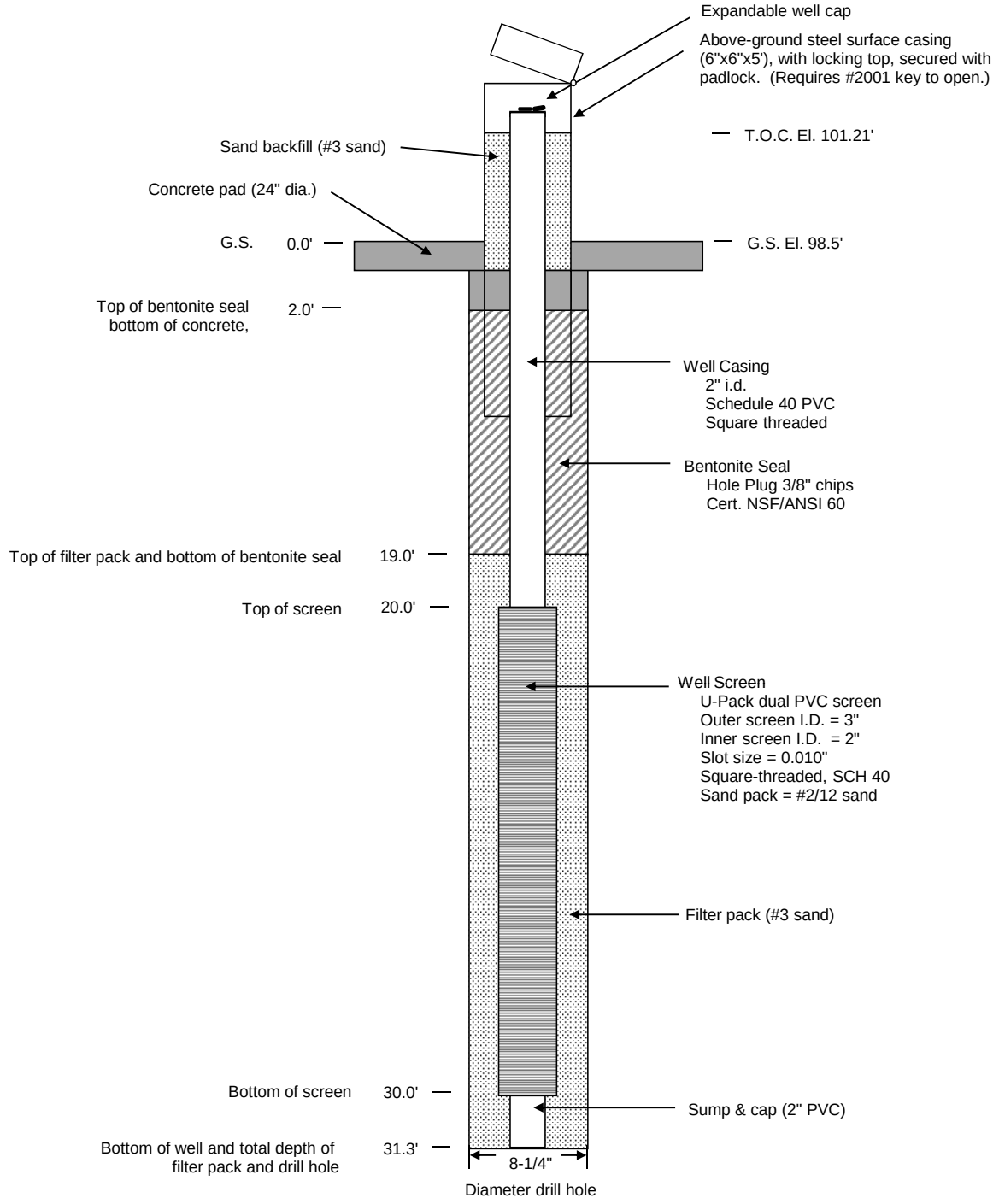
17. Additional comments on development:
10:57-11:07 - hard bail 5 gal
11:09-11:16 pump 20 gal

Name and Address of Facility Contact /Owner/Responsible Party
First Name: _____ Last Name: _____
Facility/Firm: _____
Street: _____
City/State/Zip: _____

I hereby certify that the above information is true and correct to the best of my knowledge.
Signature: _____
Print Name: _____
Firm: _____

NOTE: See instructions for more information including a list of county codes and well type codes.

MW-10-109	GEOLOGIST: A. Warren
WELL COMPLETION DIAGRAM	DRILLER: G. Hansen
DATE COMPLETED: 11/16/2010	HELPERS: D. Read & C. Peterson
LOCATION: Field east of Turner Island Road T.O.C. COORDINATES: N2301959.12 E6075822.75 (NAD93) EL. 101.21' (NAVD88) G.S. ELEVATION: 98.5' (NAVD88)	



***NOT TO SCALE**

NOTES:

T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, El. = Elevation
Dia. = Diameter NS = Not Surveyed

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-110

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Left, Merced County
BEGUN: 11/12/10 FINISHED: 11/13/10
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 9.25 ft. (83.8 ft. - 12/08/2010)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,312,999.7 E 6,050,877.0 NAD83
TOTAL DEPTH: 30.9 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 92.4 ft. NADV88
ANGLE FROM HORIZONTAL: -90°
HOLE LOGGED BY: A. Warren
REVIEWED BY: S. Dalton

NOTES

ALL MEASUREMENTS ARE IN FEET FROM THE GROUND SURFACE

PURPOSE OF HOLE:
To recover core, collect data to determine geologic and hydrologic site conditions, and install a groundwater monitoring well.

LOCATION:
Reach 4B1, River Bank Left, Merced County, at intersection of ditch and San Joaquin River, North of Hereford Road.

DRILLED BY:
Bureau of Reclamation: PN Region drill crew:
Gerry Hansen, driller
Chris Peterson, helper
Dennis Read, helper

DRILL RIG:
Truck mounted Central Mining Equipment (CME) 75

DRILLING & SAMPLING METHODS:
The drill hole was advanced using 8-1/4 inch o.d. by 4-1/4 inch i.d. hollow stem flight augers equipped with an 8-1/2 inch o.d. bullet and spade drill bit. Continuous (undisturbed) sampling was performed by advancing a 4 inch o.d. by 3-3/8 inch i.d. by 5 feet long split barrel dry core system (FADC). Unless indicated otherwise, the FADC was placed inside the augers and the cutting shoe of the FADC extended 0.2 foot beyond the auger drill bit. A free-spinning adapter was placed at the top of the FADC, so that the FADC did not rotate while advancing the augers.

Interval Method
0.0 to 30.9 ft. FADC

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
0.0 to 3.6 ft. - Soft
8.4 to 18.4 ft. - Medium soft, add water, catcher with nylon
18.4 to 23.4 ft. - Add catcher with nylon

DRILLING FLUID, RETURN AND COLOR:
0.0 to 30.9 ft. - Drilled without fluid

WATER LEVEL FROM TOC:
8.2 ft. on 11/12/2010

REASON FOR HOLE TERMINATION:
The hole was terminated upon successful completion to the target depth.

HOLE COMPLETION:
Well Casing: +3.0 to 18.0 ft. (2-inch blank PVC)
Dual U-pack Screen: 18.0 to 28.0 ft. (2-inch inner screen; 3-inch outer screen; slotted 0.010-inch)
U-Pack Screen Filter Pack: #2/12 Sand
Filter Pack: 16.0 to 30.9 ft. (#3 Sand)
Sump: 28.0 to 30.9 ft. (2-inch blank PVC with slip cap)
Bentonite Seal: 2.0 to 16.0 ft.
Concrete Seal: 0.0 to 2.0 ft.
Well Completion: Steel surface casing with locking top, 6-inch by 6-inch by 5-foot long; 2.0 ft. diameter concrete pad.
Lock: #2001 Masterlock

DEPTH	% CORE RECOVERY	LABORATORY DATA: <0.005	<0.075	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION / El.	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / El.
											SM 91.1
	75										CL 90.2
											SM
5											
	81.25										86.3
		1.3	11.6	87.1	0.0	NP	NP	13.7	SM 84.4		
										▼	SP
10		0.0	3.6	96.4	0.0	NP	NP	23.0	SP 81.4		
	70										
											79.0
	0										
15										Qal	NR
	0										
											74.0
		0.0	4.6	95.4	0.0	NP	NP	24.4	SP 72.4		

0.0 to 30.9 ft.
QUATERNARY ALLUVIUM - Qal

0.0 to 1.3 ft. SILTY SAND, SM:
About 75% fine sand, micaceous; about 25% non plastic fines; dry, brown; firm.

1.3 to 2.2 ft. LEAN CLAY, CL:
About 95% fines with medium plasticity, low toughness, slow dilatancy; about 5% fine sand; dry, brown; very firm; spongey texture.

2.2 to 6.1 ft. SILTY SAND, SM:
About 75% fine sand, micaceous; about 25% non plastic fines; dry, brown; firm.

6.1 to 13.4 ft. POORLY GRADED SAND, SP:
About 90-95% fine to medium sand (predominately fine, coarsening downwards); about 10-5% non plastic fines; moist to wet, gray with reddish orange oxidation; soft.

Lab Data Interval
6.0 to 7.0 ft.

Note: 8.4 to 13.4. ft.: Predominately medium with trace coarse sand; less oxidation (gray); saturated.

Lab Data Interval
9.0 to 11.0 ft.

13.4 to 18.4 ft. NO RECOVERY

18.4 to 23.2 ft. POORLY GRADED SAND, SP:
About 95% fine to medium sand, trace coarse sand; about 5% fines; wet, gray; soft; about 1.0 ft. thick layers of fine and medium sand.

Lab Data Interval
19.0 to 20.0 ft.

23.2 to 23.4 ft. CLAYEY SAND, SC:
About 60% fine sand; about 40% fines with medium plasticity; wet, gray.

23.4 to 30.9 ft. NO RECOVERY

COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-plastic
NR = No Recovery
NA = Not applicable
I.D. = inner diameter
O.D. = outer diameter
G.S. = Ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-110

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Left, Merced County
BEGUN: 11/12/10 FINISHED: 11/13/10
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 9.25 ft. (83.8 ft. - 12/08/2010)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,312,999.7 E 6,050,877.0 NAD83
TOTAL DEPTH: 30.9 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 92.4 ft. NADV88
ANGLE FROM HORIZONTAL: -90°
HOLE LOGGED BY: A. Warren
REVIEWED BY: S. Dalton

NOTES	DEPTH	% CORE RECOVERY	LABORATORY DATA: <0.005	<0.075	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION / El.	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / El.	CLASSIFICATION AND PHYSICAL CONDITION
		48										SP 69.2	
												SC 69.0	
	25	0										NR	
		0											
	30											61.5	

BOTTOM OF HOLE

COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-plastic
NR = No Recovery
NA = Not applicable
I.D. = inner diameter
O.D. = outer diameter
G.S. = Ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

San Joaquin River Restoration Program
U.S. Department of Interior, Bureau of Reclamation

MONITORING WELL DEVELOPMENT

Facility/Project Name	County Name	Well Name
SJRRP	Merced	MW-10-110
Facility License, Permit or Monitoring Number	**County Code**	**Wis. Unique Well Number** / **DNR Well ID Number**

1. Can this well be purged dry? Yes ☐ No ☒

2. Well development method

surged with bailer and bailed	☐ 41
surged with bailer and pumped	☒ 61
surged with block and bailed	☐ 42
surged with block and pumped	☐ 62
surged with block, bailed and pumped	☐ 70
compressed air	☐ 20
bailed only	☐ 10
pumped only	☐ 51
pumped slowly	☐ 50
Other _____	☐ __

3. Time spent developing well 30 min.

4. Depth of well (from top of well casisng) 86.7 ft.

5. Inside diameter of well 2.0 in.

6. Volume of water in filter pack and well casing ____.__ gal.

7. Volume of water removed from well 30.__ gal.

8. Volume of water added (if any) ____.__ gal.

9. Source of water added _____

10. Analysis performed on water added? (If yes, attach results) ☐ Yes ☐ No

	Before Development	After Development
11. Depth to Water (from top of well casing) a.	11.15 ft.	11.10 ft. (2.70)
Date b. (m m / d d / y y y y)	12/08/2010	12/09/2010
Time c.	13:05 ☐ a.m. ☒ p.m.	13:30 ☐ a.m. ☒ p.m.
12. Sediment in well bottom	.1 inches	____ inches
13. Water clarity	Clear ☐ 10 Turbid ☒ 15 (Describe) green	Clear ☒ 20 Turbid ☐ 25 (Describe)

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids	____.__ mg/l	____.__ mg/l
15. COD	____.__ mg/l	____.__ mg/l

16. Well developed by: Name (first, last) and Firm
First Name: GERRY Last Name: HANSEN
Firm: _____

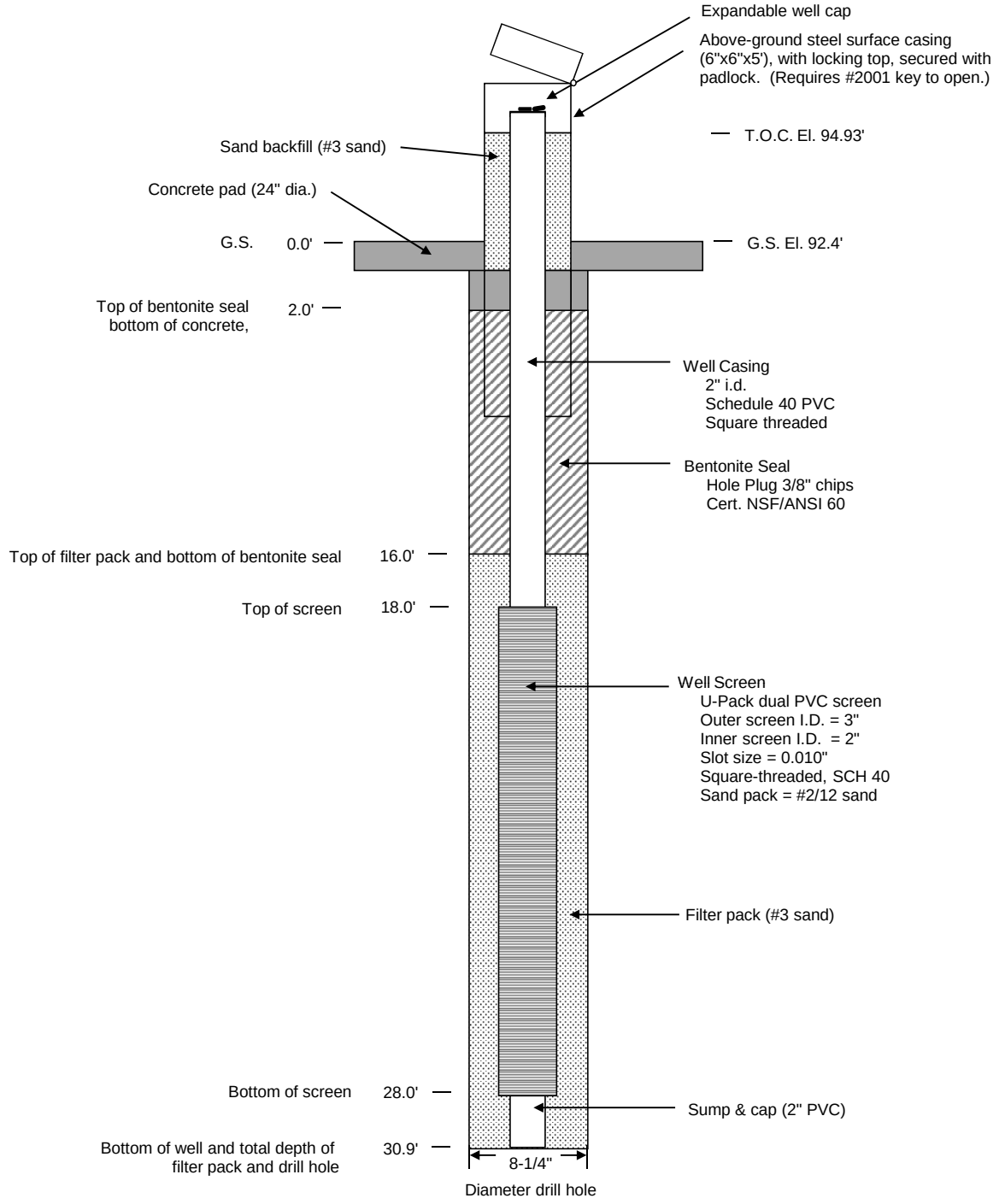
17. Additional comments on development:
1310-1318 Hand bail 5 gallo
1318-1328 Pump out 25 gallo

Name and Address of Facility Contact /Owner/Responsible Party
First Name: _____ Last Name: _____
Facility/Firm: _____
Street: _____
City/State/Zip: _____

I hereby certify that the above information is true and correct to the best of my knowledge.
Signature: _____
Print Name: _____
Firm: _____

NOTE: See instructions for more information including a list of county codes and well type codes.

MW-10-110	GEOLOGIST: A. Warren
WELL COMPLETION DIAGRAM	DRILLER: G. Hansen
DATE COMPLETED: 11/13/2010	HELPERS: D. Read & C. Peterson
LOCATION: Field north of Hereford Road T.O.C. COORDINATES: N2312999.71 E6050876.99 (NAD93) EL. 94.93' (NAVD88) G.S. ELEVATION: 92.4' (NAVD88)	



***NOT TO SCALE**

NOTES:

T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, El. = Elevation
Dia. = Diameter NS = Not Surveyed

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-111

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Left, Merced County
BEGUN: 11/11/10 FINISHED: 11/12/10
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 6.59 ft. (83.9 ft. - 12/08/2010)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,307,942.6 E 6,049,544.3 NAD83
TOTAL DEPTH: 31.0 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 90.5 ft. NADV88
ANGLE FROM HORIZONTAL: -90°
HOLE LOGGED BY: A. Warren
REVIEWED BY: S. Dalton

NOTES

ALL MEASUREMENTS ARE IN FEET FROM THE GROUND SURFACE

PURPOSE OF HOLE:
To recover core, collect data to determine geologic and hydrologic site conditions, and install a groundwater monitoring well.

LOCATION:
Reach 4B1, River Bank Left, Merced County, on a farm road about 900 feet East of the end of Hereford Road.

DRILLED BY:
Bureau of Reclamation: PN Region drill crew:
Gerry Hansen, driller
Chris Peterson, helper
Dennis Read, helper

DRILL RIG:
Truck mounted Central Mining Equipment (CME) 75

DRILLING & SAMPLING METHODS:
The drill hole was advanced using 8-1/4 inch o.d. by 4-1/4 inch i.d. hollow stem flight augers equipped with an 8-1/2 inch o.d. bullet and spade drill bit. Continuous (undisturbed) sampling was performed by advancing a 4 inch o.d. by 3-3/8 inch i.d. by 5 feet long split barrel dry core system (FADC). Unless indicated otherwise, the FADC was placed inside the augers and the cutting shoe of the FADC extended 0.2 foot beyond the auger drill bit. A free-spinning adapter was placed at the top of the FADC, so that the FADC did not rotate while advancing the augers.

Interval Method
0.0 to 31.0 ft. FADC

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
0.0 to 4.3 ft. - Soft
13.5 to 18.5 ft. - Very wet and soft
18.5 to 23.5 ft. - Add water, catcher with bag
23.5 to 26.0 ft. - Add catcher with bag

DRILLING FLUID, RETURN AND COLOR:
0.0 to 31.0 ft. - Drilled without fluid

WATER LEVEL FROM TOC:
9.28 ft. on 12/08/2010

REASON FOR HOLE TERMINATION:
The hole was terminated upon successful completion to the target depth.

HOLE COMPLETION:
Well Casing: +3.0 to 8.0 ft. (2-inch blank PVC)
Dual U-pack Screen: 8.0 to 28.0 ft. (2-inch inner screen; 3-inch outer screen; slotted 0.010-inch)
U-Pack Screen Filter Pack: #2/12 Sand
Filter Pack: 7.0 to 31.0 ft. (#3 Sand)
Sump: 28.0 to 31.0 ft. (2-inch blank PVC with slip cap)
Bentonite Seal: 2.0 to 7.0 ft.
Concrete Seal: 0.0 to 2.0 ft.
Well Completion: Steel surface casing with locking top, 6-inch by 6-inch by 5-foot long; 2.0 ft. diameter concrete pad.
Lock: #2001 Masterlock

DEPTH	% CORE RECOVERY	LABORATORY DATA: <0.005	<0.075	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION / El.	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / El.
											s(ML) 87.7
	100	1.6	19.9	78.5	0.0	NP	NP	9.7	SM 86.2		SM 84.8
5											
	100	34.0	56.3	9.7	0.0	39.4	19.5	31.4	CL 83.0		CL/ML 81.1
10											
	100	16.6	47.4	36.0	0.0	NP	NP	33.5	s(ML) 78.5		s(ML) 77.8
											SM 77.5
											CL 76.6
15		24.2	52.5	23.3	0.0	28.9	11.4	23.8	(CL)s 75.0	Qal	(CL)s 72.0
	100										SM

CLASSIFICATION AND PHYSICAL CONDITION

0.0 to 31.0 ft.
QUATERNARY ALLUVIUM - Qal

0.0 to 2.8 ft. SANDY SILT, s(ML):
About 60% fines with low plasticity, low toughness, rapid dilatancy; about 40% fine sand; dry, brown; micaceous; abundant roots and organics; calcareous veins at about 2.0 to 2.5 ft.

Note: Layer of SILTY SAND, SM, from 1.0 to 1.9 ft.

2.8 to 5.7 ft. SILTY SAND, SM:
About 80% fine sand; about 20% non plastic fines, no toughness, rapid dilatancy; moist to dry, brown; micaceous; soft; homogenous.

Lab Data Interval
4.0 to 4.3 ft.

5.7 to 9.4 ft. LEAN CLAY WITH SILT, (CL/ML):
About 90% fines with low plasticity, low toughness, slow dilatancy; about 10% fine sand; moist, brown with few reddish brown oxidation veinlettes; wet sandy zone from 8.0 to 8.1 ft.; trace woody debris; micaceous.

Lab Data Interval
6.5 to 7.5 ft.

Note: 8.5 to 9.4 ft.: Grades to about 35-40% sand; many vertically oriented 0.5 to 1.0 inch woody debris pieces with reddish brown oxidation halos.

9.4 to 12.7 ft. SANDY SILT, s(ML):
About 65% non plastic fines, rapid dilatancy; about 35% fine sand; wet, gray; some black roots and vegetation from 3.0 inch to fragments; soft; flows when placed in corebox.

Lab Data Interval
11.0 to 12.0 ft.

12.7 to 13.0 ft. SILTY SAND, SM:
About 55% fine sand; about 45% fines with low plasticity, rapid dilatancy; wet, gray; <0.1 ft. layer of white, medium SP at 13.0 ft.

13.0 to 13.9 ft. LEAN CLAY, CL:
About 95% fines with medium plasticity, medium toughness, medium dilatancy; about 5% fine sand, micaceous; moist, gray with trace reddish brown oxidation; moderate firm consistency.

13.9 to 18.5 ft. LEAN CLAY WITH SAND, (CL)s:
About 75% fines with low plasticity, slow dilatancy; about 25% fine sand, micaceous; moist, gray-brown with reddish brown oxidation; moderately firm; wet, sandy layer from 18.3 to 18.4 ft.

Lab Data Interval
13.9 to 18.5 ft.

COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-plastic
NR = No Recovery
NA = Not applicable
I.D. = inner diameter
O.D. = outer diameter
G.S. = Ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-111

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Left, Merced County
BEGUN: 11/11/10 FINISHED: 11/12/10
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 6.59 ft. (83.9 ft. - 12/08/2010)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,307,942.6 E 6,049,544.3 NAD83
TOTAL DEPTH: 31.0 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 90.5 ft. NADV88
ANGLE FROM HORIZONTAL: -90°
HOLE LOGGED BY: A. Warren
REVIEWED BY: S. Dalton

NOTES	DEPTH	% CORE RECOVERY	LABORATORY DATA: <0.005	<0.075	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION / El.	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / El.	CLASSIFICATION AND PHYSICAL CONDITION
		66										69.3	**18.5 to 21.2 ft. SILTY SAND, SM:** About 85% fine sand; about 15% non plastic fines; wet, olive brown; loose and flowing; somewhat micaceous; firms up at bottom of interval.
			20.0	68.4	11.6	0.0	NP	NP	29.5	ML 68.6		ML 68.6	**21.2 to 21.9 ft. SILT, ML:** About 90% fines with low plasticity, rapid dilatancy; about 10% fine sand; wet, gray; moderately soft; spongey, slippery texture.
												SP-SM 68.0	
												SP 67.3	Lab Data Interval 21.2 to 21.9 ft.
	25	60	4.5	12.2	83.3	0.0	NP	NP	25.6	SM 64.5		SP-SM 64.5	**21.9 to 22.5 ft. POORLY GRADED SAND WITH SILT, SP-SM:** About 90% fine sand; about 10% fines; gray, wet.
													22.5 to 23.2 ft. POORLY GRADED SAND, SP: About 95% medium sand; about 5% fines; gray to reddish brown, wet.
		0											**23.2 to 26.0 ft. POORLY GRADED SAND WITH SILT, SP-SM:** About 90-95% fine sand; about 5-10% fines; wet, gray; micaceous.
												NR	Note: 23.5 to 26.0 ft.: Flowing.
	30	0											Lab Data Interval 23.5 to 26.0 ft.
												59.5	**26.0 to 31.0 ft. NO RECOVERY**

BOTTOM OF HOLE

COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-plastic
NR = No Recovery
NA = Not applicable
I.D. = inner diameter
O.D. = outer diameter
G.S. = Ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

San Joaquin River Restoration Program
U.S. Department of Interior, Bureau of Reclamation

MONITORING WELL DEVELOPMENT

Facility/Project Name	County Name	Well Name
SJRRP	Merced	MW-10-111

Facility License, Permit or Monitoring Number	County Code	Wis. Unique Well Number	DNR Well ID Number

1. Can this well be purged dry? Yes ☐ No ☒

2. Well development method

surged with bailer and bailed	☐ 41
surged with bailer and pumped	☒ 61
surged with block and bailed	☐ 42
surged with block and pumped	☐ 62
surged with block, bailed and pumped	☐ 70
compressed air	☐ 20
bailed only	☐ 10
pumped only	☐ 51
pumped slowly	☐ 50
Other _____	☐

3. Time spent developing well 50 min.

4. Depth of well (from top of well casisng) 25.1 ft.

5. Inside diameter of well 2 in.

6. Volume of water in filter pack and well casing _____ gal.

7. Volume of water removed from well 65.0 gal.

8. Volume of water added (if any) _____ gal.

9. Source of water added _____

10. Analysis performed on water added? (If yes, attach results) ☐ Yes ☐ No

	Before Development	After Development
11. Depth to Water (from top of well casing) a.	9.28 ft.	9.40 ft. (2.7)
Date b. (m m / d d / y y y y)	12/08/2010	12/08/2010
Time c.	13:40 ☐ a.m. ☐ p.m.	14:30 ☐ a.m. ☐ p.m.
12. Sediment in well bottom	IV. inches	— inches
13. Water clarity	Clear ☐ 10 Turbid ☒ 15	Clear ☒ 20 Turbid ☐ 25
(Describe)	green	green tint
14. Total suspended solids	_____ mg/l	_____ mg/l
15. COD	_____ mg/l	_____ mg/l

Fill in if drilling fluids were used and well is at solid waste facility:

16. Well developed by: Name (first, last) and Firm
First Name: GERRY Last Name: HANSEN
Firm:

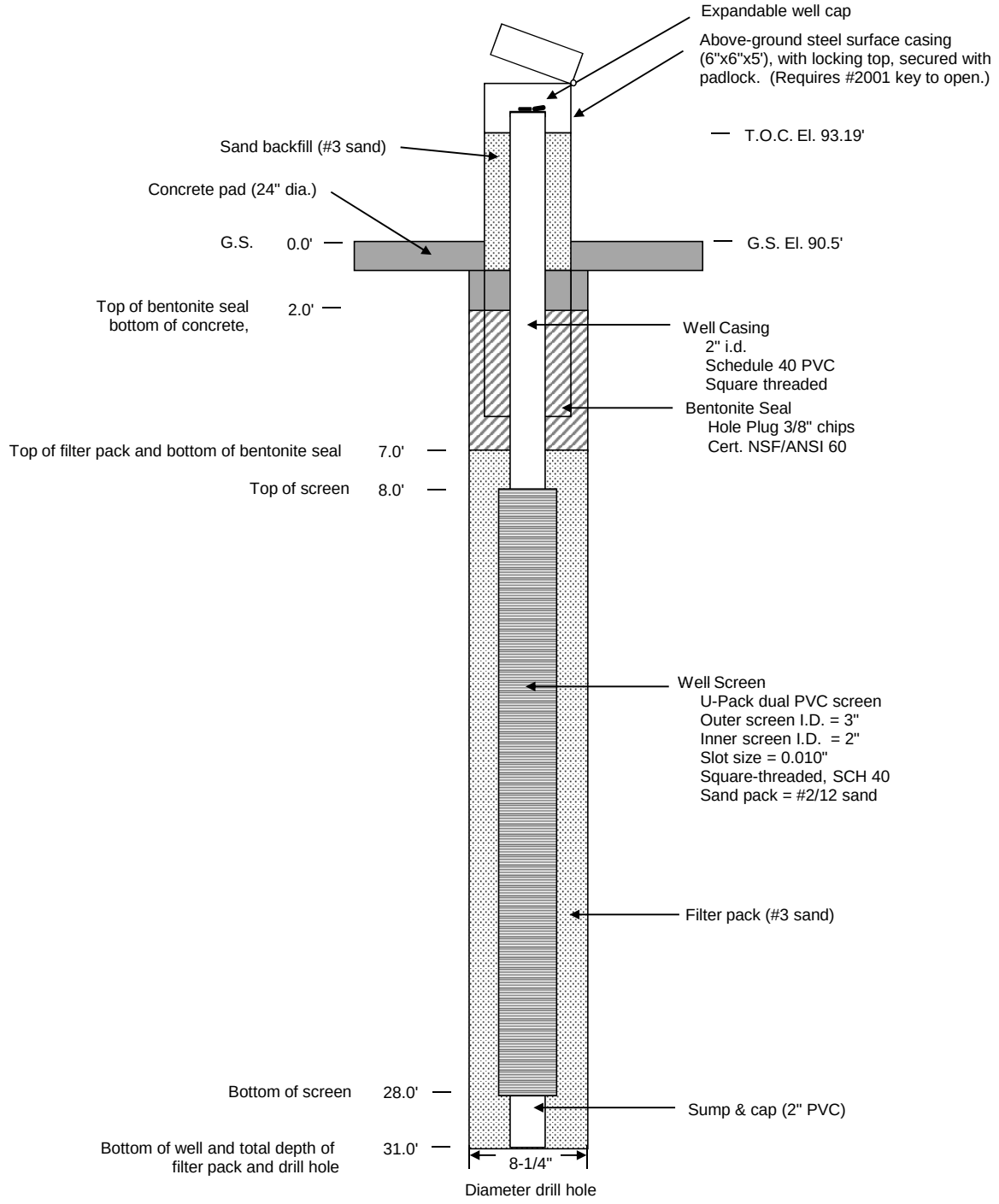
17. Additional comments on development:
1346-1354 - hand bail 5 gals.
1355-1420 - pump out 60 gals - Still slightly tinted but consistent color for 30 gals. Well in silter material.

