PROPOSED AMENDMENT

10 CSR 23-3.090 [Regionalization] Drilling Areas. The Board is amending the Division name, Chapter name, rule name, rule purpose, amending sections (1), (2), (3), (4), (5), and (6) and adding sections (7), (8), (9), (10), (11), (12), and (13). The Board is also adding Tables 3.10 through 3.15, Figures 3.1 through 3.10 and removing Figures 1 through 6. Note: Figures 7, 7A, 7B, 7C, 7D, and Figure 8 are also being removed (these were referenced in 10 CSR 23-3.100 Sensitive Areas which is being rescinded).

PURPOSE: This amendment incorporates substantive requirements from 10 CSR 23-3.100 Sensitive Areas and renames the rule to include all drilling areas. This amendment also renumbers drilling areas sequentially.

PURPOSE: This rule sets [specific additional] construction standards [for certain regions in Missouri] in addition to 10 CSR 23-3.030 Standards for Construction of Water Wells. These additional standards apply to domestic and multifamily wells and vary by geographic area based on geologic, hydrologic, and/or environmental factors (see Figure 3.1).

(1) Area 1. [All persons engaged in drilling domestic wells in Area 1, a limestone or dolomite area (Figure 1 and 8) shall--] This area encompasses portions of southwestern, central, east central, and southeastern Missouri (see Figure 3.2).

   (A) [Set no less than eighty feet (80’) of casing, extending not less than thirty feet (30’) into bedrock. Example: if sixty feet (60’) of residual (weathered rock) material is encountered in drilling before bedrock, then ninety feet (90’) of casing must be set.]

   Bedrock wells.

   1. A minimum of eighty feet (80’) of casing shall be installed and extend a minimum of thirty feet (30’) into solid bedrock. Example: if sixty feet (60’) of residual material or broken rock is encountered during drilling above solid bedrock, then ninety feet (90’) of casing will be installed.

   [(B)] 2. [Construct] The [drill] borehole for a domestic well shall be a minimum of eight and five-eighths inches (8 5/8”) in diameter to the [surface] casing [point] depth.

   [(C)] 3. Install new[, steel or plastic] casing [as specified in] pursuant to 10 CSR 23-3.030(steel) or 10 CSR 23-3.070 (plastic)/(1)(A).

   [(D) Install and seal casing as follows:] 4. Grouting Requirements

   [1. Full-length grout is preferred and will ensure a better annular seal but sealing t] A. The lowermost thirty feet (30’) of casing [using approved grout material and procedures set out in 10 CSR 23-3.030 is required.
Drill cuttings and a drive shoe or drill cuttings used by themselves are not approved grout materials. Drill cuttings may be placed above the grouted interval to fill in the annular space—shall be grouted. Table 3.10 lists the minimum amount of grout required by type and size of annulus or open hole.

B. Grouting materials and methods shall be followed pursuant to 10 CSR 23-3.030(1)(C).

C. The annular space above the grouted interval shall be filled with clean fill.

[A. If steel casing is used, a drive shoe is required except on wells where the grout is allowed to cure before drilling resumes;

B. If plastic casing is used, a packer, coupling or inverted bell is required to be secured near the bottom of the casing and must hold the grout in place while drilling continues. No packer, coupling or inverted bell is required if grout is allowed to cure before drilling resumes;

C. The following times must be followed for curing grout when no packer is used:

(1) Hi-early cement—minimum set time of twelve (12) hours.
(II) Portland Type I cement—minimum set time of seventy-two (72) hours;
(III) Chipped bentonite—minimum hydration time of four (4) hours; and
(IV) High solids bentonite slurry—varies based on additives and manufacturer's specifications;]

[(E) If the well is to be drilled as an alluvial well--] (B) Unconsolidated material wells.

1. [No less than] A minimum of twenty feet (20') of casing shall be [set] installed above the screened or perforated interval [of the well:]

2. [The drill hole shall be constructed a minimum of ten and five-eighths inches (10 5/8") in diameter being at least four inches (4") larger than the casing to be placed into it. Well casing must be at least six inch (6") nominal diameter. Graded, chlorinated gravel may be placed into the annular space adjacent to the well screen or natural gravels in the formation being drilled can be allowed to cave back against the screen;] The borehole for a domestic well shall be a minimum of ten and five-eighths inches (10 5/8") in diameter to the casing depth. The borehole shall be a minimum of four inches (4") larger in diameter than the casing being installed.

3. [Full-length grout is preferred (above the screened interval) and will ensure a better annular seal but sealing the upper twenty feet (20') of casing using approved grout materials and procedures set out in 10 CSR 23-3.030 is required.] Install new casing pursuant to 10 CSR 23-3.030(1)(A).


A. The upper twenty feet (20') of casing shall be grouted. Table 3.11 lists the minimum amount of grout required by type and size of annulus or open hole.

B. Grouting methods and materials shall be followed pursuant to 10 CSR 23-3.030(1)(C).

C. A chlorinated gravel pack may be placed into the annular space or native materials may be allowed to collapse against the well screen or perforated interval.
(2) **Area 2.** This area encompasses west central Missouri and is delineated separately because the bedrock has the potential to produce groundwater with high dissolved solids compared to other areas of the state (see Figure 3.3). [All persons engaged in drilling domestic wells in Area 2, Central Western Missouri (Figure 2) shall--]

(A) [Set no less than forty feet (40') of casing, extending not less than fifteen feet (15') into bedrock. Areas where Cherokee Group sediments are present; set casing through caving zones and into waterbearing sands. In some instances this might require several hundred feet of casing. Liners may be used with minimum amount of casing listed for this area:] **Bedrock wells.**

1. A minimum of forty feet (40') of casing shall be installed and extend a minimum of fifteen feet (15') into solid bedrock.

(B) **The drill borehole for domestic wells shall be** a minimum of eight and five-eighths inches (8 5/8") in diameter to the surface casing point. **depth.**

(C) 3. Install new [steel or plastic] casing[s as specified in] pursuant to 10 CSR 23-3.030 (steel) or 10 CSR 23.3.070 (plastic)(1)(A).

(D) Install and seal casing as follows: Full-length grout is preferred and will ensure a better annular seal but sealing the lowermost thirty feet (30') of casing using approved grout materials and procedures set out in 10 CSR 23-3.030 is required. Drill cuttings and a drive shoe or drill cuttings used by themselves are not approved grout material. Drill cuttings may be placed above the grouted interval to fill in the annular space--

1. If steel casing is used, a drive shoe is required except on wells where the grout is allowed to cure before drilling resumes;
2. If plastic casing is used, a packer, coupling or inverted bell is required to be secured near the bottom of the casing and must hold the grout in place while drilling continues. No packer, coupling or inverted bell is required if grout is allowed to cure before drilling resumes;
3. The following times must be followed for curing grout when no packer is used:
   A. Hi-early cement—minimum set time of twelve (12) hours;
   B. Portland Type I cement—minimum set time of seventy-two (72) hours;
   C. Chipped bentonite—minimum hydration time of four (4) hours; and
   D. High solids bentonite slurry—varies based on additives and manufacturer's specifications;

(E) In areas where shale or shaley material is present above the waterbearing zones, casing or liner shall be set so as to exclude intervals which would cave into the drill hole or cause muddy water to be pumped:

4. **Grouting Requirements.**

   A. The lowermost thirty feet (30') of casing shall be grouted. Table 3.10 lists the minimum amount of grout required by type and size of annulus or open hole.

