GEOLOGIC LOG OF DRILL HOLE NO. MW-09-83

FEATURE: Groundwater Monitoring
LOCATION: Reach 4A, River Bank Right, Merced County
BEGUN: 11/3/09 FINISHED: 11/5/09
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 50.7 ft. (El. 64.14 ft.) 11/6/2009

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,274,920.0 E 6,112,632.9 (NAGD83)
TOTAL DEPTH: 62.5 ft.

STATE: California
GROUND SURFACE ELEVATION: 114.8 ft. (NAVD88)
T.O.C ELEVATION: 114.84 ft. (NAVD88)
HOLE LOGGED BY: G. Russell & J. Vauk
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.

DRILLED BY:
USGS Drill Crew
James Huckaby, Driller
Todd Menning, Helper

DRILL RIG:
CME-550

DRILLING & SAMPLING METHODS:
Drill hole MW-09-83 was advanced using hollow stem flight augers with continuous dry core sampling system (FADC) from the ground surface to a total depth of 62.5 feet. FADC system uses augers with a 7-5/8-inch O.D. and 4-1/4-inch I.D., and a 5-foot-long, 3-inch I.D. split sample barrel.

Interval Method
0.0 to 62.5 ft. - FADC

MW-09-83B was drilled and completed as a well using 7-5/8-inch O.D. and 4-1/4-inch I.D. hollow stem flight augers and a wooden plug. The total depth of the hole was 43.0 feet b.g.s. and the bottom of the well screen was set at 42.5 feet of depth.

Interval Method
0.0 to 43.0 ft. - FADC with wooden plug

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
MW-09-83
0.0 to 37.5 ft. - smooth drilling
37.5 to 42.5 ft. - hard clay bogging down augers
42.5 to 50.5 ft. - smooth drilling
50.5 to 62.5 ft. - add water, smooth drilling

MW-09-83B
0.0 to 43.0 ft. - blind drilled
43.0 ft. - knocked out wooden plug and set well

DRILLNG FLUID, RETURN AND COLOR:
MW-09-83
0.0 to 50.5 ft. - None
50.5 to 62.5 ft. - Water, no return

MW-09-83B
0.0 to 43.0 ft. - None

WATER LEVEL:
50.7 ft. b.g.s. on 11/6/2009 (MW-09-83)

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
	100													Fill
5	96											(CL)s		
													105.1	
10	90											SM		
												(CL)s	102.1 / 102.0	Qal
15	100	40.5	19.1	59.6	40.4	0.0	26.7	10.7	12.5	s(CL)	99.5	s(ML)		
													97.7	
												SM		
													96.2	
												s(ML)		
20	96												94.2	
		36.2	46.9	83.1	16.9	0.0	40.3	21.7	31.4	(CL)s	93.8			
												(CL)s		
													91.8	
												s(ML)	91.1	
												s(ML)	90.9	
												SM		

SOIL DESCRIPTIONS CHARACTERIZE SAMPLES FROM DRILL HOLE MW-09-83.

0.0 to 2.0 feet
RECENT FILL (Fill)

0.0 to 2.0 ft.: FILL/ROAD BASE - LEAN CLAY WITH SAND, (CL)s: About 85% fines with medium plasticity, slow dilatancy, medium dry strength, and medium toughness; about 15% fine to medium sand; maximum size: medium sand; dry, light brown; firm consistency; contains some organics (roots).

2.0 to 62.5 feet
QUATERNARY ALLUVIUM (Qal)

2.0 to 9.7 ft.: LEAN CLAY WITH SAND, (CL)s: About 85% fines with medium plasticity, toughness, and dry strength, and slow dilatancy; about 15% fine to medium sand; maximum size: medium sand; dry, light brown; firm consistency.

9.7 to 12.7 ft.: SILTY SAND, SM: About 80% fine to medium sand; about 20% non-plastic fines with rapid dilatancy; maximum size: medium sand; dry, light gray to light brown; soft consistency.

12.7 to 12.8 ft.: LEAN CLAY WITH SAND, (CL)s: About 75% fines with medium plasticity, toughness and dry strength, and slow dilatancy; about 25% fine to medium sand; maximum size: medium sand; moist, light brown; firm consistency.

12.8 to 17.1 ft.: SANDY SILT, s(ML): About 65% fines with low plasticity, toughness and dry strength, and rapid dilatancy; about 35% fine to medium sand; maximum size: medium sand; moist, light brown; soft consistency.

Laboratory Data Interval
15.0 to 15.3 ft.

17.1 to 18.6 ft.: SILTY SAND, SM: About 80% fine to medium sand; about 20% non-plastic fines with rapid dilatancy; maximum size: medium sand; moist, light brown; soft consistency.

18.6 to 20.6 ft.: SANDY SILT, s(ML): About 70% fines with low plasticity, toughness and dry strength, and no dilatancy; about 30% fine to medium sand; maximum size: medium sand; moist, light brown; firm consistency.

20.6 to 23.0 ft.: LEAN CLAY WITH SAND, (CL)s: About 85% fines with medium plasticity, toughness and dry strength, and no dilatancy; about 15% fine sand; maximum size: fine sand; moist, light brown; firm consistency.

Laboratory Data Interval
20.7 to 21.0 ft.

23.0 to 23.7 ft.: SANDY SILT, s(ML): About 55% non-plastic fines with rapid dilatancy; about 45% fine sand; maximum size: fine sand; slightly moist, light brown, soft consistency.

COMMENTS:
FADC = Flight Auger Dry Core
HSA = Hollow Stem Auger
NP = Non-plastic
NR = No Recovery
NA = Not applicable
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing

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

MW-09-83B
TOC Coordinates= N 2274916.7 E 6112625.6 (NAGD83) El. 115.01 (NAVD88)
Ground surface El.= 115.0 (NAVD88)

GEOLOGIC LOG OF DRILL HOLE NO. MW-09-83

FEATURE: Groundwater Monitoring
LOCATION: Reach 4A, River Bank Right, Merced County
BEGUN: 11/3/09 FINISHED: 11/5/09
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 50.7 ft. (El. 64.14 ft.) 11/6/2009

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,274,920.0 E 6,112,632.9 (NAGD83)
TOTAL DEPTH: 62.5 ft.

STATE: California
GROUND SURFACE ELEVATION: 114.8 ft. (NAVD88)
T.O.C ELEVATION: 114.84 ft. (NAVD88)
HOLE LOGGED BY: G. Russell & J. Vauk
REVIEWED BY: J. Vauk

HOLE COMPLETION:

MW-09-83
Well Casing - 0.0 to 51.5 ft. (T.O.C. El. 114.84 ft.)
Dual Pre-pack Screen - 51.5 to 61.5 ft. (Slotted 0.020-inch)
Well Screen Filter Pack - #3 Sand Filter Pack - 46.5 to 62.5 ft. (#3 Sand)
Bentonite Seal - 2.0 to 46.5 ft.
Well Protection - flush-mounted 18-inch manhole (15/16-inch hexbolts)

MW-09-83B
Well Casing - 0.0 to 22.5 ft. (T.O.C. El. 115.01 ft.)
Dual Pre-pack Screen - 22.5 to 42.5 ft. (Slotted 0.020-inch)
Well Screen Filter Pack - #3 Sand Filter Pack - 18.3 to 43.0 ft. (#3 Sand)
Bentonite Seal - 2.0 to 18.3 ft.
Well Protection - flush-mounted 18-inch manhole (15/16-inch hexbolts)

DEPTH	% CORE RECOVERY	% SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION	ELEVATION	VISUAL CLASSIFICATION	ELEVATION	GEOLOGIC UNIT SYMBOL
	94												89.5	
												ML	87.6	
		48.1	18.8	66.9	33.1	0.0	30.2	10.2	18.6	s(CL)	87.3			
												s(CL/ML)	84.8	
30	100													
												SM	82.6	
		41.7	7.5	49.2	50.8	0.0	NP	NP	13.7	SM	82.8			
												SM	81.7	
												s(ML)	80.8	
												SM	80.5	
35	100													
												s(CL/ML)	77.6	
														Qal
		20.2	16.1	36.3	63.7	0.0	24.3	5.9	11.5	SC-SM	74.8	SM		
40	96												72.5	
45	100											(CL)s		
		63.0	24.3	87.3	12.7	0.0	31.5	7.7	24.1	ML	68.6		66.3	
												SM	65.8	
												s(CL/ML)	65.3	
												SM		

23.7 to 23.9 ft.: SANDY SILT, s(ML): About 70% non-plastic fines with rapid dilatancy; about 30% fine sand; maximum size: fine sand; moist, light brown; soft consistency.

23.9 to 25.3 ft.: SILTY SAND, SM: About 70% fine to medium sand; about 30% non-plastic fines with rapid dilatancy; maximum size: medium sand; dry, light brown; soft consistency.

25.3 to 27.2 ft.: SILT, ML: About 90% fines with low to medium plasticity, toughness and dry strength, and no to slow dilatancy; about 10% fine sand; maximum size: fine sand; moist, light brown; soft consistency.

27.2 to 30.0 ft.: SANDY SILTY CLAY, s(CL/ML): About 70% fines with medium plasticity, low to medium dry strength and toughness, no to slow dilatancy; about 30% fine sand; maximum size: fine sand; moist, light brown; soft consistency.

Laboratory Data Interval
27.2 to 27.5 ft.

30.0 to 32.2 ft.: SILTY SAND, SM: About 60% fine sand; about 40% non-plastic fines; maximum size: fine sand; moist, light brown; very soft consistency.

Laboratory Data Interval
31.7 to 32.0 ft.

32.2 to 33.1 ft.: SILTY SAND, SM: About 75% fine sand; about 25% non-plastic fines; maximum size: fine sand; moist, light brown; very soft consistency.

33.1 to 34.0 ft.: SANDY SILT, s(ML): About 65% non-plastic fines with slow dilatancy; about 35% fine sand; maximum size: fine sand; moist, light brown; soft consistency.

34.0 to 34.3 ft.: SILTY SAND, SM: About 60% fine to medium sand; about 40% fines; trace of gravel; maximum size: ¾-inch; moist, light brown; soft consistency.

34.3 to 37.2 ft.: SANDY SILTY CLAY, s(CL/ML): About 65% fines with low plasticity, medium toughness and dry strength, and slow dilatancy; about 35% fine sand; maximum size: fine sand; moist, light brown; soft to firm consistency.

37.2 to 42.3 ft.: SILTY SAND, SM: About 65% fine sand; about 35% fines; maximum size: fine sand; moist, brown; soft to firm consistency.

Laboratory Data Interval
39.7 to 40.0 ft.

42.3 to 48.5 ft.: LEAN CLAY WITH SAND, (CL)s: About 75% fines with medium plasticity, toughness and dry strength, and no to slow dilatancy; about 25% fine to coarse sand; trace of gravel; maximum size: 1/2 inches; moist, gray-brown; soft consistency; gravel consists of angular fragments of cemented sand with fines.

Laboratory Data Interval
45.9 to 46.2 ft.

COMMENTS:
FADC = Flight Auger Dry Core
HSA = Hollow Stem Auger
NP = Non-plastic
NR = No Recovery
NA = Not applicable
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing

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

MW-09-83B
TOC Coordinates= N 2274916.7 E 6112625.6 (NAGD83) El. 115.01 (NAVD88)
Ground surface El.= 115.0 (NAVD88)

GEOLOGIC LOG OF DRILL HOLE NO. MW-09-83

FEATURE: Groundwater Monitoring
LOCATION: Reach 4A, River Bank Right, Merced County
BEGUN: 11/3/09 FINISHED: 11/5/09
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 50.7 ft. (El. 64.14 ft.) 11/6/2009

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,274,920.0 E 6,112,632.9 (NAGD83)
TOTAL DEPTH: 62.5 ft.

STATE: California
GROUND SURFACE ELEVATION: 114.8 ft. (NAVD88)
T.O.C ELEVATION: 114.84 ft. (NAVD88)
HOLE LOGGED BY: G. Russell & J. Vauk
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
		96												64.5		
											50.7 ft. (El. 64.14 ft.)					
			41.2	0.6	41.8	58.2	0.0	NP	NP	24.3	SM	63.1				
	55	8											SM	57.8	Qal	
			2.1	0.0	2.1	97.9	0.0	NP	NP	18.4	SP	55.5	SP	54.5		
	60	86														
			45.1	24.7	69.8	30.2	0.0	37.9	16.9	24.2	s(CL)	52.9	s(CL/ML)	52.3		

BOTTOM OF HOLE

48.5 to 49.0 ft.: SILTY SAND, SM: About 85% fine to medium sand; about 15% fines; maximum size: medium sand; moist, light brown; very soft consistency.

49.0 to 49.5 ft.: SANDY SILTY CLAY, s(CL/ML): About 55% fines with low plasticity, toughness and dry strength, and no to slow dilatancy; about 45% sand; maximum size: fine sand; moist, light to medium brown; soft consistency.

49.5 to 50.3 ft.: SILY SAND, SM: About 60% fine sand; about 40% fines; maximum size: fine sand; moist to wet, brown (some rust staining); firm consistency.

50.3 to 57.0 ft.: SILTY SAND, SM: About 80% fine sand; about 20% fines; maximum size: fine sand; wet, gray-brown; very soft consistency.

Laboratory Data Interval
51.4 to 51.7 ft.

57.0 to 60.3 ft.: POORLY GRADED SAND, SP: About 95% fine to medium sand; about 5% fines; maximum size: medium sand; wet, gray-brown; very soft consistency.

Laboratory Data Interval
59.0 to 59.3 ft.

60.3 to 62.5 ft.: SANDY SILTY CLAY, s(CL/ML): About 65% fines with low plasticity, toughness and dry strength, and slow dilatancy; about 35% sand; maximum size: coarse sand; moist, green-gray to brown; firm to hard consistency.

Laboratory Data Interval
61.6 to 61.9 ft.

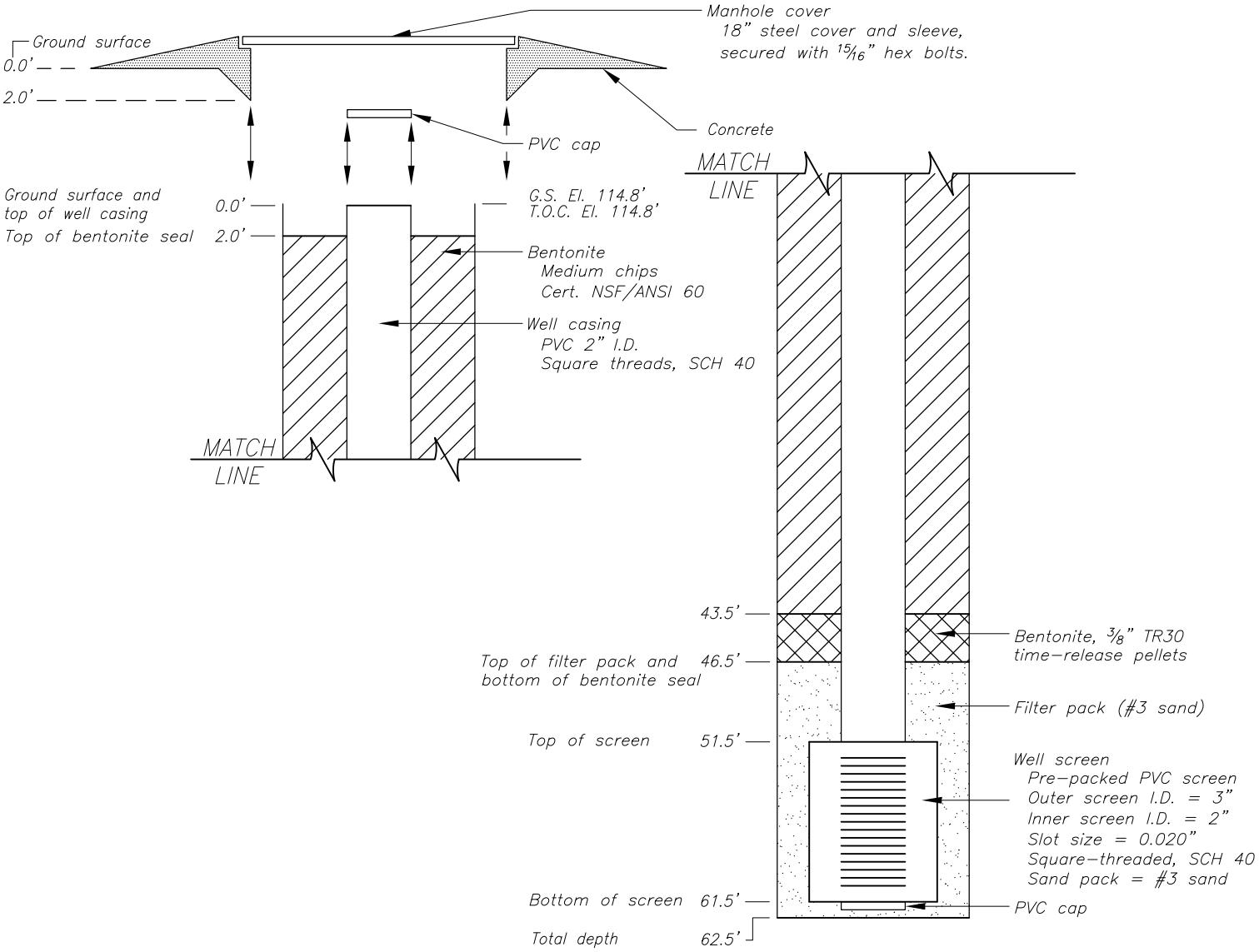
T.D.= 62.5 ft.

COMMENTS:
FADC = Flight Auger Dry Core
HSA = Hollow Stem Auger
NP = Non-plastic
NR = No Recovery
NA = Not applicable
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing

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

MW-09-83B
TOC Coordinates= N 2274916.7 E 6112625.6 (NAGD83) El. 115.01 (NAVD88)
Ground surface El.= 115.0 (NAVD88)

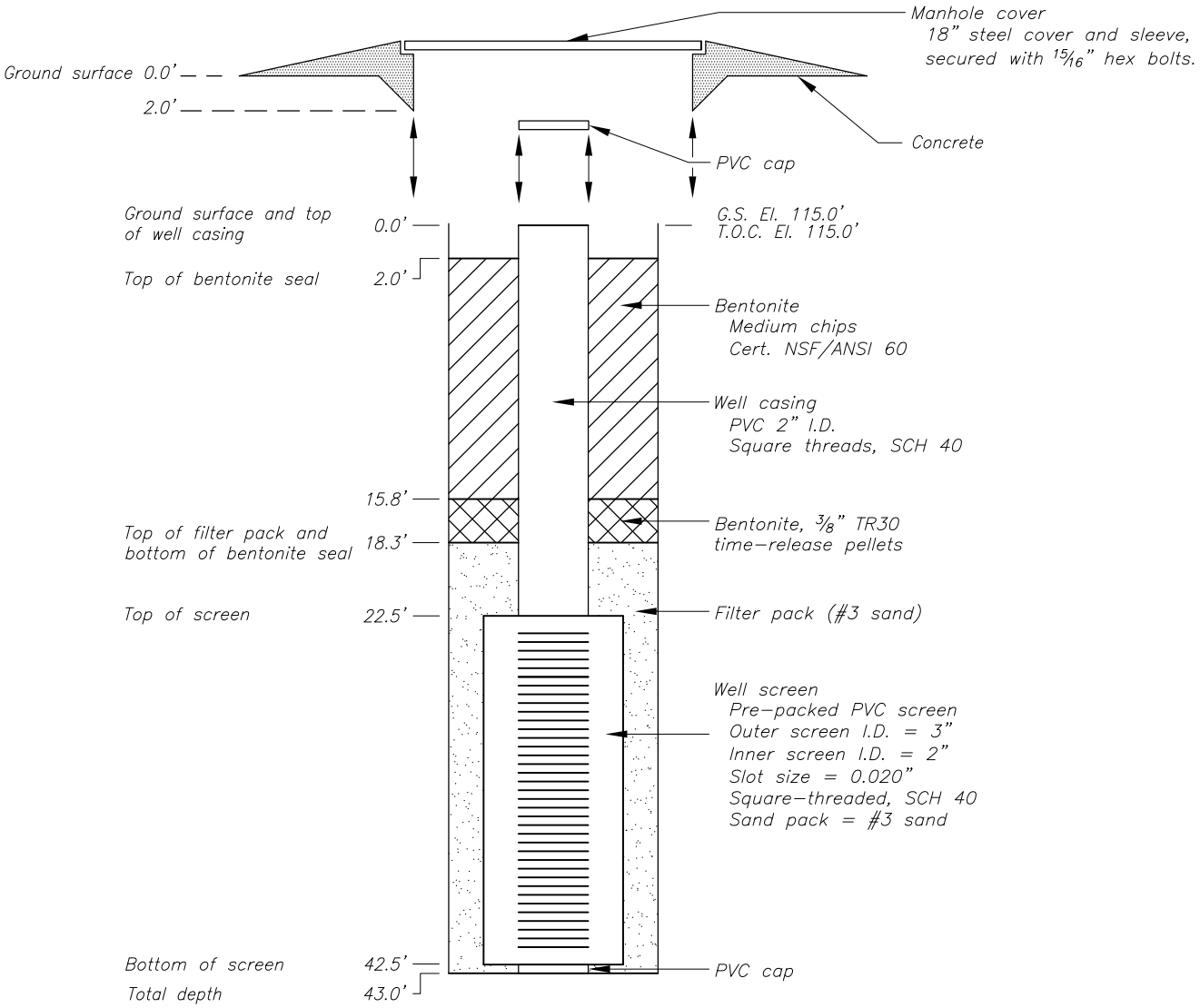
MW–09–83	GEOLOGIST: J. VAUK
WELL COMPLETION DIAGRAM	DRILLER: J. HUCKABY
DATE COMPLETED: 11/05/2009	HELPER: T. MENNING
TOP OF WELL CASING COORDINATES: N2274920.0 E6112632.9 (NAD83) ELEVATION 114.8' (NAVD88) GROUND SURFACE ELEVATION 114.8' (NAVD88)	



*NOT TO SCALE

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

MW-09-83B	GEOLOGIST: J. VAUK
WELL COMPLETION DIAGRAM	DRILLER: J. HUCKABY
DATE COMPLETED: 11/05/2009	HELPER: T. MENNING
TOP OF WELL CASING COORDINATES: N2274916.7 E6112625.6 (NAD83) ELEVATION 115.0' (NAVD88) GROUND SURFACE ELEVATION 115.0' (NAVD88)	



*NOT TO SCALE

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

GEOLOGIC LOG OF DRILL HOLE NO. MW-09-84

FEATURE: Groundwater Monitoring
LOCATION: Reach 4A, River Bank Right, Merced County
BEGUN: 10/27/09 FINISHED: 10/28/09
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 45.0 ft. (El. 70.65 ft.) 10/28/2009

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,271,709.4 E 6,110,066.2 (NAGD83)
TOTAL DEPTH: 52.5 ft.

STATE: California
GROUND SURFACE ELEVATION: 115.8 ft. (NAVD88)
T.O.C ELEVATION: 115.65 ft. (NAVD88)
HOLE LOGGED BY: G.Turlington
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.

DRILLED BY:
USGS Drill Crew
James Huckaby, Driller
Jim Rauman, Helper

DRILL RIG:
CME-550

DRILLING & SAMPLING METHODS:
Drill hole MW-09-84 was advanced using hollow stem flight augers dry core system (FADC) with a 7-5/8-inch O.D. and 4-1/4-inch I.D., and a 5-foot-long 3-inch I.D. split sample barrel.

Interval Method
0.0 to 45.2 ft. - FADC

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
0.0 to 47.5 ft. - smooth drilling
47.5 to 52.5 ft. - add water, smooth drilling

DRILL FLUID, RETURN AND COLOR:
0.0 to 47.5 ft. - None
47.5 to 52.5 ft. - Water, no return

WATER LEVEL:
45.0 ft. from ground surface, on 10/28/09

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

HOLE COMPLETION:
Well Casing - 0.1 to 32.0 ft. (T.O.C. El. 115.65 ft.)
Dual Pre-pack Screen - 32.0 to 52.0 ft. (Slotted 0.020-inch)
Well Screen Filter Pack - #3 Sand Filter Pack - 27.0 to 52.5 ft. (#3 Sand)
Bentonite Seal - 2.0 to 27.0 ft.
Well Protection - flush-mounted 18-inch manhole (15/16-inch hexbolts)

DEPTH	% CORE RECOVERY	% SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION / ELEVATION	VISUAL CLASSIFICATION / ELEVATION	GEOLOGIC UNIT SYMBOL
	88	21.4	15.9	37.3	62.3	0.4	22.4	7.6	2.2	SC 113.5	SM 113.5	
		20.3	7.0	27.3	72.7	0.0	NP	NP	1.9	SM 112.1	SM 112.1	
		29.9	53.0	82.9	17.1	0.0	49.0	26.1	20.9	(CL)s 111.3	CH 111.3	
5	84											
	100	39.7	28.8	68.5	31.5	0.0	29.5	9.9	7.8	s(CL)	s(ML)	
10												
	96									100.6	100.6	
15		8.1	1.6	9.7	90.0	0.3	NP	NP	0.8	SW-SM 99.3	SP 99.3	Qal
	100	53.3	34.2	87.5	12.5	0.0	30.8	14.0	9.0	CL	s(CL)	
20												
										92.2	92.2	
	100	58.2	12.6	70.8	29.2	0.0	25.9	6.9	7.3	(CL-ML)s	(CL)s	
25												
										87.2	87.2	

0.0 to 52.5 feet
QUATERNARY ALLUVIUM (Qal)

0.0 to 2.2 ft.: SILTY SAND, SM: About 80% fine to medium sand; about 20% non-plastic fines with rapid dilatancy; trace of hard to very hard, sub-rounded to sub-angular gravel; maximum size: 1/2 inches; dry, tan, no reaction with HCl; hard consistency; includes grass and roots from 0.0 to 0.2 feet.

Laboratory Data Interval
0.0 to 2.2 ft.

2.2 to 3.6 ft.: SILTY SAND, SM: About 85% fine to medium sand; about 15% non-plastic fines with rapid dilatancy; maximum size: coarse sand; dry, light gray, no reaction with HCl; very soft consistency.

Laboratory Data Interval
2.2 to 3.6 ft.

3.6 to 4.4 ft.: FAT CLAY, CH: About 90% fines with medium to high plasticity, medium toughness, high to very high dry strength, and slow dilatancy; about 10% fine sand; maximum size: fine sand; moist, dark gray to black, no reaction with HCl; very hard consistency.

Laboratory Data Interval
3.6 to 4.4 ft.

4.4 to 15.1 ft.: SANDY SILT, s(ML): About 70% non-plastic fines with rapid dilatancy; about 30% fine to medium sand; maximum size: medium sand; dry, brown, no reaction with HCl; very soft consistency.

Laboratory Data Interval
4.4 to 15.1 ft.

15.1 to 16.4 ft.: POORLY GRADED SAND, SP: About 95% fine to coarse sand (coarse sand is sub-rounded to sub-angular, hard to very hard); about 5% non-plastic fines with rapid dilatancy; maximum size: coarse sand; dry, tan, no reaction with HCl; very soft consistency.

Laboratory Data Interval
15.1 to 16.4 ft.

16.4 to 23.5 ft.: SANDY LEAN CLAY, s(CL): About 70% fines with low plasticity and toughness, low to medium dry strength, and slow to rapid dilatancy; about 30% fine to medium sand (mostly fine); maximum size: medium sand; moist, tan, no reaction with HCl; firm consistency.

Laboratory Data Interval
16.4 to 23.5 ft.

23.5 to 28.5 ft.: LEAN CLAY WITH SAND, (CL)s: About 80% fines with low plasticity, toughness and dry strength, slow to rapid dilatancy; about 20% fine sand; maximum size: fine sand; moist, tan, no reaction with HCl; firm consistency.

Laboratory Data Interval
23.5 to 28.5 ft.

COMMENTS:
FADC = Flight Auger Dry Core
HSA = Hollow Stem Auger
NP = Non-plastic
NR = No Recovery
NA = Not applicable
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing

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-09-84

FEATURE: Groundwater Monitoring
LOCATION: Reach 4A, River Bank Right, Merced County
BEGUN: 10/27/09 FINISHED: 10/28/09
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 45.0 ft. (El. 70.65 ft.) 10/28/2009

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,271,709.4 E 6,110,066.2 (NAGD83)
TOTAL DEPTH: 52.5 ft.

STATE: California
GROUND SURFACE ELEVATION: 115.8 ft. (NAVD88)
T.O.C ELEVATION: 115.65 ft. (NAVD88)
HOLE LOGGED BY: G.Turlington
REVIEWED BY: J. Vauk

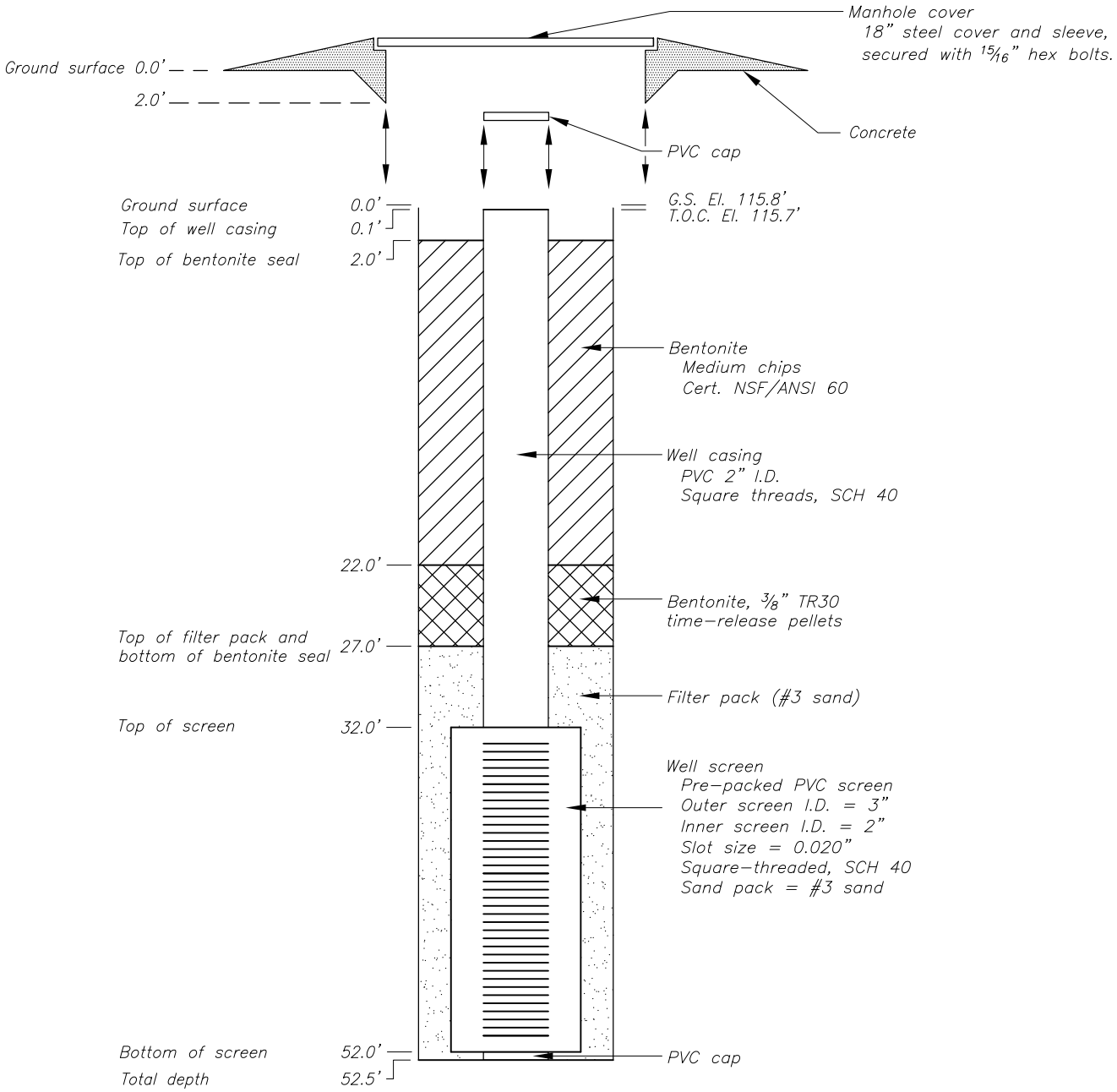
NOTES	DEPTH	% CORE RECOVERY	LABORATORY DATA: % SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION / ELEVATION	VISUAL CLASSIFICATION / ELEVATION	GEOLOGIC UNIT SYMBOL	CLASSIFICATION AND PHYSICAL CONDITION
	35	100	47.8	18.1	65.9	34.1	0.0	29.6	9.6	10.3	s(CL) 78.5	s(CL) 78.5	Qal	**28.5 to 37.2 ft.: SANDY LEAN CLAY, s(CL):** About 65% fines with medium plasticity, low toughness, no dry strength, and rapid dilatancy, about 35% fine sand; maximum size: fine sand; moist, tan, no reaction with HCl; soft consistency. Laboratory Data Interval 28.5 to 37.2 ft. **37.2 to 45.7 ft.: SANDY LEAN CLAY, s(CL):** About 55% fines with low plasticity toughness and dry strength, and slow dilatancy; about 45% fine sand; maximum size: fine sand; moist, brown, no reaction with HCl; soft to firm consistency. Laboratory Data Interval 37.2 to 45.7 ft.
	40	94												
		100	36.0	18.0	54.0	46.0	0.0	29.2	11.6	11.6	s(CL)	s(CL)		**45.7 to 52.5 ft.: POORLY GRADED SAND, SP:** About 95% fine to coarse sand (coarse sand is sub-rounded to sub-angular, hard to very hard); about 5% non-plastic fines with rapid dilatancy; maximum size: coarse sand; brown, wet, no reaction with HCl; very soft consistency. Laboratory Data Interval 45.7 to 52.5 ft.
	45	100									▼ 45.0 ft. (El. 70.65 ft.) 70.0	70.0		
			8.6	1.4	10.0	90.0	0.0	NP	NP	17.3	SP-SM	SP		***T.D.= 52.5 ft.***
	50	38									63.2	63.2		

BOTTOM OF HOLE

COMMENTS:
FADC = Flight Auger Dry Core
HSA = Hollow Stem Auger
NP = Non-plastic
NR = No Recovery
NA = Not applicable
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing

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

MW–09–84	GEOLOGIST: G. TURLINGTON
WELL COMPLETION DIAGRAM	DRILLER: J. HUCKABY
DATE COMPLETED: 10/28/2009	HELPER: T. RAUMAN
TOP OF WELL CASING COORDINATES: N2271709.4 E6110066.2 (NAD83) ELEVATION 115.7' (NAVD88) GROUND SURFACE ELEVATION 115.8' (NAVD88)	



*NOT TO SCALE

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

GEOLOGIC LOG OF DRILL HOLE NO. MW-09-85

FEATURE: Groundwater Monitoring
LOCATION: Reach 4A, River Bank Right, Merced County
BEGUN: 10/26/09 FINISHED: 10/27/09
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 34.0 ft. (El. 86.65 ft.) 10/26/2009

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,271,341.5 E 6,109,606.0 (NAGD83)
TOTAL DEPTH: 82.5 ft.

STATE: California
GROUND SURFACE ELEVATION: 120.8 ft. (NAVD88)
T.O.C ELEVATION: 120.65 ft. (NAVD88)
HOLE LOGGED BY: G.Turlington
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.

DRILLED BY:
USGS Drill Crew
James Huckaby, Driller
Todd Menning, Helper

DRILL RIG:
CME-550

DRILLING & SAMPLING METHODS:
Drill hole MW-09-85 was advanced using hollow stem flight augers with continuous dry core sampling system (FADC) from the ground surface to a total depth of 82.5 feet. FADC system uses augers with a 7-5/8-inch O.D. and 4-1/4-inch I.D., and a 5-foot-long, 3-inch I.D. split sample barrel.

Interval Method
0.0 to 82.5 ft. - FADC

MW-09-85B was drilled and completed as a well using hollow stem flight augers and a wooden plug. The total depth of the hole was 30.0 feet b.g.s. and the bottom of the well screen was set at 29.5 feet of depth.

Interval Method
0.0 to 30.0 ft. - FADC with wooden plug

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
MW-09-85
0.0 to 62.5 ft. - smooth drilling
62.5 to 82.5 ft. - added water, smooth drilling

MW-09-85B
0.0 to 30.0 ft. - blind drilled
30.0 ft. - knocked out wooden plug and set well

DRILL FLUID, RETURN AND COLOR:
MW-09-85
0.0 to 50.5 ft. - None
50.5 to 82.5 ft. - Water, no return

MW-09-85B
0.0 to 30.0 ft. - None

WATER LEVEL:
34.0 ft. b.g.s. on 10/27/2009 (MW-09-85)

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

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
	100										SP/SM 118.9	Fill
5	82										(SP/SM)g 112.7	
10	90	26.0	10.2	36.2	63.8	0.0	NP	NP	5.6	SM 105.4	SM 105.4	Qal
15	92	14.4	7.0	21.4	78.6	0.0	NP	NP	4.3	SM 101.5	SM 101.5	
20	100	44.4	26.8	71.2	28.8	0.0	26.3	11.3	20.6	(CL)s 100.1	s(CL) 100.1	
		8.1	0.8	8.9	91.1	0.0	NP	NP	2.4	SP-SM 98.0	SP 98.0	
25	100	38.3	41.8	80.1	19.9	0.0	31.0	14.8	16.6	(CL)s 93.9	(CL)s 93.9	
30	100	74.7	14.7	89.4	10.6	0.0	27.4	6.8	14.0	CL-ML ▼ 34.0 ft. (El. 86.65 ft.) 84.9	(ML)s 84.9	
35	100											
40	70	17.2	0.9	18.1	81.9	0.0	NP	NP	15.9	SM	SM	

SOIL DESCRIPTIONS CHARACTERIZE SAMPLES FROM DRILL HOLE MW-09-85.

