DISTRICT I

SCOTT A. VERHINES, P.E.
STATE ENGINEER

5550 San Antonio NE
Albuquerque, NM 87109
(505) 383-4000

November 7, 2014

FILE: NO OSE NUMBER (FW26 & TMW 32)

U.S. Army
5338 Montgomery NE, Suite 300/400
Albuquerque, NM 87109

Greetings:

Enclosed is the Well Plugging Plan of Operations which has been approved subject to the Conditions of Approval, attached hereto.

Sincerely,

Jennifer M. Allred
Water Resource Specialist

JMA:jma
Enclosures as stated

CC: ZAPATA Incorporated, Contact: Steven E. Morrissette, 4312 S. 198th Street, Omaha, NE 68135

DISTRICT 6

SCOTT A. VERHINES, P.E.

NEW MEXICO STATE ENGINEER

Materials submitted by David Henry / US Army Corps of Engineers (USACOE) and Steven Morrissette / Zapata, Inc., on behalf the USACOE of the identify two defunct monitor wells to be plugged at the Fort Wingate Depot site. Geomechanics Southwest, Inc. (WD-1522) is scheduled to plug the wells.

Permittee: US Army
Location: Fort Wingate, McKinley County, New Mexico

Approximate coordinates:

Applicant well	NMOSE File No.	Latitude (NAD 83)	Longitude (NAD 83)	Depth	Reported static water level bgl	Casing diameter
FW26	Unknown	35° 30' 56.2248"	-108° 35' 34.2708"	31'	dry	4"
TMW32	Unknown	35° 30' 28.71"	-108° 35' 15.97"	137.5'	36.3'	2"

Specific Plugging Conditions of Approval for tabulated Fort Wingate Project Monitor Wells

1. Water well drilling and well drilling activities, including well plugging, are regulated under 19.27.4 NMAC, which requires any person engaged in the business of well drilling within New Mexico to obtain a Well Driller License issued by the New Mexico Office of the State Engineer (NMOSE). Therefore, the firm of a New Mexico licensed Well Driller shall perform the well plugging.

2. Theoretical volumes of sealant required for abandonment of 2" and 4" ID casings are approximately 0.16 and 0.65 gallons per foot respectively; if casing is extracted, more sealant will be necessary.

   The Well Plugging Plans of Operation submitted request use of 3% - 5% bentonite-enriched cement grout. Pure bentonite powder ("90 barrel yield") is allowed as a cement additive under NMOSE / AWWA guidelines, and neither granular bentonite nor extended-yield bentonite should be mixed with cement for the purpose of these pluggings. When supplementing a cement slurry with bentonite powder as requested, water demand for the mix increases at a rate of approximately 0.65 gallons of water for each 1% increment of bentonite bdwc (by dry weight cement) above fundamental water demand of 5.2 gallons water per 94-lb. sack of cement. A 3% bentonite/cement slurry may therefore contain up to 7.2 gallons of water <u>total</u> per 94-lb. sack of cement / approximate 3-lb. bentonite increment, when appropriately mixed; a 5% bentonite/cement slurry may therefore contain up to 8.5 gallons of water <u>total</u> per 94-lb. sack of cement / approximate 5-lb. bentonite increment, when appropriately mixed.

   The bentonite shall be hydrated separately with its required increment of water before being mixed into the neat cement slurry. If water is otherwise added to the combination of dry ingredients or the dry bentonite blended into wet cement, the hardness and alkalinity imparted to the mix water by the cement will restrict yield of the bentonite powder, resulting in excess free water in the slurry and enhanced cement shrinkage upon curing.

3. Placement of the grout slurry within the wells shall be by pumping through a tremie pipe extended to near well bottom and kept below top of the slurry column as the well is plugged from bottom-upwards in a manner that displaces any standing water column upwards from below (note Condition 5, below). Tremie pipe may be pulled as necessary to retain minimal submergence in the advancing column of sealant.

4. Any open annulus encountered at the wellhead shall also be sealed by the placement of the approved cement grout mix. Prior to, or upon completion of plugging, the well casing may be cut-off below grade as necessary to allow redevelopment of the site, provided a minimum 6-inch thickness of abandonment grout or concrete completely encapsulates the top of the cut-off casing. More stringent local building codes may apply.

5. Should the New Mexico Environment Department, US Environmental Protection Agency, or another regulatory agency sharing jurisdiction of the project authorize, or by regulation require a more stringent well plugging procedure than herein acknowledged, the more-stringent procedure should be followed. This, in part, includes provisions regarding pre-authorization to proceed, contaminant remediation, inspection, pulling/perforating of casing, or prohibition of free discharge of any fluid from the borehole during or related to the plugging process.

6. NMOSE witnessing of the plugging of non-artesian wells is not required, but shall be facilitated if a NMOSE observer is onsite. NMOSE witnessing may be requested during normal work hours by calling the District 6 NMOSE Office at 505-383-4000, at least 48-hours in advance. NMOSE inspection will occur dependant on personnel availability.

