| CP4-ES-0069<br>FRev. 2 | **TITLE**:<br>Monitoring Well And Associated Infrastructure Installation | Page 1 of 24 |
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**DOCUMENT CATEGORY**: ☐ Administrative ☒ Technical

**LEVEL OF USE**: ☐ Information Level ☒ Reference Level ☐ Continuous Use

| | |
|---|---|
| **FUNCTIONAL AREA**:<br>Environmental Stewardship<br>**SUBJECT MATTER AREA:**<br>Monitoring Well Installation | **SUBJECT MATTER EXPERT**:<br>Barry Kinsall, Environmental Scientist |
| **NUCLEAR SAFETY REVIEW DOCUMENTATION**:<br>FRNP-19-0645-D | **APPROVED BY/DATE** (Signature on file):<br>Lisa Crabtree, Environmental Monitoring Manager<br>12/18/19 |
| **REQUIRED REVIEW DATE** (or expiration date for temporary change):<br>12/18/22 | **EFFECTIVE DATE**:<br>12/19/19 |

**REVISION/CHANGE LOG**

| Revision/Change Letter | Description of Changes | Pages Affected | Date of Revision/Change |
|---|---|---|---|
| FR0 | Bluesheet | All | 09/22/2017 |
| FR1 | Non-Intent Revision to remove Bluesheet | All | 12/5/2017 |
| FR2 | General Revision | All | 12/18/19 |

**TABLE OF CONTENTS**

1.0 PURPOSE AND SCOPE ..... 3
1.1 Purpose ..... 3
1.2 Scope ..... 3
2.0 REFERENCES ..... 3
2.1 Use References ..... 3
2.2 Source References ..... 4
3.0 COMMITMENTS ..... 5
4.0 PRECAUTIONS AND LIMITATIONS ..... 5
4.1 Precautions ..... 5
4.2 Limitations ..... 5
5.0 PREREQUISITES ..... 5
6.0 INSTRUCTIONS ..... 7
6.1 Pre-Performance Activities ..... 7
6.2 Well Installation ..... 8
6.3 Well Development ..... 11
6.4 Well Pad Construction ..... 12
6.5 Bollard Installation ..... 13
6.6 Well Infrastructure Finishing ..... 14
6.7 Installation of Sampling Access Road/Pad ..... 14
6.8 Well Installation Closeout ..... 16
7.0 ACCEPTANCE CRITERIA ..... 17
8.0 POST PERFORMANCE WORK ACTIVITIES ..... 17
9.0 RECORDS ..... 17
9.1 Records Generated ..... 17
9.2 Records Disposition ..... 17
APPENDIX A – ACRONYMS/DEFINITIONS ..... 18
APPENDIX B – WELL DEVELOPMENT DOCUMENTATION DATA ..... 20
APPENDIX C – GROUND WATER MONITORING WELLS TYPICAL WELL DETAILS (C7DCWELLSA002) ..... 21
APPENDIX D – GROUND WATER MONITORING WELLS INSTALLATION DETAILS (C7DCWELLSA003) ..... 22
APPENDIX E – GROUND WATER PIEZOMETER WELLS INSTALLATION DETAILS (C5E-FA1950-A12) ..... 23
APPENDIX F – MCNAIRY MONITORING WELL INSTALLATION DETAILS (C5D-FA5410-A03) ..... 24

## 1.0 PURPOSE AND SCOPE

### 1.1 Purpose

This procedure defines the methods and requirements for the installation of groundwater monitoring wells (MW). The procedure steps and requirements provide guidance according to U.S. Environmental Protection Agency (EPA) directives and Kentucky Administrative Regulations (KAR).

The Environmental Monitoring Project Manager is responsible for accepting any new monitoring wells to be installed and ensuring that the wells meet the following standards:

- 401 KAR 6:350, *Monitoring Well Construction Practices and Standards*
- Construction requirements, as outlined in the project scope of work, field sampling plan, engineering drawings, or work plan
- Acceptance criteria for well development, as outlined in the U.S. Department of Energy's (DOE) prime contractor procedures
- Proper function of the well with no deficiencies

Monitoring wells that do **NOT** meet these requirements will **NOT** be accepted by the Environmental Monitoring Project Manager until all deficiencies have been corrected.

### 1.2 Scope

This procedure applies to all Paducah Gaseous Diffusion Plant (PGDP) Deactivation and Remediation (D&R) employees and/or subcontractors installing monitoring wells and associated infrastructure components at the U.S. DOE Paducah site.

The Environmental Monitoring organization has organizational ownership and maintenance responsibility for this procedure. The approval authority for this document is the Environmental Monitoring Project Manager.

The Engineering & Technical Services (E&TS) Organization will be consulted regarding alternative technical specifications.

## 2.0 REFERENCES

### 2.1 Use References

- 401 KAR 6:310, *Section 11, Well Abandonment*
- 401 KAR 6:320, *Certification of Water Well Driller*
- 401 KAR 6:350, *Monitoring Well Construction Practices and Standards*
- CP2-ES-0006, *Environmental Monitoring Plan*
- CP2-ES-0024, *Monitoring Well Maintenance Implementation Plan*
- CP2-WM-0001, *Four Rivers Nuclear Partnership, LLC Paducah Deactivation and Remediation Project Waste Management Plan*
- CP2-WM-0011, *Waste Acceptance Criteria for the Treatment, Storage and Disposal Facilities at the Paducah U.S. Department of Energy Site*
- CP2-SM-0024, *PGDP Hoisting and Rigging Program*

- CP2-WM-0661, *Transportation Safety Document for On-Site Transportation*
- CP3-EN-0227, *Trenching, Excavation, and Penetration Permit*
- CP3-ES-0003, *Environmental Incident Reporting*
- CP3-FP-2005, *Welding, Burning, and Hotwork*
- CP3-OP-0207, *Use of Procedures*
- CP3-OP-0208, *Required Reading Crew Briefing*
- CP3-RD-0010, *Records Management Process*
- CP3-SM-0051, *Hoisting and Rigging*
- CP3-SM-0054, *Mobile Construction Equipment*
- CP3-TR-0102, *Conduct of Training*
- CP3-WM-3030, *Commercial Motor Vehicle Operations*
- CP4-ER-2701, *Large Equipment Decontamination*
- CP4-ES-0077, *Monitoring Well Abandonment*
- CP4-ES-2700, *Logbooks and Data Forms*
- CP4-ES-2702, *Decontamination of Sampling Equipment and Devices*
- Drawing C5D-FA5410-A03, *McNairy Monitoring Well Installation Details*
- Drawing C5E-FA1950-A12, *Ground Water Piezometer Wells Installation Details*
- Drawing C7DCWELLSA002, *Ground Water Monitoring Wells Typical Well Details*
- Drawing C7DCWELLSA003, *Ground Water Monitoring Wells Installation Details*
- PAD-REG-1005, *Spill Prevention, Control and Countermeasure Plan for the U.S. DOE, Paducah Site, McCracken County, Kentucky*
- PAD-REG-1006, *Best Management Practices Plan*
- SSPC-SP6, *Surface Preparation Standard from the Society for Protective Coatings; Commercial Blast Cleaning*