0.0 to 82.5 feet
QUATERNARY ALLUVIUM (Qal)

0.0 to 1.8 ft.: POORLY GRADED SAND WITH SILT, SP/SM: About 80% fine to coarse sand (coarse sand is angular to sub-angular, hard to very hard); about 10% fine, hard to very hard, rounded to sub-rounded gravel; about 10% non-plastic fines with rapid dilatancy; maximum size: ½-inch; dry, light brown, no reaction with HCl; soft consistency; includes grass and roots.

1.8 to 8.0 ft.: POORLY GRADED SAND WITH SILT AND GRAVEL, (SP/SM)g: About 75% fine to coarse sand; about 15% fine, hard, sub-rounded to sub-angular gravel; about 10% non-plastic fines with rapid dilatancy; maximum size: ½-inch; dry, black and tan, no reaction with HCl; very soft consistency; asphalt encountered.

8.0 to 15.3 ft.: SILTY SAND, SM: About 60-90% fine to medium sand; about 10-40% non-plastic fines with rapid dilatancy; maximum size: medium sand; dry to moist, light brown, no reaction with HCl; very soft to soft consistency.

Laboratory Data Interval
8.0 to 15.3 ft.

15.3 to 19.2 ft.: SILTY SAND, SM: About 80% fine to coarse sand (coarse sand is sub-rounded to sub-angular, hard); about 20% non-plastic fines with rapid dilatancy; maximum size: coarse sand; dry, light brown, no reaction with HCl; very soft consistency.

Laboratory Data Interval
15.3 to 19.2 ft.

19.2 to 20.6 ft.: SANDY LEAN CLAY, s(CL): About 60% fines with low plasticity, toughness and dry strength, and slow dilatancy; about 40% fine sand; maximum size: fine sand; moist, dark gray, no reaction with HCl; soft consistency.

Laboratory Data Interval
19.2 to 20.6 ft.

20.6 to 22.7 ft.: POORLY GRADED SAND, SP: About 95% fine to coarse sand, (coarse sand is sub-rounded to sub-angular, hard); about 5% non-plastic fines with rapid dilatancy; maximum size: coarse sand; dry, light brown, no reaction with HCl; very soft consistency.

Laboratory Data Interval
20.6 to 22.7 ft.

22.7 to 26.8 ft.: LEAN CLAY WITH SAND, (CL)s: About 85% fines with low to medium plasticity, medium toughness, no dry strength, and rapid dilatancy; about 15% fine sand; maximum size: fine sand; moist, dark gray to brown, no reaction with HCl; hard consistency.

Laboratory Data Interval
22.7 to 26.8 ft.

COMMENTS:
FADC = Flight Auger Dry Core
HSA = Hollow Stem Auger
NP = Non-plastic
NR = No Recovery
NA = Not applicable
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing

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

MW-09-85B
TOC Coordinates= N 2271346.9 E 6109601.5 (NAGD83) El. 120.51 (NAVD88)
Ground surface El.= 120.63 (NAVD88)

GEOLOGIC LOG OF DRILL HOLE NO. MW-09-85

FEATURE: Groundwater Monitoring
LOCATION: Reach 4A, River Bank Right, Merced County
BEGUN: 10/26/09 FINISHED: 10/27/09
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 34.0 ft. (El. 86.65 ft.) 10/26/2009

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,271,341.5 E 6,109,606.0 (NAGD83)
TOTAL DEPTH: 82.5 ft.

STATE: California
GROUND SURFACE ELEVATION: 120.8 ft. (NAVD88)
T.O.C ELEVATION: 120.65 ft. (NAVD88)
HOLE LOGGED BY: G.Turlington
REVIEWED BY: J. Vauk

HOLE COMPLETION:

MW-09-85
Well Casing - 0.1 to 52.0 ft. (T.O.C. El. 120.65 ft.)
Dual Pre-pack Screen - 52.0 to 82.0 ft. (Slotted 0.020-inch)
Well Screen Filter Pack - #3 Sand Filter Pack - 44.0 to 82.5 ft. (#3 Sand)
Bentonite Seal - 2.0 to 44.0 ft.
Well Protection - flush-mounted 18-inch manhole (15/16-inch hexbolts)

MW-09-85B
Well Casing - 0.1 to 9.5 ft. (T.O.C. El. 120.51 ft.)
Dual Pre-pack Screen - 9.5 to 29.5 ft. (Slotted 0.020-inch)
Well Screen Filter Pack - #3 Sand Filter Pack - 8.0 to 30.0 ft. (#3 Sand)
Bentonite Seal - 2.0 to 8.0 ft.
Well Protection - flush-mounted 18-inch manhole (15/16-inch hexbolts)

DEPTH	% CORE RECOVERY	% SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION	ELEVATION	VISUAL CLASSIFICATION	ELEVATION	GEOLOGIC UNIT SYMBOL
	64										73.2		73.2	
50	100													
	98													
55														
	100	47.9	14.0	61.9	38.1	0.0	25.2	9.2	16.2	s(CL)		s(ML)		
60														
	100													Qal
65														
	100													
70											48.5		48.5	
	100													
75		40.8	28.7	69.5	30.5	0.0	37.7	18.9	19.0	s(CL)		(CL)s		
	100													
80											38.2		38.2	

BOTTOM OF HOLE

26.8 to 35.8 ft.: SILT WITH SAND, (ML)s: About 80% fines with no to low plasticity, low toughness, no dry strength, and rapid dilatancy; about 20% fine sand; maximum size: fine sand; moist, brown, no reaction with HCl; very soft to soft consistency; occasional reddish-brown blebs and laminations.

Laboratory Data Interval
26.8 to 35.8 ft.

35.8 to 47.5 ft.: SILTY SAND, SM: About 85% fine to coarse sand (mostly fine to medium); about 15% non-plastic fines with rapid dilatancy; maximum size: coarse sand; dry, tan, no reaction with HCl; very soft consistency.

Laboratory Data Interval
35.8 to 47.5 ft.

47.5 to 72.2 ft.: SANDY SILT, s(ML): About 70% non-plastic fines with slow to rapid dilatancy; about 30% fine sand; maximum size: fine sand; moist, brown, no reaction with HCl; very soft to soft consistency.

Laboratory Data Interval
47.5 to 72.2 ft.

72.2 to 82.5 ft.: LEAN CLAY WITH SAND, (CL)s: About 80% fines with low plasticity, toughness, no to low dry strength, and slow dilatancy; about 20% fine sand; maximum size: fine sand; moist, brown, no reaction with HCl; soft to firm consistency.

Laboratory Data Interval
72.2 to 82.5 ft.

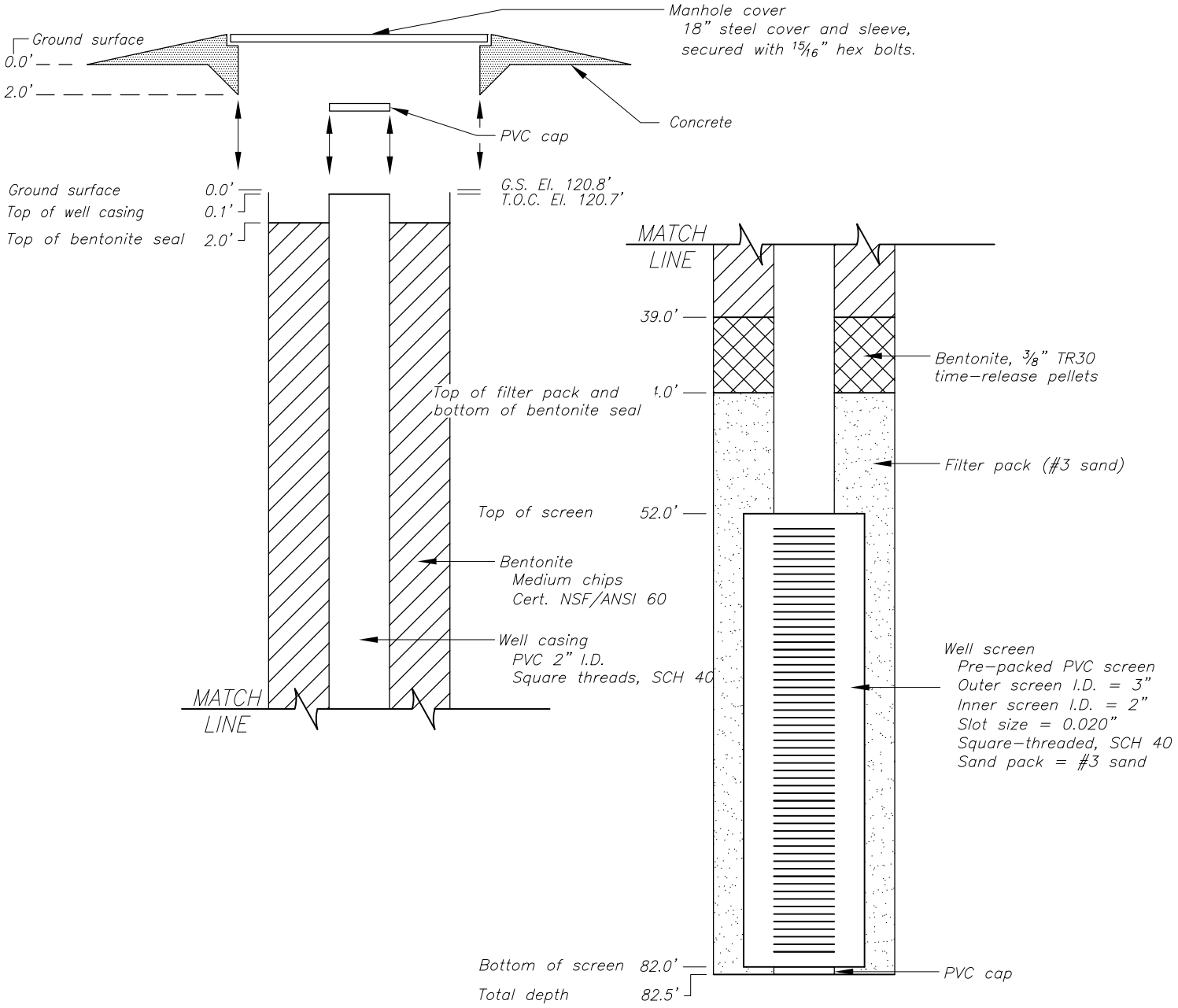
T.D.= 82.5 ft.

COMMENTS:
FADC = Flight Auger Dry Core
HSA = Hollow Stem Auger
NP = Non-plastic
NR = No Recovery
NA = Not applicable
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing

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

MW-09-85B
TOC Coordinates= N 2271346.9 E 6109601.5 (NAGD83) El. 120.51 (NAVD88)
Ground surface El.= 120.63 (NAVD88)

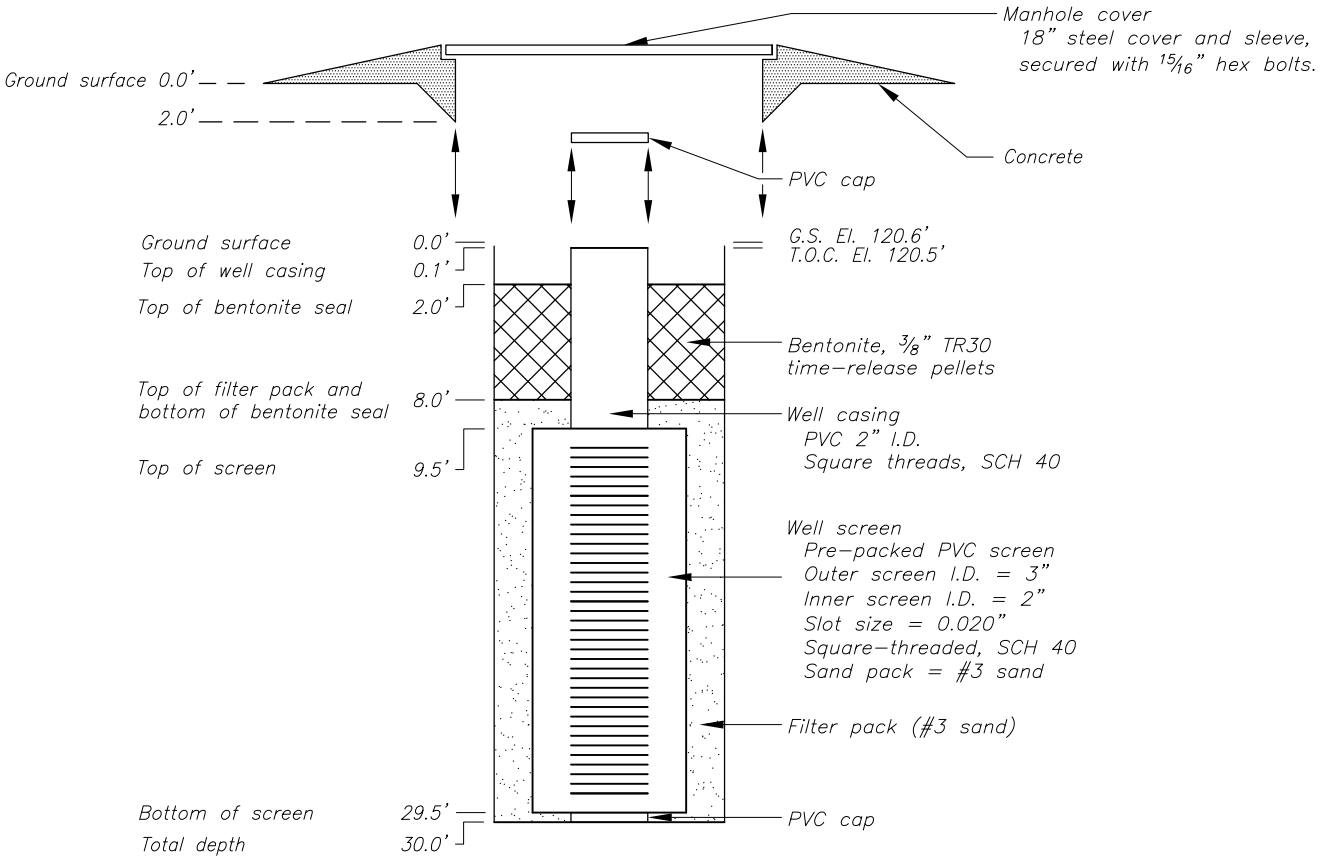
MW–09–85	GEOLOGIST: G. TURLINGTON
WELL COMPLETION DIAGRAM	DRILLER: J. HUCKABY
DATE COMPLETED: 10/27/2009	HELPER: T. MENNING
TOP OF WELL CASING COORDINATES: N2271341.5 E6109606.0 (NAD83) ELEVATION 120.7' (NAVD88) GROUND SURFACE ELEVATION 120.8' (NAVD88)	



*NOT TO SCALE

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

MW–09–85B	GEOLOGIST: G. TURLINGTON
WELL COMPLETION DIAGRAM	DRILLER: J. HUCKABY
DATE COMPLETED: 10/27/2009	HELPER: T. MENNING
TOP OF WELL CASING COORDINATES: N2271346.9 E6109601.5 (NAD83) ELEVATION 120.5' (NAVD88) GROUND SURFACE ELEVATION 120.6' (NAVD88)	



*NOT TO SCALE

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

GEOLOGIC LOG OF DRILL HOLE NO. MW-09-86

FEATURE: Groundwater Monitoring
LOCATION: Reach 4A, River Bank Left, Merced County
BEGUN: 11/6/09 FINISHED: 11/8/09
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 37.8 ft. (El. 83.09 ft.) 11/8/2009

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,271,050.7 E 6,109,195.1 (NAGD83)
TOTAL DEPTH: 72.5 ft.

STATE: California
GROUND SURFACE ELEVATION: 121.0 ft. (NAVD88)
T.O.C ELEVATION: 120.89 ft. (NAVD88)
HOLE LOGGED BY: G.Turlington
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.

DRILLED BY:
USGS Drill Crew
James Huckaby, Driller
Todd Menning, Helper

DRILL RIG:
CME-550

DRILLING & SAMPLING METHODS:
Drill hole MW-09-86 was advanced using hollow stem flight augers with continuous dry core sampling system (FADC) from the ground surface to a total depth of 72.5 feet. FADC system uses augers with a 7-5/8-inch O.D. and 4-1/4-inch I.D., and a 5-foot-long, 3-inch I.D. split sample barrel.

Interval Method
0.0 to 72.5 ft. - FADC

MW-09-86B was drilled and completed as a well using 7-5/8-inch O.D. and 4-1/4-inch I.D. hollow stem flight augers and a wooden plug. The total depth of the hole was 25.0 feet b.g.s. and the bottom of the well screen was set at 24.5 feet of depth.

Interval Method
0.0 to 25.0 ft. - FADC with wooden plug

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
MW-09-86
0.0 to 52.5 ft. - smooth drilling
52.5 to 72.5 ft. - added water, smooth drilling

MW-09-86B
0.0 to 25.0 ft. - blind drilled
25.0 ft. - knocked out wooden plug and set well

DRILL FLUID, RETURN AND COLOR:
MW-09-86
0.0 to 52.5 ft. - None
50.5 to 72.5 ft. - Water, no return

MW-09-86B
0.0 to 25.0 ft. - None

WATER LEVEL:
37.8 ft. b.g.s. on 11/8/2009 (MW-09-86)

REASON FOR HOLE TERMINATION:
The holes were terminated upon successful completion to the target depth.

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
	40										s(ML)g	Fill
											116.3	
5	80										s(CL)	
											113.9	
											s(ML)	
											112.1	
10	100										(CL/CH)s	
		29.8	46.6	76.4	23.6	0.0	45.1	26.5	17.0	(CL)s 109.6	108.4	
											(CL)s	
											107.4	
		44.1	26.2	70.3	29.7	0.0	26.6	9.8	15.5	(CL)s 106.6	s(CL)	
15	100										104.8	
											SM	
											103.4	Qal
		5.8	4.8	10.6	89.4	0.0	NP	NP	4.9	SP-SM 101.6	SM	
20	88										100.4	
											s(CL)	
											98.9	
		6.6	5.4	12.0	88.0	0.0	NP	NP	5.1	SW-SM 98.3	SP/SM	
											97.9	
											s(CL)	
											96.7	
25	100										(CL)s	
		45.1	34.1	79.2	20.8	0.0	29.6	13.8	15.5	(CL)s 94.6	93.2	
											ML	
											91.4	

SOIL DESCRIPTIONS CHARACTERIZE SAMPLES FROM DRILL HOLE MW-09-86.

0.0 to 72.5 feet
QUATERNARY ALLUVIUM (Qal)

0.0 to 4.6 ft.: SANDY SILT WITH GRAVEL, s(ML)g: About 50% fines with low plasticity; about 25% sand; about 25% gravel; maximum size: 3-inches; dry, light gray-brown; soft consistency; grass and roots.

4.6 to 7.0 ft.: SANDY LEAN CLAY, s(CL): About 70% fines with medium plasticity and toughness, high dry strength, and no dilatancy; about 30% fine to medium sand; maximum size: medium sand; moist, brown with light brown streaks; hard consistency.

7.0 to 8.8 ft.: SANDY SILT, s(ML): About 60% fines with no to low plasticity and dry strength, and rapid dilatancy; about 40% fine sand; maximum size: fine sand; moist, dark brown; very soft to soft consistency.

8.8 to 12.5 ft.: LEAN TO FAT CLAY WITH SAND, (CL/CH)s: About 80% fines with high plasticity and toughness, very high dry strength, and no dilatancy; about 20% sand; maximum size: fine sand; moist, very dark brown; firm to hard consistency.

Laboratory Data Interval
11.0 to 11.3 ft.

12.5 to 13.5 ft.: LEAN CLAY WITH SAND, (CL)s: About 75% fines with medium to high plasticity, medium toughness, high dry strength, and slow dilatancy; about 25% fine sand; maximum size: fine sand; moist, mottled greenish-brown; soft to firm consistency.

13.5 to 16.1 ft.: SANDY LEAN CLAY, s(CL): About 70% fines with low plasticity and toughness, high dry strength, and slow dilatancy; about 30% fine sand; maximum size: fine sand; moist, olive brown; soft to firm consistency.

Laboratory Data Interval
14.0 to 14.3 ft.

16.1 to 17.5 ft.: SILTY SAND, SM: About 75% fine sand with grains consisting of quartz, mica, and various other minerals; about 25% fines; maximum size: fine sand; moist, brown; very soft consistency.

17.5 to 20.5 ft.: SILTY SAND, SM: About 85% fine sand; about 15% fines; maximum size: fine sand; moist, light greenish-brown; very soft consistency.

Laboratory Data Interval
19.0 to 19.3 ft.

20.5 to 22.0 ft.: SANDY LEAN CLAY, s(CL): About 60% fines with low to medium plasticity and toughness, high dry strength, no to slow dilatancy; about 40% fine to medium sand; maximum size: medium sand; moist, olive brown with dark brown blotches; hard consistency.

COMMENTS:
FADC = Flight Auger Dry Core
HSA = Hollow Stem Auger
NP = Non-plastic
NR = No Recovery
NA = Not applicable
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing

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

MW-09-86B
TOC Coordinates= N 2271045.1 E 6109201.2 (NAGD83) El. 120.79 (NAVD88)
Groundsurface El.= 120.87 (NAVD88)

GEOLOGIC LOG OF DRILL HOLE NO. MW-09-86

FEATURE: Groundwater Monitoring
LOCATION: Reach 4A, River Bank Left, Merced County
BEGUN: 11/6/09 FINISHED: 11/8/09
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 37.8 ft. (El. 83.09 ft.) 11/8/2009

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,271,050.7 E 6,109,195.1 (NAGD83)
TOTAL DEPTH: 72.5 ft.

STATE: California
GROUND SURFACE ELEVATION: 121.0 ft. (NAVD88)
T.O.C ELEVATION: 120.89 ft. (NAVD88)
HOLE LOGGED BY: G.Turlington
REVIEWED BY: J. Vauk

HOLE COMPLETION:

MW-09-86
Well Casing - 0.1 to 52.0 ft. (T.O.C. El. 120.89 ft.)
Dual Pre-pack Screen - 52.0 to 72.0 ft. (Slotted 0.020-inch)
Well Screen Filter Pack - #3 Sand Filter Pack - 49.0 to 72.5 ft. (#3 Sand)
Bentonite Seal - 2.0 to 49.0 ft.
Well Protection - flush-mounted 18-inch manhole (15/16-inch hexbolts)

MW-09-86B
Well Casing - 0.1 to 14.5 ft. (T.O.C. El. 120.79 ft.)
Dual Pre-pack Screen - 14.5 to 24.5 ft. (Slotted 0.020-inch)
Well Screen Filter Pack - #3 Sand Filter Pack - 12.0 to 25.0 ft. (#3 Sand)
Bentonite Seal - 2.0 to 12.0 ft.
Well Protection - flush-mounted 18-inch manhole (15/16-inch hexbolts)

DEPTH	% CORE RECOVERY	% SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION	ELEVATION	VISUAL CLASSIFICATION	ELEVATION	GEOLOGIC UNIT SYMBOL
	100											SM	89.6	
35	100											(CL/ML)s	84.9	
											37.8 ft. (El. 83.09 ft.)	CL/CH	80.9	
		37.4	52.0	89.4	10.6	0.0	50.1	27.0	26.9	CH	81.6			
40	100											(CL)s	77.9	
												SM	75.4	
45	100													Qal
		57.4	29.4	86.8	13.2	0.0	31.4	10.8	26.8	CL	72.6	(CL)s	69.9	
50	100											(CL)s	68.6	
												SM	66.9	
55	88											SM	64.7	
												SM		
		8.7	0.9	9.6	90.4	0.0	NP	NP	19.6	SP-SM	61.6			

22.0 to 23.0 ft.: POORLY GRADED SAND WITH SILT, SP/SM: About 90% fine to medium sand with grains consisting of quartz, mica, and various other minerals; about 10% non-plastic fines; maximum size: medium sand; moist, brown; very soft consistency.

Laboratory Data Interval
22.3 to 22.6 ft.

23.0 to 24.2 ft.: SANDY LEAN CLAY, s(CL): About 60% fines with low to medium plasticity and toughness, high dry strength, no to slow dilatancy; about 40% fine to medium sand; maximum size: medium sand; moist, olive brown with dark brown blotches; hard consistency.

24.2 to 27.7 ft.: LEAN CLAY WITH SAND, (CL)s: About 75% fines with medium plasticity and toughness, high dry strength, and no dilatancy; about 25% sand; maximum size: medium sand; moist, greenish-brown; hard consistency.

Laboratory Data Interval
26.0 to 26.3 ft.

27.7 to 29.5 ft.: SILT, ML: About 90% fines with low plasticity toughness and dry strength, and slow to rapid dilatancy; about 10% fine sand; maximum size: fine sand; moist, greenish-brown; firm consistency.

29.5 to 31.3 ft.: SILTY SAND, SM: About 55% fine sand; about 45% fines; maximum size: fine sand; moist, greenish-brown; soft consistency.

31.3 to 36.0 ft.: SILTY CLAY WITH SAND, (CL/ML)s: About 80% fines with low plasticity, toughness and dry strength, and slow to rapid dilatancy; about 20% fine sand; maximum size: fine sand; moist from 31.3 to 34.5 ft. and wet from 34.5 to 36.0 ft., greenish-brown; soft to firm consistency; higher plasticity (clay content) from 33.0 to 34.0 feet.

36.0 to 40.0 ft.: LEAN TO FAT CLAY, CL/CH: About 95% fines with high plasticity and toughness, high to very high dry strength, and no dilatancy; about 5% fine sand; maximum size: fine sand; moist, greenish-brown with dark brown spots; firm consistency.

Laboratory Data Interval
39.0 to 39.3 ft.

40.0 to 43.0 ft.: LEAN CLAY WITH SAND, (CL)s: About 85% fines with low to medium plasticity and toughness, medium dry strength, and slow dilatancy; about 15% fine sand; maximum size: fine sand; moist, greenish-brown with light stringers; firm consistency.

43.0 to 45.5 ft.: SILTY SAND, SM: About 60% fine sand with grains consisting of quartz, mica, and various other minerals; about 40% fines; maximum size: fine sand; moist to wet, greenish-brown with light streaks and occasional dark spots; soft consistency; drill rods wet at 44 feet.

COMMENTS:
FADC = Flight Auger Dry Core
HSA = Hollow Stem Auger
NP = Non-plastic
NR = No Recovery
NA = Not applicable
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing

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

MW-09-86B
TOC Coordinates= N 2271045.1 E 6109201.2 (NAGD83) El. 120.79 (NAVD88)
Groundsurface El.= 120.87 (NAVD88)

GEOLOGIC LOG OF DRILL HOLE NO. MW-09-86

FEATURE: Groundwater Monitoring
LOCATION: Reach 4A, River Bank Left, Merced County
BEGUN: 11/6/09 FINISHED: 11/8/09
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 37.8 ft. (El. 83.09 ft.) 11/8/2009

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,271,050.7 E 6,109,195.1 (NAGD83)
TOTAL DEPTH: 72.5 ft.

STATE: California
GROUND SURFACE ELEVATION: 121.0 ft. (NAVD88)
T.O.C ELEVATION: 120.89 ft. (NAVD88)
HOLE LOGGED BY: G.Turlington
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
		40												
	65	40	2.1	0.0	2.1	97.9	0.0	NP	NP	15.7	SP 55.6	SP 57.9	Qal	
	70	36										SM 53.4		
												48.4		

BOTTOM OF HOLE

45.5 to 51.0 ft.: LEAN CLAY WITH SAND, (CL)s: About 80% fines with low plasticity, toughness and dry strength, and slow dilatancy; about 20% fine sand; maximum size: fine sand; wet, brown with slight rust-colored mottling; firm consistency.

Laboratory Data Interval
48.0 to 48.3 ft.

51.0 to 52.3 ft.: LEAN CLAY WITH SAND, (CL)s: About 80% fines with low plasticity, low to medium toughness and dry strength, and slow dilatancy; about 20% fine sand; maximum size: fine sand; wet, brown with occasional dark spots; firm to hard consistency.

52.3 to 54.0 ft.: SILTY SAND, SM: About 50% fine sand; about 40% fines; about 10% sub-rounded gravel consisting of fragments of fine sand with fines; maximum size: ¾-inch; wet, brown; soft to very soft consistency.

54.0 to 56.2 ft.: SILTY SAND, SM: About 65% fine to coarse sand with grains consisting of cemented fragments of fine sand; about 35% fines; trace of gravel that consisted of cemented sand with fines; maximum size: ½-inch; wet, brown; very soft consistency.

56.2 to 63.0 ft.: SILTY SAND, SM: About 85% fine sand; about 15% fines; maximum size: fine sand; wet, brown; very soft consistency.

Laboratory Data Interval
59.0 to 59.3 ft.

63.0 to 67.5 ft.: POORLY GRADED SAND, SP: About 95% fine to medium sand; about 5% fines; maximum size: medium sand; wet, light gray; very soft consistency.

Laboratory Data Interval
65.0 to 65.3 ft.

67.5 to 72.5 ft.: SILTY SAND, SM: About 85% fine sand; about 15% fines; maximum size: fine sand; wet, gray-brown; very soft consistency.

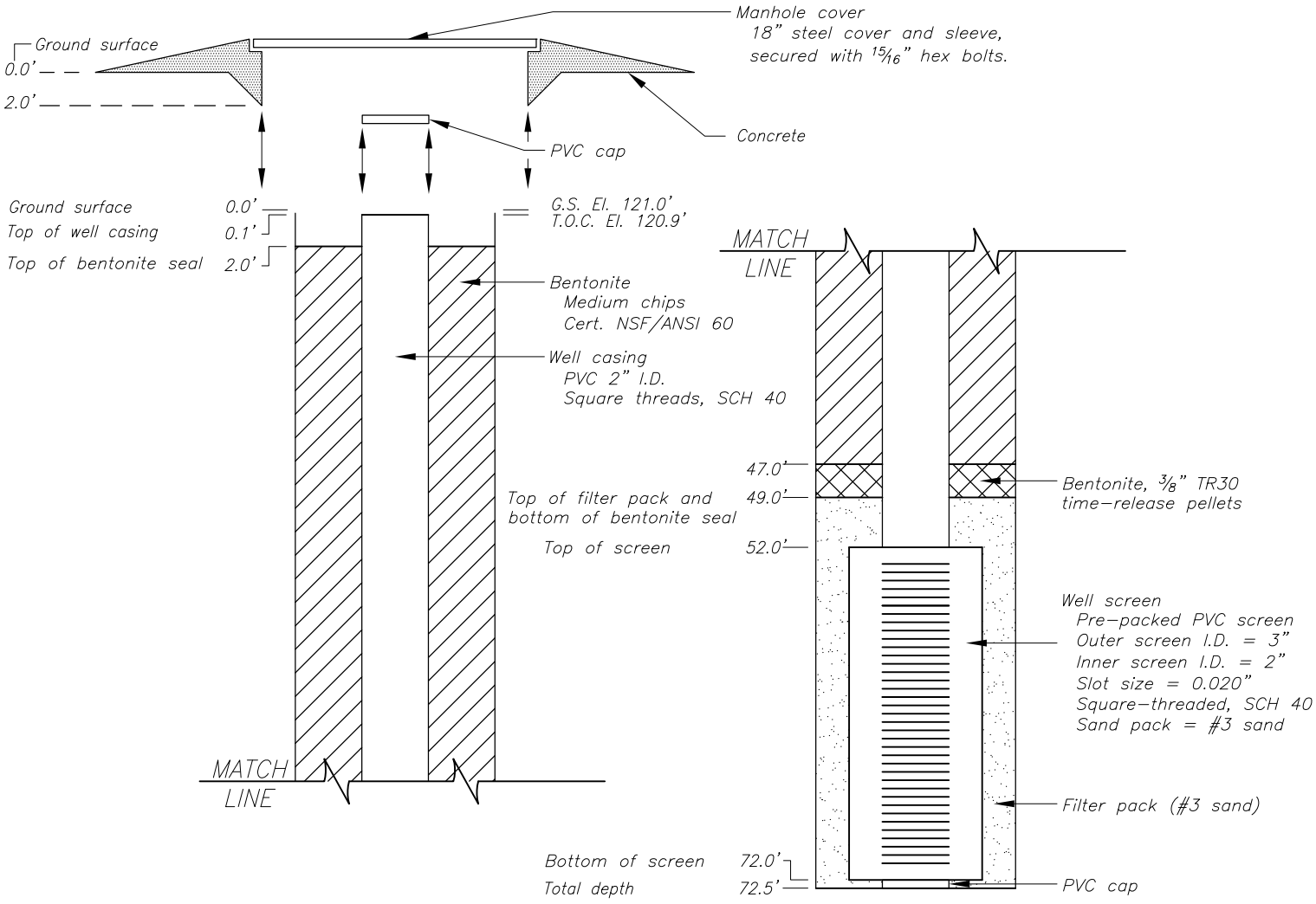
T.D.= 72.5 ft.

COMMENTS:
FADC = Flight Auger Dry Core
HSA = Hollow Stem Auger
NP = Non-plastic
NR = No Recovery
NA = Not applicable
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing

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

MW-09-86B
TOC Coordinates= N 2271045.1 E 6109201.2 (NAGD83) El. 120.79 (NAVD88)
Groundsurface El.= 120.87 (NAVD88)

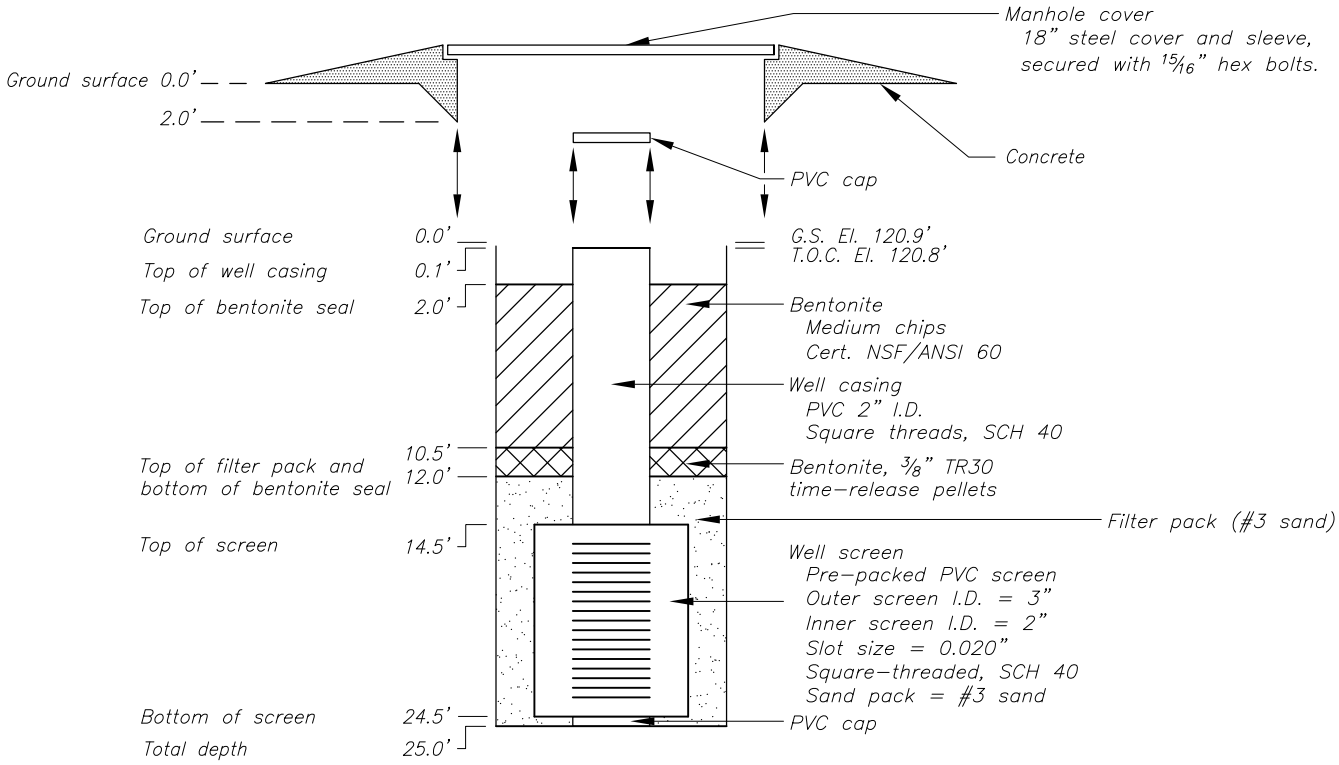
MW–09–86	GEOLOGIST: G. TURLINGTON
WELL COMPLETION DIAGRAM	DRILLER: J. HUCKABY
DATE COMPLETED: 11/08/2010	HELPER: T. MENNING
TOP OF WELL CASING COORDINATES: N2271050.7 E6109195.1 (NAD83) ELEVATION 120.9' (NAVD88) GROUND SURFACE ELEVATION 121.0' (NAVD88)	



*NOT TO SCALE

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

MW–09–86B	GEOLOGIST: G. TURLINGTON
WELL COMPLETION DIAGRAM	DRILLER: J. HUCKABY
DATE COMPLETED: 11/08/2009	HELPER: T. MENNING
TOP OF WELL CASING COORDINATES: N2271045.1 E6109201.2 (NAD83) ELEVATION 120.8' (NAVD88) GROUND SURFACE ELEVATION 120.9' (NAVD88)	



*NOT TO SCALE

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

GEOLOGIC LOG OF DRILL HOLE NO. MW-09-87

FEATURE: Groundwater Monitoring
LOCATION: Reach 4A, River Bank Left, Merced County
BEGUN: 11/8/09 FINISHED: 11/10/09
DEPTH AND ELEVATION OF WATER LEVEL AND DATE MEASURED: NA

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,270,565.2 E 6,108,221.5 (NAGD83)
TOTAL DEPTH: 50.0 ft.

