New Mexico Copper Corporation

Copper Flat Groundwater Level Monitoring Plan

For

Probable Hydrologic Consequences

and

Predictive Geochemical Modeling
Of Pit Lake Water Quality
Reports

May 2018
New Mexico Copper Corporation
Copper Flat Groundwater Level Monitoring Plan

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1.0 Introduction
New Mexico Copper Corporation (NMCC) has prepared this Groundwater Level Monitoring Plan to monitor groundwater levels at its proposed Copper Flat Mine. Groundwater level monitoring will be conducted before, during and after mine operation to compare against ground water model projections. The monitoring network has been established by NMCC to gather data on the three identified groundwater systems that may be affected by pumping the Production Wells that will supply production water for the mine operation. These ground water systems include the Santa Fe Group aquifer, shallow alluvial aquifers along area streams, and the Bedrock Crystalline (JSAI, 2014). Potential effects on these groundwater systems are presented in the report prepared by John Shomaker & Associates (JSAI) on behalf of NMCC and submitted to the Mining & Minerals Division, titled Probable Hydrologic Consequences of the Copper Flat Project Sierra County New Mexico, December 2017. The proposed monitoring network is adequately distributed to track potential drawdown effects from proposed Copper Flat pit dewatering and proposed pumping from supply wells PW-1 through PW-4. As designed, the monitoring plan will provide the necessary data to track water-level changes in the crystalline bedrock, shallow alluvial, and Santa Fe Group aquifer units. In addition, the water level data set can be used to verify model predictions and to identify potential hydrologic impacts before becoming significant.

Although some of the wells identified in the monitoring well network presented below will be used for other data collection purposes, this Groundwater Level Monitoring Plan is proposed as a separate adjunct to the Copper Flat Groundwater Quality Monitoring Plan described in Appendix E of the NMCC Discharge Permit Application (and incorporated into NMCC’s Mine Operation and Reclamation Plan). Each of these plans will contribute to the collection of data regarding ground water and surface water at Copper Flat and in the surrounding area. For example, water level measurements will be taken at all of the wells identified in the various monitoring networks, providing a comprehensive view of ground water conditions at the site. In addition, while water quality monitoring is not the purpose of this monitoring program, water quality results obtained from the rest of the monitoring network at the site will be utilized to provide a comprehensive view of groundwater conditions in the mine permit area and potential affected areas.

The proposed groundwater level monitoring network will facilitate the collection of groundwater levels prior to mine operation to help establish baseline conditions. Monitoring will continue throughout the time Production Wells are pumped and beyond to monitor the effects of pumping. NMCC anticipates some continued monitoring of groundwater levels after mine operation ceases for a number of years, the timeframe to be determined based on monitoring results, to confirm groundwater levels rebounding. This monitoring will create a body of data for long term use, allowing for analysis of potential impairment to wells or surface waters. This Groundwater Level Monitoring Plan provides a guideline and reference for planning and implementing groundwater level monitoring at the Copper Flat Permit Area and in potential affected area by the proposed operation of Copper Flat. This plan includes a description of the monitoring network as well as proposed data collection plans and protocols.
2.0 Monitoring Well Network
NMCC has identified 27 monitoring wells at the mine and in the potential affected area that will be utilized to assess projected effects on the Santa Fe Group aquifer (eight wells), the Quaternary-age alluvial aquifers along Las Animas Creek (four wells) and Percha Creek (three wells) and the crystalline bedrock (including the Andesite) of the Animas uplift (eight wells). The monitoring plan also includes the four production wells which will be monitored post-mining. Plate 1 presents the locations of these monitoring wells in relation to the mine permit area, potential affected area, and the Production Wells. Table 1 provides additional detailed information for each of these wells.

Some of these wells are also part of the Monitoring Plan in Appendix E of the Discharge Permit, and others are in addition to it. NMCC has obtained permission from private land owners where needed for access to monitor wells through mine operation and reclamation. Many of these wells have been in place for years and NMCC has background data on water levels and water quality. Some of the wells are newly identified monitoring locations. Three of the wells will be new wells drilled to replace wells that will be lost due to the planned pit expansion.

2.1 Santa Fe Group
As reported by JSAI’s December 2017 Probable Hydrologic Consequences report, the pumping of Production wells completed in the Santa Fe Group Aquifer for Copper Flat Operation is projected to create water-level drawdown in this aquifer. A maximum drawdown of 70 ft. at the well field is projected to occur at the end of mining. Drawdown will decrease with distance from the Production wells and water levels are projected to recover over a period of approximately 20 to 30 years. Other projected effects from pumping the Production Wells in the Santa Fe group include minimal effects to shallow groundwater systems along Las Animas Creek and Percha Creek, decreases in flow rates of flowing wells along Las Animas and Percha Creeks, and depletion of water that would have flowed to the Rio Grande (JSAI, 2017). In addition to the four Production Wells, eight Santa Fe Group aquifer wells have been selected to monitor effects in the Santa Fe Group Aquifer (see Table 1). As shown on Plate 1, MW-5 is near the Production Wells, MW-9 and MW-10 north of the Production Wells along Las Animas Creek, MW-6 west of the wellfield, MW-8, MW-4 and MW-2 near the mine area to the west and southwest of the wellfield, and GWQ11-27 northeast of the wellfield in the flowing well area along Animas Creek. All of these wells have been monitored historically by NMCC and others and a significant database on historic groundwater levels in these wells already exists. These wells in the Santa Fe Group network have been selected to monitor the projected effects in these areas. The proposed monitoring network is adequately distributed to track potential drawdown effects from proposed Copper Flat pit dewatering and proposed pumping from supply wells PW-1 through PW-4. As designed, the monitoring plan will provide the necessary data to track water-level changes in the Santa Fe Group aquifer.

