

0047



State of Utah

DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING

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August 16, 1989

TO: Susan Linner, Permit Supervisor

FROM: Mike DeWeese, Reclamation Hydrologist *MD*

RE: Mid-Permit Term Review, U. S. Fuel Company, Hiawatha Mines Complex, ACT/007/011, Folder #2, Carbon County, Utah

SUMMARY:

The operator is initiating a reorganization process of the current Mining and Reclamation Plan (MRP). The following comments and attachments are provided as an aid to the operator in facilitating the reorganization process.

ANALYSIS:

UMC 817.42 Hydrologic Balance: Water Quality Standards and Effluent Limitations

Surface drainage from disturbed areas must be treated by a pond or other appropriate structure until adequate vegetative cover has been established as part of the reclamation process.

UMC 817.43 Hydrologic Balance: Diversions

All temporary diversions should be designed to convey the 10 year 24 hour event with 0.3 feet of freeboard. Permanent diversions should be designed to convey the 100 year 24 hour event with 1 foot of freeboard.

Diversion design calculations must be submitted for maximum and minimum slope conditions to determine maximum velocities and channel capacities. Channel cross-sections and longitudinal profiles sufficient to accurately determine channel slopes and dimensions must be submitted along with designs for riprap linings, check dams, and other channel protection structures or a demonstration that these measures are unnecessary.

UMC 817.44 Hydrologic Balance: Stream Channel Diversions

In addition to the aforementioned criteria the operator must submit cross sections of the natural channel immediately above and below the diversion structure sufficient to demonstrate that the diversion channel capacity is at least equal to the natural channel capacity.

UMC 817.46 Hydrologic Balance: Sedimentation Ponds

Design calculations for all sedimentation ponds must be submitted demonstrating that the ponds will provide adequate sediment storage volume as per criteria in subsection (b) of this regulation. In addition it must be demonstrated that ponds will provide the required detention time for the 10 year 24 hour event. Ponds designed for total containment of the design storm must have a manual decant device which will allow the operator to maintain the water level at a specific elevation in order to maintain the detention storage volume.

As-built drawings of each pond certified by a registered professional engineer must be submitted presenting longitudinal profiles through the spillway structure and plan views. Contours should be shown at no greater than 2 foot intervals and extend a minimum of 100 feet beyond the pond embankment. Drawings should depict the following elevations:

- Top of embankment
- Emergency spillway crest
- Principle spillway crest
- Maximum water level
- Maximum and cleanout sediment levels
- Pond bottom
- Spillway outlet invert

The operator should commit to install reference markers in all sedimentation ponds which clearly show the sediment cleanout level. For ponds designed to totally contain the design event these markers should also show the maximum storage volume elevation.

UMC 817.47 Hydrologic Balance: Discharge Structures

Designs for energy dissipators or a demonstration that these structures are unnecessary must be submitted for each pond spillway outlet, culvert outlet, and diversion-natural channel contact.

UMC 817.49 Hydrologic Balance: Permanent and Temporary Impoundments

Designs for channel linings or demonstrations that these measures are unnecessary must be submitted for impoundment inlets to the base of the inner sideslope.

Certification reports must be submitted for all impoundments addressing the items enumerated in subsection (h) of this regulation.

UMC 817.50 Hydrologic Balance: Underground Mine Entry and Access Discharges

Gravity discharge from underground mine workings shall be prohibited unless the operator demonstrates that the discharge meets the requirements enumerated in subsection (b) of this regulation.

UMC 817.52 Hydrologic Balance: Surface and Groundwater Monitoring

The operator should submit a current surface and ground water monitoring program commensurate with the Division's guidelines (see attached).

UMC 817.53 Hydrologic Balance: Transfer of Wells

Any transfer or abandonment of exploration or monitoring wells must be conducted with the procedures outlined in the State Engineer's "Administrative Rules for Water Well Drillers" (see attached).

UMC 817.55 Hydrologic Balance: Discharge of Water Into an Underground Mine

Discharge of surface into underground mine workings is prohibited unless the operator demonstrates that the discharge meets the requirements enumerated by this regulation.

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UMC 817.57 Hydrologic Balance: Stream Buffer Zones

All areas within 100 feet of any perennial or intermittent stream must be designated a buffer zone and marked in the field unless the operator demonstrates that the conditions under subsection (a)(1) and (a)(2) are met.

BT98/63-66

UTAH COAL MINING HYDROLOGY REGULATIONS

- 783.13 Description of Hydrology and Geology-General Requirements
- 783.14 Geology description
- 783.15 Groundwater Information
- 783.16 Surface water information
- 783.17 Alternate water supply information
- 783.18 Climatological Information
- 783.24 Maps: General Requirements
- 783.25 Cross-Sections, Maps and Plans
- 784.11 Operation Plan: General Requirements
- 784.13 Reclamation plan: General Requirements
- 784.14 Reclamation plan: protection of hydrologic balance
- 784.16 Reclamation plan: Ponds, Impoundments, Banks, Dams, and Embankments
- 784.19 Underground Development Wastes
- 784.22 Diversions
- 784.23 Operation plan: maps and plans
- 784.25 Return of Coal Processing Waste to Abandoned Underground Workings
- 785.19 Underground Coal Mining Activities on Areas or Adjacent to Areas Including Alluvial Valley Floors in the Arid or Semi-Arid Areas of Utah
- 785.21 Coal Processing Plants or Support Facilities Not Located Within the Permit Area of a Specified Mine
- 786.19 Criteria for Permit Approval or Denial
- 788.12 Permit Changes
- 795 Small Operator Assistance Program
- 817.15 Casing and Sealing of Underground Openings: Permanent
- 817.41 Hydrologic Balance: General Requirements
- 817.42 Hydrologic Balance: Water Quality Standards and Effluent Limitations
- 817.43 Hydrologic Balance: Diversions
- 817.44 Hydrologic Balance: Stream Channel Diversions
- 817.45 Hydrologic Balance: Sediment Control Measures
- 817.46 Hydrologic Balance: Sedimentation Ponds
- 817.47 Hydrologic Balance: Discharge Structures
- 817.48 Hydrologic Balance: Acids and Toxic Forming Materials
- 817.49 Hydrologic Balance: Permanent and Temporary Impoundments
- 817.50 Hydrologic Balance: Underground Mine Entry and Access Discharges
- 817.52 Hydrologic Balance: Surface and Groundwater Monitoring
- 817.53 Hydrologic Balance: Transfer of Wells
- 817.55 Hydrologic Balance: Discharge of Water Into an Underground Mine
- 817.56 Hydrologic Balance: Postmining Rehabilitation of Sedimentation Ponds, Diversions, Impoundments, and Treatment Facilities
- 817.57 Hydrologic Balance: Stream Buffer Zones
- 817.71 Disposal of Excess Spoil and Underground Development Waste: General Requirements
- 817.72 Disposal of Excess Spoil and Underground Development Waste: Valley Fills
- 817.73 Disposal of Excess Spoil and Underground Development Waste: Head-of-Hollow Fills

817.74 Disposal of Excess Spoil and Underground Development Waste:
Durable Rock Fills

817.81 Coal Processing Waste Banks: General Requirements

817.83 Coal Processing Waste Banks: Water Control Measures

817.89 Disposal of Noncoal Wastes

817.91 Coal Processing Wastes: Dams and Embankments: General
Requirements

817.92 Coal Processing Wastes: Dams and Embankments: Site Preparation

817.93 Coal Processing Wastes: Dams and Embankments: Design and
Construction

817.103 Backfilling and Grading: Covering Coal and Acid-and-Toxic
Forming Materials

817.126 Subsidence Control: Buffer Zones

817.133 Postmining Land Use

817.150 Roads: Class I: General

817.151 Roads: Class I: Location

817.152 Roads: Class I: Design and Construction

817.53 Roads: Class I: Drainage

817.156 Roads: Class I: Restoration

817.160 Roads: Class II: General

817.162 Roads: Class II: Design and Construction

817.163 Roads: Class II: Drainage

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817.171 Roads: Class III: Location

817.172 Roads: Class III: Design and Construction

817.173 Roads: Class III: Drainage

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822 Alluvial Valley Floors

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FINDINGS

I. IMPACTS TO WATER QUALITY AND QUANTITY

UMC 783.16(a)

A. Monitoring

1. Insure the following baseline surface water information is provided:

a. Description of affected watersheds:

Location of the following within and adjacent to the mine plan area:

i Streams (perennial, intermittent and ephemeral).

ii Lakes.

iii Ponds.

iv Springs.

v Other discharges (i.e., old portals, etc.).