STATE: California
GROUND SURFACE ELEVATION: 115.0 ft. (NAVD88)
T.O.C ELEVATION: 114.87 ft. (NAVD88)
HOLE LOGGED BY: G. Russell
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.

DRILLED BY:
USGS Drill Crew
Kevin Coy, Driller
Jim Rauman, Helper

DRILL RIG:
CME-550

DRILLING & SAMPLING METHODS:
Drill hole MW-09-87 was advanced using hollow stem flight augers with continuous dry core sampling system (FADC) from the ground surface to a total depth of 50.0 feet. FADC system uses augers with a 7-5/8-inch O.D. and 4-1/4-inch I.D., and a 5-foot-long, 3-inch I.D. split sample barrel.

Interval Method
0.0 to 50.0 ft. - FADC

MW-09-87B was drilled and completed as a well using7-5/8-inch O.D. and 4-1/4-inch I.D. hollow stem flight augers and a wooden plug. The total depth of the hole was 16.0 feet b.g.s.

Interval Method
0.0 to 16.0 ft. - FADC with wooden plug

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
MW-09-87
0.0 to 50.0 ft. - smooth drilling

MW-09-87B
0.0 to 16.0 ft. - blind drilled
16.0 ft. - knocked out wooden plug and set well

DRILL FLUID, RETURN AND COLOR:
MW-09-87
0.0 to 50.0 ft. - None

MW-09-87B
0.0 to 16.0 ft. - None

WATER LEVEL:
None

REASON FOR HOLE TERMINATION:
The holes were terminated upon successful completion to the target depth.

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
												s(ML)g	113.8	
	100													
		32.6	18.8	51.4	48.6	0.0	31.2	13.0	12.6	s(CL)	112.9	s(ML)	112.3	
5	76													
10	76											SP/SM		
		4.2	0.7	4.9	95.1	0.0	NP	NP	3.3	SP	101.9			
15	84												99.1	Qal
												(CL)s	97.5	
		36.2	25.7	61.9	38.1	0.0	22.7	8.7	15.6	s(CL)	97.6			
		30.9	18.5	49.4	50.6	0.0	25.8	8.5	14.8	SC	95.5	s(CL)	94.5	
20	98													
		3.2	2.7	5.9	94.1	0.0	NP	NP	7.8	SP-SM	90.6	SP/SM	87.4	
25	80											s(ML)	86.8	
												SM	85.4	
												s(CL)	85.1	

CLASSIFICATION AND PHYSICAL CONDITION

SOIL DESCRIPTIONS CHARACTERIZE SAMPLES FROM DRILL HOLE MW-09-87.

0.0 to 50.0 feet
QUATERNARY ALLUVIUM (Qal)

0.0 to 1.1 ft.: SANDY SILT WITH GRAVEL, s(ML)g: About 50% fines with low plasticity; about 25% sand; about 25% gravel; maximum size: 1.5 inches; dry, brown; soft to firm consistency; grass and roots.

1.1 to 2.6 ft.: SANDY SILT, s(ML): About 60% fines with low plasticity, no to low dry strength, and slow dilatancy; about 40% fine sand; maximum size: fine sand; dry, dark brown; firm to hard consistency.

Laboratory Data Interval
1.8 to 2.0 ft.

2.6 to 15.8 ft.: POORLY GRADED SAND WITH SILT, SP/SM: About 90% fine to coarse sand with grains consisting of quartz, mica, and various other minerals (mostly fine to medium)(coarse sand is sub-angular and hard); about 10% fines; maximum size: coarse sand; moist (wet near base), light gray-brown; very soft consistency; slightly higher fines percentage near top and bottom of depth interval.

Laboratory Data Interval
12.5 to 13.0 ft.

15.8 to 17.4 ft.: LEAN CLAY WITH SAND, (CL)s: About 80% fines with medium plasticity and toughness, high dry strength, and no dilatancy; about 20% fine sand; maximum size: fine sand; moist, olive-brown with occasional iron-oxide staining; firm consistency.

Laboratory Data Interval
17.0 to 17.3 ft.

17.4 to 20.4 ft.: SANDY LEAN CLAY, s(CL): About 55% fines with medium plasticity, and toughness, high dry strength, and no dilatancy; about 45% fine sand; maximum size: fine sand; moist, olive-brown (occasional iron staining); firm consistency; bottom 1.0-foot has higher sand percentage.

Laboratory Data Interval
19.0 to 19.4 ft.

20.4 to 27.5 ft.: POORLY GRADED SAND WITH SILT; SP/SM: About 90% fine to medium sand with grains consisting of quartz, mica, and various other minerals; about 10% fines; maximum size: medium sand; moist to wet, olive-brown; very soft consistency.

Laboratory Data Interval
24.0 to 24.3 ft.

27.5 to 28.1 ft.: SANDY SILT, s(ML): About 60% fines with low plasticity, toughness and dry strength, and rapid dilatancy; about 40% fine sand; maximum size: fine sand; wet, dark olive green; very soft consistency.

28.1 to 29.5 ft.: SILTY SAND, SM: About 60% fine to medium sand (mostly fine); about 40% fines; maximum size: medium sand; wet, olive-brown with rust-colored staining; very soft consistency.

COMMENTS:
FADC = Flight Auger Dry Core
HSA = Hollow Stem Auger
NP = Non-plastic
NR = No Recovery
NA = Not applicable
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing

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

MW-09-87B
TOC Coordinates= N 2270557.6 E 6108224.1 (NAGD83) El. 114.83 (NAVD88)
Ground surface El.= 115.03 (NAVD88)

GEOLOGIC LOG OF DRILL HOLE NO. MW-09-87

FEATURE: Groundwater Monitoring
LOCATION: Reach 4A, River Bank Left, Merced County
BEGUN: 11/8/09 FINISHED: 11/10/09
DEPTH AND ELEVATION OF WATER LEVEL AND DATE MEASURED: NA

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,270,565.2 E 6,108,221.5 (NAGD83)
TOTAL DEPTH: 50.0 ft.

STATE: California
GROUND SURFACE ELEVATION: 115.0 ft. (NAVD88)
T.O.C ELEVATION: 114.87 ft. (NAVD88)
HOLE LOGGED BY: G. Russell
REVIEWED BY: J. Vauk

HOLE COMPLETION:

MW-09-87
Well Casing - 0.1 to 37.0 ft. (T.O.C. El. 114.87 ft.)
Dual Pre-pack Screen - 37.0 to 47.0 ft. (Slotted 0.020-inch)
Well Screen Filter Pack - #3 Sand Filter Pack - 36.0 to 48.0 ft. (#3 Sand)
Bottom Backfill (Native Material) - 48.0 to 50.0 ft.
Bentonite Seal - 34.0 to 36.0 ft.
Backfill - 24.0 to 34.0 ft. (Native material caved)
Upper Bentonite Seal - 2.0 to 24.0 ft.
Well Protection - flush-mounted 18-inch manhole (15/16-inch hexbolts)

MW-09-87B
Well Casing - 0.1 to 10.0 ft. (T.O.C. El. 114.83 ft.)
Dual Pre-pack Screen - 10.0 to 15.0 ft. (Slotted 0.020-inch)
Well Screen Filter Pack - #3 Sand Filter Pack - 8.0 to 16.0 ft. (#3 Sand)
Bentonite Seal - 2.0 to 8.0 ft.
Well Protection - flush-mounted 18-inch manhole (15/16-inch hexbolts)

DEPTH	% CORE RECOVERY	% SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION	ELEVATION	VISUAL CLASSIFICATION	ELEVATION	GEOLOGIC UNIT SYMBOL
	100											SM	84.8	
												CL/CH		
											81.9			
		33.6	59.8	93.4	6.6	0.0	58.6	33.8	30.1	CH			80.9	
35	100											s(CL)		
													77.2	
		40.7	9.6	50.3	49.7	0.0	NP	NP	23.0	s(ML)	76.6	s(CL/ML)		
													75.0	
40	74													Qal
		4.0	0.6	4.6	95.4	0.0	NP	NP	12.5	SP	73.4	SP/SM		
													71.9	
	100													
		46.5	36.9	83.4	16.6	0.0	33.8	14.9	24.6	(CL)s	70.4	(CL)s		
45													69.9	
	100											(CL/ML)s		
50													64.9	

BOTTOM OF HOLE

29.5 to 29.8 ft.: SANDY LEAN CLAY, s(CL): About 60% fines with low plasticity, medium toughness, and slow dilatancy; about 40% fine sand; maximum size: fine sand; wet, olive brown; soft to firm consistency.

29.8 to 30.1 ft.: SILTY SAND, SM: About 60% fine to medium sand; about 40% fines; maximum size: medium sand; wet, olive-brown with rust-colored staining; very soft consistency.

30.1 to 34.0 ft.: LEAN TO FAT CLAY, CL/CH: About 90% fines with medium to high plasticity, high toughness, high to very high dry strength, and no dilatancy; about 10% fine sand; maximum size: fine sand; moist, olive-brown; firm consistency.

Laboratory Data Interval
32.8 to 33.0 ft.

34.0 to 37.7 ft.: SANDY LEAN CLAY, s(CL): About 70% fines with medium plasticity, toughness, and high dry strength, and no dilatancy; about 30% fine sand; maximum size: fine sand; moist, olive brown with occasional rust and dark brown spots; soft to firm consistency.

37.7 to 39.9 ft.: SANDY SILTY CLAY, s(CL/ML): About 55% fines with low plasticity and toughness, and slow dilatancy; about 45% sand; trace of rounded, tan gravel, consisting of cemented sand; maximum size: ½-inch; wet, olive brown; soft consistency.

Laboratory Data Interval
38.0 to 38.3 ft.

39.9 to 43.0 ft.: POORLY GRADED SAND WITH SILT; SP/SM: About 90% fine to medium sand; about 10% fines; maximum size: medium sand; moist to wet, olive-brown; very soft consistency.

Laboratory Data Interval
41.0 to 41.5 ft.

43.0 to 45.0 ft.: LEAN CLAY WITH SAND, (CL)s: About 85% fines with medium plasticity and toughness, high dry strength, and no dilatancy; about 15% fine sand; maximum size: fine sand; wet, olive brown with occasional iron-oxide staining and dark brown spots; firm consistency.

Laboratory Data Interval
44.0 to 44.5 ft.

45.0 to 50.0 ft.: SILTY CLAY WITH SAND, (CL/ML)s: About 75% fines with low plasticity and toughness, medium dry strength, and slow dilatancy; about 25% fine sand; maximum size: fine sand; very moist, olive brown with occasional iron-oxide staining; soft consistency.

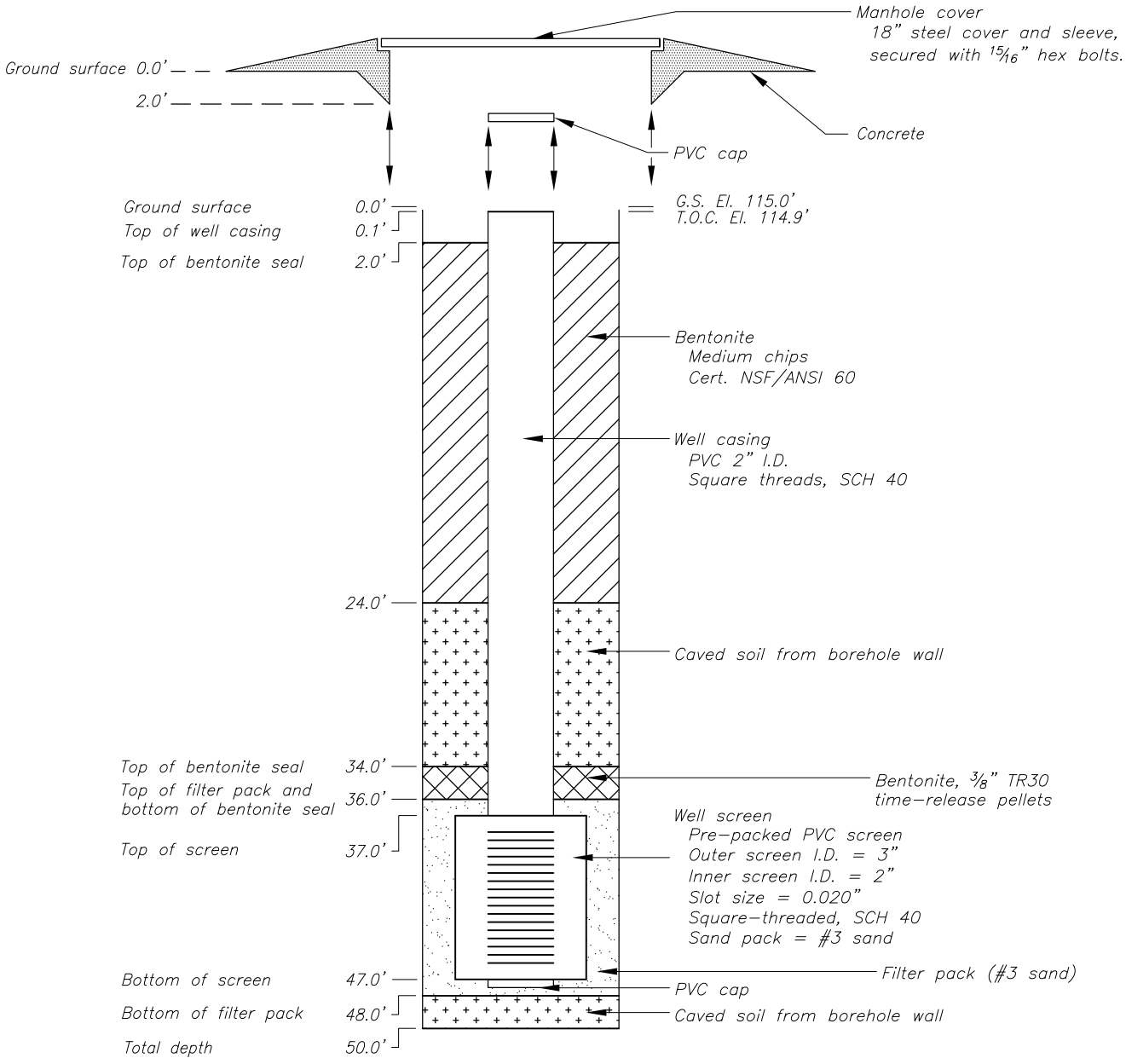
T.D. = 50.0 ft.

COMMENTS:
FADC = Flight Auger Dry Core
HSA = Hollow Stem Auger
NP = Non-plastic
NR = No Recovery
NA = Not applicable
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing

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

MW-09-87B
TOC Coordinates= N 2270557.6 E 6108224.1 (NAGD83) El. 114.83 (NAVD88)
Ground surface El.= 115.03 (NAVD88)

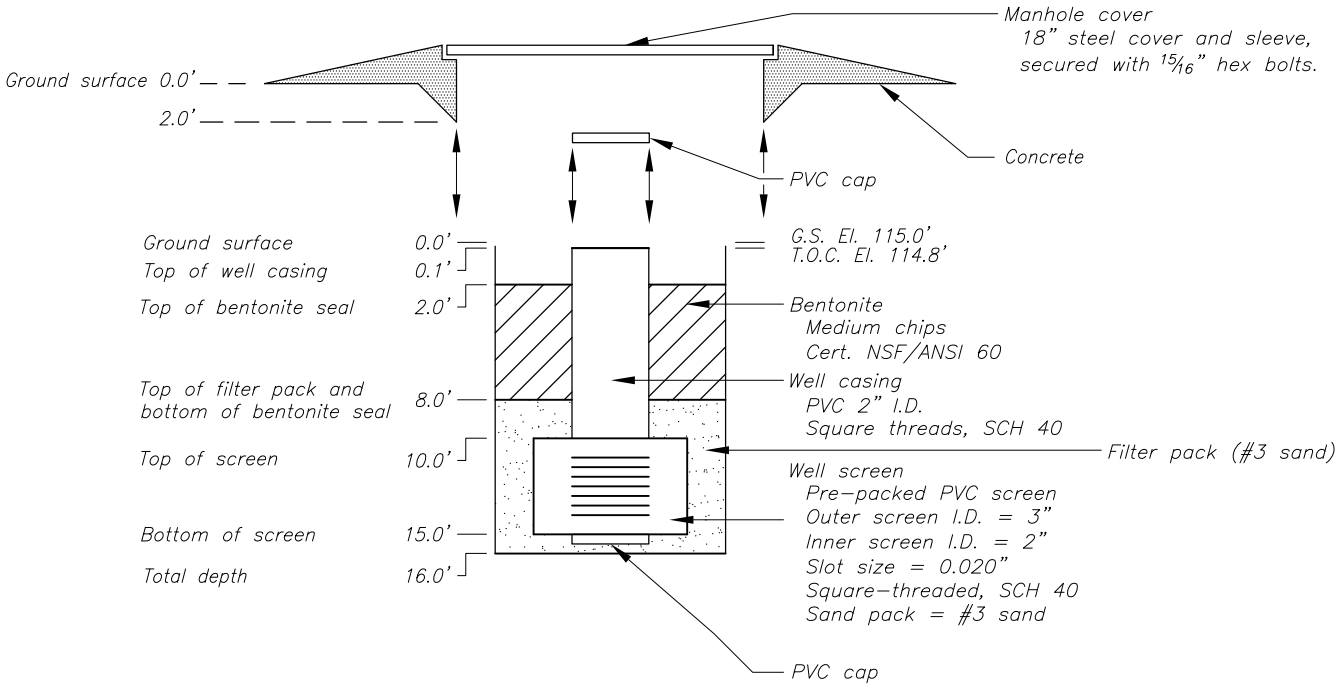
MW–09–87	GEOLOGIST: G. RUSSELL
WELL COMPLETION DIAGRAM	DRILLER: K. COY
DATE COMPLETED: 11/10/2009	HELPER: J. RAUMAN
TOP OF WELL CASING COORDINATES: N2270565.2 E6108221.5 (NAD83) ELEVATION 114.9' (NAVD88) GROUND SURFACE ELEVATION 115.0' (NAVD88)	



*NOT TO SCALE

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

MW-09-87B	GEOLOGIST: G. RUSSELL
WELL COMPLETION DIAGRAM	DRILLER: K. COY
DATE COMPLETED: 11/10/2009	HELPER: J. RAUMAN
TOP OF WELL CASING COORDINATES: N2270557.6 E6108224.1 (NAD83) ELEVATION 114.8' (NAVD88) GROUND SURFACE ELEVATION 115.0' (NAVD88)	



*NOT TO SCALE

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

GEOLOGIC LOG OF DRILL HOLE NO. MW-09-88

FEATURE: Groundwater Monitoring
LOCATION: Reach 4A, River Bank Left, Merced County
BEGUN: 11/11/09 FINISHED: 11/12/09
DEPTH AND ELEVATION OF WATER LEVEL AND DATE MEASURED: NA

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,269,675.6 E 6,103,010.8 (NAGD83)
TOTAL DEPTH: 50.2 ft.

STATE: California
GROUND SURFACE ELEVATION: 112.0 ft. (NAVD88)
T.O.C ELEVATION: 111.84 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.

DRILLED BY:
USGS Drill Crew
Kevin Coy, Driller
Jim Rauman, Helper

DRILL RIG:
CME-550

DRILLING & SAMPLING METHODS:
Drill hole MW-09-88 was advanced using hollow stem flight augers dry core system (FADC) with a 7-5/8-inch O.D. and 4-1/4-inch I.D., and a 5-foot-long 3-inch I.D. split sample barrel.

Interval Method
0.0 to 50.2 ft. - FADC

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
0.0 to 45.0 ft. - smooth drilling
45.0 to 50.2 ft. - add water, smooth drilling

DRILL FLUID, RETURN AND COLOR:
0.0 to 45.0 ft. - None
45.0 to 50.2 ft. - Water, no return

WATER LEVEL:
45.0 ft. from ground surface, on 10/28/09

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

HOLE COMPLETION:
Well Casing - 0.4 to 25.0 ft. (T.O.C. El. 111.84 ft.)
Dual Pre-pack Screen - 25.0 to 45.0 ft. (Slotted 0.020-inch)
Well Screen Filter Pack - #3 Sand Filter Pack - 20.3 to 46.5 ft. (#3 Sand and Native material caved)
Bentonite Seal - 2.0 to 20.3 ft.
Bottom Backfill (Bentonite) - 46.5 to 50.2 ft.
Well Protection - flush-mounted 18-inch manhole (15/16-inch hexbolts)

DEPTH	% CORE RECOVERY	% SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION	ELEVATION	VISUAL CLASSIFICATION	ELEVATION	GEOLOGIC UNIT SYMBOL
	100											(CL)s	109.3	
5	100	53.5	38.4	91.9	8.1	0.0	30.6	11.2	24.3	CL		CL		
											104.0		104.0	Qal
10	72	11.8	3.4	15.2	84.8	0.0	NP	NP	17.0	SM		SM		
											99.3		99.2	
		60.7	30.0	90.7	9.3	0.0	28.8	9.0	25.0	CL		ML		
15	98										96.7		96.7	
												s(ML)	96.2	
												SM	95.5	
												CL	95.4	
												SM	95.1	

0.0 to 50.2 feet
QUATERNARY ALLUVIUM (Qal)

0.0 to 2.5 ft.: LEAN CLAY WITH SAND, (CL)s: About 85% fines with low plasticity, toughness and dry strength, and slow dilatancy; about 15% fine sand; maximum size: fine sand; dry, dark brown, no reaction with HCl; soft consistency.

2.5 to 7.8 ft.: LEAN CLAY, CL: About 95% fines with medium plasticity, toughness and dry strength, and no dilatancy; about 5% fine to medium sand; maximum size: medium sand; moist, dark brown (from 2.5 to 5.3 feet) and light brown (from 5.3 to 7.5 feet), strong reaction with HCl; firm consistency; spots of calcium carbonate.

Laboratory Data Interval
2.5 to 7.8 ft.

7.8 to 12.6 ft.: SILTY SAND, SM: About 70% fine to coarse sand (trace of coarse); about 30% non-plastic fines with rapid dilatancy; maximum size: coarse sand; moist, light brown and brownish-gray, no reaction with HCl; soft consistency.

Laboratory Data Interval
7.5 to 12.5 ft.

12.6 to 15.1 ft.: SILT, ML: About 90% fines with low plasticity, toughness and dry strength, and rapid dilatancy; about 10% fine sand; maximum size: fine sand; wet, light brown and greenish-gray, no reaction with HCl; moderate to firm consistency.

Laboratory Data Interval
12.6 to 15.1 ft.

15.1 to 15.6 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 with HCl; soft consistency.

15.6 to 16.3 ft.: SILTY SAND, SM: About 80% fine to medium sand; about 20% non-plastic fines with rapid dilatancy; maximum size: medium sand; wet, light brown, no reaction with HCl; soft consistency.

16.3 to 16.4 ft.: LEAN CLAY, CL: About 90% fines with medium plasticity, toughness and dry strength, and no dilatancy; about 10% fine sand; maximum size: fine sand; moist, greenish-gray, no reaction with HCl; firm consistency.

16.4 to 16.7 ft.: SILTY SAND, SM: About 60% fine to medium sand; about 40% non-plastic fines with rapid dilatancy; maximum size: medium sand; wet, no reaction with HCl; soft consistency.

16.7 to 17.5 ft.: SILTY CLAY, CL/ML: About 90% fines with medium plasticity, low toughness and dry strength, and rapid dilatancy; about 10% fine sand; maximum size: fine sand; moist, medium brown streaked with orange, no reaction with HCl; moderate to firm consistency.

COMMENTS:
FADC = Flight Auger Dry Core
HSA = Hollow Stem Auger
NP = Non-plastic
NR = No Recovery
NA = Not applicable
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing

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-09-88

FEATURE: Groundwater Monitoring
LOCATION: Reach 4A, River Bank Left, Merced County
BEGUN: 11/11/09 FINISHED: 11/12/09
DEPTH AND ELEVATION OF WATER LEVEL AND DATE MEASURED: NA

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,269,675.6 E 6,103,010.8 (NAGD83)
TOTAL DEPTH: 50.2 ft.

STATE: California
GROUND SURFACE ELEVATION: 112.0 ft. (NAVD88)
T.O.C ELEVATION: 111.84 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
												CL/ML 94.3	Qal	**17.5 to 22.5 ft.: SILTY CLAY WITH SAND, (CL/ML)s:** About 75% fines with medium plasticity, low toughness and dry strength, and rapid dilatancy; about 25% fine sand; maximum size: fine sand; moist, medium brown streaked with orange, no reaction with HCl; moderate to firm consistency.
														Laboratory Data Interval 17.5 to 22.5 ft.
	20	94	55.7	18.4	74.1	25.9	0.0	28.4	4.9	27.9	(ML)s 89.3	(CL/ML)s 89.3		**22.5 to 24.3 ft.: SILT, ML:** About 90% fines with no to low plasticity, low toughness and dry strength, and rapid dilatancy; about 10% fine sand; maximum size: fine sand; wet, greenish-gray, no reaction with HCl; moderate to firm consistency.
														24.3 to 24.4 ft.: SANDY SILT, s(ML): About 70% fines with no to low plasticity, low toughness and dry strength, and rapid dilatancy; about 30% fine sand; maximum size: fine sand; wet, greenish-gray, no reaction with HCl; moderate to firm consistency.
												ML 87.5		**24.4 to 27.1 ft.: SILT, ML:** About 90% fines with no to low plasticity, low toughness and dry strength, and rapid dilatancy; about 10% fine sand; maximum size: fine sand; wet, greenish-gray, no reaction with HCl; moderate to firm consistency.
												s(ML) 87.4		Laboratory Data Interval 22.5 to 27.1 ft.
	25	80	72.6	13.1	85.7	14.3	0.0	NP	NP	30.7	ML 84.7	ML 84.7		**27.1 to 27.5 ft.: SILTY SAND, SM:** About 60% fine to medium sand; about 40% non-plastic fines with rapid dilatancy; maximum size: medium sand; wet, orange-brown, no reaction with HCl; soft consistency.
												SM 84.3		**27.5 to 31.6 ft.: SILTY SAND, SM:** About 75% fine to coarse sand (trace of coarse sand); about 25% non-plastic fines with rapid dilatancy; maximum size: coarse sand; wet, light brown, no reaction with HCl; soft to firm consistency.
														Laboratory Data Interval 27.5 to 31.6 ft.
	30	70	8.5	4.8	13.3	86.7	0.0	NP	NP	22.6	SM 80.2	SM 80.2		**31.6 to 32.0 ft.: SANDY LEAN CLAY, s(CL):** About 70% fines with medium plasticity, toughness and dry strength, and no dilatancy; about 30% fine to medium sand; maximum size: medium sand; moist, light brown, no reaction with HCl; firm consistency.
														32.0 to 37.5 ft.: SILTY SAND, SM: About 80% fine sand; about 20% non-plastic fines with rapid dilatancy; maximum size: fine sand; wet, light brown, no reaction with HCl; firm consistency.
												s(CL) 79.8		Laboratory Data Interval 32.0 to 41.7 ft.
														37.5 to 41.7 ft.: SILTY SAND, SM: About 60% fine to coarse sand (trace of coarse sand); about 40% non-plastic fines with rapid dilatancy; maximum size: coarse sand; wet, light brown, no reaction with HCl; firm consistency.

COMMENTS:
FADC = Flight Auger Dry Core
HSA = Hollow Stem Auger
NP = Non-plastic
NR = No Recovery
NA = Not applicable
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing

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-09-88

FEATURE: Groundwater Monitoring
LOCATION: Reach 4A, River Bank Left, Merced County
BEGUN: 11/11/09 FINISHED: 11/12/09
DEPTH AND ELEVATION OF WATER LEVEL AND DATE MEASURED: NA

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,269,675.6 E 6,103,010.8 (NAGD83)
TOTAL DEPTH: 50.2 ft.

STATE: California
GROUND SURFACE ELEVATION: 112.0 ft. (NAVD88)
T.O.C ELEVATION: 111.84 ft. (NAVD88)
HOLE LOGGED BY: J. Vauk
REVIEWED BY: A. Warren

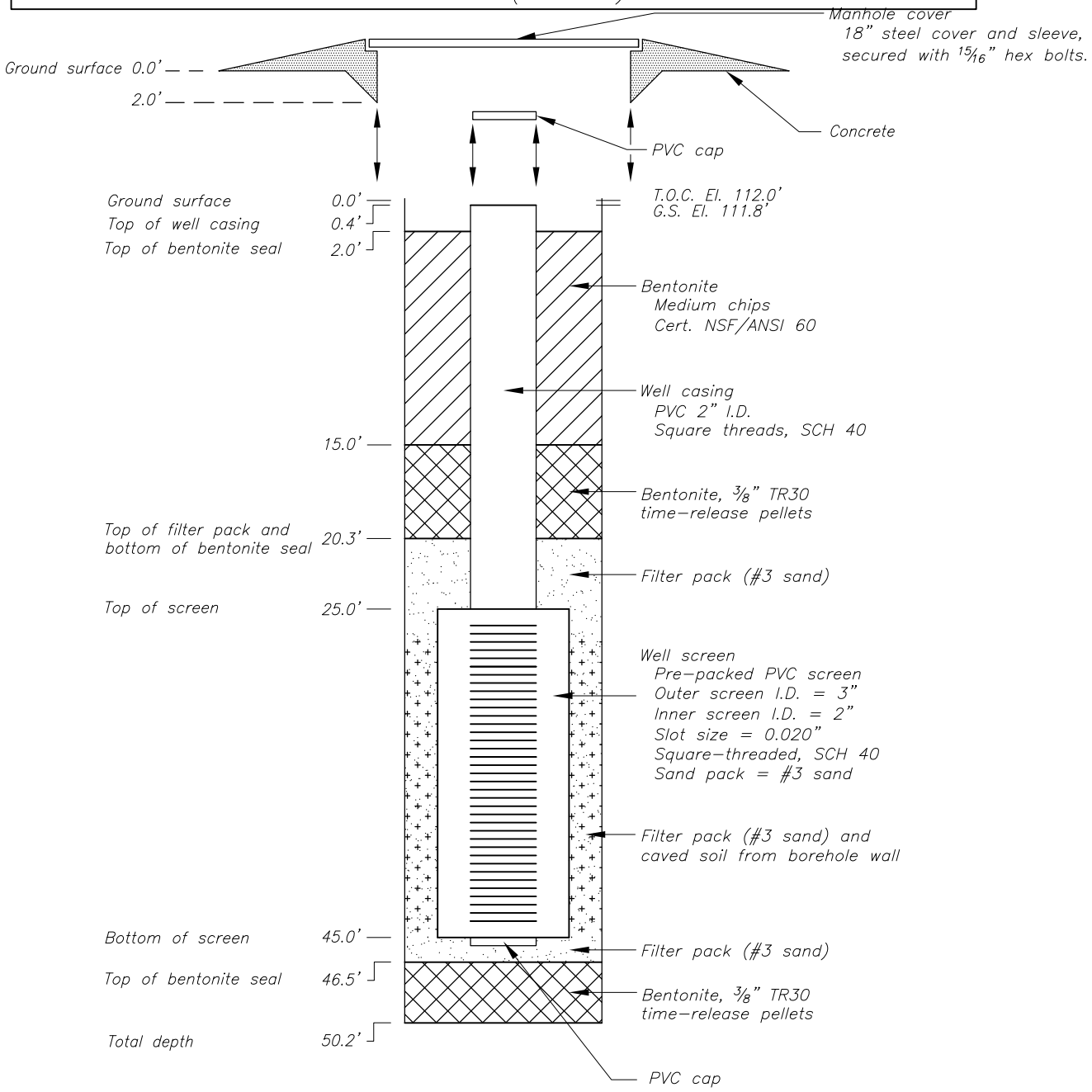
NOTES	DEPTH	% CORE RECOVERY	LABORATORY DATA: % SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION / ELEVATION	VISUAL CLASSIFICATION / ELEVATION	GEOLOGIC UNIT SYMBOL	CLASSIFICATION AND PHYSICAL CONDITION
	35	50	8.8	4.8	13.6	86.4	0.0	NP	NP	27.3	SM	SM		**41.7 to 45.6 ft.: SILTY SAND, SM:** About 85% fine to coarse sand; about 15% non-plastic fines; maximum size: coarse sand; wet, light brown, no reaction with HCl; soft to firm consistency.
												74.3		Laboratory Data Interval 41.7 to 45.6 ft.
														45.6 to 50.2 ft.: FAT CLAY, CH: About 95% fines with high plasticity, medium toughness and dry strength, and no dilatancy; about 5% fine sand; maximum size: fine sand; moist, greenish-gray, no reaction with HCl; firm consistency.
	40	78										SM		Laboratory Data Interval 45.6 to 50.2 ft.
											70.1	70.1	Qal	***T.D. = 50.2 ft.***
			7.5	1.4	8.9	88.6	2.5	NP	NP	19.7	SW-SM	SM		
	45	88									66.2	66.2		
			47.0	48.1	95.1	4.9	0.0	44.9	25.3	26.0	CL	CH		
		100												
	50										61.6	61.6		

BOTTOM OF HOLE

COMMENTS:
FADC = Flight Auger Dry Core
HSA = Hollow Stem Auger
NP = Non-plastic
NR = No Recovery
NA = Not applicable
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing

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

MW–09–88	GEOLOGIST: J. VAUK
WELL COMPLETION DIAGRAM	DRILLER: K. COY
DATE COMPLETED: 11/12/2009	HELPER: J. RAUMAN
TOP OF WELL CASING COORDINATES: N2269675.6 E6103010.8 (NAD83) ELEVATION 111.8' (NAVD88) GROUND SURFACE ELEVATION 112.0' (NAVD88)	



*NOT TO SCALE

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

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-80

FEATURE: Groundwater Monitoring
PROJECT: San Joaquin River Restoration Program
STATE: California
LOCATION: Reach 4A, Right Side of River, North of Sack Dam
COORDINATES: N 2,251,292.7 E 6,121,295.6 (NAGD83)
GROUND SURFACE ELEVATION: 124.9 ft. (NAVD88)
BEGUN: 3/22/10 FINISHED: 3/22/10
TOTAL DEPTH: 30.5 ft.
T.O.C ELEVATION: 127.5 ft. (NAVD88)
WATER LEVEL DEPTH AND ELEVATION: 12.0 ft. b.g.s. (El. 112.9 ft.)
HOLE LOGGED BY: A. Warren
DATE WATER LEVEL WAS MEASURED: 3/22/2010
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 4A, river right, about 400 feet east from the center of the SJR, about 2.2 miles southwest from the intersection of Road 4 and Avenue 18½.

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-10-80 was advanced using hollow stem flight augers with a continuous dry core sampling system (FADC) from the ground surface to a total depth of 30.5 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 30.5 ft. - FADC

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
0.0 to 8.0 ft. smooth drilling, soft
8.0 to 13.0 ft. damp
13.0 to 18.0 ft. very wet
18.0 to 23.0 ft. soft to very soft
23.0 to 30.5 ft. firm

CAVING CONDITIONS:
None

DRILL FLUID, RETURN AND COLOR:
0.0 to 18.0 ft. None
18.0 to 30.5 ft. Water, no return

WATER LEVEL:
12.0 ft. b.g.s. 3/22/2010

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. 127.5 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 30.5 ft. (#3 Sand)
Sump: 25.0 to 27.0 ft. (2-inch blank PVC with cap)
Bentonite Seal: 2.0 to 9.5 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
	47										s(CL/ML)	Qal
5	81	46.1	23.9	70.0	30.0	0.0	NP	NP	9.4	(ML)s 121.0	116.9	
10	98	67.2	29.9	97.1	2.9	0.0	40.8	13.5	23.1	ML 115.9	(CL/ML) 115.8	
											s(ML) 115.4	
		64.9	23.9	88.8	11.2	0.0	33.8	9.1	29.2	ML 114.4	ML 114.4	
										▼	SC/SM	

0.0 to 30.5 feet
QUATERNARY ALLUVIUM (Qal)

0.0 to 8.0 ft.: SANDY SILTY CLAY, s(CL/ML): About 60% fines with low plasticity, medium toughness, slow dilatancy; about 40% fine sand; maximum size: fine sand; dry, brown; soft to firm, lightly cemented lenses; organic odor and high organic content encountered near the surface.

Laboratory Data Interval
4.3 to 6.5 ft.

8.0 to 9.1 ft.: SILTY CLAY, (CL/ML): About 90% fines with low plasticity, medium toughness, slow dilatancy; about 10% fine sand; maximum size: fine sand; dry, brown; firm, thinly bedded.

Laboratory Data Interval
8.0 to 9.0 ft.