NMCC has right of way access from BLM (via NMNM 125870) to monitor MW-2, MW-5, MW-6 and MW-8. NMCC owns the land where MW-4 is located. NMCC also has permission from the rangeland allotment holders to monitor MW-6. NMCC owns MW-9 and MW-10 and has permission from the private landowners to access these wells.
Monitoring groundwater levels in the four Production Wells and in the eight identified additional wells completed in the Santa Fe Group aquifer will provide the data necessary to assess groundwater model projections, including effects to shallow groundwater systems along Las Animas Creek and Percha Creek and changes in pressure on flowing wells. Data collected will also be used to track depletions to the Rio Grande.

2.2 Shallow Alluvial Aquifer
Las Animas Creek runs from west to east to the north of the Copper Flat Production Wells and Percha Creek runs from west to east to the south (see Plate 1). Surface flow in these creeks result largely from precipitation and runoff from the Black Range to the west, and have perennial, intermittent and ephemeral reaches. NMCC has identified seven existing wells completed in the shallow alluvial aquifers beneath Las Animas and Percha Creeks to monitor effects of Production Well pumping (see Plate 1).

Four shallow alluvial wells will be monitored along Las Animas Creek. MW-11 has been monitored historically. The other three wells are existing wells that are new additions to the monitoring network. NMCC owns well MW-11 and has permission from the private landowners for access. Three existing shallow alluvial wells owned by private landowners along Animas Creek will be added along Las Animas Creek: one west of MW-11 and another east of MW-11, and a third east of GWQ11-27 near I-25. The private wells will be monitored via transducers that will not interfere with the use of the wells. NMCC has permission from the private landowners to access and monitor the wells.

The three existing wells identified on Plate 1 for monitoring the alluvium along Percha Creek were installed by the Bureau of Reclamation (BOR). BOR has granted NMCC ownership of these wells, which is noted in OSE well file records, and NMCC has permission from the private landowners for access and monitoring.

2.2.1 Surface Water Along Las Animas and Percha Creeks
The data collected from shallow alluvial wells along Las Animas and Percha Creeks will provide data regarding the groundwater model’s prediction of no measurable effects in shallow alluvial groundwater on the western side of Las Animas Creek and Percha Creek and, therefore, no measurable effects on the surface water flows on these streams. While performing groundwater level data collection, NMCC will also check and document stream flows, if present, along Las Animas and Percha Creeks. This data will provide seasonal data regarding stream flows that can be tracked before, during and after mine operation.

2.3 Bedrock Crystalline
Groundwater in fractures in the bedrock crystalline around the Copper Flat pit will be drawn down as a result of pumping out water that gathers in the open pit to allow mining to take place. As discussed in the PHC and the Ground Water Model report (JSAI, 2014) the pit is currently a hydrologic sink. At the end of mining, groundwater drawdown in the bedrock around the open pit is projected to be about 800 ft. A permanent cone of depression will form around the pit which will reestablish the evaporative hydrologic sink in the future after mining ceases (JSAI, 2017).
Eight wells are proposed for monitoring the groundwater in the bedrock crystalline (see Table 1). Seven of these wells in the bedrock around the open pit have provided historic data: GWQ-5R, GWQ-6N, GWQ96-22, GWQ96-23, GWQ11-24, GWQ11-25, and GWQ11-26. Wells GWQ11-23 and GWQ11-25 will be lost by the expansion of the pit. Three new wells proposed in the New Mexico Copper Discharge Permit Appendix E Monitoring Plan, PGWQ-1, PGWQ-2, and PGWQ-3, will replace these existing wells. These new wells will be installed prior to operation of Copper Flat. Access to these wells is provided either through NMCC ownership of the well site and well or through an approved access permit with BLM.

2.4 Well Construction
Table 1 presents available well information for the identified monitoring well network. Appendix A presents well construction diagrams where available.

All selected monitoring wells are completed in the groundwater system they are designated to monitor. Some of these wells were completed specifically for monitoring. These wells are generally 2-4” in diameters and have screen lengths designed for groundwater quality monitoring. Other wells were completed for domestic use or exploration purposes and thus have larger diameter casings and/or long saturated screen lengths. When wells are being used for purposes other than monitoring, a transducer may be set it the well to collect well data and not interfere with its use.

3.0 Monitoring Plan
3.1 Monitoring Frequency & Measured Parameters
NMCC will monitor groundwater levels in the bedrock and Santa Fe Group groundwater monitoring network on a quarterly basis beginning 6 months to 12 months prior to initiation of pumping of Production Wells for construction or operation purposes. Collecting groundwater levels prior to pumping of Production wells will supplement previous baseline data collection. The baseline data will establish seasonal groundwater variation patterns not affected by pumping. Groundwater level data collection will occur quarterly and be conducted by NMCC staff or consultants.

Data collected at monitoring wells will include at a minimum depth-to-water measure to the nearest 0.01 foot. Pressure transducers will be installed in the Alluvial monitoring network wells, so continuous water level monitoring can be implemented. The transducers will be programed to measure water levels hourly. Data will be retrieved quarterly.

All data collection will be logged in field books or other appropriate data collection documentation and industry standard practices will be employed to ensure quality of data collection.

During collection of groundwater level data from shallow alluvial wells on Las Animas and Percha Creeks, field personnel will also document if surface water is flowing in the creeks near the monitoring wells. If flow is observed, NMCC staff or consultants will document stream flow rate to the extent practicable.
3.1.1 Access
NMCC will contact private landowners in advance of visiting wells for data collection. If access to monitoring wells requires passing through closed or open gates, staff will leave the gate in the position it was encountered. NMCC staff or consultants will conduct themselves in a professional and courteous manner and will not damage personal property or well heads during data collection. Care will be taken to avoid accessing wells during or directly after heavy rainfall events to prevent rutting dirt roads.