   B. Grouting materials and methods shall be followed pursuant to 10 CSR 23-3.030(1)(C).

   (F) If the well is to be drilled as an alluvial well--] **(B) Unconsolidated material wells.**
1. [No less than] A minimum of twenty feet (20') of casing shall be [set] installed above the screened or perforated interval [of the well:).

2. The [drill] borehole shall be [constructed] a minimum of ten and five-eighths inches (10 5/8") in diameter [being at least] to the casing depth. The borehole for domestic wells shall be a minimum of four inches (4") larger in diameter [than the casing to be placed into it. Well casing must be at least six-inch (6") nominal diameter. Graded, chlorinated gravel may be placed into the annular space adjacent to the well screen or natural gravels in the formation being drilled can be allowed to cave back against the screen; and 3. Full-length grout is preferred (above the screened interval) and will ensure a better annular seal but sealing the upper twenty feet (20') of casing using approved grout materials and procedures set out in 10 CSR 23-3.030 is required].

3. Install new casing pursuant to 10 CSR 23-3.030(1)(A).

   A. The upper twenty feet (20') of casing shall be grouted. Table 3.11 lists the minimum amount of grout required by type and size of annulus or open hole.
   B. Grouting materials and methods shall be followed pursuant to 10 CSR 23-3.030(1)(C).
   C. A chlorinated gravel pack may be placed into the annular space or native materials may be allowed to collapse against the well screen or perforated interval.

[(G) Five-Inch (5") Casing Wells. A well may be completed using a five-inch (5") nominal casing if the following standards are met:
   1. The casing must be set full length and be slotted across the producing horizons.
   2. The drill hole must be eight and five-eighths inches (8 5/8") in diameter with the upper forty feet (40') to be reamed out to ten and five-eighths inches (10 5/8") in diameter; and
   3. The upper forty feet (40') of annular space must be grouted and the remainder of the borehole below the grout must be gravel packed.]

(3) Area 3. [All persons engaged in drilling domestic wells in area 3, northwest Missouri area, (Figure 3) shall--] This area encompasses northwestern and north central Missouri and is delineated separately because glacial till overlies bedrock that has the potential to produce groundwater with high dissolved solids compared to other areas of the state (see Figure 3.4).

   (A) [If the well is to be drilled as a glacial drift or alluvial well;
   1. No less than twenty feet (20') of casing shall be set above the screened or perforated interval of the well;
   2. The drill hole shall be constructed a minimum of ten and five-eighths inches (10 5/8") in diameter being at least four inches (4") larger in diameter than the casing to be placed into it. Well casing must be at least six-inch (6") nominal diameter. Graded, chlorinated gravel may be placed into the annular space adjacent to the well screen or natural (native) gravels in the formation being drilled can be allowed to cave back against the screen;]
3. Full-length grout is preferred (above the screened interval) and will ensure a better annular seal but sealing the upper twenty feet (20') of casing using approved grout materials and procedures set out in 10 CSR 23-3.030 is required.

(B) If the well is to be drilled as a bedrock well--
   1. Set no less than forty feet (40') of casing, extending not less than fifteen feet (15') into bedrock;
   2. Construct the drill hole a minimum of eight and five-eighths inches (8 5/8") in diameter to the surface casing point;
   3. Install new steel or plastic casing as specified in 10 CSR 23-3.030 (steel) or 10 CSR 23-3.070 (plastic); and
   4. Install and seal casing as follows:
      A. Full-length grout is preferred and will ensure a better annular seal, but sealing the lowermost thirty feet (30') of casing using approved grout materials and procedures set out in 10 CSR 23-3.030 is required. Drill cuttings and a drive shoe or drill cuttings used by themselves are not approved grout materials. Drill cuttings may be placed above grouted interval to fill in the annular space--
         (I) If steel casing is used, a drive shoe is required except on wells where the grout is allowed to cure before drilling resumes;
         (II) If plastic casing is used, a packer, coupling or inverted bell is required to be secured near the bottom of the casing and must hold the grout in place while drilling continues. No packer, coupling or inverted bell is required if grout is allowed to cure before drilling resumes;
         (III) The following times must be followed for curing grout when no packer is used:
            (a) Hi-early cement--minimum set time of twelve (12) hours;
            (b) Portland Type I cement--minimum set time of seventy-two (72) hours;
            (c) Chipped bentonite--minimum hydration time of four (4) hours; and
            (d) High solids bentonite slurry--varies based on additives and manufacturer's specifications;

Bedrock wells.
1. A minimum of forty feet (40’) of casing shall be installed and extend a minimum of fifteen feet (15’) into solid bedrock.
2. Construct the borehole for domestic wells a minimum of eight and five-eighths inches (8 5/8") in diameter to casing depth.
3. Install new casing pursuant to 10 CSR 23-3.030(1)(A).
4. The casing shall be a minimum of five and one-half inches (5 ½") in diameter and the borehole shall be a minimum of two inches (2") larger in diameter than the casing being installed.
5. Grouting Requirements
   A. The lowermost thirty feet (30') of casing shall be grouted. Table 3.12 lists the minimum amount of grout required by type and size of annulus or open hole.
   B. Grouting materials and methods shall be followed pursuant to 10 CSR 23-3.030(1)(C).
   C. The annular space above the grouted interval shall be filled with clean fill.
6. Shallow Bedrock Wells - If usable quantities of water are not expected to be available in deeper bedrock horizons and water is only available from the upper, fractured and weathered portion of bedrock, and if the water is coming from a zone that is at least forty feet (40') deep, you must set a minimum of forty feet (40') of casing but only one foot (1') of this casing need be set into the bedrock. This allows the use of shallower water horizons under some circumstances; and one of the following construction methods may be used.

A. Method 1
(I) A minimum of forty feet (40') of casing shall be installed pursuant to 10 CSR 23-3.030(1)(A).
(II) A minimum of only one foot (1') of [this] casing shall extend into solid bedrock.
(III) The borehole for domestic wells shall be a minimum of eight and five eighths (8 5/8") in diameter to the casing depth.
(IV) The casing shall be a minimum of five and one-half inches (5 ½") in diameter and the borehole shall be a minimum of two inches (2") larger in diameter than the casing being installed.
(V) The lower thirty feet (30') of casing shall be grouted. Table 3.12 lists the minimum amount of grout required by type and size of annulus or open hole.
(VI) Grouting materials and methods shall be followed pursuant to 10 CSR 23-3.030(1)(C).
(VII) The annular space above the grouted interval shall be filled with clean fill.

B. Method 2
(I) The casing shall be installed full-length pursuant to 10 CSR 23-3.030(1)(A) and perforated below twenty (20') feet across the producing horizon.
(II) The borehole for domestic wells shall be eight and five-eighths inches (8 5/8") in diameter with the upper twenty feet (20') reamed out to ten and five-eighths inches (10 ⅝") in diameter.
(III) The casing shall be a minimum of five and one-half inches (5 ½") in diameter.
(IV) The upper twenty feet (20') of annular space shall be grouted and the remainder of the borehole below the grout shall be gravel packed if a packer is not installed. Table 3.13 lists the minimum amount of grout required by type and size of annulus or open hole.

