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

FEATURE: Groundwater Monitoring
LOCATION: Reach 4A, River Bank Right, Merced County
BEGIN: 11/3/09 FINISHED: 11/5/09
DEPT & ELEV OF WATER LEVEL: 50.7 ft. (El. 64.14 ft.) 11/6/2009

NOTES:

| DEPTH | % CORE RECOVERY | % SILT | % CLAY | % FINE | % SAND | % GRAVEL | LIQUID LIMIT | PLASTICITY INDEX | MOISTURE CONTENT | VISUAL CLASSIFICATION | LABORATORY CLASSIFICATION | GEOLOGIC UNIT |
|-------|------------------|--------|--------|--------|--------|----------|-------------|------------------|-------------------|----------------------|--------------------------|---------------|---------------|
| 0.0   | 100              | 0.0    | 0.0    | 40.5   | 59.5   | 40.4     | 0.0         | 26.7            | 10.7             | 12.5                 | (CL)S                    | Fill           |
| 2.0   | 100              | 0.0    | 0.0    | 30.1   | 69.9   | 40.3     | 0.0         | 21.7            | 31.4             | 21.3                 | (CL)S                    | Fill           |
| 50.7  | 96               | 0.0    | 0.0    | 83.1   | 16.9   | 0.0      | 0.0         | 40.5            | 21.7             | 31.4                 | (CL)S                    | Fill           |

LABORATORY DATA:

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

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

- 0.0 to 2.0 ft: RECENT FILL (Fill)
- 0.0 to 2.0 ft: FILL/ROAD BASE - LEAN CLAY WITH SAND, (CL)s: About 85% fines with medium plasticity, toughness, and dry strength, and dilatancy; about 15% fine to medium sand; maximum size: medium sand; dry, light brown; firm consistency; contains some organics (roots).
- 2.0 to 6.25 ft: QUATERNARY ALLUVIUM (Qa)
- 2.0 to 7.9 ft: LEAN CLAY WITH SAND, (CL)s: About 85% fines with medium plasticity, toughness, and dry strength, and slow dilatancy; about 25% 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; dry, 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.
- 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.
- 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
- 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-09-83

**FEATURE:** Groundwater Monitoring  
**LOCATION:** Reach 4A, River Bank Right, Merced County  
**BEGIN:** 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

**HOLE COMPLETION:**

<table>
<thead>
<tr>
<th>Depth</th>
<th>Well Casing</th>
<th>Filter Pack</th>
<th>Bentonite Seal</th>
<th>Well Protection</th>
<th>BORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0 ft. to 22.5 ft.</td>
<td>22.5 to 46.5 ft.</td>
<td>46.5 to 62.5 ft.</td>
<td>2.0 to 26.5 ft.</td>
<td>flush-mounted</td>
<td>16-inch manhole (15/16-inch hexbolts)</td>
</tr>
</tbody>
</table>

**Well Development Information:**

- **Total Depth:** 62.5 ft.  
- **TOC Elevation:** 114.84 ft. (NAVD88)  
- **Groundwater Monitoring Feature:** Groundwater Monitoring  
- **Beginning Date:** 11/3/09  
- **Finishing Date:** 11/5/09  
- **Location:** Reach 4A, River Bank Right, Merced County  
- **Water Level Depth and Elevation:** BEGUN: 50.7 ft. (El. 64.14 ft.) 11/6/2009  
- **Laboratory Data Classifications:**
  - **% Sand:** 20.2 to 30.0 ft.  
  - **% Silt:** 31.7 to 32.0 ft.  
  - **% Clay:** 37.2 to 42.3 ft.  
  - **% Silts:** 65.3 to 66.3 ft.  
  - **% Fines:** 65.8 to 66.3 ft.  
  - **% Gravel:** 66.3 to 66.8 ft.  
  - **Liquid Limit:** 68.8 to 72.5 ft.  
  - **Plasticity Index:** 74.8 to 80.5 ft.  
  - **Moisture Content:** 80.8 to 82.8 ft.  
  - **Elevation:** 82.6 to 89.5 ft. (NAVD88)  

**Not Applicable:**

- **T.O.C. = Top of well casing**  
- **b.g.s. = Below the ground surface**  
- **G.S. = Ground surface**  
- **NA = Not applicable**  
- **NR = No Recovery**  
- **NP = Non-plastic**  
- **HSA = Hollow Stem Auger**  
- **FADC = Flight Auger Dry Core**  
- **SC-SM = Silty Clay-Sandy Mud**  
- **ML = Medium Plasticity**  
- **SM = Slightly Plastic**  

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

**REVIEWS:**

- **T.O.C. Elevation:** 114.84 ft. (NAVD88)  
- **Coordinates:** N 2274916.7 E 6112625.6 (NAGD83) El. 115.01 (NAVD88)  
- **T.O.C. 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

### PROJECT:
San Joaquin River Restoration Project

### LOCATION:
Reach 4A, River Bank Right, Merced County

### BEGIN:
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

### CLASSIFICATION AND PHYSICAL CONDITION

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>% CORE RECOVERY</th>
<th>% SILT</th>
<th>% CLAY</th>
<th>% FINES</th>
<th>% SAND</th>
<th>LIQUID LIMIT</th>
<th>PLASTICITY INDEX</th>
</tr>
</thead>
<tbody>
<tr>
<td>51.4</td>
<td>56.8</td>
<td>38.2</td>
<td>5.0</td>
<td>0.0</td>
<td>NP</td>
<td>23.8</td>
<td>SM</td>
</tr>
<tr>
<td>51.7</td>
<td>64.5</td>
<td>35.5</td>
<td>0.0</td>
<td>0.0</td>
<td>14.5</td>
<td>2.2</td>
<td>SP</td>
</tr>
</tbody>
</table>

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 to light medium brown; soft consistency.

49.5 to 50.3 ft.: **Silty 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-09-33B
T.O.C. Coordinates: N 2274916.7 E 6112625.6 (NAD83) El. 115.01 (NAVD88)

Ground surface El. = 115.0 (NAVD88)
**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, E.I. = Elevation

Sand backfills the well above the top of bentonite seal, inside the manhole.
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.
**NOTES**

<table>
<thead>
<tr>
<th>Depth</th>
<th>% Core Recovery</th>
<th>% Silty Clays</th>
<th>% Finely Grained Sands</th>
<th>% Sandy Grains</th>
<th>% Gravel</th>
<th>Plasticity</th>
<th>Liquid Limit</th>
<th>Moisture Content %</th>
<th>Laboratory Classification</th>
<th>Visual Classification</th>
<th>Driller’s Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>88</td>
<td>21.4</td>
<td>15.9</td>
<td>37.3</td>
<td>62.3</td>
<td>0.4</td>
<td>22.4</td>
<td>7.6</td>
<td>2.2</td>
<td>SC</td>
<td>SM</td>
</tr>
<tr>
<td>0.0</td>
<td>10</td>
<td>20.3</td>
<td>7.0</td>
<td>27.3</td>
<td>72.7</td>
<td>0.0</td>
<td>NP</td>
<td>NP</td>
<td>1.9</td>
<td>SM</td>
<td>SM</td>
</tr>
<tr>
<td>0.0</td>
<td>5</td>
<td>29.8</td>
<td>53.0</td>
<td>82.9</td>
<td>17.1</td>
<td>0.0</td>
<td>49.0</td>
<td>26.1</td>
<td>20.9</td>
<td>(CL)s</td>
<td>(ML)s</td>
</tr>
<tr>
<td>0.0</td>
<td>10</td>
<td>39.7</td>
<td>28.8</td>
<td>69.5</td>
<td>31.5</td>
<td>0.0</td>
<td>29.5</td>
<td>9.9</td>
<td>7.8</td>
<td>s(CL)</td>
<td>s(ML)</td>
</tr>
<tr>
<td>0.0</td>
<td>40</td>
<td>100.6</td>
<td>1.6</td>
<td>9.7</td>
<td>90.0</td>
<td>0.3</td>
<td>NP</td>
<td>NP</td>
<td>0.8</td>
<td>SW-SM</td>
<td>SP</td>
</tr>
<tr>
<td>0.0</td>
<td>15</td>
<td>100.6</td>
<td>99.3</td>
<td>0.7</td>
<td>99.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.0</td>
<td>47.5</td>
<td>92.2</td>
<td>92.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.0</td>
<td>52.5</td>
<td>87.2</td>
<td>87.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**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.

**DRILLING CONDITIONS AND DRILLER’S COMMENTS:**
Interval Method
0.0 to 4.4 ft.: FADC
4.4 to 15.1 ft.: SANDY Silt, s(ML): About 70% non-plastic fines with rapid dilatancy; about 30% fine to medium sand; about 15% medium sand; about 5% non-plastic fines with rapid dilatancy; maximum size: about 20% fine sand; maximum size: medium sand; dry, brown, no reaction with HCl; firm consistency.

**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)

**LABORATORY DATA**

<table>
<thead>
<tr>
<th>Depth</th>
<th>% Silty Clays</th>
<th>% Finely Grained Sands</th>
<th>% Sandy Grains</th>
<th>% Gravel</th>
<th>Plasticity</th>
<th>Liquid Limit</th>
<th>Moisture Content %</th>
<th>Laboratory Classification</th>
<th>Visual Classification</th>
<th>Driller’s Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>21.4</td>
<td>15.9</td>
<td>37.3</td>
<td>62.3</td>
<td>0.4</td>
<td>22.4</td>
<td>7.6</td>
<td>2.2</td>
<td>SC</td>
<td>SM</td>
</tr>
<tr>
<td>0.0</td>
<td>20.3</td>
<td>7.0</td>
<td>27.3</td>
<td>72.7</td>
<td>0.0</td>
<td>NP</td>
<td>NP</td>
<td>1.9</td>
<td>SM</td>
<td>SM</td>
</tr>
<tr>
<td>0.0</td>
<td>29.8</td>
<td>53.0</td>
<td>82.9</td>
<td>17.1</td>
<td>0.0</td>
<td>49.0</td>
<td>26.1</td>
<td>20.9</td>
<td>(CL)s</td>
<td>(ML)s</td>
</tr>
<tr>
<td>0.0</td>
<td>39.7</td>
<td>28.8</td>
<td>69.5</td>
<td>31.5</td>
<td>0.0</td>
<td>29.5</td>
<td>9.9</td>
<td>7.8</td>
<td>s(CL)</td>
<td>s(ML)</td>
</tr>
<tr>
<td>10.0</td>
<td>100.6</td>
<td>1.6</td>
<td>9.7</td>
<td>90.0</td>
<td>0.3</td>
<td>NP</td>
<td>NP</td>
<td>0.8</td>
<td>SW-SM</td>
<td>SP</td>
</tr>
<tr>
<td>15.0</td>
<td>92.2</td>
<td>92.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20.0</td>
<td>87.2</td>
<td>87.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**CLASSIFICATION AND PHYSICAL PROPERTY TABLE**

<table>
<thead>
<tr>
<th>Depth</th>
<th>Classification</th>
<th>Physical Property</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>QUATERNARY ALLUVIUM (Qal)</td>
<td></td>
</tr>
<tr>
<td>0.0</td>
<td>FINE SAND, SM: About 80% fine to medium sand; about 20% non-plastic fines with rapid dilatancy; maximum size: about 1/2 inches; about 10% reaction with HCl; very hard consistency.</td>
<td></td>
</tr>
<tr>
<td>0.0</td>
<td>LEAN CLAY, CH: About 85% fine to medium sand; about 15% medium sand; about 5% non-plastic fines with rapid dilatancy; maximum size: dry, light gray, no reaction with HCl; very hard consistency.</td>
<td></td>
</tr>
<tr>
<td>0.0</td>
<td>SANDY Silt, s(ML): About 70% non-plastic fines with rapid dilatancy; about 30% fine to medium sand; about 15% medium sand; about 5% non-plastic fines with rapid dilatancy; maximum size: medium sand; dry, brown, no reaction with HCl; firm consistency.</td>
<td></td>
</tr>
<tr>
<td>0.0</td>
<td>POORLY GRADED SAND, SP: About 95% fine to medium sand; sub-rounded to sub-angular, hard to very hard; about 5% non-plastic fines with rapid dilatancy; maximum size: medium sand; dry, brown, no reaction with HCl; very hard consistency.</td>
<td></td>
</tr>
<tr>
<td>0.0</td>
<td>SANDY LEAN CLAY, s(CL): About 70% fines with low plasticity, toughness, low to medium dry strength, and slow to rapid dilatancy; maximum size: medium sand; moist, tan, no reaction with HCl; firm consistency.</td>
<td></td>
</tr>
<tr>
<td>0.0</td>
<td>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.</td>
<td></td>
</tr>
</tbody>
</table>

**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

**PROJECT:** San Joaquin River Restoration Project  
**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  
**FEATURE:** Groundwater Monitoring  
**BEGUN:** 10/27/09  
**FINISHED:** 10/28/09  
**LOCATION:** Reach 4A, River Bank Right, Merced County  
**TOTAL DEPTH:** 52.5 ft.  
**COORDINATES:** N 2,271,709.4 E 6,110,066.2 (NAGD83)  
**GROUND SURFACE ELEVATION:** 115.8 ft. (NAVD88)  
**GROUND SURFACE ELEVATION:** 115.8 ft. (NAVD88)  
**HOLE LOGGED BY:** G.Turlington  
**REVIEWED BY:** J. Vauk  
**LOCATION:** Reach 4A, River Bank Right, Merced County  

#### NOTES

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>% CORE RECOVERY</th>
<th>% SILT</th>
<th>% CLAY</th>
<th>% SAND</th>
<th>% GRAVEL</th>
<th>LIQUID LIMIT</th>
<th>PLASTICITY INDEX</th>
<th>MOISTURE CONTENT</th>
<th>LABORATORY CLASSIFICATION</th>
<th>VISUAL CLASSIFICATION</th>
<th>ELEVATION</th>
<th>ELEVATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>s(CL)</td>
<td>s(CL)</td>
<td>47.8</td>
<td>18.1</td>
</tr>
<tr>
<td>35</td>
<td>94</td>
<td>47.8</td>
<td>18.1</td>
<td>65.9</td>
<td>34.1</td>
<td>0.0</td>
<td>29.6</td>
<td>9.6</td>
<td>10.3</td>
<td>s(CL)</td>
<td>78.5</td>
<td>78.5</td>
</tr>
<tr>
<td>40</td>
<td>100</td>
<td>36.0</td>
<td>18.0</td>
<td>54.0</td>
<td>46.0</td>
<td>0.0</td>
<td>29.2</td>
<td>11.6</td>
<td>11.6</td>
<td>s(CL)</td>
<td>45.6</td>
<td>45.6</td>
</tr>
<tr>
<td>45</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>s(CL)</td>
<td>s(CL)</td>
<td>45.6</td>
<td>45.6</td>
</tr>
<tr>
<td>50</td>
<td>38</td>
<td>8.6</td>
<td>1.4</td>
<td>10.0</td>
<td>90.0</td>
<td>0.0</td>
<td>NP</td>
<td>NP</td>
<td>17.3</td>
<td>SP-SM</td>
<td>63.2</td>
<td>63.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**CLASSIFICATION AND PHYSICAL CONDITION**

- **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 65% 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.  
- **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.  

T.D. = 52.5 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.
**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
BEGIN: 10/26/09 FINISHED: 10/27/09
DEPT AND ELEVATION OF WATER LEVEL: 34.0 ft. (El. 86.65 ft.) 10/26/09
AND DATE MEASURED: 34.0 ft. (El. 86.65 ft.)

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
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 62.5 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
Light 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.

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

CLASSIFICATION AND PHYSICAL CONDITION

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: 1/8-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):
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: 1/8-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):
About 85% fines with low to medium plasticity, medium toughness, no dry strength, and rapid dilatancy; about 15% fine; maximum size: fine sand; moist, dark gray to brown, no reaction with HCl; hard consistency.

LABORATORY DATA INTERVAL
22.7 to 26.8 ft.

TOTAL DEPTH: 82.5 ft.
COORDINATES: N 2,271,341.5 E 6,109,606.0 (NAGD83)
GROUND SURFACE ELEVATION: 120.8 ft. (NAVD88)
T.O.C ELEVATION: 120.65 ft. (NAVD88)
GROUND SURFACE EL.: 120.63 (NAVD88)

PROJECT: San Joaquin River Restoration Project
GROUND SURFACE ELEVATION: 120.8 ft. (NAVD88)
T.O.C ELEVATION: 120.65 ft. (NAVD88)
HOLE LOGGED BY: G. Turfing
REVIEWED BY: J. Vauk

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  
**GROUND SURFACE ELEVATION:** 120.8 ft. (NAVD88)  
**T.O.C ELEVATION:** 120.51 ft. (NAVD88)  
**HOLE LOGGED BY:** G. Turlington  
**REVIEWED BY:** J. Vauk

### Laboratory Data

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>% CORE RECOVERY</th>
<th>% SILT</th>
<th>% CLAY</th>
<th>% FINES</th>
<th>% SAND</th>
<th>% GRAVEL</th>
<th>MOISTURE CONTENT</th>
<th>PLASTICITY INDEX</th>
<th>LIQUID LIMIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>26.8 to 35.8 ft.: SILT WITH SAND, (ML)s:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>73.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35.8 to 72.5 ft.: LEAN CLAY WITH SAND, (CL)s:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>73.2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**LABORATORY DATA**

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>% CORE RECOVERY</th>
<th>% SILT</th>
<th>% CLAY</th>
<th>% FINES</th>
<th>% SAND</th>
<th>% GRAVEL</th>
<th>MOISTURE CONTENT</th>
<th>PLASTICITY INDEX</th>
<th>LIQUID LIMIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>26.8 to 35.8 ft.: SILT WITH SAND, (ML)s:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>73.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35.8 to 72.5 ft.: LEAN CLAY WITH SAND, (CL)s:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>73.2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTES**

**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  
  - 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  
  - Bentonite Seal - 2.0 to 8.0 ft.  
  - Well Protection - flush-mounted 18-inch manhole (15/16-inch hexbolts)

**COMMENTS:**  
FADC = Flight Auger Dry Core  
HSA = Hollow Stem Auger  
NP = Non-plastic  
NR = No Recovery  
NA = Not applicable  
s(ML) = 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.
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.
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

### Notes

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>% CORE RECOVERY</th>
<th>% SILT</th>
<th>% CLAY</th>
<th>% FINE</th>
<th>% SAND</th>
<th>% GRAVEL</th>
<th>LIQUID LIMIT</th>
<th>PLASTICITY</th>
<th>MOISTURE CONTENT %</th>
<th>VISUAL CLASSIFICATION</th>
<th>ELEVATION</th>
<th>GEOLOGIC UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>s(ML)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>0.0</td>
<td>50</td>
<td>20</td>
<td>80</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>s(CL)</td>
<td>116.3</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>113.9</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**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.

**DRILLING & SAMPLING CONDITIONS AND DRILLER’S COMMENTS:**
- 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.

**WATER LEVEL:**
- 0.0 to 25.0 ft: blind drilled
- 25.0 to 72.5 ft: added water, smooth drilling

**WATER FLUID, RETURN AND COLOR:**
- MW-09-86B: 75% fines, 25% sand; maximum size: fine sand; moist, light greenish-brown, firm to hard consistency.

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

**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): 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 13.3 ft.
- 12.5 to 13.5 ft: LEAN CLAY WITH SAND, s(CL): 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
- 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.
### HOLE COMPLETION:

**MW-09-86**

- **Well Casing**: 0.1 to 52.0 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 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)

### LABORATORY DATA

<table>
<thead>
<tr>
<th>Depth</th>
<th>% Core Recovery</th>
<th>% Silt</th>
<th>% Clay</th>
<th>% Sand</th>
<th>% gravel</th>
<th>Liquid Content</th>
<th>Plasticity</th>
<th>Measure Content</th>
<th>% fines</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>100</td>
</tr>
<tr>
<td>10-20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30-40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40-50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50-60</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60-70</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>70-80</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>80-90</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>90-100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### CLASSIFICATION AND PHYSICAL CONDITION

- **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 22.5 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.
- **Laboratory Data Interval**: 23.0 to 24.2 ft.