## 2.2 Source References

- CP2-SM-0020, *Administrative Controls for Powered Industrial Trucks*
- CP3-WM-1037, *Generation and Temporary Storage of Waste Materials*
- CP3-WM-3015, *Waste Packaging*
- JHA-11026, *Monitoring Well Installation and DPT Sampling*
- EPA Technology Innovation Office 1992, *Ground Water Forum, Monitoring Well Development Guidelines for Superfund Project Managers*, Washington, D.C.

## 3.0 COMMITMENTS

None

## 4.0 PRECAUTIONS AND LIMITATIONS

### 4.1 Precautions

4.1.1 **If** left unattended, **then** open borings shall be sufficiently barricaded and/or marked to prevent unauthorized entry or injury.

4.1.2 Approval shall be obtained from Project Manager **or** Designee for source of potable water prior to drilling.

### 4.2 Limitations

Use of glue or solvents is **NOT** permitted to connect the well screen **or** riser casing sections.

## 5.0 PREREQUISITES

**5.1** Prior to daily use, verify that the procedure is current.

**5.2** Prior to performing any action steps identified in this procedure for the first time, review this document based upon its level of use according to CP3-OP-0207, *Use of Procedures*.

**5.3** Prior to performing any action steps identified in this procedure, complete any required applicable training identified for the position according to CP3-TR-0102, *Conduct of Training,* and CP3-OP-0208, *Required Reading Crew Briefing*.

**5.4** Employ best management practices according to PAD-REG-1006, *Best Management Practices Pla*n, to prevent spills and releases.

**5.5** Clean-up **and** report spills and/or releases according to CP3-ES-0003, *Environmental Incident Reporting*, and PAD-REG-1005, *Spill Prevention, Control and Countermeasure Plan for the DOE Paducah Site, McCracken County, Kentucky*.

**5.6** Well installations and repairs of monitoring wells must be performed under the supervision of a Kentucky Certified Well Driller according to 401 KAR 6:320, *Certification of Water Well Drillers*.

**5.7** Contact RADCON if equipment, signs, postings, etc., are removed from the ground as they may be contaminated.

**5.8** Prior to installing or repairing any well, determine if there are any specific requirements (for example, Solid Waste Management Unit [SWMU] notifications, National Environmental Policy Act (NEPA) reviews, etc.) that need to be addressed.

**5.9** Prior to installing or repairing compliance monitoring wells at each location, obtain approval from Environmental Stewardship.

**5.10** Prior to installing or repairing well contact Safety and Health (S&H) for needed coverage, Industrial Health (IH) sampling and specific Personal Protective Equipment (PPE) requirements.

**5.11** Obtain required Excavation/Penetration Permit according to CP3-EN-0227, *Trenching, Excavation, and Penetration Permit*.

**5.12** Complete well installations according to 401 KAR 6:350, *Monitoring Well Construction Practices and Standards*.

**5.13** **If** an obstruction is encountered during drilling and/or digging at the planned location, **then** cease operations **and** contact Project Manager for further direction.

**5.14** Prior to installing monitoring wells, obtain written approval from Environmental Monitoring Project Manager and assigned Well Identifications.

**5.15** **If** inside a radiological area, **then** prior to installing monitoring wells for each location, obtain written approval from Radiological Control (RADCON).

**5.16** Obtain guidance from Waste Disposition to properly containerize and/or manage waste according to CP3-WM-1037, *Generation and Temporary Storage of Waste Materials*.

**5.17** Perform all hot work (generation of flames, high heat or hot particles/sparks) according to CP3-FP-2005, *Welding, Burning, and Hotwork.*

**5.18** Prior to the initiation of well construction, submit manufacturer's technical specifications and data sheets for well materials to the Project Manager and Geologist for approval.

**5.19** Prior to the initiation of well construction, submit documentation of cleanliness for pre-cleaned material to the Project Manager and Geologist for approval.

**5.20** Document conditions of well materials in a project logbook according to CP4-ES-2700, *Logbooks and Data Forms*.

**5.21** Prior to initiation of well construction by the certified well driller, provide bentonite pellet manufacturer's recommendations for hydration to the project manager.

**5.22** Ensure well site is in a location to allow for water drainage away from the well.

**5.23** Inspect power equipment according to CP3-SM-0054, *Mobile Construction Equipment*.

**5.24** **If** any of the below conditions exist, **then** decontaminate drill rigs **and/or** associated tooling according to CP4-ES-2702, *Decontamination of Sampling Equipment and Devices*, **and** CP4-ER-2701, *Large Equipment Decontamination*:

- Upon arrival on-site at the PGDP unless accepted as clean by Geologist
- If contamination is detected on equipment during its incoming survey, the equipment will be rejected and not allowed on site
- Previously rejected equipment (with radiological and/or chemical contamination) which has undergone additional decontamination offsite, may be allowed to undergo additional incoming surveys
- (Downhole tooling only) upon completion of each well or boring
- Upon a Project Manager and/or RADCON determination based on the presence of dirt or mud or based on field screening data
- Prior to radiological scan out and demobilization from the site

**5.25** All waste generated will be managed according to the most recent revision of the *Four Rivers Nuclear Partnership, LLC Paducah Deactivation and Remediation Project Waste Management Plan,* CP2-WM-0001. All waste management activities must comply with applicable contractor procedures and the *Waste Acceptance Criteria for the Treatment, Storage and Disposal Facilities at the Paducah U.S. Department of Energy Site,* CP2-WM-0011.

**5.26** Conduct transportation activities according to CP2-WM-0661, *Transportation Safety Document for On-Site Transport within the PGDP*.

**5.27** Use commercial motor vehicles according to CP3-WM-3030, *Commercial Motor Vehicle Operations*.

## 6.0 INSTRUCTIONS

### 6.1 Pre-Performance Activities

**Project Manager**

6.1.1 Obtain approval of project scope and post-project Environmental Monitoring (EM) scope prior to installation of the well from Environmental Monitoring Project Manager.