7. All construction requirements pursuant to 10 CSR 23-3.030 shall be met except as stated in 10 CSR 23-3.090(3)(A)6.

(D) Five-Inch (5") Casing Wells. A well may be completed using a five-inch (5") nominal casing if the following standards are met:
1. The casing must be set full-length and be slotted across the producing horizons;
2. The drillhole must be eight and five-eighths inches (8 5/8") in diameter with the upper forty feet (40') to be reamed out to ten and five-eighths inches (10 5/8") in diameter; and
3. The upper forty feet (40') of annular space must be grouted and the remainder of the borehole below the grout must be gravel packed.]

(B) Unconsolidated material wells and glacial drift wells.
1. A minimum of twenty feet (20') of casing shall be installed above the screened or perforated interval.
2. The borehole for domestic wells shall be a minimum of ten and five-eighths inches (10 ⅝") in diameter to casing depth. The borehole shall be a minimum of four inches (4") larger in diameter than the casing being installed.
3. Well casing shall be a minimum of five and one-half inches (5 ½") in diameter.
4. Grouting Requirements
   A. The upper twenty feet (20') of casing shall be grouted. Table 3.13 lists the minimum amount of grout required by type and size of annulus or open hole.
   B. Grouting materials and methods shall be followed pursuant to 10 CSR 23-3.030(1)(C).
   C. A chlorinated gravel pack may be placed into the annular space or native materials may be allowed to collapse against the screen or perforated interval.

(4) Area 4. [All persons engaged in drilling domestic wells in Area 4, northeast Missouri area, (Figure 7) shall--]
This area encompasses northeastern Missouri and is delineated separately because the glacial till overlies bedrock that has the potential to produce groundwater with high dissolved solids compared to other areas of the state (see Figure 3.5).

(A) [If the well is to be drilled as a bedrock well--] Bedrock wells.
1. [Set no less than] A minimum of forty feet (40') of casing [extending not less than] shall be installed and extend a minimum of fifteen feet (15') into bedrock;
2. Construct the [drill] borehole for domestic wells a minimum of eight and five-eighths inches (8 5/8") in diameter to the [surface] casing [point; depth.]
3. Install new [steel or plastic] casing [as specified in] pursuant to 10 CSR 23-3.030(1)(A). [(steel) or 10 CSR 23-3.070 (plastic); and]
4. The casing shall be a minimum of five and one-half inches (5 ½") in diameter and the borehole shall be a minimum of two inches (2") larger in diameter than the casing being installed.
[Install and seal casing as follows:] 5. Grouting Requirements
   A. [Full-length grout is preferred and will ensure a better annular seal but sealing t] The lowermost thirty (30') of casing [using approved grout materials and procedures set out in 10 CSR 23-3.030 is required. Drill cuttings and a drive shoe or drill cuttings used by themselves are not approved grout materials. Drill cuttings may be placed above grouted interval to fill in the annular space--
(I) If steel casing is used, a drive shoe is required except on wells where the grout is allowed to cure before drilling resumes;
(II) If plastic casing is used, a packer, coupling or inverted bell is required to be secured near the bottom of the casing and must hold the grout in place while drilling continues. No packer, coupling or inverted bell is required if grout is allowed to cure before drilling resumes; and
(III) The following times must be followed for curing grout when no packer is used:
   (a) Hi-early cement—minimum set time of twelve (12) hours;
   (b) Portland Type I cement—minimum set time of seventy-two (72) hours;
   (c) Chipped bentonite—minimum hydration time of four (4) hours; and
   (d) High solids bentonite slurry—varies based on additives and manufacturer's specifications; shall be grouted.

B. Grouting materials and methods shall be followed pursuant to 10 CSR 23-3.030(1)(C).

C. The annular space above the grouted interval shall be filled with clean fill.

(B) If the well is to be drilled as an unconsolidated materials well--
1. No less than twenty feet (20') of casing shall be set above the screened or perforated interval of the well;
2. The drill hole shall be constructed a minimum of ten and five-eighths inches (105/8") in diameter being at least four inches (4") larger in diameter than the casing to be placed into it. Well casing must be at least six-inch (6") nominal diameter. Graded, chlorinated gravel may be placed into the annular space adjacent to the well screen or natural (native) gravels in the formation being drilled can be allowed to cave back against the screen; and
3. Full-length grout is preferred (above the screened interval) and will ensure a better annular seal but sealing the upper twenty feet (20') of casing using approved grout materials and procedures set out in 10 CSR 23-3.030 is required.

(C) If usable amounts of water or water of acceptable quality are not expected to be available in deeper bedrock horizons and water is only available from the upper, fractured and weathered portion of bedrock, and if the water is coming from a zone that is at least forty feet (40') deep, a minimum of forty feet (40') of casing must be set but only one foot (1') of this casing need be set into the bedrock. This allows the use of shallower water horizons under some circumstances.

6. Shallow bedrock wells - If usable quantities of water are not expected to be available in deeper bedrock horizons the following construction method may be used.

A. Method 1
   (I) A minimum of forty feet (40') of casing shall be installed pursuant to 10 CSR 23-3.030(1)(A).
   (II) A minimum of [only] one foot (1') of [this] casing shall [need] extend into [be set into] solid bedrock.
(III) The borehole for domestic wells shall be a minimum of eight and five-eighths inches (8 5/8”) in diameter to the casing depth.

(IV) The casing shall be a minimum of five and a half inches (5 ½”) in diameter and the borehole shall be a minimum of two inches (2”) larger in diameter than the casing being installed. [This allows the use of shallower water horizons under some circumstances; and]

(V) The lower thirty feet (30’) of casing shall be grouted. Table 3.12 lists the minimum amount of grout required by type and size of annulus or open hole.

(VI) Grouting materials and methods shall be followed pursuant to 10 CSR 23-3.030(1)(C).

(VII) The annular space above the grouted interval shall be filled with clean fill.

7. All construction requirements pursuant to 10 CSR 23-3.030 shall be met except as stated 10 CSR 23-3.090(4)(A).6.

(B) Unconsolidated material wells and glacial drift wells.
1. A minimum of twenty feet (20’) of casing shall be installed above the screened or perforated interval.
2. The borehole for domestic wells shall be a minimum of ten and five-eighths inches (10 ⅝”) in diameter to casing depth. The borehole shall be a minimum of four inches (4”) larger in diameter than the casing being installed.
3. Well casing shall be a minimum of five and one-half inches (5 ½”) in diameter.
4. Grouting Requirements
   A. The upper twenty feet (20’) of casing shall be grouted. Table 3.13 lists the minimum amount of grout required by type and size of annulus or open hole.
   B. Grouting materials and methods shall be followed pursuant to 10 CSR 23-3.030(1)(C).
   C. A chlorinated gravel pack may be placed into the annular space or native materials may be allowed to collapse against the screen or perforated interval.