7. A NMOSE Plugging Record (available at: http://www.ose.state.nm.us/PDF/WellDrillers/WD-11.pdf) itemizing actual abandonment process and materials used shall be filed with the State Engineer (NMOSE, 5550 San Antonio Drive NE, Albuquerque, NM 87109-4127), within 20 days after completion of well plugging. Please attach a copy of these plugging conditions.

The NMOSE Well Plugging Plans of Operation, as annotated, are hereby approved with the aforesaid conditions applied.

Witness my hand and seal this 6th day of November, 2014

By: _____

Jennifer M. Allred
Water Resource Specialist
NMOSE District 1

WELL PLUGGING PLAN OF OPERATIONS

NOTE: A Well Plugging Plan of Operations shall be filed with and accepted by the Office of the State Engineer prior to plugging.

I. FILING FEE: There is no filing fee for this form.

II. GENERAL / WELL OWNERSHIP:

Existing Office of the State Engineer POD Number (Well Number) for well to be plugged: FW26

Name of well owner: U.S. Army

Mailing address: 5338 Montgomery NE Suite 300/400

City: Albuquerque State: NM Zip code: 87109

Phone number: 505-342-3139 E-mail: David.W.Henry@usace.army.mil

III. WELL DRILLER INFORMATION:

Well Driller contracted to provide plugging services: Geomechanics Southwest, Inc.

New Mexico Well Driller License No.: WD-1522 Expiration Date: April 30, 2015

IV. WELL INFORMATION:

Note: A copy of the existing Well Record for the well to be plugged should be attached to this plan.

1) GPS Well Location: Latitude: 35 deg, 30 min, 56.2248 sec
Longitude: 108 deg, 35 min, 34.2708 sec, NAD 83

2) Reason(s) for plugging well: Well is dry and no longer useful for monitoring purposes.

3) Was well used for any type of monitoring program? Yes If yes, please use section VII of this form to detail what hydrogeologic parameters were monitored. If the well was used to monitor contaminated or poor quality water, authorization from the New Mexico Environment Department may be required prior to plugging.

4) Does the well tap brackish, saline, or otherwise poor quality water? Dry If yes, provide additional detail, including analytical results and/or laboratory report(s):

5) Static water level: Dry feet below land surface / feet above land surface (circle one)

6) Depth of the well: 31.0 feet

7) Inside diameter of innermost casing: 4.0 inches.

8) Casing material: PVC

9) The well was constructed with:

_____ an open-hole production interval, state the open interval: _____

X a well screen or perforated pipe, state the screened interval(s): 11.0 – 31.0

10) What annular interval surrounding the artesian casing of this well is cement-grouted? NA

11) Was the well built with surface casing? Yes If yes, is the annulus surrounding the surface casing grouted or otherwise sealed? Yes If yes, please describe: Steel above-ground protective casing with concrete cement plug and pad.

12) Has all pumping equipment and associated piping been removed from the well? No If not, describe remaining equipment and intentions to remove prior to plugging in Section VII of this form.

V. DESCRIPTION OF PLANNED WELL PLUGGING:

Note: If this plan proposes to plug an artesian well in a way other than with cement grout, placed bottom to top with a tremie pipe, a detailed diagram of the well showing proposed final plugged configuration shall be attached, as well as any additional technical information, such as geophysical logs, that are necessary to adequately describe the proposal.

1) Describe the method by which cement grout shall be placed in the well, or describe requested plugging methodology proposed for the well:

2) Will well head be cut-off below land surface after plugging? Yes

VI. PLUGGING AND SEALING MATERIALS:

Note: The plugging of a well that taps poor quality water may require the use of a specialty cement or specialty sealant

1) For plugging intervals that employ cement grout, complete and attach Table A.

2) For plugging intervals that will employ approved non-cement based sealant(s), complete and attach Table B.

3) Theoretical volume of grout required to plug the well to land surface: 20.25 gal. ✓

4) Type of Cement proposed: Portland Type I/II

5) Proposed cement grout mix: 7.4 See Table A gallons of water per 94 pound sack of Portland cement.

6) Will the grout be:_____ batch-mixed and delivered to the site

X mixed on site

7) Grout additives requested, and percent by dry weight relative to cement: 3-5% bentonite

8) Additional notes and calculations: _____

VII. ADDITIONAL INFORMATION: List additional information below, or on separate sheet(s):

#3: The well was installed in 1980 for groundwater monitoring purposes and is part of the FWDA groundwater monitoring network and is located in FWDA parcel 7. The well is reported to now be dry and no longer useful for monitoring. #12: If the well is found to contain any piping or pumping equipment, the equipment will be removed prior to well abandonment. It is likely that the well does not contain any piping or pumping equipment.

