GEOLOGIC LOG OF DRILL HOLE NO. MW-09-21

FEATURE: Groundwater Monitoring
LOCATION: Reach 1B, River Bank Left, Fresno County
BEGUN: 10/24/09 FINISHED: 10/24/09
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 32.0 ft. (El. 194.45 ft.) 10/24/2009

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,182,805.1 E 6,252,472.3 (NAGD83)
TOTAL DEPTH: 57.5 ft.

STATE: California
GROUND SURFACE ELEVATION: 226.6 ft. (NAVD88)
T.O.C ELEVATION: 226.5 ft. (NAVD88)
HOLE LOGGED BY: G. Turlington
REVIEWED BY: J. Vauk

ALL MEASUREMENTS ARE IN FEET FROM THE GROUND SURFACE.

MW-09-21 was drilled and completed as a well on 10/03/2009 using hollow stem flight augers and a wooden plug.

MW-09-21B was drilled and continuously sampled on 10/24/2009 about five feet to the east from the MW-09-21.

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
Sam Cummings, Helper

DRILL RIG:
CME-550

DRILLING & SAMPLING METHODS:
Drill hole DH-09-21 was advanced using hollow stem flight augers (FADC) and a wooden plug from the ground surface to a total depth of 52.5 feet. The system uses 7-5/8-inch O.D, 4-1/4-inch hollow stem augers and a wooden (knock-out) plug.

Interval Method
0.0 to 52.5 ft. FADC with wooden plug

Drill hole DH-09-21B was advanced using hollow stem flight augers with continuous dry core sampling system (FADC) from the ground surface to a total depth of 57.5 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 57.5 ft. - FADC

DRILLING CONDITIONS AND DRILLER'S COMMENTS:

MW-09-21
0.0 to 52.5 ft. - blind drilled
52.5 ft. - knocked out wooden plug and set well

DEPTH	% CORE RECOVERY	% SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION	ELEVATION	VISUAL CLASSIFICATION	ELEVATION	GEOLOGIC UNIT SYMBOL
												SP/SM	226.1	Fill
												(SW)g	226.0	
										ASPHALT			225.5	
	72											SP/SM		
													223.0	
5	70	23.3	7.2	30.5	65.2	4.3	NP	NP	3.7	SM		SM		
											215.6		215.6	
10	78	3.0	1.2	4.2	53.6	42.2	NP	NP	1.0	(SP)g		(SP)g		
											211.5		211.5	
15	60	19.0	3.3	22.3	77.3	0.4	NP	NP	4.8	SM	210.4	SM	210.4	Qal
20	72													
		3.3	2.0	5.3	94.0	0.7	NP	NP	1.7	SP-SM		SP		
25	78										197.6		197.6	
	100	33.8	7.4	41.2	58.8	0.0	NP	NP	16.1	SM	195.7	SM	195.7	
30														

SOIL DESCRIPTIONS CHARACTERIZE SAMPLES FROM DRILL HOLE MW-09-21B.

0.0 to 1.0 feet
RECENT FILL (Fill)

0.0 to 0.4 ft. FILL - POORLY GRADED SAND WITH SILT, SP/SM: About 80% fine to coarse sand, (coarse sand is angular to sub-angular); about 10% non-plastic fines with rapid dilatancy; about 10% fine, hard to very hard gravel; maximum size: 1/2 inches; dry, light brown, no reaction with HCl; soft consistency; includes grass and roots.

0.4 to 0.5 ft. ASPHALT: 0.1 feet of asphalt overlying road base material.

0.5 to 1.0 ft. FILL - WELL GRADED SAND WITH GRAVEL, (SW)g: About 60% fine to coarse sand; about 35% fine, hard to very hard, rounded to subrounded gravel; about 5% non-plastic fines with rapid dilatancy; maximum size: 1/2 inches; dry, light brown, no reaction with HCl; very soft consistency; road base material.

1.0 to 57.5 ft.
QUATERNARY ALLUVIUM (Qal)

1.0 to 3.5 ft. POORLY GRADED SAND WITH SILT, SP/SM: About 80% fine to coarse sand; about 10% fine, hard to very hard gravel; about 10% non-plastic fines with rapid dilatancy; maximum size: 3/4 inches; dry, light brown, no reaction with HCl; very soft consistency.

3.5 to 10.9 ft. SILTY SAND, (SM): About 70% fine to coarse sand; about 30% fines with low plasticity, toughness and dry strength, and rapid dilatancy; maximum size: 3/4 inches; moist, reddish brown, no reaction with HCl; very soft consistency.

Laboratory Data Interval
3.5 to 10.9 ft.

10.9 to 15.0 ft. POORLY GRADED SAND WITH GRAVEL (SP)g: About 70% fine to coarse sand; about 25% fine to coarse, rounded to subrounded gravel; about 5% non-plastic fines with rapid dilatancy; maximum size: 1.75 inches, dry; tan; no reaction with HCl; very soft consistency.

Laboratory Data Interval
10.9 to 15.0 ft.

15.0 to 16.1 ft. SILTY SAND, SM: About 80% fine to coarse sand, 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
15.0 to 16.1 ft.

16.1 to 28.9 ft. POORLY GRADED SAND, SP: About 100% fine to coarse sand; trace of fines; maximum size: coarse sand; dry, tan to white, no reaction with HCl; very soft consistency.

Laboratory Data Interval
16.1 to 28.9 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.

GEOLOGIC LOG OF DRILL HOLE NO. MW-09-21

FEATURE: Groundwater Monitoring
LOCATION: Reach 1B, River Bank Left, Fresno County
BEGUN: 10/24/09 FINISHED: 10/24/09
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 32.0 ft. (El. 194.45 ft.) 10/24/2009

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,182,805.1 E 6,252,472.3 (NAGD83)
TOTAL DEPTH: 57.5 ft.

STATE: California
GROUND SURFACE ELEVATION: 226.6 ft. (NAVD88)
T.O.C ELEVATION: 226.5 ft. (NAVD88)
HOLE LOGGED BY: G. Turlington
REVIEWED BY: J. Vauk

NOTES

MW-09-21B
0.0 to 1.0 ft. - refusal at 1.0 foot b.g.s.
1.0 to 2.5 ft. - pilot bit added
2.5 to 7.5 ft. - clay, sands, and gravel
7.5 to 17.5 ft. - material disturbed due to gravel rolling in sampler,
17.5 to 21.5 ft. - very rough drilling, cobble in bottom of bit
21.5 to 22.5 ft. - refusal, pilot bit added
22.5 to 32.5 ft. - clay, sands, and gravel
32.4 to 57.5 ft. - saturated sand, difficult drilling recovery conditions

DRILL FLUID, RETURN AND COLOR:

MW-09-21
0.0 to 52.5 ft. - None
52.5 ft. - Water was used to fill hole before plug was knocked out and well installed.

MW-09-21B
0.0 to 17.5 ft. - None
17.5 to 57.5 ft. - Water, no return

WATER LEVEL:
32.0 ft. b.g.s. on 10/24/2009 (MW-09-21)

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

HOLE COMPLETION:

MW-09-21
Well Casing - 0.1 to 31.5 ft. (T.O.C. El. 276.46 ft.)
Dual Pre-pack Screen - 31.5 to 51.5 ft. (Slotted 0.020-inch)
Well Screen Filter Pack - #3 Sand Filter Pack - 26.0 to 51.5 ft. (#3 Sand)
Bottom Backfill - 51.5 to 52.5 ft. (Native material caved)
Bentonite Seal - 2.0 to 26.0 ft.
Well Protection - flush-mounted 18-inch manhole (15/16-inch hexbolts)

MW-09-21B
MW-09-21B was backfilled with bentonite hole plug from 1.0 to 57.5 feet b.g.s. Drill cuttings were backfilled the hole from ground surface to 1.0 feet b.g.s.

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
		52.2	18.4	70.6	29.4	0.0	NP	NP	30.8	(ML)s 195.3	(ML)s 195.3	
	100									▼ 32.0 ft. (El. 194.45 ft.)		
35	88											
40	76											
		47.1	5.0	52.1	47.9	0.0	NP	NP	29.2	s(ML)	s(ML)	
45	54											Qal
50	28									174.5	174.5	
55	62	6.5	0.7	7.2	92.8	0.0	NP	NP	22.2	SP-SM	SP	
										169.0	169.0	

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

28.9 to 30.8 ft. SILTY SAND, SM: About 70% fine to medium sand; about 30% non-plastic fines with rapid dilatancy; maximum size: medium sand; moist; brown, no reaction with HCl; very soft consistency.

Laboratory Data Interval
28.9 to 30.8 ft.

30.8 to 31.2 ft. SILT WITH SAND, (ML)s: About 75% fines with low plasticity and toughness, high dry strength, and slow dilatancy; about 25% fine sand; maximum size: fine sand; moist, brown, no reaction with HCl; hard consistency.

Laboratory Data Interval
30.8 to 31.2 ft.

31.2 to 52.0 ft. SANDY SILT, s(ML): About 50% non-plastic fines with rapid dilatancy; about 50% fine to medium sand; maximum size: medium sand; wet, brown and reddish-brown laminations from 43.0 to 48.0 feet, no reaction with HCl; soft consistency.

Laboratory Data Interval
31.2 to 52.0 ft.

52.0 to 57.5 ft. POORLY GRADED SAND, SP: About 95% fine to coarse sand; about 5% non-plastic fines with rapid dilatancy; maximum size: coarse sand; wet, brown, no reaction with HCl, very soft consistency.

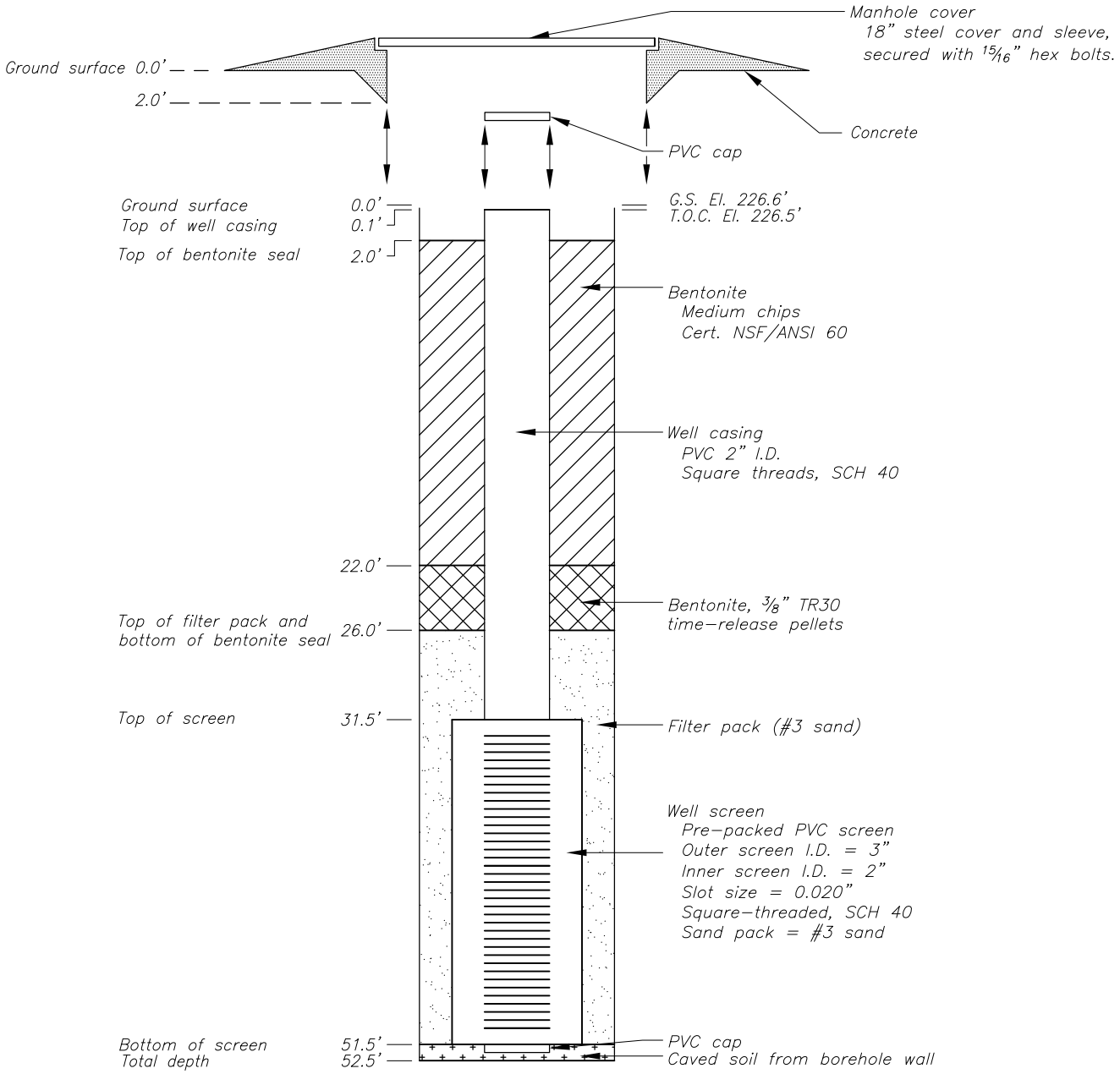
Laboratory Data Interval
52.0 to 57.5 ft.