3.1.2 Resources
Monitoring of water levels, data collection and reporting will be conducted at NMCC expense. NMCC will maintain industry standard equipment for data collection.

4.0 Reporting
NMCC will prepare annual reports on groundwater levels collected. Reports will include groundwater levels and an area groundwater level map generated by at least one quarter of the data collected. NMCC reports will be maintained internally and provided to appropriate agencies for review as may be required.

5.0 References


JSAI, 2017, Probable Hydrologic Consequences of the Copper Flat Project Sierra County New Mexico. Prepared for New Mexico Copper Corporation, Albuquerque, New Mexico. December 2017.
Las Animas Creek
Percha Creek

PW-4
PW-3
PW-2
PW-1
MW-9
MW-10
MW-11
LA-058
LA-074
LA-082
GWQ-5R
GWQ11-26
GWQ11-24A
GWQ-6N

Explanation
- to be drilled bedrock monitoring point
- bedrock well
- alluvial well
- Santa Fe Group well
- pumping well
- mine area

D:\ACAD\NMCC\Monitoring.mxd

Plate 1. Copper Flat Ground Water Monitoring Network
## Table 1

### Copper Flat Monitor Well Network

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<th>Aquifer</th>
<th>Well ID</th>
<th>OSE Record Number</th>
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<th>Well log</th>
<th>Year drilled</th>
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<th>DTW (ft bgl)</th>
<th>Screen interval (ft bgl)</th>
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* New well to be drilled  
** Alluvial well along Las Animas Creek  
*** Alluvial well along Percha Creek
Appendices
Appendix A - Well Construction Diagrams
Santa Fe Group Aquifer Wells
Figure B13. Well completion diagram for LRG-4652-S-12 (MW-2), Copper Flat Mine, Sierra County, New Mexico.
Figure B14. Well completion diagram for LRG-4652-S-13 (MW-4), Copper Flat Mine, Sierra County, New Mexico.
Figure B15. Well completion diagram for LRG-4652-S-14 (MW-5), Copper Flat Mine, Sierra County, New Mexico.
Figure B16. Well completion diagram for LRG-4652-S-15 (MW-6), Copper Flat Mine, Sierra County, New Mexico.
Figure B17. Well completion diagram for LRG-4652-S-16 (MW-8), Copper Flat Mine, Sierra County, New Mexico.
LOG OF MONITORING WELL MW-9

MATERIALS DESCRIPTION

0-10', Soil/gravel, dark brown, w/abundant, silt, sand, cobbles/pebbles, wet @ 5'

7.75', ENCOUNTERED GROUNDWATER

10'-30', Alluvial gravels, varying amounts of silt/clay, sand & silt, abundant pebbles/cobbles very poorly sorted, Oxidized, wet

30'-40', Gravel, brown-slightly red brown, within clayey matrix very poorly sorted, min.-mod. sand, Oxidized, wet

40'-48', Gravel, as above with less clay/silt matrix.

48'-52', Gravel, brown-red brown within clay/silt matrix, min.-mod. sand very poorly sorted, wet.

52'-53.5', Gravel, as at 40'-48', relatively clean

53.5'-65', Gravel, brown-red brown, moderate-abundant clay/silt matrix, minor sand, very poorly sorted; wet

65'-75', clay, dark red-brown, w/min.-mod. sand & pebbles, no cobbles, moist-wet, very smooth drilling

PROJECT Copper Flat - Hillsboro, N.M.
LOCATION N713191.10, E603249.22, N.M., S.P.C.
JOB NUMBER 66607 (ref: 66607M9)
GEOLGIST C.W.
DRILL RIG Air Rotary
DRILLING COMPANY Bevilk Drilling
DATE DRILLED 09/20/94 - 09/26/94
SURFACE ELEVATION 4440.14
TOTAL DEPTH OF HOLE 252.50 Feet
WATER LEVEL Static, from TOC on 11/7/94: 71.05 Feet
75'-80', Gravel, very clayey/silty matrix, red-brown, trace-min. sand, very poorly sorted, wet.

80'-112', Gravel, light-med brown-grey Brown, min.-mod. Grv/silt, min.-mod. sand, wet. Very clayey zone @ 80'-82'.

112'-114', Gravel, med. brown-red brown in clayey matrix, min.-mod. sand, wet.
114'-117', Gravel, dark brown-red brown, min.-mod. clay/silt, trace sand, wet.
117'-118', As at 114-117 with abundant clay/silt.
118'-125', Gravel, med. red brown, min.-mod. clay/silt matrix, trace-min. sand, oxidized.
125'-130', Gravel, dark brown-red brown, abundant clay/silt matrix, min. sand, oxidized.
130'-150', Gravel, med. red brown, mod. silt/clay matrix, very poorly sorted, oxidized.

PROJECT   Cooper Flat - Hillsboro, N.M.
LOCATION   N71°19'10", E80°32'49.22" N.M. S.P.C.
JOB NUMBER  68607 (ref: 68607M9)
GEOLOGIST  C.W.
DRILL RIG   Air Rotary
DRILLING COMPANY   Beylik Drilling
DATE DRILLED   09/20/94 - 09/28/94
SURFACE ELEVATION   4440.14
TOTAL DEPTH OF HOLE   252.50 Feet
WATER LEVEL   Static, from TDC on 11/7/94; 71.05 Feet
WELL DIAGRAM

PH / Temp. (°C) | Conductivity (μS/cm) | Water Prod. (gpm) | DEPTH (ft) | SAMPLES SYMBOLS | MATERIALS DESCRIPTION

130'-150', Gravel, med. red brown, mod. silt/clay matrix, very poorly sorted, Oxidized.