- **24.2 to 27.7 ft.**: LEAN CLAY WITH SAND, CL/CH: 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**: 24.2 to 27.7 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.
- **Laboratory Data Interval**: 27.7 to 29.5 ft.

- **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.
- **Laboratory Data Interval**: 29.5 to 31.3 ft.

- **31.3 to 36.0 ft.**: SILTY CLAY WITH SAND, (CL/ML)s: 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 with dark brown spots; firm consistency.
- **Laboratory Data Interval**: 31.3 to 36.0 ft.

- **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**: 36.0 to 40.0 ft.

- **40.0 to 43.0 ft.**: LEAN TO FAT SAND, CL/CH: 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.
- **Laboratory Data Interval**: 40.0 to 43.0 ft.

- **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**

- **T.O.C. Coordinates**: N 2271045.1 E 6109201.2 (NAD83) El. 120.79 (NAVD88)
- **Ground surface El.**: 121.0 ft. (NAVD88)
### GEOLOGIC LOG OF DRILL HOLE NO.  MW-09-86

**FEATURE:** Groundwater Monitoring  
**PROJECT:** San Joaquin River Restoration Project  
**LOCATION:** Reach 4A, River Bank Left, Merced County  
**BEGUN:** 11/6/09  
**FINISHED:** 11/8/09  
**COORDINATES:** N 2,271,050.7  E 6,109,195.1 (NAGD83)  
**TOTAL DEPTH:** 72.5 ft.  
**GROUND SURFACE ELEVATION:** 121.0 ft. (NAVD88)  
**T.O.C. ELEVATION:** 120.89 ft. (NAVD88)  
**HOLE LOGGED BY:** G.Turlington  
**REVIEWED BY:** J. Vauk  
**GROUND SURFACE ELEVATION:** 120.87 (NAVD88)  

**GEOLOGIC LOG OF DRILL HOLE MW-09-86**  

**GROUND DEVELOPMENT INFORMATION:** Well completion information is provided in attached Well Completion Diagram.  
Well development information is provided in attached Monitoring Well Development form.

**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

---

### LABORATORY DATA

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>% CORE RECOVERY</th>
<th>% SILT</th>
<th>% CLAY</th>
<th>% FINES</th>
<th>% SAND</th>
<th>% GRAVEL</th>
<th>LIQUID LIMIT</th>
<th>PLASTICITY</th>
<th>MOISTURE CONTENT %</th>
<th>LABORATORY CLASSIFICATION</th>
<th>VISUAL CLASSIFICATION</th>
<th>ELEVATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>65</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>70</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**BOTTOM OF HOLE**

**CLASSIFICATION AND PHYSICAL CONDITION**

- **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:** 46.0 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: ½-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.**
NOT TO SCALE

NOTES:
T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, E1. = Elevation
Sand backfills the well above the top of bentonite seal, inside the manhole.
MW-09-86B

WELL COMPLETION DIAGRAM

DATE COMPLETED: 11/08/2009

GEOLOGIST: G. TURLINGTON
DRILLER: J. HUCKABY
HELPERS: T. MENNING

TOP OF WELL CASING COORDINATES:
N22°71045.1 E61°09201.2 (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,
E1. = 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:** Reacht 4A, River Bank Left, Merced County  
**BEGUN:** 11/8/09 **FINISHED:** 11/10/09  
**AND DATE MEASURED:** NA  
**REVIEWED BY:** J. Vauk  
**REVIEWED BY:** J. Vauk  

**NOTES**

<table>
<thead>
<tr>
<th>Lab Data Interval</th>
<th>% Core Recovery</th>
<th>% Clay</th>
<th>% Silt</th>
<th>% Sand</th>
<th>% gravel</th>
<th>Liquid Plasticity</th>
<th>Plasticity Index</th>
<th>% Liquid Content</th>
<th>Soil Type</th>
<th>Physical Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0 to 1.1 ft.</td>
<td>110.4</td>
<td>25.4</td>
<td>4.4</td>
<td>60.2</td>
<td>0.0</td>
<td>3.3</td>
<td>101.2</td>
<td>0.7</td>
<td>Qal</td>
<td>QUATERNARY ALLUVIUM (Qal)</td>
</tr>
<tr>
<td>0.0 to 5.0 ft.</td>
<td>112.3</td>
<td>30.9</td>
<td>9.5</td>
<td>59.6</td>
<td>0.0</td>
<td>SP/SM</td>
<td>97.6</td>
<td>99.3</td>
<td>Gq</td>
<td>COARSE SAND WITH +G</td>
</tr>
<tr>
<td>1.0 to 6.0 ft.</td>
<td>84.1</td>
<td>15.8</td>
<td>19.4</td>
<td>65.3</td>
<td>0.0</td>
<td>s(CL)g</td>
<td>97.5</td>
<td>95.5</td>
<td>Gq</td>
<td>SANDY CLAY WITH Silt (SP/SM)</td>
</tr>
<tr>
<td>1.0 to 16.0 ft.</td>
<td>94.5</td>
<td>20.9</td>
<td>18.5</td>
<td>60.6</td>
<td>0.0</td>
<td>s(CL)</td>
<td>95.5</td>
<td>94.5</td>
<td>Gq</td>
<td>LEAN CLAY WITH SAND (CLq)</td>
</tr>
<tr>
<td>1.0 to 19.4 ft.</td>
<td>67.4</td>
<td>29.7</td>
<td>27.7</td>
<td>44.3</td>
<td>0.0</td>
<td>SP/SM</td>
<td>86.8</td>
<td>86.4</td>
<td>Gq</td>
<td>SANDY SILT, s(ML): About 60% fine to medium sand; moist, olive-brown with occasional iron-oxide staining; firm consistency.</td>
</tr>
</tbody>
</table>

**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): About 50% fines with low plasticity; about 25% sand; about 25% gravel; maximum size: 1.5 inches; dry, brown; soft to firm consistency; grasses 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.  
  - Laboratory Data Interval
- 12.5 to 13.0 ft.  
  - Laboratory Data Interval
- 17.0 to 17.3 ft.  
  - Laboratory Data Interval
- 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 20% fine sand; maximum size: fine sand; moist, olive-brown with occasional iron-oxide staining; firm consistency.
- 20.4 to 27.5 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.
- 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.

**LABORATORY DATA INTERVAL:**

- 19.0 to 19.4 ft.  
  - Laboratory Data Interval
- 24.0 to 24.3 ft.  
  - Laboratory Data Interval

**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.  

**REVIEWED BY:** J. Vauk
**GEOLOGIC LOG OF DRILL HOLE NO. MW-09-87**

- **FEATURE:** Groundwater Monitoring
- **PROJECT:** San Joaquin River Restoration Project
- **LOCATION:** Reach 4A, River Bank Left, Merced County
- **BEGIN:** 11/8/09
- **FINISHED:** 11/10/09
- **DEPT** AND DATE MEASURED: NA
- **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:

<table>
<thead>
<tr>
<th>MW-09-87</th>
<th>MW-09-87B</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Well Casing:</strong> 0.1 to 37.0 ft. (T.O.C. El. 114.87 ft.)</td>
<td><strong>Well Casing:</strong> 0.1 to 10.0 ft. (T.O.C. El. 114.83 ft.)</td>
</tr>
<tr>
<td><strong>Dual Pre-pack Screen:</strong> 37.0 to 47.0 ft. (Slotted 0.020-inch)</td>
<td><strong>Dual Pre-pack Screen:</strong> 10.0 to 15.0 ft.</td>
</tr>
<tr>
<td><strong>Well Screen Filter Pack:</strong> #3 Sand</td>
<td><strong>Well Screen Filter Pack:</strong> #3 Sand</td>
</tr>
<tr>
<td><strong>Filter Pack:</strong> 36.0 to 48.0 ft. (#3 Sand)</td>
<td><strong>Filter Pack:</strong> 8.0 to 16.0 ft. (#3 Sand)</td>
</tr>
<tr>
<td><strong>Bottom Backfill (Native Material):</strong> 48.0 to 50.0 ft.</td>
<td><strong>Well Protection:</strong> 2.0 to 4.0 ft.</td>
</tr>
<tr>
<td><strong>Bentonite Seal:</strong> 34.0 to 36.0 ft.</td>
<td><strong>Backfill:</strong> 24.0 to 34.0 ft. (Native material caved)</td>
</tr>
<tr>
<td><strong>Upper Bentonite Seal:</strong> 2.0 to 24.0 ft.</td>
<td><strong>Well Protection:</strong> flush-mounted 18-inch manhole (15/16-inch hexbolts)</td>
</tr>
<tr>
<td><strong>Well Protection:</strong> flush-mounted 18-inch manhole (15/16-inch hexbolts)</td>
<td><strong>Well Protection:</strong> flush-mounted 18-inch manhole (15/16-inch hexbolts)</td>
</tr>
</tbody>
</table>

### Well Completion Information

- **T.O.C. Elevation:** 114.87 ft. (NAVD88)
- **Ground Surface El.:** 115.0 ft. (NAVD88)
- **MW-09-87B TOC Coordinates:** N 2270557.6  E 6108224.1 (NAGD83) El. 115.03 (NAVD88)
- **Ground surface El.:** 115.03 (NAVD88)

### Laboratory Data

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>% CORE RECOVERY</th>
<th>% SILT</th>
<th>% CLAY</th>
<th>% SAND</th>
<th>% GRAVEL</th>
<th>LIQUID LIMIT</th>
<th>PLASTICITY INDEX</th>
<th>MOISTURE CONTENT</th>
<th>LABORATORY CLASSIFICATION</th>
<th>VISUAL CLASSIFICATION</th>
<th>GEOLOGIC UNIT</th>
<th>SYMBOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>46.6</td>
<td>100</td>
<td>36.9</td>
<td>83.4</td>
<td>16.6</td>
<td>0.0</td>
<td>33.8</td>
<td>14.0</td>
<td>24.6</td>
<td>CL/JS</td>
<td>SP/SM</td>
<td>(CL/ML)</td>
<td></td>
</tr>
<tr>
<td>4.0</td>
<td>74</td>
<td>4.6</td>
<td>95.4</td>
<td>0.0</td>
<td>0.0</td>
<td>12.5</td>
<td>SP/SM</td>
<td>73.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40.7</td>
<td>74</td>
<td>9.6</td>
<td>90.5</td>
<td>49.7</td>
<td>0.0</td>
<td>23.0</td>
<td>SM</td>
<td>84.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35.0</td>
<td>100</td>
<td>33.6</td>
<td>66.4</td>
<td>6.6</td>
<td>0.0</td>
<td>58.6</td>
<td>33.8</td>
<td>30.1</td>
<td>CH</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Classification and Physical Condition

- **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:** 32.6 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 35% 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):** 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):** 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.**

### Laboratory Data Interval

- **Depth:** 50.0 ft.
- **Coordinates:** N 2270557.6  E 6108224.1 (NAGD83) El. 115.03 (NAVD88)

### Comments

- **FADC = Flight Auger Dry Core**
- **HSA = Hollow Stem Auger**
- **NP = Non-plastic**
- **NR = No Recovery**
- **NA = Not applicable**
- **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**

**T.O.C Coordinates:** N 2270557.6  E 6108224.1 (NAGD83) El. 114.83 (NAVD88)

**Ground surface El.:** 115.03 (NAVD88)

**REVIEWS:**
- **Reviewed by:** J. Vauk
- **Logged by:** G. Russell
**WELL COMPLETION DIAGRAM**

**DATE COMPLETED:** 11/10/2009

**TOP OF WELL CASING COORDINATES:**
N2270565.2 E6108221.5 (NAD83) ELEVATION 114.9’ (NAVD88)
GROUND SURFACE ELEVATION 115.0’ (NAVD88)

---

**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.
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

## NOTES

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>% CORE RECOVERY</th>
<th>% SILT</th>
<th>% CLAY</th>
<th>% SAND</th>
<th>% GRAVEL</th>
<th>LIQUID LIMIT</th>
<th>PLASTICITY INDEX</th>
<th>MOISTURE CONTENT</th>
<th>VISUAL CLASSIFICATION</th>
<th>CLASSIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
<td>100</td>
<td>38.4</td>
<td>91.9</td>
<td>8.1</td>
<td>0.0</td>
<td>30.6</td>
<td>11.2</td>
<td>24.3</td>
<td>CL</td>
<td>CL</td>
</tr>
</tbody>
</table>

**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-350

**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.

**WATER LEVEL:**
45.0 to 50.2 ft. - Water, no return
0.0 to 45.0 ft. - None

**COLOR:**
Drill Fluid, Return and Drilling
45.0 to 50.2 ft. - add water, smooth drilling
0.0 to 45.0 ft. - smooth drilling

**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. 111.8 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)

**LABORATORY DATA**

<table>
<thead>
<tr>
<th>INTERVAL</th>
<th>% CORE RECOVERY</th>
<th>% SILT</th>
<th>% CLAY</th>
<th>% SAND</th>
<th>% GRAVEL</th>
<th>LIQUID LIMIT</th>
<th>PLASTICITY INDEX</th>
<th>MOISTURE CONTENT</th>
<th>VISUAL CLASSIFICATION</th>
<th>CLASSIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0 to 2.5 ft:</td>
<td>90% NON-PLASTIC SILT</td>
<td>20% NON-PLASTIC SAND</td>
<td>FINEST</td>
<td>ABOUT 15% SILT</td>
<td>ABOUT 85% SAND</td>
<td>WITH LOW PLASTICITY</td>
<td>ABOUT 15% DILATANCY</td>
<td>ABOUT 15% FINE</td>
<td>ABOUT 15% FINE</td>
<td>ABOUT 15% FINE</td>
</tr>
<tr>
<td>2.5 to 7.8 ft:</td>
<td>90% NON-PLASTIC SILT</td>
<td>ABOUT 10% SILT</td>
<td>ABOUT 90% SAND</td>
<td>WITH LOW PLASTICITY</td>
<td>ABOUT 10% SILT</td>
<td>WITH LOW PLASTICITY</td>
<td>ABOUT 10% DILATANCY</td>
<td>ABOUT 10% FINE</td>
<td>ABOUT 10% FINE</td>
<td>ABOUT 10% FINE</td>
</tr>
<tr>
<td>7.8 to 12.6 ft:</td>
<td>100% SILT</td>
<td>IMAGE DESCRIBED</td>
<td>ABOUT 90% SILT</td>
<td>WHITE</td>
<td>ABOUT 10% SILT</td>
<td>WITH LOW PLASTICITY</td>
<td>ABOUT 10% DILATANCY</td>
<td>ABOUT 90% SILT</td>
<td>ABOUT 90% SILT</td>
<td>ABOUT 90% SILT</td>
</tr>
<tr>
<td>12.6 to 15.1 ft:</td>
<td>95% SILT</td>
<td>ABOUT 90% SILT</td>
<td>ABOUT 5% SAND</td>
<td>WHITE</td>
<td>ABOUT 90% SILT</td>
<td>WHITE</td>
<td>ABOUT 90% SILT</td>
<td>ABOUT 90% SILT</td>
<td>ABOUT 90% SILT</td>
<td>ABOUT 90% SILT</td>
</tr>
<tr>
<td>15.1 to 15.6 ft:</td>
<td>90% SILT</td>
<td>ABOUT 10% SILT</td>
<td>ABOUT 90% SAND</td>
<td>WITH LOW PLASTICITY</td>
<td>ABOUT 10% SILT</td>
<td>WITH LOW PLASTICITY</td>
<td>ABOUT 10% DILATANCY</td>
<td>ABOUT 90% SILT</td>
<td>ABOUT 90% SILT</td>
<td>ABOUT 90% SILT</td>
</tr>
<tr>
<td>15.6 to 16.3 ft:</td>
<td>85% SILT</td>
<td>ABOUT 10% SILT</td>
<td>ABOUT 90% SAND</td>
<td>WITH LOW PLASTICITY</td>
<td>ABOUT 10% SILT</td>
<td>WITH LOW PLASTICITY</td>
<td>ABOUT 10% DILATANCY</td>
<td>ABOUT 90% SILT</td>
<td>ABOUT 90% SILT</td>
<td>ABOUT 90% SILT</td>
</tr>
<tr>
<td>16.3 to 16.4 ft:</td>
<td>90% SILT</td>
<td>ABOUT 10% SILT</td>
<td>ABOUT 90% SAND</td>
<td>WITH LOW PLASTICITY</td>
<td>ABOUT 10% SILT</td>
<td>WITH LOW PLASTICITY</td>
<td>ABOUT 10% DILATANCY</td>
<td>ABOUT 90% SILT</td>
<td>ABOUT 90% SILT</td>
<td>ABOUT 90% SILT</td>
</tr>
<tr>
<td>16.4 to 16.7 ft:</td>
<td>90% SILT</td>
<td>ABOUT 10% SILT</td>
<td>ABOUT 90% SAND</td>
<td>WITH LOW PLASTICITY</td>
<td>ABOUT 10% SILT</td>
<td>WITH LOW PLASTICITY</td>
<td>ABOUT 10% DILATANCY</td>
<td>ABOUT 90% SILT</td>
<td>ABOUT 90% SILT</td>
<td>ABOUT 90% SILT</td>
</tr>
<tr>
<td>16.7 to 17.5 ft:</td>
<td>85% SILT</td>
<td>ABOUT 10% SILT</td>
<td>ABOUT 90% SAND</td>
<td>WITH LOW PLASTICITY</td>
<td>ABOUT 10% SILT</td>
<td>WITH LOW PLASTICITY</td>
<td>ABOUT 10% DILATANCY</td>
<td>ABOUT 90% SILT</td>
<td>ABOUT 90% SILT</td>
<td>ABOUT 90% SILT</td>
</tr>
</tbody>
</table>

**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.
### Notes

<table>
<thead>
<tr>
<th>Depth (ft.)</th>
<th>% Core Recovery</th>
<th>% Silts</th>
<th>% Fines</th>
<th>% Sands</th>
<th>Liquid Limit</th>
<th>Plasticity Index</th>
<th>Consistency</th>
</tr>
</thead>
<tbody>
<tr>
<td>17.5 to 22.5 ft.</td>
<td>Silty Clay with Sand (CL/ML): 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.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22.5 to 24.3 ft.</td>
<td>Silty Clay (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.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24.3 to 24.4 ft.</td>
<td>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.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24.4 to 27.1 ft.</td>
<td>Silty Sand (SM): 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.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27.1 to 27.5 ft.</td>
<td>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.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27.5 to 31.6 ft.</td>
<td>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.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31.6 to 32.0 ft.</td>
<td>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.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32.0 to 37.5 ft.</td>
<td>Silty Sand (SM): About 60% fine to medium sand; about 40% non-plastic fines with rapid dilatancy; maximum size: coarse sand; wet, light brown, no reaction with HCl; firm consistency.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>37.5 to 41.7 ft.</td>
<td>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.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## GEOLOGIC LOG OF DRILL HOLE NO. MW-09-88

**FEATURE:** Groundwater Monitoring  
**PROJECT:** San Joaquin River Restoration Project  
**LOCATION:** Reach 4A, River Bank Left, Merced County  
**BEGUN:** 11/11/09  
**FINISHED:** 11/12/09  
**TOTAL DEPTH:** 50.2 ft.  
**GROUND SURFACE ELEVATION:** 112.0 ft. (NAVD88)  
**T.O.C ELEVATION:** 111.84 ft. (NAVD88)  
**HOLE LOGGED BY:** J. Vauk  
**REVIEWED BY:** A. Warren  