UMC 783.16(b)(1)

b. Baseline flow data (minimum of two years).

i Assure sufficient data to identify seasonal variation is given (annual and low peak flows, average monthly flows) for:

(A) Perennial streams - monthly flow.

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(B) Intermittent streams - monthly flow during flow periods.

(C) Ephemeral streams - crest gage data.

ii Field data included: pH; conductivity; temperature; DO; and, flow.

iii Assure that data are portrayed in a graphical or tabular format.

UMC 783.16(b)(2)

c. Baseline water quality data (minimum of two years):

i Parameters sampled should be according to DOGM baseline monitoring guidelines.

ii Sample frequency should be:

Quarterly for:

(A) Perennial streams.

(B) Lakes.

(C) Ponds.

(D) Springs.

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(E) Other Discharges.

Monthly for:

(A) Intermittent streams.

By precipitation event for:

(A) Ephemeral streams.

(B) Applicability determined on site-specific basis.

iii Assure that data are summarized and portrayed in a graphical or tabular format.

UMC 817.49(a)(1)

d. Hydrologic balance: Impoundments.

i Assure the intended use of impounded waters is described.

ii Assure data are present and a monitoring plan is described in the MRP to predict water quality of discharges from impoundments.

iii Assure that data are present and a monitoring plan is described in the MRP to show the water quality of receiving waters.

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I. IMPACTS TO WATER QUALITY AND QUANTITY - CONTINUED

- iv Assess if any use will be negatively impacted by changes to water quality as a result of mining. If so, disapprove plan.
- v Assess if the receiving waters are to be degraded to less than applicable water quality standards (check NPDES, EPA mining point source and Department of Health, Bureau of Water Quality). If so, disapprove plan.

UMC 817.52(b)

3. Surface water monitoring (operational and postmining water monitoring).

a. Sampling sites.

i Assure the locations of monitoring points are:

- (A) Above and below disturbed areas.
- (B) At sediment pond discharges.
- (C) At mine water pond discharges.

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I. IMPACTS TO WATER QUALITY AND QUANTITY - CONTINUED

- (D) At alternative sediment treatment structures.
- (E) At lakes, ponds, streams and representative springs.
- ii Assure sampling points are located to isolate disturbed area impacts from contributing undisturbed tributaries.
- iii Assure that method and equipment for flow measurements are given (float method and ocular estimates not acceptable).
- b. Assure water quality sampling parameters are given.
 - i See operational field and quality parameters, Table 1 of DOGM guidelines.
- c. Assure sampling frequency is given.
 - i See operational frequencies, Table 2 of DOGM monitoring guidelines.
- d. Postmining monitoring plan.

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I. IMPACTS TO WATER QUALITY AND QUANTITY - CONTINUED

i Assure that a postmining sampling program is described and includes:

(A) Sampling points.

(B) Sampling parameters.

(C) Sampling frequencies

ii Assure the plan has a commitment to remove any monitoring structures or equipment prior to bond release.

UMC 817.46(u)

iv Assure a monitoring station is at the entrance to each sediment pond and at each treatment facility for discharge from underground workings (see UMC 817.46[u]).

UMC 784.14(b)(3)

e. Reporting.

i Assure the plan commits to reporting quality and quantity data quarterly with an annual summary.

UMC 817.71(a)(1)
UMC 817.81(B)(1)

4. Monitoring plan for underground development waste and coal processing waste (impacts to water quality).

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I. IMPACTS TO WATER QUALITY AND QUANTITY - CONTINUED

- a. Make sure the analysis of the waste includes the following:
 - i pH.
 - ii Neutralization potential as tons of CaCO_3 equivalent per tons of material.
 - iii Percent pyritic sulfur.
 - iv Leachate study using baseline parameters from water monitoring guidelines.
- b. Assure, based on the above analysis, that the effluent limits of UMC 817.42 will be met. If not, assure an adequate treatment facility is proposed.
- c. A continued long-term annual sampling program should be committed to in the MRP. The items to be analyzed are noted above (check UMC 817.48).

UMC 784.14(c)
UMC 817.41(a)
UMC 817.41(b)

B. Predicted Impacts to Hydrologic Balance

1. Assure the MRP has a description of the probable hydrologic consequences. The description of impacts to the proposed mine plan area and adjacent area must include:

UMC 784.14(c)

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I. IMPACTS TO WATER QUALITY AND QUANTITY - CONTINUED

- a. Impacts to surface and ground water quality. At a minimum include:
 - i Increased TSS.
 - ii Increased TDS.
 - iii Oil and grease.
 - iv Other parameters (iron, pH, manganese).
- b. Impacts to surface and ground water quantity. At a minimum, include:
 - i Reduced streamflow (i.e., interception of runoff).
 - ii Increased stream flow (i.e., less permeable surfaces, pads, roads, etc.).
 - iii Reduced spring flow (i.e., subsidence).
 - iv Contributions of mine water.
 - v Affects on seasonal timing of flows (i.e., low flows, high flows).
 - vi Depth to ground water.

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UMC 817.41(a)

- c. Discussion of the proposed operations potential to produce long-term (i.e., after reclamation) impacts to the surface and/or ground water quality and quantity.
 - i Assess if adequate information for the following is given to determine long-term impacts:
 - (A) Mine dewatering practices.
 - (B) Length of time it will take for system to reach equilibrium.
 - (C) Stability and location of reclaimed stream channels.
 - (D) Potential long-term sources of degraded quality water (i.e., refuse or rock waste disposal areas).
 - (E) Potential to achieve postmining land use.

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II. SEDIMENTATION CONTROL

A. General Controls

UMC 784.14(a)(1 and 3)

1. Insure that the MRP includes plans to prevent additional contributions of sediment to stream flow or to runoff outside the permit area.
2. Assure the MRP contains a detailed description of measures to protect water quantity and quality. The plan is to include:
 - a. That the proposed site configuration and associated drainage plan is the best alternative to prevent or minimize water pollution within the constraints of the mining operation.
 - b. Undisturbed area diversions and detail designs (see UMC 784.22).
 - c. Disturbed area diversions and detail designs (see UMC 784.22).
 - d. Sediment control measures and locations.
 - e. Assure disturbed areas are shaped to minimize slope.
3. Check sediment control for:

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- a. Road cut and fill slopes.
- b. Downslopes from pads.
- c. All disturbed area drainage prior to discharge off the permit area.
- d. Drainage from sediment pond outslopes.
- e. Protection of stream channels by required buffer zones and/or temporary culverting of streams.
- f. Measures proposed during construction periods.
- g. Assure mulching is well secured via:
 - i Crimping.
 - ii Chemical tackifiers.
 - iii Stakes or staples.
- 4. Common sediment control measures include:
 - a. Sediment ponds.
 - b. Silt fences.