(5) Area 5. [All persons engaged in drilling domestic wells in area 5, Missouri Bootheel and all major stream alluvial areas (Figure 5) shall—] This area encompasses the Missouri and Mississippi River floodplains and is delineated separately because the uppermost aquifer consists of unconsolidated alluvium (see Figure 3.6).

(A) [If the well is to be drilled as a bedrock well—] Bedrock wells.
1. [Set no less than] A minimum of eighty feet (80’) of casing [] extending not less than shall extend a minimum of thirty feet (30’) into bedrock;
2. Construct the [drill] borehole a minimum of eight and five-eighths inches (8 5/8”) in diameter to the [surface] casing [point; ] depth.
3. Install new [steel or plastic] casing [as specified in] pursuant to 10 CSR 23-3.030(1)(A) [(steel) or 10 CSR 23-3.070 (plastic)].

4. Install and seal casing as follows:
   A. Full-length grout is preferred and will ensure a better annular seal but sealing t. The lowermost thirty feet (30') of casing [using approved grout materials and procedures set out in 10 CSR 23-3.030 is required. Drill cuttings and a drive shoe or drill cuttings used by themselves are not approved grout materials. Drill cuttings may be placed above grouted interval to fill in the annular space; shall be grouted pursuant to 10 CSR 23-3.030(1)(C). Table 3.10 lists the minimum amount of grout by type and size of annulus or open hole. The annular space above the grouted interval shall be filled with clean fill.

   (I) If steel casing is used, a drive shoe is required except on wells where the grout is allowed to cure before drilling resumes;
   (II) If plastic casing is used, a packer, coupling or inverted bell is required to be secured near the bottom of the casing and must hold the grout in place while drilling continues. No packer, coupling or inverted bell is required if grout is allowed to cure before drilling resumes; and
   (III) The following times must be followed for curing grout when no packer is used:
       (a) Hi-early cement--minimum set time of twelve (12) hours;
       (b) Portland Type I cement--minimum set time of seventy-two (72) hours;
       (c) Chipped bentonite--minimum hydration time of four (4) hours; and
       (d) High solids bentonite slurry--varies based on additives and manufacturer's specifications;

   (B) If the well is to be drilled as an unconsolidated material[s] wells [--]
   1. A minimum of [No less than] twenty feet (20') of casing shall be [set] installed above the screened or perforated interval [of the well; ].
   2. [The drill hole shall be constructed a minimum of four inches (4") larger than the casing to be placed into it. Well casing must be at least four-inch (4") nominal diameter. Graded, chlorinated gravel may be placed into the annular space adjacent to the well screen or natural (native) gravels in the formation being drilled can be allowed to cave back against the screen; and] The borehole for domestic wells shall be a minimum of four inches (4") larger than the casing diameter installed. Unconsolidated material wells that have a casing diameter less than four inches (<4") in diameter are exempt from these rules.
   3. [Full-length grout is preferred (above the screened interval) and will ensure a better annular seal but sealing t. The upper twenty feet (20') of casing [using approved grout materials and procedures set out in 10 CSR 23-3.030 is required.] shall be grouted pursuant to 10 CSR 23-3.030(1)(C). Table 3.14 lists the minimum amount of grout required by type and size of annulus or open hole.
   4. A chlorinated gravel pack may be placed into the annular space adjacent to the well screen or native materials may be allowed to collapse against the screen or perforated interval.
   5. All construction requirements pursuant to 10 CSR 23-3.030 shall be met except as stated in 10 CSR 23-3.090(5)(B)2,3.
(C) Shallow unconsolidated wells located in Area 5, the Missouri Bootheel (Figure 8) and all major stream alluvial areas may be exempted from this rule. If the wells and drillers of the wells meet the following specifications they are exempted:

1. Wells are drilled, jetted, driven, washed or constructed in other ways;
2. Wells are constructed in unconsolidated materials; and
3. Well casing diameters are no larger than two inches (2"").

(6) Area 6. All persons engaged in drilling domestic wells in Area 6, St. Francois Mountain area (Figure 6) shall--

This area encompasses the St. Francois Mountains and is delineated separately because igneous bedrock, which has low permeability, occurs close to the ground surface (Figure 3.7).

(A) Where granite or igneous rock is within one hundred feet (100') below the surface, set not less than forty feet (40') of casing extending not less than fifteen feet (15') into bedrock--

1. Construct the drill hole a minimum of eight and five-eighths inches (8 5/8") in diameter to the surface casing point;
2. Install new steel or plastic casing as specified in 10 CSR 23-3.030 (steel) or 10 CSR 23-3.070 (plastic);
3. Install and seal casing as follows:
   A. Full-length grout is preferred and will ensure a better annular seal, but sealing the lowermost thirty feet (30') of casing using approved grout materials and procedures set out in 10 CSR 23-3.030 is required. Drill cuttings and a drive shoe or drill cuttings used by themselves are not approved grout materials. Drill cuttings may be placed above the grouted interval to fill in the annular space;
   (I) If steel casing is used, a drive shoe is required except on wells where the grout is allowed to cure before drilling resumes;
   (II) If plastic casing is used, a packer, coupling or inverted bell is required to be secured near the bottom of the casing and must hold the grout in place while drilling continues. No packer, coupling or inverted bell is required if grout is allowed to cure before drilling resumes; and
   (III) The following times must be followed for curing grout when no packer is used:
      (a) Hi-early cement--minimum set time of twelve (12) hours;
      (b) Portland Type I cement--minimum set time of seventy-two (72) hours;
      (c) Chipped bentonite--minimum hydration time of four (4) hours; and
      (d) High solids bentonite slurry--varies based on additives and manufacturer's specifications.

Bedrock wells.

1. Bedrock wells where granite is less than one hundred feet (<100’) below the surface.

   A. A minimum of forty feet (40’) of casing shall be installed and extend a minimum of fifteen feet (15’) into solid bedrock. Example: if sixty feet (60’) of residual material or broken rock is encountered during drilling above solid bedrock, then seventy-five feet (75’) of casing shall be installed.
   B. Construct the borehole for domestic wells a minimum of eight and five-eighths inches (8 5/8”) in diameter to the casing depth.
   C. Install new casing pursuant to 10 CSR 23-3.030(1)(A).
   D. The lowermost thirty feet (30’) of casing shall be grouted. Table 3.10 lists the minimum amount of grout required by type and size of
annulus or open hole. The annular space above the grouted interval shall be filled with clean fill.
E. Grouting materials and methods shall be followed pursuant to 10 CSR 23-3.030(1)(C).

[ (B) In areas where granite is more than one hundred feet (100') below the surface, set not less than eighty feet (80') of casing not less than thirty feet (30') into bedrock.