9.1 to 9.5 ft.: SANDY SILT, s(ML): About 65% fines with no plasticity, low toughness; about 35% fine sand; maximum size: fine sand; moist, olive brown to reddish oxidation; moderately firm, several lenses of fine sand.

9.5 to 10.5 ft.: SILT, ML: About 90% fines with low plasticity and toughness, slow dilatancy; about 10% fine sand; maximum size: fine sand; dry, brown; firm, thinly bedded.

Laboratory Data Interval
9.5 to 10.5 ft.

10.5 to 13.0 ft.: CLAYEY TO SILTY SAND, SC/SM: About 20% fines with low to medium plasticity; about 80% fine sand; maximum size: fine sand; wet to moist, olive brown with reddish brown oxidation; moderately soft.

13.0 to 21.3 ft.: POORLY GRADED SAND, SP: About 95 to 100% fine to medium sand; about a trace to 5% fines; maximum size: medium sand; wet, gray; loose, sand consists of quartz, biotite, micas, and feldspars. 3 lenses of fine sand from 13.0 to 13.1 ft., 14.1 to 14.2 ft., and 15.0 to 15.1 ft., tree bark present.

21.3 to 23.3 ft.: POORLY GRADED SAND WITH SILT, SP/SM: About 90% fine sand; about 10% fines with low plasticity; maximum size: fine sand; wet, olive brown with reddish brown oxidation layers; micaceous, stratified, moderately soft to firm. Organic layer (decomposed organic odor) containing black, bark and sand from 21.7 to 22.2 ft. dipping about 45°.

23.3 to 24.5 ft.: SILTY SAND, SM: About 85% fine sand; about 15% nonplastic fines; maximum size: fine sand; wet, olive brown to gray; moderately firm.

24.5 to 25.8 ft.: LEAN CLAY WITH SAND, (CL)s: About 80% fines with medium plasticity, no dilatancy; about 20% fine to medium sand; maximum size: medim sand; moist, olive gray; firm, lightly cemented in layers.

Laboratory Data Interval
24.5 to 25.8 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-10-80

FEATURE: Groundwater Monitoring
PROJECT: San Joaquin River Restoration Program
STATE: California
LOCATION: Reach 4A, Right Side of River, North of Sack Dam
COORDINATES: N 2,251,292.7 E 6,121,295.6 (NAGD83)
GROUND SURFACE ELEVATION: 124.9 ft. (NAVD88)
BEGUN: 3/22/10 FINISHED: 3/22/10
TOTAL DEPTH: 30.5 ft.
T.O.C ELEVATION: 127.5 ft. (NAVD88)
WATER LEVEL DEPTH AND ELEVATION: 12.0 ft. b.g.s. (El. 112.9 ft.)
HOLE LOGGED BY: A. Warren
DATE WATER LEVEL WAS MEASURED: 3/22/2010
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.		98										SC/SM 111.9		**25.8 to 27.0 ft.:<u>POORLY GRADED SAND WITH SILT, SP/SM</u>:** About 90% fine sand; about 10% fines with low plasticity; maximum size: fine sand; wet, olive brown with reddish brown oxidation layers; micaceous, stratified, moderately soft to firm. **27.0 to 29.5 ft.:<u>LEAN CLAY WITH SAND, (CL)s</u> :** About 80% fines with medium plasticity, no dilatancy; about 20% fine to medium sand; maximum size: medium sand; moist, olive gray; firm, lightly cemented in layers. **29.5 to 30.5 ft.:<u>POORLY GRADED SAND WITH SILT, SP/SM</u>:** About 90% fine sand; about 10% nonplastic fines; maximum size: fine sand; wet, olive brown with reddish brown oxidation, moderately soft. **T.D. = 30.5 ft.**
	15	58										SP		
													Qal	
	20	0										103.6 SP/SM 101.6		
		100										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

REPORT: SJRRP DRILL HOLE PROJECT DATABASE: SJRRP.GPJ

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-80

FEATURE: Groundwater Monitoring
PROJECT: San Joaquin River Restoration Program
STATE: California
LOCATION: Reach 4A, Right Side of River, North of Sack Dam
COORDINATES: N 2,251,292.7 E 6,121,295.6 (NAGD83)
GROUND SURFACE ELEVATION: 124.9 ft. (NAVD88)
BEGUN: 3/22/10 FINISHED: 3/22/10
TOTAL DEPTH: 30.5 ft.
T.O.C ELEVATION: 127.5 ft. (NAVD88)
WATER LEVEL DEPTH AND ELEVATION: 12.0 ft. b.g.s. (El. 112.9 ft.)
HOLE LOGGED BY: A. Warren
DATE WATER LEVEL WAS MEASURED: 3/22/2010
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
												SM 100.4		
	25	100	41.7	30.1	71.8	28.2	0.0	24.4	9.2	23.8	(CL)s 99.1	(CL)s 99.1		
												SP/SM 97.9	Qal	
												(CL)s 95.4		
	30	92										SP/SM 94.4		

BOTTOM OF HOLE

COMMENTS:

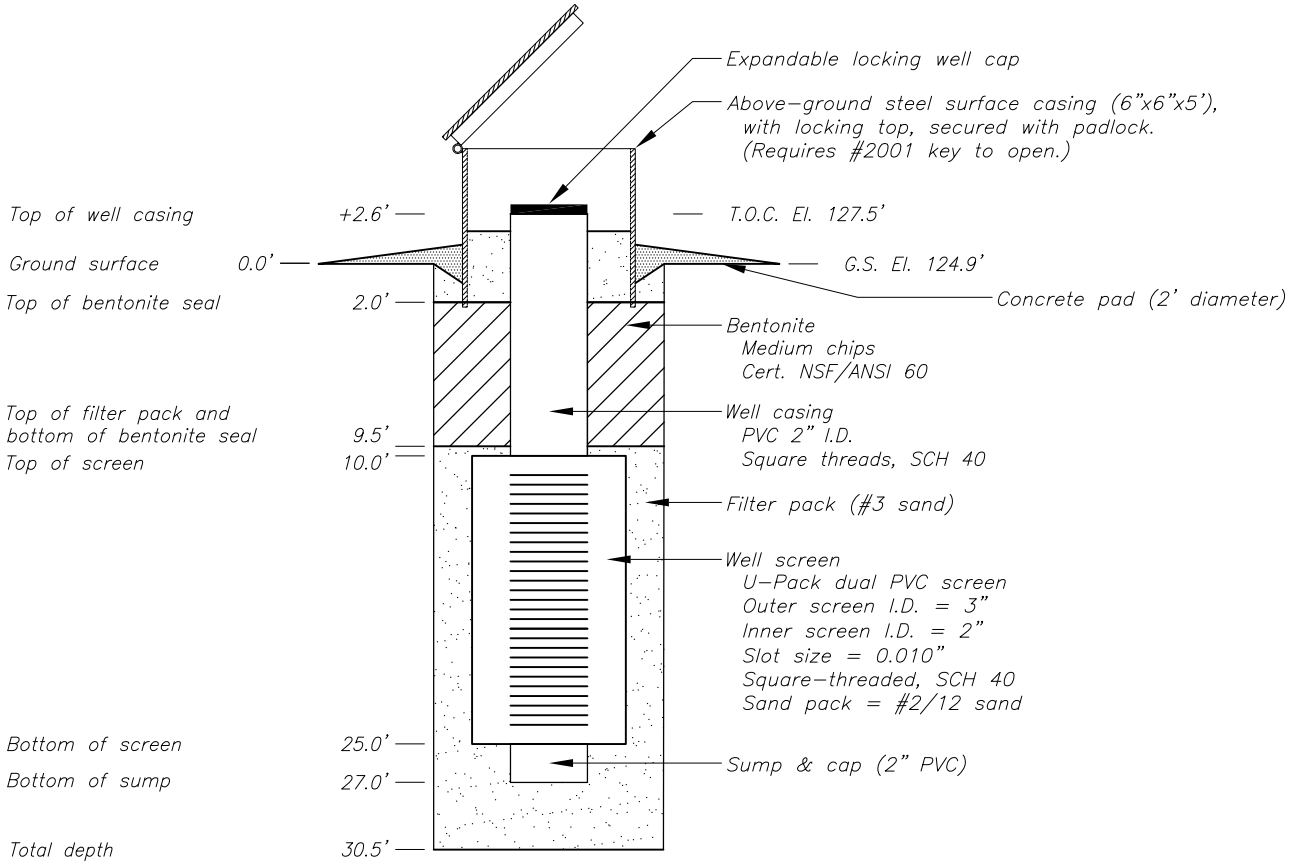
FADC = Flight Auger Dry Core
NP = Non-plastic
NR = No Recovery
NA = Not applicable
I.D. = inner diameter
RM = River Mile
O.D. = outer diameter
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

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–10–80	GEOLOGIST: A. WARREN
WELL COMPLETION DIAGRAM	DRILLER: G. HANSEN
DATE COMPLETED: 3/22/2010	HELPER: C. KELLY, K. KREITZ
TOP OF WELL CASING COORDINATES: N2251292.7 E6121295.6 (NAD83) ELEVATION 127.5' (NAVD88) GROUND SURFACE ELEVATION 124.9' (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-10-89

FEATURE: Groundwater Monitoring
LOCATION: Reach 4A, Right Side of River, SW of Road 1 and Ave. 21
BEGUN: 3/24/10 FINISHED: 3/24/10
WATER LEVEL DEPTH AND ELEVATION: NA
DATE WATER LEVEL WAS MEASURED: NA

PROJECT: San Joaquin River Restoration Program
COORDINATES: N 2,260,977.3 E 6,110,854.1 (NAGD83)
TOTAL DEPTH: 31.5 ft.

STATE: California
GROUND SURFACE ELEVATION: 118.8 ft. (NAVD88)
T.O.C ELEVATION: 121.5 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 4A, river right, about 350 feet east from the center of the SJR, about 1.8 miles south and 0.9 miles west of the intersection of Road 1 and Avenue 21.

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-10-89 was advanced using hollow stem flight augers with a continuous dry core sampling system (FADC) from the ground surface to a total depth of 31.5 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 31.5 ft. - FADC

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
0.0 to 4.5 ft. smooth drilling, soft
1.5 to 19.0 ft. wet, add water
19.0 to 29.0 ft. firm
29.0 to 31.5 ft. firm to moderately firm

CAVING CONDITIONS:
None

DRILL FLUID, RETURN AND COLOR:
0.0 to 4.9 ft. None
4.9 to 31.5 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 10.0 ft. (T.O.C. El. 121.5 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 31.5 ft. (#3 Sand)
Sump: 25.0 to 27.0 ft. (2-inch blank PVC with cap)
Bentonite Seal: 2.0 to 9.5 ft.
Well Completion: Steel surface

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
	71										SM 118.2	
5											s(ML) 116.6	
	44											Qal
10		2.5	1.1	3.6	96.2	0.2	NP	NP	19.8	SP 107.8	SP	
	60											

0.0 to 31.5 feet
QUATERNARY ALLUVIUM (Qal)

0.0 to 0.6 ft.: SILTY SAND, SM: About 55% fine sand; about 45% fines with low plasticity; maximum size: fine sand; moist, brown, organic odor; moderately soft.

0.6 to 2.2 ft.: SANDY SILT, s(ML): About 60% fines with low plasticity; about 40% fine sand; maximum size: fine sand; moist, dark brown, organic odor; firm.

2.2 to 19.0 ft.: POORLY GRADED SAND, SP : About 100% fine to medium sand; trace fines; maximum size: medium sand; dry, moist at 5.0 ft. and wet at 9.0 ft., tan, gray at 14.0 ft.; soft, loose, uniform, orange oxidation discoloration from 2.2 to 2.5 ft. SP/SM from 6.3 to 9.0 ft., alternating beds about 0.6 ft. thick of fine and medium sand throughout interval.

Laboratory Data Interval
10.0 to 11.0 ft.
16.0 to 17.0 ft.

19.0 to 25.0 ft.: FAT CLAY WITH SAND, (CH)s : About 80 to 85% fines with high plasticity and toughness, no dilatancy; about 15 to 20% fine sand; maximum size: fine sand; moist; olive tan with reddish brown oxidation veins from 19.0 to 24.0 feet; very firm; stratified with infrequent layers of fine sand and s(CH); dark gray blue, hydrogen sulfide odor from 24.0 to 25.0 feet.

Laboratory Data Interval
21.0 to 22.0 ft.

25.0 to 26.2 ft.: POORLY GRADED SAND WITH CLAY, SP/SC: About 90% fine sand; about 10% nonplastic fines; maximum size: fine sand; wet, brown; moderately soft.

26.2 to 27.6 ft.: SANDY LEAN CLAY, s(CL) : About 65% fines with medium plasticity, high toughness; about 35% fine sand; maximum size: fine sand; moist, orange brown; moderately soft, stratified.

Laboratory Data Interval
26.5 to 27.5 ft.

27.6 to 28.5 ft.: POORLY GRADED SAND WITH SILT, SP/SM: About 90% fine sand; about 10% nonplastic fines; maximum size: fine sand; wet, brown; moderately soft.

28.5 to 29.0 ft.: SANDY LEAN CLAY, s(CL) : About 65% fines with medium plasticity, high toughness; about 35% fine sand; maximum size: fine sand; moist, orange brown; moderately soft, stratified.

29.0 to 31.5 ft.: POORLY GRADED SAND, SP : About 95% fine to medium sand; about 5% fines; maximum size: fine sand; wet, brown; soft.

T.D. = 31.5 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-10-89

FEATURE: Groundwater Monitoring
LOCATION: Reach 4A, Right Side of River, SW of Road 1 and Ave. 21
BEGUN: 3/24/10 FINISHED: 3/24/10
WATER LEVEL DEPTH AND ELEVATION: NA
DATE WATER LEVEL WAS MEASURED: NA

PROJECT: San Joaquin River Restoration Program
COORDINATES: N 2,260,977.3 E 6,110,854.1 (NAGD83)
TOTAL DEPTH: 31.5 ft.

STATE: California
GROUND SURFACE ELEVATION: 118.8 ft. (NAVD88)
T.O.C ELEVATION: 121.5 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.		60										SP		
	15	28	6.1	1.0	7.1	92.9	0.0	NP	NP	24.1	SP-SM 101.8		Qal	
												99.8		
	20	100	39.9	41.4	81.3	18.7	0.0	32.3	16.3	21.4	(CL)s 96.8	(CH)s		

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-10-89

FEATURE: Groundwater Monitoring
LOCATION: Reach 4A, Right Side of River, SW of Road 1 and Ave. 21
BEGUN: 3/24/10 FINISHED: 3/24/10
WATER LEVEL DEPTH AND ELEVATION: NA
DATE WATER LEVEL WAS MEASURED: NA

PROJECT: San Joaquin River Restoration Program
COORDINATES: N 2,260,977.3 E 6,110,854.1 (NAGD83)
TOTAL DEPTH: 31.5 ft.

STATE: California
GROUND SURFACE ELEVATION: 118.8 ft. (NAVD88)
T.O.C ELEVATION: 121.5 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	100	38.9	33.9	72.8	27.2	0.0	29.1	16.3	19.4	(CL)s 91.3	(CH)s 93.8 SP/SC 92.6 s(CL) 91.2 SP/SM 90.3 s(CL) 89.8	Qal	
	30	88										SP 87.3		

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

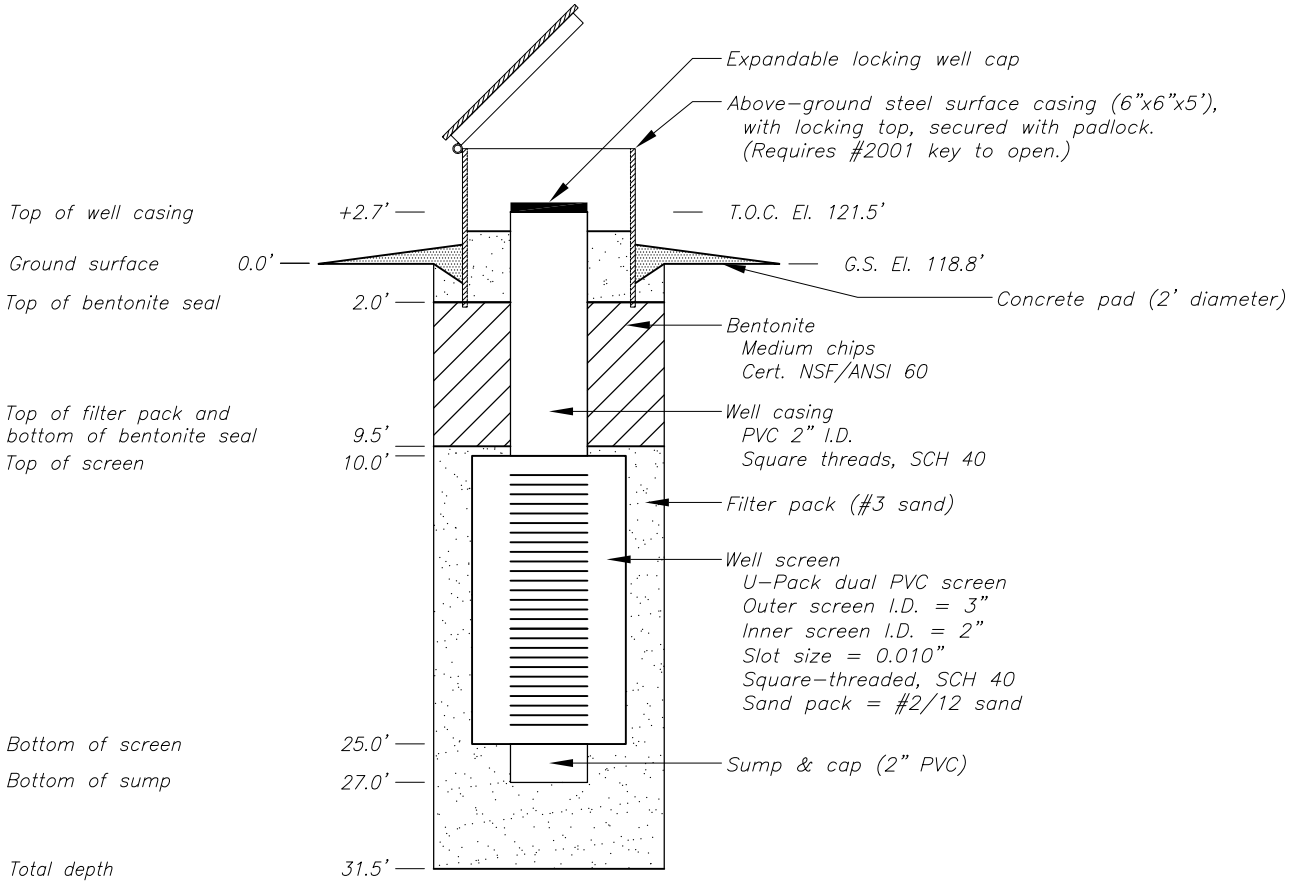
O.D. = outer diameter
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

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–10–89	GEOLOGIST: A. WARREN
WELL COMPLETION DIAGRAM	DRILLER: G. HANSEN
DATE COMPLETED: 3/24/2010	HELPER: C. KELLY, K. KREITZ
TOP OF WELL CASING COORDINATES: N2260977.3 E6110854.1 (NAD83) ELEVATION 121.5' (NAVD88) GROUND SURFACE ELEVATION 118.8' (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-10-90

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Right, North of Sand Slough Structure
BEGUN: 4/17/10 FINISHED: 4/17/10
WATER LEVEL DEPTH AND ELEVATION: NA
DATE WATER LEVEL WAS MEASURED: NA

PROJECT: San Joaquin River Restoration Program
COORDINATES: N 2,297,746.3 E 6,099,622.5 (NAGD83)
TOTAL DEPTH: 31.2 ft.

STATE: California
GROUND SURFACE ELEVATION: 101.3 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
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 850 feet east of the center of the Eastside Bypass, north-side of the W. El Nido Road at its intersection with the Eastside Bypass levee. **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-10-90 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 4.3 ft. smooth drilling, soft 4.3 to 8.7 ft. moved sampler out 0.2 ft. 8.7 to 13.7 ft. moved sampler out 0.2 ft. 13.7 to 18.7 ft. moved sampler in 0.3 ft. 18.7 to 31.2 ft. soft **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: +2.6 to 10.0 ft. (T.O.C. El. 103.9 ft.) Dual U-pack Screen: 10.0 to 25.0 ft. (Slotted 0.010-inch) Well Screen Filter Pack: 2/12 Sand Filter Pack: 9.0 to 31.2 ft. (#3 Sand) Sump: 25.0 to 27.0 ft. (2-inch blank	5 10	91 100 100	42.3 38.2	14.5 27.7	56.8 65.9	43.2 34.1	0.0 0.0	24.3 31.0	5.1 15.8	20.2 17.2	s(CL-ML) 94.3 s(CL) 91.3	SC 98.8 SM 96.8 SC/SM 93.7 (CL)s 92.6 s(CL) 91.3 SM 89.5	Qal	***0.0 to 31.2 feet*** ***QUATERNARY ALLUVIUM (Qal)*** **0.0 to 2.5 ft.: CLAYEY SAND WITH ORGANIC FINES, SC:** About 60% fine sand; about 40% fines with medium plasticity and organic soil; trace of fine, elongated, flat, hard, angular gravel; maximum size: fine gravel; moist, brown; moderately soft consistency, soil is previously disturbed. **2.5 to 4.5 ft.: SILTY SAND, SM:** About 70% fine to coarse sand; about 30% fines with low plasticity; maximum size: coarse sand; moist, tan; soft consistency; several clayey layers; cemented lens approximately 0.1- to 1-inch-thick. **4.5 to 7.6 ft.: SILTY CLAYEY SAND, SC/SM:** About 55% fine sand containing mica; about 45% fines with low plasticity; maximum size: fine sand; moist to wet, brown; soft consistency. Laboratory Data Interval 6.0 to 7.0 ft. **7.6 to 8.7 ft.: LEAN CLAY WITH SAND, (CL)s:** About 85% fines with medium plasticity, low toughness, and slow dilatancy; about 15% fine sand; maximum size: fine sand; moist, dark brown with reddish brown; moderately firm consistency. **8.7 to 10.0 ft.: SANDY LEAN CLAY, s(CL):** About 65% fines with medium plasticity, low toughness, and slow dilatancy; about 35% fine sand; maximum size: fine sand; moist, dark brown with reddish brown; moderately firm consistency; percentage of sand increases with depth. Laboratory Data Interval 9.0 to 10.0 ft. **10.0 to 11.8 ft.: SITY SAND, SM:** About 80% fine sand containing mica; about 20% non-plastic fines; maximum size: fine sand; wet, brown; moderately firm consistency; percentage of sand increases with depth. **11.8 to 18.7 ft.: POORLY GRADED SAND, SP:** About 95% fine to medium sand; about 5% non-plastic fines; maximum size: medium sand; wet, gray; soft consistency; percentage of sand increases with depth. Laboratory Data Interval 12.0 to 13.0 ft. **18.7 to 23.7 ft.: CLAYEY SAND, SC:** About 55% fine sand (trace of medium sand); about 45% fines with medium to high plasticity; maximum size: medium sand; moist, brown; very firm consistency; stratified in 0.1- to 0.3-foot-thick layers of +/-10% fines. Laboratory Data Interval 22.0 to 23.0 ft. **23.7 to 25.2 ft.: CLAYEY SAND, SC:** About 80% medium sand; about 20% fines with low plasticity; maximum size: medium sand; wet to moist, 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

REPORT: SJRRP DRILL HOLE
PROJECT DATABASE: SJRRP.GPJ

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-90

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Right, North of Sand Slough Structure
BEGUN: 4/17/10 FINISHED: 4/17/10
WATER LEVEL DEPTH AND ELEVATION: NA
DATE WATER LEVEL WAS MEASURED: NA

PROJECT: San Joaquin River Restoration Program
COORDINATES: N 2,297,746.3 E 6,099,622.5 (NAGD83)
TOTAL DEPTH: 31.2 ft.

STATE: California
GROUND SURFACE ELEVATION: 101.3 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
PVC with cap) Bentonite Seal: 2.0 to 9.0 ft. Well Completion: Steel surface casing with locking top, square 6-inches-wide and 5-foot-long.		100	7.2	2.0	9.2	90.8	0.0	NP	NP	19.0	SW-SM 88.3			**25.2 to 31.2 ft.: <u>SILTY CLAY, CL/ML</u>:** About 95% fines with low plasticity and toughness, slow dilatancy; about 5% sand; moist, brown with reddish brown oxidation; firm consistency; contains mica, layers of (CL)s to s(CL) from 28.7 to 31.2 feet. <u>Laboratory Data Interval</u> 27.0 to 28.0 ft. **T.D.= 31.2 ft.**
	15											SP		
		10												
													Qal	
												82.6		
	20											SC		
		100	34.3	23.7	58.0	42.0	0.0	26.9	9.6	16.6	s(CL) 78.3			
		100										77.6 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

REPORT: SJRRP DRILL HOLE
PROJECT DATABASE: SJRRP.GPJ

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-90

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Right, North of Sand Slough Structure
BEGUN: 4/17/10 FINISHED: 4/17/10
WATER LEVEL DEPTH AND ELEVATION: NA
DATE WATER LEVEL WAS MEASURED: NA

PROJECT: San Joaquin River Restoration Program
COORDINATES: N 2,297,746.3 E 6,099,622.5 (NAGD83)
TOTAL DEPTH: 31.2 ft.

STATE: California
GROUND SURFACE ELEVATION: 101.3 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	100										SC 76.1		
			62.5	32.4	94.9	5.1	0.0	34.0	12.9	23.1	CL 73.3		Qal	
												CL/ML		
	30	100										70.1		

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

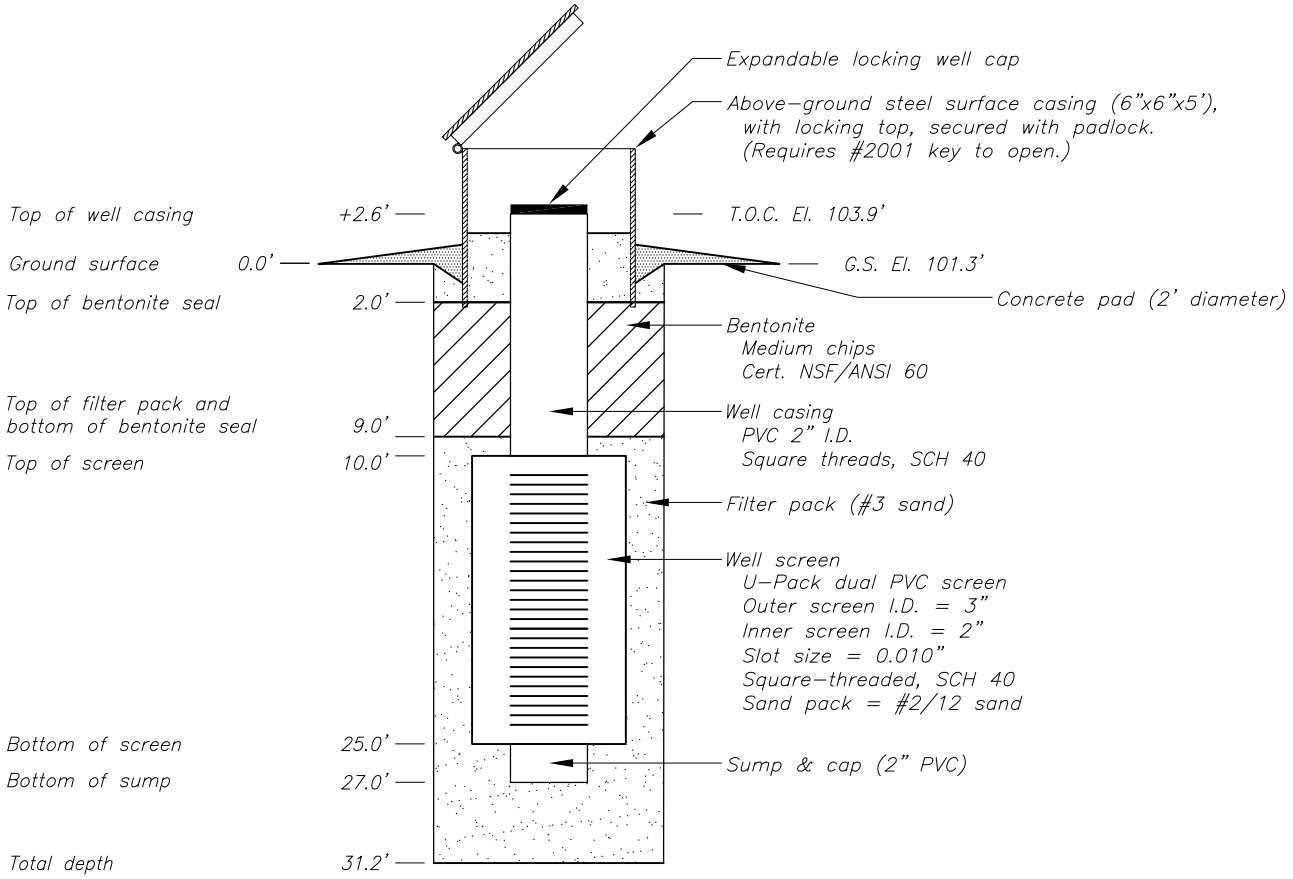
O.D. = outer diameter
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

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–10–90	GEOLOGIST: A. WARREN
WELL COMPLETION DIAGRAM	DRILLER: G. HANSEN
DATE COMPLETED: 4/17/2010	HELPER: C. KELLY, K. KREITZ
TOP OF WELL CASING COORDINATES: N2297746.3 E6099622.5 (NAD83) ELEVATION 103.9' (NAVD88) GROUND SURFACE ELEVATION 101.3' (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-10-91

FEATURE: Groundwater Monitoring
LOCATION: Reach 4A1, River Bank Left, RM 169.0
BEGUN: 4/7/10 FINISHED: 4/7/10
WATER LEVEL DEPTH AND ELEVATION: NA
DATE WATER LEVEL WAS MEASURED: NA

PROJECT: San Joaquin River Restoration Program
COORDINATES: N 2,289,756.4 E 6,098,164.1 (NAGD83)
TOTAL DEPTH: 29.8 ft.

STATE: California
GROUND SURFACE ELEVATION: 107.2 ft. (NAVD88)
T.O.C ELEVATION: 109.9 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, RM 169, river left, about 400 feet southwest from the center of the SJR, about 2,160 feet south-southwest of the Sand Slough Control Structure.

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-10-91 was advanced using hollow stem flight augers with a continuous dry core sampling system (FADC) from the ground surface to a total depth of 29.8 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 29.8 ft. - FADC

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
0.0 to 4.8 ft. smooth drilling, moderately soft
4.8 to 8.9 ft. moderately soft to firm, moved sampler out to 0.3 ft.
8.9 to 12.3 ft. soft, moved sampler out 0.1 ft.
12.3 to 17.3 ft. soft, moved sampler out 0.1 ft.
17.3 to 29.8 ft. soft, moved sampler out 0.1 ft.

CAVING CONDITIONS:
None

DRILL FLUID, RETURN AND COLOR:
0.0 to 12.3 ft. None
12.3 to 29.8 ft. Water, no return

WATER LEVEL:
Not measured

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

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
											s(CL)	
	54	25.7	31.8	57.5	42.5	0.0	30.4	14.1	18.2	s(CL) 103.2	102.9	
5		14.4	12.2	26.6	73.4	0.0	NP	NP	13.6	SM 102.1	SC 101.9	Qal
	100	26.8	43.6	70.4	27.1	2.5	35.6	19.3	21.0	(CL)s 97.6	CH 97.4	
	100										SC 97.2	

0.0 to 29.8 feet
QUATERNARY ALLUVIUM (Qal)

0.0 to 4.3 ft.: SANDY LEAN CLAY, s(CL): About 55% fines with medium plasticity, toughness, and dry strength, slow dilatancy; about 45% fine sand; maximum size: fine sand; moist, dark brown, no reaction to HCl; soft consistency; roots in top 0.5 feet.

Laboratory Data Interval
1.0 to 4.0 ft.

4.3 to 5.3 ft.: CLAYEY SAND, SC: About 65% fine to medium sand (mostly fine); about 35% fines with low plasticity and toughness, no dry strength, rapid dilatancy; maximum size: medium sand; moist, dark brown, no reaction to HCl; soft consistency.

Laboratory Data Interval
4.5 to 5.1 ft.

5.3 to 9.8 ft.: FAT CLAY, CH: About 90% fines with high plasticity, toughness, and dry strength, no dilatancy; about 10% fine sand; maximum size: fine sand; moist, brown, strong reaction to HCl; very firm consistency; nodules of calcium carbonate present.

Laboratory Data Interval
5.5 to 9.6 ft.

9.8 to 10.0 ft.: CLAYEY SAND, SC: About 80% fine to medium sand; about 20% fines with low plasticity, no dry strength, rapid dilatancy; maximum size: medium sand; wet, brown, no reaction to HCl; soft consistency.

10.0 to13.7 ft.: FAT CLAY, CH: About 90% fines with high plasticity, toughness, and dry strength, no dilatancy; about 10% fine sand; maximum size: fine sand; moist, brown, strong reaction to HCl; very firm consistency; streaked with calcium carbonate.

Laboratory Data Interval
10.2 to 13.5 ft.

13.7 to 15.9 ft.: CLAYEY SAND, SC: About 55% fine sand; about 45% fines with low plasticity, toughness, and dry strength, rapid dilatancy; maximum size: fine sand; moist, brown.

Laboratory Data Interval
13.9 to 15.7 ft.

15.9 to 16.9 ft.: CLAYEY SAND, SC: About 70% fine to coarse sand (mostly fine to medium); about 30% fines with low plasticity, no dry strength, rapid dilatancy; maximum size: coarse sand; moist, brown, no reaction to HCl; soft consistency.

16.9 to 19.8 ft.: FAT CLAY, CH: About 90% fines with high plasticity, toughness, and dry strength, no dilatancy; about 10% fine sand; maximum size: fine sand; moist, brown, no to strong reaction to HCl; soft consistency; gravel-sized calcium carbonate encountered from 17.3 to 19.8 ft.

Laboratory Data Interval
17.1 to 19.6 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-10-91

FEATURE: Groundwater Monitoring
LOCATION: Reach 4A1, River Bank Left, RM 169
BEGUN: 4/7/10 FINISHED: 4/7/10
WATER LEVEL DEPTH AND ELEVATION: NA
DATE WATER LEVEL WAS MEASURED: NA

PROJECT: San Joaquin River Restoration Program
COORDINATES: N 2,289,756.4 E 6,098,164.1 (NAGD83)
TOTAL DEPTH: 29.8 ft.

STATE: California
GROUND SURFACE ELEVATION: 107.2 ft. (NAVD88)
T.O.C ELEVATION: 109.9 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
HOLE COMPLETION: Well Casing: +2.7 to 12.8 ft. (T.O.C. El. 109.9 ft.) Dual U-pack Screen: 12.8 to 27.8 ft. (Slotted 0.010-inch) Well Screen Filter Pack: 2/12 Sand Filter Pack: 7.5 to 29.8 ft. (#3 Sand) Sump: 27.8 to 29.8 ft. (2-inch blank PVC with cap) Bentonite Seal: 2.0 to 7.5 ft. Well Completion: Steel surface casing with locking top, square 6-inches-wide and 5-foot-long.		100	45.3	40.8	86.1	13.6	0.3	34.4	15.1	26.8	CL 93.7	CH 93.5		**19.8 to 20.4 ft.: SILTY CLAY WITH SAND, (CL/ML)s:** About 85% fines with medium plasticity, low toughness and dry strength, and no dilatancy; about 15% fine sand; maximum size: fine sand; wet, brown, strong reaction to HCl; soft consistency. Laboratory Data Interval 19.9 to 20.3 ft. **20.4 to 27.9 ft.: FAT CLAY, CH:** About 90% fines with high plasticity, toughness, and dry strength, no dilatancy; about 10% fine sand; maximum size: fine sand; moist, brown, no reaction to HCl; soft consistency. Laboratory Data Interval 20.0 to 27.7 ft. **27.9 to 28.4 ft.: SILTY CLAY WITH SAND, (CL/ML)s:** About 75% fines with medium plasticity, low toughness and dry strength, rapid dilatancy; about 25% fine sand; maximum size: fine sand; moist, brown, no reaction to HCl; soft consistency. **28.4 to 29.8 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, brown, no reaction to HCl; firm consistency. **T.D. = 29.8 ft.**
		100	31.5	14.2	45.7	54.3	0.0	NP	NP	21.0	SM 91.5	SC 91.3	Qal	
	15	96										SC 90.3		
		100	48.9	30.9	79.8	20.2	0.0	31.2	12.4	28.5	(CL)s 87.6	CH 87.4		
		100										(CL/ML)s		

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-10-91

FEATURE: Groundwater Monitoring
LOCATION: Reach 4A1, River Bank Left, RM 169
BEGUN: 4/7/10 FINISHED: 4/7/10
WATER LEVEL DEPTH AND ELEVATION: NA
DATE WATER LEVEL WAS MEASURED: NA

PROJECT: San Joaquin River Restoration Program
COORDINATES: N 2,289,756.4 E 6,098,164.1 (NAGD83)
TOTAL DEPTH: 29.8 ft.