150'-152', Gravel as above w/abundant clay/silt matrix.

152'-160', Gravel, med. red brown, mod. clay/silt matrix material (less than @ 150-152)

160'-168', Gravel, dark red brown, abundant clay/silt matrix

168'-175', Gravel, medium brown-red brown, min.-mod. clay/silt matrix (most of matrix material washed out of cuttings)

175'-178', Sand in clay/silt matrix, med.-very coarse, minor pebbles.

176'-178', Gravel, dark grey brown - red brown, w/min. - mod. clay/silt matrix, wet w/mod. sand.

178'-180', Gravel, brown-red brown, mod. sand, mod.-abundant clay/silt, Oxidized.

180'-190', Gravel, red brown, min.-mod. sand, min.-mod. clay/silt matrix, wet.

192'-202', Gravel, dark brown-red brown, mod.-abundant clay/silt matrix.

202'-253', Gravel, light-red brown, w/mod. sand, abundant pebbles/cobbles, min.-mod. clay/silt matrix, very poorly sorted, Oxidized, very uniform throughout zone, wet.

PROJECT Copper Flat - Hillsboro, N.M.
LOCATION 47°31'11.10", E6032.49;22 N.M. S.P.C.
JOB NUMBER 66607 (ref: 66607MG)
GEOLGIST C.W.
DRILL RIG Air Rotary

DRILLING COMPANY Beylik Drilling
DATE DRILLED 09/20/94 - 09/26/94
SURFACE ELEVATION 4440.14
TOTAL DEPTH OF HOLE 252.50 Feet
WATER LEVEL Static, from TOC on 11/7/94; 71.05 Feet
202'-253': Gravel, light-red brown, w/mod. sand, abundant pebbles/cobbles, min.-mod. clay/silt matrix, very poorly sorted, oxidized, very uniform throughout zone, wet.

Total depth = 252.5'
## LOG OF MONITORING WELL MW-10

### WELL DIAGRAM

- **B' dia. Steel Pipe w/locking well cap, approx. 3.5' above surface**
- **Sand**
  - Cement Grout Seal (0-10')
  - Bentonite Grout (VoiClay) Seal (10'-65.7')
- **4-1/2" dia. Sched. 80 Blank pvc w/cap, 2.29' above ground to 80.36' depth**
  - **8.3 / 24**
  - **Conductivity 400**
  - **Water Prod. 3.5**

### MATERIALS DESCRIPTION

- **0 - 12':** Gravelly soil, dark brown w/abundant cobbles & pebbles, and moderately abundant sand, silt soil, very poorly sorted, Oxidized, dry to 7.75'
  
  Groundwater encountered @ 7.75'

- **12'-22':** Gravel - medium brown-light red brown, min-mod clay/silt, Oxidized, wet

- **22'-24':** Red-brown, abundant cobbles/pebbles, min-mod sand, abundant silt, Oxidized, no water

- **24'-34.5':** Clay, brown-red brown, min pebbles, min-mod cobbles, "dry"

- **34.5'-40':** Gravel, grey brown, abundant brown-red brown clay/silt, Oxidized, "dry", tr-min sand

- **40'-60':** Gravel, med brown-red brown, abundant cobbles/pebbles, min-mod med-very coarse sand, "dry", Oxidized

---

**PROJECT** Cooper Flat - Hillsboro, N.M.  
**LOCATION** N719968.25, E836740.99 N.M. S.P.C.  
**JOB NUMBER** 68607 (ref: 68607MIC)  
**GEOLIGIST** CW  
**DRILL RIG** Air Rotary  
**DRILLING COMPANY** Beylik Drilling  
**DATE DRILLED** 10/94  
**SURFACE ELEVATION** 4439.27  
**TOTAL DEPTH OF HOLE** 128.0 Feet  
**WATER LEVEL** Static, from TOC on 11/7/94: 70.625 Feet
## Well Diagram

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Materials Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>40' - 60'</td>
<td>Gravel, medium brown-red brown, abundant cobbles/pebbles, min-mod med-very coarse sand, &quot;dry&quot;, Oxidized</td>
</tr>
<tr>
<td>60' - 64'</td>
<td>Gravel, medium brown, within clay/silt matrix, WET (not saturated)</td>
</tr>
<tr>
<td>64' - 78'</td>
<td>Clay, medium grey brown, w/some red brown zones, min-mod sand, wet (not saturated) does not produce water on drilling</td>
</tr>
<tr>
<td>78' - 83'</td>
<td>Clay, as above w/slight increase in cobbles/pebbles &amp; trace water</td>
</tr>
<tr>
<td>83' - 83.5'</td>
<td>Gravel, medium brown-grey brown w/clay/silt matrix, produces 2-3 gpm water on drilling</td>
</tr>
<tr>
<td>83.5' - 87'</td>
<td>Gravel, medium brown-red brown, abundant clay/silt matrix, mod sand, Oxidized</td>
</tr>
<tr>
<td>87' - 95'</td>
<td>Gravel, medium brown, abundant clay/silt matrix produces 1/2-1 gpm on drilling</td>
</tr>
<tr>
<td>95' - 105'</td>
<td>Gravel - medium brown - w/abundant clay/silt, mod-abundant sand, 1 1/2-2 gpm water when blowing</td>
</tr>
<tr>
<td>105' - 115'</td>
<td>Gravel - medium brown-grey brown, abundant clay/silt matrix, minor sand, produces 1 1/2-2 gpm on drilling</td>
</tr>
</tbody>
</table>