1. Construct the drillhole a minimum of eight and five-eighths inches (8 5/8") in diameter to the surface casing point.
2. Install new steel or plastic casing as specified in 10 CSR 23-3.030 (steel) or 10 CSR 23-3.070 (plastic);
3. Install and seal casing as follows:
   A. Full-length grout is preferred and will ensure a better annular seal, but sealing the lowermost thirty feet (30') of casing using approved grout materials and procedures set out in 10 CSR 23-3.030 is required. Drill cuttings and a drive shoe or drill cuttings used by themselves are not approved grout materials. Drill cuttings may be placed above the grouted interval to fill in the annular space;
      (I) If steel casing is used, a drive shoe is required except on wells where the grout is allowed to cure before drilling resumes;
      (II) If plastic casing is used, a packer, coupling or inverted bell is required to be secured near the bottom of the casing and must hold the grout in place while drilling continues. No packer, coupling or inverted bell is required if grout is allowed to cure before drilling resumes; and
      (III) The following times must be followed for curing grout when no packer is used:
         (a) Hi-early cement--minimum set time of twelve (12) hours;
         (b) Portland Type I cement--minimum set time of seventy-two (72) hours;
         (c) Chipped bentonite--minimum hydration time of four (4) hours; and
         (d) High solids bentonite slurry--varies based on additives and manufacturer's specifications.]

2. Bedrock wells where granite is one hundred feet or more (≥100’) below the surface.
   A. A minimum of eighty feet (80’) of casing shall be installed and shall extend a minimum of thirty feet (30’) into solid bedrock.
   B. Construct the borehole for domestic wells a minimum of eight and five-eighths inches (8 5/8") in diameter to casing depth.
   C. Install new casing pursuant to 10 CSR 23-3.030(1)(A).
   D. The lowermost thirty feet (30’) of casing shall be grouted. Table 3.10 lists the minimum amount of grout required by type and size of annulus or open hole. The annular space above the grouted interval shall be filled with clean fill.
   E. Grouting materials and methods shall be followed pursuant to 10 CSR 23-3.030(1)(C).

(B) Unconsolidated material wells.
1. A minimum of twenty feet (20') of casing shall be installed above the screened or perforated interval.
2. The borehole for domestic wells shall be a minimum of ten and five-eighths inches (10 ⅝”) in diameter. The borehole shall be a minimum of four inches (4”) larger in diameter than the casing being installed.
3. Install new casing pursuant to 10 CSR 23-3.030(1)(A).
4. The upper twenty feet (20’) of casing shall be grouted. Table 3.11 lists the minimum amount of grout required by type and size of annulus or open hole.
5. B. Grouting materials and methods shall be followed pursuant to 10 CSR 23-3.030(1)(C).
6. A chlorinated gravel pack may be placed into the annular space or native materials may be allowed to collapse against the well screen or perforated interval.

(7) Area 7 (formerly Sensitive Area A). This area encompasses Osage, Gasconade, Maries, and parts of Phelps, Crawford, and Franklin counties and is delineated separately because it is overlain in part by Pennsylvanian-aged bedrock which is capable of producing groundwater with high dissolved solids (see Figure 3.2).

(A) Bedrock Wells
1. A minimum of eighty feet (80’) of casing shall be installed and extend a minimum of thirty feet (30’) into solid bedrock. Example: if sixty feet (60’) of residual material or broken rock is encountered during drilling above solid bedrock, then ninety feet (90’) of casing shall be installed.
2. In areas where Pennsylvanian-age strata (shale, sandstone and/or clay) are present, a minimum of one hundred fifty feet (150’) of casing shall be installed and extend at least thirty feet (30’) below the Pennsylvanian age strata (shale, sandstone and/or clay).
3. The borehole for domestic wells shall be a minimum of eight and five-eighths inches (8 ⅝”) in diameter to casing depth.
4. Install new casing pursuant to 10 CSR 23-3.030(1)(A).
5. Grouting Requirements
   A. The lowermost thirty feet (30’) of casing shall be grouted. Table 3.10 lists the minimum amount of grout required by type and size of annulus or open hole.
   B. Grouting materials and methods shall be followed pursuant to 10 CSR 23-3.030(1)(C).
   C. The annular space above the grouted interval shall be filled with clean fill.

(B) Unconsolidated material wells
1. A minimum of twenty feet (20’) of casing shall be installed above the screened or perforated interval.
2. The borehole for domestic wells shall be a minimum of ten and five-eighths inches (10 ⅝”) in diameter and a minimum of four inches (4”) larger in diameter than the casing being installed.
3. Install new casing pursuant to 10 CSR 23-3.030(1)(A).
4. Grouting Requirements
A. The upper twenty feet (20’) of casing shall be grouted. Table 3.11 lists the minimum amount of grout required by and size of annulus or open hole.

B. Grouting materials and methods shall be followed pursuant to 10 CSR 23-3.030(1)(C).

C. A chlorinated gravel pack may be placed into the annular space or native materials may be allowed to collapse against the well screen or perforated interval.

(8) Area 8 (formerly Sensitive Area B). This area encompasses a one-quarter (¼) mile buffer from the twenty foot (20’) water depth contour line of major lakes in Missouri (see Figure 3.2).

(A) The major lakes include:

1. Truman
2. Stockton
3. Table Rock
4. Bull Shoals
5. Lake of the Ozarks
6. Pomme de Terre
7. Norfolk
8. Clearwater

(B) Bedrock Wells

1. Casing shall be installed fifty feet (50’) below the deepest point of the lake within one-quarter (¼) mile radius of the well location. Casing shall not be less than the minimum requirements outlined in Drill Area 1 (10 CSR 23.090(1)) a minimum of eighty feet (80’) and extend thirty feet (30’) into bedrock. Formula: well site elevation (feet) – deepest lake elevation within one-quarter (¼) mile (feet) + fifty feet (50’) = casing depth. Example: 1000’ (well site elevation) - 850’ (deepest lake elevation within one-quarter (¼) mile) + 50’ = 200’ casing depth.

2. A casing point may be requested prior to drilling in Drill Area 8.

3. The borehole for domestic wells shall be a minimum of eight and five-eighths inches (8 ⅝”) in diameter to casing depth.

4. Install new casing pursuant to 10 CSR 23-3.030(1)(A).

5. When plastic casing is used liner shall not be used in lieu of casing.

6. When steel casing is used and the minimum casing depth cannot be achieved due to geologic reasons, casing shall be installed to a minimum of eighty feet (80’) extending a minimum of thirty feet (30’) into bedrock and a liner used to achieve the remaining casing depth provided the following requirements are met:

   A. Have a minimum annular space of one-half inch (½”);

   B. Have a minimum of two (2) three(3)-ribbed rubber packers (K-packers) secured at or below the bottom of the minimum casing depth;

   C. Have the top of the liner extend to within ten feet (10’) of the top of casing.
D. Have packers placed a maximum of ten feet (10’) apart; and
E. Grout pursuant to 10 CSR 23-3.090(8)(B)(7) using the
gravity or tremie grouting method using cement slurry or coated bentonite pellets.
F. Liner specifications shall be followed pursuant to
10 CSR 23-3.080(1), (2), (4), and (5).

7. Grouting Requirements
   A. The lowermost thirty feet (30’) of casing shall be grouted.
   Table 3.10 lists the minimum amount of grout required by type
   and size of annulus or open hole.
   B. Grouting materials and methods shall be followed pursuant
to 10 CSR 23-3.030(1)(C).
   C. The annular space above the grouted interval shall be filled
   with clean fill.

(C) Unconsolidated material wells. The unconsolidated requirements for the
Drill Area adjacent to the lake apply.