6.1.2 **If** well is **NOT** to be used after completion of field project, **then** well must be abandoned according to 401 KAR 6:310, Section 11, Well Abandonment, **and** CP4-ES-0077, *Monitoring Well Abandonment*.

6.1.3 Obtain Excavation/Penetration permit for each location where the surface will need to be disturbed.

**Environmental Monitoring Project Manager**

6.1.4 Prior to approval of installation of the well, ensure funding is in place to sample and maintain well(s) according to the current version of CP2-ES-0006, *Environmental Monitoring Plan* **and** CP2-ES-0024, *Monitoring Well Maintenance Implementation Plan*.

**Scientist/Employee**

6.1.5 Prior to installing a well in an area identified as a wetland, obtain approval from Regulatory Compliance.

6.1.6 Prior to beginning site preparation, inspect for the presence of wetland conditions.

6.1.7 Consult historic wetland surveys as appropriate in evaluating possible wetlands.

6.1.8 In the event wetland conditions are encountered, consult Regulatory Compliance for guidance on how to proceed.

6.1.9 Prior to beginning site preparation, inspect the area for the presence of active bird nests.

| NOTE: |
|---|
| The Project Manager can consult Regulatory Compliance for guidance. |

6.1.10 **If** a bird nest is found, **then** contact the Project Manager for direction before proceeding with any work activities.

6.1.11 **After** issues involving the presence of a bird nest have been resolved, **then** request overgrowth/grass, overhanging limbs/objects, and weeds to be cleared from the vicinity of the installation locations, as needed, in order to ensure worker safety **and** minimize trip **and/or** fall hazards.

## 6.2 Well Installation

NOTES:

- The Project Manager and Geologist will approve and select the appropriate drilling method, depending on site conditions, equipment limitations, and the depth and purpose of the monitoring well. In all instances, the ultimate installation methods employed shall be documented by the Geologist in accordance with CP4-ES-2700.
- Changes can be made and documented by the Field Geologist based on as found data and conditions in the field and shall be documented in the project logbook.

**Project Manager**

6.2.1 **If** there are changes to the installation and/or construction of the well, **then** contact engineering **and** ensure that drawings are revised as necessary.

**Certified Well Driller**

6.2.2 Obtain the Assembled Kentucky Ground Water (AKGWA) Database numbers **and/or** registration for all permanently installed wells **and** provide to the Project Manager.

6.2.3 Install well according to 401 KAR 6:350 **and** the following Drawings:

- C7DCWELLSA002, *Ground Water Monitoring Wells Typical Well Details*
- C7DCWELLSA003, *Ground Water Monitoring Wells Installation Details*
- C5E-FA1950-A12, *Ground Water Piezometer Wells Installation Details*
- C5D-FA5410-A03, *McNairy Monitoring Well Installation Details*

6.2.4 Prior to drilling, cutting concrete, or pouring cement, sand or bentonite, contact IH for respiratory protection and PPE requirements.

6.2.5 Use a containment device to retain drilling wastes such as fluids and drill cuttings that is compatible to the drilling method selected. Transfer expended drilling fluids **and/or** cuttings to a tank or approved container for storage and later treatment.

6.2.6 Measure **and** report to the geologist the amount of potable water added during drilling operations and construction of each well for documentation purposes.

6.2.7 Measure **and** report volume of fluids extracted during monitoring well drilling operations to the geologist.

NOTES:

4-inch well - (Drawing C7DCWELLSA003)

- Requires an 8-inch minimum borehole.

Well casing - (Drawing C7DCWELLSA003)

- Requires 4-inch diameter, NSF schedule 40 Polyvinyl Chloride (PVC) or 304SS well casing sump, 18-24 inches long, with a PVC schedule 40 or 304SS threaded, flush joint cap.
- Requires 4-inch diameter, NSF schedule 40 PVC or 304SS well casing.
- Requires use of a stainless steel centralizer.
- Requires 4-inch diameter, NSF schedule 40 PVC or 304SS screen with 0.01 inch slot size.

Isolation casing (when required) - (Drawing C7DCWELLSA003)

- Requires 10-inch diameter – minimum – schedule 10 steel isolation casing.
- Requires steel guide shoes on the outside of the steel isolation casing.
- Requires isolation casing to extend upwards to 6 inches below grade.
- Requires the isolation casing to be installed at least 10 feet into the confining formation (for example, Upper Continental Recharge System [UCRS], McNairy, etc.).

6.2.8 **When** adding the sand pack and bentonite pellets, **then** take measurements continuously using a stainless steel-weighted tagline.

NOTES:

Coated bentonite pellets are acceptable, if approved by the Project Manager and Geologist.

Bentonite Grouts - (Drawing C7DCWELLSA003)

- Requires use of cement bentonite grout – 90:10 – or 30% solids bentonite grout for installation of the isolation casing.
- Requires a bentonite pellet seal with a minimum thickness of 2 feet.
- Requires a 30% solids bentonite grout or cement bentonite grout 90:10 as annular seal in the UCRS, (as required by project specifications) and utilize a 30% solids bentonite grout in the McNairy Formation. Reference project specifications for additional information on grout mixture.

6.2.9 Mix bentonite grout according to project requirements and the manufacturer's recommendation.

NOTES:

Mixing a grout to a 30% solids slurry may require specialized equipment.

**Scientist**

6.2.10 Verify **and** document the correct grout/water mix by recording the weight of grout and the volume of water used to make the slurry (according to the manufacturer's specifications) or by measuring the slurry density with a mud scale before placement.

**Field Personnel**

**WARNING**

**If** left unattended, **then** open borings shall be sufficiently barricaded and/or marked to prevent unauthorized entry or injury.

NOTES:

Finishing - (Drawing C7DCWELLSA003)

- Flush mount completions require that the cover of a flush mount well be an 8-inch flushmount Sherwood well covering or contractor accepted equal.
- Stickup completions require an aluminum locking well cap and collar, including padlock, for 8-inch OD casing, Drillers Service Inc., Part #56OLWC412, or contractor accepted equal. Field install spacers on padlock shackle as required to minimize cap opening access. Padlocks and spacers shall be supplied by the contractor.

6.2.11 **If** well is to be completed as flush with ground, **then** finish according to Drawing C7DCWELLSA003 and 401 KAR 6:350 Section 4 (below ground).