T.D. = 57.5 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.

MW–09–21	GEOLOGIST: G. TURLINGTON
WELL COMPLETION DIAGRAM	DRILLER: J. HUCKABY
DATE COMPLETED: 10/24/2009	HELPER: S. CUMMINGS
TOP OF WELL CASING COORDINATES: N2182805.1 E6252472.3 (NAD83) ELEVATION 226.5' (NAVD88) GROUND SURFACE ELEVATION 226.6' (NAVD88)	



*NOT TO SCALE

NOTES:
T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, El. = Elevation
Excellent well completion with sand around entire screened interval.
Sand backfills the well above the top of bentonite seal, inside the manhole.

GEOLOGIC LOG OF DRILL HOLE NO. MW-09-22

FEATURE: Groundwater Monitoring
LOCATION: Reach 1B, River Bank Left, Fresno County
BEGUN: 10/22/09 FINISHED: 10/22/09
DEPTH AND ELEVATION OF WATER LEVEL AND DATE MEASURED: NA

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,183,840.4 E 6,252,462.2 (NAGD83)
TOTAL DEPTH: 57.5 ft.

STATE: California
GROUND SURFACE ELEVATION: 222.8 ft. (NAVD88)
T.O.C ELEVATION: 222.73 ft. (NAVD88)
HOLE LOGGED BY: G. Turlington
REVIEWED BY: J. Vauk

DEPTH	% CORE RECOVERY	% SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION	ELEVATION	VISUAL CLASSIFICATION	ELEVATION	GEOLOGIC UNIT SYMBOL
												Fill	222.3	Fill
	88	36.1	5.0	41.1	57.3	1.6	NP	NP	3.1	SM	217.8	SM	217.8	
5	90	27.3	6.9	34.2	65.2	0.6	NP	NP	3.2	SM	210.8	SM	210.8	
10	82													
	76	6.5	1.9	8.4	40.2	51.4	NP	NP	1.7	(GP-GM)s	200.1	(GP)s	200.1	Qal
15	72													
	40													
20														
	100	50.8	13.1	63.9	36.1	0.0	20.5	4.3	18.5	s(CL-ML)	195.2	s(ML)	195.2	
25														

NOTES

ALL MEASUREMENTS ARE IN FEET FROM THE GROUND SURFACE.

MW-09-22 was drilled and completed as a well on 10/03/2009 using hollow stem flight augers and a pilot bit.

MW-09-22B was drilled and continuously sampled on 10/22/2009 about five feet to the south from the MW-09-22.

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
Sam Cummings, Helper

DRILL RIG:
CME-550

DRILLING & SAMPLING METHODS:
Drill hole DH-08-22 was advanced using hollow stem flight augers (FADC) and a pilot bit from the ground surface to a total depth of 57.5 feet. FADC uses 7-5/8-inch O.D., 4-1/4-inch I.D. hollow stem augers and a tri-cone pilot bit.

Interval Method
0.0 to 57.5 ft. - FADC with pilot bit

Drill hole DH-08-22B was advanced using hollow stem flight augers with continuous dry core sampling system (FADC) from the ground surface to a total depth of 57.5 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 57.5 ft. - FADC

DRILLING CONDITIONS AND DRILLER'S COMMENTS:

MW-09-22
0.0 to 52.5 ft. - blind drilled
52.5 to 57.5 ft. - pilot bit temporarily stuck in augers

MW-09-22B
0.0 to 22.5 ft. - smooth drilling
22.5 to 27.5 ft. - cobble encountered
27.5 to 42.5 ft. - smooth drilling
42.5 to 52.5 ft. - core dropped out of sample barrel
52.5 to 57.5 ft. - smooth drilling

CLASSIFICATION AND PHYSICAL CONDITION

SOIL DESCRIPTIONS CHARACTERIZE SAMPLES FROM DRILL HOLE MW-09-22B.

0.0 to 0.4 feet
RECENT FILL (Fill)

0.0 to 0.2 ft. FILL - SILTY SAND, SM: Soil graded dirt road, with grass, and roots.

0.2 to 0.4 ft. ASPHALT

0.4 to 57.5 ft.
QUATERNARY ALLUVIUM (Qal)

0.4 to 4.9 ft. SILTY SAND, SM: About 65% fine to coarse sand; about 30% non-plastic fines with rapid dilatancy; about 5% fine, hard to very hard, round to subrounded gravel; maximum size: 1/2 inches; dry, light brown, no reaction with HCl; very soft consistency.

Laboratory Data Interval
0.4 to 4.9 ft.

4.9 to 11.9 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, brown, no reaction with HCl; very soft consistency.

Laboratory Data Interval
4.9 to 11.9 ft.

11.9 to 22.6 ft. POORLY GRADED GRAVEL WITH SAND, (GP)s: About 50% fine to coarse, hard to very hard, round to subrounded gravel; about 45% fine to coarse sand; about 5% non-plastic fines with rapid dilatancy; maximum size: 2.5 inches; dry, light brown, no reaction with HCl; very soft consistency.

Laboratory Data Interval
11.9 to 22.6 ft.

22.6 to 27.5 ft. SANDY SILT, s(ML): About 60% fines with low plasticity, toughness and dry strength, and slow dilatancy; about 40% fine to coarse sand (mostly fine and medium); maximum size: coarse sand; moist to wet, brown, no reaction with HCl; very soft to soft consistency.

Laboratory Data Interval
22.6 to 27.5 ft.

27.5 to 32.5 ft. SILT, ML: About 90% fines with low plasticity, toughness and dry strength, and rapid dilatancy; about 10% fine sand; maximum size: fine sand; moist to wet, brown, no reaction with HCl; very soft to soft consistency.

Laboratory Data Interval
27.5 to 32.5 ft.

32.5 to 42.5 ft. SILT WITH SAND, (ML)s: About 85% fines with low plasticity, toughness and dry strength, and rapid dilatancy; about 15% fine sand; maximum size: fine sand; moist to wet, brown, no reaction with HCl; very soft to 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.

GEOLOGIC LOG OF DRILL HOLE NO. MW-09-22

FEATURE: Groundwater Monitoring
LOCATION: Reach 1B, River Bank Left, Fresno County
BEGUN: 10/22/09 FINISHED: 10/22/09
DEPTH AND ELEVATION OF WATER LEVEL AND DATE MEASURED: NA

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,183,840.4 E 6,252,462.2 (NAGD83)
TOTAL DEPTH: 57.5 ft.

STATE: California
GROUND SURFACE ELEVATION: 222.8 ft. (NAVD88)
T.O.C ELEVATION: 222.73 ft. (NAVD88)
HOLE LOGGED BY: G. Turlington
REVIEWED BY: J. Vauk

DRILL FLUID, RETURN AND COLOR:

MW-09-22
0.0 to 57.5 ft. - None
57.5 ft. - Water was used to fill hole before pilot bit was retracted and during well installation.

MW-09-22B
0.0 to 27.5 ft. - None
27.5 to 57.5 ft. - Water, no return

WATER LEVEL:
Not Recorded

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

HOLE COMPLETION:

MW-09-22
Well Casing - 0.1 to 33.0 ft. (T.O.C. El. 222.73 ft.)
Dual Pre-pack Screen - 33.0 to 53.0 ft. (Slotted 0.020-inch)
Well Screen Filter Pack - #3 Sand Filter Pack - 26.0 to 57.5 ft. (#3 Sand and Native material caved)
Bentonite Seal - 2.0 to 26.0 ft.
Well Protection - flush-mounted 18-inch manhole (15/16-inch hexbolts)

MW-09-22B
MW-09-22B was backfilled with bentonite hole plug from 1.0 to 57.5 feet b.g.s. Drill cuttings were backfilled the hole from ground surface to 1.0 feet b.g.s.