STATE: California
GROUND SURFACE ELEVATION: 107.2 ft. (NAVD88)
T.O.C ELEVATION: 109.9 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
			47.8	25.7	73.5	26.5	0.0	30.3	12.1	30.8	(CL)s 86.9	(CL/ML)s 86.8		
		100	34.9	42.4	77.3	22.7	0.0	29.6	12.5	24.1	(CL)s	CH		
	25	92									79.5	79.3	Qal	
												(CL/ML)s 78.8		
												(CL)s 77.4		

BOTTOM OF HOLE

COMMENTS:

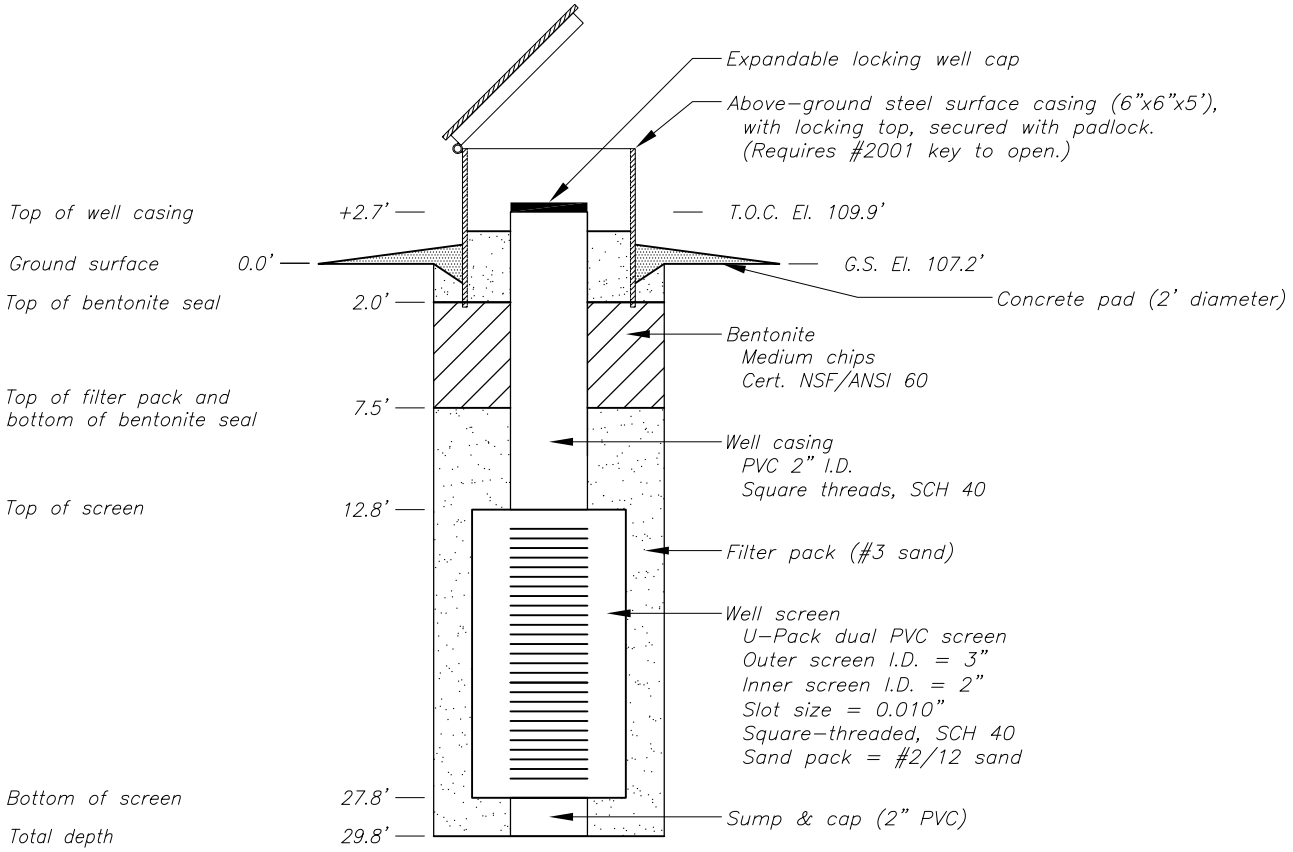
FADC = Flight Auger Dry Core
NP = Non-plastic
NR = No Recovery
NA = Not applicable
I.D. = inner diameter
RM = River Mile
O.D. = outer diameter
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

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-10-91	GEOLOGIST: J. VAUK
WELL COMPLETION DIAGRAM	DRILLER: G. HANSEN
DATE COMPLETED: 4/07/2010	HELPER: C. KELLY, K. KREITZ
TOP OF WELL CASING COORDINATES: N2289756.4 E6098164.1 (NAD83) ELEVATION 109.9' (NAVD88) GROUND SURFACE ELEVATION 107.2' (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-10-92

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Left, RM 169
BEGUN: 4/4/10 FINISHED: 4/4/10
WATER LEVEL DEPTH AND ELEVATION: NA
DATE WATER LEVEL WAS MEASURED: NA

PROJECT: San Joaquin River Restoration Program
COORDINATES: N 2,289,060.6 E 6,097,531.8 (NAGD83)
TOTAL DEPTH: 28.5 ft.

STATE: California
GROUND SURFACE ELEVATION: 106.0 ft. (NAVD88)
T.O.C ELEVATION: 107.4 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 169, river left, about 1,800 feet southwest from the center of the SJR, about 3,370 feet south-southwest of the Sand Slough Control Structure.

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-10-92 was advanced using hollow stem flight augers with a continuous dry core sampling system (FADC) from the ground surface to a total depth of 28.5 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 28.5 ft. - FADC

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
0.0 to 4.3 ft. smooth drilling, moderately soft
4.3 to 8.5 ft. very soft, moved sampler out to 0.4 ft.
8.5 to 13.5 ft. soft to very firm, add catcher
13.5 to 18.5 ft. moved sampler out 0.2 ft.
18.5 to 28.5 ft. soft

CAVING CONDITIONS:
Soil caved from the borehole wall from 27.2 to 28.5 ft.

DRILL FLUID, RETURN AND COLOR:
0.0 to 13.5 ft. None
13.5 to 28.5 ft. Water, no return

WATER LEVEL:
Not measured

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
											s(CL)	
											104.0	
	81										CL	
											103.5	
											s(CL)	
											102.5	
											CL	
											102.2	
											CH	
											101.7	
5												Qal
	100	38.3	52.7	91.0	9.0	0.0	42.4	23.7	23.8	CL	CL	
										97.7		
											97.5	
											s(CL)	
											97.1	
	90	24.8	4.7	29.5	70.3	0.2	19.8	2.8	10.3	SM	SM	
										96.2	96.1	

0.0 to 28.5 feet
QUATERNARY ALLUVIUM (Qal)

0.0 to 2.0 ft.: SANDY LEAN CLAY, s(CL): About 60% fines with high plasticity, low toughness and dry strength, and slow dilatancy; about 40% fine sand (trace of medium sand); maximum size: medium sand; dry to moist, brown, mostly strong reaction to HCl (zones with no reaction to HCl); soft consistency.

2.0 to 2.5 ft.: LEAN CLAY, CL: About 95% fines with medium plasticity, toughness, and dry strength, no dilatancy; about 5% fine sand; maximum size: fine sand; moist, dark brown, no reaction to HCl.

2.5 to 3.5 ft.: SANDY LEAN CLAY, s(CL): About 60% fines with high plasticity, low toughness and dry strength, slow dilatancy; about 40% fine sand (trace of medium sand); maximum size: medium sand; dry to moist, brown, mostly strong reaction to HCl (zones with no reaction to HCl); soft consistency.

3.5 to 3.8 ft.: LEAN CLAY, CL: About 95% fines with medium plasticity, toughness, and dry strength, no dilatancy; about 5% fine sand; maximum size: fine sand; moist, dark brown, no reaction to HCl.

3.8 to 4.3 ft.: FAT CLAY, CH: About 95% fines with high plasticity, toughness, and dry strength, no dilatancy; about 5% fine sand; maximum size: fine sand; moist, strong reaction to HCl; hard nodules of calcium carbonate present.

4.3 to 8.5 ft.: LEAN CLAY, CL: About 90% fines with medium plasticity and toughness, low dry strength, no dilatancy; about 10% fine to medium sand; maximum size: medium sand; moist, brown, strong reaction to HCl; firm consistency; sand-sized calcium carbonate.

Laboratory Data Interval
4.5 to 8.3 ft.

8.5 to 8.9 ft.: SANDY LEAN CLAY, s(CL): About 65% fines with low plasticity, toughness, and dry strength, no dilatancy; about 35% fine to coarse sand; maximum size: coarse sand; wet, brown, no reaction to HCl; soft consistency.

8.9 to 9.9 ft.: SILTY SAND, SM: About 70% fine to coarse sand, coarse sand is hard and sub-angular; about 30% fines with low plasticity, toughness and dry strength, and rapid dilatancy; maximum size: coarse sand; wet, brown, no reaction to HCl; soft consistency.

Laboratory Data Interval
9.0 to 9.8 ft.

9.9 to 10.8 ft.: CLAYEY SAND, SC: About 80% fine to coarse sand, coarse sand is sub-angular and hard; about 20% fines with low plasticity, toughness, and dry strength, rapid dilatancy; maximum size: coarse sand; wet, 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

PROJECT DATABASE: SJRRP.GPJ
REPORT: SJRRP DRILL HOLE

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-92

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Left, RM 169
BEGUN: 4/4/10 FINISHED: 4/4/10
WATER LEVEL DEPTH AND ELEVATION: NA
DATE WATER LEVEL WAS MEASURED: NA

PROJECT: San Joaquin River Restoration Program
COORDINATES: N 2,289,060.6 E 6,097,531.8 (NAGD83)
TOTAL DEPTH: 28.5 ft.

STATE: California
GROUND SURFACE ELEVATION: 106.0 ft. (NAVD88)
T.O.C ELEVATION: 107.4 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
HOLE COMPLETION: Well Casing: +1.4 to 10.2 ft. (T.O.C. El. 107.4 ft.) Dual U-pack Screen: 10.2 to 25.2 ft. (Slotted 0.010-inch) Well Screen Filter Pack: 2/12 Sand Filter Pack: 9.4 to 27.2 ft. (#3 Sand) Sump: 25.2 to 27.2 ft. (2-inch blank PVC with cap) Bottom Backfill: 27.2 to 28.5 ft. (soil caved from borehole wall) Bentonite Seal: 2.0 to 9.4 ft. Well Completion: Steel surface casing with locking top, square 6-inches-wide and 5-foot-long.											SC 95.2		**10.8 to 13.5 ft.: POORLY GRADED SAND, SP:** About 95% fine to coarse sand (mostly coarse), coarse sand is sub-angular, hard, and contains quartz and feldspar; about 5% non-plastic fines with rapid dilatancy; maximum size: coarse sand; wet, light brown, no reaction to HCl; soft consistency; greater percentage of fine sand with depth. Laboratory Data Interval 11.0 to 13.3 ft.
		90												**13.5 to 23.5 ft.: No Recovery - POORLY GRADED SAND WITH SILT, SP/SM:** Description is based on soil collected in the shoe and drilling conditions.
			4.8	2.7	7.5	91.9	0.6	NP	NP	10.5	SW-SM	SP		**23.5 to 25.2 ft.: SILT WITH SAND, (ML)s:** About 80% fines with medium plasticity, low toughness and dry strength, and rapid dilatancy; about 20% fine sand; maximum size: fine sand; wet, light brown, no reaction to HCl; firm consistency. Laboratory Data Interval 23.7 to 25.0 ft.
											92.7	92.5		**25.2 to 25.6 ft.: SILTY SAND, SM:** About 75% fine to medium sand; about 25% non-plastic fines with rapid dilatancy; maximum size: medium sand; wet, medium brown, no reaction to HCl; soft consistency.
	15												Qal	**25.6 to 26.4 ft.: SILT WITH SAND, (ML)s:** About 85% fines with medium plasticity, low toughness and dry strength, and rapid dilatancy; about 15% fine sand; maximum size: fine sand; light brown, no reaction to HCl; hard consistency. **26.4 to 28.5 ft.: No Recovery-SILTY SAND, SM:** Description is based on soil collected in the shoe and drilling conditions. **T.D. = 28.5 ft.**
		0										SP/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

REPORT: SJRRP DRILL HOLE PROJECT DATABASE: SJRRP.GPJ

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-92

FEATURE: Groundwater Monitoring
LOCATION: Reach 4B1, River Bank Left, RM 169
BEGUN: 4/4/10 FINISHED: 4/4/10
WATER LEVEL DEPTH AND ELEVATION: NA
DATE WATER LEVEL WAS MEASURED: NA

PROJECT: San Joaquin River Restoration Program
COORDINATES: N 2,289,060.6 E 6,097,531.8 (NAGD83)
TOTAL DEPTH: 28.5 ft.

STATE: California
GROUND SURFACE ELEVATION: 106.0 ft. (NAVD88)
T.O.C ELEVATION: 107.4 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
	0											SP/SM		
												82.5		
			53.7	19.6	73.3	26.7	0.0	23.4	5.4	19.9	(CL-ML)s	(ML)s	Qal	
	25										81.0	80.8		
												SM		
												80.4		
		58										(ML)s		
												79.6		
												SM		
												77.5		

BOTTOM OF HOLE

COMMENTS:

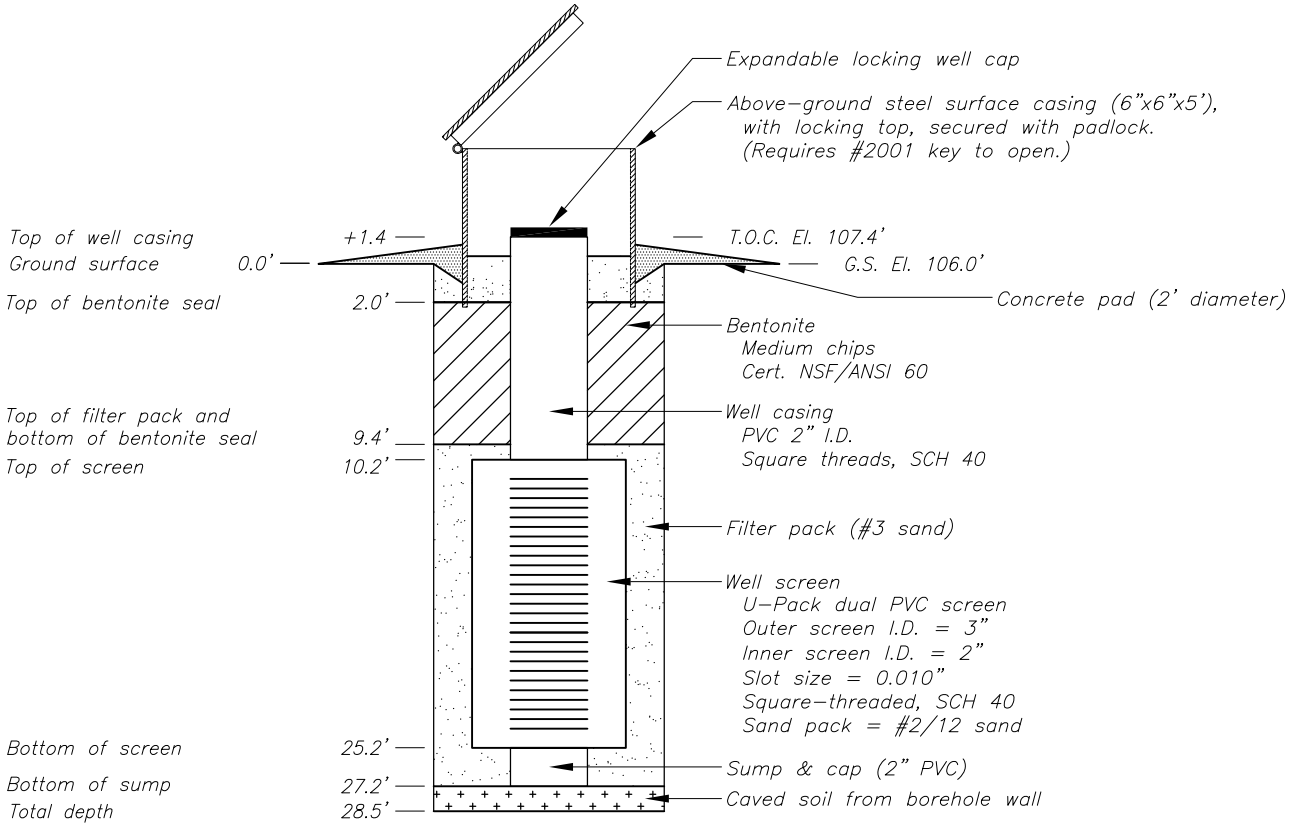
FADC = Flight Auger Dry Core
NP = Non-plastic
NR = No Recovery
NA = Not applicable
I.D. = inner diameter
RM = River Mile
O.D. = outer diameter
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

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–10–92	GEOLOGIST: J. VAUK
WELL COMPLETION DIAGRAM	DRILLER: G. HANSEN
DATE COMPLETED: 4/04/2010	HELPER: C. KELLY, K. KREITZ
TOP OF WELL CASING COORDINATES: N2289060.6 E6097531.8 (NAD83) ELEVATION 107.4' (NAVD88) GROUND SURFACE ELEVATION 106.0' (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-10-93

FEATURE: Groundwater Monitoring
LOCATION: Reach 4A, River Bank Right, RM 168.9
BEGUN: 4/3/10 FINISHED: 4/3/10
WATER LEVEL DEPTH AND ELEVATION: 9.3 ft. b.g.s (El. 96.1 ft.)
DATE WATER LEVEL WAS MEASURED: 4/17/2010

PROJECT: San Joaquin River Restoration Program
COORDINATES: N 2,288,314.4 E 6,096,811.9 (NAGD83)
TOTAL DEPTH: 26.5 ft.

STATE: California
GROUND SURFACE ELEVATION: 105.4 ft. (NAVD88)
T.O.C ELEVATION: 108.5 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 169, river left, about 2,450 feet southwest from the center of the SJR, about 4,000 feet south-southwest of the Sand Slough Control Structure.

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-10-93 was advanced using hollow stem flight augers with a continuous dry core sampling system (FADC) from the ground surface to a total depth of 26.5 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 26.5 ft. - FADC

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
0.0 to 4.2 ft. smooth drilling, soft
4.2 to 9.0 ft. moved sampler out 0.2 ft.
9.0 to 14.0 ft. moved sampler out 0.1 ft., wet, add water
14.0 to 19.0 ft. firm
19.0 to 26.5 ft. moved sampler out 0.1 ft.

CAVING CONDITIONS:
None

DRILL FLUID, RETURN AND COLOR:
0.0 to 9.0 ft. None
9.0 to 26.5 ft. Water, no return

WATER LEVEL:
9.3 ft. b.g.s. on 4/7/2010

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

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
	43	25.9	25.3	51.2	48.8	0.0	27.5	11.2	16.7	s(CL) / 101.2	CH/SC / 104.1	
5	100	35.1	33.5	68.6	31.4	0.0	35.2	21.6	19.7	s(CL) / 97.4	s(CL) / 97.8	Qal
											CL / 96.9	
											s(CL) / 96.4	
	28									SP-SM	SP/SM	

0.0 to 26.5 feet
QUATERNARY ALLUVIUM (Qal)

0.0 to 4.4 ft.: SANDY FAT CLAY, CH/SC: About 50% fines with high plasticity, low toughness, medium dry strength, slow dilatancy; about 50% fine sand; maximum size: fine sand; dry to moist, dark brown to black, no reaction with HCl; soft to firm consistency.

Laboratory Data Interval
1.0 to 4.2 ft.

4.4 to 7.6 ft.: SANDY LEAN CLAY, s(CL): About 70% fines with medium plasticity, toughness, and dry strength, no dilatancy; about 30% fine sand; maximum size: fine sand; moist, light brown, strong reaction with HCl and veins of calcium carbonate; firm consistency.

Laboratory Data Interval
4.6 to 8.0 ft.

7.6 to 8.5 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, light brown, no reaction with HCl; firm consistency.

8.5 to 9.0 ft.: SANDY LEAN CLAY, s(CL): About 60% fines with medium plasticity, low toughness and dry strength, rapid dilatancy; about 40% fine sand with a trace of medium sand; maximum size: medium sand; moist, light brown, no reaction with HCl; firm consistency.

9.0 to 19.0 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 with HCl; soft consistency; no recovery from 14.0 to 19.0 ft. but traces of SP/SM and SM were found in sample barrel.

Laboratory Data Interval
9.2 to 13.8 ft.

19.0 to 23.6 ft.: SILTY SAND, SM: About 75% fine to medium sand; about 25% non-plastic fines with rapid dilatancy; maximum size: medium sand; wet, light brown, no reaction with HCl; soft consistency.

Laboratory Data Interval
19.2 to 23.4 ft.

23.6 to 26.2 ft.: LEAN CLAY WITH SAND, (CL)s: About 75% fines with medium plasticity, low toughness and dry strength, and no dilatancy; about 25% fine sand; maximum size: fine sand; moist, light brown, no reaction with HCl; firm consistency.

Laboratory Data Interval
23.8 to 26.0 ft.

26.2 to 26.5 ft.: SILTY SAND, SM: About 75% fine to medium sand; about 25% non-plastic fines with rapid dilatancy; maximum size: medium sand; wet, brown, no reaction with HCl; soft consistency.

T.D. = 26.5 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-10-93

FEATURE: Groundwater Monitoring
PROJECT: San Joaquin River Restoration Program
STATE: California
LOCATION: Reach 4A, River Bank Right, RM 168.9
COORDINATES: N 2,288,314.4 E 6,096,811.9 (NAGD83)
GROUND SURFACE ELEVATION: 105.4 ft. (NAVD88)
BEGUN: 4/3/10 FINISHED: 4/3/10
TOTAL DEPTH: 26.5 ft.
T.O.C ELEVATION: 108.5 ft. (NAVD88)
WATER LEVEL DEPTH AND ELEVATION: 9.3 ft. b.g.s (El. 96.1 ft.)
HOLE LOGGED BY: J. Vauk
DATE WATER LEVEL WAS MEASURED: 4/17/2010
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
HOLE COMPLETION: Well Casing: +3.1 to 8.5 ft. (T.O.C. El. 108.5 ft.) Dual U-pack Screen: 8.5 to 23.5 ft. (Slotted 0.010-inch) Well Screen Filter Pack: 2/12 Sand Filter Pack: 8.0 to 25.5 ft. (#3 Sand) Sump: 23.5 to 25.5 ft. (2-inch blank PVC with cap) Bottom Backfill: 25.5 to 26.5 ft. (Bentonite) Bentonite Seal: 2.0 to 8.0 ft. Well Completion: Steel surface casing with locking top, square 6-inches-wide and 5-foot-long.		28	4.8	2.5	7.3	92.7	0.0	NP	NP	20.1	SP-SM 91.6	SP/SM		
	15	100											Qal	
												86.4		
		100										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

PROJECT DATABASE: SJRRP.GPJ
REPORT: SJRRP DRILL HOLE

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-93

FEATURE: Groundwater Monitoring
LOCATION: Reach 4A, River Bank Right, RM 168.9
BEGUN: 4/3/10 FINISHED: 4/3/10
WATER LEVEL DEPTH AND ELEVATION: 9.3 ft. b.g.s (El. 96.1 ft.)
DATE WATER LEVEL WAS MEASURED: 4/17/2010

PROJECT: San Joaquin River Restoration Program
COORDINATES: N 2,288,314.4 E 6,096,811.9 (NAGD83)
TOTAL DEPTH: 26.5 ft.

STATE: California
GROUND SURFACE ELEVATION: 105.4 ft. (NAVD88)
T.O.C ELEVATION: 108.5 ft. (NAVD88)
HOLE LOGGED BY: J. Vauk
REVIEWED BY: A. Warren

NOTES	DEPTH	% CORE RECOVERY	LABORATORY DATA								LABORATORY CLASSIFICATION / ELEVATION	VISUAL CLASSIFICATION / ELEVATION	GEOLOGIC UNIT SYMBOL	CLASSIFICATION AND PHYSICAL CONDITION
			% SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %				
		100	19.4	6.8	26.2	73.8	0.0	NP	NP	20.5	SM 82.0	SM 81.8	Qal	
	25	100	62.3	12.4	74.7	25.3	0.0	23.3	4.9	21.4	(CL-ML)s 79.4	(CL)s 79.2		
												SM 78.9		

BOTTOM OF HOLE

COMMENTS:

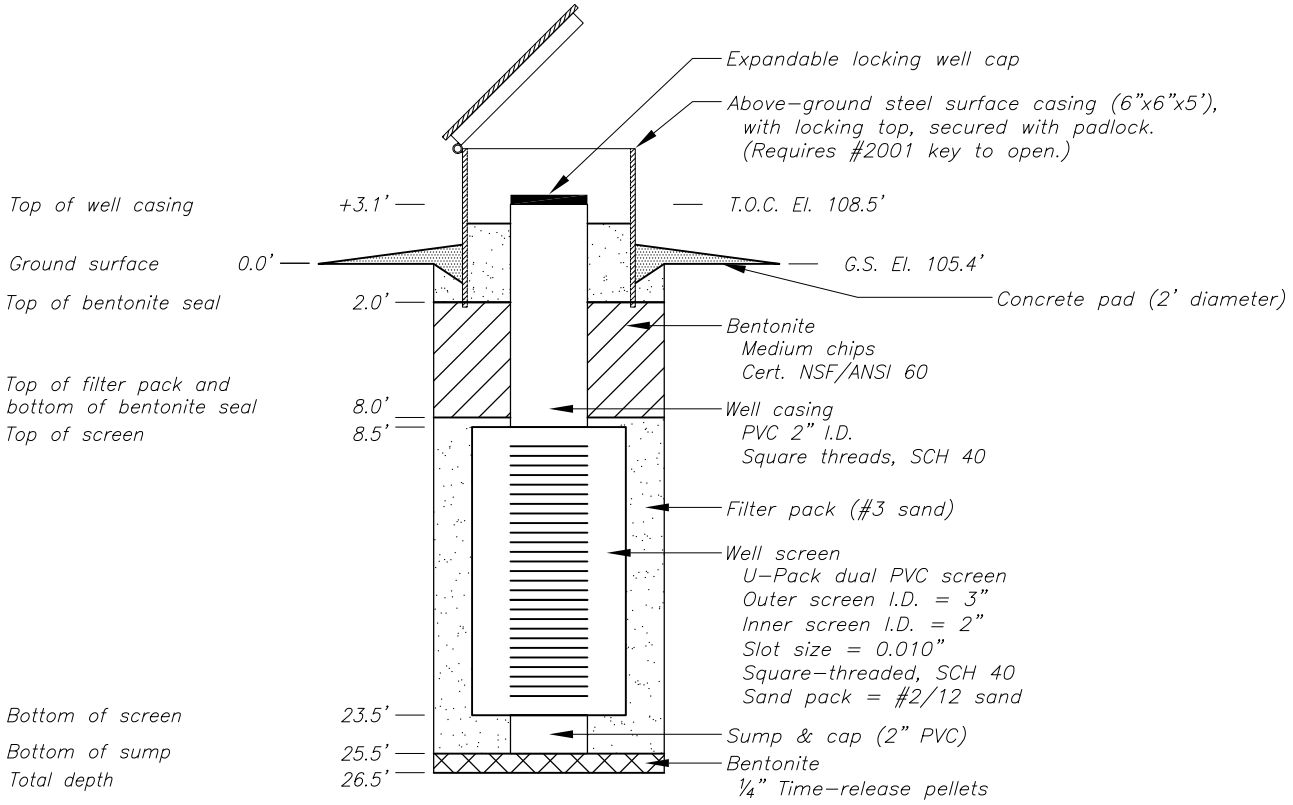
FADC = Flight Auger Dry Core
NP = Non-plastic
NR = No Recovery
NA = Not applicable
I.D. = inner diameter
RM = River Mile
O.D. = outer diameter
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

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

REPORT: SJRRP DRILL HOLE PROJECT DATABASE: SJRRP.GPJ

MW–10–93	GEOLOGIST: J. VAUK
WELL COMPLETION DIAGRAM	DRILLER: G. HANSEN
DATE COMPLETED: 4/03/2010	HELPER: C. KELLY, K. KREITZ
TOP OF WELL CASING COORDINATES: N2288314.4 E6096811.9 (NAD83) ELEVATION 108.5' (NAVD88) GROUND SURFACE ELEVATION 105.4' (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-10-188

FEATURE: Groundwater Monitoring
LOCATION: Reach 4A, River Bank Left
BEGUN: 5/1/10 FINISHED: 5/1/10
WATER LEVEL DEPTH AND ELEVATION: NA
DATE WATER LEVEL WAS MEASURED: NA

PROJECT: San Joaquin River Restoration Program
COORDINATES: N 2,262,126.4 E 6,111,217.2 (NAGD83)
TOTAL DEPTH: 28.6 ft.

STATE: California
GROUND SURFACE ELEVATION: 116.9 ft. (NAVD88)
T.O.C ELEVATION: 120.0 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 4A, river left, about 250 feet northwest from the center of the SJR, about 4,500 feet southeast of the intersection of Island Road and Emory 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-10-188 was advanced using hollow stem flight augers with a continuous dry core sampling system (FADC) from the ground surface to a total depth of 28.6 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 28.6 ft. - FADC **DRILLING CONDITIONS AND DRILLER'S COMMENTS:** 0.0 to 8.6 ft. smooth drilling, soft 8.6 to 13.6 ft. very soft and wet 13.6 to 28.6 ft. soft **CAVING CONDITIONS:** Soil caved from the borehole wall at 14.6 to 15.6 ft. **DRILL FLUID, RETURN AND COLOR:** 0.0 to 8.6 ft. – None 8.6 to 28.6 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: +3.1 to 8.6 ft. (T.O.C. El. 120.0 ft.) Dual U-pack Screen: 8.6 to 13.6 ft. (Slotted 0.010-inch) Well Screen Filter Pack: 2/12 Sand Filter Pack: 7.0 to 14.6 ft. (#3 Sand) Sump: 13.6 to 14.6 ft. (2-inch blank PVC with cap) Bottom Backfill: 15.6 to 28.6 ft. (Bentonite) Bottom Backfill: 14.6 to 15.6 ft. (Soil	5 10	73										CL/ML 114.2		***0.0 to 28.6 feet*** ***QUATERNARY ALLUVIUM (Qal)*** **0.0 to 2.7 ft.: SILTY CLAY, CL/ML:** About 90% fines with high plasticity, low toughness and dry strength, no dilatancy; about 10% fine sand; maximum size: fine sand; dry, dark brown, no reaction to HCl; soft consistency; organics in top 0.5 feet. **2.7 to 4.6 ft.: SANDY SILT, s(ML):** About 60% non-plastic fines with rapid dilatancy; about 40% fine sand; maximum size: fine sand; dry, light brown, no reaction to HCl; soft consistency. Laboratory Data Interval 2.7 to 5.6 ft. **4.6 to 5.6 ft.: SILTY SAND, SM:** About 75% fine sand; about 25% non-plastic fines with rapid dilatancy; maximum size: fine sand; dry, light brown, no reaction to HCl; soft consistency. **5.6 to 8.6 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; dry, gray, no reaction to HCl; soft consistency, loose; moist from 8.0 to 8.6 ft. Laboratory Data Interval 5.6 to 8.6 ft. **8.6 to 14.4 ft.: POORLY GRADED SAND, SP:** About 95% fine to medium sand; about 5% non-plastic fines with rapid dilatancy; maximum size: medium sand; wet, brown, no reaction to HCl; soft consistency. Laboratory Data Interval 8.6 to 14.4 ft. **14.4 to 17.3 ft.: LEAN CLAY WITH SAND, (CL)s:** About 85% fines with medium to high plasticity, medium toughness and dry strength, no dilatancy; about 15% fine sand; maximum size: fine sand; moist, medium brown, no reaction to HCl; firm consistency. Laboratory Data Interval 14.4 to 17.3 ft. **17.3 to 18.6 ft.: SANDY LEAN CLAY, s(CL):** About 70% fines with medium plasticity, toughness, and dry strength, rapid dilatancy; about 30% fine to medium sand; maximum size: medium sand; moist, medium brown, no reaction to HCl. **18.6 to 20.2 ft.: CLAYEY SAND, SC:** About 60% fine to medium sand; about 40% fines with medium plasticity, low toughness and dry strength, rapid dilatancy; maximum size: medium sand; moist, brown, no reaction to HCl; firm consistency. Laboratory Data Interval 18.6 to 20.2 ft. **20.2 to 23.6 ft.: No Recovery.**
			21.5	10.0	31.5	68.5	0.0	NP	NP	2.2	SM 111.3	s(ML) 112.3 SM 111.3		
		69	6.7	2.1	8.8	91.2	0.0	NP	NP	12.9	SP-SM 108.3	SP/SM 108.3	Qal	
		4	4.5	0.6	5.1	94.9	0.0	NP	NP	25.2	SP-SM 102.5	SP 102.5		
		100												

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-10-188

FEATURE: Groundwater Monitoring
LOCATION: Reach 4A, River Bank Left
BEGUN: 5/1/10 FINISHED: 5/1/10
WATER LEVEL DEPTH AND ELEVATION: NA
DATE WATER LEVEL WAS MEASURED: NA

PROJECT: San Joaquin River Restoration Program
COORDINATES: N 2,262,126.4 E 6,111,217.2 (NAGD83)
TOTAL DEPTH: 28.6 ft.

STATE: California
GROUND SURFACE ELEVATION: 116.9 ft. (NAVD88)
T.O.C ELEVATION: 120.0 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
caved from the borehole wall) Bentonite Seal: 2.0 to 7.0 ft. Well Completion: Steel surface casing with locking top, square 6-inches-wide and 5-foot-long.		100	52.0	25.7	77.7	22.3	0.0	30.8	15.4	22.3	(CL)s 99.6	(CL)s 99.6		**23.6 to 24.1 ft.: CLAYEY SAND, SC:** About 60% fine to medium sand; about 40% fines with medium plasticity, low toughness and dry strength, rapid dilatancy; maximum size: medium sand; moist, brown, no reaction to HCl; firm consistency.
												s(CL) 98.3		**24.1 to 28.6 ft.: LEAN CLAY, CL:** About 90% fines with medium plasticity, low toughness and dry strength, no dilatancy; about 10% fine sand; maximum size: fine sand; moist, light brown, no reaction to HCl; firm consistency.
														Laboratory Data Interval 24.1 to 28.6 ft.
	20		29.6	10.4	40.0	60.0	0.0	NP	NP	15.3	SM 96.7	SC 96.7		**T.D.= 28.6 ft.**
		38										No Rec 93.3	Qal	
												SC 92.8		
	25	100	51.8	24.1	75.9	24.1	0.0	24.6	9.7	22.1	(CL)s 91.4	CL 91.4		

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

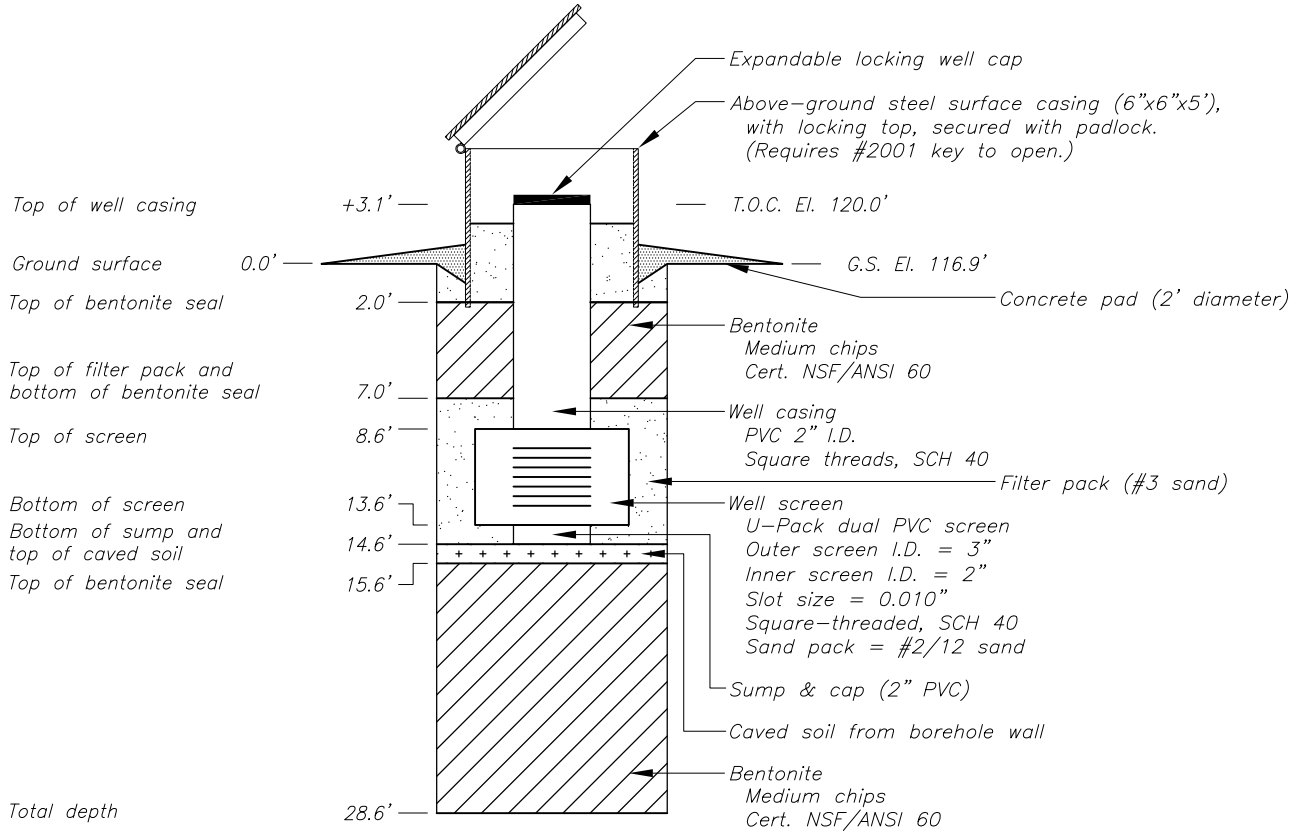
O.D. = outer diameter
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing
SJR = San Joaquin River

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–10–188	GEOLOGIST: J. VAUK
WELL COMPLETION DIAGRAM	DRILLER: G. HANSEN
DATE COMPLETED: 5/01/2010	HELPER: C. KELLY, K. KREITZ
TOP OF WELL CASING COORDINATES: N2262126.4 E6111217.2 (NAD83) ELEVATION 120.0' (NAVD88) GROUND SURFACE ELEVATION 116.9' (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-10-115

FEATURE: Groundwater Monitoring
LOCATION: Reach 4A, River Bank Left, Merced County
BEGUN: 11/19/10 FINISHED: 11/19/10
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 6.70 ft. (- 724.3 ft. - 12/09/2010)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,276,117.6 E 6,089,808.7 NAD83
TOTAL DEPTH: 31.1 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 108.1 ft. NADV88
ANGLE FROM HORIZONTAL: -90°
HOLE LOGGED BY: 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 4A, River Bank Left, Merced County, at the intersection of Palm Avenue and Roxbury Road, about 30 ft. south and 5 ft. east of intersection.