VIII. SIGNATURE:

I, David Henry, say that I have carefully read the foregoing Well Plugging Plan of Operations and any attachments, which are a part hereof; that I am familiar with the rules and regulations of the State Engineer pertaining to the plugging of wells and will comply with them, and that each and all of the statements in the Well Plugging Plan of Operations and attachments are true to the best of my knowledge and belief.

(US Army Corps of Engineers) Signature of Applicant — 9/15/2014 Date

IX. ACTION OF THE STATE ENGINEER:

This Well Plugging Plan of Operations is:

X Approved subject to the attached conditions.
___ Not approved for the reasons provided on the attached letter.

Witness my hand and official seal this 7th day of November, 2014

Scott A. Verhines, State Engineer

By: _____

TABLE A - For plugging intervals that employ cement grout. Start with deepest interval.

	Interval 1 – deepest	Interval 2	Interval 3 – most shallow
			Note: if the well is non-artesian and breaches only one aquifer, use only this column.
Top of proposed interval of grout placement (ft bgl)			0
Bottom of proposed interval of grout placement (ft bgl)			31.0
Theoretical volume of grout required per interval (gallons)			20.25
Proposed cement grout mix gallons of water per 94-lb. sack of Portland cement			MAX 7.2 GALS/SK TOTAL FOR 3% BENTONITE BOWC ~~7.4~~ MAX 8.5 GALS/SK TOTAL FOR 5% BENTONITE BOWC
Mixed on-site or batch-mixed and delivered?			Mixed on-site
Grout additive 1 requested			Bentonite
Additive 1 percent by dry weight relative to cement			3-5%
Grout additive 2 requested			n/a
Additive 2 percent by dry weight relative to cement			n/a

TABLE B - For plugging intervals that will employ approved non-cement based sealant(s). Start with deepest interval.

	Interval 1 – deepest	Interval 2	Interval 3 – most shallow
			Note: if the well is non-artesian and breaches only one aquifer, use only this column.
Top of proposed interval of sealant placement (ft bgl)			n/a
Bottom of proposed sealant of grout placement (ft bgl)			n/a
Theoretical volume of sealant required per interval (gallons)			n/a
Proposed abandonment sealant (manufacturer and trade name)			n/a

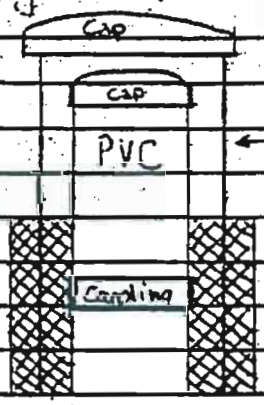
Boring No. FW 26 SHEET 4 OF 4

Relative Scales

- Plasticity	- Cohesiveness	- Density
non-plastic		
very slightly plastic	very slightly cohesive	loose
slightly plastic	slightly cohesive	slightly packed
plastic	cohesive	moderately packed
very plastic	very cohesive	firmly packed

- Bentonite slurry (Quik-Gel) used.
- Grout was poured into hole; stirred and shaken to seal completely
- water was not detected

- Two feet of PVC above ground; 2.5' of steel casing above ground



XXX Grout
:=: Bentonite
∴ Sand pack
| | Slotted casing
|=| Screen

Not to Scale

steel casing vented
PVC cap vented

- Blow counts - All values represent blows/6" unless noted
All counts recorded by dropping a 140 lb hammer 36"

- Sampling: Sampling done with split-barrel sampler, 1 5/8" ID unless noted

22 Nov 1980
DATE

Robert Gregory
SIGNED

SOURCE: Environmental Science and Engineering, Inc., 1980

Boring No. FW 26 — Location Coordinates N —

Hole Size 8" OD — Slot 0.010 — E —

Screen Length 20' — Mat'l Sch 40 PVC — Filter Materials Silica sand #20

Diameter 4" ID — Mat'l — — Grout Type Sand cement 2:1

Casing Length 13' (2' above ground) — Mat'l Sch 40 PVC — Development NA

Diameter 4" ID — Static Water Level NA

Date Start 19 Nov 1980 — Finish 19 Nov 1980 — Top of Well Elevation —

Contractor ETL — Driller RJS — Drill Type CME 75

Ground elevation: — — Depth to first water: Not encountered

Depth (feet)	Sample length recovered	Lithology, Color	Sketch of Construction (Not to scale)	Standard Penetration Blow Count blow/6" unless noted
0–1.5	1 (11")	Dark reddish brown SM-SC 5YR 3/4 w/roots (5%), slightly plastic, loose, moisture: dry, granular, alluvium	Cuttings 1'	4, 6, 6
1.5–3.0	2 (19")	Brown SM-SC 7.5YR 4/4 w/roots (5%), slightly plastic, loose, moisture: dry, granular, alluvium		6, 5, 6
3.0–4.5	3 (17")	Brown SM-SC 7.5YR 4/4 w/roots (5%), slightly plastic, loose, moisture: dry, granular, alluvium		5, 3, 3
4.5–6.0	4 (17")	Reddish brown SM-SC 5YR 4/4 slightly plastic, loose moisture: <2%, granular w/ bedding (color bands), alluvium		3, 2, 3
6.0–7.5	5 (18")	Dark reddish brown CL 5YR 3/3 slightly sandy (10%) plastic, cohesive, moisture: (5%), massive alluvium	6'	5/12", 12