### Well Log Details

**Project:** Cooper Flat - Hillsboro, N.M.  
**Location:** N719988.25, E636740.99, N.M. S.P.C.  
**Job Number:** 68807 (ref: 68807M10)  
**Geologist:** CW  
**Drill Rig:** Air Rotary  
**Drilling Company:** Beylik Drilling  
**Date Drilled:** 10/94  
**Surface Elevation:** 4439.27  
**Total Depth of Hole:** 1280 Feet  
**Water Level:** Static, from TOC on 11/7/94: 70.825 Feet
## WELL DIAGRAM

<table>
<thead>
<tr>
<th>PH / TEMPERATURE</th>
<th>Conductivity (μS/cm)</th>
<th>Water Prod (gpm)</th>
<th>Depth (ft)</th>
<th>MATERIALS DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.6 / 19</td>
<td>300</td>
<td>&lt; 0.5</td>
<td>120</td>
<td>105-115', Gravel - medium brown-grey brown, abundant clay/silt matrix, minor sand, produces 1 1/2 - 2 gpm on drilling</td>
</tr>
<tr>
<td>7.9 / 19.5</td>
<td>300</td>
<td>&lt; 0.5</td>
<td>125</td>
<td>115-128', Gravel - medium brown-grey brown, abundant clay/silt matrix, mod-abundant sand, produces less than 1 gpm on drilling</td>
</tr>
<tr>
<td>7.8 / 20.5</td>
<td>300</td>
<td>&lt; 1</td>
<td>130</td>
<td>Total depth = 128'</td>
</tr>
</tbody>
</table>

Total depth = 128'

**NOTE:** Well developed 10/07/94 for 2.25 hrs. at 25 to 30 gpm

## LOG OF MONITORING WELL MW-10

**PROJECT** Copper Flat - Hillsboro, N.M.

**LOCATION** N71°08'25", E63°40'09", N.M. S.P.C.

**JOB NUMBER** 68607 (ref: 68607MIO)

**GEOLOGIST** CW

**DRILL RIG** Air Rotary

**DRILLING COMPANY** Beylik Drilling

**DATE DRILLED** 10/94

**SURFACE ELEVATION** 4,439.27

**TOTAL DEPTH OF HOLE** 128.0 Feet

**WATER LEVEL** Static, from TOC on 11/7/94: 70.825 Feet
Figure B19. Well completion diagram for GWQ-11-27 (LA 00228 POD 1), Copper Flat Mine, Sierra County, New Mexico

Completed December 21, 2012
Flowed at 19.5 gpm with a close in pressure of 15 psi
Figure B1. Well completion diagram for LRG-4652 (PW-1), Copper Flat Mine, Sierra County, New Mexico.
30' diameter steel surface casing

16' diameter blank steel casing

26' borehole

1/8' to 3/8' gravel

16' perforated casing, vertical slots
saw cut slots, 1/8' wide by 3' length
36 cuts per round
2 rounds per foot
open area = 27 in²/ft

Figure B2. Well completion diagram for LRG-4652-S (PW-2), Copper Flat Mine, Sierra County, New Mexico.
Figure B3. Well completion diagram for LRG-4652-S-2 (PW-3), Copper Flat Mine, Sierra County, New Mexico.
Figure B4. Well completion diagram for LRG-4652-S-3 (PW-4),
Copper Flat Mine, Sierra County, New Mexico.
Shallow Alluvial Aquifer Wells
WELL DIAGRAM

Sand
Cement grout seal (0-5.19')
Bentonite (5.16'-7.20')
4-1/2'' dia. Sched.
40 blank svc w/cap, 2.39' above ground to 11.84'
depth
Sand Pack Filter (10'-37.69')

4-1/2'' dia. Sched.
60.02'' Slotted PVC (11.84'-31.84')
Bentonite (37.69'-40.1')

Backfilled w/cuttings (40'-65')

Total depth = 65'
NOTE: Well developed on 10/07/94 for 2.2 hrs. at 50 gpm

DEPT (ft)

SAMPLES

0-15', Soil and gravel, dark brown, abundant cobbles, min.-mod. sand, wet @ 15'.
15'-29', Gravel; med. brown, silty soil matrix w/mod. clay, wet.
29'-32', Clay/silt; med. brown, moist - damp, (not saturated) abundant cobbles/pebbles, min.-mod. sand.
32'-65', Clay, as above but "dry"

MATERIALS DESCRIPTION

Total depth = 65'

PROJECT       Copper Flat - Hillsboro, N.M.
LOCATION      N7137'S31', E60337'8.24", N.M., S.P.C.
JOB NUMBER    68607 (ref: 68607M11)
GEOLOGIST     CW
DRILL RIG      Air Rotary
DRILLING COMPANY   Beylik Drilling
DATE DRILLED   10/11/94
SURFACE ELEVATION 4439.48
TOTAL DEPTH OF HOLE 65 Feet
WATER LEVEL Static, from TOC on 11/7/94, 10.65 Feet
**WELL RECORD & LOG**

**OFFICE OF THE STATE ENGINEER**

**www.ose-state.nm.us**

---

**POD NUMBER (WELL NUMBER):** LRG-14545-POD1 (MO/OL)

**WELL OWNER NAME: (FROM OP5):** U.S. Bureau of Reclamation

**WELL OWNER MAILING ADDRESS:** H.C. 32 Box 312

**PHONE (OPTIONAL):** 575-894-6661 ext 105

**CITY:** Truth or Consequences

**STATE:** NM

**ZIP:** 87901

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**DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS**