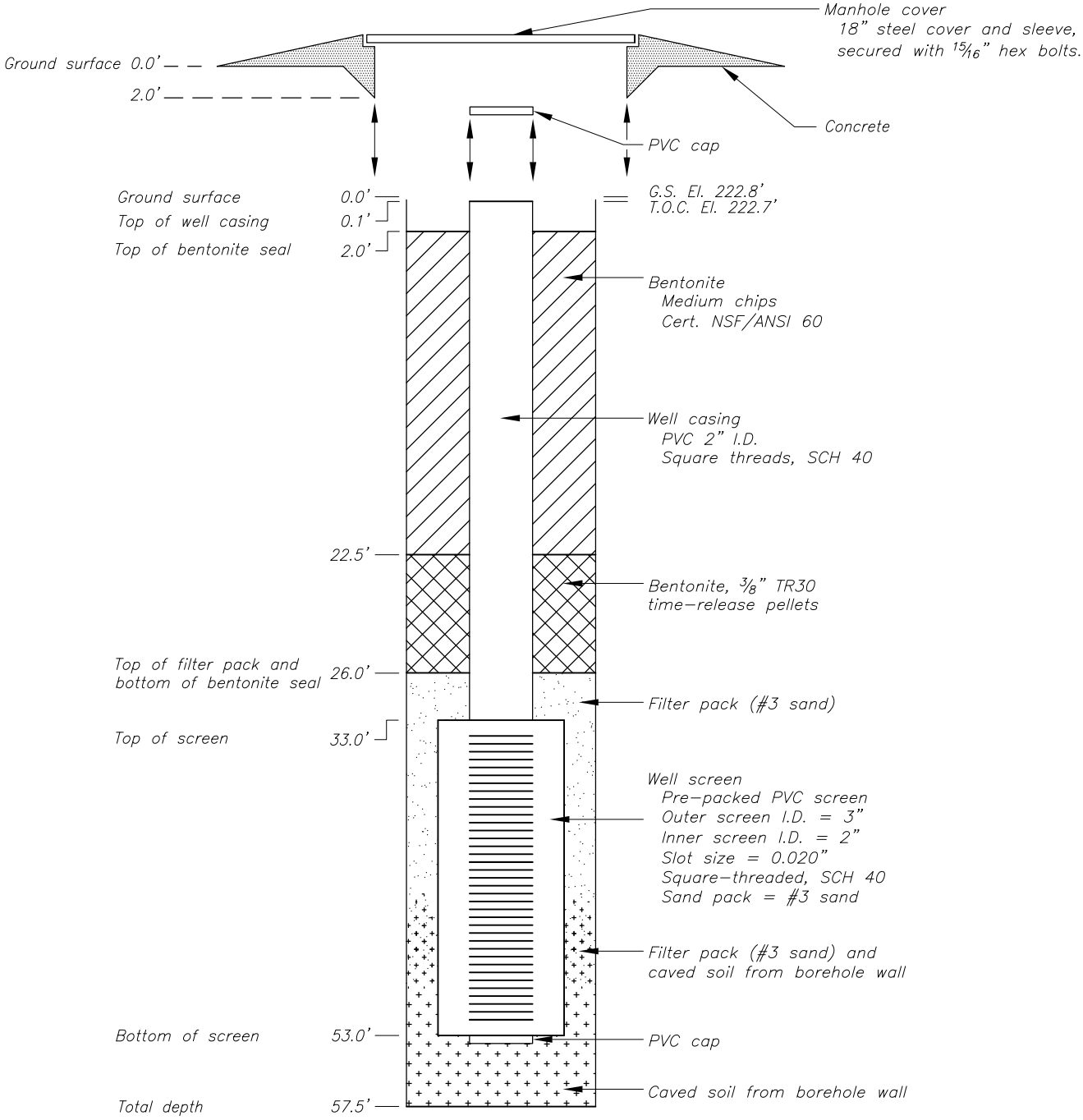
DEPTH	% CORE RECOVERY	LABORATORY DATA: % SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION / ELEVATION	VISUAL CLASSIFICATION / ELEVATION	GEOLOGIC UNIT SYMBOL	CLASSIFICATION AND PHYSICAL CONDITION
	100	75.3	13.3	88.6	11.4	0.0	NP	NP	23.7	ML	ML		**42.5 to 57.1 ft. POORLY GRADED SAND WITH SILT, SP/SM:** About 90% fine and coarse sand; about 10% non-plastic fines with rapid dilatancy; trace of fine, hard to very hard, subrounded gravel; maximum size: 1/2 inches; moist, brown, no reaction with HCl; very soft consistency.
										190.2	190.2		Laboratory Data Interval 42.5 to 57.1 ft.
35	100												**57.1 to 57.5 ft. LEAN CLAY WITH SAND, (CL)s:** About 85% fines with no to low plasticity, low toughness and dry strength, slow dilatancy; about 15% fine to coarse sand (mostly fine to medium); maximum size, coarse sand; moist, reddish brown, no reaction with HCl; firm consistency.
											(ML)s		Laboratory Data Interval 57.1 to 57.5 ft.
40	100										180.2		***T.D. = 57.5 ft.***
45	32											Qal	
50	0	6.1	4.6	10.7	87.5	1.8	NP	NP	22.5	SW-SM	SP/SM		
55	100												
		57.8	15.6	73.4	26.6	0.0	33.8	9.6	26.1	165.6 (ML)s 165.2	165.6 (CL)s 165.2		

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–09–22	GEOLOGIST: G. TURLINGTON
WELL COMPLETION DIAGRAM	DRILLER: J. HUCKABY
DATE COMPLETED: 10/22/2009	HELPER: S. CUMMINGS
TOP OF WELL CASING COORDINATES: N2183840.4 E6252462.2 (NAD83) ELEVATION 222.7' (NAVD88) GROUND SURFACE ELEVATION 222.8' (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-09-23

FEATURE: Groundwater Monitoring
LOCATION: Reach 1B, River Bank Left, Fresno County
BEGUN: 10/21/09 FINISHED: 10/22/09
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 10.5 ft. (El. 199.98 ft.) 10/21/2009

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,184,135.4 E 6,252,440.0 (NAGD83)
TOTAL DEPTH: 37.5 ft.

STATE: California
GROUND SURFACE ELEVATION: 210.6 ft. (NAVD88)
T.O.C ELEVATION: 210.48 ft. (NAVD88)
HOLE LOGGED BY: G. Turlington
REVIEWED BY: J. Vauk

ALL MEASUREMENTS ARE IN FEET FROM THE GROUND SURFACE

MW-09-23 was drilled and completed as a well on 10/02/2009 using hollow stem flight augers and a pilot bit.

MW-09-23B was drilled, continuously sampled, and completed as a well on 10/21/2009 about five feet to the west from MW-09-23.

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
Sam Cummings, Helper

DRILL RIG:
CME-550

DRILLING & SAMPLING METHODS:
Drill hole DH-09-23 was advanced using hollow stem flight augers (FADC) and a pilot bit from the ground surface to a total depth of 37.0 feet. FADC uses 7-5/8-inch O.D., 4-1/4-inch I.D. hollow stem augers and a tri-cone pilot bit.

Interval Method
0.0 to 37.0 ft. - FADC with pilot bit

Drill hole DH-09-23B was advanced using hollow stem flight augers with continuous dry core sampling system (FADC) from the ground surface to a total depth of 37.5 feet. FADC uses 7-5/8-inch I.D., 4-1/4-inch hollow stem augers, with a 5-foot-long, 3-inch I.D. split sample barrel.

Interval Method
0.0 to 37.5 ft. - FADC

DRILLING CONDITIONS AND DRILLER'S COMMENTS:

MW-09-23
0.0 to 37.0 ft. - blind drilled
37.0 ft. - material sluffed into open hole while retracting pilot bit, bottom 10 feet was drilled again and a full water column was maintained while pilot bit was retracted.

MW-09-22B
0.0 to 15.0 ft. - moderately rough drilling
15.0 to 17.5 ft. - rough drilling, material stuck in shoe
17.5 to 21.5 ft. - moderately rough drilling
21.5 to 37.5 ft. - smooth drilling

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	22.4	3.8	26.2	73.0	0.8	NP	NP	0.5	SM 208.3	SM 208.3	Qal
5	20	3.2	0.9	4.1	25.9	70.0	NP	NP	1.5	(GW)s 201.5	(GP)s 201.5	
	48											
10										▼ 10.5 ft. (El. 199.98 ft.)		
	16	5.6	2.3	7.9	66.9	25.2	NP	NP	7.0	(SW-SM)g 197.0	(SP)g 197.0	
	12											
15												
	32											
		2.0	0.4	2.4	19.3	78.3	NP	NP	4.2	(GP)s 189.0	(GP)s 189.0	
20	62											
		35.9	6.4	42.3	56.4	1.3	NP	NP	21.3	SM 187.7	SM 187.7	
	100	54.5	38.4	92.9	7.1	0.0	NP	NP	26.9	ML 186.5	CL 186.5	

SOIL DESCRIPTIONS CHARACTERIZE SAMPLES FROM DRILL HOLE MW-09-23B.

0.0 to 37.5 ft.
QUATERNARY ALLUVIUM (Qal)

0.0 to 2.2 ft. SILTY SAND, SM About 85% medium sand; about 15% non-plastic fines with rapid dilatancy; trace of fine, hard to very hard, rounded to subrounded gravel; maximum size: 1/2 inches; dry, tan, no reaction with HCl; soft consistency; material has been disturbed by road grading, and soil contains landscaping bark from 0.0 to 0.1 feet of depth.

Laboratory Data Interval
0.1 to 2.2 ft.

2.2 to 9.0 ft. POORLY GRADED GRAVEL WITH SAND, (GP)s: About 70% fine to coarse (mostly coarse), hard to very hard, rounded to subrounded gravel; about 25% fine to coarse sand; about 5% non-plastic fines; maximum size: 3 inches; dry, light brown; no reaction with HCl; very soft consistency.

Laboratory Data Interval
2.2 to 9.0 ft.

9.0 to 13.5 ft. POORLY GRADED SAND WITH GRAVEL, (SP)g: About 80% fine to coarse sand; about 15% fine to coarse (mostly fine), hard to very hard, subrounded to rounded gravel; about 5% non-plastic fines; maximum size: 1/2 inches; moist to wet, light brown, no reaction with HCl; very soft consistency.

Laboratory Data Interval
0.9 to 13.5 ft.

13.5 to 21.5 ft. POORLY GRADED GRAVEL WITH SAND, (GP)s: About 60% fine to coarse, hard to very hard, rounded to subrounded gravel; about 35% fine to coarse sand; about 5% fines; maximum size: 3.5 inches; wet, light brown, no reaction with HCl; very soft consistency.

Laboratory Data Interval
13.5 to 21.5 ft.

21.5 to 22.8 ft. SILTY SAND, SM: About 55% fine to coarse sand (mostly medium to coarse); about 45% non-plastic fines; trace of fine, hard to very hard, rounded to subrounded gravel; maximum size: 1/2 inches: wet, dark brown, no reaction with HCl; very soft consistency.

Laboratory Data Interval
21.5 to 22.8 ft.

22.8 to 24.0 ft. LEAN CLAY, CL: About 90% fines with low plasticity, dry strength, and toughness, and slow dilatancy; about 10% fine sand; maximum size: fine sand; wet, brown, no reaction with HCl; firm consistency.

Laboratory Data Interval
22.8 to 24.0 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-09-23B
TOC Coordinates= N 2184135.0 E 6252446.1 (NAGD83) El. 210.53 (NAVD88)
Groundsurface El.= 210.6 (NAVD88)

GEOLOGIC LOG OF DRILL HOLE NO. MW-09-23

FEATURE: Groundwater Monitoring
LOCATION: Reach 1B, River Bank Left, Fresno County
BEGUN: 10/21/09 FINISHED: 10/22/09
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 10.5 ft. (El. 199.98 ft.) 10/21/2009

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,184,135.4 E 6,252,440.0 (NAGD83)
TOTAL DEPTH: 37.5 ft.

STATE: California
GROUND SURFACE ELEVATION: 210.6 ft. (NAVD88)
T.O.C ELEVATION: 210.48 ft. (NAVD88)
HOLE LOGGED BY: G. Turlington
REVIEWED BY: J. Vauk

DRILL FLUID, RETURN AND COLOR:

MW-09-23
0.0 to 37.0 ft. - None
37.0 ft. - Water added to retract pilot bit and install well, no return

MW-09-23B
0.0 to 10.0 ft. - None
10.0 to 37.5 ft. - Water, no return.

WATER LEVEL:
Not Recorded

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

HOLE COMPLETION:

MW-09-23
Well Casing - 0.1 to 14.5 ft. (T.O.C. El. 210.48 ft.)
Dual Pre-pack Screen - 14.5 to 34.5 ft. (Slotted 0.020-inch)
Well Screen Filter Pack - #3 Sand Filter Pack - 12.0 to 37.0 ft. (Native material caved)
Bentonite Seal - 10.0 to 12.0 ft.
Backfill - 4.0 to 10.0 ft. (Native material caved)
Backfill - 2.0 to 4.0 ft. (Bentonite)
Well Protection - flush-mounted 18-inch manhole (15/16-inch hexbolts)

MW-09-23B
Well Casing - 0.1 to 12.0 ft. (T.O.C. El. 210.53 ft.)
Dual Pre-pack Screen - 12.0 to 22.0 ft. (Slotted 0.020-inch)
Well Screen Filter Pack - #3 Sand Filter Pack - 9.0 to 22.0 ft. (#3 Sand)
Bentonite Bottom Seal - 22.0 to 37.5 ft. (Bentonite and Native material caved)
Bentonite Seal - 2.0 to 9.0 ft.
Well Protection - flush-mounted 18-inch manhole (15/16-inch hexbolts)

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
25	80											
		10.3	2.5	12.8	84.2	3.0	NP	NP	13.9	SM / 177.7	SM / 177.7	Qal
30	100											
35	64	52.9	18.9	71.8	28.2	0.0	NP	NP	24.5	(ML)s / 173.0	SP / 173.0	

BOTTOM OF HOLE

24.0 to 32.8 ft. SILTY SAND, SM: About 80% fine to medium sand; about 20% non-plastic fines with rapid dilatancy; maximum size: medium sand; wet, no reaction with HCl; soft consistency.