SOURCE: Environmental Science and Engineering, Inc., 1980

Boring No. FW 26 | Location Coordinates N —

Hole Size 8" OD | Slot 0.010 | E —

Screen Length 20' | Mat'l Sch 40 PVC | Filter Materials Silica sand #20

Diameter 4" ID | Mat'l — | Grout Type Sand cement 2:1

Casing Length 13' (2' above ground) | Mat'l Sch 40 PVC | Development NA

Diameter 4" ID | Static Water Level NA

Date Start 19 Nov 1980 | Finish 19 Nov 1980 | Top of Well Elevation —

Contractor ETL | Driller RTS | Drill Type CME 75

Ground elevation: — | Depth to first water: Not encountered

Depth (feet)	Sample & length recovered	Lithology, Color	Sketch of Construction (Not to Scale)	Standard Penetration Blow Count blows/6" unless noted
7.5-9.0	6 (14")	SM-SC Brown 7.5YR 5/4 w/ roots (5%), slightly plastic, loose, moisture: dry, granular, alluvium		5, 5, 4
9.0-10.5	7 (16")	SM-SC Reddish brown 5YR 5/3 very slightly plastic, loose, moisture: dry, granular, alluvium	9'	3, 4, 4
15.0-16.5	8 (13")	SM-SC Brown 7.5YR 5/4 very slightly plastic, loose, moisture: dry, granular, alluvium	Coupling 11'	4, 5, 5
20.0-21.5	9 (11")	CL Brown 7.5YR 4/4 Sandy (20%), plastic, cohesive, moisture: dry, blocky to massive, alluvium, brown mottling	Coupling 21'	8, 10, 14
25.0-26.5	10 (15")	SM-SC Light reddish brown 5YR 6/3 slightly plastic, slightly cohesive moisture: dry, granular bedding (color bands), alluvium		7, 9, 10

SOURCE: Environmental Science and Engineering, Inc., 1980

Boring No. FW 26 | Location Coordinates N —

Hole Size 8" OD | Slot 0.010 | E —

Screen Length 20' | Mat'l Sch 40 PVC | Filter Materials Silica sand #20

Diameter 4" ID | Mat'l — | Grout Type Sand cement 2:1

Casing Length 13' (2' above ground) | Mat'l Sch 40 PVC | Development NA

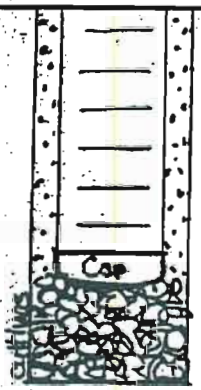
Diameter 4" ID | Static Water Level NA

Date Start 19 Nov 1980 | Finish 19 Nov 1980 | Top of Well Elevation —

Contractor ETL | Driller RJS | Drill Type CME 75

Ground elevation: —

Depth to first water: Not encountered

Depth (feet)	Sample (length recovered ↓)	Lithology, Color	Sketch of Construction (Not to Scale)	Standard Penetration Blow Count blows/6" unless noted
30.0-31.5	11 (1')	ML Reddish brown 5YR 5/3 non-plastic, loose, moisture: dry, [illegible] alluvium		7, 10, 10
		Drilled to 32' to provide open hole to 30'		

SOURCE: Environmental Science and Engineering, Inc., 1980

WELL PLUGGING PLAN OF OPERATIONS

NOTE: A Well Plugging Plan of Operations shall be filed with and accepted by the Office of the State Engineer prior to plugging.

I. FILING FEE: There is no filing fee for this form.

II. GENERAL / WELL OWNERSHIP:

Existing Office of the State Engineer POD Number (Well Number) for well to be plugged: TMW32

Name of well owner: U.S. Army

Mailing address: 5338 Montgomery NE Suite 300/400

City: Albuquerque State: NM Zip code: 87109

Phone number: 505-342-3139 E-mail: David.W.Henry@usace.army.mil

III. WELL DRILLER INFORMATION:

Well Driller contracted to provide plugging services: Geomechanics Southwest, Inc.

New Mexico Well Driller License No.: WD-1522 Expiration Date: April 30, 2015

IV. WELL INFORMATION:

Note: A copy of the existing Well Record for the well to be plugged should be attached to this plan.