NOTES:

Outer casing - (Drawing C7DCWELLSA003)

- Requires a minimum 8-inch diameter, schedule 40 pipe, 5 feet-6 inch long for the outer protective surface casing.
- Requires that the protective casing be cleaned according to *Surface Preparation Standard from the Society for Protective Coatings; Commercial Blast Cleaning*, SSPC-SP6, and primed with TNEMEC Series 37-77W @ 3-5 mils and finished with TNEMEC Series 82-BW56 @ 2-3 mils, or Engineering accepted equal.
- Requires the outer protective surface casing to extend 4 inches above the installed well cap assembly.
- Requires the protective casing extend 3 feet above grade.
- Requires the protective casing to be installed in concrete to approximately 2 feet-6 inches below the ground surface.
- Requires the weep holes to be installed above the concrete fill inside the protective casing/above the surface pad.
- Requires minimum of 6-inch of pea gravel fill above the concrete fill inside the protective casing, covering the weep holes.

6.2.12 Upon completion, ensure each monitoring well is sufficiently straight to allow the passage of pumps or sampling devices.

## 6.3 Well Development

NOTES:

- Recommended methods include pumping, overpumping, surging with surge blocks, and bailing across successive intervals of well screen.
- The well development process will be considered complete when the well produces water that is visually clear (goal of ≤ 10 nephelometric turbidity units [NTU]) and the other water quality parameters (pH, specific conductance, temperature) have stabilized.
- Although turbidity is the most important water quality indicator during well development, development should continue until the other parameters are seen to stabilize within 10% between three consecutive measurements taken at least three minutes apart.
- Stabilization of all parameters is indicative of the presence of formation water.
- If NTU values remain high after reaching stabilization parameter criteria, geologist may approve early termination of development activities.
- Additional well development criteria and direction may be provided in the project Field Sampling Plan.
- Documentation requirements are located in Appendix B.

**Field Personnel**

NOTE:

Development is complete when turbidity of discharge water remains low at the start of successive pumping periods.

6.3.1 Record static water level and total depth.

6.3.2 Calculate net volume of potable water introduced during drilling activities (i.e., subtract Step **6.2.7** volume from Step **6.2.6** volume) and purge at least 3 times the net volume from the well or as stipulated in project work documentation.

6.3.3 Unless otherwise directed, set the pump at the top of the well screen **and** record pumping rate and each water quality parameter.

6.3.4 Move the pump gradually up and down across the well screen.

6.3.5 Pump until turbidity reaches desired level or stabilizes.

6.3.6 **If** turbidity is greater than **10 NTU**, **then** discontinue pumping and surge the well.

6.3.7 Reset the pump depth, record pumping rate, turbidity and other water quality parameters.

6.3.8 Pump until turbidity reaches desired level or stabilizes.

6.3.9 Repeat surging and pumping throughout the length of the well screen until well yields water of acceptable turbidity **(≤ 10 NTU)** at the beginning of the pumping cycle and other parameters remain stable.

6.3.10 **If** water quality requirements have been met, **then** measure depth to the bottom of the well.

6.3.11 **If** more than **10%** of the screen is occluded by sediment, **then** remove excess sediment by bailing or air lift pumping.

## 6.4 Well Pad Construction

**Field Personnel**

NOTE:

Drawings C7DCWELLSA002 and C7DCWELLSA003 provide details and material specifications for the surface completions.

6.4.1 Place outer protective casing according to 401 KAR 6:350.

NOTES:

- Each monitoring well will typically have four bollards installed outside of the corners of the concrete pad to protect the well. Well clusters may require a different number of bollards and shall be installed as directed by the Project Manager or Geologist with approval from the Environmental Monitoring Project Manager and approved variance from Kentucky Division of Water processed through a Kentucky Certified Well Driller.
- Absence of bollards for flush mount wells is acceptable; however, absence of bollards in aboveground MWs is not acceptable unless approval is obtained prior to installation by the Environmental Monitoring Project Manager and the Kentucky Division of Water.
- In all cases the area around the well shall be left in a manner to promote surface water runoff away from the well casing. Ponding at the well casing is prohibited.

6.4.2 Dig the foundation for the well pad. Soil removed from the well pad excavation shall be spread evenly around the well site and sloped away from the well pad **ONLY if** permitted by project work documentation.

6.4.3 **If** excavated soil is **NOT** allowed to remain at the site, **then** the material must be managed as waste.

NOTE:

Soil or gravel may be used to establish a uniform grade across the form.

6.4.4 Construct a form around the well.

6.4.5 Fabricate the form so the concrete pad will be a **minimum of 2 inches** above the surrounding grade.

NOTE:

An edger shall be used around the form to round the edges to limit chipping of the concrete. For large jobs of multiple locations, the use of a power trowel may be necessary.

6.4.6 Mix concrete materials according to manufacturer's instructions.

6.4.7 Slope the concrete away from the casing to facilitate runoff so that **no** water will collect around the well casing.

NOTE:

The monitoring well number on brass marker plate shall be minimum ½ inch size letters. ¼ inch size stamps or larger may be used to stamp brass markers with all other required information. Brass plate shall be domed survey marker, **3-inch** diameter, Lietz Number 8134-18 or contractor accepted equal.

6.4.8 Before the concrete cures, install two brass marker plates, each **3 inches** in diameter, on the front side of each monitoring well.

6.4.9 After concrete has cured, remove fabricated form, stamp brass markers with monitoring well number, AKGWA number, elevation, and coordinates.

## 6.5 Bollard Installation

**Field Personnel**

NOTES:

Appropriate machinery such as a bobcat with auger attachments or hand tools can be used as required to create a boring for installing the bollards.

Bollards - Drawing C7DCWELLSA002

- Requires schedule 40 steel pipes with a minimum of 4 inches in diameter and a minimum of 6 feet in length.
- Requires the bollards be installed to a depth of a minimum of 2 feet – in a hole that is a minimum of 1 feet-4 inch in diameter.
- Requires that the bollard be cleaned according to SSPC-SP6 and primed with TNEMEC Series 37-77W @ 3-5 mills. If bollard sleeves are not used, then finish bollard with TNEMEC Series 82-BW56 @ 2-3 mils. or contractor accepted equal.
- Requires a specified location for the bollards, a minimum of 3 feet-2inch off the center of the well.
- Requires that the concrete be 3,000 psi @ 28 days.

6.5.1 Install bollards at locations outside of the concrete well pad as shown on drawing C7DCWELLSA002 **or** an Engineering approved equivalent.

6.5.2 See project waste management plan for guidance on waste soil handling.

6.5.3 Mix concrete and completely fill bollard boring.

6.5.4 Fill concrete in the boring to above the top of the ground surface **and** slope the concrete base away from the bollard, as necessary, to prevent water pooling around the bollard.