(9) Area 9 (formerly Sensitive Area C). This area encompasses Greene and parts of
Christian county where rapid urbanization is occurring in a sensitive geologic and
hydrologic setting. The upper aquifer (Springfield Plateau Aquifer) and lower aquifer
(Ozark Aquifer) are separated by low-permeability bedrock (Ozark Confining Unit). This
low-permeability bedrock limits migration of groundwater and any associated
contamination from the upper aquifer to the lower aquifer (see Figure 3.2).

(A) Bedrock Wells
   1. The casing shall be installed a minimum of ten feet (10’) below
   the Ozark Confining Unit or as indicated in the digital geospatial dataset
   ‘DRILL AREAS’ developed by the Missouri Department of Natural Resources, Missouri Geological Survey. Hard copies may be obtained by
   contacting the Missouri Department of Natural Resources, Missouri
   Geological Survey, 111 Fairgrounds Road, Rolla, Missouri 65401.
   2. A casing point request may be submitted to the Department.
   3. The borehole for domestic wells shall be a minimum of eight and five-eighths inches (8 5/8”) in diameter to casing depth.
   4. Install new casing pursuant to 10 CSR 23-3.030(1)(A).
   5. When plastic casing is used liner shall not be used in lieu of casing.
   6. When steel casing is used and the minimum casing depth cannot be
      achieved due to geologic reasons, casing shall be installed to a minimum of
      one hundred feet (100’) extending a minimum of thirty feet (30’) into
      bedrock and a liner used to achieve the remaining casing depth provided the
      following requirements are met:
      A. Have a minimum annular space of one-half inch (½”);
      B. Have a minimum of two (2) three(3)-ribbed rubber packers (K-
packers) secured at or below the bottom of the Ozark Confining
      Unit pursuant to 10 CSR 23-3.090(9)(A)1;
      C. Have the top of the liner extend to within ten feet (10’) of the top
      of casing.
D. Have packers placed a maximum of ten feet (10') apart; and
E. Grout pursuant to 10 CSR 23-3.090(9)(A)7 using the gravity or
tremie grouting method using cement slurry or coated bentonite
pellets.
F. Liner specifications shall be followed pursuant to 10 CSR 23-
3.080(1), (2), (4), and (5).

7. Grouting Requirements
   A. The Ozark Confining Unit shall be grouted from ten feet (10')
      below the formation to the top of the shale and at a minimum the
      lowermost thirty feet (30') of casing shall be grouted.
   B. When the casing extends more than ten feet (10') below the bottom
      of the Ozark Confining Unit, more than thirty feet (30') of grout will
      be required to seal off the Ozark Confining Unit.
   C. Grouting materials and methods shall be followed pursuant to
      10 CSR 23-3.030(1)(C).
   D. The annular space above the grouted interval shall be filled with
      clean fill.

(B) Unconsolidated material wells. The unconsolidated requirements for Drill Area
1 apply.

(10) Area 10 (formerly Special Area 1). This area encompasses a portion of southeastern
Missouri and is composed of deeply weathered and highly fractured bedrock where
openings may be filled with mud extending deep into bedrock (see Figure 3.8).
   (A) Bedrock Wells
1. A minimum of eighty feet (80') of casing shall be installed and extend a
   minimum of fifteen feet (15') into solid bedrock. Example: if sixty feet (60') of
   residual material or broken rock is encountered during drilling above solid
   bedrock, then seventy five feet (75') of casing shall be installed. If solid
   bedrock is not encountered within one hundred and fifty feet (150') the
   contractor may consult the Department for further instructions regarding a
   variance or install casing into deeper solid bedrock.
2. The borehole for domestic wells shall be a minimum of eight and five-
   eighths inches (8 5/8'') in diameter to casing depth.
3. In areas where poor drilling conditions exist and it is necessary to drive
   multiple strings of smaller diameter casing through the surface casing, each
   succeeding smaller diameter casing shall extend into the preceding casing at
   least twenty feet (20').
4. Install new steel casing pursuant to 10 CSR 23-3.030(1)(A).
5. Grouting Requirements
   A. If casing is driven, see 10 CSR 23-3.030(1)(D) for liner and
      grouting requirements.
   B. If casing is not driven, the lowermost thirty feet (30') of casing shall
      be grouted. Table 3.10 lists the minimum amount of grout required
      by type and size of annulus or open hole.
Grouting materials and methods shall be followed pursuant to 10 CSR 23-3.030(1)(C).

The annular space above the grouted interval shall be filled with clean fill.

If unconsolidated material wells are drilled in Area 10, Drill Area 1 requirements for unconsolidated wells apply.

Area 11 (formerly Special Area 2). This area encompasses Newton and Jasper County and is delineated separately due to the contamination of portions of the upper aquifer by one (1) or more of the following: lead, cadmium, TCE, TCE degradation products, or other contaminants of the National Primary Drinking Water Regulations (NPDWR). The upper aquifer (Springfield Plateau Aquifer) and lower aquifer (Ozark Aquifer) are separated by low-permeability bedrock (Ozark Confining Unit). This low-permeability bedrock limits migration of groundwater and any associated contamination from the upper aquifer to the lower aquifer (see Figure 3.2).

Bedrock Wells

1. Consult the digital geospatial dataset ‘DRILL AREAS’ developed by the Missouri Department of Natural Resources, Missouri Geological Survey. Hard copies may be obtained by contacting the Missouri Department of Natural Resources, Missouri Geological Survey, 111 Fairgrounds Road, Rolla, Missouri 65401.t. This dataset identifies the maximum well depth for wells completed in the upper aquifer; the required casing depth for a lower aquifer well; TCE Concern Areas; and TCE Impact Areas.

2. Wells outside of the TCE Impact Area may be installed in the upper aquifer provided they do not penetrate the Ozark Confining Unit; or wells may be installed and cased/sealed through the Ozark Confining Unit and open to only the lower aquifer.

   A. Total depth of the well shall not penetrate the Ozark Confining Unit and not exceed the upper depth indicated digital geospatial dataset ‘DRILL AREAS’.
   B. A minimum of eighty feet (80') of casing shall be installed and extend a minimum of thirty feet (30') into solid bedrock. Example: if sixty feet (60') of residual material or broken rock is encountered during drilling above solid bedrock, then ninety feet (90') of casing will be installed.
   C. The borehole for domestic wells shall be a minimum of eight and five-eighths inches (8 5/8") in diameter to casing depth.
   D. Install new casing pursuant to 10 CSR 23-3.030(1)(A).

Grouting Requirements

(I) The lowermost thirty feet (30') of casing shall be grouted. Table 3.10 lists the minimum amount of grout required by type and size of annulus or open hole.

(II) Grouting materials and methods shall be followed pursuant to 10 CSR 23-3.030(1)(C).
(III) The annular space above the grouted interval shall be filled with clean fill.

F. New upper aquifer wells within the TCE Concern Area shall follow sampling requirements pursuant to 10 CSR 23-3.090(11)(A)6.