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II. SEDIMENTATION CONTROL - CONTINUED

- c. Gabions.
- d. Berms.
- e. Riprap energy dissipators.
- f. Culverts with inlet and outlet protection.
- g. Flocculants.
- h. Vegetative filters.
- i. Revegetation.

B. Sediment Control Plan

- 1. Sediment control methods used during reclamation.
 - a. Sedimentation ponds.
 - b. Silt fences.
 - c. Trenching.
 - d. Straw bales.
 - e. Timing of construction and reclamation regrading.
 - f. Contouring, pitting sediment ponds, catch basins, terraces.

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	g.		Assure the above methods will minimize erosion until revegetation is successfully achieved.
UMC 784.14(b)(3)	2.		Assure that operational and postmining water monitoring plans are in accord with UMC 817.52 of this guideline.
UMC 784.23(b)(1)	3.		Assure all sediment treatment structures and the contributing drainage to the structure are delineated on a map.
UMC 817.41(d) UMC 817.92(b) UMC 817.45(iii)(a)	4.		Insure the MRP contains plans for contemporaneous reclamation of all disturbed areas no longer required by the operation.
UMC 817.45(iii)(b)	5.		Insure that the MRP includes plans for the appropriate backfilling and grading methods and these plans incorporate designs for any of the following areas which apply to the mine site. <ul style="list-style-type: none"> a. Cut and fill terraces. b. Culverts and underground rock drains. c. Outslopes (not to exceed 50 percent).

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II. SEDIMENTATION CONTROL - CONTINUED

- d. Small depressions to control erosion.
- e. Final grading plan including placement of topsoil and overburden along the contour to minimize erosion.

UMC 817.42(a)(3)

- C. Proposed Small Area Exemptions
 - 1. Alternatives discussed.
 - 2. Area of disturbance depicted on map.
 - 3. Volume of expected runoff from the design precipitation event presented.
 - 4. Proposed alternative sediment control structure (check dams, silt fences, straw bales, catch basin) with demonstration that the proposed structure has potential to treat drainage to meet limitations.
 - 5. Map of proposed structure location.
 - 6. Design of structure.
 - 7. Maintenance methods and schedule.
 - 8. Monitoring plan to demonstrate compliance with limitation standards.

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UMC 817.42(a)(3)(ii)(B)	9.		Demonstration that all undisturbed drainage is not mixed with discharge from underground mine workings.
	10.		Include a plan for treatment and monitoring of all disturbed area drainage which is mixed with discharge from underground mine workings.
	D. Sedimentation Ponds		
	1. General requirements.		
UMC 817.46(a)(1) UMC 817.42(a)(5)	a.		Insure MRP has a commitment to construct all sediment ponds before disturbance.
UMC 817.46(a)(2)	b.		Insure ponds are located near disturbance. All alternative sites evaluated.
UMC 784.14(b)(1), 784.16(a)(2)(iv) 784.16(a)(3)(iv)	c.		Insure reclamation timetable includes removal of ponds and diversions. Timetable must reflect that removal will occur only following successful completion of the requirements of UMC 817.111-.117 and when drainage entering pond meets all water quality standards.
UMC 817.46(a)(2)	d.		Pond not in perennial stream channel. Approval only if:

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II. SEDIMENTATION CONTROL - CONTINUED

UMC 817.44(b)(1)	<ul style="list-style-type: none"> i Alternative pond locations evaluated and positively not feasible. ii Pond design includes adequate stabilization (riprap) measures for in and outslopes of embankment and rerouted stream channel. iii Pond design includes capability to safely pass the peak flow (determined by Division) of perennial stream. iv Complete plan for stream reclamation is submitted as per UMC 817.44 guidelines. v Insure construction plan minimizes disturbance to stream in terms of timing, interim sediment protection, and temporary stream diversion. 		
UMC 784.16(b)(2)	<ul style="list-style-type: none"> e. Insure plans address requirements of 30 CFR 77.216-1 and 77.216-2. These requirements are as follows: 		

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II. SEDIMENTATION CONTROL - CONTINUED

i A permanent identification marker, at least six feet high and showing the identification number of the impounding structure as assigned by the District Manager, the name associated with the impounding structure and name of the person owning, operating or controlling the structure, shall be located on or immediately adjacent to each water, sediment or slurry impounding structure within the time specified in paragraph (a) or (b) of this section as applicable.

(A) For existing water, sediment or slurry impounding structures, markers shall be placed before May 1, 1976.

(B) For new or proposed water, sediment, or slurry impounding structures, markers shall be placed within 30 days from the start of construction.

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II. SEDIMENTATION CONTROL - CONTINUED

ii The plan specified in Section 77.216 shall contain as a minimum the following information:

(A) The name and address of the persons owning, operating or controlling the impoundment or impounding structure; the name associated with the impoundment or impounding structure; the identification number of the impounding structure as assigned by the District Manager; and, the identification number of the mine or preparation plants as assigned by MSIIA.

(B) The location of the structure indicated on the most recent U. S. Geological Survey (USGS) 7-1/2 minute or 15 minute topographic quadrangle map, or a topographic map of equivalent scale if a USGS map is not available.

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II. SEDIMENTATION CONTROL - CONTINUED

- (C) A statement of the purpose for which the structure is or will be used.
- (D) The name and size in acres of the watershed affecting the impoundment.
- (E) A description of the physical and engineering properties of the foundation materials on which the structure is or will be constructed.
- (F) A statement of the type, size, range and physical and engineering properties of the materials used, or to be used, in constructing each zone or stage of the impounding structure; the method of site preparation and construction of each zone; the approximate dates of construction of the structure and each successive stage; and for existing structures,

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II. SEDIMENTATION CONTROL - CONTINUED

such history of construction as may be available, and any record or knowledge of structural instability.

- (G) At a scale not to exceed 1 inch = 100 feet, detailed dimensional drawings of the impounding structure including a plan view and cross sections of the length and width of the impounding structure, showing all zones, foundation improvements, drainage provisions, spillways, diversion ditches, outlets, instrument locations and slope protection, in addition to the measurement of the minimum vertical distance between the crest of the impounding structure and the reservoir surface at present and under design storm conditions, sediment or slurry level, water level and

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II. SEDIMENTATION CONTROL - CONTINUED

other information pertinent to the impoundment itself, including any identifiable natural or manmade features which could affect operation of the impoundment.

- (H) A description of the type and purpose of existing or proposed instrumentation.
- (I) Graphs showing area-capacity curves.
- (J) A statement of the runoff attributable to the probable maximum precipitation of 6-hour duration and the calculations used in determining such runoff.
- (K) A statement of the runoff attributable to the storm for which the structure is designed and the calculations used in determining such runoff.

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II. SEDIMENTATION CONTROL - CONTINUED

- (L) A description of the spillway and diversion design features and capacities and calculations used in their determination.
- (M) The computed minimum factor of safety range for the slope stability of the impounding structure including methods and calculations used to determine each factor of safety.
- (N) The locations of surface and underground coal mine workings including the depth and extent of such workings within the area 500 feet around the perimeter, shown at a scale not to exceed one inch = 500 feet.
- (O) Provisions for construction surveillance, maintenance, and repair of the impounding structure.

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II. SEDIMENTATION CONTROL - CONTINUED

- (P) General provisions for abandonment.