### FEATURES

**GROUND SURFACE ELEVATION:** 112.0 ft. (NAVD88)  
**COORDINATES:** N 2,269,675.6 E 6,103,010.8 (NAGD83)  

### DEPTH AND ELEVATION OF WATER LEVEL

**TOTAL DEPTH:** 50.2 ft.  
**ELEVATION:** 112.0 ft. (NAVD88)  
**T.O.C ELEVATION:** 111.84 ft. (NAVD88)  

### LABORATORY DATA

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>% CORE RECOVERY</th>
<th>% SILT</th>
<th>% CLAY</th>
<th>% FINE</th>
<th>% SAND</th>
<th>% GRAVEL</th>
<th>LIQUID LIMIT</th>
<th>PLASTICITY INDEX</th>
<th>LABORATORY CLASSIFICATION</th>
<th>VISCUAL CLASSIFICATION</th>
<th>CLASSIFICATION AND PHYSICAL CONDITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>35-50</td>
<td>8.8</td>
<td>4.8</td>
<td>13.6</td>
<td>86.4</td>
<td>0.0</td>
<td>NP</td>
<td>NP</td>
<td>27.3</td>
<td>SM</td>
<td>Qal</td>
<td>41.7 to 45.6 ft.: <strong>Silty Sand, SM:</strong> 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. Laboratory Data Interval 41.7 to 45.6 ft.</td>
</tr>
<tr>
<td>40-78</td>
<td>7.5</td>
<td>1.4</td>
<td>8.9</td>
<td>88.1</td>
<td>2.5</td>
<td>NP</td>
<td>NP</td>
<td>19.7</td>
<td>SW-SM</td>
<td>Qal</td>
<td>45.6 to 50.2 ft.: <strong>Fat Clay, CH:</strong> 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. Laboratory Data Interval 45.6 to 50.2 ft.</td>
</tr>
<tr>
<td>45-88</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>T.O.C. ELEVATION: 111.84 ft. (NAVD88)</td>
<td>66.2</td>
<td></td>
</tr>
<tr>
<td>50-</td>
<td></td>
<td>47.0</td>
<td>48.1</td>
<td>55.1</td>
<td>4.9</td>
<td>0.0</td>
<td>25.3</td>
<td>26.0</td>
<td>CH</td>
<td>61.6</td>
<td><strong>Bottom of Hole</strong></td>
</tr>
</tbody>
</table>

**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.
NOTES:
T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface,
E'l. = Elevation
Sand backfills the well above the top of bentonite seal, inside the manhole.
**GEOLOGIC LOG OF DRILL HOLE NO. MW-10-80**

**LOCATION:** Reach 4A, Right Side of River, North of Sack Dam
**COORDINATES:** N 2,251,292.7 E 6,121,295.6 (NAD83)
**TOTAL DEPTH:** 30.5 ft.
**WATER LEVEL:** 12.0 ft. b.g.s. (El. 112.9 ft.)
**DATE WATER LEVEL WAS MEASURED:** 3/22/2010
**BEGUN:** 3/22/10 **FINISHED:** 3/22/10

### REPORT: SJRRP DRILL HOLE PROJECT DATABASE: SJRRP.GPJ

**Well Completion:**
- Steel surface
**Bentonite Seal:** 2.0 to 9.5 ft. (PVC with cap)
**Filter Pack:** 9.5 to 30.5 ft. (#3 Sand)
**Well Screen Filter Pack:** 2/12 Sand (Slotted 0.010-inch)
**Dual U-pack Screen:** 10.0 to 25.0 ft. (Slotted 0.010-inch)
**Well Casing:** +2.6 to 10.0 ft. (T.O.C. depth)

**TERMINATION:**
- 3/22/2010

**WATER LEVEL:**
- 0.0 to 18.0 ft. - Water, no return
- 18.0 to 30.5 ft. - None
- 23.0 to 30.5 ft. - Firm
- 13.0 to 18.0 ft. - Very wet
- 8.0 to 13.0 ft. - Damp
- 0.0 to 8.0 ft. - Smooth drilling, soft

**DRILLER'S COMMENTS:**
- **DRILLING CONDITION 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. depth)
  - Dual U-pack Screen: 10.0 to 25.0 ft. (Slotted 0.010-inch)
  - Medium 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

**NOTES:**

| DEPTH (FT.) | % CORE | % CLAY | % SILT | % SAND | % GRAVEL | LIQUID LIMIT | PLASTICITY | MOISTURE CONTENT | LABORATORY CLASSIFICATION | P.E. CLASSIFICATION | GEOLOGIC UNIT | ELEVATION (FT.) | VISUAL CLASSIFICATION | CLASSIFICATION AND PHYSICAL CONDITION |
|-------------|--------|--------|--------|--------|----------|--------------|------------|------------------|--------------------------|-------------------|----------------|----------------|----------------------|---------------------------|-------------------------------------|
| 0.0 to 0.5  |        |        |        |        |          |              |            |                  | Q4                  | Q4               | Q4            | Q4          | Q4                     | Q4                        | Q4                           |
| 0.5 to 10.5 |        |        |        |        |          |              |            |                  | Q4                  | Q4               | Q4            | Q4          | Q4                     | Q4                        | Q4                           |
| 10.5 to 20.0|        |        |        |        |          |              |            |                  | Q4                  | Q4               | Q4            | Q4          | Q4                     | Q4                        | Q4                           |
| 20.0 to 30.5|        |        |        |        |          |              |            |                  | Q4                  | Q4               | Q4            | Q4          | Q4                     | Q4                        | Q4                           |

**LABORATORY DATA INTERVALS:**
- **0.0 to 0.6 ft.: SANDY Silty Clay, s(CL/ML):** About 60% fines with low plasticity; medium toughness; 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.
- **0.6 to 1.1 ft.: SILTY CLAY, (CL/ML):** About 85% fine sand; about 15% nonplastic fines; maximum size: fine sand; dry, brown; gray to brown; moderately firm, several lenses of fine sand.
- **1.1 to 1.7 ft.: Silt, ML: ** About 90% fines with low plasticity and toughness; about 10% fine sand; maximum size: fine sand; moist, brown to reddish oxidation; moderately firm, several lenses of fine sand.
- **1.7 to 2.3 ft.: Poorly Graded Sand, SP:** About 85% to 95% fine sand; about 15% nonplastic fines; maximum size: fine sand; wet, olive brown to reddish oxidation; moderately firm.
- **2.3 to 3.5 ft.: Poorly Graded Sand with Silty, SP/SM:** About 90% fine sand; about 10% fines with low plasticity; maximum size: fine sand; wet, olive brown with reddish brown oxidation; moderately firm.
- **3.5 to 5.0 ft.: Clayey to Silty Sand, CL/ML:** About 85% fine sand; about 15% nonplastic fines; maximum size: fine sand; wet, olive brown with reddish brown oxidation; moderately firm.
- **5.0 to 8.0 ft.: Clayey to Silty Sand, SC/SM:** About 20% fines with low to medium plasticity; about 80% fine sand; maximum size: fine sand; wet, olive brown with reddish brown oxidation; moderately firm.

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

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.
**GEOLOGIC LOG OF DRILL HOLE NO. MW-10-80**

**FEATURE:** Groundwater Monitoring  
**PROJECT:** San Joaquin River Restoration Program  
**LOCATION:** Reach 4A, Right Side of River, North of Sack Dam  
**COORDINATES:** N 2,251,292.7 E 6,121,295.6 (NAD83)  
**STATE:** California  
**GROUND SURFACE ELEVATION:** 124.9 ft. (NAVD88)  
**T.O.C ELEVATION:** 127.5 ft. (NAVD88)  
**HOLE LOGGED BY:** A. Warren  
**REVIEWED BY:** J. Vauk

**TOTAL DEPTH:** 30.5 ft.  
**WATER LEVEL DEPTH AND ELEVATION:** 12.0 ft. b.g.s. (El. 112.9 ft.)

**DATE WATER LEVEL WAS MEASURED:** 3/22/2010

---

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>% CORE RECOVERY</th>
<th>% SILT</th>
<th>% CLAY</th>
<th>% SAND</th>
<th>% GRAVEL</th>
<th>LIQUID LIMIT</th>
<th>PLASTICITY</th>
<th>MOISTURE CONTENT</th>
<th>LABORATORY CLASSIFICATION</th>
<th>VISUAL CLASSIFICATION</th>
<th>ELEVATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>25.8 to 27.0 ft.</td>
<td>Poorly Graded Sand with Silt, SP/SM</td>
<td>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.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27.0 to 29.5 ft.</td>
<td>Lean Clay with Sand, (CL)s</td>
<td>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.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29.5 to 30.5 ft.</td>
<td>Poorly Graded Sand with Silt, SP/SM</td>
<td>About 90% fine sand; about 10% nonplastic fines; maximum size: fine sand; wet, olive brown with reddish brown oxidation, moderately soft.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**T.D. = 30.5 ft.**

---

**NOTES:**

Casing with locking top, square 6-inches-wide and 5-foot-long.

---

**COMMENTS:**

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

---

**REPORT:** SJRRP DRILL HOLE PROJECT DATABASE: SJRRP.GPJ

**DATE WATER LEVEL DEPTH AND ELEVATION:** 12.0 ft. b.g.s. (El. 112.9 ft.)

**DATE WATER LEVEL WAS MEASURED:** 3/22/2010

---

**GROUND SURFACE ELEVATION:** 124.9 ft. (NAVD88)

**GROUND SURFACE ELEVATION:** 124.9 ft. (NAVD88)

**DATE:** 9/15/2010  
**SHEET:** 2 OF 3  
**DRILL HOLE:** MW-10-80
### GEOLOGIC LOG OF DRILL HOLE NO. MW-10-80

**FEATURE:** Groundwater Monitoring  
**LOCATION:** Reach 4A, Right side of River, North of Sack Dam  
**BEGIN:** 3/22/10  
**FINISHED:** 3/22/10  
**TOTAL DEPTH:** 30.5 ft.  
**GROUND SURFACE ELEVATION:** 124.9 ft. (NAVD88)  
**T.O.C ELEVATION:** 127.5 ft. (NAVD88)  
**HOLE LOGGED BY:** A. Warren  
**REVIEWED BY:** J. Vauk  
**DATE WATER LEVEL WAS MEASURED:** 3/22/2010  
**STATE:** California

#### LABORATORY DATA

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>% SILT</th>
<th>% CLAY</th>
<th>% SAND</th>
<th>% GRAVEL</th>
<th>LIQUID LIMIT</th>
<th>PLASTICITY INDEX</th>
<th>MOISTURE CONTENT %</th>
<th>LABORATORY CLASSIFICATION</th>
<th>VISUAL CLASSIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>41.7</td>
<td>30.1</td>
<td>71.8</td>
<td>28.2</td>
<td>0.0</td>
<td>4.2</td>
<td>23.8</td>
<td>SM</td>
<td>100.4</td>
</tr>
<tr>
<td>50</td>
<td>99.1</td>
<td>99.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SP/SM</td>
<td>97.9</td>
</tr>
<tr>
<td>92</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(CL)s</td>
<td>96.4</td>
</tr>
<tr>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(CL)s</td>
<td></td>
</tr>
</tbody>
</table>

**BOTTOM OF HOLE**

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>% SILT</th>
<th>% CLAY</th>
<th>% SAND</th>
<th>% GRAVEL</th>
<th>LIQUID LIMIT</th>
<th>PLASTICITY INDEX</th>
<th>MOISTURE CONTENT %</th>
<th>LABORATORY CLASSIFICATION</th>
<th>VISUAL CLASSIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SP/SM</td>
<td></td>
</tr>
</tbody>
</table>

#### CLASSIFICATION AND PHYSICAL CONDITION

**TOTAL DEPTH:** 30.5 ft.

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

**COMMENTS:**
- Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.
MW–10–80
WELL COMPLETION DIAGRAM
DATE COMPLETED: 3/22/2010
GEOLOGIST: A. WARREN
DRILLER: G. HANSEN
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

**DATE:** 9/15/2010  
**SHEET 1 OF 3**

**LOCATION:** Reach 4A, Right Side of River, SW of Road 1 and Ave. 21  
**SITE CONDITIONS:** Groundwater Monitoring  
**SITE NUMBER:** Reach 4A, Right Side of River, SW of Road 1 and Ave. 21  
**SITE DESCRIPTION:** Groundwater monitoring well  
**SITE ACTIVITIES:** Install stainless-steel well casing, install grout seal, water level elevation, and install groundwater monitoring well  
**SITE CONDITIONS:** Groundwater monitoring well  
**SITE ACTIVITIES:** Install stainless-steel well casing, install grout seal, water level elevation, and install groundwater monitoring well  
**SITE ACTIVITIES:** Install stainless-steel well casing, install grout seal, water level elevation, and install groundwater monitoring well  

#### CLASSIFICATION AND PHYSICAL CONDITION

<table>
<thead>
<tr>
<th>ELEVATION</th>
<th>CLASSIFICATION</th>
<th>PHYSICAL CONDITION</th>
</tr>
</thead>
</table>
| 0.0 to 31.5 ft | QUATERNARY ALLUVIUM (Qal) | 0.0 to 0.6 ft: SILTY SAND, SM: About 55% fine sand; about 45% fine sands 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 sands; 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; variable spacing; 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 2.5 to 31.5 ft, alternating beds about 0.6 ft. thick of fine and medium sand throughout interval.  
19.0 to 25.0 ft: FAT CLAY WITH SAND, (CH)s: About 80 to 85% fines with high plasticity and toughness; about 15 to 20% fine sand; maximum size: fine sand; moist, brown, organic odor; firm.  
25.0 to 26.2 ft: POORLY GRADED SAND WITH CLAY, SP/SM: 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(CH): About 65% fines with medium plasticity, high toughness; about 35% fine sand; maximum size: fine sand; moist, orange brown; moderately soft, stratified.  
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.  |

#### GEOLOGIC LOG OF DRILL HOLE NO. MW-10-89

**PROJECT:** San Joaquin River Restoration Program  
**LOCATION:** Reach 4A, Right Side of River, SW of Road 1 and Ave. 21  
**SITE ACTIVITIES:** Install stainless-steel well casing, install grout seal, water level elevation, and install groundwater monitoring well  
**SITE ACTIVITIES:** Install stainless-steel well casing, install grout seal, water level elevation, and install groundwater monitoring well  
**SITE ACTIVITIES:** Install stainless-steel well casing, install grout seal, water level elevation, and install groundwater monitoring well  

#### LABORATORY DATA

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>% CORE RECOVERY</th>
<th>% SILT</th>
<th>% CLAY</th>
<th>% FINES</th>
<th>% SAND</th>
<th>% GRAVEL</th>
<th>LIQUID LIMIT</th>
<th>PLASTICITY INDEX</th>
<th>MOISTURE CONTENT</th>
<th>CLASSIFICATION</th>
<th>ELEVATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0 ft</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SM</td>
<td>116.2</td>
</tr>
<tr>
<td>0.6 ft</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>s(ML)</td>
<td>116.0</td>
</tr>
<tr>
<td>2.2 ft</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Qal</td>
<td></td>
</tr>
</tbody>
</table>

#### GEOLOGIC LOG OF DRILL HOLE NO. MW-10-89

**PROJECT:** San Joaquin River Restoration Program  
**LOCATION:** Reach 4A, Right Side of River, SW of Road 1 and Ave. 21  
**SITE ACTIVITIES:** Install stainless-steel well casing, install grout seal, water level elevation, and install groundwater monitoring well  
**SITE ACTIVITIES:** Install stainless-steel well casing, install grout seal, water level elevation, and install groundwater monitoring well  
**SITE ACTIVITIES:** Install stainless-steel well casing, install grout seal, water level elevation, and install groundwater monitoring well  

#### COMMENTS

- **FADC = Flight Auger Dry Core**  
- **NP = Non-plastic**  
- **NR = No Recovery**  
- **NA = Not applicable**  
- **I.D. = inner diameter**  
- **RM = River Mile**  
- **G.S. = Ground surface**  
- **T.O.C = Top of well casing**  
- **SJR = San Joaquin River**  
- **O.D. = outer diameter**  
- **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.
**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  
**BEGIN:** 3/24/10  
**FINISHED:** 3/24/10  
**WATER LEVEL DEPTH AND ELEVATION:** NA  
**DATE WATER LEVEL WAS MEASURED:** NA

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>LABORATORY DATA</th>
<th>CLASSIFICATION AND PHYSICAL CONDITION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% CORE RECOVERY</td>
<td>% SILT</td>
</tr>
<tr>
<td>60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>6.1</td>
<td>1.0</td>
</tr>
<tr>
<td>101.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>39.9</td>
<td>41.4</td>
</tr>
<tr>
<td>96.8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTES:**
- casing with locking top, square 6-inches-wide and 5-foot-long.

**COMMENTS:**
- Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

**DATE:** 9/15/2010  
**SHEET 2 OF 3**  
**DRILL HOLE MW-10-89**
GEOLOGIC LOG OF DRILL HOLE NO. MW-10-89

NOTES

DEPTH

% CORE RECOVERY

% SILT

% CLAY

% SAND

% GRAVEL

LIQUID LIMIT

PLASTICITY INDEX

MOISTURE CONTENT

GELOGIC LOG OF DRILL HOLE NO. MW-10-89

T.O.C ELEVATION: 121.5 ft. (NAVD88)

GROUND SURFACE ELEVATION: 118.8 ft. (NAVD88)

STATE: California

HOLE LOGGED BY: A. Warren

REVIEWED BY: J. Vauk

DATE WATER LEVEL WAS MEASURED: NA

FEATURE: Groundwater Monitoring

LOCATION: Reach 4A, Right Side of River, SW of Road 1 and Ave. 21

BEGIN: 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

DATE WATER LEVEL WAS MEASURED: NA

REPORT: SJRRP DRILL HOLE PROJECT DATABASE: SJRRP.GPJ

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.
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

NOTES

ALL MEASUREMENTS ARE IN FEET FROM THE GROUND SURFACE.

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

LOCATION:
Reach 4B1, river 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 3.1 feet = FADC

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
0.0 to 4.3 ft.: smooth drilling, soft sand; 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 clayey sand.

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. E 103.9 ft.)
Dual U-pack Screen: 10.0 to 25.0 ft. (Slotted 0.015-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)

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

CLASSIFICATION AND PHYSICAL CONDITION

0.0 to 31.2 feet QUATERNARY ALLUVIUM (Qal)

0.0 to 2.5 ft.: CLAYEY SAND WITH ORGANIC FINES, SC:
About 80% fines with medium to high plasticity; about 20% organic fines; soil trace; moderate toughness, and slow dilatancy; about 5% non-plastic; firm consistency.

2.5 to 4.5 ft.: SILTY SAND, SM:
About 70% sand with medium to high plasticity; about 30% silt; maximum size: fine sand; maximum size: fine sand; moderately firm consistency.

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; moderately soft; firm consistency.

7.6 to 8.7 ft.: LEAN CLAY WITH SAND, (CL)s:
About 85% fines with medium to low plasticity; about 15% fine sand; maximum size: fine sand; moderately soft; firm consistency.

8.7 to 10.0 ft.: SANDY LEAN CLAY, s(CL):
About 65% fines with medium to low plasticity; about 35% fine sand; maximum size: fine sand; moderately soft; firm consistency.

10.0 to 11.8 ft.: POORLY GRADED SAND, SP:
About 95% fines to medium sand; moderate to high plasticity; about 5% non-plastic; fine sand; moderately soft; firm consistency.

11.8 to 18.7 ft.: POORLY GRADED SAND, SC:
About 95% fines to medium sand; fine sand; maximum size: medium sand; moderately soft; firm consistency.

18.7 to 23.7 ft.: CLAYEY SAND, SC:
About 55% fines (trace of medium sand); about 45% fines with medium to high plasticity; maximum size: medium sand; moist; very firm consistency; stratified in 0.1- to 0.3-foot-thick layers of +/-10% fines.