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 3.8 ft. - Soft
3.8 to 8.6 ft. - Moderate soft
8.6 to 13.6 ft. - Add water, catcher with nylon, moderate firm
13.6 to 18.6 ft. - Very firm
18.6 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:
6.7 ft. on 12/7/2010

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 107.8
											(CL)s 106.1
	92										
		43.2	32.5	24.3	0.0	44.3	26.3	21.6	(CL)s 104.6		(CH)s 104.1
5											s(CL) 102.0
	94	12.5	45.2	42.3	0.0	NP	NP	19.4	s(ML) 100.9		s(ML) 100.9
											SM 99.7
											SP-SM 97.4
10											
	64	28.2	65.4	6.4	0.0	26.7	6.7	20.3	CL-ML 96.1		ML 95.8
											SP-SM 93.9
											s(CL/ML) 93.5
15										Qal	
	64										SP-SM
		1.0	4.7	94.2	0.1	NP	NP	23.2	SP-SM 89.5		

CLASSIFICATION AND PHYSICAL CONDITION

0.0 to 31.1 ft.
QUATERNARY ALLUVIUM - Qal

0.0 to 0.3 ft. SILT WITH SAND, (ML)s:
About 80% fines with low plasticity, low toughness; about 20% fine sand; dry, tan; lightly cemented.

0.3 to 2.0 ft. LEAN CLAY WITH SAND, (CL)s:
About 75% fines with medium plasticity, low to medium toughness; about 25% fine sand; dry, brown to dark brown; trace toots; broken up from drilling activity

2.0 to 4.0 ft. FAT CLAY WITH SAND, (CH)s:
About 75% fines with medium to high plasticity, medium toughness; about 25% fine sand; dry to moist, dark brown; interbedded with (ML)s.

Lab Data Interval
3.0 to 3.5 ft.

4.0 to 6.1 ft. SANDY LEAN CLAY, s(CL):
About 65% fines with low plasticity; about 35% fine sand; moist to wet, olive tan; disturbed by drilling action; layered about 0.5 inch thick, interbedded with (CH)s described in previous interval.

6.1 to 7.2 ft. SANDY SILT, s(ML):
About 55% fines with low plasticity; about 45% fine sand; wet, orange brown; medium firm.

Lab Data Interval
6.1 to 7.2 ft.

7.2 to 8.4 ft. SILTY SAND, SM:
About 70% fine sand; about 30% fines with medium plasticity; wet, orange brown; micaceous; moderate soft to firm.

8.4 to 10.7 ft. POORLY GRADED SAND WITH SILT, SP-SM:
About 90% fine to medium sand; about 10% non plastic fines; wet, orange brown; soft; homogenous.

10.7 to 12.8 ft. SILT, ML:
About 95% non plastic fines, no toughness; about 5% fine sand; moist, olive brown; layers of oxidation; thin layer of sand; firm consistency.

Lab Data Interval
11.0 to 12.0 ft.

12.8 to 14.2 ft. POORLY GRADED SAND WITH SILT, SP-SM:
About 90% fine sand; about 10% non plastic fines; moist, reddish-tan to light brown.

14.2 to 14.6 ft. SANDY LEAN CLAY/SANDY SILT, s(CL/ML):
About 60% fines with low plasticity, medium toughness; about 40% fine sand; moist to wet, olive gray with reddish brown oxidation swirls; 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.

SJRRP DH SJRRP.GPJ SJRRP.GPJ 8/10/11 4:19:32 PM

GEOLOGIC LOG OF DRILL HOLE NO. MW-10-115

FEATURE: Groundwater Monitoring
LOCATION: Reach 4A, River Bank Left, Merced County
BEGUN: 11/19/10 FINISHED: 11/19/10
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 6.70 ft. (- 724.3 ft. - 12/09/2010)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,276,117.6 E 6,089,808.7 NAD83
TOTAL DEPTH: 31.1 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 108.1 ft. NADV88
ANGLE FROM HORIZONTAL: -90°
HOLE LOGGED BY: G. Perea
REVIEWED BY: S. Dalton

NOTES

HOLE COMPLETION:
Well Casing: 0.5 to 15.0 ft. (2-inch blank PVC)
Dual U-pack Screen: 15.0 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: 9.0 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 9.0 ft.
Concrete Seal: 0.0 to 2.0 ft. (backfilled with #3 Sand inside well vault)
Well Completion: 8-inch dia 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.
											88.0
	64										SW-SP
		2.2	8.8	88.0	1.0	NP	NP	NA	SW-SM 84.5		
											84.1
											(SP)g 83.6
25	52										SP-SM
		1.9	7.4	88.8	1.9	NP	NP	22.3	SP-SM 79.5		79.5
	0										NR
30											77.0

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

14.6 to 20.1 ft. POORLY GRADED SAND WITH SILT, SP-SM:
About 90% fine to medium sand; about 10% non plastic fines; olive gray with reddish brown oxidation; layered; soft.

Note: 19.1 to 19.21 ft.: lens of gray-green SANDY LEAN CLAY, s(CL): about 55% fines with medium plasticity; about 45% fine sand.

20.1 to 24.0 ft. WELL GRADED SAND WITH SILT, SW-SM:
About 90% fine to coarse sand, rounded, hard (basalt and quartz); about 10% fines; wet, gray; soft.

Lab Data Interval
22.6 to 23.6 ft.

24.0 to 24.5 ft. POORLY GRADED SAND WITH GRAVEL, (SP)g:
About 50% fine to coarse sand; about 45% fine gravel, hard, rounded (agate and basalt); about 5% fines; maximum size 1/2 inch; moist to wet; gray.

24.5 to 28.6 ft. POORLY GRADED SAND WITH SILT, SP-SM:
About 90% fine to coarse sand, predominately fine to medium sand, subrounded, hard; about 10% fines; wet, green/gray; soft; layered.

Lab Data Interval
27.6 to 28.6 ft.

28.6 to 31.1 ft. NO RECOVERY
Note: Trace SILTY SAND, SM: About 75-80% fine sand; about 20-25% non plastic fines; 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
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.

SJRRP DH SJRRP.GPJ SJRRP.GPJ 8/10/11 4:19:32 PM

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-10-115

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 21 min.

4. Depth of well (from top of well casing) 30.3 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 30.0 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. 6.90 ft. Flush Mount	6.62 ft.
Date	b. 12/09/2010 (m m d d y y y y)	12/09/2010 (m m d d y y y y)
Time	c. 09:33 ☒ a.m. ☐ p.m.	09:59 ☒ a.m. ☐ p.m.
12. Sediment in well bottom	TR. __ inches	___.__ inches
13. Water clarity	Clear ☐ 10 Turbid ☒ 15 (Describe) Start Cloudy Ind Sheen	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: JERRY Last Name: HANSON
Firm: BOR

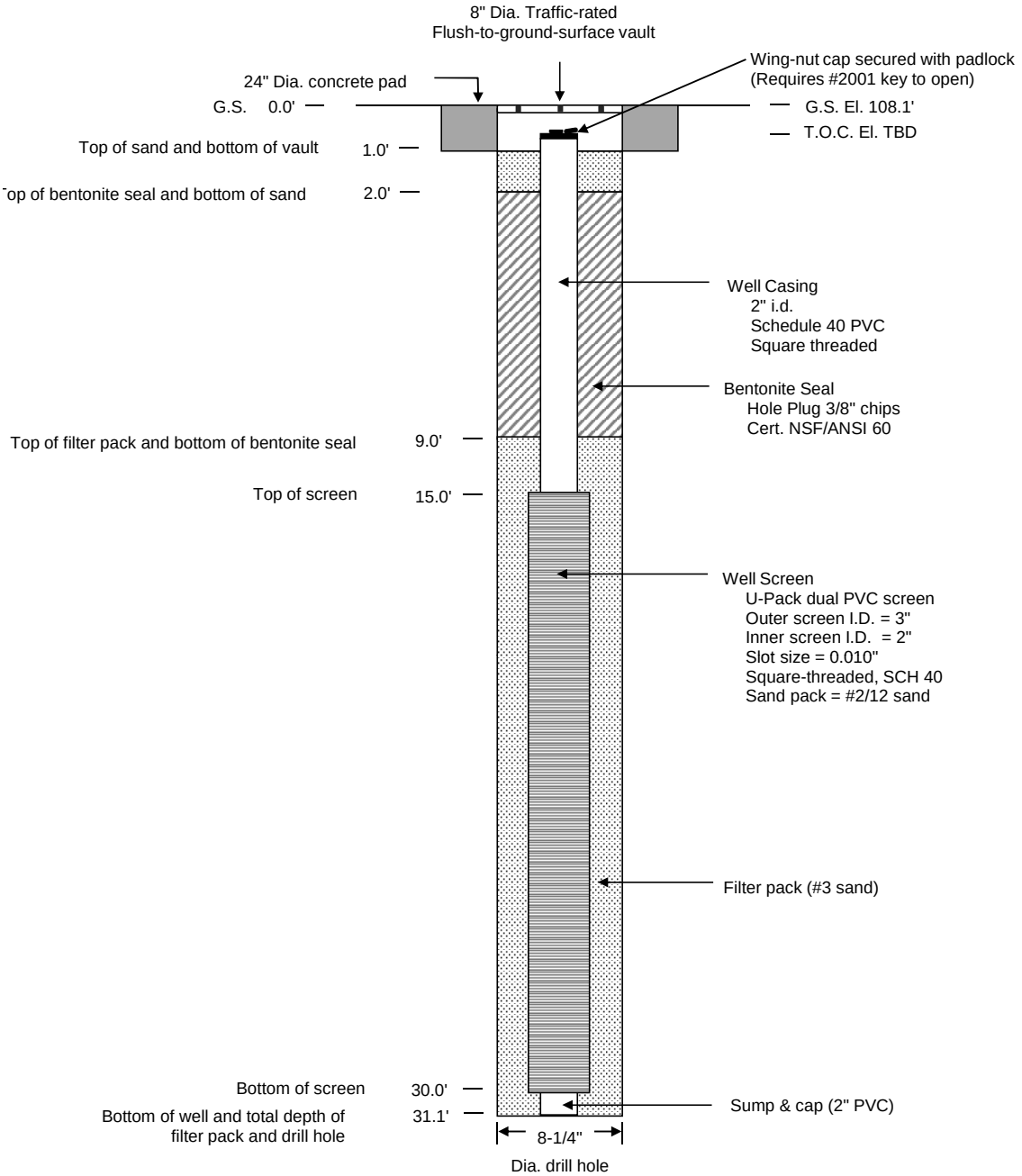
17. Additional comments on development:
0933 - 0941 Bail 5gals Silty/Cloudy
0943 - 0954 Pump 25gal
Start Clearing up After Pumping 10gals

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-10-115	GEOLOGIST: A. Warren
WELL COMPLETION DIAGRAM	DRILLER: G. Hansen
DATE COMPLETED: 11/19/2010	HELPERS: D. Read & C. Peterson
LOCATION: Roxbury Road and Palm Ave T.O.C. COORDINATES: N2276117.55 E6089808.65 (NAD83) ELEVATION NS G.S. ELEVATION: 108.1 (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-10-116

FEATURE: Groundwater Monitoring
LOCATION: Reach 4A, River Bank Right, Merced County
BEGUN: 11/20/10 FINISHED: 11/20/10
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 6.63 ft. (- 698.1 ft. - 12/10/2010)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,297,428.6 E 61,055,524.6 NAD83
TOTAL DEPTH: 31.1 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 105.3 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 4A, River Bank Right, Merced County, at the southwest corner of the termination of the paved portion of El Nido Rd.

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:
3.6 to 8.6 ft. - Add catcher
18.6 to 23.6 ft. - Add water

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

WATER LEVEL FROM TOC:
6.63 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 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 31.1 ft. (#3 Sand)
Sump: 28.0 to 31.1 ft. (2-inch blank PVC with slip cap)
Bentonite Seal: 2.0 to 16.0 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.
											ASPHALT 105.1
											s(CL)
	81										103.2
											SM
											101.1
5											SM
	100										99.6
		17.3	48.3	34.4	0.0	29.1	7.8	15.7	s(CL) 97.8		
											(CL)s
10											
		18.0	61.9	20.1	0.0	27.2	6.4	19.9	(CL-ML)s 94.3		
	100										
											92.3
											SM
15											
										Qal	89.6
	100										
		26.0	51.4	22.6	0.0	33.7	12.2	29.0	(CL)s 87.8		(CL)s
											86.9

CLASSIFICATION AND PHYSICAL CONDITION

0.0 to 31.1 ft.
QUATERNARY ALLUVIUM - Qal

0.0 to 0.2 ft. ASPHALT

0.2 to 2.1 ft. SANDY LEAN CLAY, s(CL):
About 70% fines with low to medium plasticity, low toughness, rapid dilatancy; about 30% fine sand; dry, brown todark brown; top 1.0 ft. lightly cemented and broken up from drilling activity.

2.1 to 4.2 ft. SILTY SAND, SM:
About 80% fine to medium sand (predominately fine); about 20% non plastic fines, no toughness; dry, tan to light brown.

4.2 to 5.7 ft. SILTY SAND, SM:
About 70% fine to medium sand (predominately fine), hard, subounded; about 30% fines with low plasticity; dry, tan to light brown; white CaCO3 veinlettes and 1/4 inch thick cementing layers.

5.7 to 13.0 ft. LEAN CLAY WITH SAND, (CL)s:
About 75% fines with low plasticity, no toughness; about 25% fine sand; moist towards bottom, light brown to dark brown; CaCO3 veinlettes and 1/4 inch thick cementing layers.

Lab Data Interval
6.5 to 7.5 ft.

Lab Data Interval
10.0 to 11.0 ft.

13.0 to 15.7 ft. SILTY SAND, SM:
About 65% fine sand; about 35% fines with low plasticity, low toughness; wet, brown; firm consistency.

15.7 to 18.4 ft. LEAN CLAY WITH SAND, (CL)s:
About 75% fines with medium plasticity, low toughness, no dilatancy; about 25% fine sand; moist, brown; firm consistency; CaCO3 veinlettes.

Lab Data Interval
16.5 to 17.5 ft.

18.4 to 21.6 ft. SILTY SAND, SM:
About 60% fine sand; about 40% fines with low plasticity, no toughness; moist, brown to dark brown.

Note: 18.6 to 21.6 ft.: Slight increase in sand towards bottom.

Lab Data Interval
19.5 to 20.5 ft.

21.6 to 23.0 ft. SILTY SAND, SM:
About 80-85% fine sand; about 15-20% fines with low plasticity; wet, brown; firm consistency; coarsens downwards; trace medium 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.

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GEOLOGIC LOG OF DRILL HOLE NO. MW-10-116

FEATURE: Groundwater Monitoring
LOCATION: Reach 4A, River Bank Right, Merced County
BEGUN: 11/20/10 FINISHED: 11/20/10
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 6.63 ft. (- 698.1 ft. - 12/10/2010)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,297,428.6 E 61,055,524.6 NAD83
TOTAL DEPTH: 31.1 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 105.3 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.
		17.0	23.7	59.3	0.0	23.2	7.7	19.0	SC	84.8		SM	83.7
	100											SM	82.3
25		2.2	5.0	92.8	0.0	NP	NP	18.5	SP-SM	79.3		SP-SM	77.1
	100											SM	75.8
30	100	32.9	56.2	10.9	0.0	33.1	14.9	21.1	CL	74.3		CL/ML	74.2

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

23.0 to 28.2 ft. <u>POORLY GRADED SAND WITH SILT, SP-SM</u>:
About 90% fine to medium sand; about 10% non plastic fines; wet, tan to light brown; trace coarse, subrounded, hard sand.

<u>Lab Data Interval</u>
25.0 to 26.0 ft.

28.2 to 29.5 ft. <u>SILTY SAND, SM</u>:
About 80-85% fine sand, trace coarse, elongate, subrounded sand (basalt); about 15-20% non plastic fines, no toughness; wet, brown.

29.5 to 31.1 ft. <u>LEAN CLAY WITH SILT, CL/ML</u>:
About 95% fines with low plasticity, low toughness; about 5% fine sand; moist, brown; firm consistency.

<u>Lab Data Interval</u>
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.

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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-10-116

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

1. Can this well be purged dry? Yes [X] 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 2HR 17 min.

4. Depth of well (from top of well casisng) 28.8 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 28.0 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. 6.63 ft. Hush Heat	___.___ 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. 09:48 ☒ a.m. ☐ p.m.	11:19 ☒ a.m. ☐ p.m.
12. Sediment in well bottom	TR. inches	TR. inches
13. Water clarity	Clear ☐ 10 Turbid ☒ 15 (Describe) Cloudy, Brownish Tint, Bottom Recovery	Clear ☐ 20 Turbid ☒ 25 (Describe) Cloudy Silthy
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: Jerry Last Name: Hansen
Firm:

17. Additional comments on development:
0949-0958 Bail 5gal (Clear/Cloud
1003-1006 Pump 7 gals, Pump Dry Very Silty Start (Content
1006-1013 Let Set (Recharge
1013-1036 Work Bail, Bail 5gal
1037-1039 Pump 5gal - Dry (Recharge 5min)
1042-1045 - Pump 2gal (Recharge
1056-101 Pump 5gal Recharge
1107-1117 4gal
(well is Recharge, Starting WAS VERY Silty/Start, when STARTER

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.

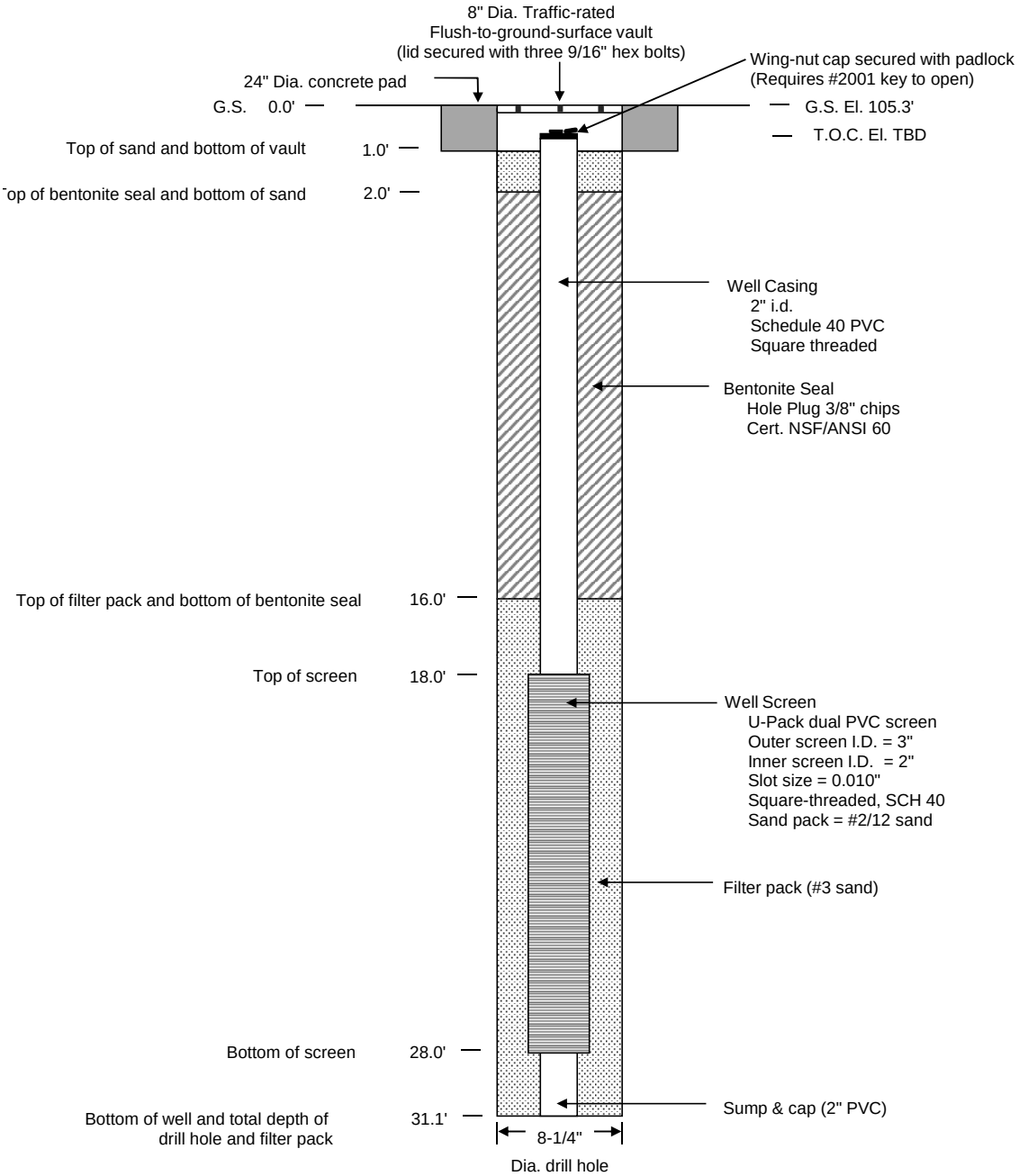
Signature: _____

Print Name: _____

Firm: _____

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

MW-10-116	GEOLOGIST: A. Warren
WELL COMPLETION DIAGRAM	DRILLER: G. Hansen
DATE COMPLETED: 11/20/2010	HELPERS: D. Read & C. Peterson
LOCATION: W El Nido Road T.O.C. COORDINATES: N2297428.55 E6105524.61 (NAD83) ELEVATION NS G.S. ELEVATION: 105.3' (NAVD88)	



***NOT TO SCALE**

NOTES:

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

GEOLOGIC LOG OF DRILL HOLE NO. MW-11-130

FEATURE: Groundwater Monitoring
LOCATION: Reach 4A, River Bank Left, RM 180, Fresno County
BEGUN: 4/15/11 FINISHED: 4/15/11
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 4.6 ft. (117.4 ft. - 5/15/2011)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,249,992.2 E 6,119,289.7 NAD83
TOTAL DEPTH: 27.1 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 122.02 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 4A, River Bank Left, RM 180, Fresno County. North side of farm road, about ¼ mile east of Wolfson Ranch.

DRILLED BY:
Bureau of Reclamation: PN Region drill crew:
Chris Peterson, driller
Dennis Read, helper
Cody Kelly, 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 27.1 ft. FADC

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
4.6 to 9.6 ft. - Wet at 7.5 ft.
19.6 to 23.4 ft. - Very hard drilling.

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

WATER LEVEL:
5/15/2011 - 4.6 ft.

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	
	91.3												118.9
		16.5	36.2	47.3	0.0	NP	NP	19.0	s(ML)	118.0		s(ML)	
													117.6
5													
	46.0												
		0.7	8.9	90.4	0.0	NP	NP	24.8	SP-SM	112.4		SM	
10													
	40.0												
											Qal		108.4
		5.7	61.3	33.0	0.0	NP	NP	26.9	s(ML)	107.5		s(ML)	

0.0 to 27.1 feet
QUATERNARY ALLUVIUM (Qal)

0.0 to 3.1 ft. LEAN CLAY, CL:
About 90% fines with low plasticity, slow dilatancy, low toughness; about 10% fine sand; dry to moist, dark brown; strong reaction with HCL; sticky when wet from $CaCO_3$ content; organic odor.

3.1 to 4.4 ft. SANDY SILT, s(ML):
About 50% fine, micaceous sand; about 50% fines with no plasticity, low dry strength, rapid dilatancy, low toughness; moist, brown; trace clumps of plastic soil.

Lab Data Interval
3.5 to 4.0 ft.

4.4 to 5.1 ft. SILTY SAND, SM:
About 75% fine, micaceous sand; about 25% fines with no plasticity, no toughness; moist, brown.

5.1 to 13.6 ft. SILTY SAND, SM:
About 85% fine to medium, micaceous sand; about 15% fines with no plasticity; wet, brown; layered.

Note: Red oxidation layers at lower contact, from 13.3 to 13.6 ft.

Lab Data Interval
8.6 to 9.6 ft.

13.6 to 15.2 ft. SANDY SILT, s(ML):
About 65% fines with no plasticity, rapid dilatancy, no toughness; about 35% fine, micaceous sand; wet, brown with reddish brown oxidation layers; finely layered.

Note: From 14.6 to 15.2 ft. sand content increases; dark reddish brown at lower contact. Contains a 1/2 inch layer of moderate cementation at 15.2 ft.

Lab Data Interval
14.0 to 14.5 ft.

15.2 to 15.5 ft. CLAYEY SAND, SC:
About 65% fine sand; about 35% fines with medium plasticity; wet, gray; micaceous; firm.

15.5 to 16.1 ft. LEAN CLAY, CL:
About 90% fines with low plasticity; high dry strength; low toughness; about 10% fine sand; moist, gray; $CaCO_3$); very fine silty layers abundant, very firm.

Lab Data Interval
15.5 to 16.0 ft.

16.1 to 17.0 ft. SANDY LEAN CLAY, s(CL):
About 65% fines with medium plasticity, medium toughness; about 35% fine sand; moist, finely layered gray-brown and reddish-brown; 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
+ = 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.

SJRRP DH SJRRP.GPJ SJRRP.GPJ 11/8/11 3:54:02 PM

GEOLOGIC LOG OF DRILL HOLE NO. MW-11-130

FEATURE: Groundwater Monitoring
LOCATION: Reach 4A, River Bank Left, RM 180, Fresno County
BEGUN: 4/15/11 FINISHED: 4/15/11
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 4.6 ft. (117.4 ft. - 5/15/2011)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,249,992.2 E 6,119,289.7 NAD83
TOTAL DEPTH: 27.1 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 122.02 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: +2.84 to 5.0 ft. (2-inch I.D. blank PVC)
Dual U-pack Screen: 5.0 to 15.0 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: 4.0 to 20.0 ft. (#3 Sand)
Sump: 15.0 to 18.0 ft. (2-inch I.D. blank PVC with slip cap)
Concrete Seal: 0.0 to 2.0 ft.
Bentonite Seal: 2.0 to 4.0 ft.
Bentonite Backfill: 20.0 to 27.1 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.
											106.8
											SM 106.5
		31.7	56.1	12.2	0.0	29.4	12.7	21.3	CL 106.0		CL 105.9
											s(CL) 105.0
	78.0										
											SM 102.4
20											
											SM 100.9
	94.7	8.1	64.4	27.5	0.0	NP	NP	36.8	(ML)s 100.0		
											(ML)s 98.6
	50.0										
											(CL)s 97.2
25											
	72.0										ML 94.9

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

17.0 to 19.6 ft. SILTY SAND, SM:
About 60% fine sand; about 40% fines with low plasticity; wet, gray; moderately firm; lightly cemented from 18.6 to 19.6 ft.; no visible white $CaCO_3$ as in other layers but reacts moderately with HCL.

19.6 to 21.1ft. SILTY SAND, SM:
About 70% fine sand; about 30% fines with low plasticity; moist, brown with very abundant white $CaCO_3$)layers; strong reaction with HCl.

21.1 to 23.4 ft. SILT WITH SAND, (ML)s:
About 75% fines with no plasticity, rapid dilatancy, no toughness; about 25% fine sand; wet, brown; soft.

Note: 22.0 to 23.4 ft.: Moderately cemented with $CaCO_3$); strong reaction with HCl; contains SILTY SAND, SM layers.

Lab Data Interval
21.5 to 22.0 ft.

23.4 to 24.8 ft. LEAN CLAY WITH SAND, (CL)s:
About 85% fines with medium plasticity, medium toughness; about 15% fine and medium sand; moist to dry, brown; very firm; layered.

24.8 to 27.1 ft. SILT, ML:
About 80 to 95% fines with no plasticity; about 20 to 5% fine and medium sand; wet, brown and reddish brown layers; trace wood and organics.

COMMENTS:

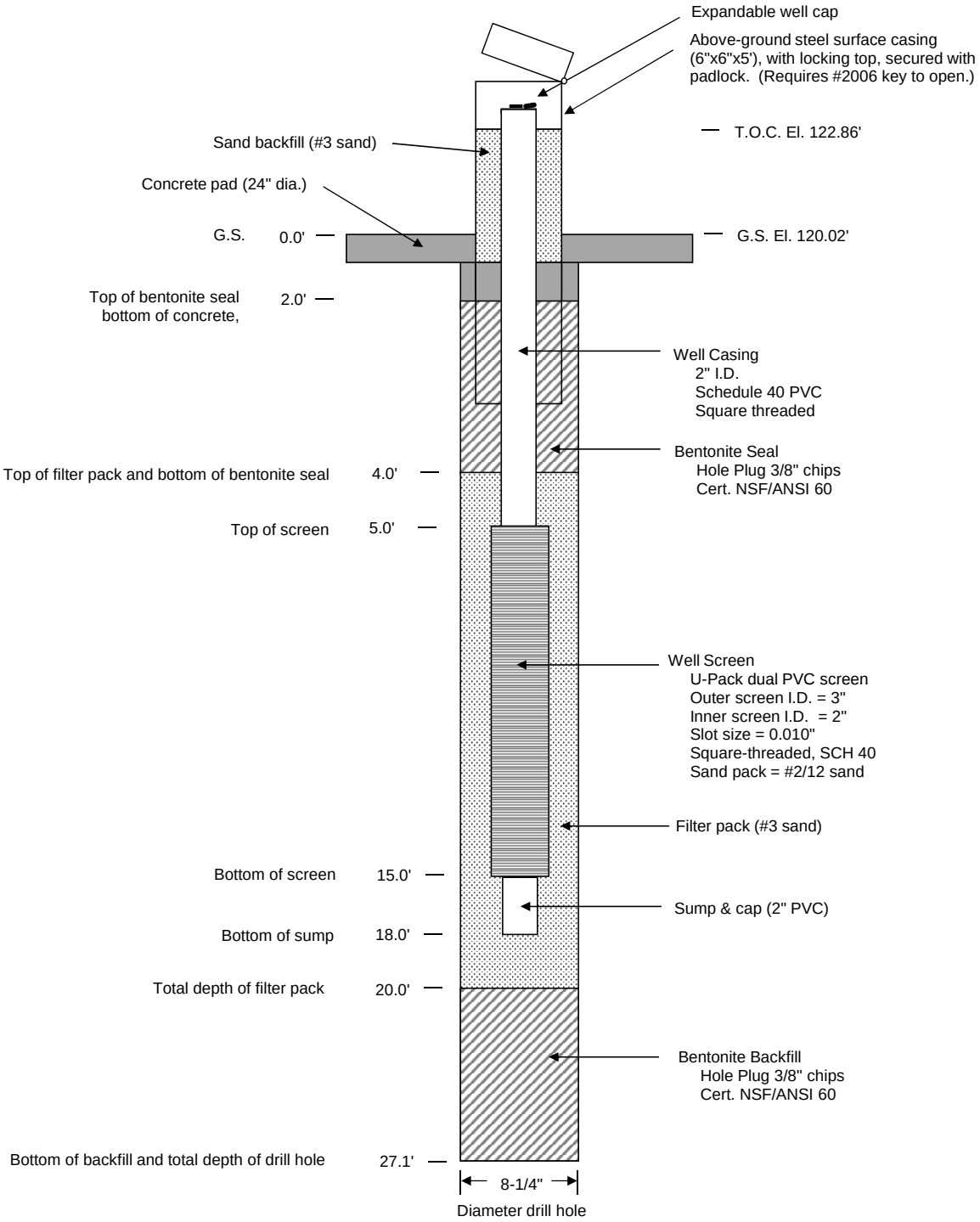
FADC = Flight Auger Dry Core
NP = Non-Plastic
NR = No Recovery
NA = Not Applicable
I.D. = Inner Diameter
O.D. = Outer Diameter

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.

SJRRP DH SJRRP.GPJ SJRRP.GPJ 11/8/11 3:54:02 PM

MW-11-130	GEOLOGIST: A. Warren
WELL COMPLETION DIAGRAM	DRILLER: C. Peterson
DATE COMPLETED: 4/15/2011	HELPERS: D. Read & C. Kelly
LOCATION: Field east of Jerrold Ave. Reach 4A, River Bank Left, RM 180, Fresno County. T.O.C. COORDINATES: N2249992.15 E6119289.73 (NAD93) EL. 122.86' (NAVD88) G.S. ELEVATION: 120.02' (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-3 / MW-11-130

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: 65 min.

4. Depth of well (from top of well casisng): 21.1 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: 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. 76.6 ft.	81.1 ft.
Date	b. 05/15/2011 (m m d d y y y y)	05/15/2011 (m m d d y y y y)
Time	c. 2:00 ☐ a.m. ☒ p.m.	3:05 ☐ 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 MINUTES EACH 2 UNTIL PUMPED 5 GALS.
PUMPED WITH SUMP PUMP UNTIL CLEAN ABOUT 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-11-131

FEATURE: Groundwater Monitoring
LOCATION: Reach 4A, River Bank Left, RM 180, Fresno County
BEGUN: 4/16/11 FINISHED: 4/16/11
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 5.1 ft. (116.9 ft. - 5/15/2011)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,250,184.6 E 6,120,234.3 NAD83
TOTAL DEPTH: 29.6 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 121.96 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 4A, River Bank Left, RM 180, Fresno County. Field east of Jerrold Avenue.

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:
NA

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

WATER LEVEL:
5.1 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.
0	100.0										SC 119.1
											(ML)s 116.0
5											CL 115.1
	88.0	26.7	42.4	30.7	0.2	30.8	16.2	29.1	s(CL) 114.0		s(CL) 112.7
10											s(ML) 111.2
	62.0	0.5	14.9	84.6	0.0	NP	NP	28.7	SM 108.5		SM 108.5
											ML 107.4
										Qal	

CLASSIFICATION AND PHYSICAL CONDITION

0.0 to 29.5 feet
QUATERNARY ALLUVIUM (Qal)

0.0 to 2.9 ft. CLAYEY SAND, SC:
About 70% fine sand, with trace medium sand; about 30% fines with medium plasticity; dry to moist, brown; firm; organic odor; micaceous.

2.9 to 6.0 ft. SILT WITH SAND, (ML)s:
About 85% fines with low plasticity, no dry strength, no toughness; about 15% fine, micaceous sand; dry to moist, brown; moderately firm; trace plastic fines layers.

6.0 to 6.9 ft. LEAN CLAY, CL:
About 95% fines with medium plasticity, no dilatancy, medium toughness; trace fine sand; moist, dark brown; very firm.

6.9 to 9.3 ft. SANDY LEAN CLAY, s(CL):
About 70% fines with medium plasticity, medium toughness; about 30% fine sand; wet, tan; moderately soft; some reddish brown iron oxidation.

Lab Data Interval
7.0 to 8.0 ft.

9.3 to 10.8 ft. SANDY SILT, s(ML):
About 70% fines with low plasticity, rapid dilatancy, low toughness; about 30% fine, micaceous sand; moist to wet, tan with reddish brown iron oxidation; moderately soft.

10.8 to 13.5 ft. SILTY SAND, SM:
About 85% fine sand; about 15% fines with no plasticity; wet, tan with reddish brown oxidation; 1 to 5 mm thick laminations.

Lab Data Interval
12.5 to 13.5 ft.

13.5 to 14.6 ft. SILT, ML:
About 95% fines with low to no plasticity, low dry strength, rapid dilatancy; about 5% to trace fine sand; moist, tan with reddish brown iron oxidation; very firm.

14.6 to 18.4 ft. SILTY SAND, SM:
About 65% fine sand, with trace medium sand; about 35% fines with low plasticity; wet, dark tan; moderately firm; 1 to 5 mm thick laminations; some 1 to 2 mm thick $CaCO_3$ layers, strong reaction with HCl.

Lab Data Interval
15.0 to 16.0 ft.

18.4 to 19.6 ft. LEAN CLAY WITH SAND, (CL)s:
About 80% fines with low plasticity, medium toughness; about 20% fine sand; moist to dry, tan with reddish brown iron oxidation.

Lab Data Interval
18.5 to 19.5 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.