- (Q) A certification by a registered engineer that the design of the impounding structure is in accordance with current, prudent engineering practices for the maximum volume of water, sediment, or slurry which can be impounded therein and for the passage of runoff from the designed storm which exceeds the capacity of the impoundment; or, in lieu of the certification, a report indicating what additional investigations, analyses, or improvement work are necessary before such a certification can be made, including what provisions have been made to carry out such work in addition to a schedule for completion of such work.

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UMC 784.16(2)(i), 784.16(3)(i) 784.23(c) UMC 817.46(h) and (r)	(R) Such other information pertaining to the stability of the impoundment or impounding structures shall be approved by the District Manager prior to the initiation of such changes or modifications.		
UMC 817.46(r)	f. Certification (sediment ponds). <ul style="list-style-type: none"> <li data-bbox="842 857 1304 987">i Insure all maps, plans, and designs are certified by a registered professional engineer. <li data-bbox="827 1019 1335 1182">ii MRP must contain a commitment for ponds inspection during construction under supervision of registered professional engineer. <li data-bbox="814 1214 1241 1300">iii MRP must contain certification of pond following construction. 		
UMC 817.46(t)	g. Inspections and reports.		

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II. SEDIMENTATION CONTROL - CONTINUED

- UMC 817.49(f)

 - i Insure MRP has plan for continued inspection of all ponds. Ponds meeting criteria of 30 CFR 77.216(a) must be inspected weekly as per 77.216-3.
 - (A) Criteria of (30 CFR 77.216[a]):
 - (1) Twenty ac-ft or greater storage and five ft impounded elevation above upstream toe, or
 - (2) Impounded elevation more than 20 ft above upstream toe.
 - (B) MRP must have commitment for reports to be submitted to the Division including submittal dates.

- UMC 817.46(t)

 - ii Ponds whose criteria do not meet 30 CFR 77.216(a) must be inspected quarterly.
 - (A) Commitment for quarterly report with submittal dates.

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II. SEDIMENTATION CONTROL - CONTINUED

2. Sediment storage volume.

UMC 817.46(b)(1)

- a. Designs must include a predicted (at a minimum) one year sediment volume. Calculations and all inputs must be justified and sources cited.

Acceptable methods:

- i USLE method.

- ii MUSLE method.

- iii PSIAC method.

UMC 817.46(b)(2)

- iv 0.1 ac-ft sediment per acre of disturbance.

UMC 817.46(b)(2)

- (A) Design may propose volumes of less than 0.1 ac-ft/ac but not less than 0.035 ac-ft/ac. If:

- (1) Plan includes method of additional sediment removal (treatment) and plans.

UMC 817.46(b)(1)

- b. Design must include a predicted volume of sediment from undisturbed areas draining to pond.

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- | | | | |
|------------------|-----|--|--|
| UMC 817.46(b)(3) | c. | | Design must include all predicted sediment from mine discharge for a one year period. |
| UMC 817.46(c) | 3. | | Insure designs demonstrate ponds can meet a detention time sufficient to meet effluent limitations. Options are: |
| | a. | | Demonstrate theoretical detention time. |
| | i | | Inflow and outflow hydrographs included. |
| | ii | | Calculations with inputs justified. |
| | b. | | Demonstrate total containment (SCS curve number methodology, NEH-4, 1972). Insure plan includes: |
| | i | | Watershed area with map. |
| | (A) | | Area defined by control structures or topography. |
| | ii | | Curve number with assumptions (refer to UMC 817.43, guidelines). |
| | (A) | | CN for each subwatershed with significantly different characteristics. |

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II. SEDIMENTATION CONTROL - CONTINUED

UMC 817.46(c)(1)(ii), 817.45(c)(2)	<ul style="list-style-type: none"> iii Design precipitation event (source cited). iv Sediment volume. v Stage-volume curve. <ul style="list-style-type: none"> (A) Contour map of pond. vi Mine water volume expected. 		
UMC 817.46(c)(2)	<ul style="list-style-type: none"> c. For ponds other than total containment, demonstrate effluent limitations can be met. <ul style="list-style-type: none"> i Insure plan demonstrates effluent limitations can be met. Options: <ul style="list-style-type: none"> (A) Variable flow rate model. All inputs supported by calculations, assumptions, and sources cited. <ul style="list-style-type: none"> (1) Inflow hydrograph. (2) Particle size distribution from undispersed soil sample. 		

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II. SEDIMENTATION CONTROL - CONTINUED

- (3) Stage-volume curve.
- (4) Stage-discharge curve.
- (5) Watershed and sediment parameters.

UMC 817.46(c)(3)

- (B) Plan for chemical treatment

UMC 817.46(c)(4)(i)

- (C) Improved sediment removal efficiency plan.
 - (1) Baffles.
 - (2) Primary settlement basin.

4. Sediment pond design.

UMC 817.46(e)

- a. Insure design is evaluated for short-circuiting potential:
 - i L:W ratio greater than 2.0 (EPA, 1976).
where: L = average length of flow; W = A/L; A = surface area of pond at maximum stage.
 - ii Flow path may be increased by use of baffles.

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UMC 817.49(d)(e)

ix Plan is included for revegetation of embankments and all areas disturbed by pond construction.

UMC 817.46(s),
817.49(d)

v Plan is included for stabilization of upstream face.

(A) Riprap design.

c. For proposed ponds meeting criteria of UMC 817.46(q):

i Embankment greater than 20 ft or,

ii Storage volume greater than 20 ac-ft.

(A) Verify with cross section and volume contour map.

iii If yes, then insure application contains the following:

UMC 817.46(q)(1)

(A) Spillways (principal and emergency) are designed for 100-year, 24-hour event.

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- UMC 817.46(q)(2)

 - (B) A demonstration of a static safety factor of 1.5.
 - (C) Design includes anti-seep collars along all embankment conduits.
 - (1) Cross section of embankment with all conduits and location of collars.
 - (2) Insure collars increase the flow length by 10 percent (Barfield, Warner and Haan, 1978, page 458).
 - (D) Insure MRP contains a plan demonstrating that the requirements of 30 CFR 77.216 will be met.

5. Spillways.

a. General.

- UMC 817.46(i)

 - i Insure designs for each pond include a principal and an open channel emergency spillway.

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II. SEDIMENTATION CONTROL - CONTINUED

UMC 817.46(g)	ii Required design events:		
	(A) 10-year, 24-hour for principal spillway.		
UMC 817.46(i)	(B) 25-year, 24-hour for emergency and principal spillway in combination.		
UMC 817.46(i)	iii Design must include all mine water inflow.		
UMC 817.46(d)	iv Design must include a dewatering device. Insure plan includes the following:		
	(A) Discharge rate achieves proposed detention time.		
	(1) Outflow hydrograph with calculations and assumptions.		
UMC 817.46(d)	(B) Elevation of decant is above sediment storage volume.		
	(C) Plan for decant operation.		
	(1) Monitoring plan specific to decant period.		

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UMC 817.46(g)

b. Principal spillways.

- i If drop inlet spillways are proposed, then insure the design includes:
 - (A) Stage-discharge curve.
 - (B) Height of drop riser.
 - (C) Diameter of inlet and embankment pipes.
 - (D) Coefficient of pipe inlet.
 - (E) n-value for pipe.
 - (F) Dimensions of all pipes (length).
 - (G) Values for K_e , K_f and K_b .
 - (H) Cross section of embankment through discharge structure.
 - (I) Peak flow calculation (see guidelines for diversions).
- ii Insure plan contains design for oil skimmer.