1) GPS Well Location: FOR AS BUILT DIAGRAM: 35° 30' 28.71"

Latitude: ~~52~~ deg, ~~17~~ min, ~~30.8400~~ sec

Longitude: ~~-089~~ -108° deg, ~~27~~ 35' min, ~~36.3214~~ 15.97" sec, NAD 83

2) Reason(s) for plugging well: Well is located in parcel 21, is part of the explosives leach beds monitoring well network, and requires abandonment due to a planned excavation and removal action for explosives contaminated soils which will include the area where this well is located.

3) Was well used for any type of monitoring program? Yes If yes, please use section VII of this form to detail what hydrogeologic parameters were monitored. If the well was used to monitor contaminated or poor quality water, authorization from the New Mexico Environment Department may be required prior to plugging.

4) Does the well tap brackish, saline, or otherwise poor quality water? No If yes, provide additional detail, including analytical results and/or laboratory report(s):

5) Static water level: 36.3 [feet below land surface] / feet above land surface (circle one)

6) Depth of the well: 137.5 feet

7) Inside diameter of innermost casing: 2.0 inches.

8) Casing material: PVC

9) The well was constructed with:

_____ an open-hole production interval, state the open interval: _____

X a well screen or perforated pipe, state the screened interval(s): 117.0 – 137.0

10) What annular interval surrounding the artesian casing of this well is cement-grouted? NA

11) Was the well built with surface casing? Yes If yes, is the annulus surrounding the surface casing grouted or otherwise sealed? Yes If yes, please describe: Steel above-ground protective casing with Portland cement plug and pad.

12) Has all pumping equipment and associated piping been removed from the well? No. If not, describe remaining equipment and intentions to remove prior to plugging in Section VII of this form.

V. DESCRIPTION OF PLANNED WELL PLUGGING:

Note: If this plan proposes to plug an artesian well in a way other than with cement grout, placed bottom to top with a tremie pipe, a detailed diagram of the well showing proposed final plugged configuration shall be attached, as well as any additional technical information, such as geophysical logs, that are necessary to adequately describe the proposal.

1) Describe the method by which cement grout shall be placed in the well, or describe requested plugging methodology proposed for the well: The well will be plugged in accordance with 19.27.4.30 C NMAC using a neat cement slurry. The well will be filled from the bottom upwards to land surface using a tremie pipe.

2) Will well head be cut-off below land surface after plugging? Yes

VI. PLUGGING AND SEALING MATERIALS:

Note: The plugging of a well that taps poor quality water may require the use of a specialty cement or specialty sealant

1) For plugging intervals that employ cement grout, complete and attach Table A.

2) For plugging intervals that will employ approved non-cement based sealant(s), complete and attach Table B.

3) Theoretical volume of grout required to plug the well to land surface: 22.7 gal. ✓

4) Type of Cement proposed: Portland Type I/II

5) Proposed cement grout mix: 7.4 SEE TABLE A gallons of water per 94 pound sack of Portland cement.

6) Will the grout be: _____ batch-mixed and delivered to the site

X mixed on site

7) Grout additives requested, and percent by dry weight relative to cement: 3-5% bentonite

8) Additional notes and calculations:

VII. ADDITIONAL INFORMATION: List additional information below, or on separate sheet(s):

#3: The well was installed in 2009 for groundwater monitoring purposes and is part of the FWDA groundwater monitoring network and is located in FWDA parcel 21 at the TNT leaching beds. A TNT contaminated soil removal and disposal action is planned which will include the area of this well which necessitates abandonment of the well.

#12: Well is equipped with a BESST Low-Flow pump and piping. This equipment will be removed before well abandonment.

VIII. SIGNATURE:

I, David Henry, say that I have carefully read the foregoing Well Plugging Plan of Operations and any attachments, which are a part hereof; that I am familiar with the rules and regulations of the State Engineer pertaining to the plugging of wells and will comply with them, and that each and all of the statements in the Well Plugging Plan of Operations and attachments are true to the best of my knowledge and belief.

(US Army Corps of Engineers)
Signature of Applicant

9/10/14
Date

IX. ACTION OF THE STATE ENGINEER:

This Well Plugging Plan of Operations is:

X Approved subject to the attached conditions.
____ Not approved for the reasons provided on the attached letter.

Witness my hand and official seal this 7th day of November, 2014.

Scott A. Verhines, State Engineer

By: J. M. Hall

TABLE A - For plugging intervals that employ cement grout. Start with deepest interval.