Laboratory Data Interval
24.0 to 32.8 ft.

32.8 to 37.5 ft. POORLY GRADED SAND, SP: About 95% fine to coarse sand; about 5% non-plastic fines with rapid dilatancy; trace of fine, hard to very hard, rounded to subrounded gravel; maximum size: 1/2 inches; moist, brown, no reaction with HCl, soft consistency.

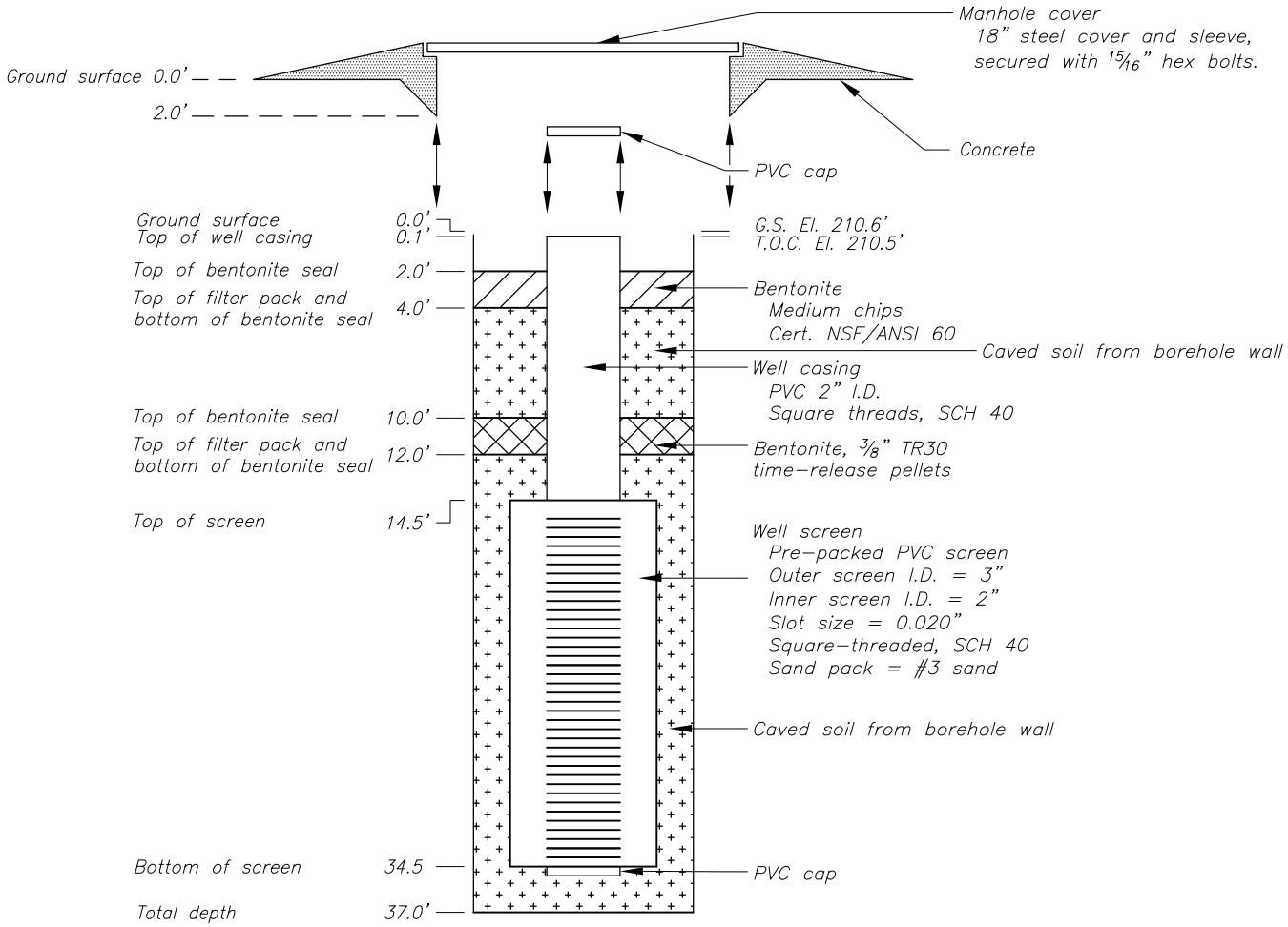
T.D. = 37.5 ft.

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-09-23B
TOC Coordinates= N 2184135.0 E 6252446.1 (NAGD83) El. 210.53 (NAVD88)
Groundsurface El.= 210.6 (NAVD88)

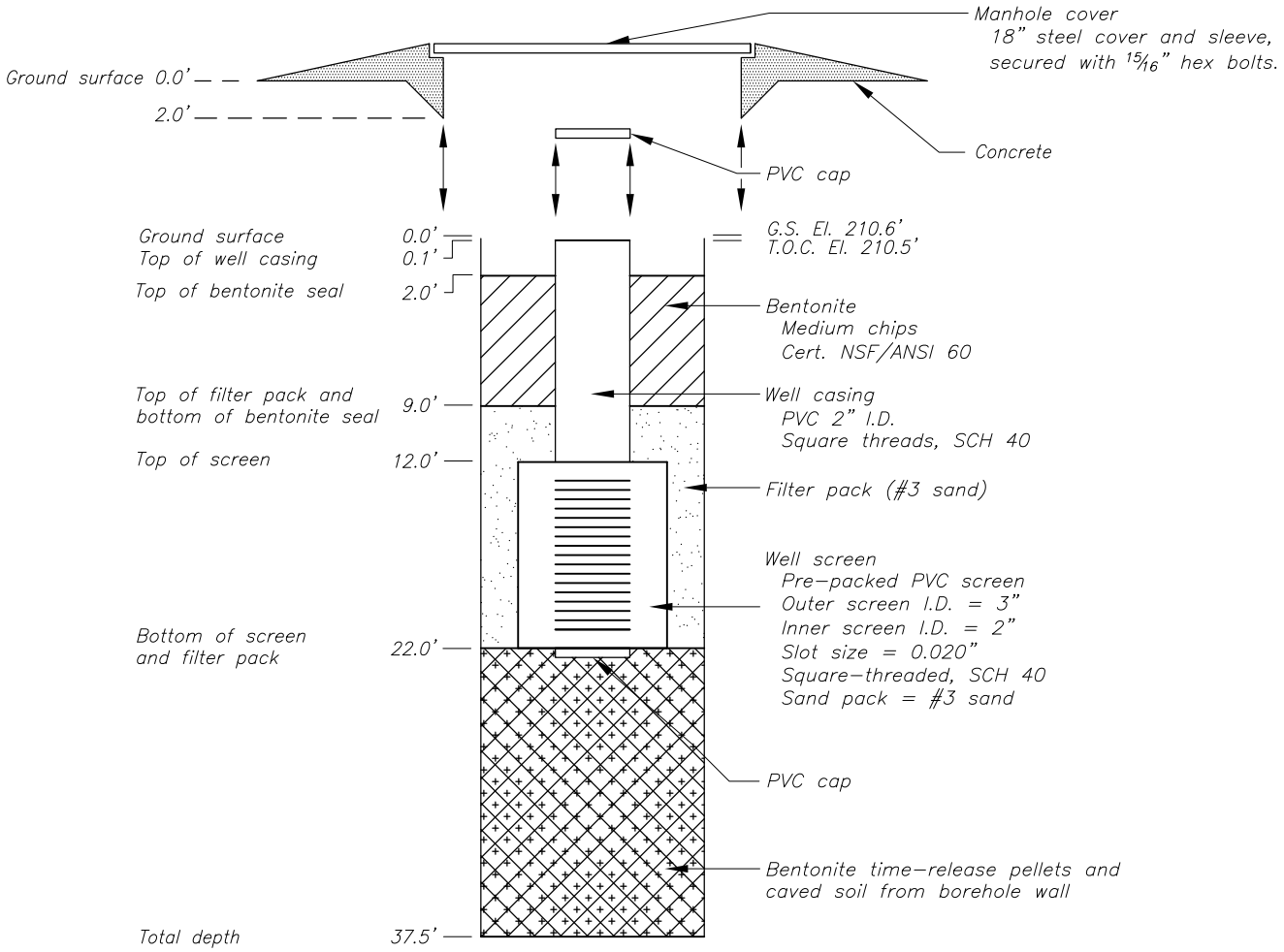
MW–09–23	GEOLOGIST: J. VAUK
WELL COMPLETION DIAGRAM	DRILLER: J. HUCKABY
DATE COMPLETED: 10/2/2009	HELPER: J. RAUMAN
TOP OF WELL CASING COORDINATES: N2184135.4 E6252440.0 (NAD83) ELEVATION 210.5' (NAVD88) GROUND SURFACE ELEVATION 210.6' (NAVD88)	



*NOT TO SCALE

NOTES:
T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, El. = Elevation
Well was advanced with a pilot bit from 0.0' to 37.0'.
Caving problems at bottom during center rod pull and at top 8' to 12'.
Sand backfills the well above the top of bentonite seal, inside the manhole.

MW–09–23B	GEOLOGIST: G. TURLINGTON
WELL COMPLETION DIAGRAM	DRILLER: J. HUCKABY
DATE COMPLETED: 10/21/2009	HELPER: J. RAUMAN
TOP OF WELL CASING COORDINATES: N2184135.0 E6252446.1 (NAD83) ELEVATION 210.5' (NAVD88) GROUND SURFACE ELEVATION 210.6' (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-09-25

FEATURE: Groundwater Monitoring
LOCATION: Reach 1B, River Bank Right, Madera County
BEGUN: 10/1/09 FINISHED: 10/1/09
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 26.8 ft. (El. 198.10 ft.) 10/1/2009

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,184,611.9 E 6,252,453.4 (NAGD83)
TOTAL DEPTH: 47.0 ft.

STATE: California
GROUND SURFACE ELEVATION: 224.9 ft. (NAVD88)
T.O.C ELEVATION: 224.9 ft. (NAVD88)
HOLE LOGGED BY: G. Turlington
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
James Huckaby, Driller
Jim Rauman, Helper

DRILL RIG:
CME-550

DRILLING & SAMPLING METHODS:
Drill hole MW-09-25 was advanced using hollow stem flight augers with continuous dry core sampling system (FADC) from the ground surface to a total depth of 47.0 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 47.0 ft. - FADC

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
0.0 to 32.0 ft. - smooth drilling
32.0 to 37.0 ft. - encountered hard sand layer
37.0 to 47.0 ft. - smooth drilling

DRILL FLUID, RETURN AND COLOR:
0.0 to 27.0 ft. - None
27.0 to 47.0 ft. - Water, no return

WATER LEVEL:
26.8 ft. on b.g.s. 10/24/2009 at 10:00 AM

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

HOLE COMPLETION:
Well Casing - 0.0 to 26.5 ft. (T.O.C. El. 224.89 ft.)
Dual Pre-pack Screen - 26.5 to 46.5 ft. (Slotted 0.020-inch)
Well Screen Filter Pack - #3 Sand Filter Pack - 26.0 to 47.0 ft. (Native material caved)
Filter Pack - 23.5 to 26.0 ft. (#3 Sand)
Bentonite Seal - 2.0 to 23.5 ft.
Well Protection - flush-mounted 18-inch manhole (15/16-inch hexbolts)

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
	95										(SM)g 223.1	Fill
											SM 221.6	
											ML 220.7	
5	100											
		36.7	11.7	48.4	51.6	0.0	21.1	3.5	11.5	SM 213.4	s(ML) 213.4	
10	100											
		53.2	16.6	69.8	30.2	0.0	23.5	5.4	14.5	s(CL-ML) 212.2	s(ML) 212.2	
											(ML)s 210.8	
15	94											Qal
		6.7	1.3	8.0	92.0	0.0	NP	NP	1.6	SP-SM	SM	
	70											
20												
										▼ 26.8 ft. (El. 198.10 ft.)		
										196.7	196.7	
	46	60.3	34.4	94.7	5.3	0.0	30.4	5.9	15.0	ML 196.3	ML 196.3	
25												
	32											

CLASSIFICATION AND PHYSICAL CONDITION

0.0 to 1.8 feet
RECENT FILL (Fill)

0.0 to 1.8 ft. FILL - SILTY SAND WITH GRAVEL, (SM)g: About 45% fine to coarse sand (mostly fine to medium); about 35% non-plastic fines with rapid dilatancy; about 20% fine to coarse, subrounded to subangular gravel; maximum size: 1 inch; dry, light brown, no reaction with HCl; soft consistency; soil is a combination of native soil and road base material.