6.5.5 Fill bollard with concrete.

6.5.6 Use bollard sleeves, as necessary, to provide additional protection for the painted steel bollard.

NOTE:

**If** bollard sleeves are used, **then** PVC caps are **NOT** required for the top of the bollards.

6.5.7 Place PVC cap over top of bollard as applicable.

6.5.8 Keep bollard vertical with bracing as needed until concrete has set up sufficiently to support the pipe.

## 6.6 Well Infrastructure Finishing

**Field Personnel**

NOTES:

- Drawing C7DCWELLSA002, C7DCWELLSA003, C5E-FA1950-A12 and C5D-FA5410-A03 provides specifications for paint.
- Finishing/labeling - (Drawing C7DCWELLSA003)
- Requires the protective casing to be labeled with black letters. Label shall include the prefix "MW" for monitoring wells and piezometers, and the number assigned by the Contractor. Letters shall be a minimum of 3 inches high and visible from the nearest roadway.

6.6.1 Paint well outer casing.

6.6.2 Once paint has been allowed to dry, inspect **and** touch up paint as necessary.

6.6.3 Stencil well number on outside of outer casing on the side of each monitoring well visible from the nearest roadway (e.g., MW123).

6.6.4 Install locking well cap **and** collar.

6.6.5 Place AKGWA tags on inside of well lid.

6.6.6 Obtain approved lock from contractor **and** lock well.

## 6.7 Installation of Sampling Access Road/Pad

6.7.1 Clear grass, brush, and overgrowth as needed. **If** required to install road along planned route, **then** remove small trees **(< 5-inch diameter)**.

NOTE:

Fence, sign posts, and signs can be removed via hand tools and power tools, or the use of hydraulic equipment may be required to safely remove the posts.

6.7.2 **If** necessary, **then** remove signs, postings, fencing and other infrastructure that are **NOT** required in the area that may obstruct the road.

6.7.3 **If** hoisting and rigging equipment are needed to remove posts, **then** follow CP2-SM-0024, *Hoisting and Rigging Program* and CP3-SM-0051, *Hoisting and Rigging*.

NOTE:

Geotextile is recommended for use in contamination areas, but may be appropriate for use at any location based on the Project Manager's observations. Project Manager may consult with RADCON to determine if geotextile is necessary.

6.7.4 Grade and/or scrape ground surface as needed to provide a smooth flat surface prior to placement of geotextile.

NOTE:

Geotextile is recommended for use beneath road beds and clean gravel cover placed over contamination areas.

6.7.5 Spread dense grade aggregate (DGA) or other approved road base (See Project Manager) at the planned road way. The Project Manager will be responsible for estimates on the amount of gravel to fill each area.

6.7.6 Use a bobcat, or other appropriate heavy equipment (for example, track hoe, backhoe, etc.) to spread the gravel evenly and to fill in low spots and compact, as necessary. Refer to CP3-SM-0054 for bobcat/trackhoe/backhoe inspection.

6.7.7 Use hand tools, as necessary, to spread gravel.

6.7.8 **If** culvert installation is needed, **then** select a location that is free of trees, brush, stones and stumps to provide a relatively smooth surface area **and** follow Steps **6.7.10** through **6.7.167**. **If** culvert installation is **NOT** needed, **then** go to Step **6.7.18**.

6.7.9 **If** necessary, **then** remove existing culvert and replace with a new one.

6.7.10 Excavate as needed to shape ditch and allow room for proper installation.

6.7.11 Place non-woven geotextile fabric in the footprint of the culvert.

6.7.12 Install **6 inches** of gravel in the bottom of the ditch to provide an even surface and proper slope to promote drainage.

6.7.13 Roll corrugated metal pipe section into ditch.

6.7.14 Using the bucket of a front-end loader, place small quantities of limestone or approved equivalent, along the sides between the culvert **and** the ditch banks up to the top of the culvert. Refer to CP3-SM-0054 for front-end loader inspection.

6.7.15 **If** there is space, **then** tamp the stone to promote compaction.

6.7.16 Place limestone or approved equivalent on top of the culvert, in approximately **6-inch** lifts, by grading with the bucket of a front end loader or the blade of a small bull dozer. Refer to CP3-SM-0054 for front-end loader and/or small bull dozer inspection.

6.7.17 Compact the lift with multiple passes of a vibratory drum roller (if necessary, as determined by the Project Manager).

6.7.18 Once the access road has been completed, restore the surrounding disturbed area and all appropriate signs and postings, if removed.

NOTES:

Sign posts should be driven to a depth that ensures the sign is stable and is **NOT** easily removed. The posts should **NOT** exceed the depth maximum given by the excavation and/or penetration permit.

6.7.19 Where needed, use hand tools and power tools, as applicable, to reinstall the posts in the ground.

## 6.8 Well Installation Closeout

**Field Personnel**

6.8.1 Restore the work site to original conditions upon completion of installation activities **and** remove all construction debris.

**Certified Well Driller**

6.8.2 Prepare drafts of Uniform Kentucky Well Construction Records and Well Construction Diagrams forms in accordance with 401 KAR 6:350.

6.8.3 Submit draft well records and/or forms to the geologist for review **and** approval.

6.8.4 Upon approval, the driller will be responsible for all record submissions to the Kentucky Division of Water in accordance with 401 KAR 6:350.

**Scientist**

6.8.5 Coordinate with Environmental Monitoring personnel to identify the water level reference point for the well.

6.8.6 Obtain **and** submit the following as-built conditions to Sample Management Office (SMO):

- Coordinates of well
- Depth of well
- Elevation of Top of outer well casing
- Elevation of Top of inner well casing
- AKGWA number
- Well Construction Diagrams
- Uniform Kentucky Well Construction Record form
- Screened Zone
- Elevation of water level reference point
- Measured water level from the north side of the top of the outer casing within **24 hours** of development.

6.8.7 Submit copy of Appendix B, Well Development Documentation Data, to Environmental Monitoring Project Manager.

6.8.8 Contact Environmental Monitoring to schedule inspection for acceptance of well.

**Environmental Monitoring Personnel**

6.8.9 Conduct inspection to ensure well meets requirements.

6.8.10 Complete CP4-ES-0069-F01, *New Well Inspection Form*, with inspection findings.

6.8.11 Submit completed CP4-ES-0069-F01 to Environmental Monitoring Project Manager.

**Field Personnel**

6.8.12 Complete any deficiencies noted by environmental monitoring inspection.

6.8.13 Contact Environmental Monitoring Personnel to re-inspect well until all requirements have been met.

**Environmental Monitoring Project Manager**

6.8.14 Contact SMO to ensure items listed in Step **6.8.6** have been submitted.

6.8.15 Review inspection findings to ensure all requirements have been met.

6.8.16 Accept ownership of well from Well Installation Project Manager.

6.8.17 Add well to well inventory for inclusion into the current version of CP2-ES-0006.

## 7.0 ACCEPTANCE CRITERIA

None

## 8.0 POST PERFORMANCE WORK ACTIVITIES

None

## 9.0 RECORDS

### 9.1 Records Generated

The following records may be generated by this procedure:

- Field Logbook
- CP4-ES-0069-F01, *New Well Inspection Form*

### 9.2 Records Disposition

The records are to be maintained in accordance with CP3-RD-0010, *Records Management Process*.