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- | | | | |
|--|--|--|--|
| <p>UMC 817.46(1)</p> | <p>d. Cross section of embankment demonstrating one ft elevation difference between spillways at design discharge.</p> | | |
| <p>UMC 817.46(a)(2)(iv),
817.46(a)(3)(iv), 817.49(g),
817.46(u), 817.46(h)</p> | <p>6. Insure MRP contains a plan for sediment pond maintenance and removal.</p> <p>a. Commitment and plan for sediment removal which includes:</p> <ul style="list-style-type: none"> i Detection of 60 percent of design storage volume: <ul style="list-style-type: none"> (A) Permanent sediment volume marker located at midpoint between pond inlet and outlet with 100 percent and 60 percent of sediment volume visible, and (B) Commitment to survey pond as deemed necessary by the Division and submit results (include submittal dates) to the Division. ii Method of sediment removal and location of approved disposal site. | | |

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II. SEDIMENTATION CONTROL - CONTINUED

UMC 817.46(u),
817.46(a)(2)

- b. Insure MRP contains a plan for pond removal.
 - i Insure plan commits to criteria for removal:
 - (A) Disturbed area meets UMC 817.111-.117 (revegetation).
 - (B) Plan for regrading (UMC 817.106-.107).
 - (C) Drainage entering pond meets limitations.
 - (1) MRP must include postreclamation monitoring plan with:
 - (a) Map of sample points entering each sediment pond.
 - (b) Sample frequency and parameter list.
 - (c) Procedure for recording and reporting of data.

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- (d) Access to site after road removal.
- (e) Commitment and bond for sampling until UMC 817.46(u) is met.

UMC 817.49

UMC 817.49(a)

- 7. Permanent impoundments.
 - a. Insure MRP contains plans demonstrating:
 - i The quality of water is suitable for proposed use.
 - ii The discharge will not degrade quality of receiving water to levels below applicable limitations.
 - iii The water level is stable.
 - iv Safety and access measures.
 - v The requirements of the Watershed and Flood Protection Act (Public Law 83-566) are met.

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II. SEDIMENTATION CONTROL - CONTINUED

- vi For ponds meeting requirements of 30 CFR 77.216(a), plans must meet requirements of SCS TR-60.
- vii For all other ponds, plans must meet requirements of SCS Practice Standard 378.

UMC 784.22 applies to all below

E. Diversions.

UMC 817.41, 817.42(a)(1)

1. Required general information.
 - a. Diversions labeled on maps. References in text must use this label.
2. Map of area draining to each diversion depicting the following:
 - a. Controls (topographic, berms, etc.) that delineate area.
 - b. Disturbed versus undisturbed areas.
 - c. Location of each diversion.
 - d. Topographic scale sufficient to determine elevation change and hydraulic length.

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- | | |
|--------------------------|--|
| <p>UMC 784.23(b)(6),</p> | <ol style="list-style-type: none"> 3. A cross section for each diversion and each section of diversion that varies in configuration. <ol style="list-style-type: none"> a. Insure cross section depicts (at an adequate scale): <ol style="list-style-type: none"> i Wetted perimeter. ii Cross-sectional area. iii Design freeboard. iv Riprap depth and size (if applicable). v Filter blanket depth (if applicable).
 4. Verify slope of each diversion. <ol style="list-style-type: none"> a. Insure MRP contains a topographic map of sufficient scale to assess slope of <u>each</u> section and, b. A longitudinal profile of each diversion.
 5. For proposed diversions on existing or potential slides, approval: <ol style="list-style-type: none"> a. May require a geotechnical analysis with a static safety factor of 1.5 or greater. |
|--------------------------|--|

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II. SEDIMENTATION CONTROL - CONTINUED

b. Will require an impervious liner for entire reach constructed on a slide area.

UMC 817.43(c)

6. Insure designs for diversions contain:

a. Peak flow value:

i Insure that applicant's proposed methodology is justified in terms of applicability to site and assumptions.

(A) Presentation of calculations with all inputs justified.

ii IF SCS methodology (NEH-4, 1972) is used, then the following must be included:.

(A) Design storm precipitation value (source cited).

(B) Watershed area. Verify with map and digitizer.

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II. SEDIMENTATION CONTROL - CONTINUED

- (C) Curve number (with justification) for each significantly different subwatershed. For each curve number, insure application contains:
 - (1) Soil group name.
 - (2) Hydrologic soil group.
 - (3) Hydrologic condition.
 - (4) Antecedent Moisture Condition II used for all design work.
 - (5) Land condition and use.
 - (6) Percent vegetation cover. Cross check with cover estimates in biology plan
 - (7) Source of all CN values cited. Reviewer will field verify the curve number used.

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II. SEDIMENTATION CONTROL - CONTINUED

- (D) Time of concentration value with all inputs referenced to topographic map.
- (E) Type of rainfall distribution assumed and justification.

UMC 817.43(c)

- b. Design velocity and channel capacity.
 - i If Manning's equation for open channel flow is used, then insure the following:
 - (A) Cross-sectional area verified with cross sections.
 - (B) Wetted perimeter verified.
 - (C) n-value is submitted with justification and source cited.
 - (D) Correct slope of diversion is used:
 - (1) Maximum slope for riprap or stability design velocity.

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(2) Minimum slope for channel capacity design.

(E) Calculated velocity value is submitted

ii All diversion designs must include a 0.3 ft. freeboard minimum.

UIC 817.43(b), (f)(1), (B)

c. Design for channel stability.

i Insure MRP contains a plan for channel lining.

(A) Verify proposed lining is stable with Manning's velocity. Insure MRP contains appropriate combination of the following:

(B) Common (acceptable) linings: riprap-angular; vegetation; concrete (temporary); culverts and 1/2 round; gunite (temporary), shotcrete; revegetation and revetment mats.

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II. SEDIMENTATION CONTROL - CONTINUED

- (1) Existing channel particle size for low gradient/low velocity channels.
- (2) Existing or proposed vegetation lining.
- (3) Riprap design.
 - (a) Design velocity.
 - (b) Riprap sizing.
 - (c) Filter blanket design.
 - (d) Riprap placement.

UMC 817.43(e)

- 7. Insure MRP contains a plan for removal of temporary diversions including:
 - a. A plan for regrading and revegetation (including timing of removal).
 - b. A plan for restoration of natural drainage patterns.

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II. SEDIMENTATION CONTROL - CONTINUED

- i Premining survey delineating original drainage pattern including all perennial, intermittent and ephemeral channels.
- ii Regrading plan including map of postmining drainage contours approximating original contours.
- iii For existing mines, the regrading plans must blend with existing adjacent drainage patterns.

UMC 815.15(g)(3)

- 8. Diversion proposed during exploration.
 - a. Commitment to not divert ephemeral, intermittent or perennial streams.
 - b. Temporary diversions of overland flow only approvable around roads, drill pads and support facilities.
 - i Insure design addresses guidelines for UMC 817.43.
- 9. If applicant proposes any of the following sites, then insure MRP contains plans for each diversion or terrace:

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II. SEDIMENTATION CONTROL - CONTINUED

a. If the MRP proposes:

i Terraces.

UMC 817.72(e)

- (A) Designs demonstrate the terraces are graded to a slope of 1v:20h (five percent) towards the embankment.
- (B) Collection ditches are proposed along the intersection of each terrace bench and the outslope.
- (C) Vertical distance between terraces is less than 50 ft.
- (D) Insure that if the diversion is permanent, the diversion shall be designed for 100-year, 24-hour precipitation event.
- (E) Insure that the MRP contains calculations and plans to support design of terraces and diversions.