	Interval 1 – deepest	Interval 2	Interval 3 – most shallow
			Note: if the well is non-artesian and breaches only one aquifer, use only this column.
Top of proposed interval of grout placement (ft bgl)			0
Bottom of proposed interval of grout placement (ft bgl)			137.5
Theoretical volume of grout required per interval (gallons)			22.7
Proposed cement grout mix gallons of water per 94-lb. sack of Portland cement			MAX 7.2 GALS/SK TOTAL FOR 3% BENTONITE BDWC 7.4 MAX 8.5 GALS/SK TOTAL FOR 5% BENTONITE BDWC DHL
Mixed on-site or batch-mixed and delivered?			Mixed on-site
Grout additive 1 requested			Bentonite
Additive 1 percent by dry weight relative to cement			3-5%
Grout additive 2 requested			n/a
Additive 2 percent by dry weight relative to cement			n/a

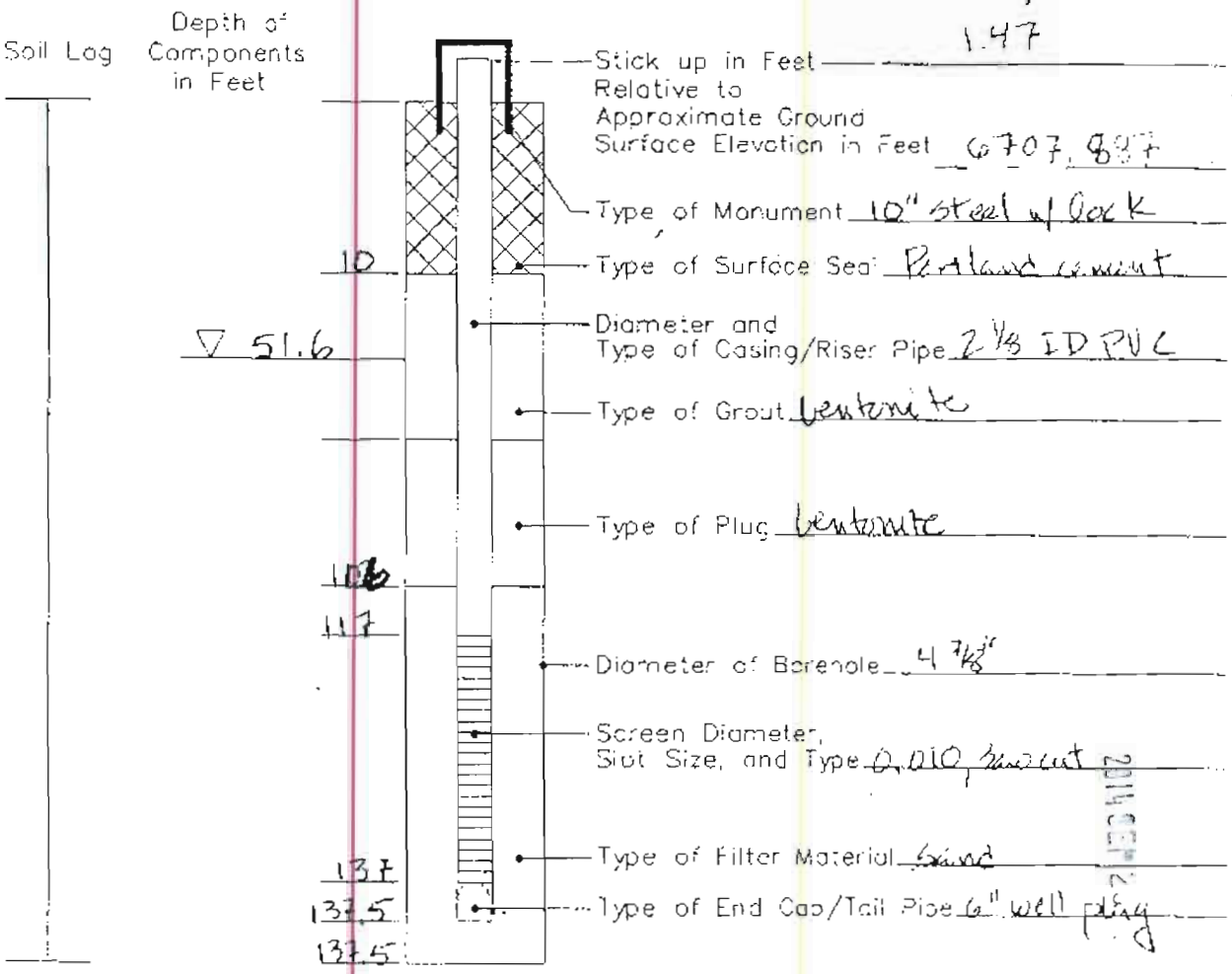
TABLE B - For plugging intervals that will employ approved non-cement based sealant(s). Start with deepest interval.