## Appendix A – Acronyms/Definitions

**ACRONYMS**

**AKGWA** – Assembled Kentucky Ground Water Database

**D&R** – Deactivation and Remediation

**DGA** – dense grade aggregate

**DOE** – U.S. Department of Energy

**E&TS** – Engineering & Technical Services

**EM** – Environmental Monitoring

**EPA** – U.S. Environmental Protection Agency

**FRNP** – Four Rivers Nuclear Partnership, LLC

**IH** – Industrial Hygiene

**KAR** – Kentucky Administrative Regulation

**MW** – monitoring well

**NEPA** – National Environmental Policy Act

**NTU** – nephelometric turbidity unit(s)

**PGDP** – Paducah Gaseous Diffusion Plant

**PPE** – Personal Protective Equipment

**PVC** – polyvinyl chloride

**RADCON** – Radiological Control

**S&H** – Safety and Health

**SMO** – Sample Management Office

**SWMU** – Solid Waste Monitoring Unit

**UCRS** – Upper Continental Recharge System

**Appendix A – Acronyms/Definitions (Continued)**

**DEFINITIONS**

**Certified Well Driller** – Driller who has completed the requirements and obtained a certificate per 401 KAR 6:320. *Certification of Water Well Drillers*.

**Monitoring Well** – Any well intended to be used either to collect water samples for purposes of water quality testing, or to measure groundwater levels. Some monitoring wells may be dry and no water samples can be obtained. Piezometer is a type of monitoring well which measures the pressure (more precisely, the piezometric head) of groundwater at a specific point.

**Overpumping** – Pumping at rates generally greater than those used during sampling or well purging. Commonly combined with surging of the well.

**Surge Block** – A plunger-like tool, consisting of leather or rubber discs sandwiched between steel or wooden disks that may be solid or valved, that is used in well development.

**Surging** – A well development technique where the surge block or development pump is alternately lifted and dropped within the borehole above or adjacent to the screen to create a strong inward and outward movement of the water through the well intake.

**Tremie Pipe** – A device that allows sand, bentonite pellets or grout to be placed in a borehole from the bottom up to avoid “sandlocking” or “bridging” of the material, ensuring uniform placement. The tremie may be either a pipe placed at the bottom of the interval or the drill stem pipe/auger.

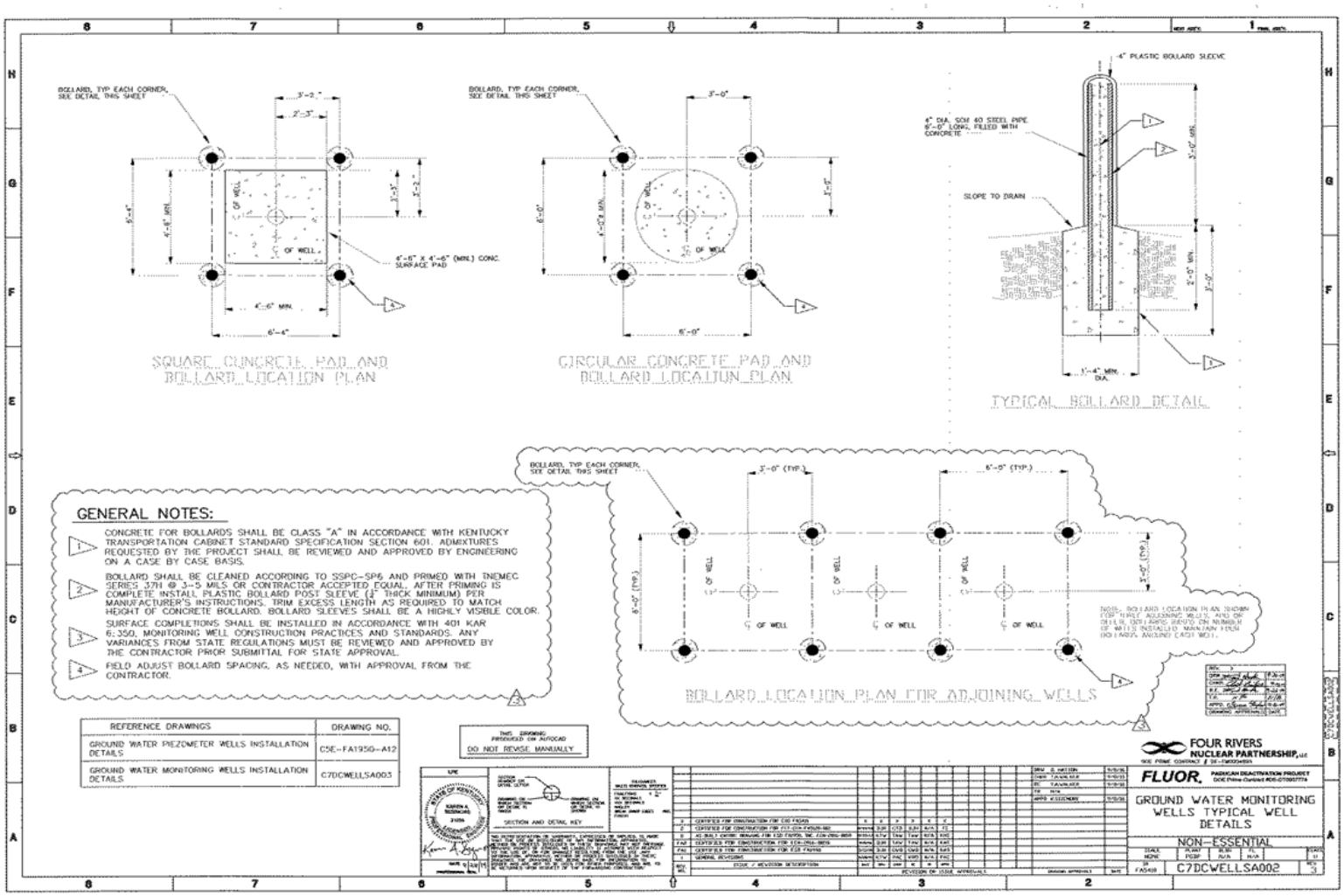
**Turbidity** – Solids and organic matter suspended in water.