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II. SEDIMENTATION CONTROL - CONTINUED

- (F) Insure that the plan and justification or alternative permanent sediment controls can be warranted.
- (G) Insure that terrace ditches do not exceed a five percent slope towards the channel.
- (H) Insure that slopes are protected against erosion and that vegetation, riprapped ditches, etc., are included as protection measures in the plan.

UMC 817.72

ii If valley fills are proposed, insure MRP proposes to:

UMC 817.72(d)

- (A) Divert drainage from area above fill away from fill.
- (B) No drainage directed over outslope.
- (C) 100-year, 24-hour design event for drainage system.

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|---------------|---|--|--|
| UMC 817.73(e) | iii If head of hollow fills are proposed: | | |
| | (A) Same requirements as section iii above. | | |
| | iv If durable rock fills are proposed, insure MRP proposes to: | | |
| UMC 817.73(d) | (A) Divert above and adjacent areas. | | |
| UMC 817.74(f) | (B) Divert surface flow occurring from fill away from outslope of the fill. | | |
| | (C) Divert outslope flow from fill. | | |
| | (D) Design for 100-year, 24-hour event. | | |
| | (E) Sediment control measures required at <u>each</u> diversion outlet. | | |
| UMC 817.83(b) | v If coal processing waste banks are proposed, insure MRP proposes to: | | |
| | (A) Divert drainage from area above bank. | | |

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II. SEDIMENTATION CONTROL - CONTINUED

(B) Divert drainage from crest and face of disposal area.

UMC 817.92(b)

(C) Diversions required during construction and after completion for surface flow that may cause erosion.

(D) Plan for maintenance.

UMC 817.47, 817.92(b)

(E) Sediment control measures required at each diversion outlet.

(F) Diversion of upstream area away from impoundment is designed for 100-year, 24-hour event.

UMC 817.43(c)

10. Insure all hydrologic designs in the MRP are based on the following design storm requirements:

a. 1-year, 6-hour event.

UMC 817.173(b)

i Class III road drainage structures.

UMC 817.43(a)

b. 2-year, 24-hour event.

i Temporary diversions.

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II. SEDIMENTATION CONTROL - CONTINUED

- ii Stream channels as determined by Division.
- iii Class I and II roads at stream crossings as required by Division.
- iv Permanent diversions of overland flow not associated with ponds.
- f. Diversion design summary. Insure design for each diversion contains:
 - i Channel capacity.
 - ii Channel stability.
 - iii Channel freeboard.
 - iv Energy dissipators.
 - (A) At all discharge points.
 - (B) Where diversions intersect natural channels.

UMC 817.47

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(C) Provide calculations and justification for each energy dissipator proposed. Include location and specific design details for each structure including source and reference of method used and all inputs justified.

(D) If not a standard engineering design or condition, provide a backwater analysis.

UMC 817.43(f)(4)

v Plan for disposal of excavated material.

UMC 817.43(g)

vi Assure that diversions of surface flows into mine will not occur (except as individually approved by Division per UMC 817.55).

F. Stream channel diversions.

1. Required general information. Insure each proposed diversion plan includes:

UMC 817.44(b)(1)

a. Longitudinal profile of existing and proposed channel.

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II. SEDIMENTATION CONTROL - CONTINUED

UMC 817.44(b)(2)	b. Cross sections of existing and proposed channel and flood plain.		
UMC 817.44(d)(3)	c. Cross sections and photo documentation of existing channel at critical habitat sections as determined in consultation with Division hydrologists and biologists at a pre-design onsite conference.		
UMC 817.44(d)(2)	d. Mapped prediversion channel morphologic pattern at an approved adequate scale.		
UMC 817.44(b)(2)	e. Upstream and downstream cross sections and hydrologic parameters (Manning's inputs) to demonstrate equal channel capacity through diverted reach.		
UMC 817.44(a)(3)	f. Insure applicant has filed and received: <ul style="list-style-type: none"> i State Engineer's Stream Alteration permit. ii Army Corps of Engineer's 404 permit. 		
UMC 817.44(b)(d)	g. Design for passage of flow in an environmentally acceptable manner. Include:		

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II. SEDIMENTATION CONTROL - CONTINUED

- i Backwater analysis for steep channels (greater than 10 percent).
- ii Energy dissipators and channel stability.
- iii Fish passage and habitat requirements (if present).

2. Insure plan includes diversion design: peak flow value; channel capacity; and, channel stability. Insure plans meet the following:

UMC 817.44(b)(2)

- a. 10-year, 24-hour event (temporary).
- b. 100-year, 24-hour event (permanent).
- c. Larger event specified by reviewer for sensitive areas.
- d. At a minimum, channel capacity through diverted reach will equal or exceed upstream and downstream reach.

UMC 817.43(b)(1)

e. Concrete and other artificial means of channel stability measures only approvable for permanent diversions on site specific basis.

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UMC 817.44(d)(1)	3.		<p>Insure MRP contains a plan for removal and restoration of diversions including.</p> <p>a. A plan for regrading and revegetation.</p> <p style="padding-left: 40px;">i Timing of regrading and diversion removal (low flow).</p> <p style="padding-left: 40px;">ii Consult with staff biologist on proposed riparian seed mix.</p>
UMC 817.44(d)(1)	b.		<p>A plan for developing a native riparian community. Consult staff biologist for required species list.</p>
UMC 817.44(d)(2)	c.		<p>A plan to restore natural stream pattern.</p> <p style="padding-left: 40px;">i Demonstration by detailed approximation of prediversion configuration of channel (see General section above).</p> <p style="padding-left: 40px;">ii Demonstration by detailed approximation of upstream and downstream channel configuration.</p> <p style="padding-left: 40px;">iii Characteristics:</p> <p style="padding-left: 80px;">(A) Cross section.</p>

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II. SEDIMENTATION CONTROL - CONTINUED

- (B) Channel bed slope.
- (C) Pool-riffle ratio.
- (D) Pool-drop ratio.
- (E) Sinuosity ratio.
- (F) Channel roughness elements.

UMC 817.44(d)(3)

- d. A plan for restoration of aquatic habitats.
 - i Sensitive and valuable habitats must be mapped prior to disturbance and included in application.
 - ii Existing diversions will require a survey of the upstream and downstream segments of the channel and/or hydrological similar channels for required data.
 - iii Insure proposal approximates prediversion quality and quantity of habitats.
 - (A) Physical habitat requirements of species.

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II. SEDIMENTATION CONTROL - CONTINUED

(B) Food source characteristics (organic debris).

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III. ROAD DRAINAGE

UMC 817.153(a)(1)

A. Class I Roads

1. Insure that Class I roads have water control systems which are capable of handling the 10-year, 24-hour or larger precipitation event, as required by the Division.

a. Water control system shall consist of: (as required)

i Ditches.

ii Culverts and bridges.

iii Stream crossings.

iv Outlet structures.

v Inlet structures.

vi Energy dissipation structures.

vii Natural drainage diversions.

UMC 817.153(a)(2)

b. Sediment control shall consist of:

i Riprap of ditches.

ii Adequate spacing of culverts (based on velocity of water versus the maximum allowable velocity of material ditch is built in).

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III. ROAD DRAINAGE - CONTINUED

- iii Downslope conveyance of runoff.
 - (A) Lined channels.
 - (B) Conduit.
 - (C) Gabion-drop structures.
 - (D) Check dams.
 - (E) Other approved methods.
- iv Catchment basins.
- v Temporary sediment control (see UMC 817.45).