Name and Address of Facility Contact /Owner/Responsible Party
First Name: _____ Last Name: _____
Facility/Firm: _____
Street: _____
City/State/Zip: _____

I hereby certify that the above information is true and correct to the best of my knowledge.
Signature: _____
Print Name: _____
Firm: _____

NOTE: See instructions for more information including a list of county codes and well type codes.

MW-10-111	GEOLOGIST: A. Warren
WELL COMPLETION DIAGRAM	DRILLER: G. Hansen
DATE COMPLETED: 11/12/2010	HELPERS: D. Read & C. Peterson
LOCATION: Field north of Hereford Road T.O.C. COORDINATES: N2307942.60 E6049544.28 (NAD93) EL. 93.19' (NAVD88) G.S. ELEVATION: 90.5' (NAVD88)	



***NOT TO SCALE**

NOTES:

T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, El. = Elevation
Dia. = Diameter NS = Not Surveyed

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-112

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Right, Merced County
BEGUN: 11/21/10 FINISHED: 11/21/10
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 15.03 ft. (88.6 ft. - 12/10/2010)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,319,024.5 E 6,082,067.1 NAD83
TOTAL DEPTH: 31.1 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 103.6 ft. NADV88
ANGLE FROM HORIZONTAL: -90°
HOLE LOGGED BY: A. Warren/G. Perea
REVIEWED BY: S. Dalton

NOTES

ALL MEASUREMENTS ARE IN FEET FROM THE GROUND SURFACE

PURPOSE OF HOLE:
To recover core, collect data to determine geologic and hydrologic site conditions, and install a groundwater monitoring well.

LOCATION:
Reach 4B1, River Bank Right, Merced County, on the South edge of Sandy Mush Rd., west of entrance to Merced Wildlife Refuge Hunter check.

DRILLED BY:
Bureau of Reclamation: PN Region drill crew:
Gerry Hansen, driller
Chris Peterson, helper
Dennis Read, helper

DRILL RIG:
Truck mounted Central Mining Equipment (CME) 75

DRILLING & SAMPLING METHODS:
The drill hole was advanced using 8-1/4 inch o.d. by 4-1/4 inch i.d. hollow stem flight augers equipped with an 8-1/2 inch o.d. bullet and spade drill bit. Continuous (undisturbed) sampling was performed by advancing a 4 inch o.d. by 3-3/8 inch i.d. by 5 feet long split barrel dry core system (FADC). Unless indicated otherwise, the FADC was placed inside the augers and the cutting shoe of the FADC extended 0.2 foot beyond the auger drill bit. A free-spinning adapter was placed at the top of the FADC, so that the FADC did not rotate while advancing the augers.

Interval Method
0.0 to 31.1 ft. FADC

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
0.0 to 3.6 ft. - Medium firm
8.6 to 13.6 ft. - Medium soft

DRILLING FLUID, RETURN AND COLOR:
0.0 to 31.1 ft. - Drilled without fluid

WATER LEVEL FROM TOC:
14.67 ft. on 12/10/2010

REASON FOR HOLE TERMINATION:
The hole was terminated upon successful completion to the target depth.

HOLE COMPLETION:
Well Casing: 0.5 to 20.0 ft. (2-inch blank PVC)
Dual U-pack Screen: 20.0 to 30.0 ft. (2-inch inner screen; 3-inch outer screen; slotted 0.010-inch)
U-Pack Screen Filter Pack: #2/12 Sand
Filter Pack: 18.0 to 31.1 ft. (#3 Sand)
Sump: 30.0 to 31.1 ft. (2-inch blank PVC with slip cap)
Bentonite Seal: 2.0 to 18.0 ft.
Concrete Seal: 0.0 to 2.0 ft. (backfilled with #3 Sand inside well vault)
Well Completion: 8-inch diameter flush-mount traffic vault secured with 2 5/16" hex bolts; 2-foot diameter concrete pad.
Lock: #2001 Masterlock

DEPTH	% CORE RECOVERY	LABORATORY DATA: <0.005	<0.075	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION / El.	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / El.
											SM 102.5
	81										CL
											100.0
5		58.4	38.2	3.4	0.0	60.3	40.7	20.1	CH 97.6		CL/CH
	100										96.9
		46.9	48.2	4.9	0.0	39.6	17.3	25.9	CL 93.6		CL
10											
	100										
											91.6
		53.6	40.7	5.7	0.0	41.7	20.7	30.7	CL 88.6	▼	CL
15										Qal	
	100										87.0
											CL/ML

CLASSIFICATION AND PHYSICAL CONDITION

0.0 to 31.1 ft.
QUATERNARY ALLUVIUM - Qal

0.0 to 1.1 ft. SILTY SAND, SM:
About 70% fine to coarse sand, hard, subangular; about 30% fines with low plasticity, low toughness; moist, brown to dark brown; organics at surface and subsurface (vegetation and roots); trace fine gravel.

1.1 to 3.6 ft. LEAN CLAY, CL:
About 95% fines with low plasticity, low toughness; about 5% fine sand; dry, mottled olive tan and dark brown; moderate firmness; layered with (CL)s.

3.6 to 6.7 ft. LEAN/FAT CLAY, CL/CH:
About 100% fines with medium plasticity, medium toughness, no dilatancy; dry to moist, brown to dark brown; firm; CaCO3 veinlettes throughout.

Lab Data Interval
5.0 to 6.0 ft.

6.7 to 12.0 ft. LEAN CLAY, CL:
About 90% fines with medium plasticity, medium toughness, no dilatancy; about 10% fine sand; moist to dry, tan to light brown.

Note: 8.6 to 8.8 ft.: Moist

Note: 10.4 to 11.4 ft.: Trace fine gravel

Lab Data Interval
9.0 to 10.0 ft.

Note: CaCO3 throughout, layers of increased sand throughout, reddish brown towards bottom of interval.

12.0 to 16.6 ft. LEAN CLAY, CL:
About 95% fines with low plasticity, low toughness; about 5% fine to medium sand; moist, olive tan; firm; CaCO3 veinlettes throughout.

Lab Data Interval
14.0 to 15.0 ft.

16.6 to 20.3 ft. LEAN CLAY/SILT, CL/ML:
About 100% fines with low plasticity, low toughness; trace sand; moist, olive tan; very firm.

Note: 18.6 to 20.3 ft.: Grades into 35% fine sand, trace medium.

20.3 to 21.6 ft. CLAYEY SAND, SC:
About 70% fine sand; about 30% fines with medium plasticity; moist, olive tan with reddish brown oxidation layers; firm; layered with fines in 0.1 ft. layers.

Lab Data Interval
20.5 to 21.5 ft.

21.6 to 28.6 ft. LEAN CLAY, CL:
About 95% fines with medium plasticity, medium toughness; about 5% fine sand; moist, olive-brown to brown; firm.

COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-plastic
NR = No Recovery
NA = Not applicable
I.D. = inner diameter
O.D. = outer diameter
G.S. = Ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-112

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Right, Merced County
BEGUN: 11/21/10 FINISHED: 11/21/10
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 15.03 ft. (88.6 ft. - 12/10/2010)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,319,024.5 E 6,082,067.1 NAD83
TOTAL DEPTH: 31.1 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 103.6 ft. NADV88
ANGLE FROM HORIZONTAL: -90°
HOLE LOGGED BY: A. Warren/G. Perea
REVIEWED BY: S. Dalton

NOTES

DEPTH	% CORE RECOVERY	LABORATORY DATA: <0.005	<0.075	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION / El.	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / El.
											83.3
	100	19.6	8.8	71.6	0.0	20.0	6.1	15.5	SC-SM 82.1		SC 82.0
25		55.2	41.8	3.0	0.0	50.1	29.9	26.1	CH 77.6		CL 75.0
	100										
30	100										s(ML) 73.0
											s(CL) 72.5

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

Lab Data Interval
25.0 to 26.0 ft.

28.6 to 30.6 ft. SANDY SILT, s(ML):
About 65% fines with low plasticity, medium toughness; about 35% fine sand; moist, light brown to gray-brown with red oxidized layers; firm consistency.

30.6 to 31.1 ft. SANDY LEAN CLAY, s(CL):
About 55% fines with medium plasticity, medium toughness; about 45% fine sand; moist, brown with reddish oxidized layers; very firm.

COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-plastic
NR = No Recovery
NA = Not applicable
I.D. = inner diameter
O.D. = outer diameter
G.S. = Ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

San Joaquin River Restoration Program
U.S. Department of Interior, Bureau of Reclamation

MONITORING WELL DEVELOPMENT

Facility/Project Name	County Name	Well Name
SJRRP	MERCED	MW-10-112
Facility License, Permit or Monitoring Number	**County Code**	**Wis. Unique Well Number**	**DNR Well ID Number**

1. Can this well be purged dry? Yes ☐ No ☒

2. Well development method

surged with bailer and bailed	☐	41
surged with bailer and pumped	☒	61
surged with block and bailed	☐	42
surged with block and pumped	☐	62
surged with block, bailed and pumped	☐	70
compressed air	☐	20
bailed only	☐	10
pumped only	☐	51
pumped slowly	☐	50
Other _____	☐	96

3. Time spent developing well 47 min.

4. Depth of well (from top of well casing) 30.38 ft.

5. Inside diameter of well 2 in.

6. Volume of water in filter pack and well casing ____.__ gal.

7. Volume of water removed from well 425 gal.

8. Volume of water added (if any) ____.__ gal.

9. Source of water added _____

10. Analysis performed on water added? (If yes, attach results) ☐ Yes ☐ No

	Before Development	After Development
11. Depth to Water (from top of well casing)	a. 14.67 ft. Flush Mount	04.68 ft.
Date	b. 12/10/2010 (m m d d y y y y)	12/10/2010 (m m d d y y y y)
Time	c. 08:12 ☒ a.m. ☐ p.m.	09:03 ☒ a.m. ☐ p.m.
12. Sediment in well bottom	TR inches	____.__ inches
13. Water clarity	Clear ☐ 10 Turbid ☒ 15 (Describe) TR. Turn/Brownish Tint	Clear ☒ 20 Turbid ☐ 25 (Describe)

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids	____.__ mg/l	____.__ mg/l
15. COD	____.__ mg/l	____.__ mg/l

16. Well developed by: Name (first, last) and Firm
First Name: Last Name:
Firm:

17. Additional comments on development:

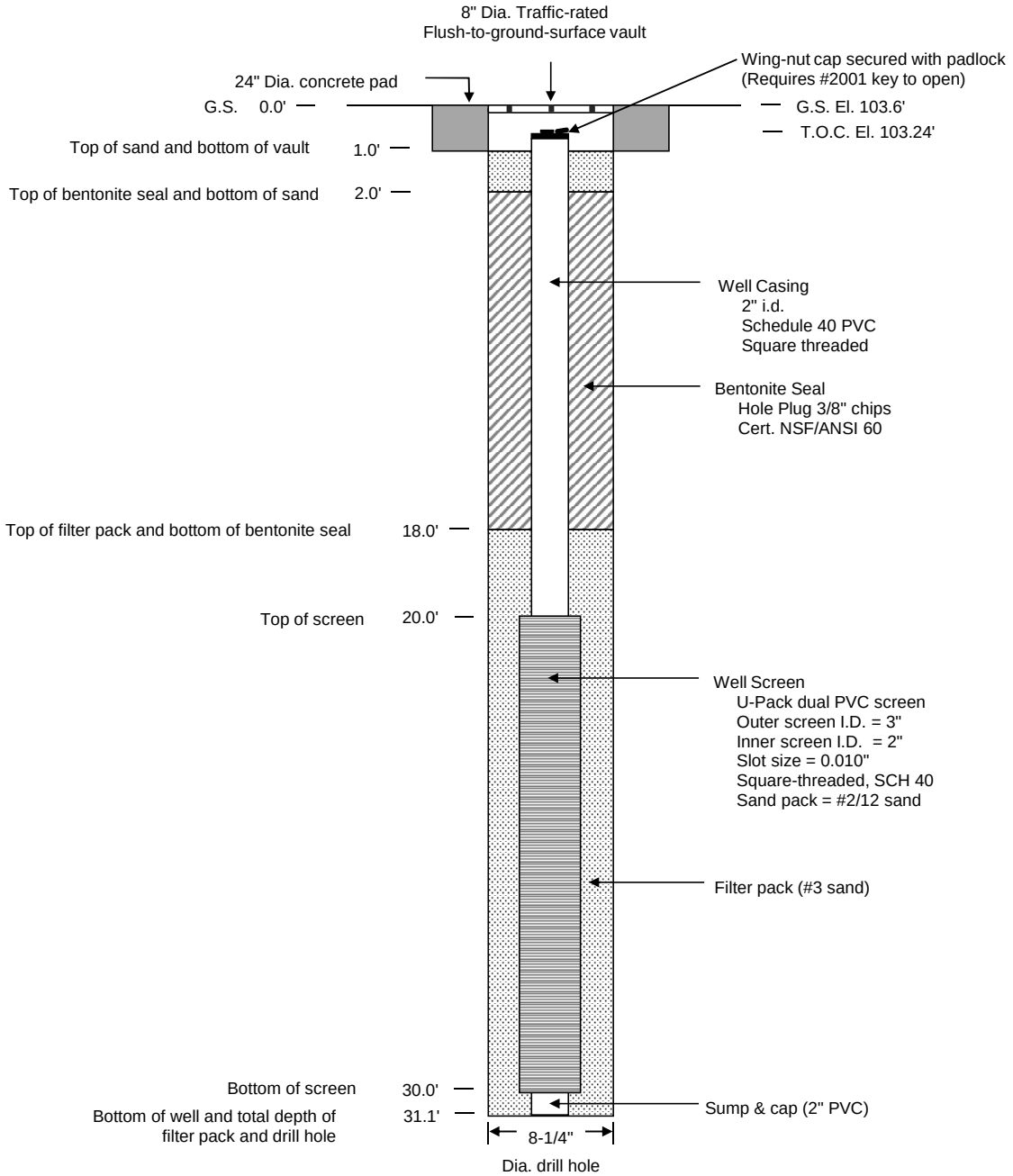
0815-0825 Bail 5gals - Cloudy - Brownish Tint
0828-0934 Pump Dry 12.5 gal Let set 5 min Recharge
0839-0853 Pump 20 gal 1st 5 gal Cloudy would not Pump Dry
0858-0902 Pump 5 gal (CK Clear)

Name and Address of Facility Contact /Owner/Responsible Party
First Name: _____ Last Name: _____
Facility/Firm: _____
Street: _____
City/State/Zip: _____

I hereby certify that the above information is true and correct to the best of my knowledge.
Signature: _____
Print Name: _____
Firm: _____

NOTE: See instructions for more information including a list of county codes and well type codes.

MW-10-112	GEOLOGIST: A. Warren
WELL COMPLETION DIAGRAM	DRILLER: G. Hansen
DATE COMPLETED: 11/21/2010	HELPERS: D. Read & C. Peterson
LOCATION: Sandy Mush Road T.O.C. COORDINATES: N2319024.46 E6082067.06 (NAD83) ELEVATION 103.24 (NAVD88) G.S. ELEVATION: 103.6 (NAVD88)	



***NOT TO SCALE**

NOTES:

T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, El. = Elevation
Dia. = Diameter NS = Not Surveyed
#3 Sand backfills the well above the top of the bentonite seal.

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-113

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Left, Merced County
BEGUN: 11/14/10 FINISHED: 11/14/10
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 10.91 ft. (93.3 ft. - 12/08/2010)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,302,079.4 E 6,081,383.4 NAD83
TOTAL DEPTH: 31.0 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 104.2 ft. NADV88
ANGLE FROM HORIZONTAL: -90°
HOLE LOGGED BY: A. Warren
REVIEWED BY: S. Dalton

NOTES

ALL MEASUREMENTS ARE IN FEET FROM THE GROUND SURFACE

PURPOSE OF HOLE:
To recover core, collect data to determine geologic and hydrologic site conditions, and install a groundwater monitoring well.

LOCATION:
Reach 4B1, River Bank Left, Merced County, on a farm road about 3.3 miles East of Turner Island Road.

DRILLED BY:
Bureau of Reclamation: PN Region drill crew:
Gerry Hansen, driller
Chris Peterson, helper
Dennis Read, helper

DRILL RIG:
Truck mounted Central Mining Equipment (CME) 75

DRILLING & SAMPLING METHODS:
The drill hole was advanced using 8-1/4 inch o.d. by 4-1/4 inch i.d. hollow stem flight augers equipped with an 8-1/2 inch o.d. bullet and spade drill bit. Continuous (undisturbed) sampling was performed by advancing a 4 inch o.d. by 3-3/8 inch i.d. by 5 feet long split barrel dry core system (FADC). Unless indicated otherwise, the FADC was placed inside the augers and the cutting shoe of the FADC extended 0.2 foot beyond the auger drill bit. A free-spinning adapter was placed at the top of the FADC, so that the FADC did not rotate while advancing the augers.

Interval Method
0.0 to 31.0 ft. FADC

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
0.0 to 3.8 ft. - Soft
8.5 to 13.5 ft. - Add water and catcher
18.5 to 23.5 ft. - Catcher with nylon
23.5 to 28.5 ft. - Remove catcher

DRILLING FLUID, RETURN AND COLOR:
0.0 to 31.0 ft. - Drilled without fluid

WATER LEVEL FROM TOC:
10.30 ft. on 12/08/2010

REASON FOR HOLE TERMINATION:
The hole was terminated upon successful completion to the target depth.

DEPTH	% CORE RECOVERY	LABORATORY DATA: <0.005	<0.075	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION / El.	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / El.
											(ML)s 103.2
											CL 102.7
	53										
		24.5	58.9	16.6	0.0	35.6	11.5	23.0	(ML)s 100.2		(ML-CL)s
											99.7
5											SM 99.4
	83										
		13.6	50.8	35.6	0.0	NP	NP	32.2	s(ML) 96.7		s(ML)
											96.0
											SP 95.7
10											
	32	4.4	9.0	86.6	0.0	NP	NP	25.3	SM 90.7		SP-SM
15										Qal	
	36	1.7	7.4	90.9	0.0	NP	NP	23.7	SP-SM 85.7		85.7
											s(CH) 84.5

CLASSIFICATION AND PHYSICAL CONDITION

0.0 to 31.0 ft.
QUATERNARY ALLUVIUM - Qal

0.0 to 1.0 ft. SILT WITH SAND, (ML)s:
About 80% fines with low plasticity; about 20% fine sand; dry, brown; soft; abundant twigs and roots.

1.0 to 1.5 ft. LEAN CLAY, CL:
About 90% fines with low plasticity, slow dilatancy; about 10% fine sand; dry to moist, dark brown; organic odor; moderate soft; gradual upper contact.

1.5 to 4.5 ft. SILT WITH SAND TO LEAN CLAY WITH SAND, (ML-CL)s:
About 85% fines with medium plasticity, low toughness, rapid dilatancy; about 15% fine sand; dry, brown; layered.

Lab Data Interval
3.0 to 4.0 ft.

4.5 to 4.8 ft. SILTY SAND, SM:
About 80% fine sand; about 20% non plastic fines; dry, gray; soft; micaceous.

4.8 to 8.2 ft. SILTY SAND, s(ML):
About 65% fines with low plasticity, high dilatancy; about 35% fine sand; moist to wet, brown with reddish brown oxidation layers; flowing and soft; 0.1 ft. layer of clean fine sand at 6.5 ft.

Lab Data Interval
6.5 to 7.5 ft.

8.2 to 8.5 ft. POORLY GRADED SAND, SP:
About 95% fine to medium sand; about 5% non plastic fines; wet, gray.

8.5 to 18.5 ft. POORLY GRADED SAND WITH SILT, SP-SM:
About 90% fine sand; about 10% non plastic fines; wet, gray; soft.

Lab Data Interval
8.5 to 13.5 ft.

Note: 13.5 to 18.5 ft.: Homogenous, slight oxidation, soft.

18.5 to 19.7 ft. SANDY FAT CLAY, s(CH):
About 60% fines with medium to high plasticity, medium to high toughness; about 40% fine sand; wet to moist, dark gray to gray; layered; moderate firmness.

19.7 to 25.0 ft. FAT CLAY, CH:
About 95-100% fines with high plasticity, high toughness, no dilatancy; about 5% to trace fine sand; moist, gray; very firm.

Note: 22.5 to 23.5 ft.: Gray mottled with brown.

Lab Data Interval
20.5 to 21.5 ft.

25.0 to 26.5 ft. LEAN CLAY INTERBEDDED WITH CLAYEY SAND, CL & SC:
LEAN CLAY, CL: About 90% fines with medium plasticity; about 10% fine sand.

COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-plastic
NR = No Recovery
NA = Not applicable
I.D. = inner diameter
O.D. = outer diameter
G.S. = Ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-113

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Left, Merced County
BEGUN: 11/14/10 FINISHED: 11/14/10
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 10.91 ft. (93.3 ft. - 12/08/2010)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,302,079.4 E 6,081,383.4 NAD83
TOTAL DEPTH: 31.0 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 104.2 ft. NADV88
ANGLE FROM HORIZONTAL: -90°
HOLE LOGGED BY: A. Warren
REVIEWED BY: S. Dalton

NOTES

HOLE COMPLETION:
Well Casing: 0.5 to 7.5 ft. (2-inch blank PVC)
Dual U-pack Screen: 7.5 to 17.5 ft. (2-inch inner screen; 3-inch outer screen; slotted 0.010-inch)
U-Pack Screen Filter Pack: #2/12 Sand
Filter Pack: 6.0 to 19.5 ft. (#3 Sand)
Sump: 17.5 to 19.5 ft. (2-inch blank PVC with slip cap)
Bentonite Seal: 2.0 to 6.0 ft.; 19.5 to 31.0 ft.
Concrete Seal: 0.0 to 2.0 ft. (backfilled with #3 Sand inside well vault)
Well Completion: 8-inch diameter flush-mount traffic vault secured with 2 5/16" hex bolts; 2-foot diameter concrete pad.
Lock: #2001 Masterlock

DEPTH	% CORE RECOVERY	LABORATORY DATA: <0.005	<0.075	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION / El.	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / El.
	100	59.3	36.8	3.9	0.0	46.3	26.7	27.4	CL 82.7		CH 79.2
25	100										CL & SC 77.7
											(CL)s 75.7
30	100	47.6	44.1	8.3	0.0	46.0	26.0	25.3	CL 74.2		CL/CH 73.2

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

CLAYEY SAND, SC: About 60% fine sand; about 40% fines with low plasticity. Wet to moist; olive brown; moderate firm to moderate soft; layers about 0.4 ft. thick.

26.5 to 28.5 ft. LEAN CLAY WITH SAND, (CL)s:
About 85% fines with medium plasticity, no dilatancy; about 15% fine sand; moist, olive brown; micaceous; firm.

Note: 27.5 to 28.5 ft.: LEAN CLAY, CL: About 90% low plasticity fines; about 10% fine sand.

28.5 to 31.0 ft. LEAN/FAT CLAY, CL/CH:
About 90-95% fines with medium plasticity, medium toughness, no dilatancy; about 10-5% fine sand; moist, dark olive brown; very firm; CaCO3 concretions and ribbons; lightly to moderately cemented.

Lab Data Interval
29.0 to 30.0 ft.

COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-plastic
NR = No Recovery
NA = Not applicable
I.D. = inner diameter
O.D. = outer diameter
G.S. = Ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

San Joaquin River Restoration Program
U.S. Department of Interior, Bureau of Reclamation

MONITORING WELL DEVELOPMENT

Facility/Project Name	County Name	Well Name
SJRRP	Merced	P31 / MW-10-113

Facility License, Permit or Monitoring Number	County Code	Wis. Unique Well Number	DNR Well ID Number

1. Can this well be purged dry? Yes ☐ No ☒

2. Well development method

surged with bailer and bailed	☐ 41
surged with bailer and pumped	☒ 61
surged with block and bailed	☐ 42
surged with block and pumped	☐ 62
surged with block, bailed and pumped	☐ 70
compressed air	☐ 20
bailed only	☐ 10
pumped only	☐ 51
pumped slowly	☐ 50
Other _____	☐

3. Time spent developing well: 50 min.

4. Depth of well (from top of well casisng): 20.8 ft.

5. Inside diameter of well: 2.00 in.

6. Volume of water in filter pack and well casing: ____.__ gal.

7. Volume of water removed from well: 31.5 gal.

8. Volume of water added (if any): ____.__ gal.

9. Source of water added: _____

10. Analysis performed on water added? (If yes, attach results) ☐ Yes ☐ No

	Before Development	After Development
11. Depth to Water (from top of well casing) a.	10.30 ft.	10.00 ft.
Date b. (m m d d y y y y)	12/08/2010	12/08/2010
Time c.	9:25 ☒ a.m. ☐ p.m.	10:15 ☐ a.m. ☐ p.m.
12. Sediment in well bottom	tr. inches	____.__ inches
13. Water clarity	Clear ☐ 10 Turbid ☒ 15	Clear ☒ 20 Turbid ☐ 25
(Describe)		
14. Total suspended solids	____.__ mg/l	____.__ mg/l
15. COD	____.__ mg/l	____.__ mg/l

Fill in if drilling fluids were used and well is at solid waste facility:

16. Well developed by: Name (first, last) and Firm
First Name: Gerry Last Name: Hansen
Firm: BOR

17. Additional comments on development:

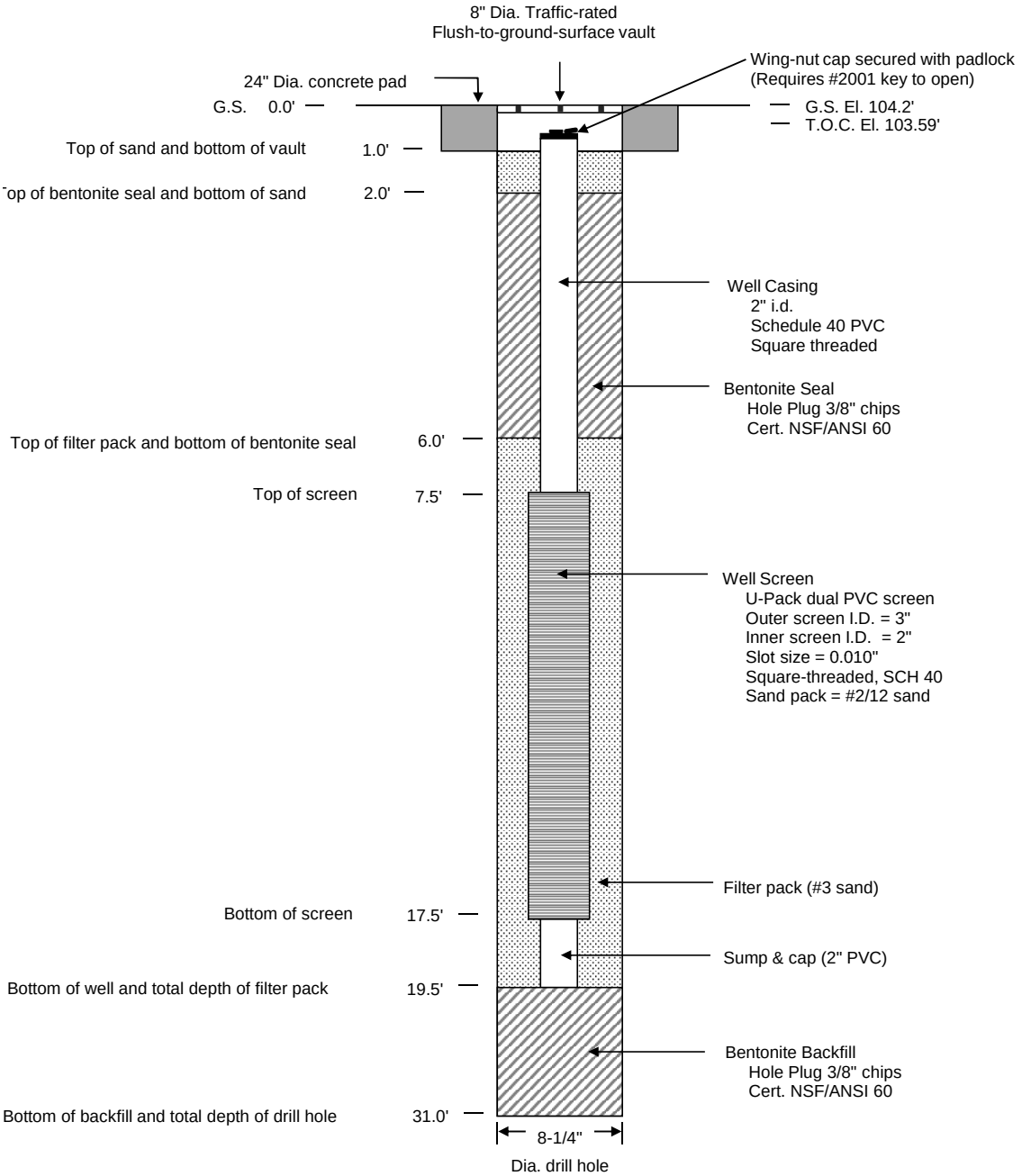
Removed 5g w/hand bailer
Started pump @ 950-952 - 6.5 gal - purged dry
recharged to 10.0' by 955
pumped 20g from 956-1006 - hot. dry

Name and Address of Facility Contact /Owner/Responsible Party
First Name: _____ Last Name: _____
Facility/Firm: _____
Street: _____
City/State/Zip: _____

I hereby certify that the above information is true and correct to the best of my knowledge.
Signature: _____
Print Name: _____
Firm: _____

NOTE: See instructions for more information including a list of county codes and well type codes.