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GEOLOGIC LOG OF DRILL HOLE NO. MW-11-131

FEATURE: Groundwater Monitoring
LOCATION: Reach 4A, River Bank Left, RM 180, Fresno County
BEGUN: 4/16/11 FINISHED: 4/16/11
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 5.1 ft. (116.9 ft. - 5/15/2011)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,250,184.6 E 6,120,234.3 NAD83
TOTAL DEPTH: 29.6 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 121.96 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: +2.82 to 12.5 ft. (2-inch I.D. blank PVC)
Dual U-pack Screen: 12.5 to 27.5 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: 11.0 to 29.5 ft. (#3 Sand)
Sump: 27.5 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 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.
		13.1	18.8	68.1	0.0	NP	NP	16.5	SM	106.0		SM	103.6
	56.0	35.8	44.8	19.4	0.0	31.8	14.3	21.4	(CL)s	102.5		(CL)s	102.4
20												SC	
	100.0												97.0
25													
	62.0	4.5	15.9	79.6	0.0	NP	NP	17.8	SM	94.0		SM	92.4

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

19.6 to 25.0 ft. <u>CLAYEY SAND, SC</u>:
About 60% fine sand; about 40% fines with medium plasticity; wet, dark tan; moderately firm; layered with 1 mm to 3 mm thick $CaCO_3$ accretions, strong reaction with HCl; moderately cemented zone from 20.0 to 20.2 ft.

Note: 23.5 to 25.0 ft.: less $CaCO_3$

25.0 to 29.6 ft. <u>SILTY SAND, SM</u>:
About 75-70% fine sand; about 25-30% fines with low to no plasticity; wet, tan; moderately soft; flowing; homogeneous.

<u>Lab Data Interval</u>
27.0 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
+ = 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.

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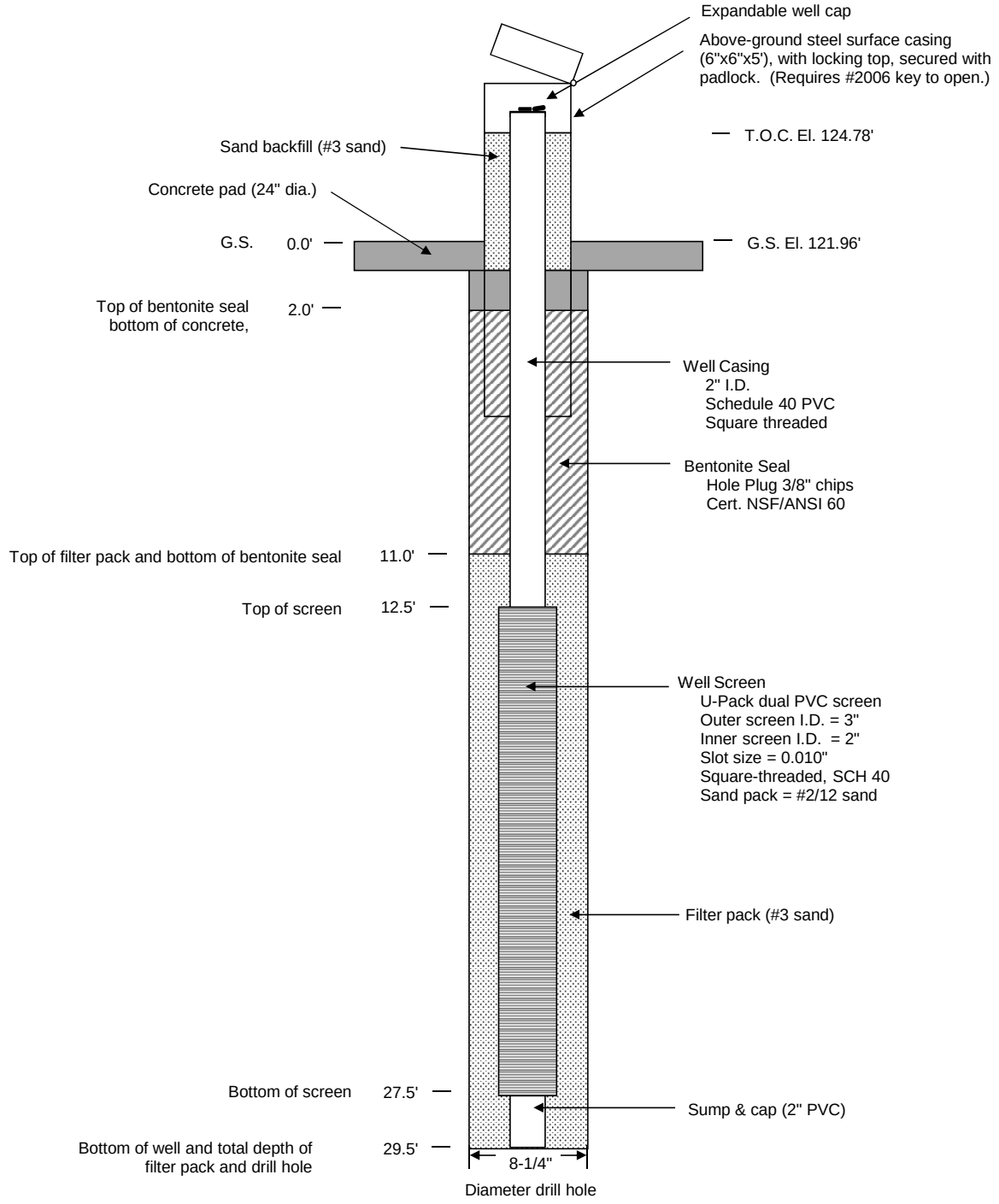
MW-11-131	GEOLOGIST: A. Warren
WELL COMPLETION DIAGRAM	DRILLER: C. Peterson
DATE COMPLETED: 4/16/2011	HELPERS: D. Read & C. Kelly
LOCATION: Field east of Jerrold Ave. Reach 4A, River Bank Left, RM 180, Fresno County. T.O.C. COORDINATES: N2250184.62 E6120234.28 (NAD93) EL. 124.78' (NAVD88) G.S. ELEVATION: 121.96' (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-2 / MW-11-131

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 _____ min.

4. Depth of well (from top of well casisng) 319 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 60.0 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. 8.10 ft.	8.16 ft.
Date	b. 05/15/2011 (m m d d y y y y)	05/15/2011
Time	c. 12:45 ☐ a.m. ☒ p.m.	1:50 ☐ 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 EACH 2 FT UNTIL 5 GALS. PUMPED

PUMPED WITH SUMP PUMP UNTIL CLEAR ABOUT 55 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-11-132

FEATURE: Groundwater Monitoring
LOCATION: Reach 4A, River Bank Left, RM 180, Fresno County
BEGUN: 4/17/11 FINISHED: 4/17/11
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 4.0 ft. (119.8 ft. - 5/15/2011)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,250,689.0 E 6,120,617.8 NAD83
TOTAL DEPTH: 30.3 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 123.78 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 4A, River Bank Left, RM 180, Fresno County. Adjacent to the Poso Creek Drain.

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:
5.0 to 8.3 ft. - Wet at 6.0 ft.

DRILLNG FLUID, RETURN AND COLOR:
0.0 to 30.3 ft. - Drilled without fluid

WATER LEVEL:
4.0 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(ML) 121.3
	68	4.9	21.4	73.7	0.0	NP	NP	14.3	SM 119.8		SM 117.6
5											
	100.0	20.3	40.0	39.7	0.0	28.3	12.6	32.8	s(CL) 113.8		CH 115.8
											s(CL) 113.8
10											
	92.0										SM 112.3
											s(CL) 109.5
											(CL)s 108.6
15										Qal	ML 108.0
	74.0										

CLASSIFICATION AND PHYSICAL CONDITION

0.0 to 30.3 feet
QUATERNARY ALLUVIUM (Qal)

0.0 to 2.5 ft. SANDY SILT, s(ML):
About 60% fines with low plasticity, low toughness; about 40% fine, micaceous sand; moist, brown; moderately firm; 1 - 5 mm thick stratifications; abundant clam shells, woody debris.

2.5 to 6.2 ft. SILTY SAND, SM:
About 75% fine, micaceous sand; about 25% fines with no plasticity; moist, brown; loose; homogenous.

Lab Data Interval
3.0 to 4.0 ft.

6.2 to 8.0 ft. FAT CLAY, CH:
About 95% fines with medium to high plasticity, no dilatancy, high toughness; trace fine sand; moist to wet, dark brown; moderately firm.

8.0 to 10.0 ft. SANDY LEAN CLAY, s(CL):
About 60% fines with medium plasticity, medium toughness; about 40% fine sand; wet, tan; soft.

Lab Data Interval
9.0 to 10.0 ft.

10.0 to 11.5 ft. SILTY SAND, SM:
About 80% fine, micaceous sand; about 20% fines with low plasticity, high dilatancy; wet, brown; loose consistency, does not hold shape when removed from sampler.

11.5 to 14.3 ft. SANDY LEAN CLAY, s(CL):
About 65% fines with low to medium plasticity; about 35% fine sand; wet, tan with reddish brown iron oxidation; 5 mm to 10 mm thick layers of up to 70% fine sand; firm.

14.3 to 15.2 ft. LEAN CLAY WITH SAND, (CL)s:
About 80% fines with low to medium plasticity; about 20% fine sand; moist, tan with reddish brown iron oxidation; moderately firm; layered with up to 3 mm thick layers of fines with no plasticity, SILT ML.

15.2 to 15.8 ft. SILT, ML:
About 95-100% fines with low plasticity, rapid dilatancy, no toughness; trace fine sand; wet, tan with abundant reddish brown iron oxidation.

15.8 to 18.3 ft. SILTY SAND, SM:
About 85% fine, micaceous sand; about 15% fines with no plasticity; wet, tan with reddish brown iron oxidation; loose, does not hold shape when removed from sampler.

Lab Data Interval
16.0 to 17.0 ft.

18.3 to 22.0 ft. POORLY GRADED SAND WITH SILT, SP-SM:
About 90% fine and medium sand; about 10% fines with no plasticity; wet, tan; loose, does not hold shape when removed from sampler.

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.

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GEOLOGIC LOG OF DRILL HOLE NO. MW-11-132

FEATURE: Groundwater Monitoring
LOCATION: Reach 4A, River Bank Left, RM 180, Fresno County
BEGUN: 4/17/11 FINISHED: 4/17/11
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 4.0 ft. (119.8 ft. - 5/15/2011)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,250,689.0 E 6,120,617.8 NAD83
TOTAL DEPTH: 30.3 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 123.78 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: +3.05 to 10.0 ft. (2-inch I.D. blank PVC)
Dual U-pack Screen: 10.0 to 25.0 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 30.3 ft. (#3 Sand)
Sump: 25.0 to 30.0 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.
		1.8	24.2	74.0	0.0	NP	NP	24.4	SM	106.8		SM	105.5
20	50.0	0.7	4.4	94.9	0.0	NP	NP	23.1	SP-SM	101.8		SP-SM	101.8
												s(CL)	99.0
25	70.0	4.9	10.6	84.5	0.0	NP	NP	23.9	SM	96.8		SC	98.6
												SM	95.5
	100.0	16.4	32.7	50.9	0.0	25.5	9.5	17.6	SC	94.3		SC	94.3
30												SM	93.5

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

Lab Data Interval
21.0 to 22.0 ft.

22.0 to 24.8 ft. SANDY LEAN CLAY, s(CL):
About 70% fines with medium plasticity, no dilatancy; about 30% fine sand; moist, brown; very firm; moderately cemented $CaCO_3$, reacts strongly with HCl, crumbles with firm pressure.

24.8 to 25.2 ft. CLAYEY SAND, SC:
About 85% fine and medium sand; about 15% fines with low plasticity; wet, brown; moderately soft; saturated with free water.

25.2 to 28.3 ft. SILTY SAND:
About 85% fine and medium sand, wih trace coarse sand; about 15% fines with low plasticity, low toughness; moist, brown; firm; crumbles with handling.

Lab Data Interval
26.0 to 27.0 ft.

28.3 to 29.5 ft. CLAYEY SAND, SC:
About 85% fine sand; about 15% fines with low plasticity; wet, brown; loose; some small (less than 3 mm dia) concretions of fine sand.

Lab Data Interval
28.5 to 29.5 ft.

29.5 to 30.3 ft. SILTY SAND, SM:
About 60% fine sand; about 40% fines with low to no plasticity; wet, brown; firm; holds shape when removed from sampler.

COMMENTS:

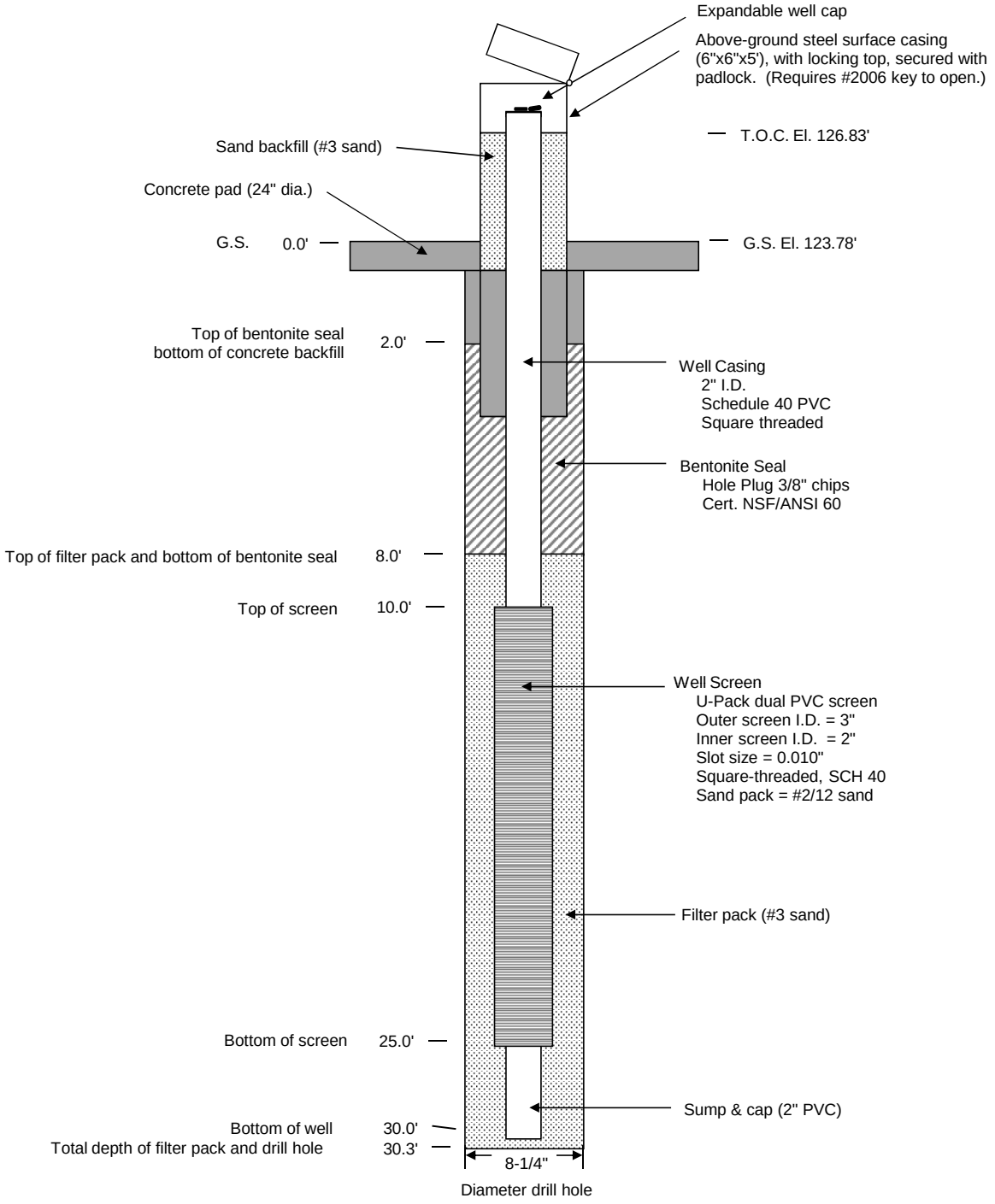
FADC = Flight Auger Dry Core
NP = Non-Plastic
NR = No Recovery
NA = Not Applicable
I.D. = Inner Diameter
O.D. = Outer Diameter

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.

SJRRP DH SJRRP.GPJ SJRRP.GPJ 11/8/11 3:54:03 PM

MW-11-132	GEOLOGIST: A. Warren
WELL COMPLETION DIAGRAM	DRILLER: C. Peterson
DATE COMPLETED: 4/17/2011	HELPERS: D. Read & C. Kelly
LOCATION: Field east of Jerrold Ave. Reach 4A, River Bank Left, RM 180, Fresno County. T.O.C. COORDINATES: N2250688.98 E6120617.75 (NAD93) EL. 126.83' (NAVD88) G.S. ELEVATION: 123.78' (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-1 / MW-11-132

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): 33.0 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: 55.0 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. 7.00 ft.	7.00 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. 11:45 ☒ a.m. ☐ p.m.	12:30 ☐ 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: USBR PN DRILL CREW

17. Additional comments on development:
SURGED WITH W/BLOCK & BAIL CHECK VALVE FOR SEVERAL MINUTES EVERY 2 FEET UNTIL 5 GALS. PUMPED. PUMPED WITH SUMP PUMP UNTIL 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.

GEOLOGIC LOG OF DRILL HOLE NO. MW-11-133

FEATURE: Groundwater Monitoring
LOCATION: Reach 4A, River Bank Left, RM 180, Fresno County
BEGUN: 4/18/11 FINISHED: 4/18/11
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 5.2 ft. (113.9 ft. - 4/27/2011)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,250,112.1 E 6,114,595.3 NAD83
TOTAL DEPTH: 29.7 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 119.10 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 4A, River Bank Left, RM 180, Fresno County. Field west of Jerrold Avenue, at Arroyo 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 29.7 ft. FADC

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
9.7 to 14.7 ft. - Wet at bottom.

DRILLNG FLUID, RETURN AND COLOR:
0.0 to 29.7 ft. - Drilled without fluid

WATER LEVEL:
5.2 ft. - 4/27/2011

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(CH)
	91.5										116.7
5											
		45.1	40.0	14.9	0.0	46.6	27.5	25.0	CL 112.1		CH
	100.0										
10											
	84.0										107.8
											s(CL)
											106.2
											CL
											105.3
		17.0	65.8	17.2	0.0	NP	NP	24.1	(ML)s 104.4		(ML)s 104.4
										Qal	

CLASSIFICATION AND PHYSICAL CONDITION

0.0 to 29.7 feet
QUATERNARY ALLUVIUM (Qal)

0.0 to 2.4 ft. SANDY FAT CLAY, s(CH):
About 60% fines with high plasticity, high toughness; about 40% fine sand; dry to moist, dark brown; moderately soft; trace live roots, woody material, worms; organic odor.

2.4 to 11.3 ft. FAT CLAY, CH:
About 90% fines with high plasticity, high toughness; about 10% fine, micaceous, sand; moist to dry, dark brown; very firm; homogenous.

Note: 9.7 to 11.3 ft.: About 0.5 ft. thick sandy pockets with reddish brown iron oxidation at contacts.

Lab Data Interval
6.0 to 7.0 ft.

11.3 to 12.9 ft. SANDY LEAN CLAY, s(CL):
About 70% fines with medium plasticity, medium toughness; about 30% fine sand; dry to moist, tan; firm but crumbled under drilling action.

12.9 to 13.8 ft. LEAN CLAY, CL:
About 90-95% fines with medium plasticity, medium toughness; about 5-10% fine sand; wet, tan and gray with reddish brown iron oxidation; moderately firm; 1 to 5 mm thick layers.

13.8 to 14.7 ft. SILT WITH SAND, (ML)s:
About 80% fines with low plasticity, low toughness; about 20% fine sand; wet, tan and gray with reddish brown iron oxidation; moderately firm; holds shape when removed from sampler.

Lab Data Interval
13.8 to 14.7 ft.

14.7 to 22.5 ft. No Recovery
Classified as POORLY SORTED SAND WITH SILT, (SP-SM) from trace present on shoe and from drilling action; About 90% fine sand; about 10% fines with no plasticity; wet, gray.

22.5 to 24.8 ft. POORLY GRADED SAND WITH SILT, SP-SM:
About 95-90% fine and medium sand, with trace coarse sand; about 5-10% fines with no plasticity; wet, tan; holds form when removed from sampler; layered in 0.1 to 0.5 ft. thick stratifications.

Lab Data Interval
23.0 to 24.0 ft.

24.8 to 26.0 ft. SILTY SAND, SM:
About 85% fine sand; about 15% fines with no plasticity; wet, tan, black and reddish brown layers; dense, holds shapes when removed from sampler; layered in 0.1 to 0.2 ft. thick stratifications .

Lab Data Interval
25.0 to 26.0 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.

SJRRP DH SJRRP.GPJ SJRRP.GPJ 11/8/11 3:54:04 PM

GEOLOGIC LOG OF DRILL HOLE NO. MW-11-133

FEATURE: Groundwater Monitoring
LOCATION: Reach 4A, River Bank Left, RM 180, Fresno County
BEGUN: 4/18/11 FINISHED: 4/18/11
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 5.2 ft. (113.9 ft. - 4/27/2011)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,250,112.1 E 6,114,595.3 NAD83
TOTAL DEPTH: 29.7 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 119.10 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: +3.1 to 14.4 ft. (2-inch I.D. blank PVC)
Dual U-pack Screen: 14.4 to 29.4 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: 29.4 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	0.0										SP-SM
											96.6
		0.6	5.5	93.9	0.0	NP	NP	22.0	SP-SM 95.1		SP-SM
	100.0										94.3
20		4.8	4.1	91.1	0.0	NP	NP	27.0	SP-SM 93.1		SM 93.1
	100.0										SP-SM
											90.9
	100.0										SM
											89.4

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

26.0 to 28.2 ft. POORLY GRADED SAND WITH SILT, SP-SM:
About 90% fine and medium sand, with trace coarse sand; about 10% fines with no plasticity; wet, tan; layered in 0.2 to 0.5 ft. thick stratifications.

28.2 to 29.7 ft. SILTY SAND, SM:
About 55% fine sand; about 45% fines with no plasticity, rapid dilatancy; wet, tan with reddish brown; moderately dense; free water pooled on surface after being placed into box.

COMMENTS:

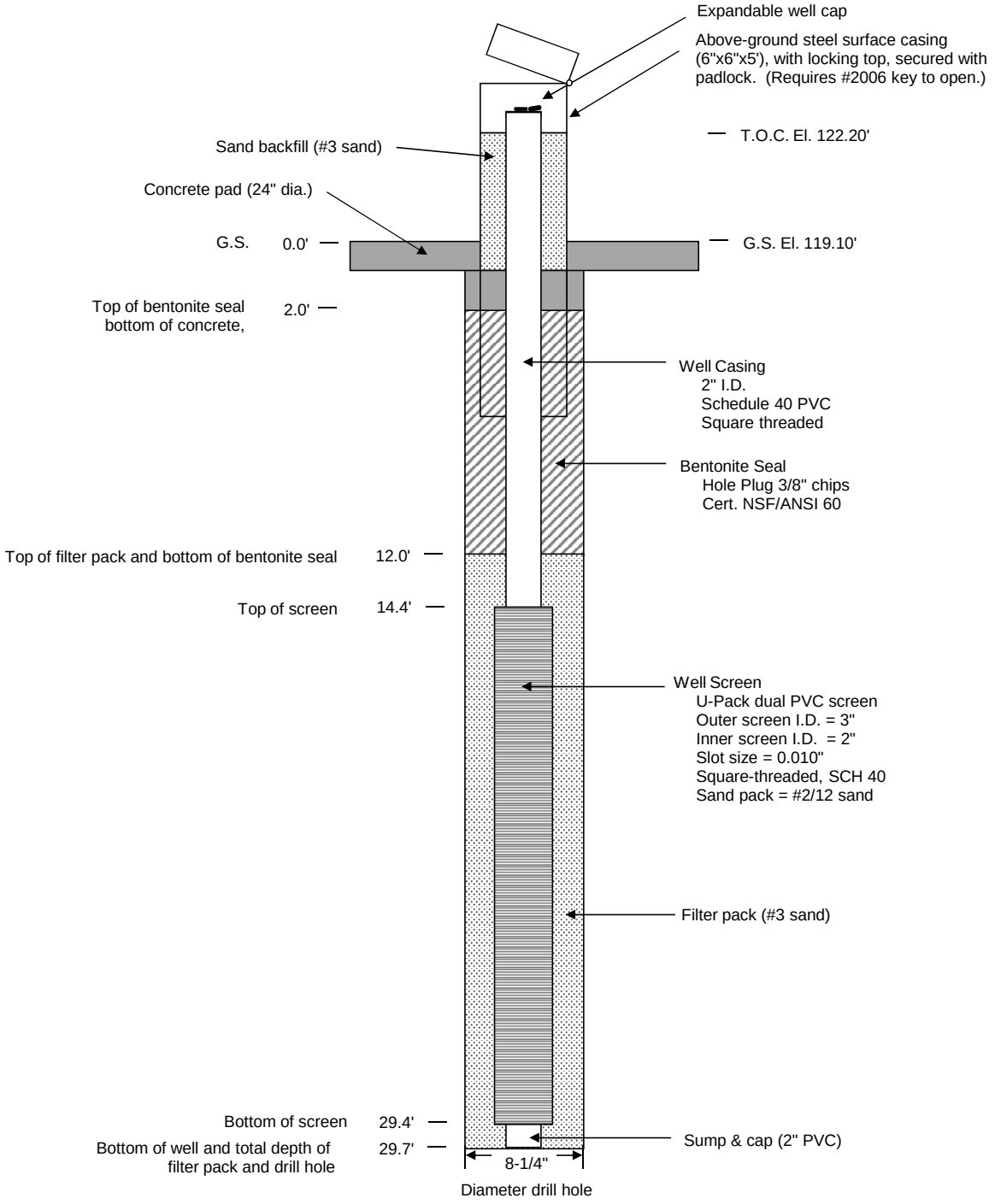
FADC = Flight Auger Dry Core
NP = Non-Plastic
NR = No Recovery
NA = Not Applicable
I.D. = Inner Diameter
O.D. = Outer Diameter

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.

SJRRP DH SJRRP.GPJ SJRRP.GPJ 11/8/11 3:54:04 PM

MW-11-133	GEOLOGIST: A. Warren
WELL COMPLETION DIAGRAM	DRILLER: C. Peterson
DATE COMPLETED: 4/18/2011	HELPERS: D. Read & C. Kelly
LOCATION: Field west of Jerrold Ave, at Arroyo Canal. Reach 4A, River Bank Left, RM 180, Fresno County. T.O.C. COORDINATES: N2250112.07 E6114595.27 (NAD93) EL. 122.20' (NAVD88) G.S. ELEVATION: 119.10' (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	Fresno	MW-11-133

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 _____ min.
Casing: 3.1 stick-up.

4. Depth of well (from ~~top of well casing~~) 29.7 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 ___.__ 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. 5.22 ft.	5.12 ft.
Date	b. 04/27/2011 (m m d d y y y y)	04/27/2011
Time	c. 13:49 ☐ a.m. ☐ p.m.	15:12 ☐ a.m. ☒ p.m.
12. Sediment in well bottom	trace inches	well depth: 29.4 inches
13. Water clarity	Clear ☐ 10 Turbid ☒ 15	Clear ☒ 20 Turbid ☐ 25
(Describe)	fine sand; brown	Clear, gray cast, no 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: Mike Ali Last Name: Lytgge Warren
Firm: BOR

17. Additional comments on development:
1349 Bailed 5 gallons using ball valve & surge block, starting from top of screen @ 15 feet and pumping for 1 min each foot. Water is turbid, brown & contained ~1 inch in bucket fine, micaceous sand.
1442: Purge pump @ bottom; 2 g/m pump rate; 45 gallons until no sand

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: Ali Warren
Firm: BOR

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

Possibly pulled in filter sand.

GEOLOGIC LOG OF DRILL HOLE NO. MW-11-134

FEATURE: Groundwater Monitoring
LOCATION: Reach 4A, River Bank Left, RM 177.4, Fresno County
BEGUN: 4/19/11 FINISHED: 4/19/11
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 5.5 ft. (111.6 ft. - 5/15/2011)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,256,655.8 E 6,112,405.1 NAD83
TOTAL DEPTH: 29.5 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 117.08 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 4A, River Bank Left, RM 177.4, Fresno County. In a field to the east of the intersection of Jerrold Avenue and Hudson Avenue.

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 at 7.0 ft.
9.5 to 14.5 ft. - Add catcher.
14.5 to 19.5 ft. - Add catcher and baggie.

DRILLING FLUID, RETURN AND COLOR:
0.0 to 29.5 ft. - Drilled without fluid

WATER LEVEL:
5.5 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.
	97.8										(CL/OL)s 114.1
		16.1	36.8	47.1	0.0	NP	NP	20.2	s(ML) 113.1		s(ML) 113.1
											CL 112.7
5	30.0									▼	SM
		11.6	20.0	68.4	0.0	NP	NP	23.0	SM 107.6		107.6
10	0.0									Qal	SP

0.0 to 29.0 feet
QUATERNARY ALLUVIUM (Qal)

0.0 to 3.0 ft. LEAN CLAY WITH SAND/ORGANIC WITH SAND, (CL/OL)s:
About 80% fines with medium plasticity, low toughness; about 20% fine sand; moist, dark brown; very firm; sticky texture when wet, moderate reaction with HCl; finely layered from 2.1 to 3.0 ft. with organic odor, woody debris.

3.0 to 4.0 ft. SANDY SILT, s(ML):
About 65% fines with low plasticity; about 45% fine, micaceous, sand; moist, brown; moderately soft; layered with 0.1 to 0.3 ft. thick stratifications.

Lab Data Interval
3.0 to 4.0 ft.

4.0 to 4.4 ft. LEAN CLAY, CL:
About 95% fines with low plasticity, slow dilatancy, low toughness; about 5% fine sand; moist, brown; firm.

4.4 to 9.5 ft. SILTY SAND, SM:
About 70% fine sand; about 30% fines with low plasticity; wet, brown; micaceous; soft and crumbles, does not hold form when removed from sampler.

Lab Data Interval
8.5 to 9.5 ft.

9.5 to 19.5 ft. No Recovery Classified as POORLY SORTED SAND, SP, from drilling action and trace recovery in sampler shoe. About 95% fine to medium sand, trace coarse sand; about 5% fines with no plasticity; wet, gray; loose.

19.5 to 20.4 ft. LEAN CLAY WITH SAND, (CL)s:
About 85% fines with medium plasticity, no dilatancy, high toughness; about 15% fine sand; trace mica; moist, gray; very firm; homogenous.

Lab Data Interval
19.5 to 20.0 ft.

20.4 to 21.4 ft. SANDY LEAN CLAY, s(CL):
About 60% fines with medium plasticity; about 40% fine sand; moist, gray; moderately firm; gradated lower contact.

21.4 to 24.0 ft. CLAYEY SAND, SC:
About 70% fine sand; about 30% fines with low plasticity; moist, brown; micaceous; moderately dense.

24.0 to 24.9 ft. SILT, ML:
About 95-100% fines with low plasticity, no toughness; trace fine sand; moist, brown to tan; firm.

Lab Data Interval
24.0 to 24.9 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.

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GEOLOGIC LOG OF DRILL HOLE NO. MW-11-134

FEATURE: Groundwater Monitoring
LOCATION: Reach 4A, River Bank Left, RM 177.4, Fresno County
BEGUN: 4/19/11 FINISHED: 4/19/11
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 5.5 ft. (111.6 ft. - 5/15/2011)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,256,655.8 E 6,112,405.1 NAD83
TOTAL DEPTH: 29.5 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 117.08 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: 0.21 to 9.0 ft. (2-inch I.D. blank PVC)
Dual U-pack Screen: 9.0 to 24.0 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: 7.5 to 29.0 ft. (#3 Sand)
Sump: 24.0 to 29.0 ft. (2-inch I.D. blank PVC with slip cap)
Concrete Seal: 0.0 to 2.0 ft.
Bentonite Seal: 2.0 to 7.5 ft.
Well Completion: Flush-mount traffic vault; requires 9/16" socket wrench to open; 2.0 ft. 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.
													97.6
	tr.												
20		44.6	38.5	16.9	0.0	41.0	21.7	21.4	(CL)s	97.1		(CL)s	96.7
												s(CL)	95.7
	64.0											SC	93.1
		19.2	75.7	5.1	0.0	27.1	5.2	23.6	ML	92.2		ML	92.2
25												(ML)s	91.1
												SM	89.9
	80.0	4.8	21.2	74.0	0.0	NP	NP	20.0	SM	89.6			
												s(CL)	87.6

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

24.9 to 26.0 ft. SILT WITH SAND, (ML)s:
About 80% fines with no plasticity; about 20% fine sand; wet, tan to brown with reddish brown iron oxidation; firm; weakly cemented, crumbles with light finger pressure.

26.0 to 27.2 ft. SILTY SAND, SM:
About 75% fine sand; about 25% fines with no plasticity; wet, tan; loose, formed to core box and water pooled on top.

Lab Data Interval
26.5 to 27.5 ft.

27.2 to 29.5 ft. SANDY LEAN CLAY, s(CL):
About 65% fines with medium plasticity; about 35% fine sand; wet, tan with reddish brown iron oxidation; firm; 0.1 ft. thicklayers of Silty Sand with 1.0 to 0.1 ft. spacing.

COMMENTS:

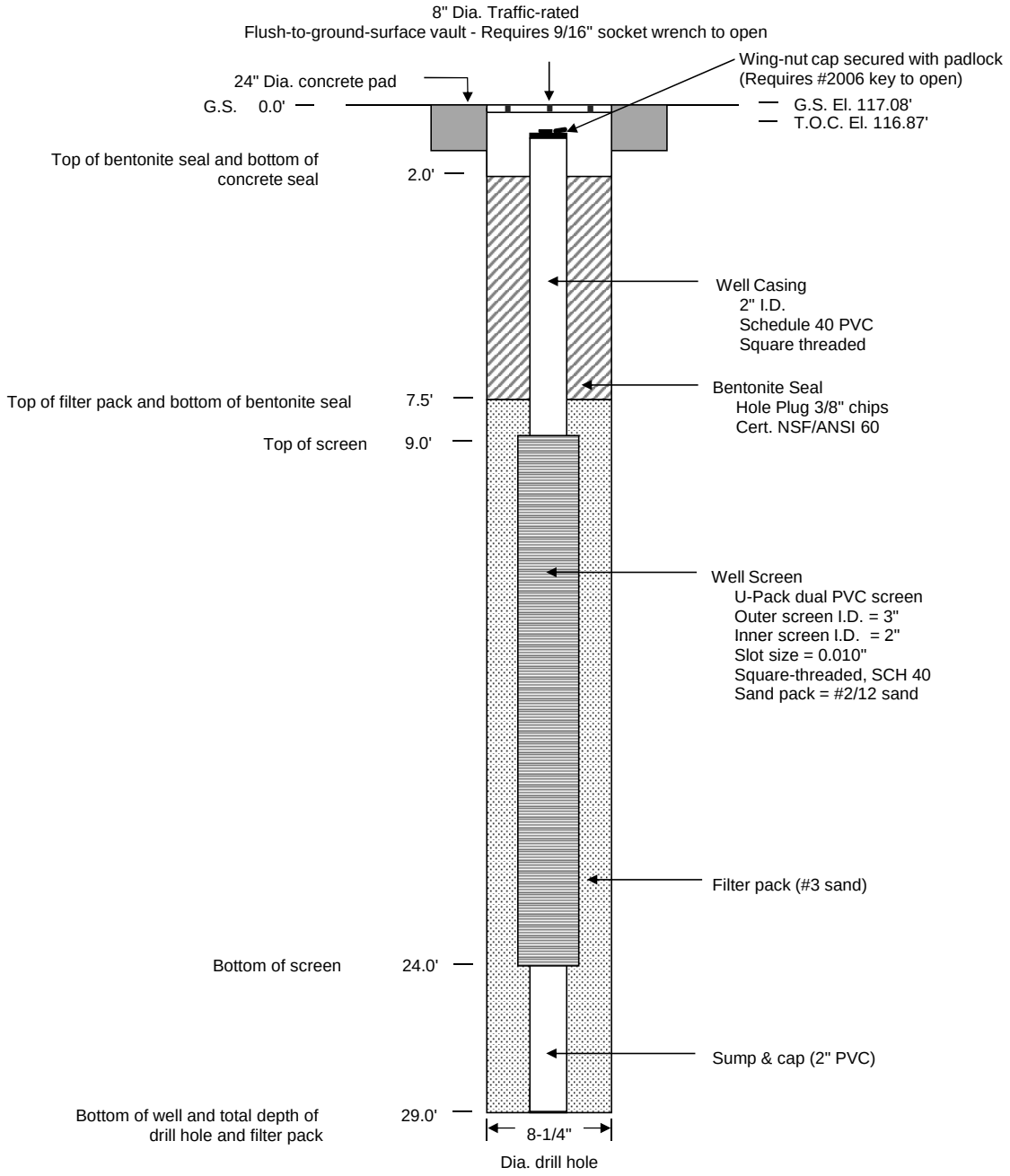
FADC = Flight Auger Dry Core
NP = Non-Plastic
NR = No Recovery
NA = Not Applicable
I.D. = Inner Diameter
O.D. = Outer Diameter

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.