## Appendix B – Well Development Documentation Data

1. Date and duration of development.
2. Measured water level from the north side of the top of the outer casing **within 24 hours** of development.
3. Depth from top of well casing to the top of any sediment present in the well, before, during, **and** after development.
4. Types and quantity of drilling fluids introduced during drilling **and/or** development.
5. Water quality measurements taken before, during, **and** after development.
6. Volume and physical characteristics of developed water (for example, odor, color, clarity, particulate matter).
7. Type and capacity of pump **and/or** bailer used **and** pumping rates.
8. Detailed description of all development methods employed.

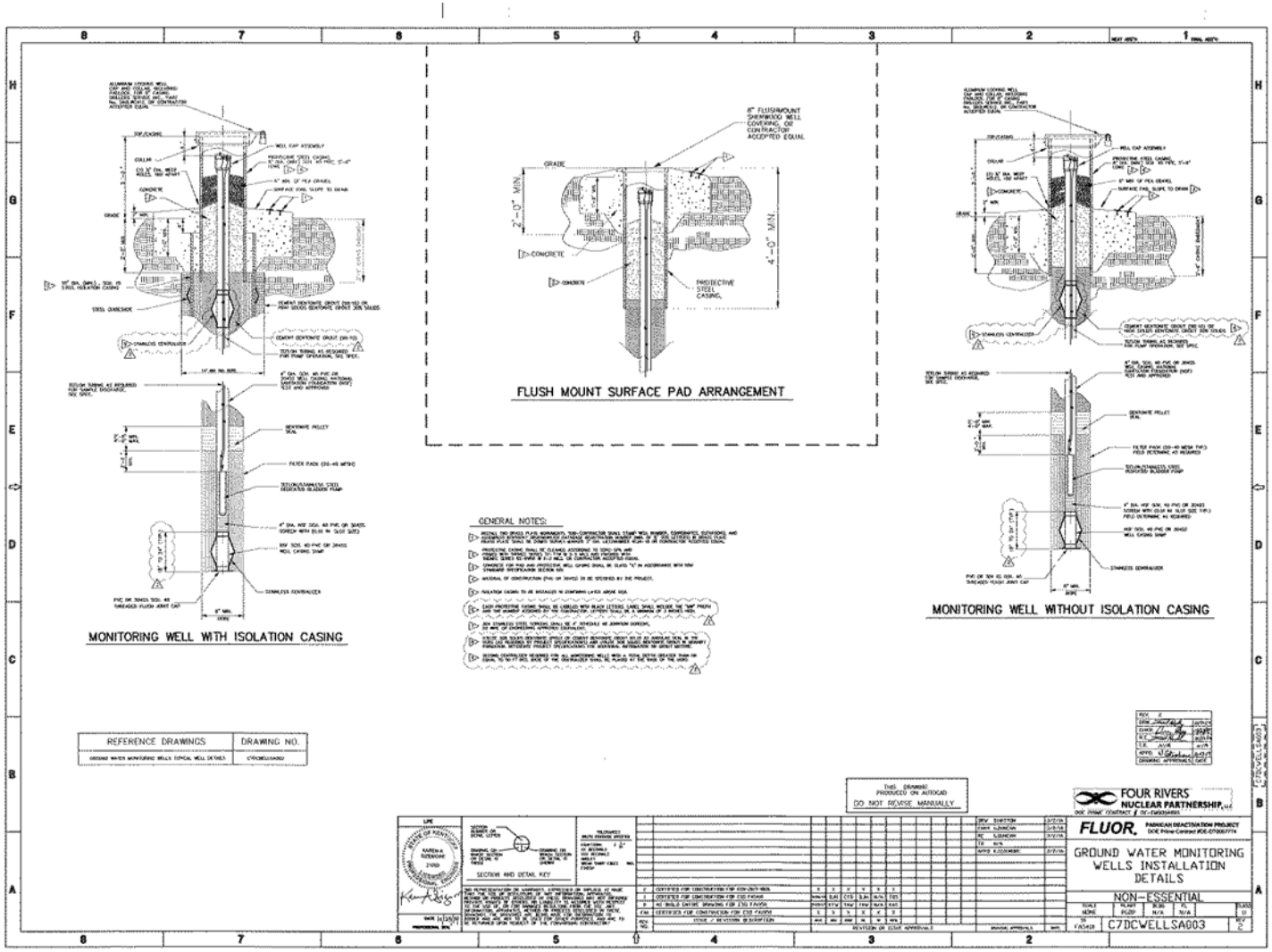
**Appendix C – Ground Water Monitoring Wells Typical Well Details (C7DCWELLSA002)**

This is an example of the details. For useable approved details, please contact Engineering.