MW-10-113	GEOLOGIST: A. Warren
WELL COMPLETION DIAGRAM	DRILLER: G. Hansen
DATE COMPLETED: 11/14/2010	HELPERS: D. Read & C. Peterson
LOCATION: Field east of Turner Island Road T.O.C. COORDINATES: N2302079.43 E6081383.44 (NAD83) ELEVATION 103.59' (NAVD88) G.S. ELEVATION: 104.2' (NAVD88)	



***NOT TO SCALE**

NOTES:

T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, El. = Elevation
Dia. = Diameter
#3 Sand backfills the well above the top of the bentonite seal.

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-114

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Left, Merced County
BEGUN: 11/17/10 FINISHED: 11/17/10
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 7.65 ft. (91.9 ft. - 12/08/2010)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,300,134.5 E 6,076,281.4 NAD83
TOTAL DEPTH: 31.1 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 99.5 ft. NADV88
ANGLE FROM HORIZONTAL: -90°
HOLE LOGGED BY: A. Warren
REVIEWED BY: S. Dalton

NOTES

ALL MEASUREMENTS ARE IN FEET FROM THE GROUND SURFACE

PURPOSE OF HOLE:
To recover core, collect data to determine geologic and hydrologic site conditions, and install a groundwater monitoring well.

LOCATION:
Reach 4B1, River Bank Left, Merced County, on Middle Ditch, South of San Joaquin River, on edge of farm field.

DRILLED BY:
Bureau of Reclamation: PN Region drill crew:
Gerry Hansen, driller
Chris Peterson, helper
Dennis Read, helper

DRILL RIG:
Truck mounted Central Mining Equipment (CME) 75

DRILLING & SAMPLING METHODS:
The drill hole was advanced using 8-1/4 inch o.d. by 4-1/4 inch i.d. hollow stem flight augers equipped with an 8-1/2 inch o.d. bullet and spade drill bit. Continuous (undisturbed) sampling was performed by advancing a 4 inch o.d. by 3-3/8 inch i.d. by 5 feet long split barrel dry core system (FADC). Unless indicated otherwise, the FADC was placed inside the augers and the cutting shoe of the FADC extended 0.2 foot beyond the auger drill bit. A free-spinning adapter was placed at the top of the FADC, so that the FADC did not rotate while advancing the augers.

Interval Method
0.0 to 31.1 ft. FADC

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
0.0 to 3.7 ft. - Moderate soft
8.6 to 13.6 ft. - Moderate firm, add water
13.6 to 31.1 ft. - Catcher with nylon

DRILLING FLUID, RETURN AND COLOR:
0.0 to 31.1 ft. - Drilled without fluid

WATER LEVEL FROM TOC:
10.45 ft. on 12/08/2010

REASON FOR HOLE TERMINATION:
The hole was terminated upon successful completion to the target depth.

HOLE COMPLETION:
Well Casing: +3.0 to 12.0 ft. (2-inch blank PVC)
Dual U-pack Screen: 13.0 to 28.0 ft. (2-inch inner screen; 3-inch outer screen; slotted 0.010-inch)
U-Pack Screen Filter Pack: #2/12 Sand
Filter Pack: 12.0 to 31.1 ft. (#3 Sand)
Sump: 28.0 to 31.1 ft. (2-inch blank PVC with slip cap)
Bentonite Seal: 2.0 to 12.0 ft
Concrete Seal: 0.0 to 2.0 ft.
Well Completion: Steel surface casing with locking top, 6-inch by 6-inch by 5-foot long; 2.0 ft. diameter concrete pad.
Lock: #2001 Masterlock

DEPTH	% CORE RECOVERY	<0.005	<0.075	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION	El.	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION	El.
	76											(CL)s	95.9
		19.1	18.9	60.9	1.1	28.7	10.2	13.9	SC	95.1		SC	93.9
5	96	57.5	38.1	4.4	0.0	44.0	22.0	24.7	CL	91.5	▼	CL	89.4
10	82	0.5	5.2	94.3	0.0	NP	NP	21.8	SP-SM	86.0		s(CL)	88.9
15	40	1.1	6.7	92.1	0.1	NP	NP	24.4	SP-SM	82.5	Qal	SP-SM	

CLASSIFICATION AND PHYSICAL CONDITION

0.0 to 31.1 ft.
QUATERNARY ALLUVIUM - Qal

0.0 to 3.6 ft. LEAN CLAY WITH SAND, (CL)s:
About 80% fines with medium plasticity, medium toughness; about 20% fine sand; dry, dark brown; firm; some CaCO3 white veinlettes and horizons.

3.6 to 5.6 ft. CLAYEY SAND, SC:
About 60% fine sand; about 40% fines with medium plasticity; dry, tan; trace cemented layers up to 1/4 inch thick; moderate firm to moderate soft.

Lab Data Interval
3.7 to 4.4 ft.

5.6 to 10.1 ft. LEAN CLAY, CL:
About 90-95% fines with medium plasticity, medium toughness; about 5-10% fine sand; dry to moist, olive tan with reddish brown oxidation; firm to very firm.

Lab Data Interval
7.0 to 8.0 ft.

Note: 8.6 to 10.1 ft.: Disturbed by drilling action, some silty layers.

10.1 to 10.6 ft. SANDY LEAN CLAY, s(CL):
About 65% fines with medium plasticity, medium toughness; about 35% fine sand; moist, olive brown with red brown; medium firmness; layered.

10.6 to 13.6 ft. POORLY GRADED SAND WITH SILT, SP-SM:
About 90% fine sand, micaceous; about 10% non plastic fines; moist to wet, olive tan; medium soft; sand coarsens downwards to fine and medium at 12.6 to 13.6 ft.

Lab Data Interval
13.0 to 13.5 ft.

13.6 to 23.6 ft. POORLY GRADED SAND, SP:
About 95% fine and medium sand, micaceous; about 5% non plastic fines; moist to wet, olive tan; medium soft.

Lab Data Interval
16.0 to 17.0 ft.

23.6 to 28.6 ft. NO RECOVERY

Note: Trace POORLY GRADED SAND, SP in sock

28.6 to 29.9 ft. POORLY GRADED SAND WITH CLAY, SP-SC:
About 90% fine sand; about 10% fines with medium to high plasticity; wet, blue to gray; medium soft.

Lab Data Interval
28.6 to 29.6 ft.

COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-plastic
NR = No Recovery
NA = Not applicable
I.D. = inner diameter
O.D. = outer diameter
G.S. = Ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-114

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Left, Merced County
BEGUN: 11/17/10 FINISHED: 11/17/10
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 7.65 ft. (91.9 ft. - 12/08/2010)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,300,134.5 E 6,076,281.4 NAD83
TOTAL DEPTH: 31.1 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 99.5 ft. NADV88
ANGLE FROM HORIZONTAL: -90°
HOLE LOGGED BY: A. Warren
REVIEWED BY: S. Dalton

NOTES	DEPTH	% CORE RECOVERY	LABORATORY DATA: <0.005	<0.075	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT	LABORATORY CLASSIFICATION / El.	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / El.	CLASSIFICATION AND PHYSICAL CONDITION
		28										75.9	**29.9 to 31.1 ft. FAT CLAY, CH:** About 90% fines with high plasticity; high toughness; about 10% fine sand; moist, green gray; very firm; homogenous.
	25	0										NR	Lab Data Interval 30.0 to 31.0 ft.
												70.9	
			0.5	4.7	94.6	0.2	NP	NP	21.1	SP-SM 69.9		SP-SC 69.6	
	30	100											
			62.5	23.5	14.0	0.0	55.0	39.3	24.0	CH 68.5		CH 68.4	

BOTTOM OF HOLE

COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-plastic
NR = No Recovery
NA = Not applicable
I.D. = inner diameter
O.D. = outer diameter
G.S. = Ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

San Joaquin River Restoration Program
U.S. Department of Interior, Bureau of Reclamation

MONITORING WELL DEVELOPMENT

Facility/Project Name	County Name	Well Name
SJRRP	Merced	P30 / MW-10-114

Facility License, Permit or Monitoring Number	County Code	Wis. Unique Well Number	DNR Well ID Number

1. Can this well be purged dry? Yes ☐ No ☒

2. Well development method

surged with bailer and bailed	☐ 41
surged with bailer and pumped	☒ 61
surged with block and bailed	☐ 42
surged with block and pumped	☐ 62
surged with block, bailed and pumped	☐ 70
compressed air	☐ 20
bailed only	☐ 10
pumped only	☐ 51
pumped slowly	☐ 50
Other _____	☐

3. Time spent developing well 30 min.

4. Depth of well (from top of well casisng) 31.5 ft.

5. Inside diameter of well 2. in.

6. Volume of water in filter pack and well casing ___.__ gal.

7. Volume of water removed from well 25 gal.

8. Volume of water added (if any) ___.__ gal.

9. Source of water added _____

10. Analysis performed on water added? (If yes, attach results) ☐ Yes ☐ No

	Before Development	After Development
11. Depth to Water (from top of well casing)	a. 10.45 ft.	10.45 ft. (2.8)
Date	b. 12/09/2010 (m m d d y y y y)	12/08/2010 (m m d d y y y y)
Time	c. 10:25 ☐ a.m. ☐ p.m.	10:48 ☐ a.m. ☐ p.m.
12. Sediment in well bottom	___.__ inches	___.__ inches
13. Water clarity	Clear ☐ 10 Turbid ☒ 15	Clear ☒ 20 Turbid ☐ 25
	(Describe)	(Describe)

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids	____.__ mg/l	____.__ mg/l
15. COD	____.__ mg/l	____.__ mg/l

16. Well developed by: Name (first, last) and Firm
First Name: Gerry Last Name: Hansen
Firm:

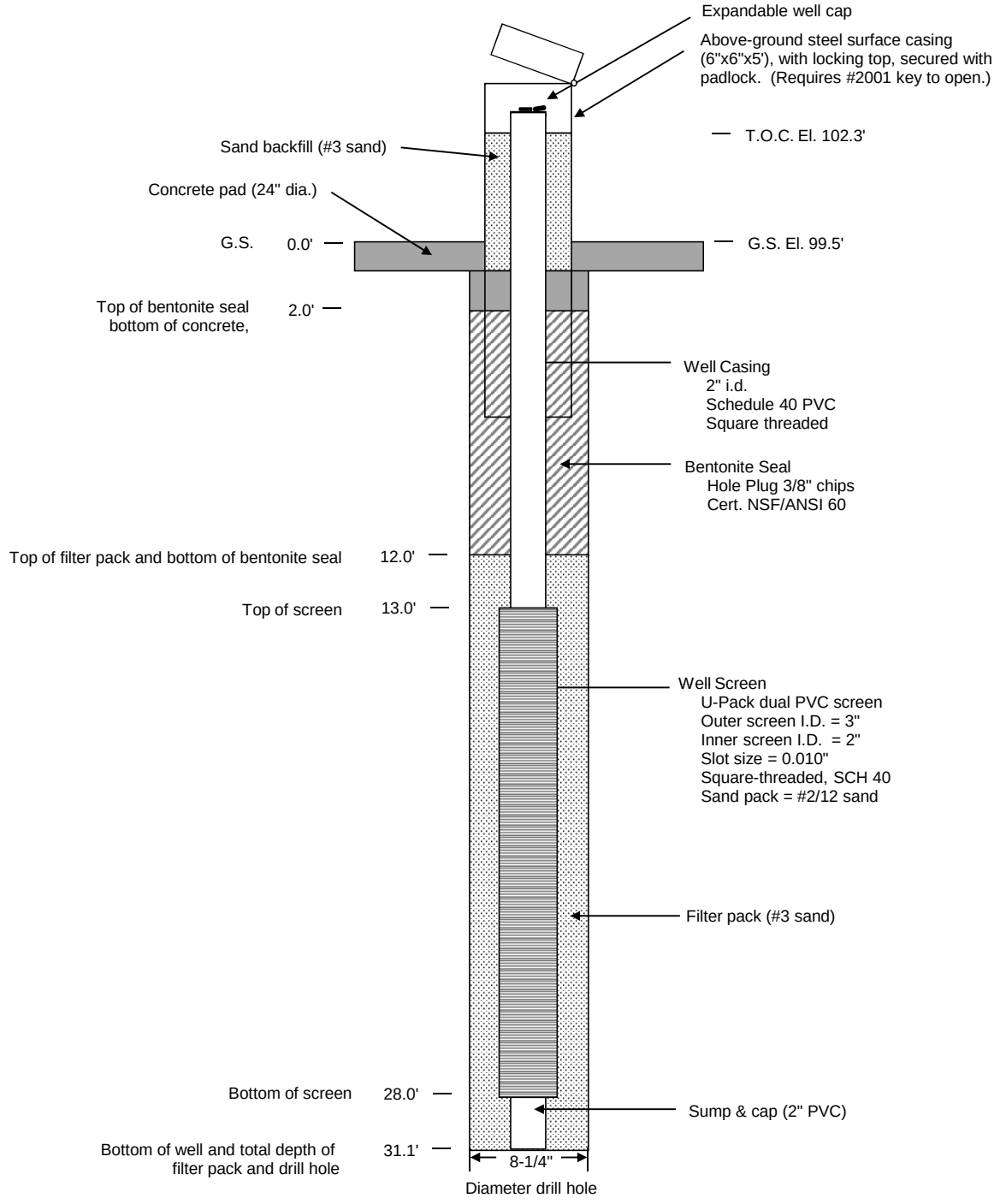
17. Additional comments on development:
1025-1040 - Hand bail 5 gal - clear then turbid
1041-1048 - pumped 20 gallons til clear.

Name and Address of Facility Contact /Owner/Responsible Party
First Name: _____ Last Name: _____
Facility/Firm: _____
Street: _____
City/State/Zip: _____

I hereby certify that the above information is true and correct to the best of my knowledge.
Signature: _____
Print Name: _____
Firm: _____

NOTE: See instructions for more information including a list of county codes and well type codes.

MW-10-114	GEOLOGIST: A. Warren
WELL COMPLETION DIAGRAM	DRILLER: G. Hansen
DATE COMPLETED: 11/17/2010	HELPERS: D. Read & C. Peterson
LOCATION: Field east of Turner Island Road T.O.C. COORDINATES: N2300134.48 E6076281.43 (NAD93) EL. 102.3' (NAVD88) G.S. ELEVATION: 99.5' (NAVD88)	



***NOT TO SCALE**

NOTES:

T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, El. = Elevation
Dia. = Diameter NS = Not Surveyed

GEOLOGIC LOG OF DRILL HOLE NO. MW-11-137

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Right, RM 153, Merced County
BEGUN: 4/28/11 FINISHED: 4/28/11
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 4.0 ft. (86.9 ft. - 5/16/2011)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,313,031.5 E 6,054,048.8 NAD83
TOTAL DEPTH: 29.6 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 90.93 ft. NADV88
ANGLE FROM HORIZONTAL: -90°
HOLE LOGGED BY: A. Warren/M. Lyttge
REVIEWED BY: T. Lewis

NOTES

ALL MEASUREMENTS ARE IN FEET FROM THE GROUND SURFACE.

PURPOSE OF HOLE:
To recover a continuous soil core, collect data to determine geologic and hydrologic site conditions, and install a groundwater monitoring well.

LOCATION:
Reach 4B1, River Bank Right, RM 153, Merced County. South of Sand Slough Road, adjacent to irrigation well and fuel tank.

DRILLED BY:
Bureau of Reclamation: PN Region drill crew:
Chris Peterson, driller
Dennis Read, helper
Cody Kelley, helper

DRILL RIG:
Truck mounted Central Mining Equipment (CME) DC512

DRILLING & SAMPLING METHODS:
The drill hole was advanced and sample using a Flight Auger Dry Core system (FADC). The drill hole was advanced using 8-1/4 inch o.d. by 4-1/4 inch i.d. hollow stem flight augers equipped with an 8-1/2 inch o.d. bullet and spade drill bit. Continuous sampling was performed by advancing a 4 inch o.d. by 3-3/8 inch i.d. by 5-foot long split barrel dry core sample system (sampler). Unless indicated otherwise, the sampler was placed inside the augers and the cutting shoe of the sampler extended 0.2 foot beyond the auger drill bit. A free-spinning adapter was placed at the top of the sampler to avoid rotation while advancing the augers.

Interval	Method
0.0 to 29.6 ft.	FADC

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
4.6 to 9.6 ft. - Wet at bottom.

DRILLING FLUID, RETURN AND COLOR:
0.0 to 29.6 ft. - Drilled without fluid

WATER LEVEL:
4.0 ft. - 5/16/2011

REASON FOR HOLE TERMINATION:
The hole was terminated upon reaching the target depth.

DEPTH	% CORE RECOVERY	LABORATORY DATA: <0.005	<0.075	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	% MOISTURE CONTENT	LABORATORY CLASSIFICATION / El.	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / El.
	100.0										s(CL)
											87.9
											(CL)s
											86.7
5		38.3	53.1	8.6	0.0	29.1	15.0	19.3	CL		CL
									84.9		84.9
	78.0	24.1	65.8	10.1	0.0	30.6	11.7	20.2	CL		CL
									82.9		82.9
											SM 82.6
10		48.7	48.4	2.9	0.0	33.8	14.5	24.6	CL		CL
									79.9		
	100.0										
											76.6
										Qal	SM

CLASSIFICATION AND PHYSICAL CONDITION

0.0 to 29.6 feet
QUATERNARY ALLUVIUM (Qal)

0.0 to 3.0 ft. SANDY LEAN CLAY, s(CL):
About 65% fines with medium plasticity, no dilatancy, medium toughness; about 35% fine sand; moist, dark brown; firm, crumbled from drilling action; strong reaction with HCL; trace white $CaCO_3$

3.0 to 4.2 ft. LEAN CLAY WITH SAND, (CL)s:
About 80% fines with medium plasticity, no dilatancy; about 20% fine sand; moist, brown; moderately firm, crumbled from drilling action; strong reaction with HCL, mottled with white $CaCO_3$.

4.2 to 6.0 ft. LEAN CLAY, CL:
About 90% fines with medium plasticity, no dilatancy, medium toughness; about 10% fine sand; moist, brown with white $CaCO_3$; moderately firm; strongly cemented with $CaCO_3$ in places.

Lab Data Interval
5.0 to 6.0 ft.

6.0 to 8.0 ft. LEAN CLAY, CL:
About 90-95% fines with low plasticity, low toughness; about 5-10% fine sand; dry to moist, tan with trace of reddish oxidation near bottom of run.

Lab Data Interval
7.0 to 8.0 ft.

8.0 to 8.3 ft. SILTY SAND, SM:
About 85% predominately fine sand, trace of medium sand; about 15% fines with no plasticity; wet, dark brown; no reaction with HCL.

8.3 to 14.3 ft. LEAN CLAY, CL:
About 95% fines with medium plasticity, medium toughness; about 5% fine sand; moist, olive; moderately firm; no reaction with HCL.

Note: Layered with small traces of Sandy Lean Clay, s(CL).

Lab Data Interval
10.0 to 11.0 ft.

14.3 to 15.4 ft. SILTY SAND, SM:
About 60% predominately fine sand; about 40% fines with low plasticity; wet; brown; somewhat molded to shape of core box; no reaction with HCL.

15.4 to 16.9 ft. SANDY LEAN CLAY, s(CL):
About 60% fines with medium plasticity, no dilatancy, medium toughness; about 40% fine sand; moist, brown; firm; no reaction with HCL; homogenous; trace of charcoal bits; minor red-brown tint from oxidation within body of core.

COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-Plastic
NR = No Recovery
NA = Not Applicable
I.D. = Inner Diameter
O.D. = Outer Diameter

G.S. = Ground Surface
+ = Above Ground Surface
T.O.C. = Top of Well Casing
SJR = San Joaquin River
▼ = Top of Groundwater

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

GEOLOGIC LOG OF DRILL HOLE NO. MW-11-137

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Right, RM 153, Merced County
BEGUN: 4/28/11 FINISHED: 4/28/11
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 4.0 ft. (86.9 ft. - 5/16/2011)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,313,031.5 E 6,054,048.8 NAD83
TOTAL DEPTH: 29.6 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 90.93 ft. NADV88
ANGLE FROM HORIZONTAL: -90°
HOLE LOGGED BY: A. Warren/M. Lyttge
REVIEWED BY: T. Lewis

NOTES

HOLE COMPLETION:
Completed as a groundwater monitoring well.

Well Casing: +2.95 to 12.6 ft. (2-inch I.D. blank PVC)
Dual U-pack Screen: 12.6 to 27.6 ft. (2-inch I.D. inner screen; 3-inch I.D. outer screen; slotted 0.010-inch)
U-Pack Screen Filter Pack: (#2/12 Sand)
Filter Pack: 11.0 to 29.6 ft. (#3 Sand)
Sump: 27.6 to 29.6 ft. (2-inch I.D. blank PVC with slip cap)
Concrete Seal: 0.0 to 2.0 ft.
Bentonite Seal: 2.0 to 11.0 ft.
Well Completion: 6-inch by 6-inch by 5-foot long steel surface casing with locking top; 2.0-foot diameter concrete pad.
Lock: #2006 Masterlock

DEPTH	% CORE RECOVERY	LABORATORY DATA: <0.005	<0.075	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	% MOISTURE CONTENT	LABORATORY CLASSIFICATION / El.	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / El.
											75.5
											s(CL)
											74.0
	100.0										
		42.9	44.4	12.7	0.0	31.5	14.4	23.0	CL 71.9		CL
											71.6
20											
	68.0										s(ML)
		10.8	57.0	32.2	0.0	NP	NP	23.7	s(ML) 66.9		
											66.1
25											SP-SC 65.7
		2.1	5.2	92.7	0.0	NP	NP	23.0	SP-SM 64.9		SP
											64.6
											SC 64.4
	38.0										
											NR
											61.3

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

16.9 to 19.3 ft. LEAN CLAY, CL:
About 85% fines with medium plasticity, no dilatancy; medium to high toughness; about 15% fine sand; moist; olive; firm; strong reaction with HCL; stratified; trace of charcoal bits; minor localized oxidation.

Note: Strong cementation from 17.9 to 18.2 ft.

Lab Data Interval
18.0 to 19.0 ft.

19.3 to 24.8 ft. SANDY SILT, s(ML):
About 60% fines with low plasticity, low dry strength, slow dilatancy, low toughness; about 40% fine sand; brown; very firm; no reaction with HCL; homogenous; slight trace of charcoal bits; localized oxidation.

Lab Data Interval
23.0 to 24.0 ft.

24.8 to 25.2 ft. POORLY SORTED SAND WITH CLAY, SP-SC:
About 90% fine sand; about 10% fines with medium plasticity; moist, gray with reddish-brown in top half; firm; no reaction with HCL; slight increase in fines toward the bottom; oxidation in top half.

25.2 to 26.3 ft. POORLY SORTED SAND, SP:
About 95% fine sand with lenses of medium sand; about 5% fines; wet, gray grading to brown toward bottom; molded to shape of core box; no reaction with HCL.

Lab Data Interval
25.5 to 26.0 ft.

26.3 to 26.5 ft. CLAYEY SAND, SC:
About 85% fine sand; about 15% fines with medium plasticity; moist, gray; soft; no reaction with HCL.

Note: Contains lenses of Lean Clay with Sand, (CL)s.

26.5 to 29.6 ft. No Recovery

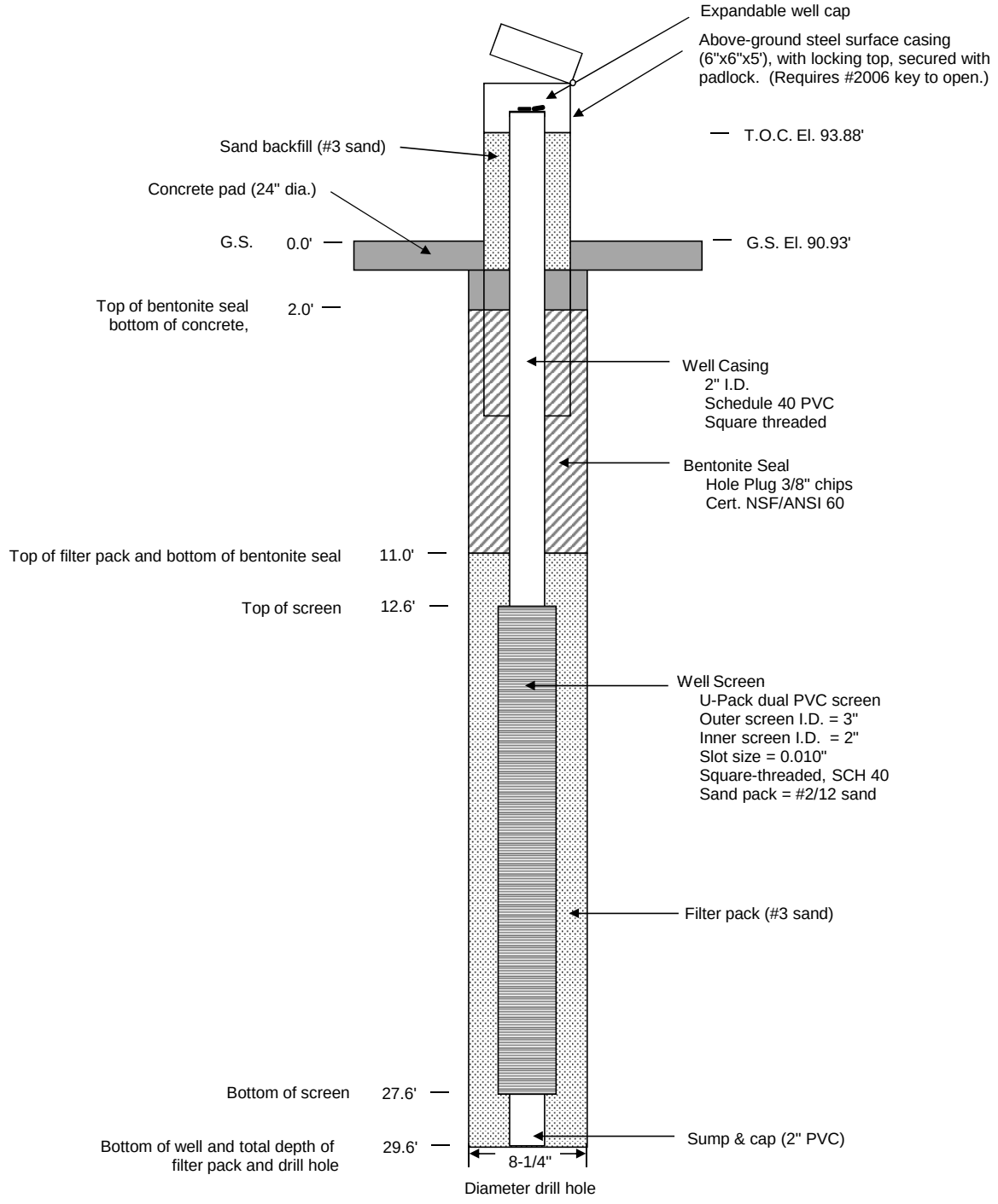
COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-Plastic
NR = No Recovery
NA = Not Applicable
I.D. = Inner Diameter
O.D. = Outer Diameter

G.S. = Ground Surface
+ = Above Ground Surface
T.O.C. = Top of Well Casing
SJR = San Joaquin River
▼ = Top of Groundwater

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

MW-11-137	GEOLOGIST: M. Lyttge
WELL COMPLETION DIAGRAM	DRILLER: C. Peterson
DATE COMPLETED: 4/28/2011	HELPERS: D. Read & C. Kelly
LOCATION: Field South of Sand Slough Road. Reach 4B1, River Bank Right, RM 153, Merced County. T.O.C. COORDINATES: N2313031.54 E6054048.76 (NAD93) EL.93.88' (NAVD88) G.S. ELEVATION: 90.93' (NAVD88)	



***NOT TO SCALE**

NOTES:

T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, El. = Elevation
Dia. = Diameter

San Joaquin River Restoration Program
U.S. Department of Interior, Bureau of Reclamation

MONITORING WELL DEVELOPMENT

Facility/Project Name	County Name	Well Name
SJRR P	MERCED	W-13 / MW-11-137
Facility License, Permit or Monitoring Number	**County Code**	**Wis. Unique Well Number**	**DNR Well ID Number**

1. Can this well be purged dry? Yes ☐ No ☐

2. Well development method

surged with bailer and bailed	☐	41
surged with bailer and pumped	☐	61
surged with block and bailed	☐	42
surged with block and pumped	☒	62
surged with block, bailed and pumped	☐	70
compressed air	☐	20
bailed only	☐	10
pumped only	☐	51
pumped slowly	☐	50
Other _____	☐	__

3. Time spent developing well: 40 min.

4. Depth of well (from top of well casisng): 318 ft.

5. Inside diameter of well: 2.00 in.

6. Volume of water in filter pack and well casing: ___.__ gal.

7. Volume of water removed from well: 55.__ gal.

8. Volume of water added (if any): ___.__ gal.

9. Source of water added: _____

10. Analysis performed on water added? (If yes, attach results) ☐ Yes ☐ No

	Before Development	After Development
11. Depth to Water (from top of well casing)	a. 70.0 ft.	___.__ ft.
Date	b. 05/16/2011 m m d d y y y y	05/16/2011 m m d d y y y y
Time	c. 12:35 ☐ a.m. ☒ p.m.	1:15 ☐ a.m. ☒ p.m.
12. Sediment in well bottom	___.__ inches	___.__ inches
13. Water clarity	Clear ☐ 10 Turbid ☒ 15	Clear ☐ 20 Turbid ☐ 25
(Describe)	GRAY SAND	

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids	____.__ mg/l	____.__ mg/l
15. COD	____.__ mg/l	____.__ mg/l

16. Well developed by: Name (first, last) and Firm

First Name: Last Name:

Firm:

17. Additional comments on development:
SURGED WITH BLOCK & BAIL CHECK VALVE FOR SEVERAL MINUTES AT 2 FT INTERVALS UNTIL 5 GALS. PUMPED.
PUMPED WITH SUMP PUMP UNTIL CLEAR. 50 GALS.