1.8 to 47.0 feet
QUATERNARY ALLUVIUM (Qal)

1.8 to 3.3 ft. SILTY SAND, SM: About 55% fine to coarse sand (mostly fine to medium); about 35% non-plastic fines with rapid dilatancy; about 10% fine, hard, subrounded gravel; maximum size: 1/2 inches; dry, reddish-brown, no reaction with HCl; soft consistency.

3.3 to 4.2 ft. SILT, ML: About 90% fines with low plasticity, toughness, and dry strength, and rapid dilatancy; about 10% fine sand; maximum size: fine sand; dry, light gray, strong reaction with HCl; firm consistency.

4.2 to 11.5 ft. SANDY SILT, s(ML): About 60% fines with low plasticity, toughness, and dry strength, and rapid dilatancy; about 40% fine to coarse sand; maximum size: coarse sand; dry, medium brown, no reaction with HCl; firm consistency.

Laboratory Data Interval
4.2 to 11.5 ft.

11.5 to 12.7 ft. SANDY SILT, s(ML): About 55% fines with low plasticity, toughness, and dry strength, and rapid dilatancy; about 45% fine sand; maximum size: fine sand; dry, light brown, no reaction with HCl; soft consistency.

Laboratory Data Interval
11.5 to 12.7 ft.

12.7 to 14.1 ft. SILT WITH SAND, (ML)s: About 85% fines with low plasticity, toughness, and dry strength, and slow dilatancy; about 15% fine sand; maximum size: fine sand; dry, medium brown, no reaction with HCl; firm consistency.

14.1 to 28.2 ft. SILTY SAND, SM: About 85% fine to medium sand; about 15% non-plastic fines with rapid dilatancy; maximum size: fine sand; dry and wet from 26.8 to 28.2 feet of depth, light brown and light gray, no reaction with HCl; soft consistency.

Laboratory Data Interval
14.9 to 28.2 ft.

28.2 to 28.6 ft. SILT, ML: About 95% fines with low plasticity, toughness, and dry strength, and slow dilatancy; about 5% fine sand; maximum size: fine sand; dry, light gray, strong reaction with HCl; firm consistency.

Laboratory Data Interval
28.2 to 28.6 ft.

28.6 to 32.0 ft. No Recovery

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-09-25

FEATURE: Groundwater Monitoring
LOCATION: Reach 1B, River Bank Right, Madera County
BEGUN: 10/1/09 FINISHED: 10/1/09
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 26.8 ft. (El. 198.10 ft.) 10/1/2009

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,184,611.9 E 6,252,453.4 (NAGD83)
TOTAL DEPTH: 47.0 ft.

STATE: California
GROUND SURFACE ELEVATION: 224.9 ft. (NAVD88)
T.O.C ELEVATION: 224.9 ft. (NAVD88)
HOLE LOGGED BY: G. Turlington
REVIEWED BY: J. Vauk

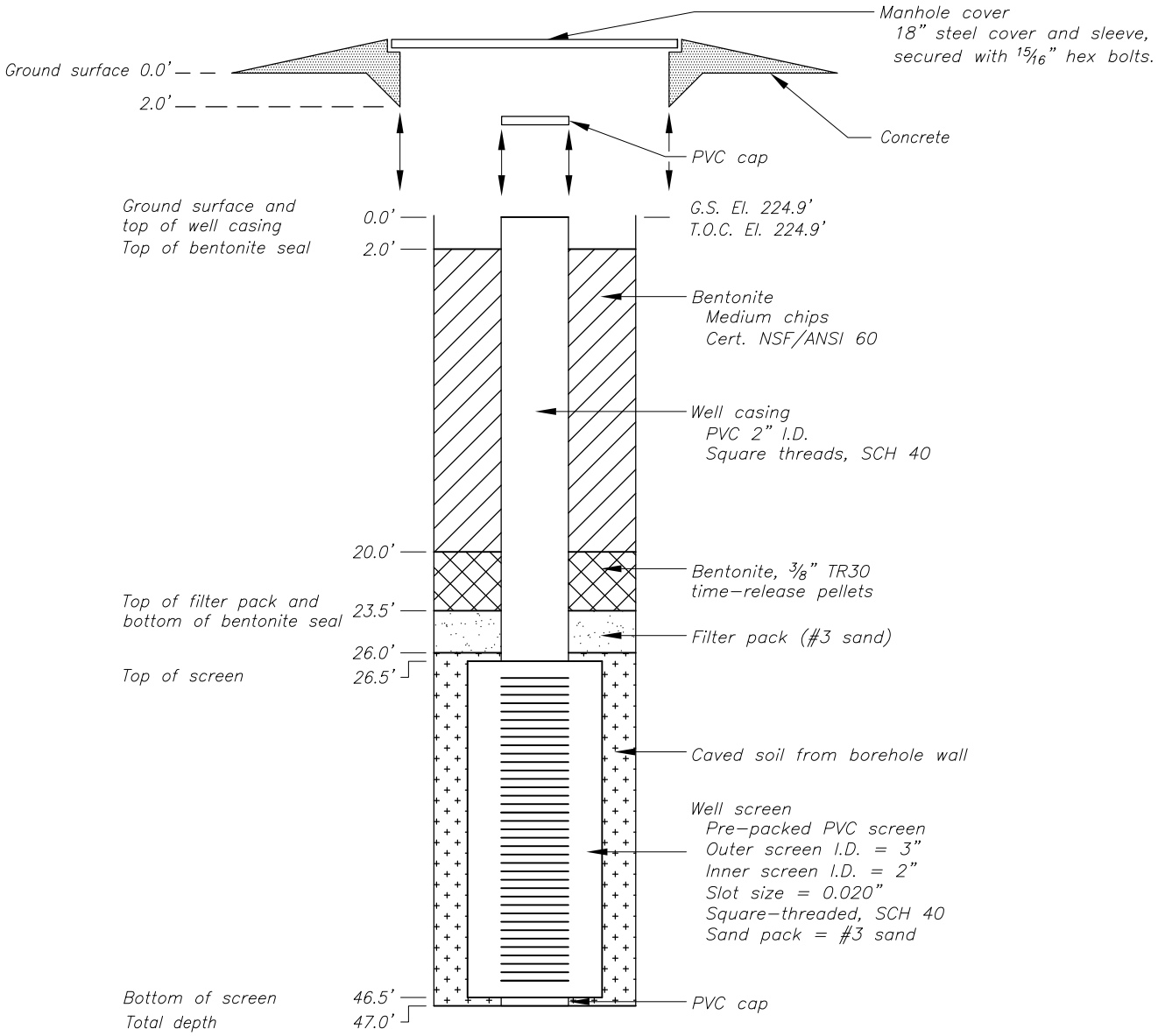
NOTES	DEPTH	% CORE RECOVERY	LABORATORY DATA: % SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION / ELEVATION	VISUAL CLASSIFICATION / ELEVATION	GEOLOGIC UNIT SYMBOL	CLASSIFICATION AND PHYSICAL CONDITION
												NR 192.9		**32.0 to 37.0 ft. 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, no reaction with HCl; soft consistency;
														Laboratory Data Interval 32.0 to 37.0 ft.
	35	24	7.6	0.0	7.6	92.4	0.0	NP	NP	19.6	SP-SM 187.9	SP/SM 187.9		**37.0 to 39.4 ft. SILTY SAND, SM:** About 80% fine to coarse sand (mostly fine to medium); about 20% non-plastic fines with rapid dilatancy; maximum size: coarse sand; wet, medium brown, no reaction with HCl; soft consistency.
														Laboratory Data Interval 37.0 to 39.4 ft.
		63	35.3	2.0	37.3	62.7	0.0	NP	NP	24.1	SM 185.5	SM 185.5	Qal	**39.4 to 47.0 ft. SILT, ML:** About 90% fines with low plasticity, toughness, and dry strength, and rapid dilatancy, about 10% fine sand; maximum size: fine sand; moist, medium brown, no reaction with HCl; firm consistency.
	40	100												Laboratory Data Interval 39.4 to 47.0 ft.
		100	75.3	10.6	85.9	14.1	0.0	22.2	1.8	25.9	ML 177.9	ML 177.9		***T.D. = 47.0 ft.***
	45													

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–09–25	GEOLOGIST: G. TURLINGTON
WELL COMPLETION DIAGRAM	DRILLER: J. HUCKABY
DATE COMPLETED: 10/01/2009	HELPER: J. RAUMAN
TOP OF WELL CASING COORDINATES: N2184611.9 E6252453.4 (NAD83) ELEVATION 224.9' (NAVD88) GROUND SURFACE ELEVATION 224.9' (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-09-26

FEATURE: Groundwater Monitoring
LOCATION: Reach 1B, River Bank Right, Madera County
BEGUN: 9/29/09 FINISHED: 9/30/09
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 33.3 ft. (El. 195.24 ft.) 9/30/2009

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,185,090.0 E 6,252,468.2 (NAGD83)
TOTAL DEPTH: 57.5 ft.

STATE: California
GROUND SURFACE ELEVATION: 228.6 ft. (NAVD88)
T.O.C ELEVATION: 228.54 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-09-26 was advanced using hollow stem flight augers with continuous dry core sampling system (FADC) from the ground surface to a total depth of 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 57.5 ft. - FADC

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
0.0 to 31.0 ft. - smooth drilling
31.0 to 47.5 ft. - encountered hard clay, adjust shoe position
47.5 to 57.5 ft. - encountered very hard clay, near refusal

DRILL FLUID, RETURN AND COLOR:
0.0 to 37.5 ft. - None
37.5 to 57.5 ft. - Water, no return

WATER LEVEL:
Not Recorded

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

HOLE COMPLETION:
Well Casing - 0.1 to 37.0 ft. (T.O.C. El. 228.54 ft.)
Dual Pre-pack Screen - 37.0 to 57.0 ft. (Slotted 0.020-inch)
Well Screen Filter Pack - #3 Sand Filter Pack - 32.0 to 57.5 ft. (#3 Sand and Native material caved)
Bentonite Seal - 1.8 to 32.0 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
	80											(SM)g	227.6	Fill
												SP/SM	226.0	
	84											(SM)g	224.4	
5												s(ML)	222.0	
		82.3	11.2	93.5	6.5	0.0	19.6	1.7	20.3	ML	221.3	ML	221.3	
												(ML)s & SM	220.2	
10	96	36.2	14.4	50.6	49.4	0.0	17.8	2.8	11.9	s(ML)	214.2	s(ML)	214.2	
15	100											(CL/ML)s	213.4	
												s(ML)	212.5	
		11.4	4.3	15.7	84.3	0.0	NP	NP	3.4	SM	209.8	SM	209.8	
												s(ML)	209.4	
20	76											SM	207.7	Qal
		4.3	1.0	5.3	94.6	0.1	NP	NP	1.9	SP-SM	199.6	SP/SM	199.6	
25	66											SM	198.8	
												s(ML)	197.6	
30	84	55.4	23.9	79.3	20.7	0.0	NP	NP	28.0	(ML)s	195.2	(ML)s	195.2	
										33.3 ft. (El. 195.24 ft.)		s(ML)	194.1	
35	98											ML	191.7	
		77.2	20.0	97.2	2.8	0.0	29.2	6.7	29.4	ML	189.6	(CL/ML)s	189.6	

0.0 to 0.9 feet
RECENT FILL (Fill)

0.0 to 0.9 ft. FILL - SILTY SAND WITH GRAVEL, (SM)g: About 40% fine to coarse sand; about 40% fines low plasticity, toughness, and toughness, and rapid dilatancy; about 20% fine to coarse (mostly fine), hard, subangular gravel; maximum size: 2 inches; dry, light brown, no reaction with HCl; firm consistency; roots; soil is a combination of native soil and road base material.