23.7 to 25.2 ft.: CLAYEY SAND, SC:
About 80% medium sand; about 20% fines with low plasticity; maximum size: medium sand; to moist, firm consistency.

LAPORATORY DATA

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>% CORE RECOVERY</th>
<th>% SILT</th>
<th>% CLAY</th>
<th>% FINES</th>
<th>% SAND</th>
<th>% GRAVEL</th>
<th>LIQUEFICATION LIMIT</th>
<th>PLASTICITY INDEX</th>
<th>PLASTICITY CLASS</th>
<th>MEASURED CONTENT %</th>
<th>LABORATORY CLASSIFICATION</th>
<th>VISUAL CLASSIFICATION</th>
<th>ELEVATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>94.3</td>
<td>0.0</td>
<td>42.3</td>
<td>14.5</td>
<td>96.8</td>
<td>0.0</td>
<td>24.3</td>
<td>5.1</td>
<td>20.2</td>
<td>s(CL-ML)</td>
<td>SC</td>
<td>SM</td>
<td>91.3</td>
</tr>
<tr>
<td>0.0</td>
<td>94.3</td>
<td>0.0</td>
<td>42.3</td>
<td>14.5</td>
<td>96.8</td>
<td>0.0</td>
<td>24.3</td>
<td>5.1</td>
<td>20.2</td>
<td>s(CL-ML)</td>
<td>SC</td>
<td>SM</td>
<td>91.3</td>
</tr>
<tr>
<td>0.0</td>
<td>94.3</td>
<td>0.0</td>
<td>42.3</td>
<td>14.5</td>
<td>96.8</td>
<td>0.0</td>
<td>24.3</td>
<td>5.1</td>
<td>20.2</td>
<td>s(CL-ML)</td>
<td>SC</td>
<td>SM</td>
<td>91.3</td>
</tr>
<tr>
<td>0.0</td>
<td>94.3</td>
<td>0.0</td>
<td>42.3</td>
<td>14.5</td>
<td>96.8</td>
<td>0.0</td>
<td>24.3</td>
<td>5.1</td>
<td>20.2</td>
<td>s(CL-ML)</td>
<td>SC</td>
<td>SM</td>
<td>91.3</td>
</tr>
<tr>
<td>0.0</td>
<td>94.3</td>
<td>0.0</td>
<td>42.3</td>
<td>14.5</td>
<td>96.8</td>
<td>0.0</td>
<td>24.3</td>
<td>5.1</td>
<td>20.2</td>
<td>s(CL-ML)</td>
<td>SC</td>
<td>SM</td>
<td>91.3</td>
</tr>
<tr>
<td>0.0</td>
<td>94.3</td>
<td>0.0</td>
<td>42.3</td>
<td>14.5</td>
<td>96.8</td>
<td>0.0</td>
<td>24.3</td>
<td>5.1</td>
<td>20.2</td>
<td>s(CL-ML)</td>
<td>SC</td>
<td>SM</td>
<td>91.3</td>
</tr>
<tr>
<td>0.0</td>
<td>94.3</td>
<td>0.0</td>
<td>42.3</td>
<td>14.5</td>
<td>96.8</td>
<td>0.0</td>
<td>24.3</td>
<td>5.1</td>
<td>20.2</td>
<td>s(CL-ML)</td>
<td>SC</td>
<td>SM</td>
<td>91.3</td>
</tr>
<tr>
<td>0.0</td>
<td>94.3</td>
<td>0.0</td>
<td>42.3</td>
<td>14.5</td>
<td>96.8</td>
<td>0.0</td>
<td>24.3</td>
<td>5.1</td>
<td>20.2</td>
<td>s(CL-ML)</td>
<td>SC</td>
<td>SM</td>
<td>91.3</td>
</tr>
<tr>
<td>0.0</td>
<td>94.3</td>
<td>0.0</td>
<td>42.3</td>
<td>14.5</td>
<td>96.8</td>
<td>0.0</td>
<td>24.3</td>
<td>5.1</td>
<td>20.2</td>
<td>s(CL-ML)</td>
<td>SC</td>
<td>SM</td>
<td>91.3</td>
</tr>
<tr>
<td>0.0</td>
<td>94.3</td>
<td>0.0</td>
<td>42.3</td>
<td>14.5</td>
<td>96.8</td>
<td>0.0</td>
<td>24.3</td>
<td>5.1</td>
<td>20.2</td>
<td>s(CL-ML)</td>
<td>SC</td>
<td>SM</td>
<td>91.3</td>
</tr>
<tr>
<td>0.0</td>
<td>94.3</td>
<td>0.0</td>
<td>42.3</td>
<td>14.5</td>
<td>96.8</td>
<td>0.0</td>
<td>24.3</td>
<td>5.1</td>
<td>20.2</td>
<td>s(CL-ML)</td>
<td>SC</td>
<td>SM</td>
<td>91.3</td>
</tr>
<tr>
<td>0.0</td>
<td>94.3</td>
<td>0.0</td>
<td>42.3</td>
<td>14.5</td>
<td>96.8</td>
<td>0.0</td>
<td>24.3</td>
<td>5.1</td>
<td>20.2</td>
<td>s(CL-ML)</td>
<td>SC</td>
<td>SM</td>
<td>91.3</td>
</tr>
<tr>
<td>0.0</td>
<td>94.3</td>
<td>0.0</td>
<td>42.3</td>
<td>14.5</td>
<td>96.8</td>
<td>0.0</td>
<td>24.3</td>
<td>5.1</td>
<td>20.2</td>
<td>s(CL-ML)</td>
<td>SC</td>
<td>SM</td>
<td>91.3</td>
</tr>
<tr>
<td>0.0</td>
<td>94.3</td>
<td>0.0</td>
<td>42.3</td>
<td>14.5</td>
<td>96.8</td>
<td>0.0</td>
<td>24.3</td>
<td>5.1</td>
<td>20.2</td>
<td>s(CL-ML)</td>
<td>SC</td>
<td>SM</td>
<td>91.3</td>
</tr>
</tbody>
</table>

COMMENTS:
Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.
### GEOLOGIC LOG OF DRILL HOLE NO. MW-10-90

**FEATURE:** Groundwater Monitoring  
**LOCATION:** Reach 4B1, River Bank Right, North of Sand Slough Structure  
**BEGIN:** 4/17/10  
**FINISHED:** 4/17/10  
**DATE WATER LEVEL WAS MEASURED:** NA  
**TOTAL DEPTH:** 31.2 ft.

**LABORATORY DATA**

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>% CORE RECOVERY</th>
<th>% SILT</th>
<th>% FINE</th>
<th>% SAND</th>
<th>% GRAVEL</th>
<th>LIQUID LIMIT</th>
<th>MOISTURE CONTENT %</th>
<th>LABORATORY CLASSIFICATION</th>
<th>VISUAL CLASSIFICATION</th>
<th>ELEVATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>31.2</td>
<td>100</td>
<td>7.2</td>
<td>2.0</td>
<td>9.2</td>
<td>90.8</td>
<td>NP</td>
<td>NP</td>
<td>SW-SM</td>
<td>88.3</td>
<td></td>
</tr>
<tr>
<td>27.0</td>
<td>100</td>
<td>7.2</td>
<td>2.0</td>
<td>9.2</td>
<td>90.8</td>
<td>NP</td>
<td>NP</td>
<td>SW-SM</td>
<td>88.3</td>
<td></td>
</tr>
<tr>
<td>20.0</td>
<td>100</td>
<td>7.2</td>
<td>2.0</td>
<td>9.2</td>
<td>90.8</td>
<td>NP</td>
<td>NP</td>
<td>SW-SM</td>
<td>88.3</td>
<td></td>
</tr>
<tr>
<td>15.0</td>
<td>100</td>
<td>7.2</td>
<td>2.0</td>
<td>9.2</td>
<td>90.8</td>
<td>NP</td>
<td>NP</td>
<td>SW-SM</td>
<td>88.3</td>
<td></td>
</tr>
<tr>
<td>10.0</td>
<td>100</td>
<td>7.2</td>
<td>2.0</td>
<td>9.2</td>
<td>90.8</td>
<td>NP</td>
<td>NP</td>
<td>SW-SM</td>
<td>88.3</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>100</td>
<td>7.2</td>
<td>2.0</td>
<td>9.2</td>
<td>90.8</td>
<td>NP</td>
<td>NP</td>
<td>SW-SM</td>
<td>88.3</td>
<td></td>
</tr>
<tr>
<td>25.2</td>
<td>100</td>
<td>7.2</td>
<td>2.0</td>
<td>9.2</td>
<td>90.8</td>
<td>NP</td>
<td>NP</td>
<td>SW-SM</td>
<td>88.3</td>
<td></td>
</tr>
<tr>
<td>2.0</td>
<td>100</td>
<td>7.2</td>
<td>2.0</td>
<td>9.2</td>
<td>90.8</td>
<td>NP</td>
<td>NP</td>
<td>SW-SM</td>
<td>88.3</td>
<td></td>
</tr>
</tbody>
</table>

**COMMENTS:**

- 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.

**CLASSIFICATION AND PHYSICAL CONDITION**

- **25.2 to 31.2 ft.:** **Silty Clay, CL/ML:** 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.

**Laboratory Data Interval**
- 27.0 to 28.9 ft.
- T.D. = 31.2 ft.
**GEOLOGIC LOG OF DRILL HOLE NO. MW-10-90**

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

---

**NOTES**

| DEPTH | % CORE RECOVERY | % CLAY | % SILT | % SAND | % GRAVEL | LIQUID LIMIT | PLASTICITY INDEX | MOISTURE CONTENT | LABORATORY CLASSIFICATION | VISUAL CLASSIFICATION | GEOLOGIC UNIT SYMBOL | GEOLGIC UNIT DESCRIPTION | ELEVATION | COMMENTS |
|-------|----------------|--------|--------|--------|----------|--------------|-----------------|-------------------|-------------------------|------------------------|----------------------|------------------------|--------------------------|------------|----------|
| 25    | 62.5           | 32.4   | 94.9   | 5.1    | 0        | 34.0         | 12.9            | 23.1              | SC                      | 76.1                   | SC                   | SC                     | 76.1                     |            |          |
| 30    | 100            | 100    | 100    | 100    | 100      | 100          | 100             | 100               | Qal                     | 73.3                   | Qal                 | Qal                    | 73.3                     |            |          |
|       |                |        |        |        |          |              |                 |                   |                         |                        |                     |                        |                          |            |          |

**BOTTOM OF HOLE**

**ELEVATION**

- **T.O.C ELEVATION:** 103.9 ft. (NAVD88)
- **GROUND SURFACE ELEVATION:** 101.3 ft. (NAVD88)

**PROJECT:** San Joaquin River Restoration Program  
**STATE:** California  
**COORDINATES:** N 2,297,746.3 E 6,099,622.5 (NAD83)

**TOTAL DEPTH:** 31.2 ft.

**REVIEWED BY:** J. Vauk

---

**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.
NOT TO SCALE

NOTES:
T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, E.I. = Elevation

#3 Sand backfills the well above the top of the bentonite seal.
GELOGIC LOG OF DRILL HOLE NO. MW-10-91

DATE: 9/14/2010

ASSOCIATE MANAGER: J. Vauk
REVIEWED BY: A. Warren

PROJECT: San Joaquin River Restoration Program
COORDINATES: N.289,756.4 E.0,986,164.1 (NAD83)
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

REPORT: SJRRP DRILL HOLE PROJECT DATABASE: SJRRP.GPJ

NOTES

ALL MEASUREMENTS ARE IN FEET FROM THE GROUND SURFACE.

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

LOCATION:
Reach 4B1, RM 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 to 2.0 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.

LABORATORY DATA

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>% CORE RECOVERY</th>
<th>% SILT</th>
<th>% CLAY</th>
<th>% SAND</th>
<th>% GRAVEL</th>
<th>LIQUID LIMIT</th>
<th>PLASTICITY INDEX</th>
<th>MOISTURE CONTENT %</th>
<th>LABORATORY CLASSIFICATION</th>
<th>VISUAL CLASSIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0 ft</td>
<td>54</td>
<td>25.7</td>
<td>31.8</td>
<td>57.5</td>
<td>42.6</td>
<td>0.0</td>
<td>30.4</td>
<td>14.1</td>
<td>08.2</td>
<td>s(CL)</td>
</tr>
<tr>
<td>0.0 to 29.8 feet QUATERNARY ALLUVIUM (Qal)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

0.0 to 4.3 ft.: SANDY LEAN CLAY, s(CL): About 55% fines with medium plasticity, toughness, and dry strength; 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 carbonate present.

Laboratory Data Interval
5.5 to 9.6 ft.

9.8 to 10.0 ft.: CLAYEY SAND, SC: About 20% 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.

Laboratory Data Interval
10.0 to 13.7 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% fines 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.

Laboratory Data Interval
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 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  O.D. = outer diameter  NR = No Recovery  G.S. = Ground surface  NA = Not applicable  b.g.s. = Below the ground surface  I.D. = inner diameter  T.O.C. = Top of well casing  RM = River Mile  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.
<table>
<thead>
<tr>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HOLE COMPLETION:</strong></td>
</tr>
<tr>
<td>Well Casing: +2.7 to 12.8 ft. (T.O.C. El. 109.9 ft.)</td>
</tr>
<tr>
<td>Dual U-pack Screen: 12.8 to 27.8 ft.</td>
</tr>
<tr>
<td>(Slotted 0.010-inch)</td>
</tr>
<tr>
<td>Well Screen Filter Pack: 2/12 Sand</td>
</tr>
<tr>
<td>Filter Pack: 7.5 to 29.8 ft. (II3 Sand)</td>
</tr>
<tr>
<td>Sump: 27.8 to 29.8 ft. (2-inch blank PVC with cap)</td>
</tr>
<tr>
<td>Bentonite Seal: 2.0 to 7.5 ft.</td>
</tr>
<tr>
<td>Well Completion: Steel surface casing with locking top, square 6-inches-wide and 5-foot-long.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>% CORE RECOVERY</th>
<th>% SILT</th>
<th>% CLAY</th>
<th>% SAND</th>
<th>% GRAVEL</th>
<th>LIQUID LIMIT</th>
<th>PLASTICITY</th>
<th>MOISTURE CONTENT %</th>
<th>LABORATORY CLASSIFICATION</th>
<th>VISUAL CLASSIFICATION</th>
<th>ELEVATION</th>
<th>ELEVATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>100</td>
<td>45.3</td>
<td>40.8</td>
<td>13.6</td>
<td>0.3</td>
<td>34.4</td>
<td>15.1</td>
<td>26.8</td>
<td>CL</td>
<td>CH</td>
<td>93.5</td>
<td>93.5</td>
</tr>
<tr>
<td>96</td>
<td>96</td>
<td>31.5</td>
<td>14.2</td>
<td>46.7</td>
<td>54.3</td>
<td>0.0</td>
<td>NP</td>
<td>NP</td>
<td>21.0</td>
<td>SC</td>
<td>91.5</td>
<td>91.5</td>
</tr>
<tr>
<td>15</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>100</td>
<td>48.9</td>
<td>30.9</td>
<td>20.2</td>
<td>0.0</td>
<td>31.2</td>
<td>12.4</td>
<td>26.5</td>
<td>(CL)s</td>
<td>CH</td>
<td>87.6</td>
<td>87.4</td>
</tr>
<tr>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**CLASSIFICATION AND PHYSICAL CONDITION**

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.

Laboratory Data Interval
28.0 to 29.8 ft.

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.
**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  

**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  

**REPORT:** SJRRP DRILL HOLE PROJECT DATABASE: SJRRP.GPJ  
**PROJECT:** San Joaquin River Restoration Program  
**COORDINATES:** N 2,289,756.4 E 6,098,164.1 (NAGD83)  
**TOTAL DEPTH:** 29.8 ft.  
**DATE WATER LEVEL DEPTH AND ELEVATION:** NA  

**NOTES**

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>% CORE RECOVERY</th>
<th>% Silt</th>
<th>% Clay</th>
<th>% Sand</th>
<th>% Gravel</th>
<th>MOISTURE CONTENT</th>
<th>VISUAL CLASSIFICATION</th>
<th>VISUAL ELEVATION</th>
<th>LABORATORY DATA</th>
<th>LABORATORY ELEVATION</th>
<th>ELEVATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>47.8</td>
<td>25.7</td>
<td>73.5</td>
<td>26.5</td>
<td>0.0</td>
<td>30.3</td>
<td>(CL)s</td>
<td>86.9</td>
<td>(CL/ML)s</td>
<td>(CL/ML)s</td>
<td>86.8</td>
</tr>
<tr>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>92</td>
<td>34.9</td>
<td>42.4</td>
<td>77.3</td>
<td>22.7</td>
<td>0.0</td>
<td>20.6</td>
<td>(CL)s</td>
<td>79.5</td>
<td>CH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>79.5</td>
<td>79.3</td>
<td>78.8</td>
<td>(CL/ML)s</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>77.4</td>
</tr>
</tbody>
</table>

**BOTTOM OF HOLE**

**COMMENTS:**

- FADC = Flight Auger Dry Core  
- O.D. = outer diameter  
- Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.  
- NP = Non-plastic  
- G.S. = Ground surface  
- NR = No Recovery  
- b.g.s. = Below the ground surface  
- NA = Not applicable  
- T.O.C. = Top of well casing  
- I.D. = inner diameter  
- SJR = San Joaquin River  
- RM = River Mile

**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  

**REPORT:** SJRRP DRILL HOLE PROJECT DATABASE: SJRRP.GPJ  
**PROJECT:** San Joaquin River Restoration Program  
**COORDINATES:** N 2,289,756.4 E 6,098,164.1 (NAGD83)  
**TOTAL DEPTH:** 29.8 ft.  
**DATE WATER LEVEL DEPTH AND ELEVATION:** NA  

**NOTES**

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>% CORE RECOVERY</th>
<th>% Silt</th>
<th>% Clay</th>
<th>% Sand</th>
<th>% Gravel</th>
<th>MOISTURE CONTENT</th>
<th>VISUAL CLASSIFICATION</th>
<th>VISUAL ELEVATION</th>
<th>LABORATORY DATA</th>
<th>LABORATORY ELEVATION</th>
<th>ELEVATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>47.8</td>
<td>25.7</td>
<td>73.5</td>
<td>26.5</td>
<td>0.0</td>
<td>30.3</td>
<td>(CL)s</td>
<td>86.9</td>
<td>(CL/ML)s</td>
<td>(CL/ML)s</td>
<td>86.8</td>
</tr>
<tr>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>92</td>
<td>34.9</td>
<td>42.4</td>
<td>77.3</td>
<td>22.7</td>
<td>0.0</td>
<td>20.6</td>
<td>(CL)s</td>
<td>79.5</td>
<td>CH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>79.5</td>
<td>79.3</td>
<td>78.8</td>
<td>(CL/ML)s</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>77.4</td>
</tr>
</tbody>
</table>

**BOTTOM OF HOLE**

**COMMENTS:**

- FADC = Flight Auger Dry Core  
- O.D. = outer diameter  
- Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.  
- NP = Non-plastic  
- G.S. = Ground surface  
- NR = No Recovery  
- b.g.s. = Below the ground surface  
- NA = Not applicable  
- T.O.C. = Top of well casing  
- I.D. = inner diameter  
- SJR = San Joaquin River  
- RM = River Mile
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.
REPORT: SJRRP DRILL HOLE PROJECT DATABASE: SJRRP.GPJ

**TERMINATION:**

**REASON FOR HOLE:**
Not measured

**WATER LEVEL:**

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Water Level</th>
<th>Reason for Hole</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.5 to 28.5</td>
<td>Water, no return</td>
<td></td>
</tr>
<tr>
<td>0.0 to 13.5</td>
<td>None</td>
<td></td>
</tr>
</tbody>
</table>

**COLOR:**

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Color</th>
<th>Reason for Hole</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.5 to 28.5</td>
<td>Soil caved from the borehole wall</td>
<td></td>
</tr>
<tr>
<td>0.0 to 13.5</td>
<td>Soft to very firm</td>
<td></td>
</tr>
<tr>
<td>4.3 to 8.5</td>
<td>Very soft</td>
<td></td>
</tr>
</tbody>
</table>

**CAVING CONDITIONS:**

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Caving Conditions</th>
<th>Reason for Hole</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.5 to 18.5</td>
<td>Soft to very firm</td>
<td></td>
</tr>
<tr>
<td>8.5 to 13.5</td>
<td>Very soft</td>
<td></td>
</tr>
<tr>
<td>4.3 to 8.5</td>
<td>Very soft</td>
<td></td>
</tr>
</tbody>
</table>

**DRILLER'S COMMENTS:**

**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.

**DRILLING CONDITIONS AND DRILLER'S COMMENTS:**

- 0.0 to 4.3 ft: Smooth drilling, moderately soft; very soft, moved sampler out to 0.4 ft. About 30% 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.
- 4.3 to 8.5 ft: Sand; moist, strong reaction to HCl; hard nodules of calcium carbonate present.
- 8.5 to 9.9 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.
- 9.9 to 10.8 ft: Clayey Sand, SC: 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.
- 10.8 to 28.5 ft: Quaternary Alluvium (QaL): About 95% fine with medium plasticity, toughness, and dry strength, no dilatancy; about 5% fine sand; maximum size: fine sand; moist, dark brown, no reaction to HCl.