Name and Address of Facility Contact/Owner/Responsible Party

First Name: _____ Last Name: _____

Facility/Firm: _____

Street: _____

City/State/Zip: _____

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature: _____

Print Name: _____

Firm: _____

NOTE: See instructions for more information including a list of county codes and well type codes.

GEOLOGIC LOG OF DRILL HOLE NO. MW-11-138

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Right, RM 148.5, Merced County
BEGUN: 4/29/11 FINISHED: 4/29/11
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 6.6 ft. (86.7 ft. - 5/16/2011)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,323,926.7 E 6,054,783.8 NAD83
TOTAL DEPTH: 30.2 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 93.32 ft. NADV88
ANGLE FROM HORIZONTAL: -90°
HOLE LOGGED BY: M. Lyttge
REVIEWED BY: T. Lewis

NOTES

ALL MEASUREMENTS ARE IN FEET FROM THE GROUND SURFACE.

PURPOSE OF HOLE:
To recover a continuous soil core, collect data to determine geologic and hydrologic site conditions, and install a groundwater monitoring well.

LOCATION:
Reach 4B1, River Bank Right, RM 148.5, Merced County. Adjacent to Mariposa Bypass.

DRILLED BY:
Bureau of Reclamation: PN Region drill crew:
Chris Peterson, driller
Dennis Read, helper
Cody Kelley, helper

DRILL RIG:
Truck mounted Central Mining Equipment (CME) DC512

DRILLING & SAMPLING METHODS:
The drill hole was advanced and sample using a Flight Auger Dry Core system (FADC). The drill hole was advanced using 8-1/4 inch o.d. by 4-1/4 inch i.d. hollow stem flight augers equipped with an 8-1/2 inch o.d. bullet and spade drill bit. Continuous sampling was performed by advancing a 4 inch o.d. by 3-3/8 inch i.d. by 5-foot long split barrel dry core sample system (sampler). Unless indicated otherwise, the sampler was placed inside the augers and the cutting shoe of the sampler extended 0.2 foot beyond the auger drill bit. A free-spinning adapter was placed at the top of the sampler to avoid rotation while advancing the augers.

Interval Method
0.0 to 30.2 ft. FADC

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
5.2 to 10.2 ft. - Wet at bottom.

DRILLNG FLUID, RETURN AND COLOR:
0.0 to 30.2 ft. - Drilled without fluid

WATER LEVEL:
6.6 ft. - 5/16/2011

REASON FOR HOLE TERMINATION:
The hole was terminated upon reaching the target depth.

DEPTH	% CORE RECOVERY	LABORATORY DATA: <0.005	<0.075	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	% MOISTURE CONTENT	LABORATORY CLASSIFICATION / El.	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / El.
0											s(CL) 91.1
	100.0										s(CL) 90.3
		63.6	24.8	11.6	0.0	61.4	47.0	24.4	CH 89.3		(CH)s
5											86.7
	60.0										(ML)s 85.2
											SP-SM 85.1
											NR 83.1
10											
		20.7	19.9	59.4	0.0	19.7	6.4	17.2	SC-SM 82.3		SM 80.5
	58.0										CL 80.2
											NR
15										Qal	78.1

CLASSIFICATION AND PHYSICAL CONDITION

0.0 to 30.2 feet
QUATERNARY ALLUVIUM (Qal)

0.0 to 2.2 ft. SANDY LEAN CLAY, s(CL):
About 65% fines with medium plasticity, medium toughness; about 35% fine sand; moist, dark brown with tan mottling; firm, portion crumbled from drilling action; strong reaction with HCL; moderately cemented with $CaCO_3$ from 1.2 to 2.0 ft.

2.2 to 3.0 ft. SANDY LEAN CLAY, s(CL):
About 60% fines with medium plasticity, no dilatancy, low toughness; about 40% fine sand; moist, light brown with dark brown mottling; firm; no reaction with HCL.

3.0 to 6.6 ft. FAT CLAY WITH SAND, (CH)s:
About 85% fines with high plasticity, high dry strength, no dilatancy, medium to high toughness; about 15% fine sand; dark brown; firm; reaction with HCL in $CaCO_3$ nodules; moderate to strong $CaCO_3$ cementation from 5.0 to 6.0 ft.

Lab Data Interval
3.0 to 4.0 ft.

6.6 to 8.1 ft. SILT WITH SAND, (ML)s:
About 90% fines with low plasticity, slow dilatancy, low toughness; about 10% fine sand; moist, tan; soft to firm; weak reaction with HCL; traces of $CaCO_3$ and charcoal.

8.1 to 8.2 ft. POORLY GRADED SAND WITH SILT, SP-SM:
About 90% fine sand; about 10% fines with low plasticity; wet, brown; retains shape of core barrel; minor oxidation; no reaction with HCL.

8.2 to 10.2 ft. No Recovery

10.2 to 12.8 ft. SILTY SAND, SM:
About 60% fine sand; about 40% fines with low plasticity; wet, brown; retains shape of core barrel; minor oxidation; no reaction with HCL.

Note: From 11.0 to 12.3 core molded to shape of core box.

Lab Data Interval
10.5 to 11.0 ft.

12.8 to 13.1 ft. LEAN CLAY, CL:
About 100% fines with medium plasticity, no dilatancy, medium toughness; trace of fine sand; moist, gray; firm.

13.1 to 15.2 ft. No Recovery

15.2 to 18.7 ft. LEAN CLAY, CL:
About 95% fines with medium plasticity, no dilatancy, medium toughness; about 5% fine sand; moist, gray; firm.

Lab Data Interval
16.0 to 17.0 ft.

COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-Plastic
NR = No Recovery
NA = Not Applicable
I.D. = Inner Diameter
O.D. = Outer Diameter

G.S. = Ground Surface
+ = Above Ground Surface
T.O.C. = Top of Well Casing
SJR = San Joaquin River
▼ = Top of Groundwater

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

GEOLOGIC LOG OF DRILL HOLE NO. MW-11-138

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Right, RM 148.5, Merced County
BEGUN: 4/29/11 FINISHED: 4/29/11
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 6.6 ft. (86.7 ft. - 5/16/2011)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,323,926.7 E 6,054,783.8 NAD83
TOTAL DEPTH: 30.2 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 93.32 ft. NADV88
ANGLE FROM HORIZONTAL: -90°
HOLE LOGGED BY: M. Lyttge
REVIEWED BY: T. Lewis

NOTES

HOLE COMPLETION:
Completed as a groundwater monitoring well.

Well Casing: +2.75 to 13.2 ft. and 18.2 to 23.2 ft. (2-inch I.D. blank PVC)
Dual U-pack Screen: 13.2 to 18.2 ft. and 23.2 to 28.2 ft. (2-inch I.D. inner screen; 3-inch I.D. outer screen; slotted 0.010-inch)
U-Pack Screen Filter Pack: (#2/12 Sand)
Filter Pack: 11.0 to 30.2 ft. (#3 Sand)
Sump: 28.2 to 30.2 ft. (2-inch I.D. blank PVC with slip cap)
Concrete Seal: 0.0 to 2.0 ft.
Bentonite Seal: 2.0 to 11.0 ft.
Well Completion: 6-inch by 6-inch by 5-foot long steel surface casing with locking top; 2.0-foot diameter concrete pad.
Lock: #2006 Masterlock

DEPTH	% CORE RECOVERY	LABORATORY DATA: <0.005	<0.075	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	% MOISTURE CONTENT	LABORATORY CLASSIFICATION	El.	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION	El.
		40.1	48.3	11.6	0.0	30.4	16.1	22.8	CL	76.3		CL	74.6
	100.0												
20		20.3	75.3	4.4	0.0	30.2	6.0	28.1	ML	73.3		ML	72.4
												s(CL)	70.9
	70.0	8.3	14.9	76.8	0.0	20.8	4.2	16.3	SC-SM	69.8		SM	69.6
25													
												NR	
	0.0												
30													63.1

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

18.7 to 20.9 ft. SILT, ML:
About 90% fines with low plasticity, slow dilatancy, low toughness; about 10% fine sand; moist, tan; firm; very weak reaction with HCL; mottled with oxidation; trace of charcoal.

Lab Data Interval
19.0 to 20.0 ft.

20.9 to 22.4 ft. SANDY LEAN CLAY, s(CL):
About 65% fines with low plasticity, slow dilatancy, medium toughness; about 35% fine sand; moist, gray; firm; no reaction with HCL.

22.4 to 23.7 ft. SILTY SAND, SM:
About 75% fine and medium sand; about 25% low plasticity fines; wet, gray; molded to shape of box; minor oxidation near bottom; no reaction with HCL.

Lab Data Interval
22.5 to 23.5 ft.

23.7 to 30.2 ft. No Recovery

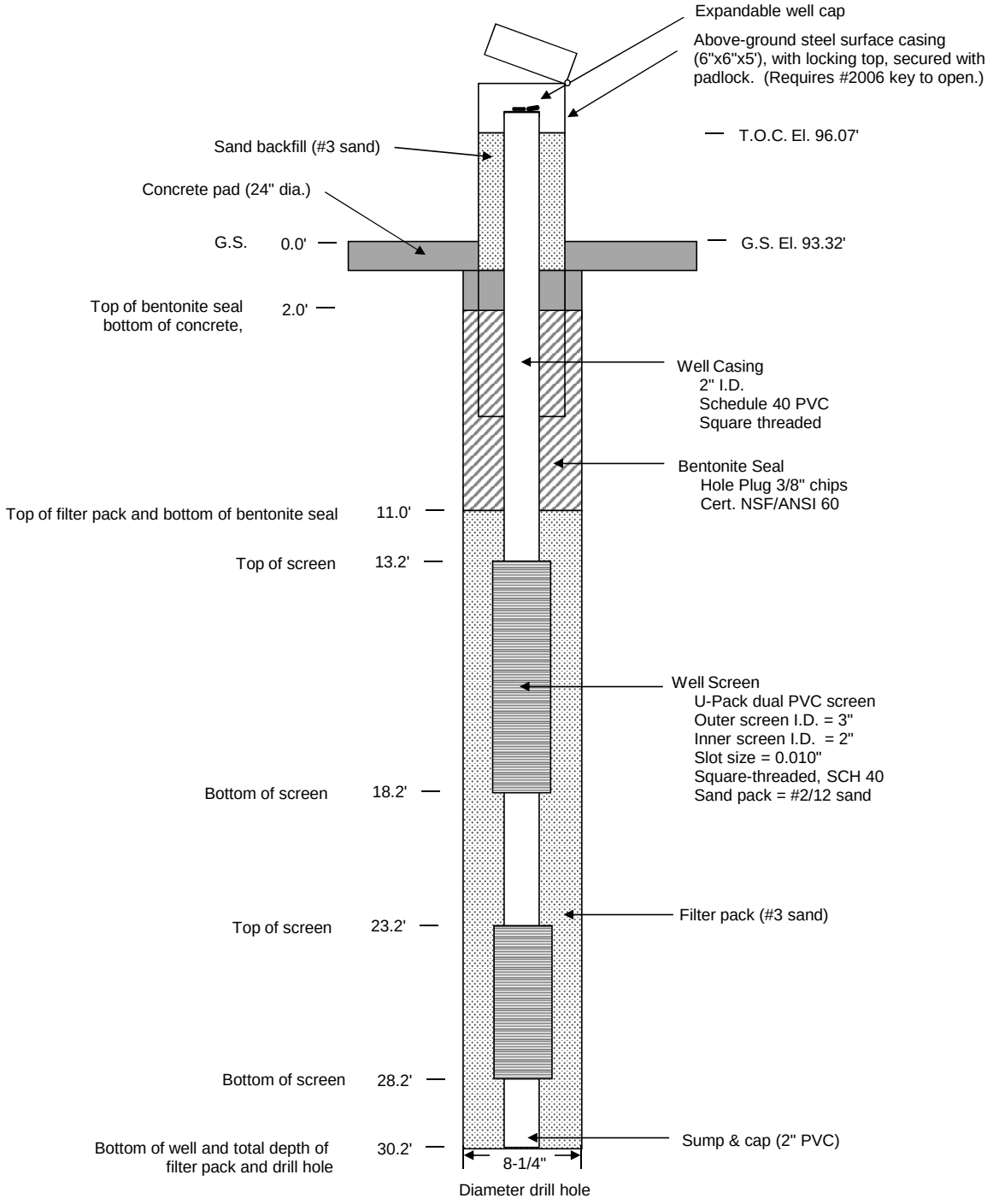
COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-Plastic
NR = No Recovery
NA = Not Applicable
I.D. = Inner Diameter
O.D. = Outer Diameter

G.S. = Ground Surface
+ = Above Ground Surface
T.O.C. = Top of Well Casing
SJR = San Joaquin River
▼ = Top of Groundwater

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

MW-11-138	GEOLOGIST: M. Lyttge
WELL COMPLETION DIAGRAM	DRILLER: C. Peterson
DATE COMPLETED: 4/29/2011	HELPERS: D. Read & C. Kelly
LOCATION: Adjacent to Mariposa Bypass. Reach 4B1, River Bank Right, RM 148.5, Merced County. T.O.C. COORDINATES: N2323926.73 E6054783.77 (NAD93) EL. 96.07' (NAVD88) G.S. ELEVATION: 93.32' (NAVD88)	



***NOT TO SCALE**

NOTES:

T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, El. = Elevation
Dia. = Diameter

San Joaquin River Restoration Program
U.S. Department of Interior, Bureau of Reclamation

MONITORING WELL DEVELOPMENT

Facility/Project Name	County Name	Well Name
SJRRP	MERCED	MW-11-13B

Facility License, Permit or Monitoring Number	County Code	Wis. Unique Well Number	DNR Well ID Number

1. Can this well be purged dry? Yes ☐ No ☒

2. Well development method

surged with bailer and bailed	☐ 41
surged with bailer and pumped	☐ 61
surged with block and bailed	☐ 42
surged with block and pumped	☒ 62
surged with block, bailed and pumped	☐ 70
compressed air	☐ 20
bailed only	☐ 10
pumped only	☐ 51
pumped slowly	☐ 50
Other _____	☐ __

3. Time spent developing well: 40 min.

4. Depth of well (from top of well casisng): 32.7 ft.

5. Inside diameter of well: 2.00 in.

6. Volume of water in filter pack and well casing: ___.__ gal.

7. Volume of water removed from well: 55.__ gal.

8. Volume of water added (if any): ___.__ gal.

9. Source of water added: _____

10. Analysis performed on water added? (If yes, attach results) ☐ Yes ☐ No

	Before Development	After Development
11. Depth to Water (from top of well casing)	a. 96.__ ft.	96.__ ft.
Date	b. 05/16/2011 (m m d d y y y y)	05/16/2011 (m m d d y y y y)
Time	c. 10:00 ☒ a.m. ☐ p.m.	10:40 ☐ a.m. ☐ p.m.
12. Sediment in well bottom	__.__ inches	__.__ inches
13. Water clarity	Clear ☐ 10 Turbid ☒ 15	Clear ☐ 20 Turbid ☐ 25
(Describe)	Brown Sand	
14. Total suspended solids	____.__ mg/l	____.__ mg/l
15. COD	____.__ mg/l	____.__ mg/l

Fill in if drilling fluids were used and well is at solid waste facility:

16. Well developed by: Name (first, last) and Firm
First Name: Last Name:
Firm:

17. Additional comments on development:
SURGED WITH BLOCK & BAIL CHECK VALVE FOR SEVERAL MINUTES AT 2 FT. INTERVALS. UNTIL 5 GALS. PUMPED.
PUMPED WIT SUMP PUMP UNTIL CLEAR. 50 GALS.

Name and Address of Facility Contact /Owner/Responsible Party
First Name: _____ Last Name: _____
Facility/Firm: _____
Street: _____
City/State/Zip: _____

I hereby certify that the above information is true and correct to the best of my knowledge.
Signature: _____
Print Name: _____
Firm: _____

NOTE: See instructions for more information including a list of county codes and well type codes.

GEOLOGIC LOG OF DRILL HOLE NO. MW-11-139

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Right, RM 148.5, Merced County
BEGUN: 4/30/11 FINISHED: 4/30/11
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 5.2 ft. (84.4 ft. - 5/16/2011)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,322,532.5 E 6,054,528.6 NAD83
TOTAL DEPTH: 29.8 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 89.60 ft. NADV88
ANGLE FROM HORIZONTAL: -90°
HOLE LOGGED BY: M. Lyttge
REVIEWED BY: T. Lewis

NOTES

ALL MEASUREMENTS ARE IN FEET FROM THE GROUND SURFACE.

PURPOSE OF HOLE:
To recover a continuous soil core, collect data to determine geologic and hydrologic site conditions, and install a groundwater monitoring well.

LOCATION:
Reach 4B1, River Bank Right, RM 148.5, Merced County. North of Sand Slough Road.

DRILLED BY:
Bureau of Reclamation: PN Region drill crew:
Chris Peterson, driller
Dennis Read, helper
Cody Kelley, helper

DRILL RIG:
Truck mounted Central Mining Equipment (CME) DC512

DRILLING & SAMPLING METHODS:
The drill hole was advanced and sample using a Flight Auger Dry Core system (FADC). The drill hole was advanced using 8-1/4 inch o.d. by 4-1/4 inch i.d. hollow stem flight augers equipped with an 8-1/2 inch o.d. bullet and spade drill bit. Continuous sampling was performed by advancing a 4 inch o.d. by 3-3/8 inch i.d. by 5-foot long split barrel dry core sample system (sampler). Unless indicated otherwise, the sampler was placed inside the augers and the cutting shoe of the sampler extended 0.2 foot beyond the auger drill bit. A free-spinning adapter was placed at the top of the sampler to avoid rotation while advancing the augers.

Interval Method
0.0 to 29.8 ft. FADC

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
4.8 to 9.8 ft. - Wet at 6.0 ft.
9.8 to 14.8 ft. - Catcher in.
14.8 to 20.8 ft. - Catcher and baggie in.
20.8 to 24.8 ft. - Catcher and baggie in.
24.8 to 29.8 ft. - Catcher and baggie in.

DRILLING FLUID, RETURN AND COLOR:
0.0 to 29.8 ft. - Drilled without fluid

WATER LEVEL:
5.2 ft. - 5/16/2011

REASON FOR HOLE TERMINATION:
The hole was terminated upon reaching the target depth.

DEPTH	% CORE RECOVERY	LABORATORY DATA: <0.005	<0.075	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	% MOISTURE CONTENT	LABORATORY CLASSIFICATION / El.	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / El.
											SC 88.9
	100.0										SM 86.6
		45.7	24.7	29.6	0.0	47.2	34.2	23.0	(CL)s 84.6		(CL)s 83.3
5										▼	
		12.9	23.1	64.0	0.0	NP	NP	22.8	SM 82.6		SM 82.2
	82.0										
		21.5	51.4	27.1	0.0	26.8	6.0	23.1	(CL-ML)s 81.1		(CL)s 81.0
											s(CL) 80.7
10											
	0.0									Qal	NR

0.0 to 29.8 feet
QUATERNARY ALLUVIUM (Qal)

0.0 to 0.7 ft. CLAYEY SAND, SC:
About 60% fine sand; about 40% fines with medium plasticity; dry to moist, light gray/brown; firm; weak reaction with HCL.

0.7 to 3.0 ft. SILTY SAND, SM:
About 80% fine sand; about 20% fines with low plasticity; dry to moist, brown; roots and grass; weak reaction with HCL; trace $CaCO_3$ nodules.

Note: 0.7 to 0.8 ft: LEAN CLAY, CL: About 100% fines with medium plasticity, medium toughness; trace of fine sand.

3.0 to 6.3 ft. LEAN CLAY WITH SAND, (CL)s:
About 80% fines with medium plasticity, medium toughness; about 20% fine sand; moist, chocolate brown mottled with light tan; strong reaction with HCL; moderately cemented with $CaCO_3$ from 4.6 to 5.4 ft., very soft where not cemented.

Lab Data Interval
4.0 to 5.0

6.3 to 7.4 ft. SILTY SAND, SM:
About 65% fine sand; about 35% fines with low plasticity; wet, brown; somewhat molded to shape of core box; no reaction with HCL; trace charcoal.

Lab Data Interval
6.5 to 7.0 ft.

7.4 to 8.6 ft. LEAN CLAY WITH SAND, (CL)s:
About 70% fines with medium plasticity; about 30% fine sand; moist to wet, gray; mostly retains shape of core barrel; no reaction with HCL; trace charcoal.

Lab Data Interval
8.0 to 8.5 ft.

8.6 to 8.9 ft. SANDY LEAN CLAY, s(CL):
About 60% fines with medium plasticity; about 40% fine sand; moist to wet, gray; retains shape of core barrel; no reaction with HCL.

8.9 to 9.8 ft. No Recovery

9.8 to 29.8 ft. No Recovery

Note: 19.8 to 24.8 ft.: Trace (0.1 ft.) recovery of heterogeneous mix of fine to medium sand. Logged as: POORLY SORTED SAND WITH SILT, SP-SM: About 90 % fine to medium sand, about 10% fines with no plasticity; wet, gray.

Note: Intervals with no recovery: when augers were pulled there was wet, fine to medium sand between threads.

COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-Plastic
NR = No Recovery
NA = Not Applicable
I.D. = Inner Diameter
O.D. = Outer Diameter

G.S. = Ground Surface
+ = Above Ground Surface
T.O.C. = Top of Well Casing
SJR = San Joaquin River
▼ = Top of Groundwater

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

GEOLOGIC LOG OF DRILL HOLE NO. MW-11-139

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Right, RM 148.5, Merced County
BEGUN: 4/30/11 FINISHED: 4/30/11
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 5.2 ft. (84.4 ft. - 5/16/2011)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,322,532.5 E 6,054,528.6 NAD83
TOTAL DEPTH: 29.8 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 89.60 ft. NADV88
ANGLE FROM HORIZONTAL: -90°
HOLE LOGGED BY: M. Lyttge
REVIEWED BY: T. Lewis

NOTES	DEPTH	% CORE RECOVERY	LABORATORY DATA: <0.005	<0.075	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	% MOISTURE CONTENT	LABORATORY CLASSIFICATION / El.	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / El.	CLASSIFICATION AND PHYSICAL CONDITION
HOLE COMPLETION: Completed as a groundwater monitoring well. Well Casing: +2.76 to 7.8 ft. (2-inch I.D. blank PVC) Dual U-pack Screen: 7.8 to 27.8 ft. (2-inch I.D. inner screen; 3-inch I.D. outer screen; slotted 0.010-inch) U-Pack Screen Filter Pack: (#2/12 Sand) Filter Pack: 6.0 to 29.8 ft. (#3 Sand) Sump: 27.8 to 29.8 ft. (2-inch I.D. blank PVC with slip cap) Concrete Seal: 0.0 to 2.0 ft. Bentonite Seal: 2.0 to 6.0 ft. Well Completion: 6-inch by 6-inch by 5-foot long steel surface casing with locking top; 2.0-foot diameter concrete pad. Lock: #2006 Masterlock		0.0											
												69.8	
	20	2.0										SP-SM	
												64.8	
	25	0.0										NR	
												59.8	

BOTTOM OF HOLE

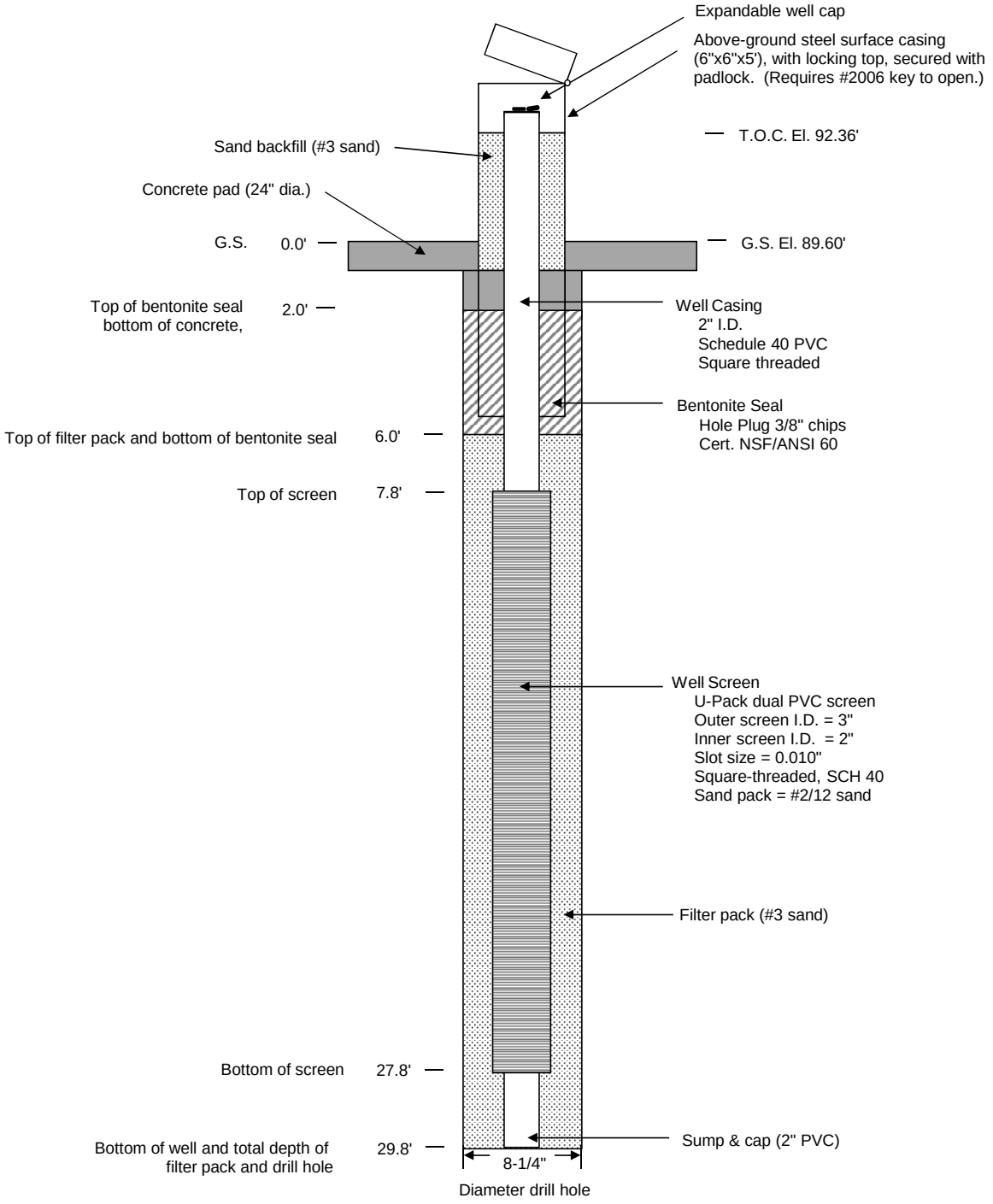
COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-Plastic
NR = No Recovery
NA = Not Applicable
I.D. = Inner Diameter
O.D. = Outer Diameter

G.S. = Ground Surface
+ = Above Ground Surface
T.O.C. = Top of Well Casing
SJR = San Joaquin River
▼ = Top of Groundwater

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

MW-11-139	GEOLOGIST: M. Lyttge
WELL COMPLETION DIAGRAM	DRILLER: C. Peterson
DATE COMPLETED: 4/30/2011	HELPERS: D. Read & C. Kelly
LOCATION: Field North of Sand Slough Road. Reach 4B1, River Bank Right, RM 148.5, Merced County. T.O.C. COORDINATES: N2322532.47 E6054528.62 (NAD93) EL.92.39' (NAVD88) G.S. ELEVATION: 89.60' (NAVD88)	



***NOT TO SCALE**

NOTES:

T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, El. = Elevation
Dia. = Diameter

San Joaquin River Restoration Program
U.S. Department of Interior, Bureau of Reclamation

MONITORING WELL DEVELOPMENT

Facility/Project Name	County Name	Well Name
SJRRP	MERCED	W-11 / MW-11-139
Facility License, Permit or Monitoring Number	**County Code**	**Wis. Unique Well Number**	**DNR Well ID Number**

1. Can this well be purged dry? Yes ☐ No ☒

2. Well development method

surged with bailer and bailed	☐	41
surged with bailer and pumped	☐	61
surged with block and bailed	☑	42
surged with block and pumped	☒	62
surged with block, bailed and pumped	☐	70
compressed air	☐	20
bailed only	☐	10
pumped only	☐	51
pumped slowly	☐	50
Other _____	☐	__

3. Time spent developing well: 45 min.

4. Depth of well (from top of well casisng): 325 ft.

5. Inside diameter of well: 2.00 in.

6. Volume of water in filter pack and well casing: ___.__ gal.

7. Volume of water removed from well: 55.__ gal.

8. Volume of water added (if any): ___.__ gal.

9. Source of water added: _____

10. Analysis performed on water added? ☐ Yes ☐ No (If yes, attach results)

	Before Development	After Development
11. Depth to Water (from top of well casing)	a. 8.2 ft.	8.2 ft.
Date	b. 05/16/2011 (m m d d y y y y)	05/16/2011
Time	c. 10:45 ☒ a.m. ☐ p.m.	11:30 ☐ a.m. ☐ p.m.
12. Sediment in well bottom	___.__ inches	___.__ inches
13. Water clarity	Clear ☐ 10 Turbid ☒ 15	Clear ☐ 20 Turbid ☐ 25
(Describe)	GRAY SAND	

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids	____.__ mg/l	____.__ mg/l
15. COD	____.__ mg/l	____.__ mg/l

16. Well developed by: Name (first, last) and Firm
First Name: Last Name:
Firm:

17. Additional comments on development:
SURGED WITH BLOCK & BALL CHECK VALVE FOR SEVERAL MINUTES AT 2 FT. INTERVAL UNTIL 5 GALS PUMPED.
PUMPED WITH SUMP PUMP 50 GALS.