UMC 817.153(a)(3)

- c. Insure minimal vegetation disturbance to prevent erosion outside those areas required for road construction.
 - i Check plans to insure disturbance related to construction is minimized.
 - ii Check for revegetation plans following construction.
 - iii Check for temporary sediment controls during construction.

UMC 817.153(b)(1)

- 2. Ditch design.

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III. ROAD DRAINAGE - CONTINUED

- | | | | |
|--------------------------|---|--|--|
| <p>UMC 817.153(b)(2)</p> | <ul style="list-style-type: none"> a. Check ditch sizing and peak flow as described in UMC 817.43. b. Location of ditches. <ul style="list-style-type: none"> i In a through-cut, both sides of road. ii On cut and fill sections on inside shoulder. iii On flat sections, road surface shall be undulated or elevated to allow for free drainage. | | |
| <p>UMC 817.153(c)</p> | <ul style="list-style-type: none"> 3. Culverts and bridge design. <ul style="list-style-type: none"> a. Check peak flow, UMC 817.43. b. Check culvert capacity. <ul style="list-style-type: none"> i Consider inlet or outlet control. ii Consider inlet type. <ul style="list-style-type: none"> (A) Projecting. (B) Mitered. (C) Headwall. | | |

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III. ROAD DRAINAGE - CONTINUED			
UMC 817.153(c)(1)(i)	<ul style="list-style-type: none"> iii Use USBR charts to determine flow capacity. 		
	<ul style="list-style-type: none"> c. Check culvert and sizing. <ul style="list-style-type: none"> i Thirty-five (35) ft² or less, 10-year, 24-hour. ii Greater than 35 ft², 20-year, 24-hour. 		
UMC 817.153(c)(2)(v)	<ul style="list-style-type: none"> iii If ditches will not overtop, less than the 10-year, 24-hour storm can be used. 		
	<ul style="list-style-type: none"> d. Check bridge sizing. <ul style="list-style-type: none"> i Thirty (30) ft² or less, 20-year, 24-hour. ii Greater than 30 ft², 100-year, 24-hour. 		
UMC 817.153(c)(1)(ii), 817.153(c)(1)(iii)	<ul style="list-style-type: none"> e. Check for trash racks and inlet protection to prevent plugging and erosion. <ul style="list-style-type: none"> i Consider a minimum size of 18 inch CMP to minimize plugging. 		
UMC 817.153(c)(1)(iv), 817.153(c)(1)(v)	<ul style="list-style-type: none"> f. Check for a minimum one foot cover on all culverts and that culverts are capable of handling vertical loads (check with engineer). 		

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III. ROAD DRAINAGE - CONTINUED

UMC 817.153(c)(2)(i)

g. Culvert spacing.

- i For road surface drainage with no drainage from areas off of the road, culverts shall be spaced as follows:
 - (A) Zero to three percent slopes, 1,000 feet.
 - (B) Three to six percent slopes, 800 feet.
 - (C) Six to ten percent slopes, 500 feet.
 - (D) Greater than 10 percent slopes, 300 feet.

UMC 817.153(c)(2)(ii)

- ii If appropriate, culvert spacing may be reduced to allow for erosion properties of soils or to allow for conveyance of intersecting drainages.
 - (A) Check Manning's velocity.

UMC 817.153(c)(2)(iii)

- ii If no increase of erosion will occur, culvert spacing may be increased.
 - (A) Check Manning's velocity.

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III. ROAD DRAINAGE - CONTINUED

UMC 817.153(c)(2)(iv)

iv Angle of culvert crossing shall not be less than 30 degrees downgradient.

h. Inlet and outlet protection.

UMC 817.153(c)(2)(vi)

i Inlets must be protected by headwalls to prevent erosion.

(A) Acceptable headwall materials are: rocks; concrete; gunite; gabion baskets; and, in some cases, logs.

ii Outlets must be protected by conduits or riprapped channels to convey water over the fill.

(A) Acceptable downslope conveyances are: lined channels; culvert downspouts; gabion-drop structures; check dams; and other methods as approved by the Division.

UMC 817.153(d)

UMC 817.153(d)(1)

4. Natural channel drainageways.

a. Relocation and alteration considerations.

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III. ROAD DRAINAGE - CONTINUED

- | | | | |
|-------------------|--|--|--|
| UMC 817.153(d)(2) | <ul style="list-style-type: none"> i Only with the approval of Division and if done in accordance with UMC 817.43 and 817.44 ii Natural drainage not blocked or impeded. iii Proposed channel configuration not cause significant erosion. iv Relocation does not adversely affect adjoining landowners. <ul style="list-style-type: none"> (A) Reduce usable areas. (B) Cause excessive erosion and mass failure. (C) Degradation of downstream quality and quantity. | | |
| UMC 817.153(e) | <ul style="list-style-type: none"> 5. Stream crossings. <ul style="list-style-type: none"> a. Drainage structures required. b. No fording allowed. c. Structures cannot effect normal flow or gradient of stream and cannot prevent fish migration. | | |

UMC 817.163(a)(1)

B. Class II Roads

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III. ROAD DRAINAGE - CONTINUED

1. Insure that Class II Roads have water control systems which are capable of handling the 10-year, 24-hour or larger precipitation event, as required by the Division.
 - a. Water control system shall consist of: (as required)
 - i Ditches.
 - ii Culverts and bridges.
 - iii Stream crossings.
 - iv Outlet structures.
 - v Inlet structures.
 - vi Energy dissipation structures.
 - vii Natural drainage diversions.
 - b. Sediment control shall consists of:
 - i Riprap of ditches.
 - ii Adequate spacing of culverts (based on velocity of water versus the maximum allowable velocity of material ditch is built in).

UMC 817.163(a)(2)

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III. ROAD DRAINAGE - CONTINUED

- iii Downslope conveyance of runoff.
 - (A) Lined channels.
 - (B) Conduit.
 - (C) Gabion-drop structures.
 - (D) Check dams.
 - (E) Other approved methods.
- iv Catchment basins.
- v Temporary sediment control (see UMC 817.45).

UMC 817.163(b)

2. Ditch Design

- a. Location to minimize erosion.
 - i Above road disturbance to divert undisturbed drainage.
 - ii Along inslope of road to collect surface runoff.
 - iii On outslopes to convey water overfill.
- b. Ditch sizing to be in accord with UMC 817.45.

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III. ROAD DRAINAGE - CONTINUED

- c. Check peak flow in accord with UMC 817.43.
- d. Where ditches are not used, dips can be used.
 - i Uses.
 - (A) Wet areas.
 - (B) Free water drainage.
 - ii Design.
 - (A) Insloped dips shall discharge to a culvert or drop inlet.
 - (B) Outsloped dips shall discharge to natural ground or into drains on embankments.
 - (C) Dips shall be rock surface to prevent erosion.
 - (D) Spacing shall be determined based on water velocity.

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III. ROAD DRAINAGE - CONTINUED

(1) If velocity greater than maximum allowable velocity for road materials, install dip.

UMC 817.163(c)

3. Culverts and Bridge Design

- a. Check peak flow, UMC 817.43.
- b. Check culvert capacity.
 - i Consider inlet or outlet control.
 - ii Consider inlet type.
 - (A) Projecting.
 - (B) Mitered.
 - (C) Headwall.
 - iii Use USBR charts to determine flow capacity.
- c. Check culvert and sizing.
 - i Thirty-five (35) ft² or less, 10-year, 24-hour.
 - ii Greater than 35 ft², 20-year, 24-hour.