	Interval 1 – deepest	Interval 2	Interval 3 – most shallow
			Note: if the well is non-artesian and breaches only one aquifer, use only this column.
Top of proposed interval of sealant placement (ft bgl)			n/a
Bottom of proposed sealant of grout placement (ft bgl)			n/a
Theoretical volume of sealant required per interval (gallons)			n/a
Proposed abandonment sealant (manufacturer and trade name)			n/a

Installation Report — Monitoring Well I-3/TMW 32

Project DHBRC Job No _____ Date 12/2/09

Location EWDA PZ1 HC Observer Hathorne Driller USGS/Grant
X 108° 35' 15.97" W Y 35° 30' 28.71" N
Type of Well (Observation, Sampling, Vapor Extraction) monitoring



Stick up in Feet Relative to Approximate Ground Surface Elevation in Feet 1.47 6707.897

Type of Monument 10" steel w/ lock

Type of Surface Seal Portland cement

Diameter and Type of Casing/Riser Pipe 2 1/8 ID PVC

Type of Grout bentonite

Type of Plug bentonite

Diameter of Borehole 4 7/8"

Screen Diameter, Slot Size, and Type 2.010, 2inch 20 slot

Type of Filter Material Sand

Type of End Cap/Tail Pipe 6" well plug

Remarks: _____

Materials Tally:

Sand 5
Cement 4
Bentonite 35

Monument: 10" steel
PVC 20ft screen/120ft. pipe, 2 1/8 ID
Other _____

GEOLOGIC BORING/WELL LOG

Project #: DHBRC | Project Name: FWDA Area IV | Boring/Well #: TMW32 (1-3)

Geologist: DALE RANKIN | Driller/Company: USGS.

Drilling Equip.: Geoprobe / Auger + Auger | Date Start: 11/19/09 | Date Completed: 12/01/09

Surface Elev.: 6707.831ft | Top of Casing Elev.: 6709.301ft | Total Depth: 139.0 ft. | Well Depth: 137.5

Method of Drilling

- ☐ Hollow Stem ☐ Direct Rotary
- ☒ Air Rotary ☐ Bucket Auger
- ☐ MUD Rotary ☑ Flight Auger

Hole Diameter: 5"

Casing/Riser Type

- ☐ Steel ☐ Threaded
- ☐ Galv ☐ Welded
- ☑ PVC ☐ Solvent
- ☐ SS ☐ Welded

Drive Shoe? ☐ Yes ☐ No

Height: (above) / below surface: 1.47ft

Diameter: 2 1/2"

Screen Portion of Well

Material: Sawcut

Diameter: 2 1/2" Length: 20ft

Set between: 117 ft and 137 ft

Slot size: 0.010

Filter Pack

Size: _____

Method of Install: tremy & slow pour

Composition: Sand

Volume Used: (5)

Depth to top of f.p.: 106 ft. BGS.

Annulus Seal

☑ Bentonite Pellets ____ Chips ____

☐ _____

Volume Used: (35)

Method of Instal.: tremy / slow pour

Depth: from 106 ft. to 137.5 ft.

Grout

Used? ☑ Yes ☐ No Volume: _____

☐ Neat Cement ☑ Bentonite

☐ _____

Method of Instal.: slow pour & tremy

Depth: from 10 ft. to 96 ft.

Well Head Completion

☐ Flushmount ☑ Stand Up

Cap Type: _____

Lock #: N/A

Volume Used: cement (4) bags

Development

Method: 2 GPM trash pump

Gallons Evacuated: 240 gal

Date: 12/5/09, 12/06/09, 12/10/09

Odor: _____

Static Water Level

Initial: 51.6 ft

Development: 51.6 ft.

24 hr.: 37.8 ft.

DRILLING		SAMPLE							GEOLOGIC LOG		
Depth	PID Reading (ppm)	Sample Type	Sample ID	Blow Count 0-6"	6-12"	12-18"	18-24"	Recovery (in)	USCS Class	Contact Depth	Descriptions and Comments
0-4								34			clayey silt-lt. red-br, dry, lost 14" @ bottom
4-8								36			@: Silty clay lt. red br, dry, lost 12" bottom
8-10								38			7: clayey silt lt. red br, dry, lost 10" @ bottom
10-14								41			Sandy silty clay lt. red br, dry, 1" bottom @ 13'10"
14-18								36			Silty clay, Lt. Brown, Dry, tight, 17'-18' lost.
18-22								52			Silty Clay, brown, slightly moist, tight top 10" slough
22-26								50			Silty Clay, brown, slightly moist, tight, lost 44-48 bottom
26-30								44			Sandy silt nr. Bottom, friable, Lt. Br, unconsolidated
											: dry 4" slough, Lost 40-48 @ bottom
30-34								46			Friable, pebbly, silty sand, clay nr bottom, Rd-Br, slightly moist, friable
											lost 6" @ bottom.