0.9 to 57.5 feet
QUATERNARY ALLUVIUM (Qal)

0.9 to 2.5 ft. POORLY GRADED SAND WITH SILT, SP/SM: About 85% fine to coarse sand; about 10% non-plastic fines with rapid dilatancy; about 5% fine, hard, subrounded gravel; maximum size: 1/4 inches; dry, light brown, no reaction with HCl; soft consistency.

2.5 to 4.1 ft. SILTY SAND WITH GRAVEL, (SM)g: About 70% fine to coarse sand (mostly fine to medium); about 15% non-plastic fines with rapid dilatancy; about 15% fine, hard, subrounded to subangular gravel; maximum size: 1.5 inches; dry, light brown, no reaction with HCl.

4.1 to 6.5 ft. SANDY SILT, s(ML): About 55% non-plastic fines with rapid dilatancy; about 45% fine sand; maximum size: fine sand; dry, light gray, no reaction with HCl; soft consistency.

6.5 to 7.2 ft. SILT, ML: About 95% fines with low plasticity, toughness, and dry strength, and rapid dilatancy; about 10% fine sand; maximum size: fine sand; dry, light gray, no reaction with HCl; firm consistency.

Laboratory Data Interval
6.5 to 7.2 ft.

7.2 to 8.3 ft. INTERBEDDED SILT WITH SAND, (ML)s, AND SILTY SAND (SM)s six laminations 0.1- to 0.5-inch-thick. (ML)s - About 80% fines with low plasticity, toughness, and dry strength, and rapid dilatancy; about 20% fine sand; maximum size: fine sand; dry, light brown, no to weak reaction HCl soft consistency. SM - About 60% fine to medium (mostly fine) sand; about 40% non-plastic fines with rapid dilatancy; maximum size: medium sand; dry, light brown, no to weak reaction with HCl; soft consistency.

8.3 to 14.3 ft. SANDY SILT, s(ML): About 60% fines with medium plasticity, low toughness, medium dry strength, and no dilatancy; about 40% fine to medium sand; maximum size: medium sand; dry, medium brown, no to strong reaction with HCl (calcium carbonate veins encountered from 11.0 to 12.5 ft.); firm consistency and very firm at calcium carbonate veins.

Laboratory Data Interval
8.3 to 14.3 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-09-26

FEATURE: Groundwater Monitoring
LOCATION: Reach 1B, River Bank Right, Madera County
BEGUN: 9/29/09 FINISHED: 9/30/09
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 33.3 ft. (El. 195.24 ft.) 9/30/2009

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,185,090.0 E 6,252,468.2 (NAGD83)
TOTAL DEPTH: 57.5 ft.

STATE: California
GROUND SURFACE ELEVATION: 228.6 ft. (NAVD88)
T.O.C ELEVATION: 228.54 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	80	42.8	3.3	46.1	53.9	0.0	NP	NP	27.6	SM 187.2	SM 187.2	Qal	**14.3 to 15.1 ft. SILTY CLAY WITH SAND, (CL/ML)s:** About 85% fines with medium plasticity, toughness, and dry strength, and rapid dilatancy; about 15% fine to medium sand; maximum size: medium sand; dry, medium brown, no reaction with HCl; firm consistency.
			64.9	12.7	77.6	22.4	0.0	23.6	1.6	27.6	(ML)s 181.0	ML 181.0		**15.1 to 16.0 ft. SANDY SILT, s(ML):** About 55% non-plastic fines with rapid dilatancy; about 45% fine to medium sand; maximum size: medium sand; dry, light brown, no reaction with HCl; soft consistency.
	45	98												**16.0 to 18.7 ft. SILTY SAND, SM:** About 80% fine to medium sand (mostly fine); about 20% non-plastic fines with rapid dilatancy; maximum size: medium sand; dry, light brown, no reaction with HCl; soft consistency.
			40.0	2.4	42.4	57.6	0.0	NP	NP	24.8	SM 177.7	SM 177.7		Laboratory Data Interval 16.0 to 18.7 ft.
	50	54												**18.7 to 19.1 ft. SANDY SILT, s(ML):** About 70% non-plastic fines with rapid dilatancy; about 30% fine to medium sand; maximum size: medium sand; dry, medium brown, no reaction with HCl; soft consistency.
			66.4	27.1	93.5	6.5	0.0	25.2	2.0	24.1	ML 175.2	(CL/ML)s 175.2		**19.1 to 20.8 ft. SILTY SAND, SM:** About 70 to 85% fine to medium sand; about 15 to 30% fines with no to low plasticity, toughness, and dry strength with rapid dilatancy; maximum size: medium sand; dry, light brown, no reaction with HCl; soft consistency; sand percentage decreases with depth.
	55	66	6.6	2.6	9.2	90.8	0.0	NP	NP	18.9	SP-SM 171.0	SM 171.0		**20.8 to 28.9 ft. POORLY GRADED SAND WITH SILT, SP/SM:** About 90% fine to medium sand; about 10% non-plastic fines with rapid dilatancy; maximum size: medium sand; wet, banded light brown, off-white, and orange, no reaction with HCl; soft consistency.
											BOTTOM OF HOLE			Laboratory Data Interval 20.8 to 28.9 ft.
														28.9 to 29.7 ft. SILTY SAND, SM: About 70% fine to medium sand; about 30% fines with low plasticity, toughness and dry strength, and rapid dilatancy; maximum size: medium sand; dry, no reaction with HCl; soft consistency.
														29.7 to 30.9 ft. SANDY SILT, s(ML): About 50% non-plastic fines with rapid dilatancy; about 50% fine to medium sand (mostly fine); maximum size: medium sand; dry, no reaction with HCl; firm consistency.
														30.9 to 33.3 ft. SILT WITH SAND, (ML)s: About 80% fines with medium plasticity, toughness and dry strength, and rapid dilatancy; about 20% fine sand; maximum size: fine sand; moist, medium brown, no to HCl; firm consistency.
														Laboratory Data Interval 30.9 to 33.3 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-09-26

FEATURE: Groundwater Monitoring
LOCATION: Reach 1B, River Bank Right, Madera County
BEGUN: 9/29/09 FINISHED: 9/30/09
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 33.3 ft. (El. 195.24 ft.) 9/30/2009

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,185,090.0 E 6,252,468.2 (NAGD83)
TOTAL DEPTH: 57.5 ft.

STATE: California
GROUND SURFACE ELEVATION: 228.6 ft. (NAVD88)
T.O.C ELEVATION: 228.54 ft. (NAVD88)
HOLE LOGGED BY: G. Turlington
REVIEWED BY: J. Vauk

CLASSIFICATION AND PHYSICAL CONDITION

33.3 to 34.4 ft. SANDY SILT, s(ML): About 70% fines with low plasticity, toughness, and dry strength, and rapid dilatancy; about 30% fine sand; maximum size: fine sand; moist to wet, medium brown, no reaction with HCl; soft consistency.

34.4 to 36.8 ft. SILT, ML: About 95% fines with low plasticity, toughness, and dry strength, and rapid dilatancy; about 5% fine sand; maximum size: fine sand; moist, medium brown, no to HCl; firm consistency.

36.8 to 38.9 ft. SILTY CLAY WITH SAND, (CL/ML)s: About 85% fines with medium plasticity, toughness and dry strength, and rapid dilatancy; about 15% fine to medium sand; maximum size: medium sand; dry, medium brown, no reaction with HCl; firm consistency.

Laboratory Data Interval
36.8 to 38.9 ft.

38.9 to 41.3 ft. SILTY SAND, SM: About 55% fine sand; about non-plastic 45% fines with rapid dilatancy; maximum size: fine sand; wet, medium brown, no reaction with HCl; firm consistency.

Laboratory Data Interval
38.9 to 41.3 ft.

41.3 to 47.5 ft. SILT, ML: About 90% fines with medium plasticity, toughness and dry strength, and rapid dilatancy; about 10% fine sand; maximum size: fine sand; wet, medium brown, no to HCl; firm consistency; about 10% gypsum.

Laboratory Data Interval
41.3 to 47.5 ft.

47.5 to 50.8 ft. SILTY SAND, SM: About 55% fine sand; about 45% non-plastic fines with rapid dilatancy; maximum size: fine sand; wet, medium brown, no reaction with HCl; soft consistency.

Laboratory Data Interval
47.5 to 50.8 ft.

50.8 to 53.3 ft. SILTY CLAY WITH SAND, (CL/ML)s: About 85% fines with medium plasticity, toughness, and dry strength, and slow dilatancy; about 15% fine sand; maximum size: fine sand; moist, medium brown, no reaction with HCl; firm consistency.

Laboratory Data Interval
50.8 to 53.3 ft.

53.3 to 57.5 ft. SILTY SAND, SM: About 85% fine to medium sand; about 15% non-plastic fines rapid dilatancy; maximum size: medium sand; moist, no reaction with HCl; soft consistency.

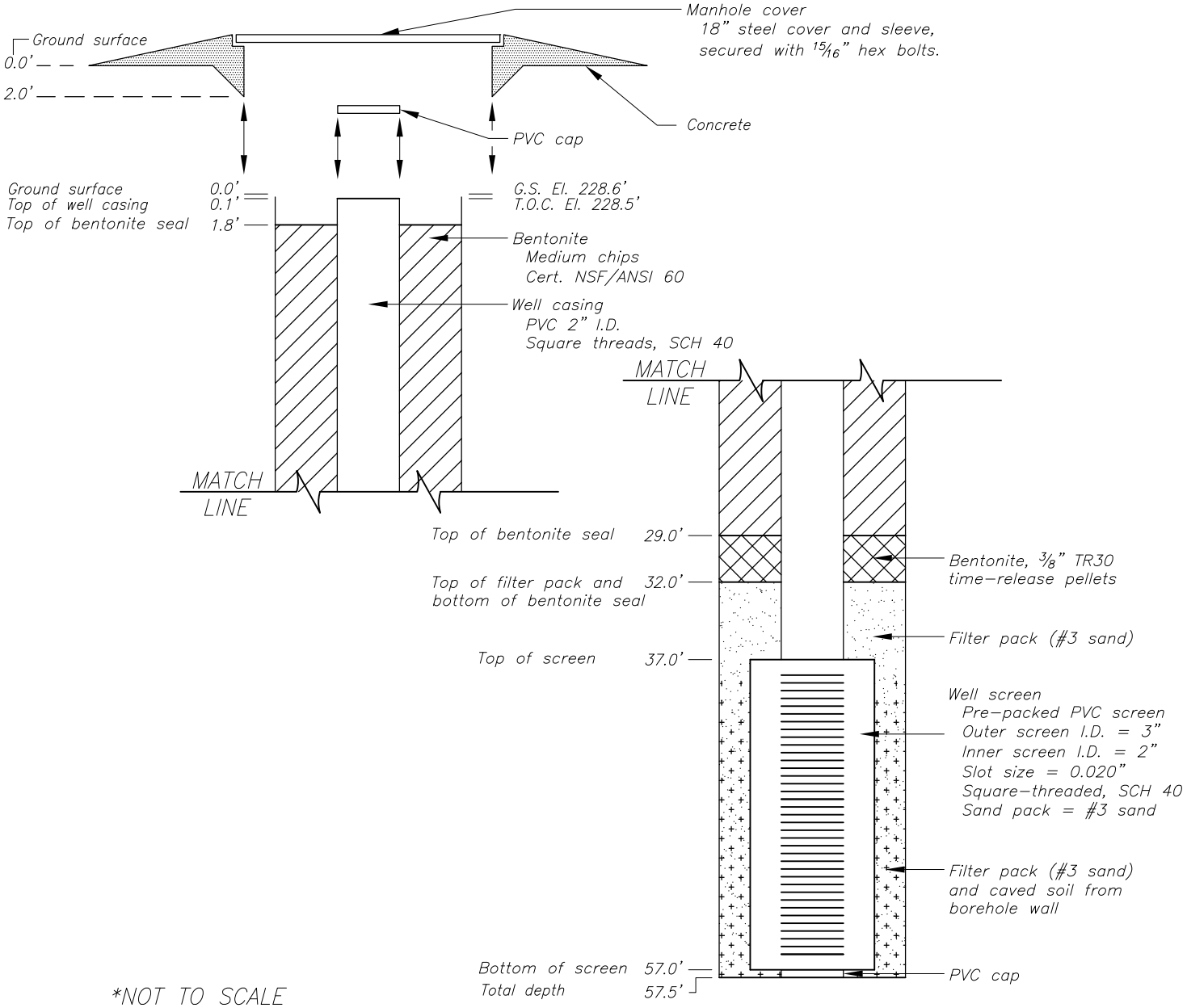
Laboratory Data Interval
53.3 to 57.5 ft.