Name and Address of Facility Contact /Owner/Responsible Party
First Name: _____ Last Name: _____
Facility/Firm: _____
Street: _____
City/State/Zip: _____

I hereby certify that the above information is true and correct to the best of my knowledge.
Signature: _____
Print Name: _____
Firm: _____

NOTE: See instructions for more information including a list of county codes and well type codes.

GEOLOGIC LOG OF DRILL HOLE NO. MW-11-140

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Left, RM 155.1, Merced County
BEGUN: 5/1/11 FINISHED: 5/1/11
DEPTH AND ELEVATION OF WATER LEVEL AND DATE MEASURED: 5.9 ft. (88.7 ft. - 5/16/2011)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,307,852.1 E 6,057,225.7 NAD83
TOTAL DEPTH: 30.3 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 94.61 ft. NADV88
ANGLE FROM HORIZONTAL: -90°
HOLE LOGGED BY: M. Lyttge
REVIEWED BY: T. Lewis

NOTES

ALL MEASUREMENTS ARE IN FEET FROM THE GROUND SURFACE.

PURPOSE OF HOLE:
To recover a continuous soil core, collect data to determine geologic and hydrologic site conditions, and install a groundwater monitoring well.

LOCATION:
Reach 4B1, River Bank Left, RM 155.1, Merced County. Field east of Turner Island Road.

DRILLED BY:
Bureau of Reclamation: PN Region drill crew:
Chris Peterson, driller
Dennis Read, helper
Cody Kelley, helper

DRILL RIG:
Truck mounted Central Mining Equipment (CME) DC512

DRILLING & SAMPLING METHODS:
The drill hole was advanced and sample using a Flight Auger Dry Core system (FADC). The drill hole was advanced using 8-1/4 inch o.d. by 4-1/4 inch i.d. hollow stem flight augers equipped with an 8-1/2 inch o.d. bullet and spade drill bit. Continuous sampling was performed by advancing a 4 inch o.d. by 3-3/8 inch i.d. by 5-foot long split barrel dry core sample system (sampler). Unless indicated otherwise, the sampler was placed inside the augers and the cutting shoe of the sampler extended 0.2 foot beyond the auger drill bit. A free-spinning adapter was placed at the top of the sampler to avoid rotation while advancing the augers.

Interval Method
0.0 to 30.3 ft. FADC

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
0.0 to 5.3 ft. - Wet at bottom.
10.3 to 15.3 ft. - Catcher in.
15.3 to 20.3 ft. - Catcher and baggie in.
20.3 to 25.3 ft. - Catcher and baggie in.
25.3 to 30.3 ft. - Catcher and baggie in.

DRILLING FLUID, RETURN AND COLOR:
0.0 to 30.3 ft. - Drilled without fluid

WATER LEVEL:
5.9 ft. - 5/16/2011

REASON FOR HOLE TERMINATION:
The hole was terminated upon reaching the target depth.

DEPTH	% CORE RECOVERY	LABORATORY DATA: <0.005	<0.075	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	% MOISTURE CONTENT	LABORATORY CLASSIFICATION / El.	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / El.
											(CL)s 92.5
	86.8									Fill	SP-SM 91.6
											SM 91.2
											SP 90.0
5											NR 89.3
		0.5	5.7	93.8	0.0	NP	NP	21.0	SP-SM 88.8		SP 88.8
	100.0										SP-SM 87.8
											CL 87.0
		68.0	29.0	3.0	0.0	72.8	43.2	52.7	CH 84.6		CH
10											
	100.0										82.6
											SP-SM 81.0
		14.6	53.0	32.4	0.0	NP	NP	34.7	s(ML) 79.6		s(ML)
15											79.3

CLASSIFICATION AND PHYSICAL CONDITION

0.0 to 3.4 feet
ROADFILL (Fill)

0.0 to 2.1 ft. LEAN CLAY WITH SAND, (CL)s: dry to moist, brown; no reaction with HCL.

2.1 to 3.0 ft. POORLY SORTED SAND WITH SILT, SP-SM About 90% fine sand; brown; no reaction with HCL.

3.0 to 3.4 ft. SILTY SAND, SM About 80% fine sand; moist; brown; no reaction with HCL.

3.4 to 30.3 feet
QUATERNARY ALLUVIUM (Qal)

3.4 to 5.8 ft. POORLY SORTED SAND, SP: About 95% fine to medium sand; moist, light brown; about 5% fines; molded to shape of core box; minor oxidation from 4.3 to 4.6 ft. and from 5.3 to 5.4 ft.; no reaction with HCL.

Note: No Recovery from 4.6 to 5.3 ft.

Lab Data Interval
5.3 to 5.8 ft.

5.8 to 6.8 ft. POORLY SORTED SAND WITH SILT, SP-SM: About 90% fine sand; about 10% fines with low plasticity; wet, brown; retains shape of core barrel; minor oxidation in 0.01 to 0.03 ft. thick bands; no reaction with HCL.

6.8 to 7.6 ft. LEAN CLAY, CL: About 100% fines with medium plasticity, medium dry strength, slow dilatancy, medium toughness; trace of fine sand, mostly mica; moist, brown; firm; minor nodules of oxidation; no reaction with HCL.

7.6 to 12.0 ft. FAT CLAY, CH: About 100% fines with high plasticity, high dry strength, high toughness; trace of fine sand, mostly mica; moist, dark gray; firm; minor oxidation.

Lab Data Interval
9.0 to 10.0 ft.

12.0 to 13.6 ft. POORLY SORTED SAND WITH SILT, SP-SM: About 90% fine sand; about 10% fines with low plasticity; wet, brown; retains shape of core barrel; minor oxidation in nodules and 0.01 to 0.03 ft. thick bands throughout; no reaction with HCL.

13.6 to 15.3 ft. SANDY SILT, s(ML): About 65% fines with low plasticity; about 35% fine sand; wet, gray; somewhat molded to shape of core box; no reaction with HCL; trace brown fibrous organics.

Lab Data Interval
14.0 to 15.0 ft.

COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-Plastic
NR = No Recovery
NA = Not Applicable
I.D. = Inner Diameter
O.D. = Outer Diameter

G.S. = Ground Surface
+ = Above Ground Surface
T.O.C. = Top of Well Casing
SJR = San Joaquin River
▼ = Top of Groundwater

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

GEOLOGIC LOG OF DRILL HOLE NO. MW-11-140

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Left, RM 155.1, Merced County
BEGUN: 5/1/11 FINISHED: 5/1/11
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 5.9 ft. (88.7 ft. - 5/16/2011)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,307,852.1 E 6,057,225.7 NAD83
TOTAL DEPTH: 30.3 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 94.61 ft. NADV88
ANGLE FROM HORIZONTAL: -90°
HOLE LOGGED BY: M. Lyttge
REVIEWED BY: T. Lewis

NOTES

HOLE COMPLETION:
Completed as a groundwater monitoring well.

Well Casing: +2.67 to 13.3 ft. (2-inch I.D. blank PVC)
Dual U-pack Screen: 13.3 to 28.3 ft. (2-inch I.D. inner screen; 3-inch I.D. outer screen; slotted 0.010-inch)
U-Pack Screen Filter Pack: (#2/12 Sand)
Filter Pack: 12.0 to 30.3 ft. (#3 Sand)
Sump: 28.3 to 30.3 ft. (2-inch I.D. blank PVC with slip cap)
Concrete Seal: 0.0 to 2.0 ft.
Bentonite Seal: 2.0 to 12.0 ft.
Well Completion: 6-inch by 6-inch by 5-foot long steel surface casing with locking top; 2.0-foot diameter concrete pad.
Lock: #2006 Masterlock

DEPTH	% CORE RECOVERY	LABORATORY DATA: <0.005	<0.075	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	% MOISTURE CONTENT	LABORATORY CLASSIFICATION / El.	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / El.
20	0.0									Qal	
25	0.0										SP-SM
30	0.0										64.3

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

15.3 to 30.3 ft. <u>No Recovery</u> Trace sand on sampler and augers. Logged as POORLY SORTED SAND WITH SILT, (SP-SM): About 90% fine sand; about 10% fines with no plasticity; wet, gray.

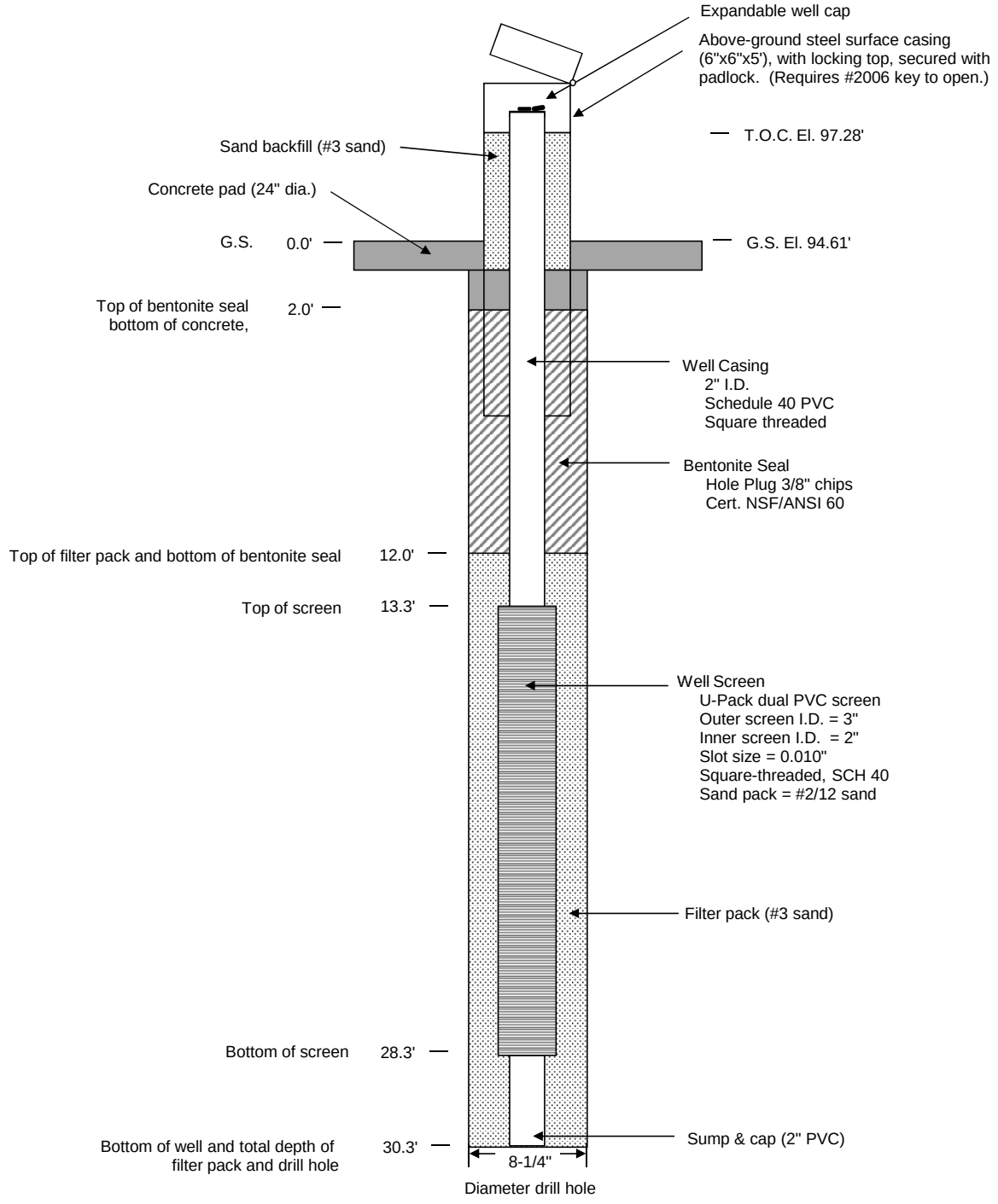
COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-Plastic
NR = No Recovery
NA = Not Applicable
I.D. = Inner Diameter
O.D. = Outer Diameter

G.S. = Ground Surface
+ = Above Ground Surface
T.O.C. = Top of Well Casing
SJR = San Joaquin River
▼ = Top of Groundwater

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

MW-11-140	GEOLOGIST: M. Lyttge
WELL COMPLETION DIAGRAM	DRILLER: C. Peterson
DATE COMPLETED: 5/1/2011	HELPERS: D. Read & C. Kelly
LOCATION: Field east of Turner Island Road. Reach 4B1, River Bank Left, RM 155.1, Merced County. T.O.C. COORDINATES: N2307852.05 E6057225.69 (NAD93) EL. 97.28' (NAVD88) G.S. ELEVATION: 94.61' (NAVD88)	



***NOT TO SCALE**

NOTES:

T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, El. = Elevation
Dia. = Diameter

San Joaquin River Restoration Program
U.S. Department of Interior, Bureau of Reclamation

MONITORING WELL DEVELOPMENT

Facility/Project Name	County Name	Well Name
SJRR P	MERCED	W-20 / MW-11-140

Facility License, Permit or Monitoring Number	County Code	Wis. Unique Well Number	DNR Well ID Number

1. Can this well be purged dry? Yes ☐ No ☒

2. Well development method

surged with bailer and bailed	☐ 41
surged with bailer and pumped	☐ 61
surged with block and bailed	☐ 42
surged with block and pumped	☒ 62
surged with block, bailed and pumped	☐ 70
compressed air	☐ 20
bailed only	☐ 10
pumped only	☐ 51
pumped slowly	☐ 50
Other _____	☐ __

3. Time spent developing well 40 min.

4. Depth of well (from top of well casisng) 330 ft.

5. Inside diameter of well 2.00 in.

6. Volume of water in filter pack and well casing ____.__ gal.

7. Volume of water removed from well 55.__ gal.

8. Volume of water added (if any) ____.__ gal.

9. Source of water added _____

10. Analysis performed on water added? (If yes, attach results) ☐ Yes ☐ No

	Before Development	After Development
11. Depth to Water (from top of well casing) a.	89.__ ft.	85.__ ft.
Date b. (m m d d y y y y)	05/16/2011	05/16/2011
Time c.	1:35 ☐ a.m. ☒ p.m.	2:15 ☐ a.m. ☒ p.m.
12. Sediment in well bottom	___.__ inches	___.__ inches
13. Water clarity	Clear ☐ 10 Turbid ☒ 15	Clear ☐ 20 Turbid ☐ 25
(Describe)	GREEN SAND	

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids	____.__ mg/l	____.__ mg/l
15. COD	____.__ mg/l	____.__ mg/l

16. Well developed by: Name (first, last) and Firm

First Name: Last Name:

Firm:

17. Additional comments on development:
SURGED WITH BLOCK & BALL CHECK VALVE FOR SEVERAL MINUTES AT 2 FT. INTERVALS UNTIL 5 BAGS. PUMPED.
PUMPED WITH SUMP PUMP UNTIL CLEAR. 50 BAGS.

Name and Address of Facility Contact /Owner/Responsible Party

First Name: _____ Last Name: _____

Facility/Firm: _____

Street: _____

City/State/Zip: _____

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature: _____

Print Name: _____

Firm: _____

NOTE: See instructions for more information including a list of county codes and well type codes.

GEOLOGIC LOG OF DRILL HOLE NO. MW-11-141

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Right, RM 148.8, Merced County
BEGUN: 5/2/11 FINISHED: 5/2/11
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 4.7 ft. (84.6 ft. - 5/16/2011)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,321,075.1 E 6,053,794.7 NAD83
TOTAL DEPTH: 29.6 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 89.26 ft. NADV88
ANGLE FROM HORIZONTAL: -90°
HOLE LOGGED BY: M. Lyttge
REVIEWED BY: T. Lewis

NOTES

ALL MEASUREMENTS ARE IN FEET FROM THE GROUND SURFACE.

PURPOSE OF HOLE:
To recover a continuous soil core, collect data to determine geologic and hydrologic site conditions, and install a groundwater monitoring well.

LOCATION:
Reach 4B1, River Bank Right, RM 148.8, Merced County. North of Sand Slough Road.

DRILLED BY:
Bureau of Reclamation: PN Region drill crew:
Chris Peterson, driller
Dennis Read, helper
Cody Kelley, helper

DRILL RIG:
Truck mounted Central Mining Equipment (CME) DC512

DRILLING & SAMPLING METHODS:
The drill hole was advanced and sample using a Flight Auger Dry Core system (FADC). The drill hole was advanced using 8-1/4 inch o.d. by 4-1/4 inch i.d. hollow stem flight augers equipped with an 8-1/2 inch o.d. bullet and spade drill bit. Continuous sampling was performed by advancing a 4 inch o.d. by 3-3/8 inch i.d. by 5-foot long split barrel dry core sample system (sampler). Unless indicated otherwise, the sampler was placed inside the augers and the cutting shoe of the sampler extended 0.2 foot beyond the auger drill bit. A free-spinning adapter was placed at the top of the sampler to avoid rotation while advancing the augers.

Interval Method
0.0 to 29.6 ft. FADC

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
4.6 to 9.6 ft. - Wet.
19.6 to 24.6 ft. - Catcher with nylon.
24.6 to 29.6 ft. - Catcher with nylon.

DRILLING FLUID, RETURN AND COLOR:
0.0 to 29.6 ft. - Drilled without fluid

WATER LEVEL:
4.7 ft. - 5/16/2011

REASON FOR HOLE TERMINATION:
The hole was terminated upon reaching the target depth.

DEPTH	% CORE RECOVERY	LABORATORY DATA: <0.005	<0.075	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	% MOISTURE CONTENT	LABORATORY CLASSIFICATION / El.	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / El.
											SC 88.2
											(CL)s 87.2
	97.8										SC 85.4
5										▼	
		14.0	30.4	55.6	0.0	NP	NP	21.3	SM 82.3		SM 81.2
	70.0										NR 79.7
10											(CL)s 77.4
	96.0	23.8	32.5	43.7	0.0	25.5	10.3	19.3	s(CL) 76.3		s(CL)
										Qal	74.3

CLASSIFICATION AND PHYSICAL CONDITION

0.0 to 29.6 feet
QUATERNARY ALLUVIUM (Qal)

0.0 to 1.1 ft. CLAYEY SAND, SC:
About 65% fine sand; about 35% fines with medium plasticity, medium toughness; dry to moist, brown; strong reaction with HCL; trace of visible $CaCO_3$ nodules.

1.1 to 2.1 ft. LEAN CLAY WITH SAND, (CL)s:
About 75% fines with medium plasticity, medium toughness; about 25% fine sand; dry to moist, gray; hard; strong reaction with HCL; $CaCO_3$ nodules, small charcoal nodules.

2.1 to 3.9 ft. CLAYEY SAND, SC:
About 60% fine sand; about 40% fines with medium plasticity; moist, brown; weak reaction with HCL.

3.9 to 8.1 ft. SILTY SAND, SM:
About 55% fine sand; about 45% fines with low plasticity; moist to wet, light brown; strong reaction with HCL; where moist keeps shape, where wet becomes loose.

Lab Data Interval
6.0 to 7.0 ft.

8.1 to 9.6 ft. No Recovery

Note: Interval possibly compacted SM above. Material is above compactible in moist section.

9.6 to 11.9 ft. LEAN CLAY WITH SAND, (CL)s:
About 75% fines with medium plasticity, no dilatancy, medium toughness; about 25% fine sand; moist, gray; firm; weak reaction with HCL; small charcoal bits throughout.

11.9 to 15.0 ft. SANDY LEAN CLAY, s(CL):
About 60% fines with medium plasticity, no dilatancy, medium toughness; about 40% fine sand; moist, gray; firm; weak reaction with HCL; minor amount of small charcoal bits throughout.

Lab Data Interval
12.0 to 13.0 ft.

15.0 to 18.3 ft. SANDY SILT, s(ML):
About 55% fines with low plasticity; about 45% fine sand; moist to wet, brown; retains shape of core barrel; no reaction with HCL; oxidation in thin bands (0.01 ft. thick); band of charcoal (0.02 ft. thick) at 16.1 ft.

Lab Data Interval
16.0 to 17.0 ft.

18.3 to 19.6 ft. No Recovery

Note: Interval possibly compacted s(ML) above.

19.6 to 19.8 ft. SILTY SAND, SM:
About 55% fine sand; about 45% fines with low plasticity; moist to wet, brown; retains shape of core barrel; no reaction with HCL.

COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-Plastic
NR = No Recovery
NA = Not Applicable
I.D. = Inner Diameter
O.D. = Outer Diameter

G.S. = Ground Surface
+ = Above Ground Surface
T.O.C. = Top of Well Casing
SJR = San Joaquin River
▼ = Top of Groundwater

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

GEOLOGIC LOG OF DRILL HOLE NO. MW-11-141

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Right, RM 148.8, Merced County
BEGUN: 5/2/11 FINISHED: 5/2/11
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 4.7 ft. (84.6 ft. - 5/16/2011)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,321,075.1 E 6,053,794.7 NAD83
TOTAL DEPTH: 29.6 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 89.26 ft. NADV88
ANGLE FROM HORIZONTAL: -90°
HOLE LOGGED BY: M. Lyttge
REVIEWED BY: T. Lewis

NOTES

HOLE COMPLETION:
Completed as a groundwater monitoring well.

Well Casing: +2.69 to 12.6 ft. (2-inch I.D. blank PVC)
Dual U-pack Screen: 12.6 to 27.6 ft. (2-inch I.D. inner screen; 3-inch I.D. outer screen; slotted 0.010-inch)
U-Pack Screen Filter Pack: (#2/12 Sand)
Filter Pack: 12.0 to 29.6 ft. (#3 Sand)
Sump: 27.6 to 29.6 ft. (2-inch I.D. blank PVC with slip cap)
Concrete Seal: 0.0 to 2.0 ft.
Bentonite Seal: 2.0 to 12.0 ft.
Well Completion: 6-inch by 6-inch by 5-foot long steel surface casing with locking top; 2.0-foot diameter concrete pad.
Lock: #2006 Masterlock

DEPTH	% CORE RECOVERY	LABORATORY DATA: <0.005	<0.075	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	% MOISTURE CONTENT	LABORATORY CLASSIFICATION / El.	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / El.
		13.9	41.9	44.2	0.0	NP	NP	24.5	s(ML) 72.3		s(ML) 71.0
	72.0										NR 69.7
											SM 69.5
20		2.4	11.3	86.3	0.0	NP	NP	26.5	SM 68.3		
	22.0										SP-SM 64.7
25											
	0.0										NR 59.7

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

19.8 to 24.6 ft.POORLY SORTED SAND WITH SAND, SP-SM:
About 90% fine sand; about 10% fines; wet, gray; molds to shape of box; no reaction with HCL.

Lab Data Interval
20.0 to 21.0 ft.

24.6 to 29.6 ft. No Recovery

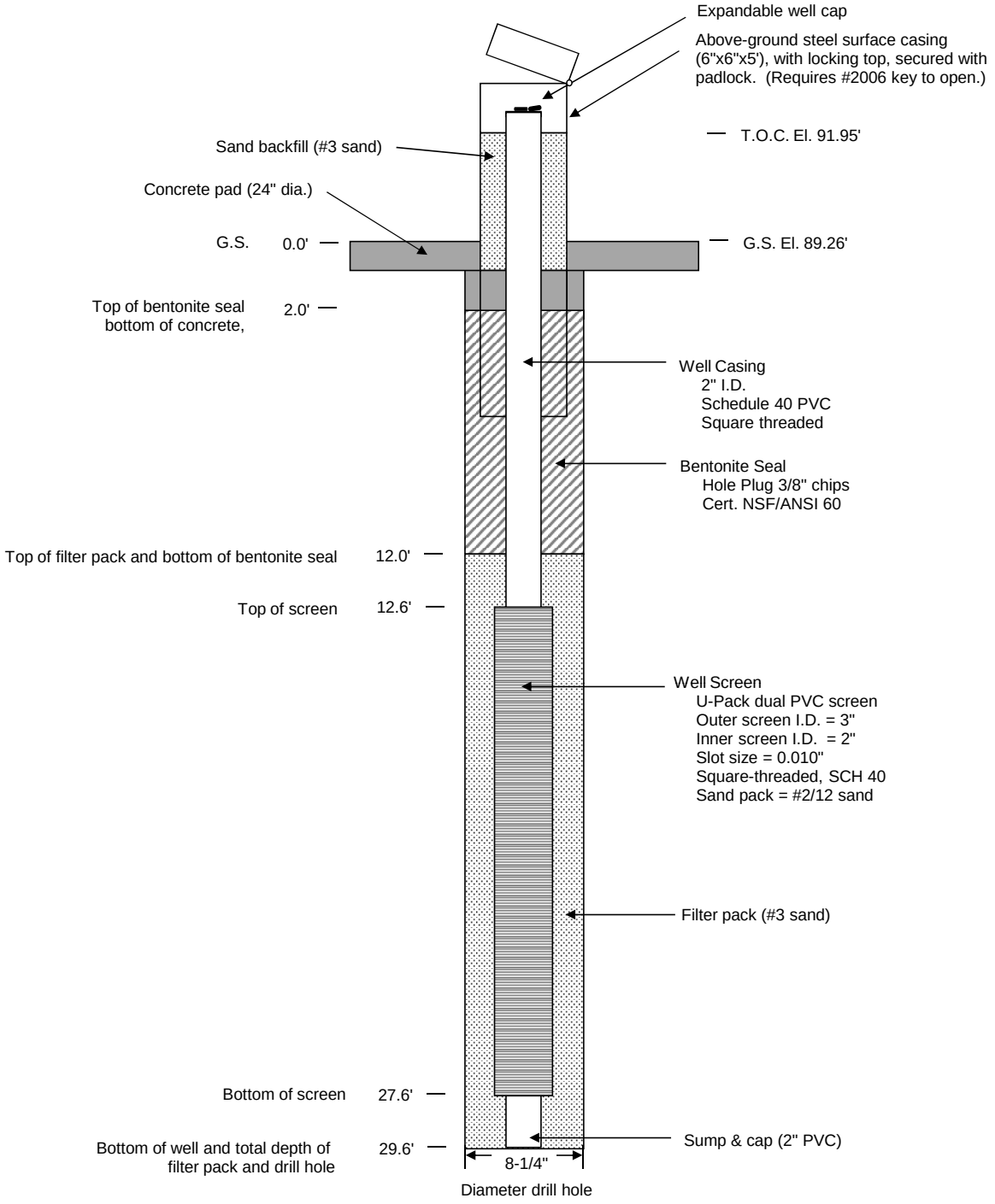
COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-Plastic
NR = No Recovery
NA = Not Applicable
I.D. = Inner Diameter
O.D. = Outer Diameter

G.S. = Ground Surface
+ = Above Ground Surface
T.O.C. = Top of Well Casing
SJR = San Joaquin River
▼ = Top of Groundwater

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

MW-11-141	GEOLOGIST: M. Lyttge
WELL COMPLETION DIAGRAM	DRILLER: C. Peterson
DATE COMPLETED: 5/2/2011	HELPERS: D. Read & C. Kelly
LOCATION: Field North of Sand Slough Road. Reach 4B1, River Bank Right, RM 148.8, Merced County. T.O.C. COORDINATES: N2321075.09 E6053794.68 (NAD93) EL.91.95' (NAVD88) G.S. ELEVATION: 89.26' (NAVD88)	



***NOT TO SCALE**

NOTES:

T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, El. = Elevation
Dia. = Diameter

San Joaquin River Restoration Program
U.S. Department of Interior, Bureau of Reclamation

MONITORING WELL DEVELOPMENT

Facility/Project Name	County Name	Well Name
SJRR P	MERCED	W-12 / MW-11-141

Facility License, Permit or Monitoring Number	County Code	Wis. Unique Well Number	DNR Well ID Number

1. Can this well be purged dry? Yes ☐ No ☒

2. Well development method

surged with bailer and bailed	☐ 41
surged with bailer and pumped	☐ 61
surged with block and bailed	☐ 42
surged with block and pumped	☒ 62
surged with block, bailed and pumped	☐ 70
compressed air	☐ 20
bailed only	☐ 10
pumped only	☐ 51
pumped slowly	☐ 50
Other _____	☐ __

3. Time spent developing well 40 min.

4. Depth of well (from top of well casisng) 39.9 ft.

5. Inside diameter of well 2.00 in.

6. Volume of water in filter pack and well casing ____.__ gal.

7. Volume of water removed from well 55.__ gal.

8. Volume of water added (if any) ____.__ gal.

9. Source of water added _____

10. Analysis performed on water added? ☐ Yes ☐ No (If yes, attach results)

	Before Development	After Development
11. Depth to Water (from top of well casing)	a. 7.7 ft.	8.2 ft.
Date	b. 05/16/2011 (m m d d y y y y)	05/16/2011
Time	c. 11:40 ☒ a.m. ☐ p.m.	12:20 ☐ a.m. ☒ p.m.
12. Sediment in well bottom	____.__ inches	____.__ inches
13. Water clarity	Clear ☐ 10 / Turbid ☒ 15	Clear ☒ 20 / Turbid ☐ 25
(Describe)	Brown Sand	

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids	____.__ mg/l	____.__ mg/l
15. COD	____.__ mg/l	____.__ mg/l

16. Well developed by: Name (first, last) and Firm

First Name: Last Name:

Firm:

17. Additional comments on development:
SURGED WITH BLOCK & BALL CHECK VALVE FOR SEVERAL MINUTES AT 2 FT. INTERVALS UNTIL 5 GALS. PUMPED.
PUMPED WITH SUMP PUMP UNTIL CLEAR. 50 GALS.