SJRRP DH SJRRP.GPJ SJRRP.GPJ 11/8/11 3:54:04 PM

MW-11-134	GEOLOGIST: A. Warren
WELL COMPLETION DIAGRAM	DRILLER: C. Peterson
DATE COMPLETED: 4/19/2011	HELPERS: D. Read & C. Kelly
LOCATION: In a field to the east of the intersection of Jerrold Ave and Hudson Ave. Reach 4A, River Bank Left, RM 177.4, Fresno County. T.O.C. COORDINATES: N2256655.75 E6112405.0 (NAD83) ELEVATION 116.87' (NAVD88) G.S. ELEVATION: 117.08' (NAVD88) (measured at vault rim)	



***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-5 / MW-11-134

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: 90 min.

4. Depth of well (from ~~top of well casing~~ ground): 299 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: 500 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~~ Ground)	a. 5.50 ft.	5.60 ft.
Date	b. 5/15/2011 (m m d d y y y y)	5/31/2011
Time	c. 9:45 ☒ a.m. ☐ p.m.	11:23 ☒ a.m. ☐ p.m.
12. Sediment in well bottom	___.__ inches	___.__ inches
13. Water clarity	Clear ☐ 10 Turbid ☒ 15	Clear ☒ 20 Turbid ☐ 25
	(Describe) brown, Sandy	(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: USBR PN Region Drill

17. Additional comments on development:
- Surged w/ block & ball check valve for several minutes every 2 feet until 5 gallons pumped.
- pumped w/ sump pump — purged dry after 3 gallons pumped @ 10:10 recovered to 19.7 @ 10:12; 17.5 @ 10:14; 18.1
- pumped 7 gallons to purge dry, recharge

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.

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GEOLOGIC LOG OF DRILL HOLE NO. MW-11-135

FEATURE: Groundwater Monitoring
LOCATION: Reach 4A, River Bank Left, RM 177.4, Fresno County
BEGUN: 4/20/11 FINISHED: 4/20/11
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 5.1 ft. (114.0 ft. - 5/15/2011)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,256,427.0 E 6,111,860.2 NAD83
TOTAL DEPTH: 29.5 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 119.12 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 4A, River Bank Left, RM 177.4, Fresno County. Field east of Jerrold Avenue.

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:
9.5 to 14.5 ft. - Heaving sand in auger.

DRILLING FLUID, RETURN AND COLOR:
0.0 to 29.5 ft. - Drilled without fluid

WATER LEVEL:
5.1 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.
	93.3										(ML)s 116.5
		1.5	6.6	91.9	0.0	NP	NP	7.1	SP-SM 115.1		SP 114.2
5	100.0									▼	
		55.9	36.6	7.5	0.0	56.8	35.9	26.9	CH 110.1		CH 109.9
10											s(CL) 107.7
	50.0										SC 106.9
										Qal	

CLASSIFICATION AND PHYSICAL CONDITION

0.0 to 29.5 feet
QUATERNARY ALLUVIUM (Qal)

0.0 to 2.6 ft. SILT WITH SAND, (ML)s:
About 70% fines with no plasticity; about 30% fine sand; moist, brown; moderately firm; trace organic content; living roots, woody debris.

2.6 to 4.9 ft. POORLY GRADED SAND, SP:
About 95% fine to coarse sand; about 5% fines with no plasticity; dry, gray; fining upward sequence; loose.

Lab Data Interval
3.0 to 4.0 ft.

4.9 to 9.2 ft. FAT CLAY, CH:
About 100% fines with high plasticity, no dilatancy, high toughness; moist, dark brown; very firm; homogeneous.

Lab Data Interval
8.0 to 9.0 ft.

9.2 to 11.4 ft. SANDY LEAN CLAY, s(CL):
About 65% fines with medium plasticity, medium toughness; about 35% fine sand; moist, tan; 5 mm to 10 mm thick laminations; sequence from 9.2 to 12.2 ft. gradually fines upwards.

11.4 to 12.2 ft. CLAYEY SAND, SC:
About 50-55% fine sand; about 50-45% fines with medium plasticity; moist to wet, tan; dense; 0.1 thick stratifications.

12.2 to 23.5 ft. SILTY SAND, SM:
About 70% fine sand; about 30% fines with low plasticity; wet, tan; moderately loose; holds form when removed from sampler.

Lab Data Interval
17.0 to 18.0 ft.

23.5 to 28.2 ft.POORLY SORTED SAND WITH SILT, SP-SM:
About 90% fine sand; about 10% fines with no plasticity; wet, gray.

Lab Data Interval
23.5 to 24.5 ft.

28.2 to 29.5 ft. SANDY SILT, s(ML):
About 60% fines with no plasticity; about 40% fine sand; moist, tan with reddish brown iron oxidation; firm; about 1 mm to 3 mm thick layers of coarse sand moderately cemented with $CaCO_3$ and oxidation, strong 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.

SJRRP DH SJRRP.GPJ SJRRP.GPJ 11/8/11 3:54:05 PM

GEOLOGIC LOG OF DRILL HOLE NO. MW-11-135

FEATURE: Groundwater Monitoring
LOCATION: Reach 4A, River Bank Left, RM 177.4, Fresno County
BEGUN: 4/20/11 FINISHED: 4/20/11
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 5.1 ft. (114.0 ft. - 5/15/2011)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,256,427.0 E 6,111,860.2 NAD83
TOTAL DEPTH: 29.5 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 119.12 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: +2.39 to 14.2.0 ft. (2-inch I.D. blank PVC)
Dual U-pack Screen: 14.2 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: 11.0 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 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.
											SM
22.0		6.8	6.5	86.7	0.0	NP	NP	26.6	SM 101.1		
											95.6
		5.2	6.6	88.2	0.0	NP	NP	26.6	SP-SM 94.6		SP-SM
48.0											90.9
											s(ML)
											89.6

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.

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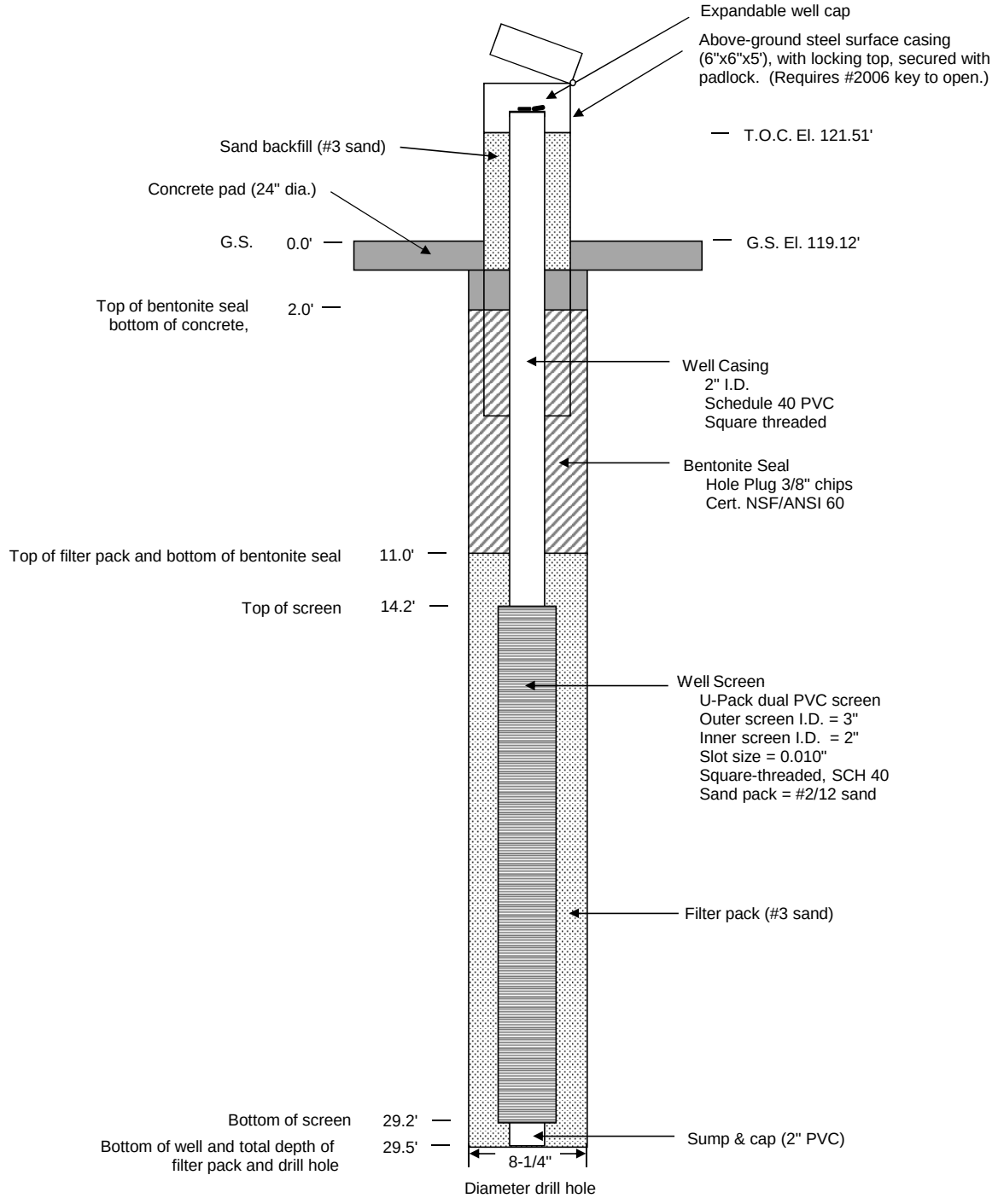
MW-11-135	GEOLOGIST: A. Warren
WELL COMPLETION DIAGRAM	DRILLER: C. Peterson
DATE COMPLETED: 4/20/2011	HELPERS: D. Read & C. Kelly
LOCATION: Field east of Jerrold Ave. Reach 4A, River Bank Left, RM 177.4, Fresno County. T.O.C. COORDINATES: N2256426.98 E6111860.18 (NAD93) EL. 121.51' (NAVD88) G.S. ELEVATION: 119.12' (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	W-6/MW-11-135

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): 31.0 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: 60.0 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.	8.10 ft	8.30 ft
Date b. (m m d d y y y y)	5/15/2011	5/15/2011
Time c.	9:00 ☒ a.m. ☐ p.m.	9:40 ☐ a.m. ☒ p.m.
12. Sediment in well bottom	trace inches	. inches
13. Water clarity	Clear ☐ 10 Turbid ☒ 15 (Describe) brown & sandy	Clear ☒ 20 Turbid ☐ 25 (Describe) sl. cloudy

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: USBR PN Drill crew

17. Additional comments on development:
Surged w/ block & ball check valve, surged ~ about 5 gallons of brown water
pumped w/ Sump pump until water is clear for 10 gallons
PN 1

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-11-136

FEATURE: Groundwater Monitoring
LOCATION: Reach 4A, River Bank Left, RM 177.4, Fresno County
BEGUN: 4/27/11 FINISHED: 4/27/11
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 4.8 ft. (111.9 ft. - 5/16/2011)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,256,245.7 E 6,110,606.5 NAD83
TOTAL DEPTH: 29.6 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 116.72 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 4A, River Bank Left, RM 177.4, Fresno County. At a yard of the intersection of Jerrold Avenue and Hudson Avenue in the southwest corner.

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:
NA

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

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

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.
												s(ML)	114.9
	100.0												
		58.8	33.2	8.0	0.0	54.6	36.7	24.7	CH	111.7		CH	
5													
	100.0												109.5
												CL	
10		44.4	42.1	13.5	0.0	37.6	19.8	28.0	CL	105.7			105.6
	68.0												
		4.6	6.7	88.7	0.0	NP	NP	21.4	SW-SM	101.7	Qal		

0.0 to 29.6 feet
QUATERNARY ALLUVIUM (Qal)

0.0 to 1.8 ft. SANDY SILT, s(ML):
About 60% fines with no to low plasticity, low toughness; about 40% fine sand, with trace medium sand; dry, brown; firm; no reaction with HCL.

1.8 to 7.2 ft. FAT CLAY, CH:
About 100% fines with high plasticity, no dilatancy, high toughness; trace fine sand; moist, dark brown; very firm; weak reaction with HCL on white $CaCO_3$ concretions from 5.5 to 7.2 ft.

Lab Data Interval
4.0 to 5.0 ft.

7.2 to 11.1 ft. LEAN CLAY, CL:
About 90% fines with low plasticity, no toughness; about 10% fine sand; wet to moist, tan with trace reddish brown iron oxidation; moderately firm.

Lab Data Interval
10.0 to 11.0 ft.

11.1 to 19.0 ft. SILTY SAND, SM:
About 85% fine sand; about 15% fines with no plasticity; wet, brown; loose; flows into box.

Note: 14.6 to 19.0 ft.: 15 to 20% fines; sand grain size coarsens to include medium.

Lab Data Interval
14.0 to 15.0 ft.

19.0 to 20.6 ft. LEAN CLAY WITH SAND, (CL)s:
About 85% fines with low plasticity, medium toughness; about 15% fine sand, with trace medium sand; wet, olive brown with reddish brown iron oxidation at upper contact; firm; no reaction with HCL.

Lab Data Interval
19.0 to 20.0 ft.

20.6 to 21.3 ft. CLAYEY SAND, SC:
About 55% fine sand; about 45% fines with low plasticity, low to medium toughness; moist, olive brown; very dense; no reaction with HCL.

21.3 to 24.2 ft. Interbedded CLAYEY SAND AND SANDY LEAN CLAY, SC & s(CL):
About 70% fine sand; about 30% fines with low plasticity layered in stratifications about 0.1 to 0.4 ft. thick with about 70% fines with low plasticity; about 30% fine sand; moist, olive brown; moderately firm; no reaction with HCL.

24.2 to 25.5 ft. CLAYSTONE:
About 90% fines with medium plasticity; about 10% fine sand; moist, tan with reddish brown iron oxidation layers throughout; finely laminated in 1 to 5 mm weakly to strongly cemented 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.

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GEOLOGIC LOG OF DRILL HOLE NO. MW-11-136

FEATURE: Groundwater Monitoring
LOCATION: Reach 4A, River Bank Left, RM 177.4, Fresno County
BEGUN: 4/27/11 FINISHED: 4/27/11
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 4.8 ft. (111.9 ft. - 5/16/2011)

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,256,245.7 E 6,110,606.5 NAD83
TOTAL DEPTH: 29.6 ft.
DEPTH TO BEDROCK: Not Encountered

STATE: California
GROUND ELEVATION: 116.72 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: .33 to 10.0 ft. (2-inch I.D. blank PVC)
Dual U-pack Screen: 10.0 to 20.0 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 23.0 ft. (#3 Sand)
Sump: 20.0 to 23.0 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.
Bentonite Backfill: 23.0 to 29.6 ft.
Well Completion: Flush-mount traffic vault; requires 5/16" allen wrench to open; 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.
											SM
											97.7
	38.0	32.2	51.4	16.4	0.0	28.7	13.3	22.9	(CL)s		(CL)s
20									96.7		96.1
											SC
											95.4
	100.0										Interbedded SC & s(CL)
											92.5
											Claystone
25											91.2
		4.9	29.9	65.2	0.0	NP	NP	19.3	SM		
									89.7		
	52.0										SM
											87.1

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

25.5 to 29.6 ft. SILTY SAND, SM:
About 65% fine sand; about 35% fines with no plasticity; wet, olive brown with reddish brown iron oxidation; loose, forms to box and water pools on surface.

Lab Data Interval
26.0 to 27.0 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.

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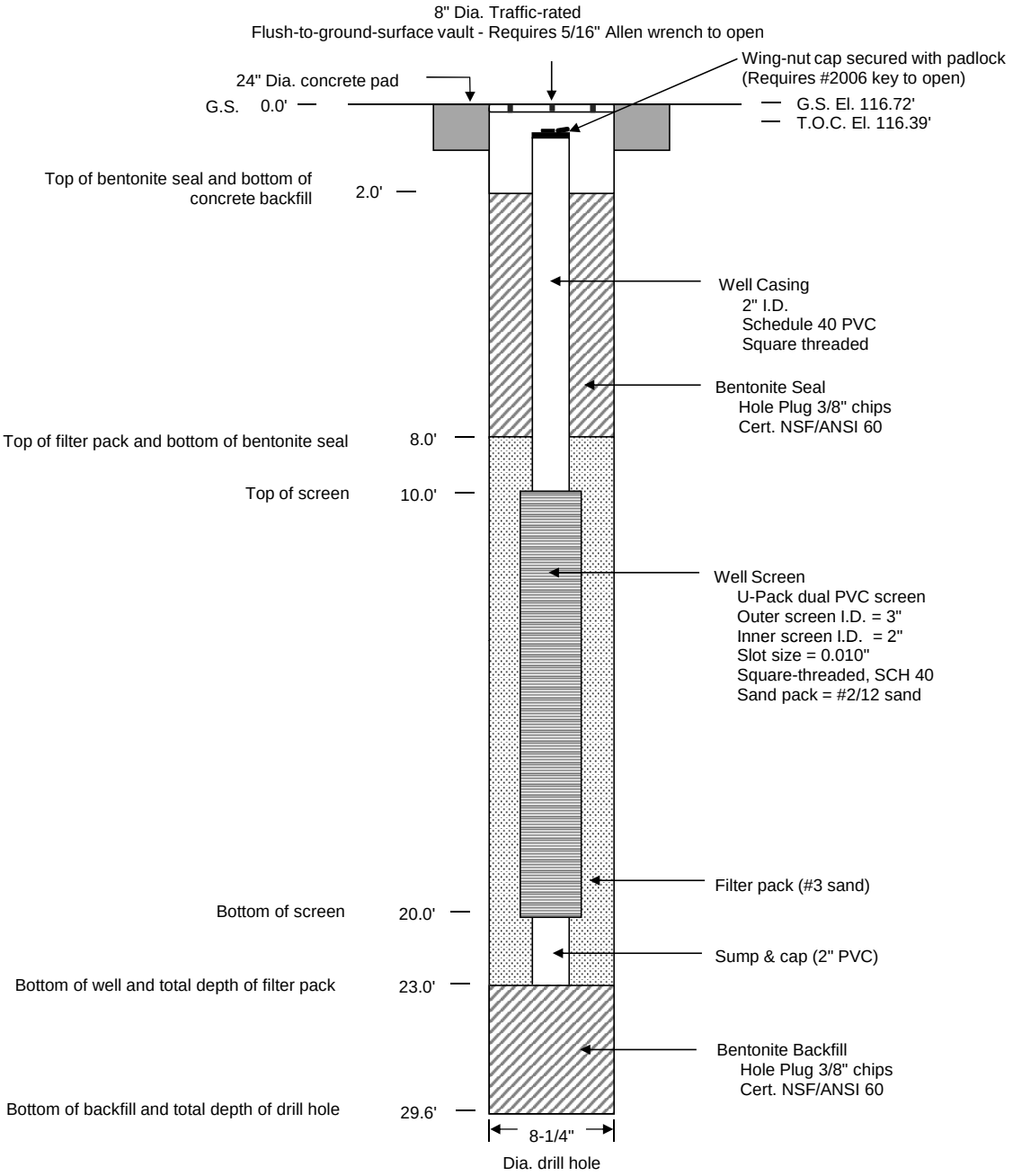
MW-11-136	GEOLOGIST: A. Warren
WELL COMPLETION DIAGRAM	DRILLER: C. Peterson
DATE COMPLETED: 4/27/2011	HELPERS: D. Read & C. Kelly
LOCATION: Southwest corner of yard at intersection of Jerrold Ave and Hudson Ave. Reach 4A, River Bank Left, RM 177.4, Fresno County. T.O.C. COORDINATES: N2256245.68 E6110606.47 (NAD83) ELEVATION 116.39' (NAVD88) G.S. ELEVATION: 116.72' (NAVD88) (measured at vault rim)	



***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

5/16/11

Facility/Project Name	County Name	Well Name
SJRRP	Merced	W-7 / MW-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: 60 min.

4. Depth of well (from top of well casisng): 23.0 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: 50.0 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. 4.80 ft. (from ground surface)	4.59 ft.
Date	b. 4/16/2011 (m m d d y y y y)	4/16/2011
Time	c. 7:45 ☒ a.m. ☐ p.m.	8:43 ☒ a.m. ☐ p.m.
12. Sediment in well bottom	tr. inches	inches
13. Water clarity	Clear ☐ 10 Turbid ☒ 15 (Describe) brown	Clear ☒ 20 Turbid ☐ 25 (Describe) clear

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: USBR PN Drill crew

17. Additional comments on development:
Surge w/ black & ball check valve for about 1 minute every few feet - surged 5 gallons of brown water
pumped from bottom w/ sump pump until clear for 110 gallons
IIII IIII

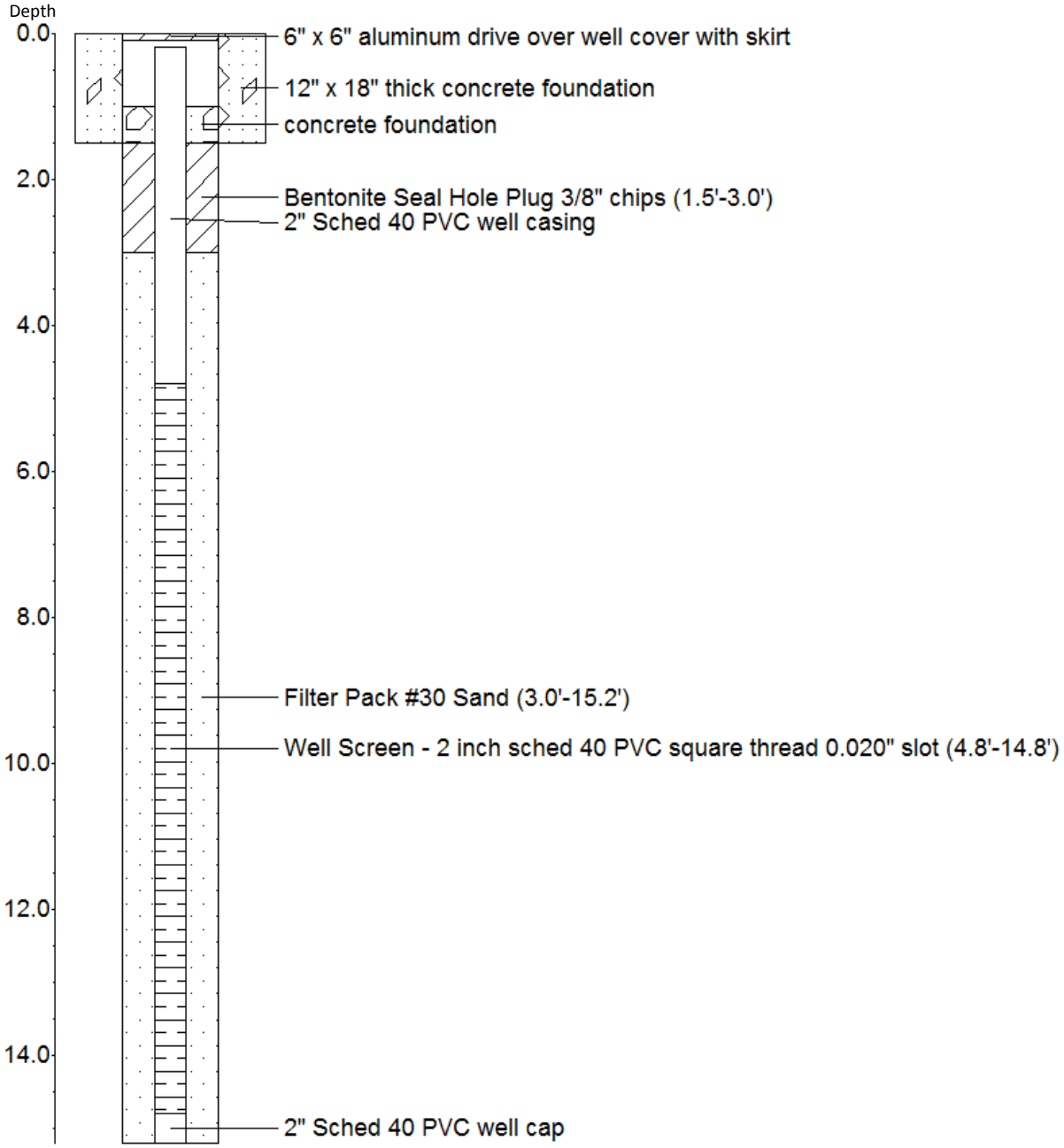
Name and Address of Facility Contact /Owner/Responsible Party
First Name: _____ Last Name: _____
Facility/Firm: _____
Street: _____
City/State/Zip: _____

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.

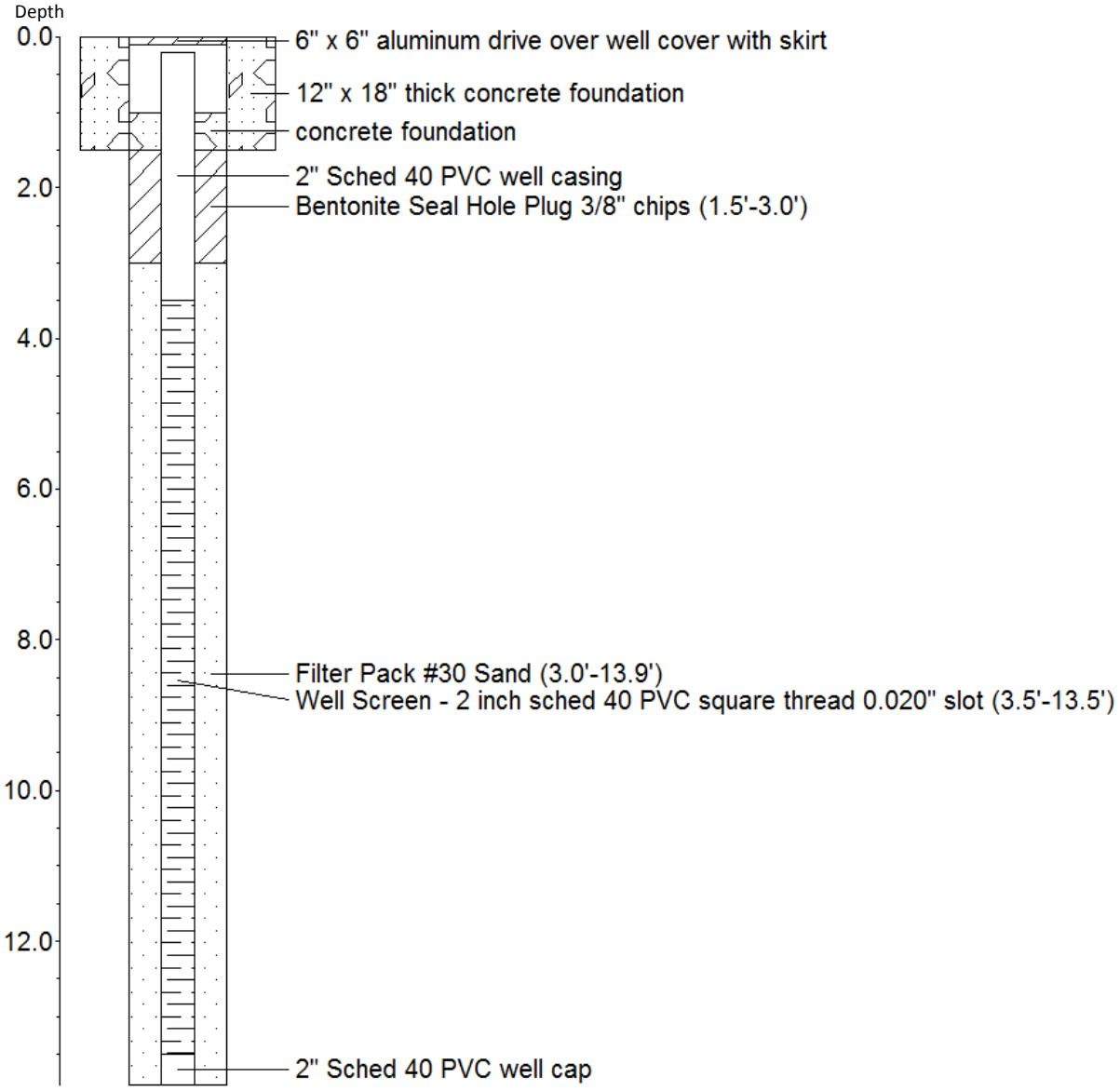
MW-16-219	Geologist: S. Lee
WELL COMPLETION DIAGRAM	DRILLER: R. Burnett
DATE COMPLETED: 7/27/2016	HELPERS: J. Papendick, C. Wagner
Willis Property, Reach 4A San Joaquin River	
Latitude: 37.06756	Longitude: -120.55745
Top of Casing Elevation: TBD	

MW-16-219



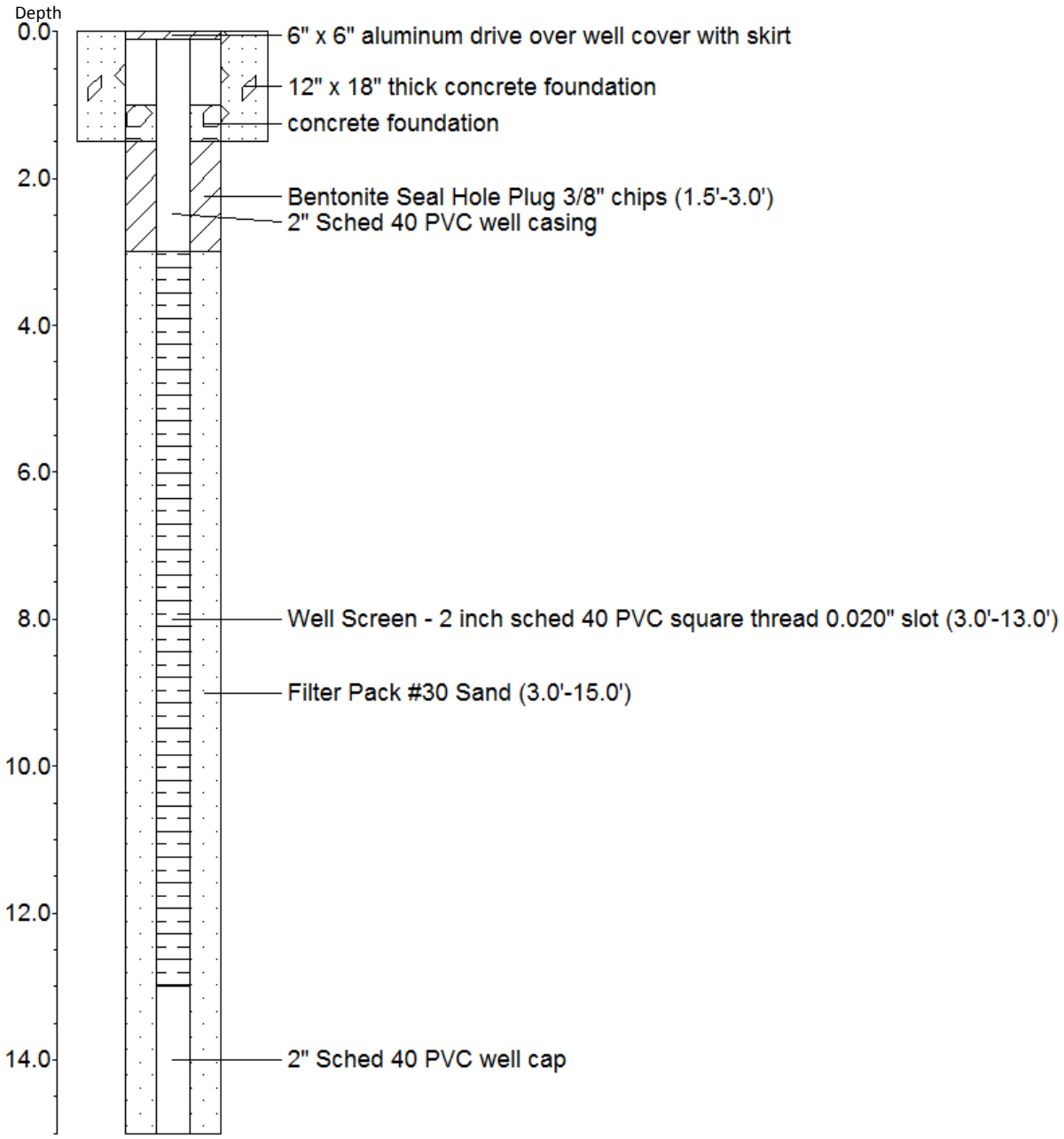
MW-16-220	Geologist: S. Lee
WELL COMPLETION DIAGRAM	DRILLER: R. Burnett
DATE COMPLETED: 7/26/2016	HELPERS: J. Papendick, C. Wagner
Willis Property, Reach 4A San Joaquin River	
Latitude: 37.07085	Longitude: -120.56314
Top of Casing Elevation: TBD	

MW-16-220



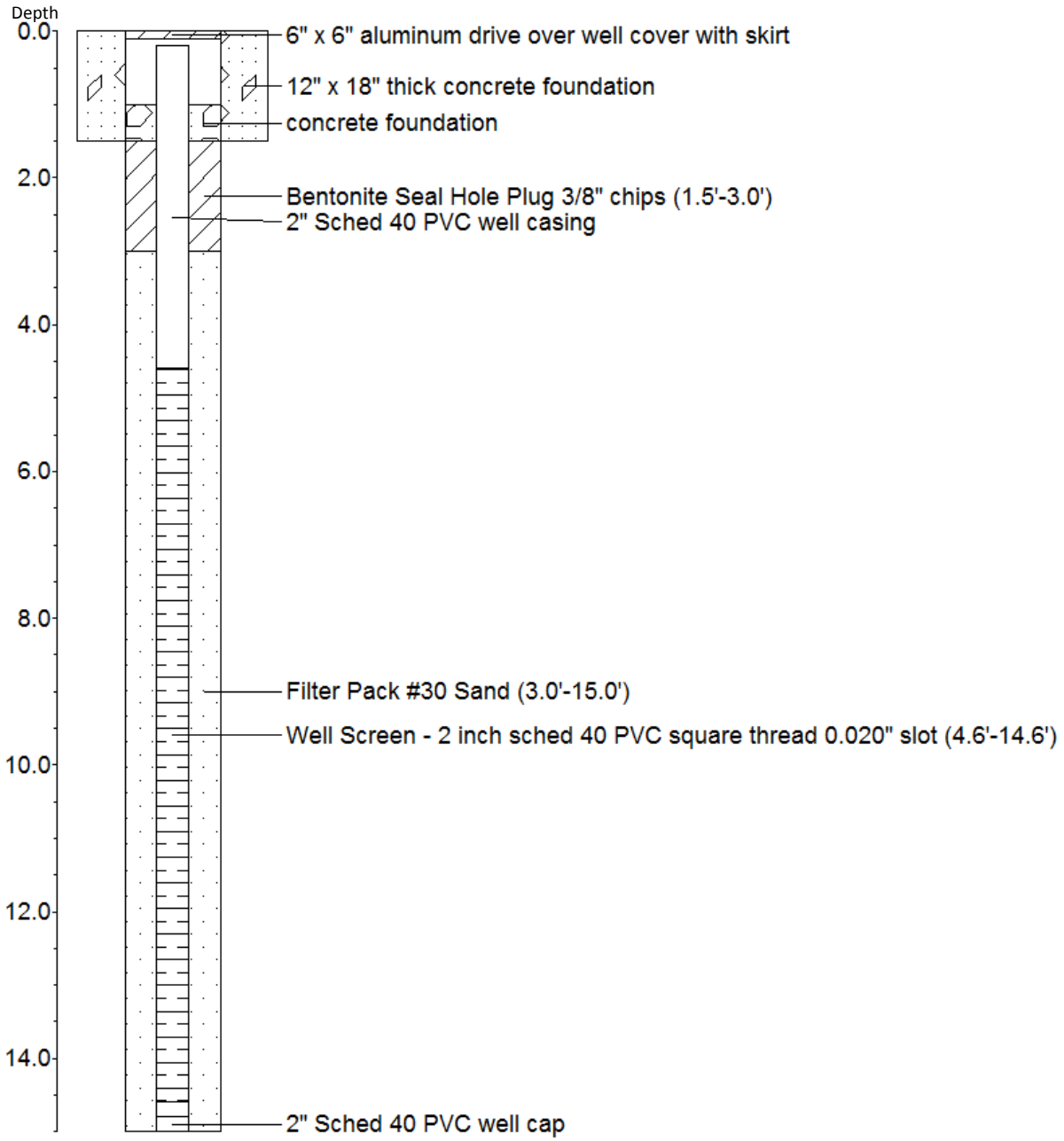
MW-16-221	Geologist: S. Lee
WELL COMPLETION DIAGRAM	DRILLER: S. Lee
DATE COMPLETED: 7/12/2016	HELPERS: J. Papendick
Willis Property, Reach 4A San Joaquin River	
Latitude: 37.07093	Longitude: -120.55920
Top of Casing Elevation: TBD	

MW-16-221



MW-16-222	Geologist: S. Lee
WELL COMPLETION DIAGRAM	DRILLER: R. Burnett
DATE COMPLETED: 7/25/2016	HELPERS: J. Papendick, C. Wagner
Willis Property, Reach 4A San Joaquin River	
Latitude: 37.06895	Longitude: -120.55562
Top of Casing Elevation: TBD	

MW-16-222



MW-16-224	GEOLOGIST: S. Lee
WELL COMPLETION DIAGRAM	DRILLER: R. Burnett
DATE COMPLETED: 7/26/16	HELPERS: J. Papendick, C. Wagner
Willis Property, Reach 4A SJR	
Latitude: 37.07501	Longitude: -120.56179
Top of Casing elevation: TBD