T.D. = 57.5 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–09–26	GEOLOGIST: G. TURLINGTON
WELL COMPLETION DIAGRAM	DRILLER: J. HUCKABY
DATE COMPLETED: 9/30/2009	HELPER: J. RAUMAN
TOP OF WELL CASING COORDINATES: N2185090.0 E6252468.2 (NAD83) ELEVATION 228.5' (NAVD88) GROUND SURFACE ELEVATION 228.6' (NAVD88)	



*NOT TO SCALE

NOTES:
T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, El. = Elevation
Well is set on SM material at 57.5'. The screen interval is from about 57.0' to 37.0' below the ground surface. Screen interval is mostly through S(ML) and (ML)s material.
Sand backfills the well above the top of bentonite seal, inside the manhole.

GEOLOGIC LOG OF DRILL HOLE NO. MW-09-27

FEATURE: Groundwater Monitoring
LOCATION: Reach 1B, River Bank Right, Madera County
BEGUN: 9/28/09 FINISHED: 9/29/09
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 49.7 ft. (El. 187.07 ft.) 9/29/2009

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,185,701.8 E 6,252,474.6 (NAGD83)
TOTAL DEPTH: 77.0 ft.

STATE: California
GROUND SURFACE ELEVATION: 236.8 ft. (NAVD88)
T.O.C ELEVATION: 236.77 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. **DRILLED BY:** USGS Drill Crew James Huckaby, Driller Jim Rauman, Helper **DRILL RIG:** CME-550 **DRILLING & SAMPLING METHODS:** Drill hole MW-09-27 was advanced using hollow stem flight augers with continuous dry core sampling system (FADC) from the ground surface to a total depth of 77.0 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 77.0 ft. - FADC **DRILLING CONDITIONS AND DRILLER'S COMMENTS:** 0.0 to 52.0 ft. - smooth drilling 52.0 to 57.0 ft. - encountered very hard clay layer 57.0 to 72.5 ft. - slow and smooth drilling 72.5 to 77.0 ft. - core barrel stuck **DRILL FLUID, RETURN AND COLOR:** 0.0 to 62.5 ft. - None 62.5 to 77.0 ft. - Water, no return **WATER LEVEL:** Not Recorded **REASON FOR HOLE TERMINATION:** The hole was terminated upon successful completion to the target depth. **HOLE COMPLETION:** Well Casing - 0.0 to 50.0 ft. (T.O.C. El. 236.77 ft.) Dual Pre-pack Screen - 50.0 to 70.0 ft. (Slotted 0.020-inch) Well Screen Filter Pack - #3 Sand Filter Pack - 48.0 to 70.0 ft. (#3 Sand and native material) Bottom Bentonite Seal - 70.0 to 77.0 ft. Bentonite Seal - 2.0 to 48.0 ft. Well Protection - flush-mounted 18-inch manhole (15/16-inch hexbolts)	5	100										SM 235.6 (SM)g 234.7 SM 233.9 (ML)s 231.7	Fill	***0.0 to 2.1 feet*** ***RECENT FILL (Fill)*** **0.0 to 1.2 ft. FILL - SILTY SAND, SM:** About 70% fine to coarse sand (mostly fine to medium); about 20% non-plastic fines with rapid dilatancy; about 10% fine, hard, subangular to subrounded gravel; maximum size: 1/2 inches; dry, light brown, weak reaction with HCl; soft consistency; roots; material was disturbed by road graded. **1.2 to 2.1 ft. FILL - SILTY SAND WITH GRAVEL, (SM)g:** About 60% fine to coarse sand; about 20% non-plastic fines rapid dilatancy; about 20% fine, soft, angular gravel; maximum size: 1/2 inches; dry, medium brown, no reaction with HCl; firm consistency; soil is a combination of native soil and road base material.
												SM 229.0		***2.1 to 77.0 feet*** ***QUATERNARY ALLUVIUM (Qal)*** **2.1 to 2.9 ft. SILTY SAND, SM:** About 85% fine to medium sand; about 15% non-plastic fines with rapid dilatancy; maximum size: medium sand; dry, light brown, no reaction with HCl; soft consistency.
	10	100	62.4	35.3	97.7	2.3	0.0	23.3	4.5	25.8	CL-ML 226.2	CL/ML 226.2		**2.9 to 5.1 ft. SILT WITH SAND, (ML)s:** About 85% fines with low plasticity, toughness, and dry strength, and rapid dilatancy; about 15% fine sand; maximum size: fine sand; moist, light brown, no reaction with HCl; firm consistency.
												SP/SM 224.9 (ML)s 224.7 SM 223.6	Qal	**5.1 to 7.8 ft. SILTY SAND, SM:** About 85% fine to medium sand; about 15% non-plastic fines with rapid dilatancy; maximum size: medium sand; moist from 5.1 to 5.5 feet and dry from 5.5 to 7.5 feet, light brown, no reaction with HCl; soft consistency.
	15	90	7.3	0.6	7.9	92.1	0.0	NP	NP	3.6	SP-SM 221.1	SP/SM 221.1		**7.8 to 10.6 ft. SILTY CLAY, CL/ML:** About 95% fines with medium plasticity, toughness, and dry strength, and no dilatancy; about 5% fine sand; maximum size: fine sand; moist, light gray, no reaction with HCl. Laboratory Data Interval 7.8 to 10.6 ft. **10.6 to 11.9 ft. POORLY GRADED SAND WITH SILT, SP/SM:** About 85% fine to coarse sand; about 10% non-plastic fines with rapid dilatancy; about 5% fine, hard, subrounded gravel; maximum size: 1/4 inches; dry, light brown, no reaction with HCl; soft consistency.
			51.3	7.9	59.2	40.7	0.1	NP	NP	11.9	s(ML) 219.3	s(ML) 216.2		**11.9 to 12.1 ft. SILT WITH SAND, (ML)s:** About 80% fines with low plasticity, toughness, and dry strength, and rapid dilatancy; about 20% fine sand; maximum size: fine sand; dry, light brown, no reaction with HCl; soft consistency. **12.1 to 13.2 ft. SILTY SAND, SM:** About 85% fine sand; about 15% non-plastic fines with rapid dilatancy; maximum size: fine sand; dry, banded light brown and orange, no reaction with HCl; soft consistency.
	20	96												**13.2 to 15.7 ft. POORLY GRADED SAND WITH SILT, SP/SM:** About 90 to 95% fine to medium (mostly fine) sand; about 5 to 10%

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-09-27

FEATURE: Groundwater Monitoring
LOCATION: Reach 1B, River Bank Right, Madera County
BEGUN: 9/28/09 FINISHED: 9/29/09
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 49.7 ft. (El. 187.07 ft.) 9/29/2009

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,185,701.8 E 6,252,474.6 (NAGD83)
TOTAL DEPTH: 77.0 ft.

STATE: California
GROUND SURFACE ELEVATION: 236.8 ft. (NAVD88)
T.O.C ELEVATION: 236.77 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
												s(ML) 214.9		non-plastic fines with rapid dilatancy; maximum size: medium; dry, banded light brown, off-white, and orange, no reaction with HCl; soft consistency.
			61.9	10.1	72.0	28.0	0.0	20.1	2.4	18.9	(ML)s 212.7	s(ML) 212.7		Laboratory Data Interval 13.2 to 15.7 ft. **15.7 to 20.6 ft. SANDY SILT, s(ML):** About 50 to 60% fines with low plasticity, toughness, and dry strength, and rapid dilatancy; about 40 to 50% fine to medium sand; maximum size: medium sand; dry, off-white, light brown and medium brown, no to weak reaction with HCl; firm consistency.
												SP/SM 212.0		
25		96	40.0	1.8	41.8	58.2	0.0	NP	NP	13.2	SM 211.2	SM 211.2		Laboratory Data Interval 15.7 to 17.5 ft. **20.6 to 21.9 ft. SANDY SILT, s(ML):** About 65% fines with medium plasticity, toughness, and dry strength, and slow dilatancy; about 35% fine to medium sand; maximum size: medium sand; dry, medium brown, strong reaction with HCl; firm consistency.
			6.2	0.6	6.8	93.1	0.1	NP	NP	1.5	SP-SM 208.6	SP/SM 208.6		**21.9 to 24.1 ft. SANDY SILT, s(ML):** About 70% non-plastic fines with rapid dilatancy, about 30% fine sand; maximum size: fine sand; dry, medium gray, no reaction with HCl; soft consistency.
30		86										SM 205.0	Qal	Laboratory Data Interval 21.9 to 24.1 ft. **24.1 to 24.8 ft. POORLY GRADED SAND WITH SILT, SP/SM:** About 90% fine to medium sand (mostly fine); about 10% non-plastic fines with rapid dilatancy; maximum size: medium sand; dry, light gray and light brown, no reaction with HCl; soft consistency.
												SP/SM 203.6		**24.8 to 25.6 ft. SILTY SAND, SM:** About 55% fine to medium sand (trace of medium); about 45% fines with no to low plasticity, toughness, and dry strength, and rapid dilatancy; maximum size: medium sand; dry, light brown and light gray, no reaction with HCl; soft consistency.
												(ML)s 202.2		
35		100										s(ML) 201.5		Laboratory Data Interval 24.8 to 25.6 ft. **25.6 to 28.2 ft. POORLY GRADED SAND WITH SILT, SP/SM:** About 90% fine to coarse sand (trace of coarse); about 10% non-plastic fines with rapid dilatancy; maximum size: coarse sand; dry, light brown, no reaction with HCl; soft consistency.
												(ML)s 199.8		
			32.1	4.4	36.5	63.5	0.0	NP	NP	11.0	SM 195.5	SM 195.5		Laboratory Data Interval 25.6 to 28.2 ft. **28.2 to 31.8 ft. SILTY SAND, SM:** About 80% fine to medium sand (mostly fine); about 20% non-plastic fines with rapid dilatancy; maximum size: medium sand; dry, light brown, no reaction with HCl; soft consistency.
40		96												**31.8 to 33.2 ft. POORLY GRADED SAND WITH SILT, SP/SM:** About 90% fine to medium sand; about 10% non-plastic fines with rapid dilatancy; maximum size: medium sand; dry, light brown, no reaction with HCl; soft consistency. **33.2 to 34.6 ft. SILT WITH SAND, (ML)s:**

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-09-27

FEATURE: Groundwater Monitoring
LOCATION: Reach 1B, River Bank Right, Madera County
BEGUN: 9/28/09 FINISHED: 9/29/09
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 49.7 ft. (El. 187.07 ft.) 9/29/2009

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,185,701.8 E 6,252,474.6 (NAGD83)
TOTAL DEPTH: 77.0 ft.