Name and Address of Facility Contact/Owner/Responsible Party

First Name: _____ Last Name: _____

Facility/Firm: _____

Street: _____

City/State/Zip: _____

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature: _____

Print Name: _____

Firm: _____

NOTE: See instructions for more information including a list of county codes and well type codes.

GEOLOGIC LOG OF DRILL HOLE NO. MW-11-142

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Right, RM 155.6, Merced County
BEGUN: 5/3/11 FINISHED: 5/3/11
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 4.2 ft. (91.8 ft. - 5/16/2011)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,319,228.4 E 6,071,446.9 NAD83
TOTAL DEPTH: 29.7 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 96.00 ft. NADV88
ANGLE FROM HORIZONTAL: -90°
HOLE LOGGED BY: M. Lyttge
REVIEWED BY: T. Lewis

NOTES

ALL MEASUREMENTS ARE IN FEET FROM THE GROUND SURFACE.

PURPOSE OF HOLE:
To recover a continuous soil core, collect data to determine geologic and hydrologic site conditions, and install a groundwater monitoring well.

LOCATION:
Reach 4B1, River Bank Right, RM 155.6, Merced County. North of Sand Slough Road.

DRILLED BY:
Bureau of Reclamation: PN Region drill crew:
Chris Peterson, driller
Dennis Read, helper
Cody Kelley, helper

DRILL RIG:
Truck mounted Central Mining Equipment (CME) DC512

DRILLING & SAMPLING METHODS:
The drill hole was advanced and sample using a Flight Auger Dry Core system (FADC). The drill hole was advanced using 8-1/4 inch o.d. by 4-1/4 inch i.d. hollow stem flight augers equipped with an 8-1/2 inch o.d. bullet and spade drill bit. Continuous sampling was performed by advancing a 4 inch o.d. by 3-3/8 inch i.d. by 5-foot long split barrel dry core sample system (sampler). Unless indicated otherwise, the sampler was placed inside the augers and the cutting shoe of the sampler extended 0.2 foot beyond the auger drill bit. A free-spinning adapter was placed at the top of the sampler to avoid rotation while advancing the augers.

Interval Method
0.0 to 29.7 ft. FADC

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
20.7 to 24.7 ft. - Add catcher.
24.7 to 29.7 ft. - Add catcher and nylon.

DRILLING FLUID, RETURN AND COLOR:
0.0 to 29.7 ft. - Drilled without fluid

WATER LEVEL:
4.2 ft. - 5/16/2011

REASON FOR HOLE TERMINATION:
The hole was terminated upon reaching the target depth.

DEPTH	% CORE RECOVERY	LABORATORY DATA: <0.005	<0.075	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	% MOISTURE CONTENT	LABORATORY CLASSIFICATION / El.	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / El.
											s(CL) 93.9
	97.9										CH 92.6
											(CL)s 91.6
5		30.3	38.6	26.8	4.3				s(CL) 90.0		s(CL) 88.2
	100.0										SM 86.3
10		53.3	34.8	11.9	0.0				CL 85.0		CL 82.9
	98.0									Qal	s(CL) 81.0

CLASSIFICATION AND PHYSICAL CONDITION

0.0 to 29.7 feet
QUATERNARY ALLUVIUM (Qal)

0.0 to 2.1 ft. SANDY LEAN CLAY, s(CL):
About 70% fines with medium plasticity, medium toughness; about 30% fine sand, trace medium sand; dry from 0.0 to 1.0 ft. and moist from 1.0 to 2.1 ft., dark gray; firm; $CaCO_3$ nodules; strongly cemented; strong reaction with HCL.

2.1 to 3.4 ft. FAT CLAY, CH:
About 95% fines with high plasticity, high toughness; about 5% fine sand; moist, dark gray; firm; strong reaction with HCL.

3.4 to 4.4 ft. LEAN CLAY WITH SAND, (CL)s:
About 80% fines with medium plasticity, medium toughness; about 20% fine sand; moist; hard; $CaCO_3$ nodules; strong reaction with HCL.

4.4 to 7.8 ft. SANDY LEAN CLAY, s(CL):
About 65% fines with medium plasticity, medium toughness; about 35% fine sand; moist, brown; firm; weak reaction with HCL; $CaCO_3$ nodules.

Lab Data Interval
5.0 to 6.0 ft.

7.8 to 9.7 ft. SILTY SAND, SM:
About 55% fine sand; about 45% fines with low plasticity; moist, brown; soft; weak reaction with HCL.

9.7 to 13.1 ft. LEAN CLAY, CL:
About 90% fines with medium plasticity, medium toughness; about 10% fine sand with trace medium and coarse sand; light gray; very soft/soupy; no reaction with HCL; water added.

Lab Data Interval
10.0 to 11.0 ft.

13.1 to 15.0 ft. SANDY LEAN CLAY, s(CL):
About 75% fines with medium plasticity, medium toughness; about 25% fine sand; gray; soft to firm; no reaction with HCL; trace charcoal bits.

15.0 to 19.7 ft. LEAN CLAY WITH SAND, (CL)s:
About 80% fines with low plasticity; about 20% fine sand; moist, brown; firm, holds shape of sampler; minor areas of oxidation; no reaction with HCL.

Lab Data Interval
17.0 to 18.0 ft.

19.7 to 24.7 ft. SILT WITH SAND, (ML)s:
About 70% fines with low plasticity; about 30% fine sand; wet, brown; soft, somewhat molded to core box; no reaction with HCL.

Lab Data Interval
19.7 to 24.7 ft.

COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-Plastic
NR = No Recovery
NA = Not Applicable
I.D. = Inner Diameter
O.D. = Outer Diameter

G.S. = Ground Surface
+ = Above Ground Surface
T.O.C. = Top of Well Casing
SJR = San Joaquin River
▼ = Top of Groundwater

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

GEOLOGIC LOG OF DRILL HOLE NO. MW-11-142

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Right, RM 155.6, Merced County
BEGUN: 5/3/11 FINISHED: 5/3/11
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 4.2 ft. (91.8 ft. - 5/16/2011)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,319,228.4 E 6,071,446.9 NAD83
TOTAL DEPTH: 29.7 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 96.00 ft. NADV88
ANGLE FROM HORIZONTAL: -90°
HOLE LOGGED BY: M. Lyttge
REVIEWED BY: T. Lewis

NOTES

HOLE COMPLETION:
Completed as a groundwater monitoring well.

Well Casing: +1.15 to 17.7 ft. (2-inch I.D. blank PVC)
Dual U-pack Screen: 17.7 to 27.7 ft. (2-inch I.D. inner screen; 3-inch I.D. outer screen; slotted 0.010-inch)
U-Pack Screen Filter Pack: (#2/12 Sand)
Filter Pack: 12.0 to 29.7 ft. (#3 Sand)
Sump: 27.7 to 29.7 ft. (2-inch I.D. blank PVC with slip cap)
Concrete Seal: 0.0 to 2.0 ft.
Bentonite Seal: 2.0 to 12.0 ft.
Well Completion: 6-inch by 6-inch by 5-foot long steel surface casing with locking top; 2.0-foot diameter concrete pad.
Lock: #2006 Masterlock

DEPTH	% CORE RECOVERY	LABORATORY DATA <0.005	<0.075	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	% MOISTURE CONTENT	LABORATORY CLASSIFICATION / El.	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / El.
	100.0	21.2	57.6	21.2	0.0				(CL)s		(CL)s
									78.0		76.3
20	14.0	14.0	57.2	28.8	0.0				(ML)s		(ML)s
									71.3		71.3
25	2.0										SP
											66.3

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

24.7 to 29.7 ft. No Recovery

Note: Trace recovery, 0.1 ft. Poorly Sorted Sand, SP: About 100% fine sand with some medium and coarse sand; wet, gray.

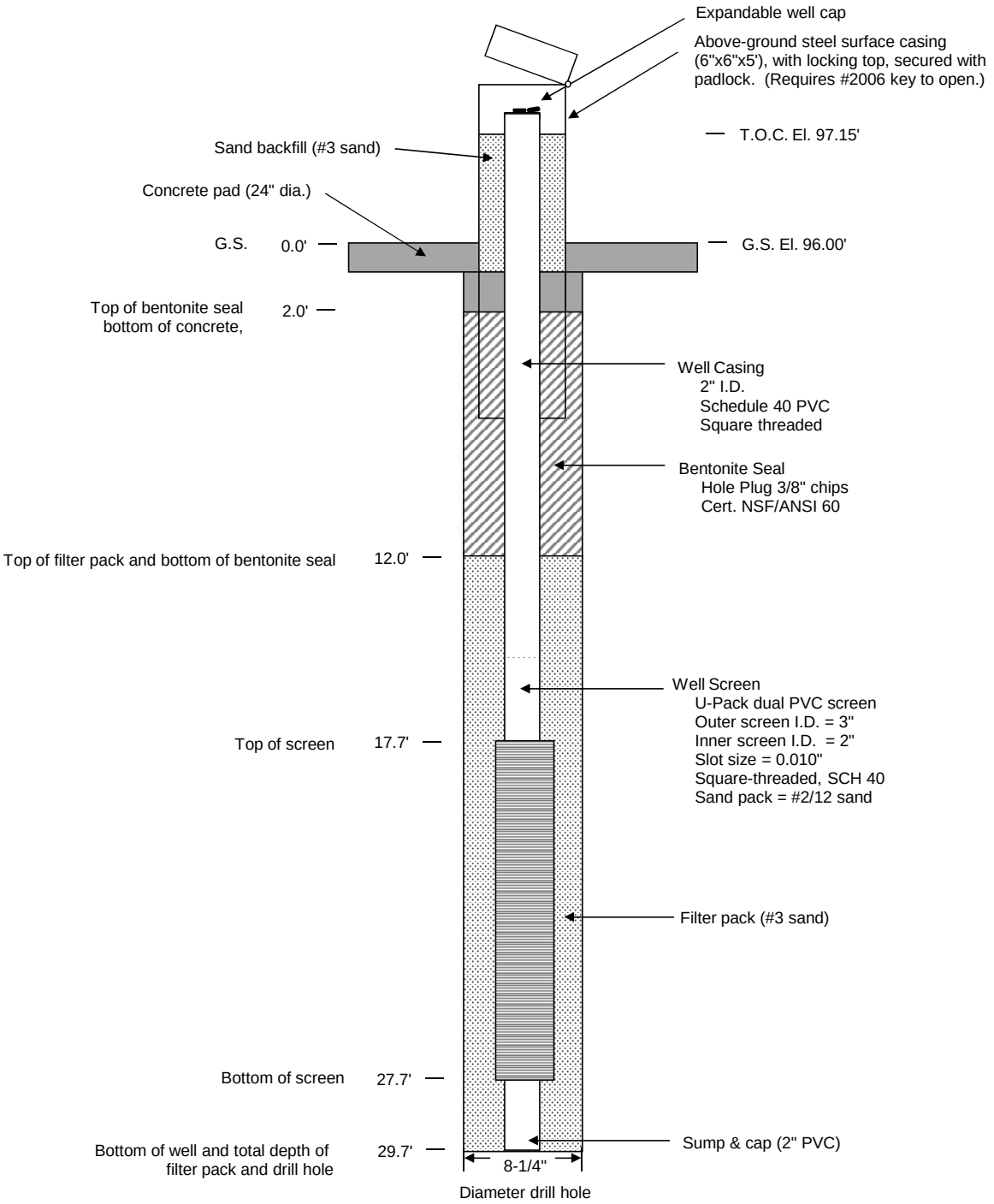
COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-Plastic
NR = No Recovery
NA = Not Applicable
I.D. = Inner Diameter
O.D. = Outer Diameter

G.S. = Ground Surface
+ = Above Ground Surface
T.O.C. = Top of Well Casing
SJR = San Joaquin River
▼ = Top of Groundwater

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

MW-11-142	GEOLOGIST: M. Lyttge
WELL COMPLETION DIAGRAM	DRILLER: C. Peterson
DATE COMPLETED: 5/3/2011	HELPERS: D. Read & C. Kelly
LOCATION: At the intersection of Sandy Mush Road and Nickel Road. Reach 4B1, River Bank Right, RM 155.6, Merced County. T.O.C. COORDINATES: N2319228.43 E6071446.90 (NAD93) EL. 97.15' (NAVD88) G.S. ELEVATION: 96.00' (NAVD88)	



***NOT TO SCALE**

NOTES:

T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, El. = Elevation
Dia. = Diameter

San Joaquin River Restoration Program
U.S. Department of Interior, Bureau of Reclamation

MONITORING WELL DEVELOPMENT

Facility/Project Name	County Name	Well Name
SJRRP	MERCED	MW-11-142

Facility License, Permit or Monitoring Number	County Code	Wis. Unique Well Number	DNR Well ID Number

1. Can this well be purged dry? Yes ☐ No ☒

2. Well development method

surged with bailer and bailed	☐	41
surged with bailer and pumped	☐	61
surged with block and bailed	☐	42
surged with block and pumped	☒	62
surged with block, bailed and pumped	☐	70
compressed air	☐	20
bailed only	☐	10
pumped only	☐	51
pumped slowly	☐	50
Other _____	☐	

3. Time spent developing well: 40 min.

4. Depth of well (from top of well casisng): 32.3 ft.

5. Inside diameter of well: 2.00 in.

6. Volume of water in filter pack and well casing: ___.__ gal.

7. Volume of water removed from well: 55.__ gal.

8. Volume of water added (if any): ___.__ gal.

9. Source of water added: _____

10. Analysis performed on water added? ☐ Yes ☐ No (If yes, attach results)

	Before Development	After Development
11. Depth to Water (from top of well casing)	a. 8.4 ft.	7.2 ft.
Date	b. 05/16/2011 (m m d d y y y y)	05/16/2011 (m m d d y y y y)
Time	c. 8:20 ☒ a.m. ☐ p.m.	9:00 ☒ a.m. ☐ p.m.
12. Sediment in well bottom	___.__ inches	___.__ inches
13. Water clarity	Clear ☐ 10 Turbid ☒ 15	Clear ☐ 20 Turbid ☐ 25
	(Describe) Brown Sand	(Describe)
14. Total suspended solids	____.__ mg/l	____.__ mg/l
15. COD	____.__ mg/l	____.__ mg/l

Fill in if drilling fluids were used and well is at solid waste facility:

16. Well developed by: Name (first, last) and Firm
First Name: Last Name:
Firm:

17. Additional comments on development:
SURGED WITH BLOCK & CHECK VALVE FOR SEVERAL MINUTES AT 2 FT. INTO UNTIL 5 GALS. PUMPED.
PUMP WITH SUMP PUMP UNTIL CLEAR. 50 GALS

Name and Address of Facility Contact /Owner/Responsible Party
First Name: _____ Last Name: _____
Facility/Firm: _____
Street: _____
City/State/Zip: _____

I hereby certify that the above information is true and correct to the best of my knowledge.
Signature: _____
Print Name: _____
Firm: _____

NOTE: See instructions for more information including a list of county codes and well type codes.

GEOLOGIC LOG OF DRILL HOLE NO. MW-11-143

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Right, RM 155.6, Merced County
BEGUN: 5/4/11 FINISHED: 5/4/11
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 1.9 ft. (91.2 ft. - 5/16/2011)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,316,951.0 E 6,071,041.9 NAD83
TOTAL DEPTH: 29.6 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 93.08 ft. NADV88
ANGLE FROM HORIZONTAL: -90°
HOLE LOGGED BY: M. Lyttge
REVIEWED BY: T. Lewis

NOTES

ALL MEASUREMENTS ARE IN FEET FROM THE GROUND SURFACE.

PURPOSE OF HOLE:
To recover a continuous soil core, collect data to determine geologic and hydrologic site conditions, and install a groundwater monitoring well.

LOCATION:
Reach 4B1, River Bank Right, RM 155.6, Merced County. West of Nickle Road, at the East Side Irrigation Canal.

DRILLED BY:
Bureau of Reclamation: PN Region drill crew:
Chris Peterson, driller
Dennis Read, helper
Cody Kelley, helper

DRILL RIG:
Truck mounted Central Mining Equipment (CME) DC512

DRILLING & SAMPLING METHODS:
The drill hole was advanced and sample using a Flight Auger Dry Core system (FADC). The drill hole was advanced using 8-1/4 inch o.d. by 4-1/4 inch i.d. hollow stem flight augers equipped with an 8-1/2 inch o.d. bullet and spade drill bit. Continuous sampling was performed by advancing a 4 inch o.d. by 3-3/8 inch i.d. by 5-foot long split barrel dry core sample system (sampler). Unless indicated otherwise, the sampler was placed inside the augers and the cutting shoe of the sampler extended 0.2 foot beyond the auger drill bit. A free-spinning adapter was placed at the top of the sampler to avoid rotation while advancing the augers.

Interval Method
0.0 to 29.6 ft. FADC

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
19.6 to 24.6 ft. - Catcher with nylon.
24.6 to 29.6 ft. - Catcher with nylon.

DRILLNG FLUID, RETURN AND COLOR:
0.0 to 29.6 ft. - Drilled without fluid

WATER LEVEL:
1.9 ft. - 5/16/2011

REASON FOR HOLE TERMINATION:
The hole was terminated upon reaching the target depth.

DEPTH	% CORE RECOVERY	LAB DATA: <0.005	<0.075	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	% MOISTURE CONTENT	LABORATORY CLASSIFICATION / El.	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / El.
											(CL)s 92.7
											(CH)s
	91.3										90.8
5		39.9	39.7	20.4	0.0	40.0	23.8	35.4	(CL)s 87.1		(CL)s
	82.0										85.1
											CL
10											83.3
											SM
	100.0	11.0	22.1	66.9	0.0	NP	NP	24.4	SM 80.1		81.4
											SM
										Qal	79.5

CLASSIFICATION AND PHYSICAL CONDITION

0.0 to 29.6 feet
QUATERNARY ALLUVIUM (Qal)

0.0 to 0.4 ft. LEAN CLAY WITH SAND, (CL)s:
Disturbed surficial material.

0.4 to 2.3 ft. FAT CLAY WITH SAND, (CH)s:
About 85% fines with high plasticity, high toughness; about 15% fine sand; moist, dark gray to brown; firm; weak reaction with HCL, strong reaction with HCL where $CaCO_3$ is visible; $CaCO_3$ present in fine gravel, strongly cemented nodules from 1.1 to 2.3 ft.

2.3 to 8.0 ft. LEAN CLAY WITH SAND, (CL)s:
About 80% fines with high plasticity, high toughness; about 15% fine sand; moist; soft and firm; weak reaction with HCL.

Lab Data Interval
5.0 to 6.0 ft.

8.0 to 9.8 ft. LEAN CLAY, CL:
About 90% fines with medium plasticity, medium toughness; about 10% fine sand; moist, gray to blue with tan mottling; hard; no reaction with HCL.

9.8 to 11.7 ft. SILTY SAND, SM:
About 55% fine sand; about 45% fines with low plasticity; moist, light brown; firm; no reaction with HCL.

11.7 to 13.6 ft. SILTY SAND, SM:
About 65% fine sand; about 35% fines with low plasticity; wet, light brown; soft; no reaction with HCL.

Lab Data Interval
12.0 to 13.0 ft.

13.6 to 17.3 ft. LEAN CLAY, CL:
About 95% fines with low plasticity, low toughness; about 5% fine sand; moist; firm; no reaction with HCL; oxidation in coarse sand-sized cemented nodules.

Lab Data Interval
15.0 to 16.0 ft.

17.3 to 19.6 ft. SILT WITH SAND, (ML)s:
About 85% fines with low plasticity; about 15% fine sand; moist, light brown to gray; firm; no reaction with HCL; minor oxidation.

Lab Data Interval
18.0 to 19.0 ft.

19.6 to 20.2 ft. SILT WITH SAND, (ML)s:
About 80% fines with low plasticity; about 20% fine sand; moist, light brown; no reaction with HCL; minor oxidation concretions.

Lab Data Interval
19.6 to 20.1 ft.

COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-Plastic
NR = No Recovery
NA = Not Applicable
I.D. = Inner Diameter
O.D. = Outer Diameter

G.S. = Ground Surface
+ = Above Ground Surface
T.O.C. = Top of Well Casing
SJR = San Joaquin River
▼ = Top of Groundwater

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

GEOLOGIC LOG OF DRILL HOLE NO. MW-11-143

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Right, RM 155.6, Merced County
BEGUN: 5/4/11 FINISHED: 5/4/11
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 1.9 ft. (91.2 ft. - 5/16/2011)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,316,951.0 E 6,071,041.9 NAD83
TOTAL DEPTH: 29.6 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 93.08 ft. NADV88
ANGLE FROM HORIZONTAL: -90°
HOLE LOGGED BY: M. Lyttge
REVIEWED BY: T. Lewis

NOTES

HOLE COMPLETION:
Completed as a groundwater monitoring well.

Well Casing: +2.87 to 17.6 ft. (2-inch I.D. blank PVC)
Dual U-pack Screen: 17.6 to 27.6 ft. (2-inch I.D. inner screen; 3-inch I.D. outer screen; slotted 0.010-inch)
U-Pack Screen Filter Pack: (#2/12 Sand)
Filter Pack: 11.0 to 29.6 ft. (#3 Sand)
Sump: 27.6 to 29.6 ft. (2-inch I.D. blank PVC with slip cap)
Concrete Seal: 0.0 to 2.0 ft.
Bentonite Seal: 2.0 to 11.0 ft.
Well Completion: 6-inch by 6-inch by 5-foot long steel surface casing with locking top; 2.0-foot diameter concrete pad.
Lock: #2006 Masterlock

DEPTH	% CORE RECOVERY	LABORATORY DATA: <0.005	<0.075	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	% MOISTURE CONTENT	LABORATORY CLASSIFICATION	El.	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION	El.
		35.7	61.9	2.4	0.0	37.2	17.0	30.5	CL	77.1		CL	
	100.0												75.8
		18.9	64.0	17.1	0.0	26.1	4.1	25.9	(ML)s	74.1		(ML)s	
													73.5
20		13.0	66.1	20.9	0.0	NP	NP	27.4	(ML)s	73.0		(ML)s	72.9
	24.0											SW-SM	
													68.8
												SM	68.5
25													
	0.0											NR	
													63.5

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

20.2 to 24.3 ft. WELL SORTED SAND WITH SILT, SW-SM:
About 90% fine sand; about 10% fines with low plasticity; moist, light brown; soft; no reaction with HCL.

24.3 to 24.6 ft. SILTY SAND, SM:
About 70% fine sand; about 30% fines with low plasticity; moist, light brown; no reaction with HCL; minor oxidation concretions.

24.6 to 29.6 ft. No Recovery

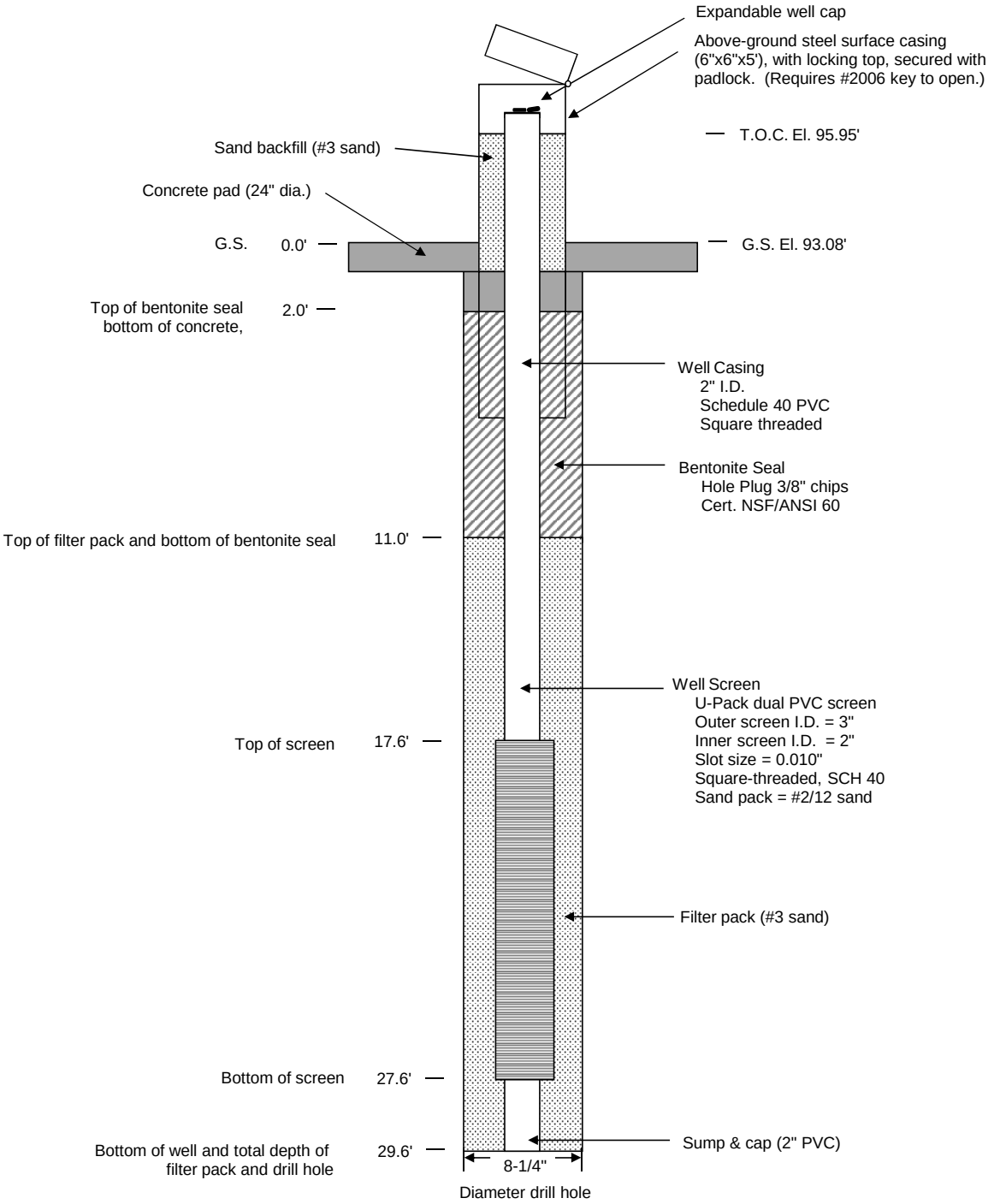
COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-Plastic
NR = No Recovery
NA = Not Applicable
I.D. = Inner Diameter
O.D. = Outer Diameter

G.S. = Ground Surface
+ = Above Ground Surface
T.O.C. = Top of Well Casing
SJR = San Joaquin River
▼ = Top of Groundwater

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

MW-11-143	GEOLOGIST: M. Lyttge
WELL COMPLETION DIAGRAM	DRILLER: C. Peterson
DATE COMPLETED: 5/4/2011	HELPERS: D. Read & C. Kelly
LOCATION: West of Nickle Road, at East Side Irrigation Canal. Reach 4B1, River Bank Right, RM 155.6, Merced County. T.O.C. COORDINATES: N2316951.03 E6071041.86 (NAD93) EL. 95.95' (NAVD88) G.S. ELEVATION: 93.08' (NAVD88)	



***NOT TO SCALE**

NOTES:

T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, El. = Elevation
Dia. = Diameter

San Joaquin River Restoration Program
U.S. Department of Interior, Bureau of Reclamation

MONITORING WELL DEVELOPMENT

Facility/Project Name	County Name	Well Name
SJRRP	MERCED	W-17 / MW-11-143

Facility License, Permit or Monitoring Number	County Code	Wis. Unique Well Number	DNR Well ID Number

1. Can this well be purged dry? Yes ☐ No ☒

2. Well development method

surged with bailer and bailed	☐	41
surged with bailer and pumped	☐	61
surged with block and bailed	☐	42
surged with block and pumped	☒	62
surged with block, bailed and pumped	☐	70
compressed air	☐	20
bailed only	☐	10
pumped only	☐	51
pumped slowly	☐	50
Other _____	☐	

3. Time spent developing well: 40 min.

4. Depth of well (from top of well casisng): 32.2 ft.

5. Inside diameter of well: 2.00 in.

6. Volume of water in filter pack and well casing: ___.__ gal.

7. Volume of water removed from well: 55.__ gal.

8. Volume of water added (if any): ___.__ gal.

9. Source of water added: _____

10. Analysis performed on water added? ☐ Yes ☐ No (If yes, attach results)

	Before Development	After Development
11. Depth to Water (from top of well casing)	a. 49.9 ft.	54.__ ft.
Date	b. 05/16/2011 (m m d d y y y y)	05/16/2011 (m m d d y y y y)
Time	c. 9:05 ☒ a.m. ☐ p.m.	9:45 ☒ a.m. ☐ p.m.
12. Sediment in well bottom	___.__ inches	___.__ inches
13. Water clarity	Clear ☐ 10 Turbid ☒ 15 (Describe) Brown Sand	Clear ☐ 20 Turbid ☐ 25 (Describe)
14. Total suspended solids	____.__ mg/l	____.__ mg/l
15. COD	____.__ mg/l	____.__ mg/l

Fill in if drilling fluids were used and well is at solid waste facility:

16. Well developed by: Name (first, last) and Firm
First Name: Last Name:
Firm:

17. Additional comments on development:
SURGED WITH BLOCK & CHECK VALVE FOR SEVERAL MINUTES AT 2 FT. INTERVALS UNTIL 5 GALS. PUMPED.
PUMPED WITH SUMP PUMP UNTIL CLEAR, 50 GALS.

Name and Address of Facility Contact /Owner/Responsible Party
First Name: _____ Last Name: _____
Facility/Firm: _____
Street: _____
City/State/Zip: _____

I hereby certify that the above information is true and correct to the best of my knowledge.
Signature: _____
Print Name: _____
Firm: _____

NOTE: See instructions for more information including a list of county codes and well type codes.

GEOLOGIC LOG OF DRILL HOLE NO. MW-11-144

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Right, RM 148.5, Merced County
BEGUN: 5/11/11 FINISHED: 5/11/11
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 3.9 ft. (85.2 ft. - 5/12/2011)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,324,756.2 E 6,057,112.5 NAD83
TOTAL DEPTH: 29.5 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 89.12 ft. NADV88
ANGLE FROM HORIZONTAL: -90°
HOLE LOGGED BY: A. Warren
REVIEWED BY: T. Lewis

NOTES

ALL MEASUREMENTS ARE IN FEET FROM THE GROUND SURFACE.