**PHYSICAL CONDITION**

**CLASSIFICATION AND PHYSICAL CONDITION:**

- 0.0 to 28.5 feet: Quaternary Alluvium (QaL): 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 10% fine to medium sand; maximum size: medium sand; moist, brown, strong reaction to HCl; firm consistency; sand-sized calcium carbonate 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 carbonate present.
- 8.9 to 9.9 ft: Sandy 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.
- 9.9 to 10.8 ft: Clayey Sand, SC: About 90% 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.
- 10.8 to 28.5 ft: Quaternary Alluvium (QaL): About 95% fine with medium plasticity, toughness, and dry strength, no dilatancy; about 5% fine sand; maximum size: fine sand; moist, dark brown, no reaction to HCl.
<table>
<thead>
<tr>
<th>DEPTH</th>
<th>% CORE RECOVERY</th>
<th>% CLAY</th>
<th>% FINES</th>
<th>% SAND</th>
<th>% GRAVEL</th>
<th>LIQUID LIMIT</th>
<th>PLASTICITY INDEX</th>
<th>MOISTURE CONTENT %</th>
<th>VISUAL CLASSIFICATION</th>
<th>ELEVATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2.7</td>
<td>7.5</td>
<td>91.8</td>
<td>0.6</td>
<td>NP</td>
<td>NP</td>
<td>10.5</td>
<td>SC</td>
<td>95.2</td>
</tr>
<tr>
<td>15</td>
<td>20</td>
<td>92.7</td>
<td>92.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>40</td>
<td>4.8</td>
<td>2.7</td>
<td>75.5</td>
<td>25.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23.5</td>
<td>25</td>
<td>13.5</td>
<td>12.5</td>
<td>65.0</td>
<td>20.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25.2</td>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25.6</td>
<td>15</td>
<td>25.6</td>
<td>26.6</td>
<td>75.0</td>
<td>25.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26.4</td>
<td>20</td>
<td>26.4</td>
<td>27.4</td>
<td>85.0</td>
<td>15.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28.5</td>
<td>20</td>
<td></td>
<td>28.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**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. (Silt 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.

**LABORATORY DATA:***
- **Visual Classification:**
  - 10.8 to 13.5 ft.: Poorly Graded Sand, SP:
  - 13.5 to 23.5 ft.: No Recovery - Poorly Graded Sand with Silt, SP/SM:
- **Physical Condition:**
  - 23.5 to 25.2 ft.: Silt with Sand, (ML)s:
  - 25.2 to 25.6 ft.: Silty Sand, SM:
  - 26.4 to 28.5 ft.: No Recovery - Silty Sand, SM:

**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
- b.g.s. = Below the ground surface
- T.O.C. = Top of well casing
- SJR = San Joaquin River
- RM = River Mile

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.
<table>
<thead>
<tr>
<th>DEPTH</th>
<th>%CORE RECOVERY</th>
<th>% SILT</th>
<th>% CLAY</th>
<th>% FINE S</th>
<th>% SAND</th>
<th>% GRAVEL</th>
<th>LIQUID LIMIT</th>
<th>PLASTICITY INDEX</th>
<th>MOISTURE CONTENT</th>
<th>CLASSIFICATION AND PHYSICAL CONDITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SP/SM</td>
</tr>
<tr>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>81.0</td>
<td></td>
<td></td>
<td>Q̅l</td>
</tr>
<tr>
<td>58</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>80.8</td>
<td></td>
<td></td>
<td>SM</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>80.4</td>
<td></td>
<td></td>
<td>(ML)s</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>79.6</td>
<td></td>
<td></td>
<td>SM</td>
</tr>
</tbody>
</table>

**LABORATORY DATA**

- **ELEVATION**

**COMMENTS:**

- **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
- **FADC** = Flight Auger Dry Core
- **NP** = Non-plastic
- **NR** = No Recovery
- **NA** = Not applicable

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

**DATE:** 9/14/2010 **SHEET:** 3 OF 3 **DRILL HOLE** MW-10-92
NOT TO SCALE

NOTES:
T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, EI. = Elevation
#3 Sand backfills the well above the top of the bentonite seal.
# GEOLOGIC LOG OF DRILL HOLE NO. MW-10-93

**PROJECT:** San Joaquin River Restoration Program  
**LOCATION:** Reach 4A, River Bank Right, RM 168.9  
**TOTAL DEPTH:** 26.5 ft.  
**TERMINATION:** The hole was terminated upon successful completion to the target depth.

## 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.

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

## 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.

## OBSERVATIONS:

<table>
<thead>
<tr>
<th>Interval</th>
<th>Color</th>
<th>Texture</th>
<th>Plasticity</th>
<th>Plasticity Index</th>
<th>Moisture Content</th>
<th>Consistency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0 to 4.4 ft.</td>
<td>Sandy Fat Clay, CH/SC</td>
<td>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.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.4 to 7.6 ft.</td>
<td>Sandy Lean Clay, s(CL)</td>
<td>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.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.6 to 8.5 ft.</td>
<td>Lean Clay, CL</td>
<td>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.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.5 to 9.0 ft.</td>
<td>Sandy Lean Clay, s(CL)</td>
<td>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.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.0 to 19.0 ft.</td>
<td>Poorly Graded Sand with Silt, SP/SM</td>
<td>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.; traces of SP/SM and SM were found in sample barrel.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19.0 to 23.6 ft.</td>
<td>Silty Sand, SM</td>
<td>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.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23.6 to 26.2 ft.</td>
<td>Lean Clay with Sand, (CL)s</td>
<td>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.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26.2 to 26.5 ft.</td>
<td>Silty Sand, SM</td>
<td>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.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## LABORATORY DATA:

### CLASSIFICATION AND PHYSICAL CONDITION

<table>
<thead>
<tr>
<th>Interval</th>
<th>% Clay</th>
<th>% Silt</th>
<th>% Sand</th>
<th>% Gravel</th>
<th>Liquid Limit</th>
<th>Plasticity Index</th>
<th>Moisture Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0 to 2.8 ft.</td>
<td>25.9</td>
<td>25.3</td>
<td>48.8</td>
<td>0.0</td>
<td>27.5</td>
<td>11.2</td>
<td>16.7</td>
</tr>
<tr>
<td>2.8 to 7.6 ft.</td>
<td>101.2</td>
<td>0.0</td>
<td>0.0</td>
<td>104.1</td>
<td>s(CL)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.6 to 8.5 ft.</td>
<td>35.1</td>
<td>33.5</td>
<td>66.6</td>
<td>31.4</td>
<td>0.0</td>
<td>35.2</td>
<td>21.6</td>
</tr>
<tr>
<td>8.5 to 9.0 ft.</td>
<td>100.0</td>
<td>0.0</td>
<td>0.0</td>
<td>5.9</td>
<td>s(CL)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.0 to 19.0 ft.</td>
<td>97.8</td>
<td>0.0</td>
<td>0.0</td>
<td>2.2</td>
<td>CL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19.0 to 23.6 ft.</td>
<td>96.5</td>
<td>0.0</td>
<td>0.0</td>
<td>3.5</td>
<td>s(CL)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23.6 to 26.2 ft.</td>
<td>96.4</td>
<td>0.0</td>
<td>0.0</td>
<td>3.6</td>
<td>SP/SM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26.2 to 26.5 ft.</td>
<td>28.0</td>
<td>0.0</td>
<td>0.0</td>
<td>72.0</td>
<td>SP/SM</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## NOTES:

ALL MEASUREMENTS ARE IN FEET FROM THE GROUND SURFACE.

### WATER LEVEL:

- **BEGUN:** 4/3/10  
- **FINISHED:** 4/3/10  
- **9.3 ft. b.g.s (El. 96.1 ft.)**

### DRILL FLUID, RETURN AND CAVING CONDITIONS:

- **DRILL FLUID:** None  
- **RETURN:** None  
- **CAVING CONDITIONS:** None  
- **DRILLER'S COMMENTS:** None  
- **WATER LEVEL DEPTH AND ELEVATION:** 9.3 ft. b.g.s (El. 96.1 ft.)

### VISUAL CLASSIFICATION:

- **Surface:** Light brown, no reaction with HCl; tight, dry, low toughness, non-plastic fines with rapid dilatancy; maximum size: medium sand; moist, light brown, no reaction with HCl; soft consistency.

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

| Interval | GEOLOGIC UNIT | SYMBOL | T.O.C ELEVATION | HOLE LOGGED BY | T.O.C.
|----------|---------------|--------|-----------------|----------------|--------|
| 0.0 to 4.4 ft. | Sandy Fat Clay | CH/SC | 108.5 ft. (NAVD88) | J. Vauk | SP/SM-SM
| 4.4 to 7.6 ft. | Sandy Lean Clay | s(CL) | 104.1 ft. (NAVD88) | J. Vauk | CP
| 7.6 to 8.5 ft. | Lean Clay | CL | 100.0 ft. (NAVD88) | J. Vauk | CP
| 8.5 to 9.0 ft. | Sandy Lean Clay | s(CL) | 97.8 ft. (NAVD88) | J. Vauk | CP
| 9.0 to 19.0 ft. | Poorly Graded Sand with Silt | SP/SM | 96.5 ft. (NAVD88) | J. Vauk | CP
| 19.0 to 23.6 ft. | Silty Sand | SM | 96.4 ft. (NAVD88) | J. Vauk | SP/SM
| 23.6 to 26.2 ft. | Lean Clay with Sand | (CL)s | 28.0 ft. (NAVD88) | J. Vauk | SP/SM
| 26.2 to 26.5 ft. | Silty Sand | SM | 0.0 ft. (NAVD88) | J. Vauk | SP/SM

### LABORATORY DATA:

<table>
<thead>
<tr>
<th>Interval</th>
<th>% Clay</th>
<th>% Silt</th>
<th>% Sand</th>
<th>% Gravel</th>
<th>Liquid Limit</th>
<th>Plasticity Index</th>
<th>Moisture Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0 to 2.8 ft.</td>
<td>25.9</td>
<td>25.3</td>
<td>48.8</td>
<td>0.0</td>
<td>27.5</td>
<td>11.2</td>
<td>16.7</td>
</tr>
<tr>
<td>2.8 to 7.6 ft.</td>
<td>101.2</td>
<td>0.0</td>
<td>0.0</td>
<td>104.1</td>
<td>s(CL)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.6 to 8.5 ft.</td>
<td>35.1</td>
<td>33.5</td>
<td>66.6</td>
<td>31.4</td>
<td>0.0</td>
<td>35.2</td>
<td>21.6</td>
</tr>
<tr>
<td>8.5 to 9.0 ft.</td>
<td>100.0</td>
<td>0.0</td>
<td>0.0</td>
<td>5.9</td>
<td>s(CL)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.0 to 19.0 ft.</td>
<td>97.8</td>
<td>0.0</td>
<td>0.0</td>
<td>2.2</td>
<td>CL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19.0 to 23.6 ft.</td>
<td>96.5</td>
<td>0.0</td>
<td>0.0</td>
<td>3.5</td>
<td>s(CL)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23.6 to 26.2 ft.</td>
<td>96.4</td>
<td>0.0</td>
<td>0.0</td>
<td>3.6</td>
<td>SP/SM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26.2 to 26.5 ft.</td>
<td>28.0</td>
<td>0.0</td>
<td>0.0</td>
<td>72.0</td>
<td>SP/SM</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## GEOLOGIC LOG OF DRILL HOLE NO. MW-10-93

**FEATURE:** Groundwater Monitoring  
**LOCATION:** Reach 4A, River Bank Right, RM 168.9  
**COREN:** 4/3/10 **FINISHED:** 4/3/10  
**TOTAL DEPTH:** 26.5 ft.  
**WATER LEVEL DEPTH AND ELEVATION:** 9.3 ft. b.g.s (El. 96.1 ft.)  
**DATE WATER LEVEL WAS MEASURED:** 4/17/2010

### NOTES

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>% CORE RECOVERY</th>
<th>% Silt</th>
<th>% Clay</th>
<th>% Fine Clays</th>
<th>% Sand</th>
<th>% Gravel</th>
<th>Liquid Limit</th>
<th>Plasticity Index</th>
<th>Classification</th>
<th>Elevation</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SP/SM</td>
<td></td>
</tr>
<tr>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SM</td>
<td></td>
</tr>
<tr>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>86.4</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>91.6</td>
</tr>
<tr>
<td>91.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 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:** 6.0 to 25.5 ft. (Gravel)
- **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.

### LABORATORY DATA

The laboratory data includes the following:
- **Visual Classification:** SP/SM
- **Moisture Content:** 20.1
- **Plasticity Index:**

### CLASSIFICATION AND PHYSICAL CONDITION

**STATE:** California  
**GROUND SURFACE ELEVATION:** 105.4 ft. (NAVD88)  
**T.O.C ELEVATION:** 108.5 ft. (NAVD88)

**PROJECT:** San Joaquin River Restoration Program

**LOCATION:** Reach 4A, River Bank Right, RM 168.9

**DATE WATER LEVEL WAS MEASURED:** 4/17/2010

**REPORT:** SJRRP DRILL HOLE PROJECT DATABASE: SJRRP.GPJ

**COMMENTS:**
- Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.
**FEATURE:** Groundwater Monitoring  
**LOCATION:** Reach 4A, River Bank Right, RM 168.9  
**BEGUN:** 4/3/10  
**FINISHED:** 4/3/10  
**TOTAL DEPTH:** 26.5 ft.  
**GROUND SURFACE ELEVATION:** 105.4 ft. (NAVD88)  
**T.O.C ELEVATION:** 108.5 ft. (NAVD88)  
**DATE WATER LEVEL WAS MEASURED:** 4/17/2010  
**WATER LEVEL DEPTH AND ELEVATION:** 9.3 ft. b.g.s (El. 96.1 ft.)

### LABORATORY DATA

<table>
<thead>
<tr>
<th>ELEVATION</th>
<th>% SILT</th>
<th>% CLAY</th>
<th>% FINE S</th>
<th>% SAND</th>
<th>% GRAVEL</th>
<th>LIQUID LIMIT</th>
<th>PLASTIC LIMIT</th>
<th>MOISTURE CONTENT</th>
<th>VISUAL CLASSIFICATION</th>
<th>ELEVATION</th>
<th>CLASSIFICATION AND PHYSICAL CONDITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>82.0</td>
<td>6.8</td>
<td>26.2</td>
<td>73.8</td>
<td>0.0</td>
<td>NP</td>
<td>NP</td>
<td>20.5</td>
<td>SM</td>
<td>SM</td>
<td>81.8</td>
<td></td>
</tr>
<tr>
<td>79.4</td>
<td>12.4</td>
<td>74.7</td>
<td>25.3</td>
<td>0.0</td>
<td>23.3</td>
<td>4.9</td>
<td>21.4</td>
<td>(CL-ML)s</td>
<td>(CL)s</td>
<td>79.2</td>
<td></td>
</tr>
<tr>
<td>78.9</td>
<td>19.4</td>
<td>68.2</td>
<td>25.8</td>
<td>0.0</td>
<td>NP</td>
<td>NP</td>
<td>20.5</td>
<td>SM</td>
<td>SM</td>
<td>78.9</td>
<td></td>
</tr>
</tbody>
</table>

**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
- **b.g.s.** = Below the ground surface
- **T.O.C.** = Top of well casing
- **SJR** = San Joaquin River
- **CL** = Clay
- **ML** = Mudstone
- **SM** = Silt
- **NP** = Non-plastic
- **NR** = No Recovery
- **NA** = Not applicable

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.
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.
**REPORT:** SJRRP DRILL HOLE PROJECT DATABASE: SJRRP.GPJ

**Bottom Backfill:** 14.6 to 15.6 ft. (Soil (Bentonite) Bottom Backfill: 15.6 to 28.6 ft. PVC with cap)

**Sump:** 13.6 to 14.6 ft. (2-inch blank Filter Pack: 7.0 to 14.6 ft. (#3 Sand) Well Screen Filter Pack: 2/12 Sand (Slotted 0.010-inch) Dual U-pack Screen: 8.6 to 13.6 ft. El. 120.0 ft.)

**HOLE COMPLETION:**
The hole was terminated upon completion diagram. Well development information is provided in attached Monitoring Well Development form.

**TERMINATION:**

**REASON FOR HOLE:**
Not measured

**COLOR:**
DRILL FLUID, RETURN AND 8.6 to 28.6 ft. – Water, no return 0.0 to 8.6 ft. – None

**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 14.8 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)

**NOTES**

**CLASSIFICATION AND PHYSICAL CONDITION**

0.0 to 28.6 feet QUATERNARY ALLUVIUM (Qa)

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.

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.

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; dry, brown, no reaction to HCl; soft consistency.

14.4 to 17.3 ft.: LEAN CLAY WITH SAND, CL/ML: 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.

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% fines 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.

20.2 to 23.6 ft.: No Recovery.
### GEOLOGIC LOG OF DRILL HOLE NO. MW-10-188

**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

**REPORT:** SJRRP DRILL HOLE PROJECT DATABASE: SJRRP.GPJ

---

#### LABORATORY DATA

<table>
<thead>
<tr>
<th>Depth</th>
<th>% Core Recovery</th>
<th>% Silt</th>
<th>% Clay</th>
<th>% Fines</th>
<th>% Sand</th>
<th>% Gravel</th>
<th>Liquid Limit</th>
<th>Plasticity Index</th>
<th>Moisture Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>100</td>
<td>52.0</td>
<td>25.7</td>
<td>77.7</td>
<td>22.3</td>
<td>0.0</td>
<td>30.8</td>
<td>15.4</td>
<td>22.3</td>
</tr>
</tbody>
</table>

**CLASSIFICATION AND PHYSICAL CONDITION**

- **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.

- **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**

**T.D. = 28.6 ft.**

**TOTAL DEPTH:** 28.6 ft.

---

### NOTES

- 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.

---

**COMMENTS:**

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

---

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

---

**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
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  
**PROJECT:** San Joaquin River Restoration Project  
**LOCATION:** Reach 4A, River Bank Left, Merced County  
**BEGUN:** 11/19/10  
**FINISHED:** 11/19/10  
**COORDINATES:** N 2,276,117.6 E 6,089,808.7 NAD83  
**DEPT ION ELEVATION:** 108.1 ft. NADV88  
**DEPTH TO BEDROCK:** Not Encountered  
**ANGLE FROM HORIZONTAL:** -90°  
**HOLE LOGGED BY:** G. Perea  
**REVIEWED BY:** S. Dalton  
**STATE:** California  

### 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  
- 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

#### 0.0 to 31.1 ft.
**FADC**

### DRILLING CONDITIONS AND DRILLER’S COMMENTS:
0.0 to 3.8 ft. - Soft  
3.8 to 6.6 ft. - Moderate soft  
6.6 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.