GEOLOGIC BORING/WELL LOG

Project #: DHBRC | Project Name: FWDA Parcel | Boring/Well #: TMW 32 1-3

Geologist: | Driller/Company:

Drilling Equip.: | Date Start: 11/19/09 | Date Completed:

Surface Elev.: | Top of Casing Elev.: | Total Depth: | Well Depth:

DRILLING	SAMPLE								GEOLOGIC LOG			
Depth (FT)	PID Reading (ppm)	Sample Type	Sample ID	Blow Count 0-6"	6-12"	12-18"	18-24"	Recovery (in)	USCS Class	Contact Depth	Descriptions and Comments
34-38								48			unconsolidated, clayey silty sand with pebbles and gravel yellowish-reddish brown slightly moist, lost 4" @ bottom
38-42								55			very tight silty clay w/ $CaCO_3$ inclusions, dark brown, slightly moist Break @ 48' 3" slough, lost 6" @ bottom
42-46								48			very tight silty clay, dk red-brown, slightly moist, lost 3" @ bottom Squeezing? from 42-45; tagged bottom of hole @ 44.9' 3" slough
44-47								48			clay, friable, dk red-brown with green clay inclusions, slightly moist, no loss. Suspected refusal @ 47' But going to try again.
45-49								49			friable, silty clay, dark red, slightly moist
49-53											Tried but stopped @ 45', cored to 49', but got little recovery 16" STOPPING @ 48.4'
45-50				Flight auger							Cuttings show more moisture
55-60											59' possible caliche layer was tighter, broke thru, then softer but getting tighter -
60-64											-Sheared bit Start coring

GEOLOGIC BORING/WELL LOG

Project #: TMW 32	Project Name: FWDA Parcel 21	Boring/Well #: TMW 32 (1-3)
Geologist: AM MacMorne	Driller/Company: USGS.	
Drilling Equip.: Flight Auger.	Date Start: 11/19/09	Date Completed: 12/01/09
Surface Elev.: 6707.83ft	Top of Casing Elev.: 6709.30ft	Total Depth: 139ft. / Well Depth: 137.5ft.

Method of Drilling

- ☐ Hollow Stem ☐ Direct Rotary
- ☑ Air Rotary ☐ Bucket Auger
- ☐ MUD Rotary ☑ Flight Auger

Hole Diameter: 5"

Casing/Riser Type

- ☐ Steel ☐ Threaded
- ☐ Galv ☐ Welded
- ☑ PVC ☐ Solvent
- ☐ SS ☐ Welded

Drive Shoe? ☐ Yes ☐ No

Height above/below surface: 1.47ft.

Diameter: 2½

Screen Portion of Well

Material: Sawcut

Diameter: 2½" Length: 20ft.

Set between: 117 ft and 137 ft

Slot size: 0.010

Filter Pack

Size: _____

Method of Install: tremy + slow pour

Composition: sand

Volume Used: (5)

Depth to top of f.p.: 106ft BGS

Annulus Seal

☑ Bentonite Pellets ——— Chips ———

☐ _____

Volume Used? (35)

Method of Instal.: tremy / slow pour.

Depth: from 106 ft. to 1325 ft. BGS

Grout

Used? ☐ Yes ☐ No Volume: _____

☐ Neat Cement ☑ Bentonite

☐ _____

Method of Instal.: Slow pour

Depth: from 10 ft. to 96 ft.

Well Head Completion

☐ Flushmount ☑ Stand Up

Cap Type: _____

Lock #: N/A

Volume Used: cement (4)

Development

Method: 2 open trash pump.

Gallons Evacuated: 240 gallons.

Date: 12/5/09, 12/6/09, 12/12/09

Odor: _____

Static Water Level

Initial: 57.6 ft

Development: 51.6 ft.

24 hr.: 37.8 ft.

DRILLING		SAMPLE							GEOLOGIC LOG		
Depth (ft)	PID Reading (ppm)	Sample Type	Sample ID	Blow Count 0-6"	6-12"	12-18"	18-24"	Recovery (ft)	USCS Class	Contact-Depth	Descriptions and Comments
64-73								7.6		63'	Top of SSt.
										67.5'	SS to claystone
73-78								4.7			Claystone
78-87								8.5			"
87-93								6.0			"
93-103								10.			"
103-113										108.5	claystone to SSt
										110.	harder SSt/Bonded begin making water
112-11											112-115' clay partings in SSt
113-123								10.3			core - brown + blue mottled. top 5' blue banded SSt

GEOLOGIC BORING/WELL LOG

Project #: DHSRC	Project Name: FWDA Parcel 21	Boring/Well #: TMW 32 (1-3)
Geologist: Dale Rankin	Driller/Company: USGS.	
Drilling Equip.: Geoprobe / Right Auger	Date Start: 11/19/09	Date Completed: 12/01/09
Surface Elev.: 6707.83ft Top of Casing Elev.: 6709.31ft	Total Depth: 139ft	Well Depth: 137.5ft

DRILLING		SAMPLE							GEOLOGIC LOG		
				Blow Count							
Depth	PID Reading (ppm)	Sample Type	Sample ID	0-6"	6-12"	12-18"	18-24"	Recovery-(in)	USCS Class	Contact-Depth	Descriptions and Comments
123-133								7.6			SST into conglomeritic clay blue clay last 1ft.
										130'	Contact SST / claystone
133-138								5.0			Claystone
											TD: 138.