PURPOSE OF HOLE:
To recover a continuous soil core, collect data to determine geologic and hydrologic site conditions, and install a groundwater monitoring well.

LOCATION:
Reach 4B1, River Bank Right, RM 148.5, Merced County. Adjacent to Mariposa Bypass.

DRILLED BY:
Bureau of Reclamation: PN Region drill crew:
Chris Peterson, driller
Dennis Read, helper
Cody Kelley, helper

DRILL RIG:
Truck mounted Central Mining Equipment (CME) DC512

DRILLING & SAMPLING METHODS:
The drill hole was advanced and sample using a Flight Auger Dry Core system (FADC). The drill hole was advanced using 8-1/4 inch o.d. by 4-1/4 inch i.d. hollow stem flight augers equipped with an 8-1/2 inch o.d. bullet and spade drill bit. Continuous sampling was performed by advancing a 4 inch o.d. by 3-3/8 inch i.d. by 5-foot long split barrel dry core sample system (sampler). Unless indicated otherwise, the sampler was placed inside the augers and the cutting shoe of the sampler extended 0.2 foot beyond the auger drill bit. A free-spinning adapter was placed at the top of the sampler to avoid rotation while advancing the augers.

Interval Method
0.0 to 29.5 ft. FADC

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
4.5 to 9.5 ft. - Wet.
14.5 to 19.5 ft. - Catcher with nylon.
19.5 to 24.5 ft. - Catcher with nylon.
24.5 to 29.5 ft. - Catcher with nylon.

DRILLING FLUID, RETURN AND COLOR:
0.0 to 29.5 ft. - Drilled without fluid

WATER LEVEL:
3.9 ft. - 5/12/2011

REASON FOR HOLE TERMINATION:
The hole was terminated upon reaching the target depth.

DEPTH	% CORE RECOVERY	LABORATORY DATA: <0.005	<0.075	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	% MOISTURE CONTENT	LABORATORY CLASSIFICATION / El.	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / El.
											s(CL) 87.1
	68.9	32.6	28.4	38.4	0.6	32.6	20.2	16.7	s(CL) 87.1		(CL)s 84.4
5		32.5	29.3	38.2	0.0	29.9	16.5	24.1	s(CL) 83.1		s(CL) 82.2
	90.0	42.1	47.8	10.1	0.0	45.5	31.5	30.2	CL 80.1		CL 79.6
10											SC 78.6
	48.0									Qal	

0.0 to 29.5 feet
QUATERNARY ALLUVIUM (Qal)

0.0 to 2.0 ft. SANDY LEAN CLAY, s(CL):
About 55% fines with medium plasticity, no dilatancy, medium toughness; about 45% fine sand; trace fine, angular gravel in top inches; dry to moist, brown; layered; roots and organics; slight reaction with HCL.

Note: 1.1 to 2.0 ft.: Moist; moderately soft, crumbled by drilling action.

Lab Data Interval
1.0 to 2.0 ft.

2.0 to 4.7 ft. LEAN CLAY WITH SAND, (CL)s:
About 85% fines with low to medium plasticity, medium toughness; about 15% fine sand; moist, dark brown; moderately firm; layered; slight reaction with HCL.

4.7 to 6.9 ft. SANDY LEAN CLAY, s(CL):
About 60% fines with low plasticity; about 40% fine sand; moist to wet, light brown; soft; strong reaction with HCL; white streaks and layers of $CaCO_3$.

Note: Dark brown clay smeared down sides of sampler from drilling action.

Lab Data Interval
5.0 to 6.0 ft.

6.9 to 9.5 ft. LEAN CLAY, CL:
About 90% fines with medium plasticity, medium toughness; about 10% fine sand; moist, dark brown; very firm; no reaction with HCL.

Note: 8.4 to 8.5 ft.: Lens of Sandy Clay, SC: 55% fine sand; 45% fines; dark gray.

Lab Data Interval
8.0 to 9.0 ft.

9.5 to 10.5 ft. CLAYEY SAND, SC:
About 60% fine sand; about 40% fines with low to medium plasticity; wet, dark gray; soft to medium soft; interbedded in about 0.5 to 0.1 ft. layers; no reaction with HCL.

10.5 to 19.5 ft. POORLY GRADED SAND, SP:
About 95% fine and medium sand with abundant mica; about 5% fines; wet, dark gray to gray; no reaction with HCL.

Lab Data Interval
14.5 to 15.5 ft.

19.5 to 29.5 ft. No Recovery

Note: Recovered trace amounts of Poorly Sorted Sand, SP, material similar to 10.5 to 19.5 interval.

COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-Plastic
NR = No Recovery
NA = Not Applicable
I.D. = Inner Diameter
O.D. = Outer Diameter

G.S. = Ground Surface
+ = Above Ground Surface
T.O.C. = Top of Well Casing
SJR = San Joaquin River
▼ = Top of Groundwater

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

GEOLOGIC LOG OF DRILL HOLE NO. MW-11-144

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Right, RM 148.5, Merced County
BEGUN: 5/11/11 FINISHED: 5/11/11
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 3.9 ft. (85.2 ft. - 5/12/2011)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,324,756.2 E 6,057,112.5 NAD83
TOTAL DEPTH: 29.5 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 89.12 ft. NADV88
ANGLE FROM HORIZONTAL: -90°
HOLE LOGGED BY: A. Warren
REVIEWED BY: T. Lewis

NOTES

HOLE COMPLETION:
Completed as a groundwater monitoring well.

Well Casing: +2.79 to 13.5 ft. (2-inch I.D. blank PVC)
Dual U-pack Screen: 13.5 to 28.5 ft. (2-inch I.D. inner screen; 3-inch I.D. outer screen; slotted 0.010-inch)
U-Pack Screen Filter Pack: (#2/12 Sand)
Filter Pack: 10.0 to 29.5 ft. (#3 Sand)
Sump: 28.5 to 29.5 ft. (2-inch I.D. blank PVC with slip cap)
Concrete Seal: 0.0 to 2.0 ft.
Bentonite Seal: 2.0 to 10.0 ft.
Well Completion: 6-inch by 6-inch by 5-foot long steel surface casing with locking top; 2.0-foot diameter concrete pad.
Lock: #2006 Masterlock

DEPTH	% CORE RECOVERY	LABORATORY DATA: <0.005	<0.075	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	% MOISTURE CONTENT	LABORATORY CLASSIFICATION / El.	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / El.
		1.5	4.5	94.0	0.0	NP	NP	32.8	SP-SM		SP
									73.6		
	32.0										
20											
	0.0										
25											
	0.0										
											59.6

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

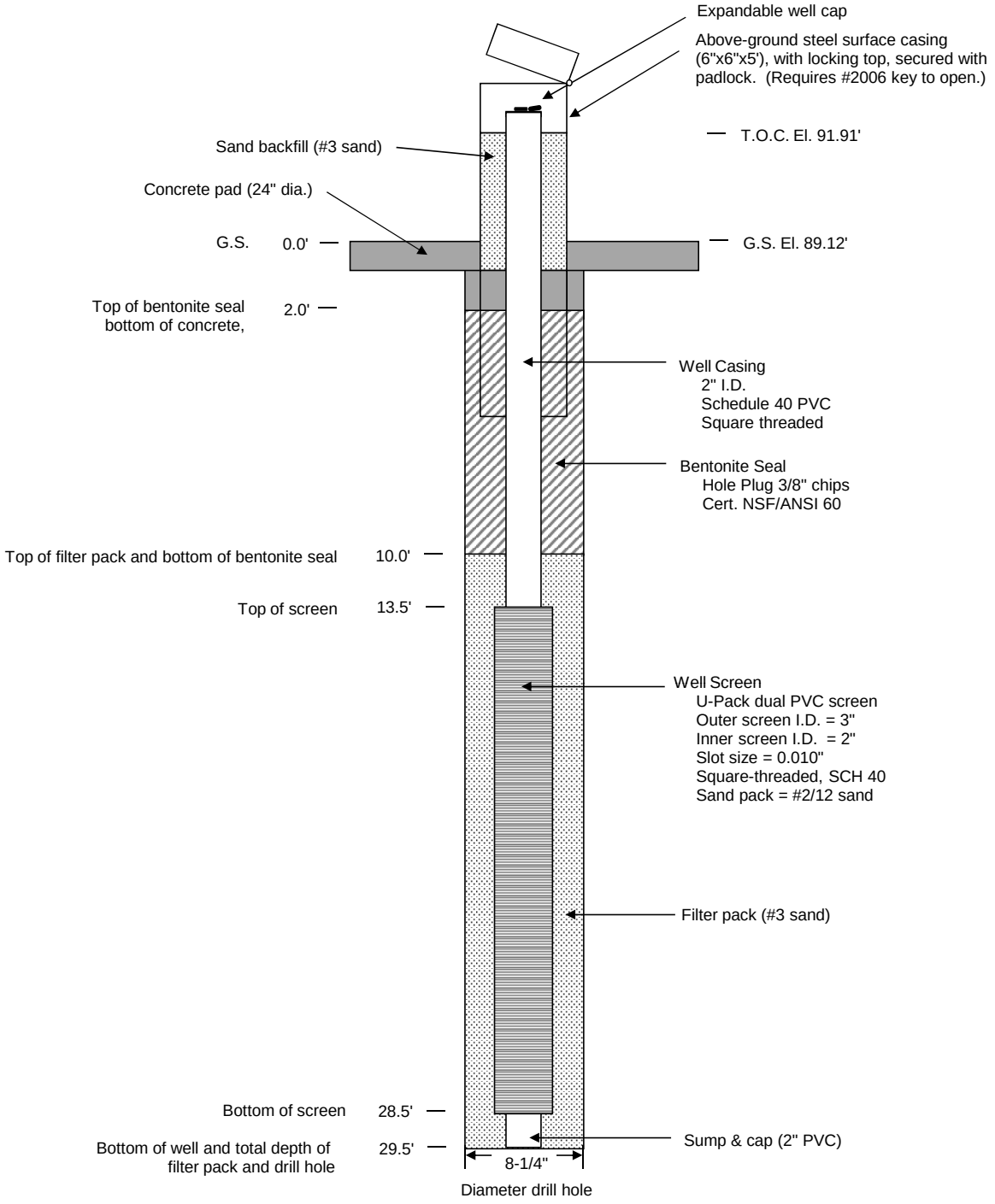
COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-Plastic
NR = No Recovery
NA = Not Applicable
I.D. = Inner Diameter
O.D. = Outer Diameter

G.S. = Ground Surface
+ = Above Ground Surface
T.O.C. = Top of Well Casing
SJR = San Joaquin River
▼ = Top of Groundwater

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

MW-11-144	GEOLOGIST: A. Warren
WELL COMPLETION DIAGRAM	DRILLER: C. Peterson
DATE COMPLETED: 5/11/2011	HELPERS: D. Read & C. Kelly
LOCATION: Adjacent to Mariposa Bypass. Reach 4B1, River Bank Right, RM 148.5, Merced County. T.O.C. COORDINATES: N2324756.23 E6057112.53 (NAD93) EL. 91.91' (NAVD88) G.S. ELEVATION: 89.12' (NAVD88)	



***NOT TO SCALE**

NOTES:

T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, El. = Elevation
Dia. = Diameter

San Joaquin River Restoration Program
U.S. Department of Interior, Bureau of Reclamation

MONITORING WELL DEVELOPMENT

Facility/Project Name	County Name	Well Name
SJRRP	Merced	MW-11-144 / W-9

Facility License, Permit or Monitoring Number	County Code	Wis. Unique Well Number	DNR Well ID Number

1. Can this well be purged dry? Yes ☐ No ☒

2. Well development method

surged with bailer and bailed	☐ 41
surged with bailer and pumped	☐ 61
surged with block and bailed	☐ 42
surged with block and pumped	☒ 62
surged with block, bailed and pumped	☐ 70
compressed air	☐ 20
bailed only	☐ 10
pumped only	☐ 51
pumped slowly	☐ 50
Other _____	☐ __

3. Time spent developing well: 45 min.

4. Depth of well (from top of well casisng): 27.0 ft.

5. Inside diameter of well: 2 in.

6. Volume of water in filter pack and well casing: ___.__ gal.

7. Volume of water removed from well: 42.5 gal.

8. Volume of water added (if any): ___.__ gal.

9. Source of water added: _____

10. Analysis performed on water added? ☐ Yes ☐ No (If yes, attach results)

	Before Development	After Development
11. Depth to Water (from top of well casing) a.	3.90 ft.	3.90 ft.
Date b. (m m d d y y y y)	5/12/2011	5/12/2011
Time c.	3:30 ☐ a.m. ☒ p.m.	4:15 ☐ a.m. ☒ p.m.
12. Sediment in well bottom	trace inches	trace inches
13. Water clarity	Clear ☐ 10 Turbid ☒ 15	Clear ☐ 20 Turbid ☒ 25
(Describe)	brown, opaque, fine (sugar sized) sand is present in water stream	Cloudy, pearlescent w/ micas; lt. gray.
Fill in if drilling fluids were used and well is at solid waste facility:		
14. Total suspended solids	___.__ mg/l	___.__ mg/l
15. COD	___.__ mg/l	___.__ mg/l

16. Well developed by: Name (first, last) and Firm
First Name: Last Name:
Firm:

17. Additional comments on development:
Surged for 5 mins w/ tube & ball check valve 2.5 gallons
purged w/ pump ~2 gal/min; starts clearing after 20 gallons; still cloudy & opaque
well depth 27.0 before measuring;

Name and Address of Facility Contact /Owner/Responsible Party
First Name: _____ Last Name: _____
Facility/Firm: _____
Street: _____
City/State/Zip: _____

I hereby certify that the above information is true and correct to the best of my knowledge.
Signature: [signature]
Print Name: Alison Warren
Firm: BOR

NOTE: See instructions for more information including a list of county codes and well type codes.

27.5 13.5-28.5 29.5

GEOLOGIC LOG OF DRILL HOLE NO. MW-11-145

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Left, RM 153, Merced County
BEGUN: 5/12/11 FINISHED: 5/12/11
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 5.7 ft. (83.6 ft. - 5/13/2011)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,306,718.2 E 6,045,189.3 NAD83
TOTAL DEPTH: 29.7 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 89.26 ft. NADV88
ANGLE FROM HORIZONTAL: -90°
HOLE LOGGED BY: A. Warren
REVIEWED BY: T. Lewis

NOTES

ALL MEASUREMENTS ARE IN FEET FROM THE GROUND SURFACE.

PURPOSE OF HOLE:
To recover a continuous soil core, collect data to determine geologic and hydrologic site conditions, and install a groundwater monitoring well.

LOCATION:
Reach 4B1, River Bank Left, RM 153, Merced County. Circle Island.

DRILLED BY:
Bureau of Reclamation: PN Region drill crew:
Chris Peterson, driller
Dennis Read, helper
Cody Kelley, helper

DRILL RIG:
Truck mounted Central Mining Equipment (CME) DC512

DRILLING & SAMPLING METHODS:
The drill hole was advanced and sample using a Flight Auger Dry Core system (FADC). The drill hole was advanced using 8-1/4 inch o.d. by 4-1/4 inch i.d. hollow stem flight augers equipped with an 8-1/2 inch o.d. bullet and spade drill bit. Continuous sampling was performed by advancing a 4 inch o.d. by 3-3/8 inch i.d. by 5-foot long split barrel dry core sample system (sampler). Unless indicated otherwise, the sampler was placed inside the augers and the cutting shoe of the sampler extended 0.2 foot beyond the auger drill bit. A free-spinning adapter was placed at the top of the sampler to avoid rotation while advancing the augers.

Interval Method
0.0 to 29.7 ft. FADC

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
9.7 to 14.7 ft. - Catcher
14.7 to 19.7 ft. - Catcher with nylon.
19.7 to 24.7 ft. - Catcher with nylon.
24.7 to 29.7 ft. - Catcher with nylon.

DRILLING FLUID, RETURN AND COLOR:
0.0 to 29.7 ft. - Drilled without fluid

WATER LEVEL:
5.7 ft. - 5/13/2011

REASON FOR HOLE TERMINATION:
The hole was terminated upon reaching the target depth.

DEPTH	% CORE RECOVERY	LABORATORY DATA: <0.005	<0.075	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	% MOISTURE CONTENT	LABORATORY CLASSIFICATION / El.	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / El.
	61.7										s(ML) 86.3
											s(ML) 84.6
5		14.6	45.6	39.8	0.0	NP	NP	28.6	s(ML) 83.3	▼	s(ML)
	80.0										82.1
		50.5	43.3	6.2	0.0	56.5	33.4	31.2	CH 80.8		CL 79.5
10											SC 78.2
	60.0									Qal	SM 74.6

CLASSIFICATION AND PHYSICAL CONDITION

0.0 to 29.7 feet
QUATERNARY ALLUVIUM (Qal)

0.0 to 3.0 ft. SANDY SILT, s(ML):
About 70% fines with low plasticity, no dilatancy, no toughness; about 30% fine sand; dry, brown; firm; abundant roots, one live worm; moderate reaction with HCL.

3.0 to 4.7 ft. SANDY SILT, s(ML):
About 65% fines with low plasticity, slow dilatancy, low toughness; about 35% fine sand, micaceous; moist, dark brown; soft; layered; no reaction with HCL.

4.7 to 7.2 ft. SANDY SILT, s(ML):
About 60% fines with no plasticity; about 40% fine sand; wet, tan; soft; micaceous.

Lab Data Interval
5.0 to 6.0 ft.

7.2 to 9.8 ft. LEAN CLAY, CL:
About 90% fines with medium plasticity, no dilatancy, medium to high toughness; about 10% fine sand; moist, dark brown; firm; homogenous; some crenulations of reddish brown oxidation.

Lab Data Interval
7.5 to 8.5 ft.

9.8 to 11.1 ft. CLAYEY SAND, SC:
About 60% fine sand; about 40% fines with medium plasticity; wet, tan; moderately soft; some reddish brown oxidation; no reaction with HCL.

11.1 to 14.7 ft. SILTY SAND, SM:
About 85% fine sand; about 15% fines with no plasticity; wet, tan; saturated and flowing, several firmer lenses at bottom.

14.7 to 19.7 ft. No Recovery

19.7 to 24.7 ft. POORLY GRADED SAND WITH SILT, SP-SM:
About 90% fine sand, trace medium sand; about 10% fines with no plasticity; wet, gray; several ½ in. thick lenses of clay, spaced about 1.0 ft. intervals; medium soft; no reaction with HCL.

Lab Data Interval
19.7 to 24.7 ft.

24.7 to 29.7 ft. CLAYEY GRAVEL WITH SAND, (GC)s:
About 65% coarse, soft, subrounded gravels; about 20% fine to coarse sand, trace white, rounded, coarse sand; about 15% fines with medium plasticity; maximum particle size, less than 3 inches; wet, gray; no reaction with HCL.

COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-Plastic
NR = No Recovery
NA = Not Applicable
I.D. = Inner Diameter
O.D. = Outer Diameter

G.S. = Ground Surface
+ = Above Ground Surface
T.O.C. = Top of Well Casing
SJR = San Joaquin River
▼ = Top of Groundwater

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

GEOLOGIC LOG OF DRILL HOLE NO. MW-11-145

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Left, RM 153, Merced County
BEGUN: 5/12/11 FINISHED: 5/12/11
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 5.7 ft. (83.6 ft. - 5/13/2011)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,306,718.2 E 6,045,189.3 NAD83
TOTAL DEPTH: 29.7 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 89.26 ft. NADV88
ANGLE FROM HORIZONTAL: -90°
HOLE LOGGED BY: A. Warren
REVIEWED BY: T. Lewis

HOLE COMPLETION:
Completed as a groundwater monitoring well.

Well Casing: +2.83 to 13.7 ft. (2-inch I.D. blank PVC)
Dual U-pack Screen: 13.7 to 28.7 ft. (2-inch I.D. inner screen; 3-inch I.D. outer screen; slotted 0.010-inch)
U-Pack Screen Filter Pack: (#2/12 Sand)
Filter Pack: 12.0 to 29.7 ft. (#3 Sand)
Sump: 28.7 to 29.7 ft. (2-inch I.D. blank PVC with slip cap)
Concrete Seal: 0.0 to 2.0 ft.
Bentonite Seal: 2.0 to 12.0 ft.
Well Completion: 6-inch by 6-inch by 5-foot long steel surface casing with locking top; 2.0-foot diameter concrete pad.
Lock: #2006 Masterlock

DEPTH	% CORE RECOVERY	LABORATORY DATA: <0.005	<0.075	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	% MOISTURE CONTENT	LABORATORY CLASSIFICATION / El.	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / El.
	0.0										NR 69.6
20	26.0	3.6	8.5	87.9	0.0	NP	NP	23.7	SM 64.6		SP-SM 64.6
25											(GC)s 59.6

BOTTOM OF HOLE

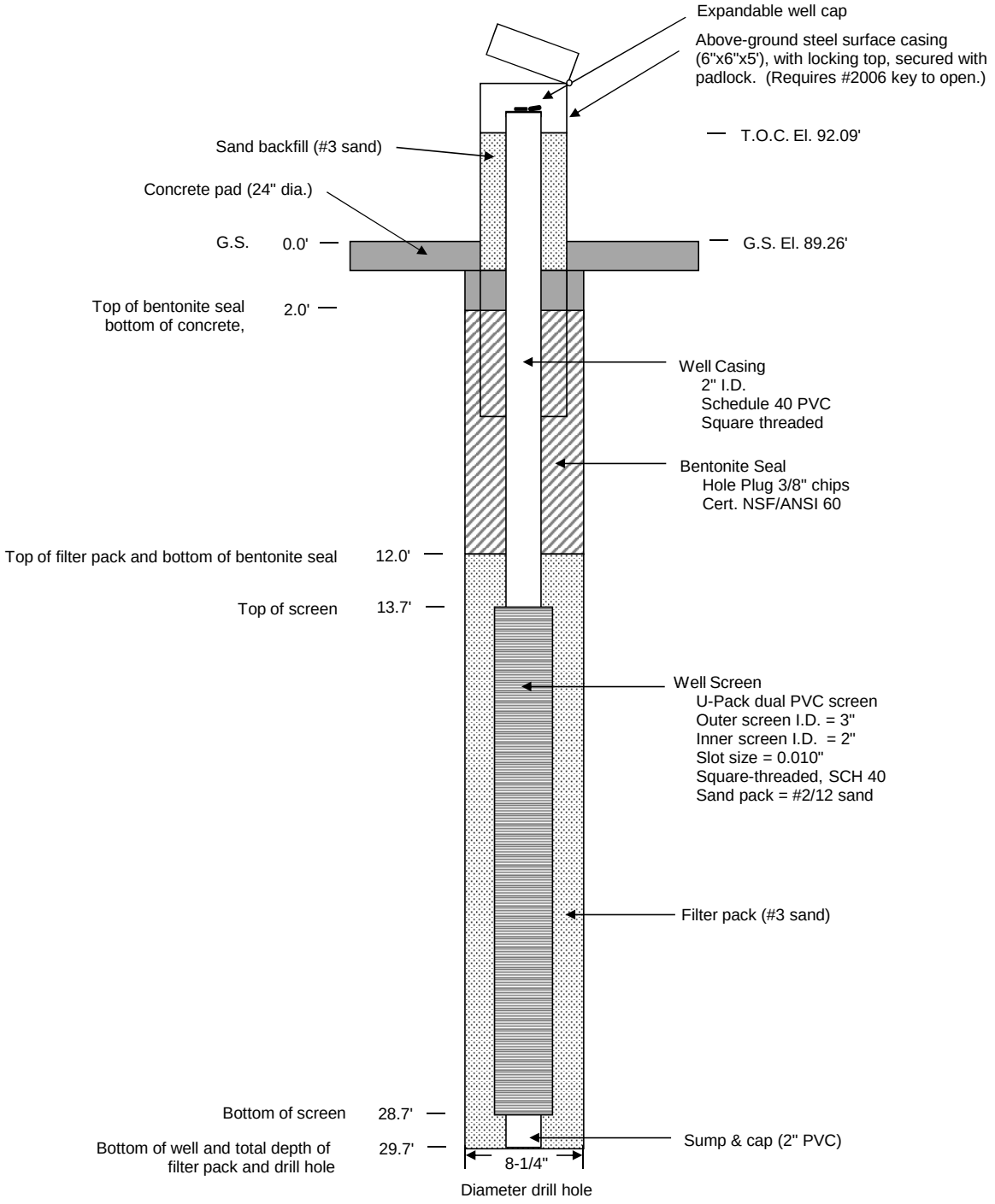
COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-Plastic
NR = No Recovery
NA = Not Applicable
I.D. = Inner Diameter
O.D. = Outer Diameter

G.S. = Ground Surface
+ = Above Ground Surface
T.O.C. = Top of Well Casing
SJR = San Joaquin River
▼ = Top of Groundwater

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

MW-11-145	GEOLOGIST: A. Warren
WELL COMPLETION DIAGRAM	DRILLER: C. Peterson
DATE COMPLETED: 5/12/2011	HELPERS: D. Read & C. Kelly
LOCATION: Circle Island. Reach 4B1, River Bank Left, RM 153, Merced County. T.O.C. COORDINATES: N2306718.15 E6045189.32 (NAD93) EL.92.09' (NAVD88) G.S. ELEVATION: 89.26' (NAVD88)	



***NOT TO SCALE**

NOTES:

T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, El. = Elevation
Dia. = Diameter

San Joaquin River Restoration Program
U.S. Department of Interior, Bureau of Reclamation

MONITORING WELL DEVELOPMENT

Facility/Project Name	County Name	Well Name
SJRRP	Merced	MW-11-145/W-14

Facility License, Permit or Monitoring Number	County Code	Wis. Unique Well Number	DNR Well ID Number

1. Can this well be purged dry? Yes ☐ No ☒

2. Well development method

surged with bailer and bailed	☐ 41
surged with bailer and pumped	☐ 61
surged with block and bailed	☐ 42
surged with block and pumped	☒ 62
surged with block, bailed and pumped	☐ 70
compressed air	☐ 20
bailed only	☐ 10
pumped only	☐ 51
pumped slowly	☐ 50
Other _____	☐ __

3. Time spent developing well: 40 min.

4. Depth of well (from top of well casisng): 290 ft.

5. Inside diameter of well: 2 in.

6. Volume of water in filter pack and well casing: ___.__ gal.

7. Volume of water removed from well: 525 gal.

8. Volume of water added (if any): ___.__ gal.

9. Source of water added: —

10. Analysis performed on water added? (If yes, attach results) ☐ Yes ☒ No

	Before Development	After Development
11. Depth to Water (from top of well casing)	a. 5.7 ft.	5.7 ft.
Date	b. 5/13/2011 (m m d d y y y y)	5/13/201 (m m d d y y y y)
Time	c. 7:35 ☒ a.m. ☐ p.m.	8:25 ☒ a.m. ☐ p.m.
12. Sediment in well bottom	~ inches	~ inches
13. Water clarity	Clear ☐ 10 / Turbid ☒ 15	Clear ☒ 20 / Turbid ☐ 25
(Describe)	brown, opaque, fine sand, some silt	opaque, cloudy white (milky)

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids	____.__ mg/l	____.__ mg/l
15. COD	____.__ mg/l	____.__ mg/l

16. Well developed by: Name (first, last) and Firm
First Name: Last Name:
Firm:

17. Additional comments on development:
Surged w/ tubing, surge block & ball check valve every 2-3 feet for ~1 min
bailed 2.5 gallons of dark brown, turbid, sandy water.
Pumped from bottom of well w/ sump pump, about 2 gall/min; ||| ||| 50 gallons

Name and Address of Facility Contact/Owner/Responsible Party
First Name: _____ Last Name: _____
Facility/Firm: _____
Street: _____
City/State/Zip: _____

I hereby certify that the above information is true and correct to the best of my knowledge.
Signature: [signature]
Print Name: Alison Warren
Firm: BOR

NOTE: See instructions for more information including a list of county codes and well type codes.

5.7

GEOLOGIC LOG OF DRILL HOLE NO. MW-11-146

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Right, RM 155.6, Merced County
BEGUN: 5/13/11 FINISHED: 5/13/11
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 3.5 ft. (93.3 ft. - 5/16/2011)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,320,427.9 E 6,072,333.8 NAD83
TOTAL DEPTH: 30.2 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 96.75 ft. NADV88
ANGLE FROM HORIZONTAL: -90°
HOLE LOGGED BY: A. Warren
REVIEWED BY: T. Lewis

NOTES

ALL MEASUREMENTS ARE IN FEET FROM THE GROUND SURFACE.

PURPOSE OF HOLE:
To recover a continuous soil core, collect data to determine geologic and hydrologic site conditions, and install a groundwater monitoring well.

LOCATION:
Reach 4B1, River Bank Right, RM 155.6, Merced County. North of Sandy Mush Road.

DRILLED BY:
Bureau of Reclamation: PN Region drill crew:
Cody Kelley, driller
Dennis Read, helper
Chris Peterson, helper

DRILL RIG:
Truck mounted Central Mining Equipment (CME) DC512

DRILLING & SAMPLING METHODS:
The drill hole was advanced and sample using a Flight Auger Dry Core system (FADC). The drill hole was advanced using 8-1/4 inch o.d. by 4-1/4 inch i.d. hollow stem flight augers equipped with an 8-1/2 inch o.d. bullet and spade drill bit. Continuous sampling was performed by advancing a 4 inch o.d. by 3-3/8 inch i.d. by 5-foot long split barrel dry core sample system (sampler). Unless indicated otherwise, the sampler was placed inside the augers and the cutting shoe of the sampler extended 0.2 foot beyond the auger drill bit. A free-spinning adapter was placed at the top of the sampler to avoid rotation while advancing the augers.

Interval Method
0.0 to 30.2 ft. FADC

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
10.2 to 15.2 ft. - Wet.
15.2 to 20.2 ft. - Catcher with nylon.
20.2 to 25.2 ft. - Catcher with nylon.
25.2 to 30.2 ft. - Catcher with nylon.