### CLASSIFICATION AND PHYSICAL CONDITION

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>% CORE RECOVERY</th>
<th>&lt;0.0035</th>
<th>&lt;0.075</th>
<th>% GRAY</th>
<th>% SAND</th>
<th>LIQUID LIMIT</th>
<th>PLASTICITY INDEX</th>
<th>LABORATORY DATA</th>
<th>CLASSIFICATION AND PHYSICAL CONDITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>100.0</td>
<td>62</td>
<td>43.2</td>
<td>32.5</td>
<td>24.3</td>
<td>0.0</td>
<td>44.3</td>
<td>26.3</td>
<td>21.8 (ML)</td>
</tr>
</tbody>
</table>
| 0.3   | 2.0 ft.        | 0.3 to 2.0 ft. LEAN CLAY WITH SAND, (CL):
|       |                | 0.0 to 0.3 ft. Silt with sand, (ML):
| 2.0   | 4.0 ft.        | 2.0 to 4.0 ft.  
| 6.1   | 7.2 ft.        | 6.1 to 7.2 ft.  
| 10.0  | 14.6 ft.       | 10.0 to 14.6 ft.  
| 14.6  | 28.2           | 14.2 to 14.6 ft.  

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

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.
**GEOLOGIC LOG OF DRILL HOLE NO. MW-10-115**

**PROJECT:** San Joaquin River Restoration Project  
**LOCATION:** Reach 4A, River Bank Left, Merced County  
**BEGIN:** 11/19/10  
**FINISHED:** 11/19/10  
**DEPT AND ELEVATION OF WATER LEVEL AND DATE MEASURED:** 6.70 ft. (724.3 ft. - 12/09/2010)

**FEATURE:** Groundwater Monitoring  
**BEGUN:** 11/19/10  
**FINISHED:** 11/19/10  
**PROJECT:** San Joaquin River Restoration Project  
**CLASSIFICATION AND PHYSICAL CONDITION**

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>% CORE RECOVERY</th>
<th>&lt;0.005</th>
<th>&lt;0.075</th>
<th>% GRAVEL</th>
<th>LIQUID LIMIT</th>
<th>PLASTICITY INDEX</th>
<th>CONTENT</th>
<th>GEOL OLOGIC LOG</th>
<th>CLASSIFICATION</th>
<th>PHYSICAL CONDITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>22.6</td>
<td>22.6</td>
<td>22.2</td>
<td>8.8</td>
<td>88.0</td>
<td>1.0</td>
<td>NP</td>
<td>NA</td>
<td>SW-SP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24.0</td>
<td>24.0</td>
<td>1.9</td>
<td>7.4</td>
<td>88.8</td>
<td>1.9</td>
<td>NP</td>
<td>22.3</td>
<td>SP-SM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>27.6</td>
<td>27.6</td>
<td>14.6</td>
<td>20.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>14.6 to 20.1 ft.</td>
<td>POORLY GRADED SAND</td>
</tr>
<tr>
<td>28.6</td>
<td>28.6</td>
<td>24.5</td>
<td>26.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>24.5 to 28.6 ft.</td>
<td>POORLY GRADED SAND</td>
</tr>
</tbody>
</table>

**COMMENTS:**

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

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.
San Joaquin River Restoration Program
U.S. Department of Interior, Bureau of Reclamation

MONITORING WELL DEVELOPMENT

Facility/Project Name: SJRRP
County Name: —
Well Name: M10-115
Wk Unique Well Number: —
DNW 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
   - bailer only
     □ 10
   - pumped slowly
     □ 51
   - 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
   □ —

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

7. Volume of water removed from well
   □ 30.3 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)

11. Depth to Water
    - Before Development: — ft.
    - After Development: — ft.

12. Sediment in well
    - Before Development: — inches
    - After Development: — inches

13. Water clarity
    - Before Development: Clear □ 10
    - After Development: Clear □ 20
    (Describe)

14. Total suspended solids
    □ — mg/l

15. COD
    □ — mg/l

16. Well developed by: Name (first, last, and firm)
    First: □ 12 □ 144
    Last: □ 12 □ 144
    Firm: □ 12 □ 144

17. Additional comments on development:
    —

Name and Address of Facility/Contact Owner/Responsible Party
First: — Last: —
Name: —

Facility/Nei:

Street: —

City/State/Zip: —

Signature: —
Print Name: —
Firm: —

I hereby certify that the above information is true and correct to the best of my knowledge.

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

### 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) 72

### 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.

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

### WEIGHTED AVERAGE LABORATORY DATA:

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Percent Core Recovery (&lt;0.035)</th>
<th>Percent Sand</th>
<th>Percent Clay</th>
<th>Plasticity Index</th>
<th>Liquid Limit</th>
<th>Plasticity Content</th>
<th>Classification</th>
<th>Index Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0 to 0.2</td>
<td>61</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>FADC</td>
<td></td>
</tr>
<tr>
<td>0.2 to 2.1</td>
<td>17.3</td>
<td>48.3</td>
<td>34.4</td>
<td>0.0</td>
<td>29.1</td>
<td>7.8</td>
<td>CL</td>
<td>CL-ML</td>
</tr>
<tr>
<td>2.1 to 4.2</td>
<td>5.7 to 13.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.7 to 13.0</td>
<td>19.5 to 20.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>LEAN CLAY WITH SAND, CL(s)</td>
<td></td>
</tr>
<tr>
<td>13.0 to 15.7</td>
<td>18.4 to 21.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>LEAN CLAY WITH SAND, CL(s)</td>
<td></td>
</tr>
<tr>
<td>15.7 to 18.4</td>
<td>4.2 to 5.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>LEAN CLAY WITH SAND, CL(s)</td>
<td></td>
</tr>
</tbody>
</table>

### CLASSIFICATION AND PHYSICAL CONDITION:

**0.0 to 31.1 ft. QUATERNARY ALLUVIUM - Qal**

- **0.0 to 0.2 ft. ASPHALT**
  - About 70% fines with low to medium plasticity, low toughness, rapid dilatancy; about 30% fine sand; dry, brown to dark brown; top 1.0 ft. lightly cemented and broken up from drilling activity.
- **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 to dark 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 (predominantly 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 (predominantly fine), hard, subbounded; about 30% fines with low plasticity; dry, tan to light brown; while 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.

**Qal**

- **18.4 to 21.6 ft. SILTY SAND, SM:**
  - About 60% fine sand; about 40% fines with low plasticity, low toughness; wet, brown; firm consistency.
- **19.5 to 21.6 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.

**Qal**

- **19.5 to 20.5 ft.**
  - About 80-85% fine sand; about 15-20% fines with low plasticity; wet, brown; firm consistency; coarsens downwards; trace medium sand.

---

**NOTES:**
All measurements are in feet from the ground surface.

**LABORATORY DATA:**

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Percent Core Recovery (&lt;0.035)</th>
<th>Percent Sand</th>
<th>Percent Clay</th>
<th>Plasticity Index</th>
<th>Liquid Limit</th>
<th>Plasticity Content</th>
<th>Classification</th>
<th>Index Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0 to 0.2</td>
<td>61</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>FADC</td>
<td></td>
</tr>
<tr>
<td>0.2 to 2.1</td>
<td>17.3</td>
<td>48.3</td>
<td>34.4</td>
<td>0.0</td>
<td>29.1</td>
<td>7.8</td>
<td>CL</td>
<td>CL-ML</td>
</tr>
<tr>
<td>2.1 to 4.2</td>
<td>5.7 to 13.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.7 to 13.0</td>
<td>19.5 to 20.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>LEAN CLAY WITH SAND, CL(s)</td>
<td></td>
</tr>
<tr>
<td>13.0 to 15.7</td>
<td>18.4 to 21.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>LEAN CLAY WITH SAND, CL(s)</td>
<td></td>
</tr>
<tr>
<td>15.7 to 18.4</td>
<td>4.2 to 5.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>LEAN CLAY WITH SAND, CL(s)</td>
<td></td>
</tr>
</tbody>
</table>

**Qal**

- **19.5 to 21.6 ft.**
  - 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  O.D. = outer diameter
NP = Non-plastic  G.S. = Ground surface
NR = No Recovery  T.O.C. = Top of well casing
NA = Not applicable  SJR = San Joaquin River
I.D. = inner diameter

**Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.**
### GEOLOGIC LOG OF DRILL HOLE NO. MW-10-116

**FEATURE:** Groundwater Monitoring  
**LOCATION:** Reach 4A, River Bank Right, Merced County  
**BEgun:** 11/20/10  
**FINISHED:** 11/20/10  
**TOTAL DEPTH:** 31.1 ft.  
**DEPTH TO BEDROCK:** Not Encountered  
**GROUND ELEVATION:** 105.3 ft. NAD88  
**ANGLE FROM HORIZONTAL:** -90°  
**REVIEWED BY:** A. Warren/G. Perea  

### CLASSIFICATION AND PHYSICAL CONDITION

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>% CORE RECOVERY</th>
<th>% SAND</th>
<th>% GRAY</th>
<th>LIQUID LIMIT</th>
<th>PLASTICITY INDEX</th>
<th>MOISTURE CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>25.0</td>
<td>100</td>
<td>92.8</td>
<td>0.0</td>
<td>18.5</td>
<td>SP-SM</td>
<td>76.3</td>
</tr>
<tr>
<td>30.0</td>
<td>100</td>
<td>96.2</td>
<td>0.0</td>
<td>33.1</td>
<td>CL</td>
<td>74.3</td>
</tr>
</tbody>
</table>

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

**28.2 to 29.5 ft. SILTY SAND, SM:**  
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. LEAN CLAY WITH SILT, CL/ML:**  
About 95% fines with low plasticity, low toughness; about 5% fine sand; moist, brown; firm consistency.  

**Lab Data Interval:**  
25.0 to 26.0 ft.  
30.0 to 31.0 ft.

### LABORATORY DATA

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>% CORE RECOVERY</th>
<th>% GRAVEL</th>
<th>LIQUID LIMIT</th>
<th>PLASTICITY INDEX</th>
<th>MOISTURE CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>25.0</td>
<td>100</td>
<td>0.0</td>
<td>18.5</td>
<td>SP-SM</td>
<td>76.3</td>
</tr>
<tr>
<td>30.0</td>
<td>100</td>
<td>0.0</td>
<td>33.1</td>
<td>CL</td>
<td>74.3</td>
</tr>
</tbody>
</table>

**COMMENTS:**  
Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.
**San Joaquin River Restoration Program**  
U.S. Department of Interior, Bureau of Reclamation

**MONITORING WELL DEVELOPMENT**

<table>
<thead>
<tr>
<th>Facility/Project Name</th>
<th>County Name</th>
<th>Well Name</th>
<th>Wk. Unique Well Number</th>
<th>DNR Well ID Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>SFRRP</td>
<td></td>
<td>MW-10-116</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Can this well be pumped dry? Yes [ ] No [x]  
2. Well development method:  
   - surging with bailer and bailed: 4 1  
   - surging with bailer and pumped: 6 1  
   - surging with black and bailed: 4 2  
   - surging with black and pumped: 6 2  
   - pumped only: 7 0  
   - pumped slowly: 2 0  
   - drilled only: 1 0  
   - drilled slowly: 0 9  
   - Other:  

3. Time spent developing well:  25.7 min.  
4. Depth of well (from top of well casing): 28 ft.  
5. Inside diameter of well: 2 0 in.  
6. Volume of water in filter pack and well casing:  
7. Volume of water removed from well: 26 gal.  
8. Volume of water added (if any):  
9. Source of water added:  
10. Analysis performed on water added? Yes [ ] No [x]  
   (If yes, attach results)  
11. Depth to Water (from top of well casing):  
   Date: 2022/01/01  
   Time: 1:30 p.m.  
12. Sediment in well bottom:  
13. Water clarity:  
   -- Clear [ ] -- Cloudy [ ]  
   Turbidity: 15  
   Turbidity: 25  
   (Describe)  
14. Total suspended solids:  
   mg/L:  
15. COD:  
   mg/L:  
16. Well developed by:  
   (First, last, and firm name)  
   Jeremy Last Name: Clean  
   Firm:  

**Addendum comments on development:**  
1999.09.30 Drill Spal (Clearwell)  
1003-1005 Complete Spal (Clearwell)  
1007-1009 Complete Spal (Clearwell)  
1012-1014 Complete Spal (Clearwell)  
1015-1017 Complete Spal (Clearwell)  

---

Name and Address of Facility/Project/Person Responsible for:  
First Name:  
Last Name:  
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.
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  
**DEPHT AND ELEVATION OF WATER LEVEL**  
**AND DATE MEASURED:** 4.6 ft. (117.4 ft. - 5/15/2011)

### NOTES

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>% CORE RECOVERY</th>
<th>% SAND</th>
<th>% GRAVEL</th>
<th>LIQUID LIMIT</th>
<th>PLASTICITY INDEX</th>
<th>FINEST CONTENT</th>
<th>CLASSIFICATION</th>
<th>CLASSIFICATION SYMBOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>&lt;0.005</td>
<td>100.0</td>
<td>&lt;0.005</td>
<td>36.2</td>
<td>47.3</td>
<td>0.0</td>
<td>NP</td>
<td>CL</td>
</tr>
<tr>
<td>3.1 to 4.4 ft. SANDY SILT, s(ML):</td>
<td>About 65% fines with no plasticity; rapid dilatancy, low toughness; moist, brown; trace clumps of plastic soil.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.4 to 5.1 ft. SILTY SAND, SM:</td>
<td>About 75% fine, micaceous sand; about 25% fines with no plasticity, no toughness; moist, brown.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.1 to 13.6 ft. SILTY SAND, SM:</td>
<td>About 85% fine to medium, micaceous sand; about 15% fines with no plasticity; wet, brown; layered.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.6 to 15.2 ft. SANDY SILT, s(ML):</td>
<td>About 65% fines with no plasticity, rapid dilatancy, no toughness; about 35% fine, micaceous sand; wet, brown with reddish brown oxidation layers; finely layered.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.2 to 15.5 ft. CLAYEY SAND, SC:</td>
<td>About 65% fine sand; about 35% fines with medium plasticity; wet, gray; micaceous; firm.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.5 to 16.1 ft. LEAN CLAY, CL:</td>
<td>About 90% fines with low plasticity, high dry strength; low toughness; about 10% fine sand; moist, gray; CaCO3; very fine silty layers abundant, very firm.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16.1 to 17.0 ft. SANDY LEAN CLAY, s(CL):</td>
<td>About 65% fines with medium plasticity, medium toughness; about 35% fine sand; moist, finely layered gray-brown and reddish-brown; very firm.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**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

**DEEP & 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.

**DRILLING & SAMPLING METHODS:**

<table>
<thead>
<tr>
<th>Lab Data Interval</th>
<th>3.5 to 4.0 ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.4 to 5.1 ft.</td>
<td>SILTY SAND, SM:</td>
</tr>
<tr>
<td>5.1 to 13.6 ft.</td>
<td>SILTY SAND, SM:</td>
</tr>
<tr>
<td>13.6 to 15.2 ft.</td>
<td>SANDY SILT, s(ML):</td>
</tr>
<tr>
<td>15.2 to 15.5 ft.</td>
<td>CLAYEY SAND, SC:</td>
</tr>
<tr>
<td>15.5 to 16.1 ft.</td>
<td>LEAN CLAY, CL:</td>
</tr>
<tr>
<td>16.1 to 17.0 ft.</td>
<td>SANDY LEAN CLAY, s(CL):</td>
</tr>
</tbody>
</table>

**REVIEWED BY:** T. Lewis
**GEOLOGIC LOG OF DRILL HOLE NO. MW-11-130**

**LOCATION:** Reach 4A, River Bank Left, RM 180, Fresno County  
**DEPTHE AND ELEVATION OF WATER LEVEL**  
**AND DATE MEASURED:** 4.6 ft. (117.4 ft. - 5/15/2011)

**FEATURE:** Groundwater Monitoring  
**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  
**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 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

---

### LABORATORY DATA

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>% CORE RECOVERY</th>
<th>&lt;0.005%</th>
<th>&lt;0.0075%</th>
<th>% GRANULE</th>
<th>LIQUID LIMIT</th>
<th>PLASTICITY INDEX</th>
<th>LABORATORY CLASSIFICATION</th>
<th>CLASSIFICATION SYMBOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.2</td>
<td>31.7</td>
<td>66.1</td>
<td>12.2</td>
<td>0.0</td>
<td>29.4</td>
<td>12.7</td>
<td>CL</td>
<td>106.0</td>
</tr>
<tr>
<td>21.3</td>
<td>21.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

### 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 CaCO₃ as in other layers but reacts moderately with HCL.

**19.6 to 21.1 ft. SILTY SAND, SM:**
About 70% fine sand; about 30% fines with low plasticity; moist, brown with very abundant white CaCO₃ 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 CaCO₃; strong reaction with HCl; contains SILTY SAND, SM layers.

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

MW-11-130
GEOLOGIST: A. Warren
WELL COMPLETION DIAGRAM
DRILLER: C. Peterson
DATE COMPLETED: 4/15/2011
HELPERS: D. Read & C. Kelly

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

<table>
<thead>
<tr>
<th>Facility/Project Name</th>
<th>County Name</th>
<th>Well Name</th>
<th>County Code</th>
<th>WIS Unique Well Number</th>
<th>DNR Well ID Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>SJRRP</td>
<td>MERCED</td>
<td>W-3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 1. Can this well be purged dry?
- Yes [ ]
- No [x]

#### 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 [x] 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 casing)
- 21 ft.

#### 5. Inside diameter of well
- 2 in.

#### 6. Volume of water in filter pack and well casing
- 55 gal.

#### 7. Volume of water removed from well
- 55 gal.

#### 8. Volume of water added (if any)
- 55 gal.

#### 9. Source of water added

#### 10. Analysis performed on water added?
- Yes [ ]
- No [ ]

#### 11. Depth to Water
- Before Development: 7.6 ft.
- After Development: 8.1 ft.

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>05/15/2011</td>
<td>2:00 p.m.</td>
</tr>
</tbody>
</table>

#### 12. Sediment in well bottom
- _ _ _ inches

#### 13. Water clarity
- Clear [ ]
- Turbid [ ]

<table>
<thead>
<tr>
<th>(Describe)</th>
<th>(Describe)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brown</td>
<td>5 HWP</td>
</tr>
</tbody>
</table>

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

#### 14. Total suspended solids
- mg/l

#### 15. COD
- 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 VALUE FOR SEVERAL MINUTES UNTIL PUMPED 5 GALS.
- PUMPED WITH SUMP PUMP UNTIL CLEAN ABOUT 50 GALS.