---

**OPTIONAL**

---

**LICENSE NUMBER:** WD-1473

**NAME OF LICENSED DRILLER:** Jefferie Van Ausdal

**NAME OF WELL DRILLING COMPANY:** U.S. Bureau of Reclamation

**DRILLING STARTED:** 1-5-09

**DRILLING ENDED:** 1-6-09

**DEPTH OF COMPLETED WELL (FT):** 32.9'

**BORE HOLE DEPTH (FT):** 32.9'

**DEPTH WATER FIRST ENCOUNTERED (FT):** 25.75'

**STATIC WATER LEVEL IN COMPLETED WELL (FT):** 25.75'

**COMPLETED WELL IS:**

- [ ] ARTISIAN
- [ ] DRY HOLE
- [x] SHALLOW (UNCONFINED)

**DRILLING FLUID:**

- [ ] AIR
- [ ] MUD
- [ ] ADDITIVES - SPECIFY:

**DRILLING METHOD:**

- [ ] ROTARY
- [ ] HAMMER
- [ ] CABLE TOOL
- [x] OTHER - SPECIFY: Auger

**DEPTH (FT):**

<table>
<thead>
<tr>
<th>FROM</th>
<th>TO</th>
</tr>
</thead>
<tbody>
<tr>
<td>33.9'</td>
<td>22.9''</td>
</tr>
<tr>
<td>22.9''</td>
<td>6''</td>
</tr>
</tbody>
</table>

**BORE HOLE DIA. (IN):**

<table>
<thead>
<tr>
<th>PVC SCR 40</th>
</tr>
</thead>
<tbody>
<tr>
<td>Threaded</td>
</tr>
<tr>
<td>2''</td>
</tr>
<tr>
<td>SCH 40</td>
</tr>
<tr>
<td>0.010</td>
</tr>
</tbody>
</table>

**CASING MATERIAL:**

<table>
<thead>
<tr>
<th>INSIDE DIA.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2''</td>
</tr>
<tr>
<td>CASING (IN):</td>
</tr>
<tr>
<td>SCH 40</td>
</tr>
<tr>
<td>CASING WALL</td>
</tr>
<tr>
<td>THICKNESS (IN):</td>
</tr>
<tr>
<td>BLANK</td>
</tr>
</tbody>
</table>

**FORMATION DESCRIPTION OF PRINCIPAL WATER-BEARING STRATA**

<table>
<thead>
<tr>
<th>DEPTH (FT):</th>
<th>THICKNESS (FT):</th>
</tr>
</thead>
<tbody>
<tr>
<td>25.75-32.9''</td>
<td>7.15''</td>
</tr>
</tbody>
</table>

- Sand & Gravel and Clay

**TOTAL ESTIMATED WELL YIELD (GPM):** Not Tested

---

**FOR OSE INTERNAL USE**

**FILE NUMBER:** LRG-14545

**POD NUMBER:** TRN-420799

**LOCATION:**

---

**WELL RECORD & LOG (Version 6/9/08)**

---

**PAGE 1 OF 2**
## 5. Seal and Pump

<table>
<thead>
<tr>
<th>Depth (FT)</th>
<th>Bore Hole Dia. (IN)</th>
<th>Material Type and Size</th>
<th>Amount (Cubic Ft)</th>
<th>Method of Placement</th>
</tr>
</thead>
<tbody>
<tr>
<td>FROM</td>
<td>TO</td>
<td>39.9' to 5.0'</td>
<td>6' No Filter Pack</td>
<td>Poured in</td>
</tr>
<tr>
<td>5.0'</td>
<td>0.0'</td>
<td>34' Gravel Bentonite</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

## 6. Geologic Log of Well

<table>
<thead>
<tr>
<th>Depth (FT)</th>
<th>Thickness (FT)</th>
<th>Color and Type of Material Encountered</th>
<th>Water Bearing?</th>
</tr>
</thead>
<tbody>
<tr>
<td>FROM</td>
<td>TO</td>
<td>(Include Water-Bearing Cavities or Fracture Zones)</td>
<td></td>
</tr>
<tr>
<td>0.0'</td>
<td>3.0'</td>
<td>Dark Brown</td>
<td>Silty Sandy Clay, Gravel</td>
</tr>
<tr>
<td>3.0'</td>
<td>9.5'</td>
<td>Dark Brown</td>
<td>Sandy Silty Clay, Gravel</td>
</tr>
<tr>
<td>9.5'</td>
<td>14.0'</td>
<td>Dark Brown</td>
<td>Sandy Clay, Silt, Gravel</td>
</tr>
<tr>
<td>14.0'</td>
<td>18.0'</td>
<td>Dark Brown</td>
<td>Gravelly Sandy Clay, Silt</td>
</tr>
<tr>
<td>18.0'</td>
<td>29.0'</td>
<td>Dark Brown</td>
<td>Gravelly Sandy Clay, Silt</td>
</tr>
<tr>
<td>29.0'</td>
<td>39.9'</td>
<td>Dark Brown</td>
<td>Gravelly Sandy Clay, Silt</td>
</tr>
</tbody>
</table>

## Additional Statements or Explanations:

- Well Has A 4" Stand Pipe 18" Above Ground Level

## Test Additional Info

METHOD: □ Bailer □ Pump □ Air Lift □ Other - Specify:

Test Results - Attach a copy of data collected during well testing, including start time, end time, and a table showing discharge and drawdown over the testing period.