DRILLING FLUID, RETURN AND COLOR:
0.0 to 30.2 ft. - Drilled without fluid

WATER LEVEL:
3.5 ft. - 5/16/2011

REASON FOR HOLE TERMINATION:
The hole was terminated upon reaching the target depth.

DEPTH	% CORE RECOVERY	LABORATORY DATA: <0.005	<0.075	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	% MOISTURE CONTENT	LABORATORY CLASSIFICATION	El.	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION	El.
												s(ML)	96.1
												(SM)g	95.3
												s(CL)	95.1
												SM	94.8
	96.2	69.9	26.0	4.1	0.0	60.1	38.7	26.2	CH	94.0		CL	94.0
5											▼		
	100.0	60.8	28.0	11.2	0.0	57.4	40.2	21.7	CH	88.8		CH	86.5
10												(CL)s	85.3
	94.0											s(CL)	83.5
		8.6	13.5	77.9	0.0	NP	NP	20.0	SM	82.5		SM	82.5
15											Qal	s(ML)	81.6

CLASSIFICATION AND PHYSICAL CONDITION

0.0 to 30.2 feet
QUATERNARY ALLUVIUM (Qal)

0.0 to 0.7 ft. SANDY SILT, s(ML):
About 65% fines with no plasticity, high dilatancy, no toughness; about 35% fine sand; dry, dark brown; lightly cemented; slight reaction with HCL.

0.7 to 1.5 ft. SILTY SAND WITH GRAVEL, (SM)g:
About 40% fine sand; about 40% fines with no plasticity; about 20% rounded, elongate, hard fine gravel; maximum particle size, ¾ inch; dry, tan; cemented; slight reaction with HCL.

1.5 to 1.7 ft. SANDY LEAN CLAY, s(CL):
About 60% fines with medium plasticity; about 40% fine sand; moist to dry, dark brown; layered with about 0.1 ft. thick sandy layers; slight reaction with HCL.

1.7 to 2.0 ft. SILTY SAND, SM:
About 50% fine sand; about 50% fines with no plasticity; dry, tan; strong reaction with HCL; about 50% $CaCO_3$

2.0 to 2.8 ft. LEAN CLAY, CL:
About 100% fines with medium plasticity, medium toughness; trace fine sand; moist, dark brown to black; crumbles easily; high amount of organics; no reaction with HCL.

Lab Data Interval
2.0 to 2.8 ft.

2.8 to 10.3 ft. FAT CLAY, CH:
About 90% fines with medium to high plasticity, no dilatancy, high toughness; about 10% fine sand; moist, dark brown; firm to very firm; no reaction with HCL.

Lab Data Interval
7.0 to 8.0 ft.

10.3 to 11.5 ft. LEAN CLAY WITH SAND, (CL)s:
About 75% fines with medium plasticity, medium toughness; about 25% fine sand; moist, dark brown with reddish brown oxidation; firm; no reaction with HCL.

11.5 to 13.3 ft. SANDY LEAN CLAY, s(CL):
About 65% fines with medium plasticity, medium toughness; about 35% fine to medium sand; moist, dark brown; no reaction with HCL.

13.3 to 14.3 ft. SILTY SAND, SM:
About 75% fine sand, trace medium sand; about 25% fines with no plasticity; wet, brown; water pools on surface.

Lab Data Interval
13.3 to 14.3 ft.

14.3 to 15.2 ft. SANDY SILT, s(ML):
About 60% fines with no plasticity, no toughness; about 40% fine sand; moist, tan with reddish brown oxidation layers; no reaction with HCL.

COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-Plastic
NR = No Recovery
NA = Not Applicable
I.D. = Inner Diameter
O.D. = Outer Diameter

G.S. = Ground Surface
+ = Above Ground Surface
T.O.C. = Top of Well Casing
SJR = San Joaquin River
▼ = Top of Groundwater

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

GEOLOGIC LOG OF DRILL HOLE NO. MW-11-146

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Right, RM 155.6, Merced County
BEGUN: 5/13/11 FINISHED: 5/13/11
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 3.5 ft. (93.3 ft. - 5/16/2011)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,320,427.9 E 6,072,333.8 NAD83
TOTAL DEPTH: 30.2 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 96.75 ft. NADV88
ANGLE FROM HORIZONTAL: -90°
HOLE LOGGED BY: A. Warren
REVIEWED BY: T. Lewis

NOTES

HOLE COMPLETION:
Completed as a groundwater monitoring well.

Well Casing: +2.92 to 19.2 ft. (2-inch I.D. blank PVC)
Dual U-pack Screen: 19.2 to 29.2 ft. (2-inch I.D. inner screen; 3-inch I.D. outer screen; slotted 0.010-inch)
U-Pack Screen Filter Pack: (#2/12 Sand)
Filter Pack: 17.0 to 30.2 ft. (#3 Sand)
Sump: 29.2 to 30.2 ft. (2-inch I.D. blank PVC with slip cap)
Concrete Seal: 0.0 to 2.0 ft.
Bentonite Seal: 2.0 to 17.0 ft.
Well Completion: 6-inch by 6-inch by 5-foot long steel surface casing with locking top; 2.0-foot diameter concrete pad.
Lock: #2006 Masterlock

DEPTH	% CORE RECOVERY	LABORATORY DATA: <0.005	<0.075	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	% MOISTURE CONTENT	LABORATORY CLASSIFICATION	El.	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION	El.
	22.0											s(ML)	
20													76.6
		0.7	3.7	95.6	0.0	NP	NP	25.8	SP	74.8			
	86.0												
25												SP	
		0.0	4.2	95.8	0.0	NP	NP	26.9	SP	69.3			
	92.0												
30													66.6

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

15.2 to 20.2 ft. <u>SANDY SILT, s(ML):</u> About 55% fines with no plasticity, rapid dilatancy, no toughness; about 45% fine sand; wet, tan with reddish brown oxidation; loose and flowing.

20.2 to 30.2 ft. <u>POORLY GRADED SAND, SP:</u>
About 95% fine to medium sand; about 5% fines with no plasticity; wet, gray; homogenous; no reaction with HCL.

<u>Lab Data Interval</u>
21.0 to 22.0 ft.

<u>Lab Data Interval</u>
26.5 to 27.5 ft.

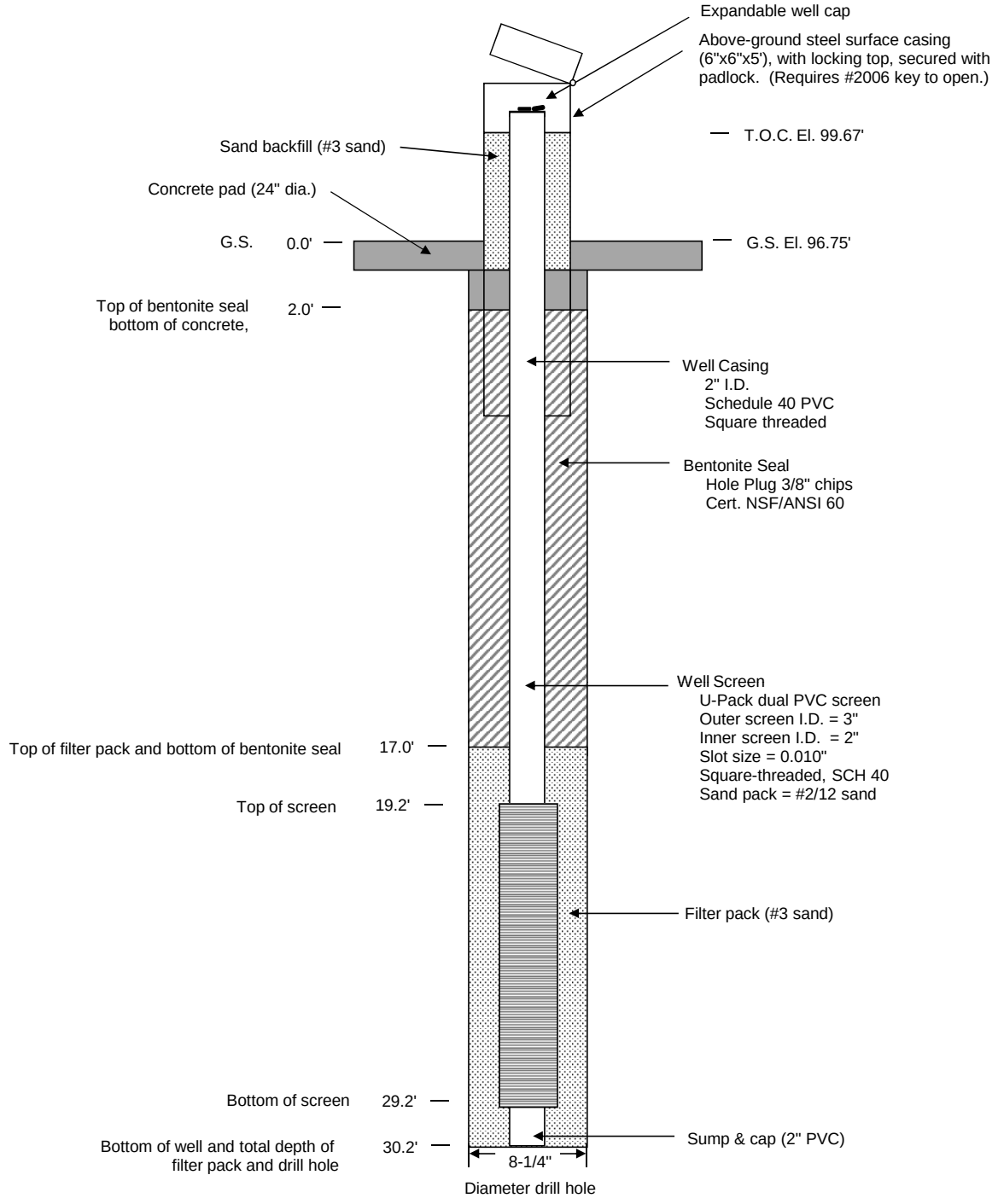
COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-Plastic
NR = No Recovery
NA = Not Applicable
I.D. = Inner Diameter
O.D. = Outer Diameter

G.S. = Ground Surface
+ = Above Ground Surface
T.O.C. = Top of Well Casing
SJR = San Joaquin River
▼ = Top of Groundwater

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

MW-11-146	GEOLOGIST: A. Warren
WELL COMPLETION DIAGRAM	DRILLER: C. Peterson
DATE COMPLETED: 5/13/2011	HELPERS: D. Read & C. Kelly
LOCATION: North of Sandy Mush Road. Reach 4B1, River Bank Right, RM 155.6, Merced County. T.O.C. COORDINATES: N2320427.88 E6072333.82 (NAD93) EL. 99.67' (NAVD88) G.S. ELEVATION: 96.75' (NAVD88)	



***NOT TO SCALE**

NOTES:

T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, El. = Elevation
Dia. = Diameter

San Joaquin River Restoration Program
U.S. Department of Interior, Bureau of Reclamation

MONITORING WELL DEVELOPMENT

Facility/Project Name	County Name	Well Name
SJRRP	MERCED	W-15 / MW-11-146

Facility License, Permit or Monitoring Number	County Code	Wis. Unique Well Number	DNR Well ID Number

1. Can this well be purged dry? Yes ☐ No ☒

2. Well development method

surged with bailer and bailed	☐	41
surged with bailer and pumped	☐	61
surged with block and bailed	☐	42
surged with block and pumped	☒	62
surged with block, bailed and pumped	☐	70
compressed air	☐	20
bailed only	☐	10
pumped only	☐	51
pumped slowly	☐	50
Other _____	☐	__

3. Time spent developing well: 40 min.

4. Depth of well (from top of well casisng): 33.1 ft.

5. Inside diameter of well: 2.00 in.

6. Volume of water in filter pack and well casing: ___.__ gal.

7. Volume of water removed from well: 50.__ gal.

8. Volume of water added (if any): ___.__ gal.

9. Source of water added: _____

10. Analysis performed on water added? ☐ Yes ☐ No (If yes, attach results)

	Before Development	After Development
11. Depth to Water (from top of well casing)	a. 65.__ ft.	68.__ ft.
Date	b. 05/16/2011 (m m d d y y y y)	05/16/2011 (m m d d y y y y)
Time	c. 7:30 ☒ a.m. ☐ p.m.	8:10 ☐ a.m. ☐ p.m.
12. Sediment in well bottom	___.__ inches	___.__ inches
13. Water clarity	Clear ☐ 10 Turbid ☑ 15 (Describe) Brown SAND	Clear ☒ 20 Turbid ☐ 25 (Describe)
14. Total suspended solids	____.__ mg/l	____.__ mg/l
15. COD	____.__ mg/l	____.__ mg/l

Fill in if drilling fluids were used and well is at solid waste facility:

16. Well developed by: Name (first, last) and Firm
First Name: Last Name:
Firm:

17. Additional comments on development:
SURGED WITH BLOCK & BALL CHECK VALVE FOR SEVERAL MINUTES AT 2 FT. INTERV. UNTIL 5 GALS. PUMPED.
PUMPED WITH SUMP PUMP UNTIL CLEAR 45 GALS.

Name and Address of Facility Contact /Owner/Responsible Party
First Name: _____ Last Name: _____
Facility/Firm: _____
Street: _____
City/State/Zip: _____

I hereby certify that the above information is true and correct to the best of my knowledge.
Signature: _____
Print Name: _____
Firm: _____

NOTE: See instructions for more information including a list of county codes and well type codes.

GEOLOGIC LOG OF DRILL HOLE NO. MW-11-147

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Right, RM 155.6, Merced County
BEGUN: 5/14/11 FINISHED: 5/14/11
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 4.6 ft. (93.3 ft. - 5/15/2011)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,321,462.9 E 6,073,278.0 NAD83
TOTAL DEPTH: 30.0 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 97.85 ft. NADV88
ANGLE FROM HORIZONTAL: -90°
HOLE LOGGED BY: A. Warren
REVIEWED BY: T. Lewis

NOTES

ALL MEASUREMENTS ARE IN FEET FROM THE GROUND SURFACE.

PURPOSE OF HOLE:
To recover a continuous soil core, collect data to determine geologic and hydrologic site conditions, and install a groundwater monitoring well.

LOCATION:
Reach 4B1, River Bank Right, RM 155.6, Merced County. North of Sandy Mush Road.

DRILLED BY:
Bureau of Reclamation: PN Region drill crew:
Chris Peterson, driller
Dennis Read, helper
Cody Kelley, helper

DRILL RIG:
Truck mounted Central Mining Equipment (CME) DC512

DRILLING & SAMPLING METHODS:
The drill hole was advanced and sample using a Flight Auger Dry Core system (FADC). The drill hole was advanced using 8-1/4 inch o.d. by 4-1/4 inch i.d. hollow stem flight augers equipped with an 8-1/2 inch o.d. bullet and spade drill bit. Continuous sampling was performed by advancing a 4 inch o.d. by 3-3/8 inch i.d. by 5-foot long split barrel dry core sample system (sampler). Unless indicated otherwise, the sampler was placed inside the augers and the cutting shoe of the sampler extended 0.2 foot beyond the auger drill bit. A free-spinning adapter was placed at the top of the sampler to avoid rotation while advancing the augers.

Interval Method
0.0 to 30.0 ft. FADC

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
10.0 to 15.0 ft. - Wet, catcher.
15.0 to 20.0 ft. - Catcher with nylon.
20.0 to 25.0 ft. - Catcher with nylon.
25.0 to 30.0 ft. - Catcher with nylon.

DRILLING FLUID, RETURN AND COLOR:
0.0 to 30.0 ft. - Drilled without fluid

WATER LEVEL:
4.6 ft. - 5/15/2011

REASON FOR HOLE TERMINATION:
The hole was terminated upon reaching the target depth.

DEPTH	% CORE RECOVERY	LABORATORY DATA: <0.005	<0.075	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	% MOISTURE CONTENT	LABORATORY CLASSIFICATION / El.	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION / El.
											s(CL) 96.6
											OL/CL 95.9
	94.0	45.7	29.6	24.7	0.0	46.6	30.8	19.7	(CL)s 94.4		(CL)s 93.1
5										▼	
											SC 91.4
	84.0	17.0	35.1	46.2	1.7	31.1	13.7	18.2	s(CL) 89.9		s(CL) 89.9
											SC 87.9
10											
		2.1	9.1	88.8	0.0	NP	NP	20.3	SP-SM 85.9		SP-SM
	38.0										
											82.9
15										Qal	(CL)s 81.9

0.0 to 29.5 feet
QUATERNARY ALLUVIUM (Qal)

0.0 to 1.3 ft. SANDY LEAN CLAY, s(CL):
About 70% fines with medium plasticity, medium toughness; about 30% fine sand; dry, tan with white $CaCO_3$; moderately cemented; strong reaction with HCL; roots and grass growth; abundant white $CaCO_3$.

1.3 to 2.0 ft. ORGANIC/LEAN CLAY, OL/CL:
About 95% fines with low plasticity, low toughness; about 5% to trace sand; moist, dark brown to black; moderately soft and crumbled from drilling action; no reaction with HCL.

2.0 to 4.8 ft. LEAN CLAY WITH SAND, (CL)s:
About 75% fines with medium plasticity; about 25% fine sand; moist, brown; moderately firm; layered; moderate reaction with HCL.

Lab Data Interval
2.5 to 3.5 ft.

4.8 to 6.5 ft. CLAYEY SAND, SC:
About 55% fine sand; about 45% fines with medium plasticity; moist, tan with white $CaCO_3$; moderately soft, crumbled from drilling action; strong reaction with HCL; abundant white $CaCO_3$.

6.5 to 8.0 ft. SANDY LEAN CLAY, s(CL):
About 55% fines with medium plasticity, slow dilatancy, medium toughness; about 45% fine sand, trace medium sand; moist, tan; moderately soft; moderate reaction with HCL.

Lab Data Interval
7.0 to 8.0 ft.

8.0 to 10.0 ft. CLAYEY SAND, SC:
About 75% fine sand; about 25% fines with medium plasticity; tan; moderately soft; no reaction with HCL.

Note: 2 inch thick layer of $CaCO_3$ at 7.0 ft.

10.0 to 15.0 ft. POORLY GRADED SAND WITH SILT, SP-SM:
About 90% fine sand, trace medium sand; about 10% fines with no plasticity; wet, tan; does not hold shape; no reaction with HCL.

Lab Data Interval
11.0 to 12.0 ft.

15.0 to 16.0 ft. LEAN CLAY WITH SAND, (CL)s:
About 70% fines with medium plasticity, medium toughness; about 30% fine sand; tan, wet; soft and disturbed from drilling action; moderate reaction with HCL.

16.0 to 16.8 ft. SILT WITH SAND, (ML)s:
About 80% fines with low plasticity, low toughness; about 20% fine sand; moist, brown to tan; firm; slight reaction with HCL; minor $CaCO_3$ veins.

COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-Plastic
NR = No Recovery
NA = Not Applicable
I.D. = Inner Diameter
O.D. = Outer Diameter

G.S. = Ground Surface
+ = Above Ground Surface
T.O.C. = Top of Well Casing
SJR = San Joaquin River
▼ = Top of Groundwater

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

GEOLOGIC LOG OF DRILL HOLE NO. MW-11-147

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Right, RM 155.6, Merced County
BEGUN: 5/14/11 FINISHED: 5/14/11
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 4.6 ft. (93.3 ft. - 5/15/2011)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,321,462.9 E 6,073,278.0 NAD83
TOTAL DEPTH: 30.0 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 97.85 ft. NADV88
ANGLE FROM HORIZONTAL: -90°
HOLE LOGGED BY: A. Warren
REVIEWED BY: T. Lewis

NOTES

HOLE COMPLETION:
Completed as a groundwater monitoring well.

Well Casing: +2.78 to 9.8 ft. and 14.8 to 24.8 ft. (2-inch I.D. blank PVC)
Dual U-pack Screen: 9.8 to 14.8 ft. and 24.8 to 29.2 ft. (2-inch I.D. inner screen; 3-inch I.D. outer screen; slotted 0.010-inch)
U-Pack Screen Filter Pack: (#2/12 Sand)
Filter Pack: 8.0 to 29.5 ft. (#3 Sand)
Sump: 29.2 to 29.5 ft. (2-inch I.D. blank PVC with slip cap)
Concrete Seal: 0.0 to 2.0 ft.
Bentonite Seal: 2.0 to 8.0 ft.
Well Completion: 6-inch by 6-inch by 5-foot long steel surface casing with locking top; 2.0-foot diameter concrete pad.
Lock: #2006 Masterlock

DEPTH	% CORE RECOVERY	LABORATORY DATA: <0.005	<0.075	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	% MOISTURE CONTENT	LABORATORY CLASSIFICATION	El.	GEOLOGIC UNIT SYMBOL	VISUAL CLASSIFICATION	El.
												(ML)s	81.1
												(CL)s	80.9
	100.0												
		33.3	56.2	10.3	0.2	33.1	15.7	24.2	CL	78.9		CL	
20													77.3
		30.6	47.8	20.6	1.0	27.4	10.7	22.0	(CL)s	75.4		(CL)s	
	92.0												75.1
												SC	
													73.1
25													
												CL	
	100.0												70.4
												SC	
		24.6	39.6	35.8	0.0	23.9	8.8	20.1	s(CL)	67.9			67.9
30													

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

16.8 to 17.0 ft. LEAN CLAY WITH SAND, (CL)s:
About 70% fines with medium plasticity, medium toughness; about 30% fine sand; tan, wet; soft and disturbed from drilling action; moderate reaction with HCL.

17.0 to 20.6 ft. LEAN CLAY, CL:
About 90% fines with low plasticity, medium toughness; about 10% fine sand; moist, brown to tan; firm; slight reaction with HCL; minor $CaCO_3$ veins.

Lab Data Interval
18.0 to 19.0 ft.

20.6 to 22.8 ft. LEAN CLAY WITH SAND, (CL)s:
About 80% fines with low plasticity, low to medium toughness; about 20% fine sand; moist, tan; firm; no reaction with HCL; layers of reddish brown oxidation at lower contact.

22.8 to 24.8 ft. CLAYEY SAND, SC:
About 75% fine sand; about 25% fines with high plasticity; wet to moist, reddish orange; firm; no reaction with HCL.

24.8 to 27.5 ft. LEAN CLAY, CL:
About 90% fines with medium to high plasticity, medium toughness; about 10% fine sand; moist, olive tan with reddish brown oxidation; moderate cementation and strong reaction with HCL from 24.8 to 25.4 ft.

Note: About 20% fine sand from 24.8 to 25.4 ft.

27.5 to 30.0 ft. CLAYEY SAND, SC:
About 60% fine sand; about 40% fines with medium plasticity; moist, reddish brown; firm; no reaction with HCl.

Lab Data Interval
29.0 to 30.0 ft.

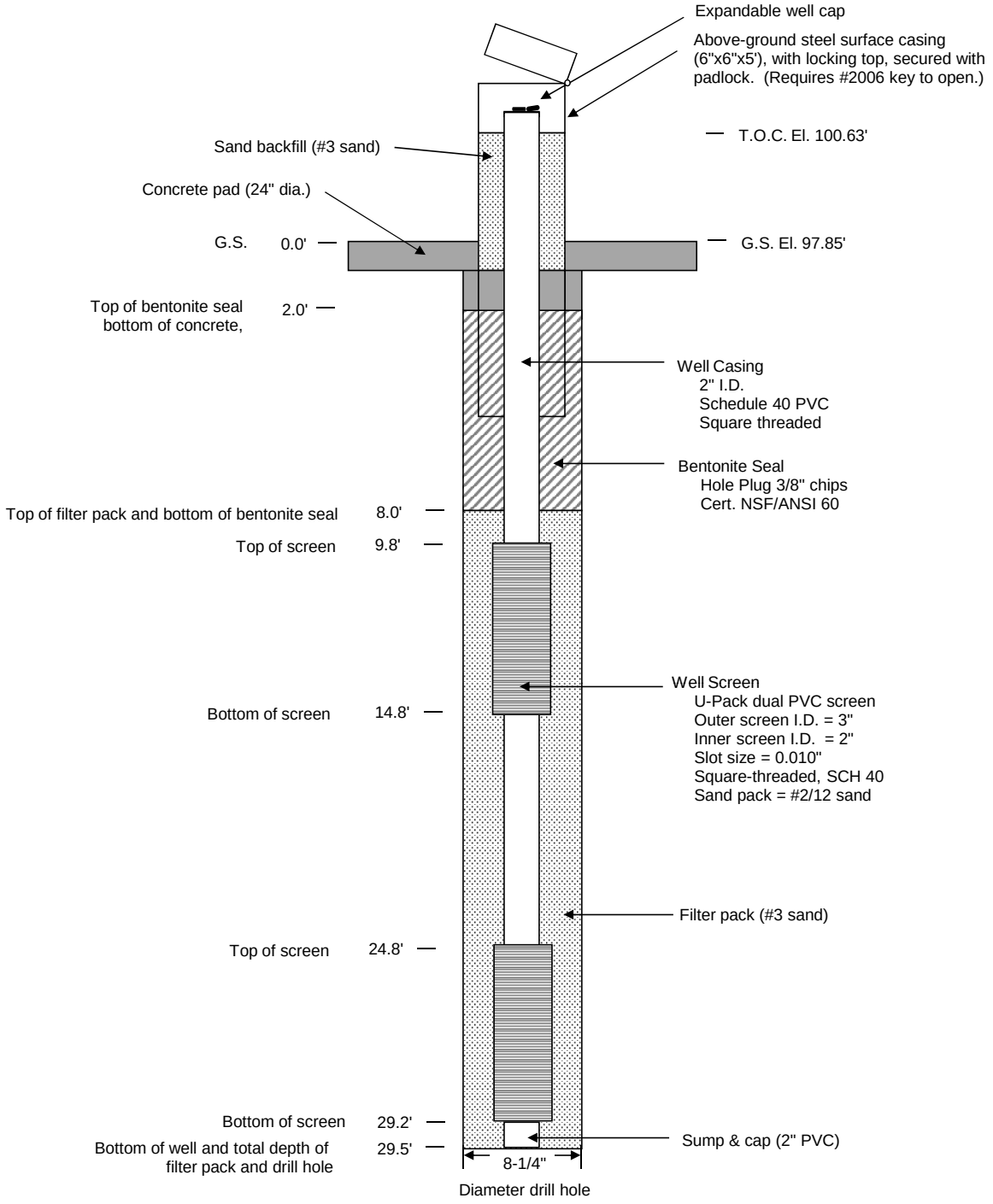
COMMENTS:

FADC = Flight Auger Dry Core
NP = Non-Plastic
NR = No Recovery
NA = Not Applicable
I.D. = Inner Diameter
O.D. = Outer Diameter

G.S. = Ground Surface
+ = Above Ground Surface
T.O.C. = Top of Well Casing
SJR = San Joaquin River
▼ = Top of Groundwater

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

MW-11-147	GEOLOGIST: A. Warren
WELL COMPLETION DIAGRAM	DRILLER: C. Peterson
DATE COMPLETED: 5/14/2011	HELPERS: D. Read & C. Kelly
LOCATION: North of Sandy Mush Road. Reach 4B1, River Bank Right, RM 155.6, Merced County. T.O.C. COORDINATES: N2321462.91 E6073278.01 (NAD93) EL. 100.63' (NAVD88) G.S. ELEVATION: 97.85' (NAVD88)	



***NOT TO SCALE**

NOTES:

T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, El. = Elevation
Dia. = Diameter

San Joaquin River Restoration Program
U.S. Department of Interior, Bureau of Reclamation

MONITORING WELL DEVELOPMENT

Facility/Project Name	County Name	Well Name
SJRRP	MERCED	W-19-MW-11-147

Facility License, Permit or Monitoring Number	County Code	Wis. Unique Well Number	DNR Well ID Number

1. Can this well be purged dry? Yes ☐ No ☒

2. Well development method

surged with bailer and bailed	☐ 41
surged with bailer and pumped	☐ 61
surged with block and bailed	☐ 42
surged with block and pumped	☐ 62
surged with block, bailed and pumped	☐ 70
compressed air	☐ 20
bailed only	☐ 10
pumped only	☐ 51
pumped slowly	☐ 50
Other _____	☐ __

3. Time spent developing well: 70 min.

4. Depth of well (from top of well casisng): 32.3 ft.

5. Inside diameter of well: 2.00 in.

6. Volume of water in filter pack and well casing: ____.__ gal.

7. Volume of water removed from well: 70.0 gal.

8. Volume of water added (if any): ____.__ gal.

9. Source of water added: _____

10. Analysis performed on water added? ☐ Yes ☐ No (If yes, attach results)

	Before Development	After Development
11. Depth to Water (from top of well casing)	a. 7.6 ft.	11.5 ft.
Date	b. 5/15/2011 (m m d d y y y y)	5/15/2011 (m m d d y y y y)
Time	c. 3:35 ☐ a.m. ☒ p.m.	4:45 ☐ a.m. ☒ p.m.
12. Sediment in well bottom	___.__ inches	___.__ inches
13. Water clarity	Clear ☐ 10 Turbid ☒ 15 (Describe) Brown SAND	Clear ☐ 20 Turbid ☐ 25 (Describe)

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids	____.__ mg/l	____.__ mg/l
15. COD	____.__ mg/l	____.__ mg/l

16. Well developed by: Name (first, last) and Firm
First Name: Last Name:
Firm:

17. Additional comments on development:
SURGED WITH BLOCK + BALL CHECK VALVE FOR SEVERAL AT EACH 2 FT
UNTIL PUMPED 5 GALS,
PUMPED WITH SUMP PUMP UNTIL CLEAR TOOK LONGER DUE IT
TO CLEAN UP.

Name and Address of Facility Contact /Owner/Responsible Party
First Name: _____ Last Name: _____
Facility/Firm: _____
Street: _____
City/State/Zip: _____

I hereby certify that the above information is true and correct to the best of my knowledge.
Signature: _____
Print Name: _____
Firm: _____

NOTE: See instructions for more information including a list of county codes and well type codes.