---

**Name and Address of Facility Contact/Owner/Responsible Party**

<table>
<thead>
<tr>
<th>First Name</th>
<th>Last Name</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Facility/Firm:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Street:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>City/State/Zip:</th>
</tr>
</thead>
</table>

---

**I hereby certify that the above information is true and correct to the best of my knowledge.**

<table>
<thead>
<tr>
<th>Signature:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Print Name:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Firm:</th>
</tr>
</thead>
</table>

---

**NOTE:** See instructions for more information including a list of county codes and well type codes.
**Feature:** Groundwater Monitoring  
**Project:** San Joaquin River Restoration Project  
**Location:** Reach 4A, River Bank Left, RM 180, Fresno County  
**Coordinates:** N 2,250,184.6 E 6,120,234.3 NAD83  
**State:** California  
**Ground Elevation:** 121.96 ft. NADV88  
**Angle From Horizontal:** -90°  
**Hole Logged By:** A. Warren  
**Reviewed By:** T. Lewis

**GEOLOGIC LOG OF DRILL HOLE NO. MW-11-131**  
**Sheet 1 of 2**  

**部位:** 地下水モニタリング  
**プロジェクト:** サンジョアン川復元プロジェクト  
**場所:** リーチ4A、河川左岸、RM180、フレノ郡  
**座標:** N 2,250,184.6 E 6,120,234.3 NAD83  
**州:** カリフォルニア州  
**地表面:** 121.96 ft. NADV88  
**水平からの角度:** -90°  
**ログ記録者:** A. Warren  
**レビュー:** T. Lewis

**目的:** 非連続的な土壌コアを収集し、地質面と水理系の条件を把握し、地下水モニタリングを実施する。

**場所:** Reach 4A, River Bank Left, RM 180, Fresno County. Field east of Jerrold Avenue.

**作業者:**  
- Bureau of Reclamation: PN Region drill crew: Chris Peterson, driller  
- Dennis Read, helper  
- Cody Kelley, helper

**ディリッジ & サンプリング方法:**  
- Flight Auger Dry Core system (FADC)を用いたドリルホールの作成
- ホールの先端まで到達した後にホールの終了が決定された。

**ホールの終了理由:**  
- 目標深さに達した。

**ホールの終了:**  
- 5.1 ft. - 5/15/2011

**測定:**  
- ホールの深さと方位: 0.0 to 29.5 feet

**氷水層のモニタリング:**  
- Begun: 4/16/11  
- Finished: 4/16/11  
- Location: Reach 4A, River Bank Left, RM 180, Fresno County.

**地質記録:**  
- ユニット: Quaternary Alluvium (Qal)  
- 0.0 to 2.9 ft. Clayey Sand, SC:  
- 2.9 to 6.0 ft. Silty Sand, SM:  
- 6.0 to 6.9 ft. Leaky Clay, CL:  
- 6.9 to 9.3 ft. Sandy Leaky Clay, s(CL):  
- 10.8 to 13.5 ft. Silty Sand, SM:  
- 14.6 to 18.4 ft. Silty Sand, SM:

**ラボデータ:**  
- Lab Data Interval  
- 7.0 to 8.0 ft.  
- 12.5 to 13.5 ft.  

**メモ:**  
- FADC = Flight Auger Dry Core  
- NP = Non-Plastic  
- NA = Not Applicable  
- I.D. = Inner Diameter  
- O.D. = Outer Diameter  

**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.

**Silty Sand, SM:**  
- About 70% fines with low plasticity, dry strength, no toughness; about 15% fine, micaceous sand; dry to moist; brown; moderately firm; trace plastic fines layers.

**Leaky Clay, CL:**  
- About 95% fines with medium plasticity, no dilatancy, medium toughness; trace fine sand; moist, dark brown; very firm.

**Sandy Leaky Clay, s(CL):**  
- About 70% fines with medium plasticity, medium toughness; about 30% fine sand; wet, tan; moderately soft; some reddish brown iron oxidation.

**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.

**Sandy Clay, s(CL):**  
- About 95% fines with no plasticity, rapid dry strength, rapid dilatancy; about 5% to trace fine sand; moist, tan with reddish brown iron oxidation; very firm.

**Lab Data Interval:**  
- 15.0 to 16.0 ft.  
- 18.5 to 19.5 ft.

**ラボデータ:**  
- Lab Data Interval  
- 7.0 to 8.0 ft.  
- 12.5 to 13.5 ft.  

**メモ:**  
- FADC = Flight Auger Dry Core  
- NP = Non-Plastic  
- NA = Not Applicable  
- I.D. = Inner Diameter  
- O.D. = Outer Diameter

**ラボデータ:**  
- Lab Data Interval  
- 7.0 to 8.0 ft.  
- 12.5 to 13.5 ft.  

**メモ:**  
- FADC = Flight Auger Dry Core  
- NP = Non-Plastic  
- NA = Not Applicable  
- I.D. = Inner Diameter  
- O.D. = Outer Diameter
GEOLOGIC LOG OF DRILL HOLE NO. MW-11-131

FEATURE: Groundwater Monitoring
LOCATION: Reach 4A, River Bank Left, RM 180, Fresno County
BEGIN: 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)

TOTAL DEPTH: 29.6 ft.
CLASSIFICATION AND PHYSICAL CONDITION

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

19.6 to 25.0 ft. CLAYEY SAND, SC:
About 60% fine sand; about 40% fines with medium plasticity; wet, dark tan; moderately firm; layered with 1 mm to 3 mm thick CaCO₃ accretions, strong reaction with HCl; moderately cemented zone from 20.0 to 20.2 ft.
Note: 23.5 to 25.0 ft.: less CaCO₃

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

Lab Data Interval
27.0 to 28.0 ft.

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

FADC = Flight Auger Dry Core
NP = Non-Plastic
NR = No Recovery
FA = Flight Auger
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
T = Top of Groundwater
+ = Above Ground Surface

STATE: California
GROUND ELEVATION: 121.96 ft. NAD88
ANGLE FROM HORIZONTAL: -90°
HOLE LOGGED BY: A. Warren
REVIEWED BY: T. Lewis
**NOT TO SCALE**

**NOTES:**
- **T.O.C.** = Top of well casing, **I.D.** = Inner Diameter, **G.S.** = Ground Surface, **E.I.** = Elevation
- **Dia.** = Diameter
### San Joaquin River Restoration Program
U.S. Department of Interior, Bureau of Reclamation

#### MONITORING WELL DEVELOPMENT

<table>
<thead>
<tr>
<th>Facility/Project Name</th>
<th>County Name</th>
<th>Well Name</th>
<th>Facility License, Permit or Monitoring Number</th>
<th>County Code</th>
<th>Wis. Unique Well Number</th>
<th>DNR Well ID Number</th>
</tr>
</thead>
</table>

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

2. Well development method
   - surged with bailer and bailed ☐
   - surged with bailer and pumped ☐ 4 1
   - surged with block and bailed ☐ 4 2
   - surged with block and pumped ☐ 6 2
   - surged with block, bailed and pumped ☐ 7 0
   - compressed air ☐ 2 0
   - bailed only ☐ 1 0
   - pumped only ☐ 5 1
   - pumped slowly ☐ 5 0
   - Other ☐

3. Time spent developing well  ☐ 3 1 9 min.

4. Depth of well (from top of well casing)  ☐ 2 1 9 ft.

5. Inside diameter of well  ☐ 2 0 0 in.

6. Volume of water in filter pack and well casing  ☐ 5 0 0 gal.

7. Volume of water removed from well  ☐ 6 0 0 gal.

8. Volume of water added (if any)  ☐ 0 0 0 gal.

9. Source of water added

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

11. Depth to Water (from top of well casing)
   a. 8 1 0 ft. 8 1 0 ft.
   Date
   b. 0 1 1 5 1 2 0 1 1 m m d d y y y y m m d d y y y y
   Time
   c. 1 2 4 5 0 a.m. 1 5 0 0 a.m.

12. Sediment in well bottom  ☐ inches ☐ inches

13. Water clarity
   - Clear ☐ 1 0
   - Turbid ☐ 1 5
   (Describe)

14. Total suspended solids  ☐ 0 0 0 mg/l 0 0 0 mg/l

15. COD  ☐ 0 0 0 mg/l 0 0 0 mg/l

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

17. Additional comments on development:

---

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: 4.0 ft. (119.8 ft. - 5/15/2011)

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.

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
5.0 to 8.3 ft. - Wet at 6.0 ft.

DRILLING 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.

REVIEWED BY: T. Lewis

STATE: California
GROUND ELEVATION: 123.78 ft. NADV88
ANGLE FROM HORIZONTAL: -90°
HOLE LOGGED BY: A. Warren

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

REVIEWED BY: T. Lewis

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

HOLE LOGGED BY: A. Warren

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
S.J.R = San Joaquin River
G.S. = Ground Surface
F = Top of Groundwater

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

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.

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 80% fines with medium plasticity, medium toughness; about 40% fine sand; wet, tan; soft.

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, (s(CL):
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 90% fine and medium sand; about 10% fines with no plasticity; wet, tan; loose, does not hold shape when removed from sampler.

18.3 to 22.0 ft. POORLY GRADED SAND WITH SILT, SP-SP:
About 80% fine and medium sand; about 10% fines with no plasticity; wet, tan; loose, does not hold shape when removed from sampler.
### GEOLOGIC LOG OF DRILL HOLE NO. MW-11-132

**LOCATION:** Reach 4A, River Bank Left, RM 180, Fresno County  
**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

**SELECTED DEPTHS - WATER LEVELS:**
- 10.8 ft. (119.8 ft. - 5/15/2011)
- 21.0 to 22.0 ft.
- 22.0 to 24.8 ft.
- 24.8 to 25.2 ft.
- 25.2 to 28.3 ft.
- 28.3 to 29.5 ft.
- 29.5 to 30.3 ft.

**SELECTED DEPTHS - GROUND WATER:**
- 105.4 ft. (111.8 ft. - 5/15/2011)
- 21.0 to 22.0 ft.
- 22.0 to 24.8 ft.
- 24.8 to 25.2 ft.
- 25.2 to 28.3 ft.
- 28.3 to 29.5 ft.

**HOLE LOGGED BY:** A. Warren  
**REVIED BY:** T. Lewis

**NOTES**

### CLASSIFICATION AND PHYSICAL CONDITION

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>% CORE RECOVERY &lt;0.035</th>
<th>% SAND</th>
<th>% GRAVEL</th>
<th>LIQUID LIMIT</th>
<th>PLASTICITY INDEX</th>
<th>SATURATION CONTENT</th>
<th>LABORATORY DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>1.8</td>
<td>24.2</td>
<td>0.0</td>
<td>NP</td>
<td>NP</td>
<td>24.4</td>
<td>SM</td>
</tr>
<tr>
<td>25</td>
<td>0.7</td>
<td>4.4</td>
<td>94.9</td>
<td>0.0</td>
<td>NP</td>
<td>23.1</td>
<td>SP-SM</td>
</tr>
<tr>
<td>30</td>
<td>4.9</td>
<td>10.6</td>
<td>84.5</td>
<td>0.0</td>
<td>NP</td>
<td>23.9</td>
<td>SM</td>
</tr>
<tr>
<td>40</td>
<td>16.4</td>
<td>32.7</td>
<td>50.9</td>
<td>0.0</td>
<td>25.0</td>
<td>9.5</td>
<td>17.6 SC</td>
</tr>
<tr>
<td>50</td>
<td>100.0</td>
<td>94.3</td>
<td>93.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**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:** 5.0 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

**LABORATORY DATA**

- **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 CaCO3, 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.
- **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.
- **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.
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)

MW-11-132

GEOLOGIST: A. Warren
DRILLER: C. Peterson
DATE COMPLETED: 4/17/2011
HELPERS: D. Read & C. Kelly

*NOT TO SCALE

NOTES:
T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, El. = Elevation
Dia. = Diameter
Facility/Project Name: SJRRP  
County Name: Madera  
Well Name: W-1  
DNR Well ID Number: 

<table>
<thead>
<tr>
<th>1. Can this well be purged dry?</th>
<th>Yes ☐ No ☑</th>
<th>2. Well development method</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>surged with bailer and bailed ☐</td>
</tr>
<tr>
<td></td>
<td></td>
<td>surged with bailer and pumped ☐</td>
</tr>
<tr>
<td></td>
<td></td>
<td>surged with block and bailed ☐</td>
</tr>
<tr>
<td></td>
<td></td>
<td>surged with block and pumped ☐</td>
</tr>
<tr>
<td></td>
<td></td>
<td>surged with block, bailed and pumped ☐</td>
</tr>
<tr>
<td></td>
<td></td>
<td>compressed air ☐</td>
</tr>
<tr>
<td></td>
<td></td>
<td>bailed only ☐</td>
</tr>
<tr>
<td></td>
<td></td>
<td>pumped only ☐</td>
</tr>
<tr>
<td></td>
<td></td>
<td>pumped slowly ☐</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Other ☐</td>
</tr>
</tbody>
</table>

| 3. Time spent developing well | 45 min |
| 4. Depth of well (from top of well casing) | 320 ft |
| 5. Inside diameter of well | 250 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 |

| 10. Analysis performed on water added? | Yes ☐ No ☑ |

| 11. Depth to Water (from top of well casing) | 700 ft | 700 ft |
| Date | 5/15/2011 | 5/15/2011 |
| Time | 11:45 AM | 12:30 PM |

| 12. Sediment in well bottom | inches | inches |
| 13. Water clarity | Clear ☐ 10' | Clear ☑ 20' |
| Turbidity | 15 | 25 |

| 14. Total suspended solids | mg/l | mg/l |
| 15. COD | mg/l | mg/l |

| 16. Well developed by: Name (first, last) and Firm |
| Firm: USBR PN DRILL CROW |

| 17. Additional comments on development: |
| Succed with w/Block & Ball Check Valve for Several Minutes Every 2 Feet until 5 Gals Pumper, Pumped with Sump Pump until Clear |

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

**BEGINNED:** 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)

---

**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.

**DRILLING 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.

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

---

**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.

- **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
T.O.C. = Top of Well Casing
SJR = San Joaquin River
NR = No Recovery
NP = Non-Plastic
FADC = Flight Auger Dry Core

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.
## GEOLOGIC LOG OF DRILL HOLE NO. MW-11-133

**LOCATION:** Reach 4A, River Bank Left, RM 180, Fresno County  
**DEPTH AND ELEVATION OF WATER LEVEL AND DATE MEASURED:** 5.2 ft. (113.9 ft. - 4/27/2011)

### 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

### 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.

### LABORATORY DATA

| DEPTH | % CORE RECOVERY | <0.005 | <0.075 | % SAND | % GRAVEL | LIQUID LIMIT | PLASTICITY INDEX | MOISTURE CONTENT | LABORATORY CLAYS | VISUAL CLAY | CLASSIFICATION | SYMBOL |
|-------|-----------------|--------|--------|--------|----------|--------------|----------------|------------------|----------------|---------------|-------------|---------------|---------|
| 0.0   | SP-SM           |        |        |        |          |              |                |                  |                |               |             |             |
| 0.6   | 5.5             | 93.9   | 0.0    | NP     | NP       | 22.0         | SP-SM          |                  |                |               |             |             |
| 96.6  |                 |        |        |        |          |              |                |                  |                |               |             |             |
| 2.1   | 4.8             | 91.1   | 0.0    | NP     | NP       | 27.0         | SP-SM          |                  |                |               |             |             |
| 93.1  |                 |        |        |        |          |              |                |                  |                |               |             |             |
| 100.0 |                 |        |        |        |          |              |                |                  |                |               |             |             |
| 4.0   | 5.0             | 95.0   | 0.0    | SP-SM  | SP-SM    |              |                |                  |                |               |             |             |
| 90.0  |                 |        |        |        |          |              |                |                  |                |               |             |             |
| 100.0 |                 |        |        |        |          |              |                |                  |                |               |             |             |

### 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.
**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

<table>
<thead>
<tr>
<th>Facility/Project Name</th>
<th>SRRP</th>
</tr>
</thead>
<tbody>
<tr>
<td>County Name</td>
<td>Fresno</td>
</tr>
<tr>
<td>Well Name</td>
<td>MW-11-138</td>
</tr>
<tr>
<td>Facility License, Permit or Monitoring Number</td>
<td></td>
</tr>
<tr>
<td>County Code</td>
<td></td>
</tr>
<tr>
<td>Wis. Unique Well Number</td>
<td></td>
</tr>
<tr>
<td>DNR Well ID Number</td>
<td></td>
</tr>
</tbody>
</table>

1. Can this well be purged dry?  
   - Yes [ ]  - No [X]  

2. Well development method  
   - surged with bailer and bailed [ ]  
   - surged with bailer and pumped [ ]  
   - surged with block and bailed [ ]  
   - surged with block and pumped [ ]  
   - surged with block, bailed and pumped [ ]  
   - compressed air [ ]  
   - bailed only [ ]  
   - pumped only [ ]  
   - pumped slowly [ ]  
   - Other [ ]  

3. Time spent developing well  
   - Casing: 31 min.  
4. Depth of well (from top of well casing)  
   - 52.2 ft.  
5. Inside diameter of well  
   - 2.0 in.  
6. Volume of water in filter pack and well casing  
   - 10 gal.  
7. Volume of water removed from well  
   - 5 gal.  
8. Volume of water added (if any)  
   - 5 gal.  
9. Source of water added  
   -  
10. Analysis performed on water added?  
    - Yes [ ]  - No [X]  

11. Depth to Water (from top of well casing)  
    - Before Development: 52.2 ft.  
    - After Development: 51.2 ft.  
    - Date: 04/27/2011  
    - Time: 1:30 p.m.  

12. Sediment in well bottom  
    - Trace inches  

13. Water clarity  
    - Clear: 10 Turbid: 15  
    - (Describe): Brown sand  

14. Total suspended solids  
    - 0 mg/l  

15. COD  
    - 0 mg/l  

16. Well developed by:  
    - Name: Altus A. Warren  

17. Additional comments on development:  
   - 1442 Purge pump @ bottom 3  

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: A. Warren  
Print Name: A. 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  
**Begin:** 4/19/11  
**Depth and Elevation of Water Level:** 5.5 ft. (111.6 ft. - 5/15/2011)  
**Proj:** San Joaquin River Restoration Project  
**State:** California  
**Ground Elevation:** 117.08 ft. NADV88  
**Angle from Horizontal:** -90°  
**Hole Logged by:** A. Warren  
**Reviewed by:** T. Lewis  

### 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  
- Cody Kelley, helper

### Drilling & Sampling Methods:
The drill hole was advanced and sampled 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. bullelt 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.

### Drilling Conditions and Driller's Comments:
- 0.0 to 29.0 feet: FADC
- 0.0 to 29.5 feet: Drilled without fluid
- 0.0 to 3.0 feet: Lean clay with sand
- 3.0 to 4.0 feet: Silty sand, s(ML): About 70% fine sand; about 30% fines with low plasticity; moist, brown; firm.
- 4.0 to 4.4 feet: Lean clay, CL: About 95% fine sand with low plasticity, slow dilatancy, low toughness; about 5% fine sand; moist, brown; firm.
- 4.4 to 9.5 feet: 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.
- 9.5 to 19.5 feet: 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 feet: 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.
- 20.4 to 21.4 feet: 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 feet: Clayey sand, SC: About 70% fine sand; about 30% fines with low plasticity; moist, brown; micaceous; moderately dense.
- 24.0 to 24.9 feet: Silty ML: About 95-100% fines with low plasticity, no toughness; trace fine sand; moist, brown to tan; firm.

### Comments:
- FADC = Flight Auger Dry Core  
- NP = Non-Plastic  
- NR = No Recovery  
- NA = Not Applicable  
- T.O.C. = Top of Well Casing  
- SJR = San Joaquin River  
- G.S. = Ground Surface  
- + = Above Ground Surface  
- S = Top of Groundwater  
- O.D. = Outer Diameter  
- I.D. = Inner Diameter  

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.
## GEOLOGIC LOG OF DRILL HOLE NO. MW-11-134

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

### 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

### LABORATORY DATA

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>% CORE RECOVERY</th>
<th>% &lt;0.005</th>
<th>% &lt;0.075</th>
<th>% GRAVEL</th>
<th>% CLAY</th>
<th>% Silt</th>
<th>% Sand</th>
<th>LIQUID LIMIT</th>
<th>PLASTICITY INDEX</th>
<th>MOISTURE CONTENT</th>
<th>RECOVERY</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>9.0</td>
<td>21.0</td>
<td>15.0</td>
<td>60.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>20.0</td>
<td>10.0</td>
<td>10.0</td>
<td>100.0</td>
</tr>
<tr>
<td>25</td>
<td>19.0</td>
<td>21.0</td>
<td>15.0</td>
<td>66.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>20.0</td>
<td>10.0</td>
<td>10.0</td>
<td>100.0</td>
</tr>
<tr>
<td>60.0</td>
<td>4.8</td>
<td>21.2</td>
<td>4.0</td>
<td>20.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>20.0</td>
<td>10.0</td>
<td>10.0</td>
<td>100.0</td>
</tr>
<tr>
<td>89.6</td>
<td>89.6</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>20.0</td>
<td>10.0</td>
<td>10.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

### 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.
- **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. thick layers of Silty Sand with 1.0 to 0.1 ft. spacing.