STATE: California
GROUND SURFACE ELEVATION: 236.8 ft. (NAVD88)
T.O.C ELEVATION: 236.77 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
												SP/SM 192.8		About 80% fines with medium plasticity, toughness, and low dry strength, and rapid dilatancy; about 20% fine sand; maximum size: fine sand; dry, light brown, no reaction with HCl; soft consistency.
												ML 191.8		**34.6 to 35.3 ft. SANDY SILT, s(ML):** About 70% fines with low plasticity, toughness, and dry strength, and rapid dilatancy; about 30% fine sand; maximum size: fine sand; dry, light brown, no reaction with HCl; soft consistency.
45		100										SM 191.1		**35.3 to 37.0 ft. SILT WITH SAND, (ML)s:** About 80% fines with medium plasticity, toughness, and low dry strength, and rapid dilatancy; about 20% fine sand; maximum size: fine sand; dry, light brown, no reaction with HCl; soft consistency.
			67.5	22.7	90.2	9.8	0.0	33.4	6.1	24.7	ML 190.2	s(ML) 190.2		
												s(ML) 188.7		**37.0 to 41.3 ft. SILTY SAND, SM:** About 55% fine to medium sand (mostly fine); about 45% non-plastic fines with rapid dilatancy; maximum size: medium sand; moist, medium brown, no reaction with HCl; soft consistency.
			62.2	29.8	92.0	8.0	0.0	36.4	7.1	32.6	ML ▼ 49.7 ft. (El. 187.07 ft.) 186.8	s(ML) 186.8		Laboratory Data Interval 37.0 to 41.3 ft.
50		100												**41.3 to 44.0 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; dry, light brown and off-white, no reaction with HCl; soft consistency.
			51.4	2.9	54.3	45.7	0.0	NP	NP	31.1	s(ML) 184.6	(ML)s 184.6		**44.0 to 45.0 ft. SILT, ML:** About 90% fines with medium plasticity, toughness, and dry strength, and rapid dilatancy, about 10% fine sand; maximum size: fine sand; moist, light brown, no reaction with HCl; firm consistency.
												(ML)s 183.1	Qal	**45.0 to 45.7 ft. SILTY SAND, SM:** About 70 to 85% fine to medium sand; about 15 to 30% non-plastic fines with rapid dilatancy; maximum size: medium sand; dry, off-white and light brown, no reaction with HCl; soft consistency; increased percentage of medium sand with depth.
			24.9	6.2	31.1	68.9	0.0	NP	NP	29.4	SM 182.1	SM 182.1		
55		100	40.5	21.5	62.0	38.0	0.0	24.8	3.3	24.1	s(ML) 181.4	s(ML) 181.4		**45.7 to 46.6 ft. SANDY SILT, s(ML):** About 70% non-plastic fines with rapid dilatancy; about 30% fine sand; maximum size: fine sand; moist, light brown, no reaction with HCl; soft consistency.
												SM 180.1		Laboratory Data Interval 45.7 to 46.6 ft.
												s(ML) 179.3		**46.6 to 48.1 ft. SANDY SILT, s(ML):** About 50% non-plastic fines with rapid dilatancy; about 50% fine sand; maximum size: fine sand; dry, off white, no reaction with HCl; soft consistency.
60		100	53.2	16.6	69.8	30.2	0.0	NP	NP	29.0	s(ML) 174.3			**48.1 to 50.0 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; dry, medium brown, no reaction with HCl; firm consistency.
														Laboratory Data Interval 48.1 to 50.0 ft.
														50.0 to 52.2 ft. SILT WITH SAND, (ML)s: About 85% non-plastic fines with rapid dilatancy; about 15% fine sand; maximum size: fine sand; dry, medium brown, no

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-09-27

FEATURE: Groundwater Monitoring
LOCATION: Reach 1B, River Bank Right, Madera County
BEGUN: 9/28/09 FINISHED: 9/29/09
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 49.7 ft. (El. 187.07 ft.) 9/29/2009

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,185,701.8 E 6,252,474.6 (NAGD83)
TOTAL DEPTH: 77.0 ft.

STATE: California
GROUND SURFACE ELEVATION: 236.8 ft. (NAVD88)
T.O.C ELEVATION: 236.77 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
	65	100	55.4	20.5	75.9	24.1	0.0	24.2	2.7	29.1	(ML)s	(ML)s		reaction with HCl; soft consistency; contains gypsum veins.
														Laboratory Data Interval 50.0 to 52.2 ft.
														52.2 to 53.7 ft. SILT WITH SAND, (ML)s: About 80% fines with low plasticity, toughness, and dry strength, and rapid dilatancy; about 20% fine sand; maximum size: fine sand; dry, medium brown, no reaction with HCl; firm consistency; contains gypsum veins.
														53.7 to 54.7 ft. SILTY SAND, SM: About 65% fine sand; about 35% non-plastic fines with rapid dilatancy; maximum size: fine sand; moist, medium brown, no reaction with HCl; soft consistency; contains gypsum veins.
														Laboratory Data Interval 53.7 to 54.7 ft.
														54.7 to 55.4 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; dry, medium brown, no reaction with HCl; firm consistency; contains gypsum veins.
	70										166.3	166.3	Qal	
														Laboratory Data Interval 54.7 to 55.4 ft.
			48.1	15.1	63.2	36.8	0.0	26.2	4.0	23.6	s(ML)	s(ML)		**55.4 to 56.7 ft. SILTY SAND, SM:** About 65% fine sand; about 35% non-plastic fines with rapid dilatancy; maximum size: fine sand; moist, medium brown, no reaction with HCl; soft consistency; contains gypsum veins.
														56.7 to 57.5 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; dry, medium brown, no reaction with HCl; firm consistency; contains gypsum veins.
											161.8	161.8		
	75	100												Laboratory Data Interval 56.7 to 62.5 ft.
												(ML)s		**57.5 to 70.5 ft. SILT WITH SAND, (ML)s:** About 85% fines with low plasticity, toughness, and dry strength, and rapid dilatancy; about 15% fine sand; maximum size: fine sand; dry, medium brown, no reaction with HCl; firm consistency; gypsum vein lattice bind the soil between 56.7 to 62.5 feet of depth.
												159.8		Laboratory Data Interval 62.5 to 70.5 ft.
														70.5 to 75.0 ft. SANDY SILT, s(ML): About 70% fines with low plasticity, toughness, and dry strength, and rapid dilatancy; about 30% fine sand; maximum size: fine sand; dry, reddish-brown, no reaction with HCl; very firm consistency; gypsum vein lattice and iron oxide bind the soil.
														Laboratory Data Interval 70.5 to 75.0 ft.
														75.0 to 77.0 ft. SILT WITH SAND, (ML)s: About 80% fines with medium plasticity, low toughness, and dry strength, and no dilatancy; about 20% fine sand; maximum size: fine sand; dry, reddish-brown, no reaction with HCl; very firm consistency; gypsum vein lattice bind the soil.

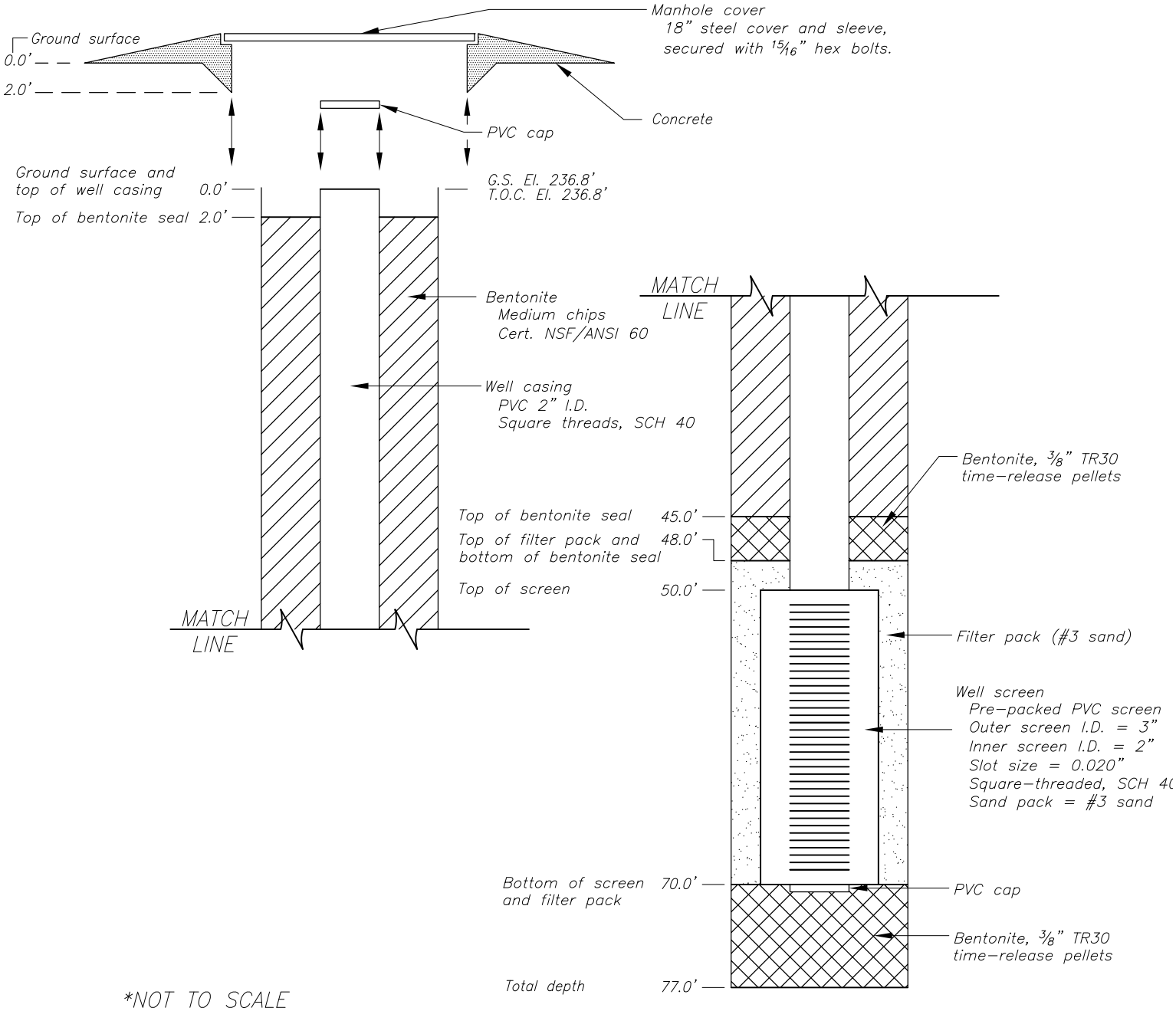
BOTTOM OF HOLE

T.D. = 77.0 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–09–27	GEOLOGIST: J. VAUK
WELL COMPLETION DIAGRAM	DRILLER: J. HUCKABY
DATE COMPLETED: 9/29/2009	HELPER: J. RAUMAN
TOP OF WELL CASING COORDINATES: N2185701.8 E6252474.6 (NAD83) ELEVATION 236.8' (NAVD88) GROUND SURFACE ELEVATION 236.8' (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.