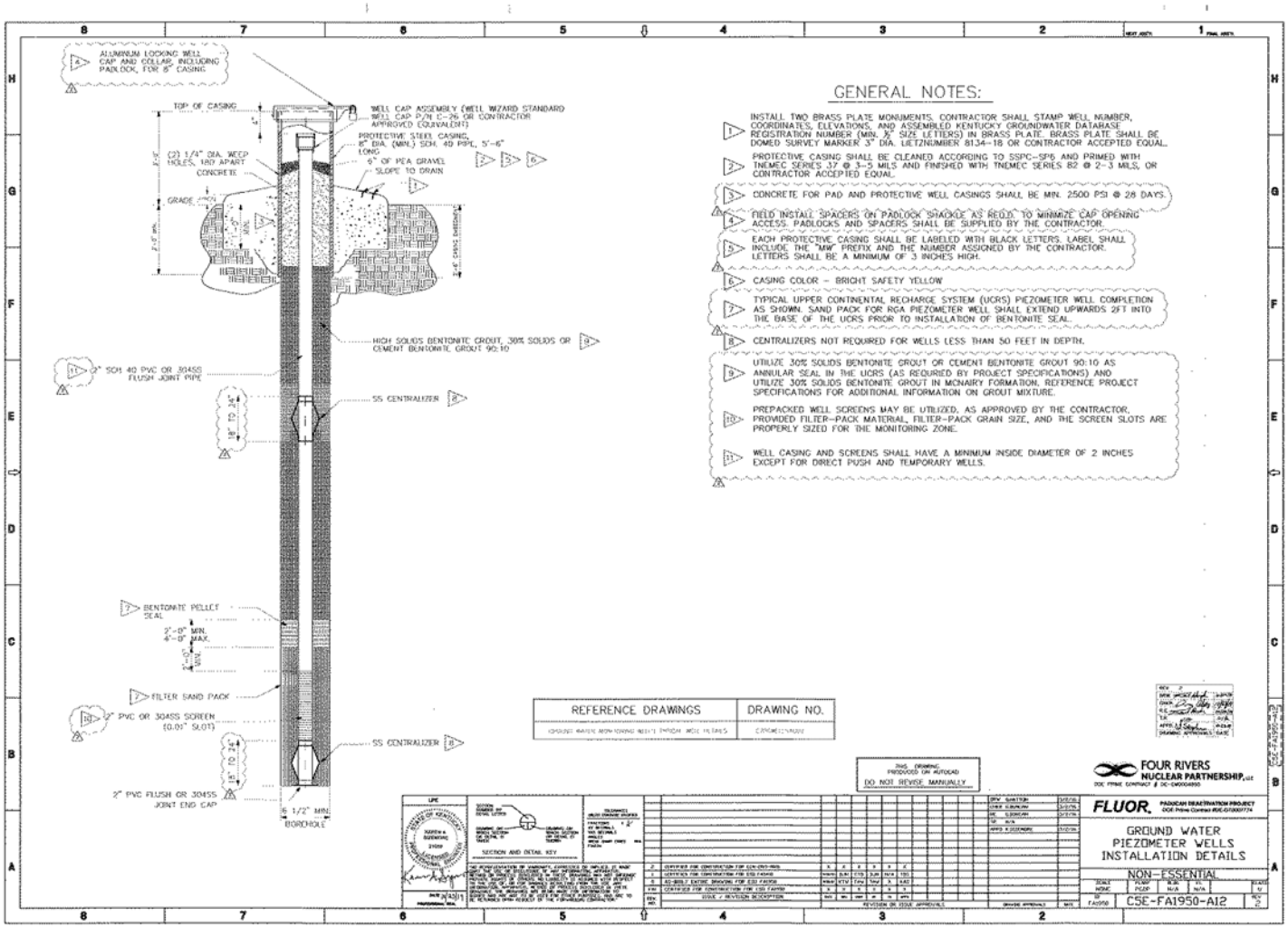
## Appendix D – Ground Water Monitoring Wells Installation Details (C7DCWELLSA003)

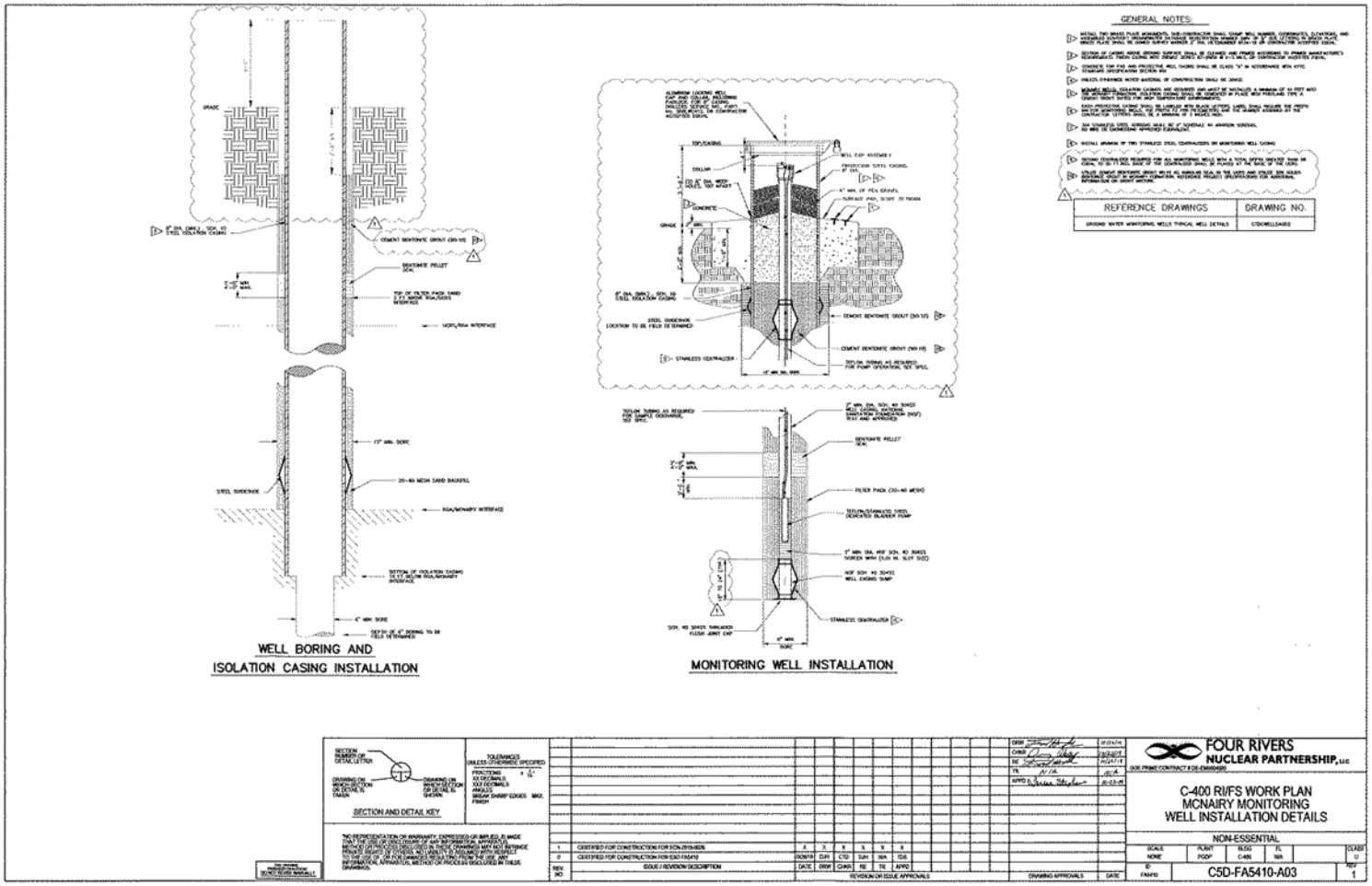
This is an example of the details. For useable approved details, please contact Engineering.



## Appendix E – Ground Water Piezometer Wells Installation Details (C5E-FA1950-A12)

This is an example of the details. For useable approved details, please contact Engineering.



## Appendix F – McNairy Monitoring Well Installation Details (C5D-FA5410-A03)

This is an example of the details. For useable approved details, please contact Engineering.