   A. The casing shall be installed a minimum of ten feet (10') below the Ozark Confining Unit or to the lower depth indicated on the digital geospatial dataset ‘DRILL AREAS’.
   B. A casing point request may be submitted to the Department.
   C. Install new casing pursuant to 10 CSR 23-3.030(1)(A).
   D. If steel casing is used, the borehole shall be a minimum of eight and five-eighths inches (8 5/8") in diameter to casing depth.
   E. When steel casing is used and the minimum casing depth cannot be achieved due to geologic reasons, casing shall be installed to a minimum of eighty feet (80’) extending thirty feet (30’) into bedrock and a liner used to achieve the remaining casing depth provided the following requirements are met:
      (I). Have a minimum annular space of one-half inch (½”);
      (II). Have a minimum of two (2) three(3)-ribbed rubber packers (K-packers) secured at or below the bottom of the Ozark Confining Unit pursuant to 10 CSR 23-3.090(11)(A)4.A.;
      (III). Have the top of the liner extend to within ten feet (10’) of the top of casing.
      (IV). Have packers placed a maximum of ten feet (10’) apart; and
      (V). Grout pursuant to 10 CSR 23-3.090(11)(A)4.G. from the top packer to extend ten feet (10’) inside the casing using the gravity or tremie grouting method using cement slurry or coated bentonite pellets.
      (VI). Liner specifications shall be followed pursuant to 10 CSR 23-3.080(1), (2), (4), and (5).

F. If plastic casing is used, the borehole shall be a minimum of ten inches (10") in diameter to the casing depth. When plastic casing is used liner shall not be used in lieu of casing.

G. Grouting Requirements
   (I) Full length grout is required.
   (II) Grouting methods shall be Tremie Pressure, Pressure, or Positive Displacement pursuant to 10 CSR 23-3.030(1)(C)1.C., 10 CSR 23-3.030(1)(C)1.D., and 10 CSR 23-3.030(1)(C)1.F.
   (III) Grouting materials shall be cement slurry or high-solids bentonite slurry.
   (IV) Wells with eighty feet (80’) of casing may use grouting materials and methods pursuant to 10 CSR 23-3.030(1)(C).
H. All construction requirements pursuant to 10 CSR 23-3.030 shall be met except as provided in 10 CSR 23-3.090(11)(A)4.G.
I. New lower aquifer wells within the TCE Concern Area shall follow sampling requirements pursuant to 10 CSR 23-3.090(11)(A)6.

5. Major reconstruction of wells in Area 11 that involves exceeding the upper depth indicated in the digital geospatial dataset ‘DRILL AREAS’ or penetrating the Ozark Confining Unit requires advanced written approval from the Department.

6. Additional Requirements for wells in TCE Concern Areas.
   A. Water sampling and analysis shall be performed for TCE and its degradation products for new wells.
   B. Permitted pump installers and owners who self-install pumps are responsible for ensuring sampling is completed according to laboratory sampling protocol and submitting sample results within sixty (60) days of pump installation.
   C. The laboratory that analyzes the sample shall be certified by the EPA or the Department for such analyses.
   D. Prior to sampling, the well shall be purged continuously for a minimum of two (2) hours and water samples collected from the tap closest to the well.
   E. All wells in a TCE Concern Area shall be constructed with a sampling port or tap within twenty feet (20') of the wellhead.
   F. If an upper aquifer well contains detectable levels of TCE or its degradation products, the well shall:
      (I) Be plugged full length with approved grout material or;
      (II) Be reconstructed and sealed through the Ozark Confining Unit pursuant to 10 CSR 23-3.090(11)(A)5.

7. Well installation in TCE Impact Areas.
   A. The casing shall be installed a minimum of ten feet (10') below the Ozark Confining Unit or to the lower depth indicated in the digital geospatial dataset ‘DRILL AREAS’.
   B. A casing point request may be submitted to the Department.
   C. Install new casing pursuant to 10 CSR 23-3.030(1)(A).
   D. The borehole shall be a minimum of ten inches (10'') in diameter to casing depth.
   E. Grouting Requirements
      (I) Full length grout is required.
      (II) Grouting methods shall be Tremie Pressure, Pressure, or Positive Displacement pursuant to 10 CSR 23-3.030(1)(C)1.C., 10 CSR 23-3.030(1)(C)1.D., and 10 CSR 23-3.030(1)(C)1.F.
      (III) Grouting materials shall be cement slurry or high-solids bentonite slurry.
F. Water sampling and analysis shall be performed for TCE and its degradation products for new wells.

G. Permitted pump installers and owners who self-install pumps are responsible for ensuring sampling is completed according to laboratory sampling protocol and submitting sample results within sixty (60) days of pump installation.

H. The laboratory that analyzes the sample shall be certified by the EPA or the Department for such analyses.

I. Prior to sampling, the well shall be purged continuously for a minimum of two (2) hours and water samples collected from the tap closest to the well.

J. All wells in the TCE impact areas shall be constructed with a sampling port or tap within twenty feet (20') of the wellhead.

(B) Unconsolidated material wells
1. If unconsolidated material wells are drilled in Area 11 outside TCE Concern and TCE Impact areas, Drill Area 1 requirements for unconsolidated wells apply.
2. Advanced written approval from the Department is required if unconsolidated material wells are drilled in TCE Concern or TCE Impact areas.

(12) Area 12 (formerly Special Area 3). This area encompasses portions of Franklin County within and south of the city of New Haven and is delineated separately due to the contamination of portions of the aquifer by one (1) or more of the following known contaminants: tetrachloroethylene or perchloroethylene (PCE), trichloroethylene (TCE), TCE degradation products, and may include other contaminants of the National Primary Drinking Water Regulations (NPDWR). It is necessary to implement more stringent well construction standards for new wells that are drilled into the aquifer and to limit the deepening of existing upper aquifer wells (see Figure 3.9).

(A) New Wells
1. Prior written approval and construction specifications shall be obtained from the Department for any new wells constructed in Area 12.
2. Water sampling for contaminants will be required pursuant to 10 CSR 23-3.090(12)(C).
3. Drilling shall cease and the Department is to be notified immediately if PCE or TCE is encountered above the maximum contaminant level (MCL) or action level (AL). The Department will determine further action.

(B) Reconstruction of Existing Wells
1. Prior written approval and reconstruction specifications shall be obtained from the Department for any reconstructed wells in area 12.
2. Water sampling for contaminants will be required pursuant to 10 CSR 23-3.090(12)(C). Wells that are contaminated at levels exceeding maximum contaminant levels (MCLs) and/or action levels (ALs) shall not be deepened.
3. Drilling shall cease and the Department is to be notified immediately if PCE or TCE is encountered above the maximum contaminant level (MCL)
or action level (AL) during reconstruction. The Department will determine further action.

(C) Water Sampling

1. Groundwater sampling for contaminants is required according to laboratory sampling protocol for any new well or reconstruction and methods will be established on a case-by-case basis by the Department.
2. The well installation contractor is responsible for ensuring sampling is conducted throughout the drilling process and results submitted in accordance with pre-approved Department sampling methods. Final sampling of the well shall be completed by the pump installation contractor within sixty (60) days of pump installation. Wells will not be certified or registered until all sampling has been completed.
3. Sampling and analysis shall be performed for known contaminants listed in 10 CSR 23-3.090(12) and other contaminants as determined by the Department.
4. The laboratory that analyzes the sample shall be certified by the EPA or the Department for analyses being requested.
5. All new and deepened wells shall be constructed with a sampling port or tap at or before the pressure tank within twenty feet (20') of the wellhead.