## Signature of Driller

Jefferson Van Arsdel

Signature of Driller

DATE: 1-12-09

The undersigned hereby certifies that, to the best of his or her knowledge and belief, the foregoing is a true and correct record of the above described hole and that he or she will file this well record with the state engineer and the permit holder within 20 days after completion of well drilling.
<table>
<thead>
<tr>
<th>Field</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>POD NUMBER (WELL NUMBER)</td>
<td>LRG-14545-POD 2 (m2102)</td>
</tr>
<tr>
<td>POD NUMBER (WELL NUMBER)</td>
<td>LRG-14545</td>
</tr>
<tr>
<td>LICENSE NUMBER</td>
<td>WD-1433</td>
</tr>
<tr>
<td>NAME OF LICENSED DRILLER</td>
<td>Jefferson Van Ausdale</td>
</tr>
<tr>
<td>NAME OF WELL DRILLING COMPANY</td>
<td>U.S. Bureau of Reclamation</td>
</tr>
<tr>
<td>DRILLING STARTED</td>
<td>1-6-09</td>
</tr>
<tr>
<td>DRILLING ENDED</td>
<td>1-6-09</td>
</tr>
<tr>
<td>DEPTH OF COMPLETED WELL (FT)</td>
<td>29.0'</td>
</tr>
<tr>
<td>BORE HOLE DEPTH (FT)</td>
<td>29.0'</td>
</tr>
<tr>
<td>DEPTH, WATER FIRST ENCOUNTERED (FT)</td>
<td>21.1'</td>
</tr>
<tr>
<td>STATIC WATER LEVEL IN COMPLETED WELL (FT)</td>
<td>21.1'</td>
</tr>
<tr>
<td>COMPLETED WELL IS</td>
<td>Shallow (Unconfined)</td>
</tr>
<tr>
<td>DRILLING FLUID</td>
<td>Air</td>
</tr>
<tr>
<td>DRILLING METHOD</td>
<td>Auger</td>
</tr>
<tr>
<td>DEPTH (FT) FROM TO</td>
<td>29.0'</td>
</tr>
<tr>
<td>BORE HOLE DIA. (IN)</td>
<td>6&quot;</td>
</tr>
<tr>
<td>CASING MATERIAL</td>
<td>PVC SCH 40</td>
</tr>
<tr>
<td>CONNECTION TYPE (CASING)</td>
<td>Threaded</td>
</tr>
<tr>
<td>INSIDE DIA. CASING (IN)</td>
<td>2&quot;</td>
</tr>
<tr>
<td>CASING WALL THICKNESS (IN)</td>
<td>SCH 40</td>
</tr>
<tr>
<td>SLOT SIZE (IN)</td>
<td>0.00</td>
</tr>
<tr>
<td>DEPTH (FT) FROM TO</td>
<td>21.1'</td>
</tr>
<tr>
<td>THICKNESS (FT)</td>
<td>Sand, Gravel and Clay</td>
</tr>
<tr>
<td>FORMATION DESCRIPTION OF PRINCIPAL WATER-BEARING STRATA</td>
<td>Not Tested</td>
</tr>
<tr>
<td>YIELD (GPM)</td>
<td></td>
</tr>
</tbody>
</table>

**TOTAL ESTIMATED WELL YIELD (GPM)**
### Annular Seal and Gravel Pack

<table>
<thead>
<tr>
<th>Depth (FT)</th>
<th>Thickness (FT)</th>
<th>Color and Type of Material Encountered</th>
<th>Water Bearing?</th>
</tr>
</thead>
<tbody>
<tr>
<td>FROM</td>
<td>TO</td>
<td>(Include water-bearing cavities or fracture zones)</td>
<td>YES</td>
</tr>
<tr>
<td>0' - 1.5'</td>
<td>1.5' - 3.5'</td>
<td>Dark Brown Silt, Sand, Clay, Gravel</td>
<td>YES</td>
</tr>
<tr>
<td>1.5' - 3.5'</td>
<td>3.5' - 5.0'</td>
<td>Dark Brown Gravelly Sand, Silt, Clay</td>
<td>YES</td>
</tr>
<tr>
<td>5.0' - 7.0'</td>
<td>7.0' - 14.0'</td>
<td>Dark Brown Gravelly Sand</td>
<td>YES</td>
</tr>
<tr>
<td>14.0' - 29.0'</td>
<td>15.0' - 60.0'</td>
<td>Dark Brown Gravelly Sand, Clay</td>
<td>YES</td>
</tr>
</tbody>
</table>

### Geologic Log of Well

#### Method of Placement
- Poured In

**Note:** Attach additional pages as needed to fully describe the geologic log of the well.

### Additional Statements or Explanations

Well has a 4" standpipe 18" above ground level.

**Signature of Driller:**

Jeffrey Van Aarde

**Date:**

1-12-09
## WELL RECORD & LOG

### OFFICE OF THE STATE ENGINEER

www.ose.state.nm.us

---

### 1. GENERAL AND WELL LOCATION

- **POD NUMBER (WELL NUMBER):** LRG-14545-POD3 (MW 03)
- **WELL OWNER NAME:** U.S. Bureau of Reclamation
- **WELL OWNER MAILING ADDRESS:** HC 32 Box 312