### COMMENTS:
- Well completion information is provided in attached Well Completion Diagram.
- Well development information is provided in attached Monitoring Well Development form.
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: N2256555.75 E6112405.0 (NAD83) ELEVATION 116.87' (NAVD88)

G.S. ELEVATION: 117.08' (NAVD88) (measured at vault rim)

MW-11-134

GEOLOGIST: A. Warren
WELL COMPLETION DIAGRAM DRILLER: C. Peterson
DATE COMPLETED: 4/19/2011 HELPERS: D. Read & C. Kelly

NOTES:
T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, El. = Elevation
Dia. = Diameter

*NOT TO SCALE*
San Joaquin River Restoration Program  
U.S. Department of Interior, Bureau of Reclamation  

**MONITORING WELL DEVELOPMENT**

<table>
<thead>
<tr>
<th>Facility/Project Name</th>
<th>County Name</th>
<th>Well Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>SJRRP</td>
<td>Merced</td>
<td>W-5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Facility License, Permit or Monitoring Number</th>
<th>County Code</th>
<th>Wis. Unique Well Number</th>
<th>DNR Well ID Number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Can this well be purged dry?  
Yes [ ]  No [ ]

2. Well development method  
- surged with bailer and bailed [ ]  
- surged with bailer and pumped [ ]  
- surged with block and bailed [ ]  
- surged with block and pumped [ ]  
- compressed air [ ]  
- bailed only [ ]  
- pumped only [ ]  
- pumped slowly [ ]  
- Other [ ]

3. Time spent developing well  
- 98 min.

4. Depth of well (from top of well casing)  
- 29.9 ft.

5. Inside diameter of well  
- 8.00 in.

6. Volume of water in filter pack and well casing  
- 10 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 [ ]

11. Depth to Water  
(from top of well casing)  
- 5.50 ft.  
- 5.60 ft.  

   - Ground
   - Date  
   - 5/12/2011  
   - m d y y y m m d d y y y
   - Time  
   - 1:45 P.M.  
   - 11:23 A.M.

12. Sediment in well bottom  
- ____ inches  
- ____ inches

13. Water clarity  
- Clear [ ]  
- Turbid [ ]  
- (Describe) [ ]

   - Brown
   - Sandy
   - [ ]

- 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:  
(First name, last name and firm)  
- Name: USBR PN Region Drill

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-11-135

**FEATURE**: Groundwater Monitoring  
**LOCATION**: Reach 4A, River Bank Left, RM 177.4, Fresno County

### 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.

### DRILLING CONDITIONS AND DRILLER’S COMMENTS:
- 9.5 to 14.5 ft.: Heaving sand in auger.

### WATER LEVEL:
- 5.1 ft. - 5/15/2011

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

### 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

### TOTAL DEPTH:
29.5 ft.

### REASON FOR HOLE TERMINATION:
- 5.1 ft. - 5/15/2011

### WATER LEVEL:
- 0.0 to 29.5 ft.: Drilled without fluid

### DRILLING FLUID, RETURN AND COLOR:
- 9.5 to 14.5 ft.: Heaving sand in auger.

## CLASSIFICATION AND PHYSICAL CONDITION

### Interval Method
- 0.0 to 2.95 ft.: FADC

### DEPTH

<table>
<thead>
<tr>
<th>Interval</th>
<th>% CORE RECOVERY</th>
<th>% SAND</th>
<th>% GRAVEL</th>
<th>LIQUID LIMIT</th>
<th>PLASTICITY INDEX</th>
<th>T.O.C.</th>
<th>% MOISTURE CONTENT</th>
<th>LABORATORY CLASSIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0 to 2.6 ft.</td>
<td>93.3</td>
<td>15.6</td>
<td>1.5</td>
<td>&lt;0.005</td>
<td>&lt;0.075</td>
<td>SP-SM</td>
<td>110.1</td>
<td></td>
</tr>
<tr>
<td>2.6 to 4.9 ft.</td>
<td>89.9</td>
<td>6.6</td>
<td>3.1</td>
<td>35.9</td>
<td>26.9</td>
<td>CH</td>
<td>109.1</td>
<td></td>
</tr>
<tr>
<td>4.9 to 9.2 ft.</td>
<td>84.8</td>
<td>15.2</td>
<td>0.0</td>
<td>56.0</td>
<td>36.9</td>
<td>CH</td>
<td>109.1</td>
<td></td>
</tr>
<tr>
<td>9.2 to 11.4 ft.</td>
<td>72.5</td>
<td>27.5</td>
<td>0.0</td>
<td>56.0</td>
<td>36.9</td>
<td>CH</td>
<td>109.1</td>
<td></td>
</tr>
<tr>
<td>11.4 to 12.2 ft.</td>
<td>63.2</td>
<td>36.8</td>
<td>0.0</td>
<td>56.0</td>
<td>36.9</td>
<td>CH</td>
<td>109.1</td>
<td></td>
</tr>
<tr>
<td>12.2 to 23.5 ft.</td>
<td>56.8</td>
<td>43.2</td>
<td>0.0</td>
<td>56.0</td>
<td>36.9</td>
<td>CH</td>
<td>109.1</td>
<td></td>
</tr>
<tr>
<td>23.5 to 28.2 ft.</td>
<td>49.2</td>
<td>50.8</td>
<td>0.0</td>
<td>56.0</td>
<td>36.9</td>
<td>CH</td>
<td>109.1</td>
<td></td>
</tr>
<tr>
<td>28.2 to 29.5 ft.</td>
<td>42.5</td>
<td>57.5</td>
<td>0.0</td>
<td>56.0</td>
<td>36.9</td>
<td>CH</td>
<td>109.1</td>
<td></td>
</tr>
</tbody>
</table>

### GEOLOGIC UNIT
- QUATERNARY ALLUVIUM (Qal)

### FEATURE:
- Groundwater Monitoring

### DEPTH AND ELEVATION OF WATER LEVEL
- BEGUN: 4/20/11    FINISHED: 4/20/11
- LOCATION: Reach 4A, River Bank Left, RM 177.4, Fresno County. Field east of Jerrold Avenue.

### PROJECT:
- San Joaquin River Restoration Project

### 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.

### Drilled By:
- Bureau of Reclamation: PN Region drill crew:
  - Chris Peterson, driller
  - Dennis Read, helper
  - Cody Kelley, helper

### 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.

### Drilling Conditions and Driller’s Comments:
- 9.5 to 14.5 ft.: Heaving sand in auger.

### Water Level:
- 5.1 ft. - 5/15/2011

### Reason for Hole Termination:
The hole was terminated upon reaching the target depth.

### 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
- ﬁ = Top of Groundwater
### GEOLOGIC LOG OF DRILL HOLE NO. MW-11-135

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

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>% CORE</th>
<th>% RECOVERY</th>
<th>&lt;0.005</th>
<th>&lt;0.075</th>
<th>% SAND</th>
<th>% GRAVEL</th>
<th>LIQUID LIMIT</th>
<th>PLASTICITY INDEX</th>
<th>CONTENT</th>
<th>LABORATORY DATA</th>
<th>CLASSIFICATION AND PHYSICAL CONDITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.0</td>
<td>6.8</td>
<td>6.5</td>
<td>86.7</td>
<td>0.0</td>
<td>NP</td>
<td>NP</td>
<td>26.6</td>
<td>SM</td>
<td>101.1</td>
<td>SM</td>
<td></td>
</tr>
<tr>
<td>25.0</td>
<td>5.2</td>
<td>6.6</td>
<td>88.2</td>
<td>0.0</td>
<td>NP</td>
<td>NP</td>
<td>26.6</td>
<td>SP-SM</td>
<td>95.6</td>
<td>SP-SM</td>
<td></td>
</tr>
<tr>
<td>48.0</td>
<td>6.6</td>
<td>6.6</td>
<td>88.2</td>
<td>0.0</td>
<td>NP</td>
<td>NP</td>
<td>26.6</td>
<td>SP-SM</td>
<td>90.6</td>
<td>SP-SM</td>
<td></td>
</tr>
</tbody>
</table>

**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

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

<table>
<thead>
<tr>
<th>Facility/Project Name</th>
<th>County Name</th>
<th>Well Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>SJRRP</td>
<td>Merced</td>
<td>W-6/MW-11-135</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Facility License, Permit or Monitoring Number</th>
<th>County Code</th>
<th>Wis. Unique Well Number</th>
<th>DNR Well ID Number</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>1. Can this well be purged dry?</th>
<th>Yes ☐ No ☒</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>2. Well development method</th>
</tr>
</thead>
<tbody>
<tr>
<td>surged with bailer and bailed ☐</td>
</tr>
<tr>
<td>surged with bailer and pumped ☐</td>
</tr>
<tr>
<td>surged with block and bailed ☐</td>
</tr>
<tr>
<td>surged with block and pumped ☐</td>
</tr>
<tr>
<td>surged with block, bailed and pumped ☐</td>
</tr>
<tr>
<td>compressed air ☐</td>
</tr>
<tr>
<td>bailed only ☐</td>
</tr>
<tr>
<td>pumped only ☐</td>
</tr>
<tr>
<td>pumped slowly ☐</td>
</tr>
<tr>
<td>Other __________________________</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. Time spent developing well</th>
<th>40 min.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>4. Depth of well (from top of well casing)</th>
<th>3 5 0 ft.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>5. Inside diameter of well</th>
<th>2 0 0 in.</th>
</tr>
</thead>
</table>

|---------------------------------------------------|---------|

<table>
<thead>
<tr>
<th>7. Volume of water removed from well</th>
<th>6 0 0 gal.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>8. Volume of water added (if any)</th>
<th>___ gal.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>9. Source of water added</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>10. Analysis performed on water added?</th>
<th>Yes ☐ No ☒</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>11. Depth to Water (from top of well casing)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. ___ ft.</td>
</tr>
<tr>
<td>Date b. 5/15/2011</td>
</tr>
<tr>
<td>Time c. 9:00 a.m.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>12. Sediment in well bottom</th>
<th>___ inches</th>
<th>___ inches</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>13. Water clarity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear ☐</td>
</tr>
<tr>
<td>Turbid ☐</td>
</tr>
<tr>
<td>Turbid ☐</td>
</tr>
<tr>
<td>(Describe) brown &amp; sandy</td>
</tr>
<tr>
<td>(Describe) cloudy</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>14. Total suspended solids</th>
</tr>
</thead>
<tbody>
<tr>
<td>___ mg/l</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>15. COD</th>
</tr>
</thead>
<tbody>
<tr>
<td>___ mg/l</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>16. Well developed by:</th>
<th>Name (first, last) and Firm</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Name:</td>
<td>USBr PN Drill crew</td>
</tr>
<tr>
<td>Last Name:</td>
<td></td>
</tr>
</tbody>
</table>

### Additional comments on development:

Surged w/ black & ball check valve, surged about 5 gallon of brown

Pumped w/ sump pump until water is clear for 10 gallons

---

### Name and Address of Facility Contact/Owner/Responsible Party

<table>
<thead>
<tr>
<th>First Name:</th>
<th>Name:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Facility/Firm:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Street:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>City/State/Zip:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

---

### 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  
**PROJECT**: San Joaquin River Restoration Project  
**LOCATION**: Reach 4A, River Bank Left, RM 177.4, Fresno County  
**BEGIN**: 4/27/11  
**FINISHED**: 5/16/2011  
**DEPTH TO BEDROCK**: Not Encountered  
**STATE**: California  

**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: Cody Kelley, helper, Dennis Read, 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.

**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.

**Drill Completion**: Provided in attached Well Completion Form. Well development information is provided in attached Monitoring Diagram. Well development information is provided in attached Monitoring Form.
**GEOLOGIC LOG OF DRILL HOLE NO. MW-11-136**

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

**HOLE LOGGED BY:** A. Warren  
**REVIEWED BY:** T. Lewis  
**PROJECT:** San Joaquin River Restoration Project  
**STATE:** California  
**GROUND ELEVATION:** 116.72 ft. NADV88  
**ANGLE FROM HORIZONTAL:** -90°

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>% CORE RECOVERY</th>
<th>&lt;0.005</th>
<th>&lt;0.075</th>
<th>% SAND</th>
<th>% CLAY</th>
<th>% SILT</th>
<th>LABORATORY CLASSIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.0</td>
<td>68.0</td>
<td>32.2</td>
<td>51.4</td>
<td>16.4</td>
<td>0.0</td>
<td>25.7</td>
<td>13.3 (CL)</td>
</tr>
<tr>
<td>25.0</td>
<td>85.0</td>
<td>4.9</td>
<td>29.9</td>
<td>66.2</td>
<td>0.0</td>
<td>NP</td>
<td>NP (CL)</td>
</tr>
<tr>
<td>30.0</td>
<td>87.1</td>
<td>52.0</td>
<td>88.7</td>
<td>19.3</td>
<td>SM</td>
<td>86.7</td>
<td>95.4 (CL)</td>
</tr>
</tbody>
</table>

**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.

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

- **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**

**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: 5.0 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

**GROUND ELEVATION:** 116.72 ft. NADV88  
**DEPTH TO BEDROCK:** Not Encountered  
**TOTAL DEPTH:** 29.6 ft.
**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)

**WELL COMPLETION DIAGRAM**

**MW-11-136**

**GEOLOGIST:** A. Warren

**DRILLER:** C. Peterson

**DATE COMPLETED:** 4/27/2011

**HELPERS:** D. Read & C. Kelly

**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**

<table>
<thead>
<tr>
<th>Facility/Project Name</th>
<th>County Name</th>
<th>Well Name</th>
<th>Wis. Unique Well Number</th>
<th>DNR Well ID Number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Merced</td>
<td>W-7</td>
<td>MW-136</td>
<td></td>
</tr>
</tbody>
</table>

**Facility License, Permit or Monitoring Number**

<table>
<thead>
<tr>
<th>County Code</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1. Can this well be purged dry?</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Well development method</th>
</tr>
</thead>
<tbody>
<tr>
<td>surged with bailer and bailed</td>
</tr>
<tr>
<td>surged with bailer and pumped</td>
</tr>
<tr>
<td>surged with block and bailed</td>
</tr>
<tr>
<td>surged with block and pumped</td>
</tr>
<tr>
<td>surged with block, bailed and pumped</td>
</tr>
<tr>
<td>compressed air</td>
</tr>
<tr>
<td>bailed only</td>
</tr>
<tr>
<td>pumped only</td>
</tr>
<tr>
<td>pumped slowly</td>
</tr>
<tr>
<td>Other</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. Time spent developing well</th>
<th>60 min.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>4. Depth of well (from top of well casing)</th>
<th>23 ft.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>5. Inside diameter of well</th>
<th>8 in.</th>
</tr>
</thead>
</table>

|--------------------------------------------------|-------------|

<table>
<thead>
<tr>
<th>7. Volume of water removed from well</th>
<th>50 gal.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>8. Volume of water added (if any)</th>
<th>~ ~ ~ gal.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>9. Source of water added</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>10. Analysis performed on water added?</th>
<th>Yes</th>
<th>☑</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(If yes, attach results)

<table>
<thead>
<tr>
<th>11. Depth to Water (from top of well casing)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. <em>4.8 ft.</em> (ground surface)</td>
</tr>
<tr>
<td>b. <em>4/16/2011</em></td>
</tr>
<tr>
<td>m m d d y y y y m m d d y y y y</td>
</tr>
<tr>
<td>c. <em>7:45 p.m.</em></td>
</tr>
<tr>
<td>a.m.</td>
</tr>
<tr>
<td>Time</td>
</tr>
<tr>
<td>a.m.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>12. Sediment in well bottom</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>-</em> inches</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>13. Water clarity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear</td>
</tr>
<tr>
<td>Turbid</td>
</tr>
<tr>
<td>(Describe)</td>
</tr>
<tr>
<td>brown</td>
</tr>
<tr>
<td>(Describe)</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>14. Total suspended solids</th>
<th><em>--</em> mg/l</th>
<th><em>--</em> mg/l</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>15. COD</th>
<th><em>--</em> mg/l</th>
<th><em>--</em> mg/l</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>16. Well developed by: Name (first, last) and Firm</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Name:</td>
</tr>
<tr>
<td>Firm:</td>
</tr>
</tbody>
</table>

### Additional comments on development:

---Surge w/ block & ball check valve for about 1 minute every few feet.
---Surge 5 gallons of brown water
---Pumped from bottom w/ sump pump until clear for 1/2 gallons.

### Name and Address of Facility Contact/Owner/Responsible Party

<table>
<thead>
<tr>
<th>First Name</th>
<th>Last Name</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Facility/Firm:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Street:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>City/State/Zip:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

I hereby certify that the above information is true and correct to the best of my knowledge.

<table>
<thead>
<tr>
<th>Signature:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Print Name:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Firm:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

### NOTE:
See instructions for more information including a list of county codes and well type codes.
MW-16-219

WELL COMPLETION DIAGRAM

DRILLER: R. Burnett
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

Depth

0.0

6" x 6" aluminum drive over well cover with skirt

12" x 18" thick concrete foundation

Concrete foundation

Bentonite Seal Hole Plug 3/8" chips (1.5'-3.0')

2" Sched 40 PVC well casing

Filter Pack #30 Sand (3.0'-15.2')

Well Screen - 2 inch sched 40 PVC square thread 0.020" slot (4.8'-14.8')

2" Sched 40 PVC well cap
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

6" x 6" aluminum drive over well cover with skirt

12" x 18" thick concrete foundation

Concrete foundation

2" Sched 40 PVC well casing

Bentonite Seal Hole Plug 3/8" chips (1.5'-3.0')

Filter Pack #30 Sand (3.0'-13.9')

Well Screen - 2 inch sched 40 PVC square thread 0.020" slot (3.5'-13.5')

2" Sched 40 PVC well cap
MW-16-221

Geologist: S. Lee

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

6" x 6" aluminum drive over well cover with skirt

12" x 18" thick concrete foundation

Bentonite Seal Hole Plug 3/8" chips (1.5'-3.0')

Well Screen - 2 inch sched 40 PVC square thread 0.020" slot (3.0'-13.0')

Filter Pack #30 Sand (3.0'-15.0')

2" Sched 40 PVC well cap
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

- 6" x 6" aluminum drive over well cover with skirt
- 12" x 18" thick concrete foundation
- 2" Sched 40 PVC well casing
- Bentonite Seal Hole Plug 3/8" chips (1.5'-3.0')
- Filter Pack #30 Sand (3.0'-15.0')
- Well Screen - 2 inch sched 40 PVC square thread 0.020" slot (4.6'-14.6')
- 2" Sched 40 PVC well cap
MW-16-224
WELL COMPLETION DIAGRAM
DATE COMPLETED: 7/26/16
Willis Property, Reach 4A SJR
Latitude: 37.07501
Longitude: -120.56179
Top of Casing elevation: TBD

6" x 6" aluminum drive over well cover with skirt
12" x 18" thick concrete foundation
2" Sched 40 PVC well casing
Bentonite Seal Hole Plug 3/8" chips
3.0' Bottom of Bentonite
3.5' Top of Screen

Filter Pack #30 Sand
Well Screen - 2 inch sched 40 PVC square thread 0.020" slot

13.5' Bottom of Screen
2" Sched 40 PVC well cap

GEOLOGIST: S. Lee
DRILLER: R. Burnett
HELPERS: J. Papendick, C. Wagner