(D) Plugging

1. Wells shall be plugged full length using bentonite slurry or cement grout via one of the tremie methods.
2. All plugging requirements in 10 CSR 23-3.110 shall be met except as required in 10 CSR 23-3.090(12)(D).

(E) All drilling-derived fluids, displaced water, and solid materials shall be containerized and sampled before disposal in accordance with federal, state, and local regulations based on analytical results.

(F) Any completed (new or reconstructed) well in which PCE and/or TCE is encountered at levels above MCL and/or AL shall be plugged full-length pursuant to 10 CSR 23-3.090(12)(D).

(13) Area 13 (formerly Special Area 4). This area encompasses portions of St. Charles County west of the city of Weldon Spring and is delineated separately due to contamination of portions of the aquifer by one (1) or more of the following known contaminants listed by source in Table 3.15. In this area it is necessary to implement more stringent well construction standards for new wells that are drilled into the aquifer and to limit the deepening of existing upper aquifer wells (see Figure 3.10).

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<th>Source</th>
<th>Known Contaminants¹</th>
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<tbody>
<tr>
<td>U.S. Army Corps of Engineers</td>
<td>trinitrotoluene (TNT), dinitrotoluene (DNT)</td>
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<td>Department of Energy Main Site</td>
<td>2,4,6-TNT, 2,4-DNT, 2,6-DNT, dinitrobenzene (1,3-DNB), nitrobenzene (NB), nitrate, uranium, and trichloroethylene (TCE)</td>
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<td>Department of Energy Quarry</td>
<td>uranium and 2,4-DNT</td>
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Table 3.15. Known contaminants of Drill Area 13 by source.
May also include other contaminants of the National Public Drinking Water Regulations (NPDWR).

(A) New Wells
1. Prior written approval and construction specifications shall be obtained from the Department for any wells constructed in Area 13.
2. Water sampling for contaminants will be required pursuant to 10 CSR 23-3.090(13)(C).
3. Drilling shall cease and the Department is to be notified immediately if contaminants listed in Table 3.x or other contaminants of the National Public Drinking Water Regulations (NPDWR) are encountered at levels above the maximum contaminant level (MCL) or action level (AL). The Department will determine further action.

(B) Reconstruction of Existing Wells
1. Prior written approval and construction specifications shall be obtained from the Department for any reconstructed wells in Area 13.
2. Groundwater sampling for contaminants listed in Table 3.15 or other contaminants of the National Public Drinking Water Regulations (NPDWR) will be required in advance of any deepening. Wells that are contaminated at levels exceeding maximum contaminant levels (MCLs) and/or action levels (ALs) shall not be deepened.
3. Any well approved to be deepened which encounters contaminants listed in Table 3.15 or other contaminants of the National Public Drinking Water Regulations (NPDWR) at levels above MCL and/or AL, drilling shall cease and the Department shall be notified immediately. The Department will determine further action.

(C) Water Sampling
1. Groundwater sampling for contaminants is required according to laboratory sampling protocol for any new well or reconstruction and methods will be established on a case-by-case basis by the Department.
2. The well installation contractor is responsible for ensuring sampling is conducted throughout the drilling process and results submitted in accordance with pre-approved Department sampling methods. Final sampling of the well shall be completed by the pump installation contractor within sixty (60) days of pump installation. Wells will not be certified or registered until all sampling has been completed.
3. Sampling and analysis shall be performed for contaminants listed in Table 3.15.
4. The laboratory that analyzes the sample shall be certified by the EPA or the Department for such analyses.
5. All new and deepened wells shall be constructed with a sampling port or tap at or before the pressure tank within twenty feet (20’) of the wellhead.

(D) Plugging
1. Wells shall be plugged full length using bentonite slurry or cement grout via one of the tremie methods.
2. All plugging requirements in 10 CSR 23-3.110 shall be met except as required in 10 CSR 23-3.090(13)(D).

(E) All drilling-derived fluids, displaced water, and solid materials shall be containerized and sampled before disposal in accordance with federal, state, and local regulations based on analytical results.

(F) Any completed (new or reconstructed) well in which contaminants listed in Table 3.15 or other contaminants of the National Public Drinking Water Regulations (NPDWR) are encountered at levels above the MCL and/or AL shall be plugged full-length (10 CSR 23-3.090 (13)(D)) or with approval from the Department the well owner may be allowed to use the well provided groundwater quality will not be degraded further.

(G) Notwithstanding these provisions, the federal government does not waive its rights and authority under federal law, regulations, or executive order within the boundaries and applicable jurisdiction of federal property.


PUBLIC COST: This proposed amendment will not cost state agencies or political subdivisions more than five hundred dollars ($500) in the aggregate.

PRIVATE COST: This proposed amendment will cost private entities $624 in the aggregate.

NOTICE OF PUBLIC HEARING AND NOTICE TO SUBMIT COMMENTS: Anyone may file a statement in support of or in opposition to this proposed amendment with Department of Natural Resources’ Geological Survey Program attention to Amber Steele at P.O. Box 250, 111 Fairgrounds Rd., Rolla, MO 65402 or via email to amber.steele@dnr.mo.gov. To be considered, comments must be received by the close of the public comment period on {September 14}, 2018 at 5:00 p.m. A public hearing is scheduled for {time, September 7, 2018, place, and address of hearing}. 
Table 3.10 All Drilling Areas (Bedrock Water Wells). Minimum Number of Bags of Grout Required in Annular Space (Ann.) or Open Hole (O.H.) for Sealing Casing with a Minimum Grout Seal of Thirty Feet (30’).

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Table 3.11 All Drilling Areas (Unconsolidated Water Wells). Minimum Number of Bags of Grout Required in Annular Space (Ann.) or Open Hole (O.H.) for Sealing Casing with a Minimum Upper Grout Seal of Twenty Feet (20’).

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Table 3.12 Drilling Areas 3 and 4 (Bedrock or Shallow Bedrock Wells Method 1 Using Five and One-half Inch (5 ½") Casing Diameter). Minimum Number of Bags of Grout Required in Annular Space (Ann.) or Open Hole (O.H.) for Sealing Casing with a Minimum Grout Seal of Thirty Feet (30').

Casing outer diameter 5 ½" (5” nominal) – Applies to Drilling Areas 3 and 4 only

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Table 3.13 Drilling Areas 3 and 4 (Unconsolidated or Shallow Bedrock Water Wells Method 2 Using Five and One-half Inch (5 ½”) Casing Diameter). Minimum Number of Bags of Grout Required in the Annular Space (Ann.) or Open Hole (O.H.) for Sealing Casing for with a Minimum Upper Grout Seal of Twenty (20’).

Casing outer diameter 5 ½” (5” Nominal) – Applies to Drilling Areas 3 and 4 Only.

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**Casing outer diameter 4 ½” (4” nominal) – applies to drilling area 5 only**

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Figure 3.5

Area 4

Lancaster
Schuyler
Kirkville
Adair
Macon
Moberly
Randolph

Mississippi River

Hannibal

S
Scottland
Clark

Knox
Lewis

Shelby
Marion

Monroe
Ralls
Pike