### 2. OPTIONAL

- **SUBDIVISION NAME:**
- **LOT NUMBER:**
- **BLOCK NUMBER:**
- **UNRESTRICTED:**
- **MAP NUMBER:**
- **TRACT NUMBER:**

### 3. DRILLING INFORMATION

- **LICENSE NUMBER:** WD-1433
- **NAME OF LICENSED DRILLER:** Jeffrey Van Ausdal
- **NAME OF WELL DRILLING COMPANY:** Bureau of Reclamation
- **DRILLING STARTED:** 1-7-09
- **DRILLING ENDED:** 1-7-09
- **DEPTH OF COMPLETED WELL (FT):** 24.8'
- **BORE HOLE DEPTH (FT):** 24.8'
- **DEPTUH WATER FIRST ENCOUNTERED (FT):** 23.3'
- **COMPLETED WELL 13:**
- **DRILLING FLUID:**
- **DRILLING METHOD:**
- **DEPTUH (FT):**
  - FROM 24.8' to 14.8'
  - FROM 14.8' to 11.8'
  - FROM 11.8' to 9.8'
  - FROM 9.8' to 4.8'
  - FROM 4.8' to 2.8'
  - FROM 2.8' to 0.8'
  - FROM 0.8' to 0.0'
- **THICKNESS (FT):**
  - FROM 23.3' to 24.8'
  - FROM 24.8' to 24.0'
  - FROM 24.0' to 23.5'
  - FROM 23.5' to 23.0'
  - FROM 23.0' to 22.5'
  - FROM 22.5' to 22.0'
  - FROM 22.0' to 21.5'
  - FROM 21.5' to 21.0'
  - FROM 21.0' to 20.5'
  - FROM 20.5' to 20.0'
  - FROM 20.0' to 19.5'
  - FROM 19.5' to 19.0'
  - FROM 19.0' to 18.5'
  - FROM 18.5' to 18.0'
  - FROM 18.0' to 17.5'
  - FROM 17.5' to 17.0'
  - FROM 17.0' to 16.5'
  - FROM 16.5' to 16.0'
  - FROM 16.0' to 15.5'
  - FROM 15.5' to 15.0'
  - FROM 15.0' to 14.5'
  - FROM 14.5' to 14.0'
  - FROM 14.0' to 13.5'
  - FROM 13.5' to 13.0'
  - FROM 13.0' to 12.5'
  - FROM 12.5' to 12.0'
  - FROM 12.0' to 11.5'
  - FROM 11.5' to 11.0'
  - FROM 11.0' to 10.5'
  - FROM 10.5' to 10.0'
  - FROM 10.0' to 9.5'
  - FROM 9.5' to 9.0'
  - FROM 9.0' to 8.5'
  - FROM 8.5' to 8.0'
  - FROM 8.0' to 7.5'
  - FROM 7.5' to 7.0'
  - FROM 7.0' to 6.5'
  - FROM 6.5' to 6.0'
  - FROM 6.0' to 5.5'
  - FROM 5.5' to 5.0'
  - FROM 5.0' to 4.5'
  - FROM 4.5' to 4.0'
  - FROM 4.0' to 3.5'
  - FROM 3.5' to 3.0'
  - FROM 3.0' to 2.5'
  - FROM 2.5' to 2.0'
  - FROM 2.0' to 1.5'
  - FROM 1.5' to 1.0'
  - FROM 1.0' to 0.5'
  - FROM 0.5' to 0.0'
- **FORMATION DESCRIPTION OF PRINCIPAL WATER-BEARING STRATA:** Sand, Gravel, Clay
- **TOTAL ESTIMATED WELL YIELD (GPM):** Not tested

---

**FOR OSE INTERNAL USE**

- **FILE NUMBER:** LRG-14545
- **POD NUMBER:** TRN-420799
- **LOCATION:**

---

**WELL RECORD & LOG (Version 6/9/08)**

**PHONE (OPTIONAL):** 575-894-6661 ext. 3005

**CITY:** Truth or Consequences
**STATE:** NM
**ZIP:** 87901
<table>
<thead>
<tr>
<th>Depth (FT)</th>
<th>Thickness (FT)</th>
<th>Color and Type of Material Encountered (Include Water-Bearing Cavities or Fracture Zones)</th>
<th>Water Bearing?</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0'</td>
<td>0.4'</td>
<td>Dark Brown, Silt, Sand, Clay</td>
<td>☑️ Yes ☐ No</td>
</tr>
<tr>
<td>0.4'</td>
<td>3.0'</td>
<td>Dark Brown, Clay, Sand, Silt</td>
<td>☑️ Yes ☐ No</td>
</tr>
<tr>
<td>3.0'</td>
<td>4.0'</td>
<td>Dark Brown, Clay, Sand, Silt</td>
<td>☑️ Yes ☐ No</td>
</tr>
<tr>
<td>4.0'</td>
<td>5.0'</td>
<td>Dark Brown, Gravel, Sand, Clay, Silt</td>
<td>☑️ Yes ☐ No</td>
</tr>
<tr>
<td>5.0'</td>
<td>13.0'</td>
<td>Dark Brown, Gravel, Sand, Clay, Silt</td>
<td>☑️ Yes ☐ No</td>
</tr>
<tr>
<td>13.0'</td>
<td>24.8'</td>
<td>Dark Brown, Gravel, Sand, Clay, Silt</td>
<td>☑️ Yes ☐ No</td>
</tr>
</tbody>
</table>

**ATTACH ADDITIONAL PAGES AS NEEDED TO FULLY DESCRIBE THE GEOLOGIC LOG OF THE WELL**

**WELL TEST**

- **METHOD:** □ BAILER □ PUMP □ AIR LIFT □ OTHER - SPECIFY:
- **TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD.**

**ADDITIONAL STATEMENTS OR EXPLANATIONS:**

*Well has a 4" stand pipe 18" above ground level*
Crystalline Bedrock Wells
Figure A1. Well diagram, GWQ96-22, Copper Flat Mine, Sierra County, New Mexico.
Figure A5. Well diagram, GWQ11-26, Copper Flat Mine, Sierra County, New Mexico.
Figure A3. Well diagram, GWQ11-24, Copper Flat Mine, Sierra County, New Mexico.
Figure A7. Well diagram, GWQ-5R, Copper Flat Mine, Sierra County, New Mexico.