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III. ROAD DRAINAGE - CONTINUED

- iii If ditches will not overtop, less than the 10-year, 24-hour storm can be used.
 - d. Check bridge sizing.
 - i Thirty (30) ft² or less design for 20-year, 24-hour event.
 - ii Greater than 30 ft² design for 100-year, 24-hour event.
 - e. Check for trash racks and inlet protection to prevent plugging and erosion.
 - i Consider a minimum size of 18 inch CMP culverts to minimize plugging.
 - f. Check for a minimum one foot cover on all culverts and that culverts are capable of handling vertical loads (consult with staff engineer).
 - g. Culvert spacing.
 - i For road surface drainage with no drainage from areas off of the road, culverts shall be spaced as follows:

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III. ROAD DRAINAGE - CONTINUED

- (A) Zero to three percent slopes, 1,000 feet.
 - (B) Three to six percent slopes, 600 feet.
 - (C) Six to ten percent slopes, 400 feet.
 - (D) Greater than 10 percent slopes, 200 feet.
- ii If appropriate, culvert spacing may be reduced to allow for erosion properties of soils or to allow for conveyance of intersecting drainages.
 - (A) Check Manning's velocity.
 - iii If no increase of erosion will occur, culvert spacing may be increased.
 - (A) Check Manning's velocity.
 - iv Angle of culvert crossing shall not be less than 30 degrees downgradient.
- h. Inlet and outlet protection.

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III. ROAD DRAINAGE - CONTINUED

- i Inlets must be protected by headwalls to prevent erosion.
 - (A) Acceptable headwall materials are: rocks; concrete; gunite; gabion baskets; and, in some cases, logs.
 - ii Outlets must be protected by conduits or riprapped channels to convey water over the fill.
 - (A) Acceptable downslope conveyances are: lined channels; culvert downspouts; gabion-drop structures; check dams; and other methods as approved by the Division.
4. Natural drainage diversions.
- a. Only with the approval of Division and if done in accordance with UMC 817.43 and 817.44
 - b. Relocation and alteration considerations.
 - i Natural drainage not blocked or impeded.

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III. ROAD DRAINAGE - CONTINUED

- ii Proposed channel configuration not cause significant erosion.
- iii Relocation does not adversely affect adjoining landowners.
 - (A) Reduce usable areas.
 - (B) Cause excessive erosion and mass failure.
 - (C) Degradation of downstream quality and quantity.

5. Stream crossings.

- a. Drainage structures required.
- b. No fording allowed.
- c. Structures cannot effect normal flow or gradient of stream and cannot prevent fish migration.

UNC 817.173(a)(1)

C. Class III Roads

- 1. Insure temporary drainage structures protect facility during life and minimize disturbances to hydrologic balance.

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<p>III. ROAD DRAINAGE - CONTINUED</p>			
UMC 817.173(b)	<p>a. Flowing streams, wet areas and ephemeral channels should be:</p> <ul style="list-style-type: none"> i Diverted by culvert. ii Sized for 1-year, 6-hour event. 		
UMC 817.173(a)(2)	<p>b. Sediment control shall consist of:</p> <ul style="list-style-type: none"> i Dips, as specified in UMC 817.163(b), to convey water off road. <ul style="list-style-type: none"> (A) Spacing of dips based on maximum allowable velocity for road materials. ii Outlet protection convey water from culverts over fill. <ul style="list-style-type: none"> (A) Lined channels, downspouts, check dams, drop structures or other approved methods. 		
UMC 817.173(c)	<p>2. Natural drainages.</p> <ul style="list-style-type: none"> a. No natural drainages shall be altered or relocated. 		
UMC 817.173(d)	<p>3. Stream crossings.</p>		

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III. ROAD DRAINAGE - CONTINUED

- a. Temporary drainage structures may be used.
 - b. Structures should not affect flow or gradient and should not adversely affect fish migration.
4. Design specifications.
- a. UMC 784.24(a).
 - i Gradient (ft/ft).
 - ii Surface material description.
 - iii Outslope.
 - (A) Slope of fill.
 - (B) Erosion protection measures.
 - iv Culverts.
 - (A) Sizing.
 - (B) Spacing.
 - (C) Inlet and outlet protection.
 - v Bridges.
 - (A) Sizing.

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III. ROAD DRAINAGE - CONTINUED

- (B) Inlet and outlet protection.
 - vi Drainage ditches.
 - (A) Sizing.
 - (B) Erosion protection measures.
 - vii Drainage structures.
 - (A) Sizing.
 - (B) Erosion protection measures.
- b. UMC 784.24(c). Plans for alteration or relocation of natural drainage ways address:
 - i Overland diversion concerns in UMC 817.43 and channel diversion concerns in UMC 817.44.
- c. UMC 784.24(d). Alternate culvert inlet protection.
 - i Will the proposed plans offer sufficient erosion protection?

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IV. WATER RIGHTS AND SUPPLY

UMC 783.17

- A. Contamination, Diminution or Interruption of Water Supply
 - 1. Applicant must identify the extent which local coal mining may result in contamination, diminution or interruption of domestic, agricultural, industrial or other legitimate water use by:
 - a. Development, presentation and interpretation of surface and ground water data collected in and within one square mile of boundaries of mine site and all affected downstream users. A larger boundary limit may be required by the Division. A plan must be submitted by the applicant that includes a description with maps of appropriate scale and cross-sectional drawings depicting:
 - i Point(s) of diversion of all water rights in and within two miles of permit boundaries.
 - ii Flow and/or volume of said water rights.

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IV. WATER RIGHTS AND SUPPLY - CONTINUED

- iii Irrigated acreage(s) of water right(s).
- iv Supplemental rights.
- v Plan of all storage impoundments, diversions, etc., as part of replacement plan for water sources of affected local users.
- vi Names of water users.
- vii Diversion details.
 - (A) Point of diversion.
 - (B) Type of diversion.
 - (C) Depth of well.
 - (D) Perforated zone.
 - (E) Geologic formation of well completion.

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IV. WATER RIGHTS AND SUPPLY - CONTINUED

- b. Developing scientifically sound conclusions based on the results of data collection and local hydrologic documentation, supporting or refuting possible detrimental effects to local water supplies due to mining.

UMC 783.17

B. Alternative Water Supply Information

- 1. If possible contamination, diminution or interruption of water supply may result, the following criteria for an alternative replacement water supply for local users apply:
 - a. Location of nearby alternative sources (springs, wells, creeks and lakes) which can make a similar volume and/or flow of water available to the applicant.
 - b. Verification that the water rights associated with the above-mentioned sources are either owned by the applicant or can be potentially acquired by the applicant.

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IV. WATER RIGHTS AND SUPPLY - CONTINUED

i Potential water rights (including equivalent flow and/or volume) must be certified by letter by local users owning the water right(s) and/or by local irrigation companies holding water shares.

c. The alternative water supplies must have the capability to be conveyed over a reasonable distance to the water user whose supply is diminished.

UMC 784.14(a)(2), (3),
B17.49(a)(4)

C. Water Rights and Quantity

1. The applicant must commit to replacement of local users' supply of water, if it can be shown that the applicant's coal mining activities have contaminated, diminished or interrupted that supply. An inventory of all water rights in the permit area and within two miles of the boundaries of the permit area shall include information outlined in the guidelines for UMC 784.14(a)(2) and (3). Determination of detrimental effects of local water supplies shall include but not be limited to:

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IV. WATER RIGHTS AND SUPPLY - CONTINUED

- a. Flow measurements.
- b. Historical flow records.
- c. Aquifer pump tests.
- d. Water quality tests.

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V. MINE DISCHARGE AND OPENINGS

- | | | | |
|---------------|---|--|--|
| UMC 817.43(g) | A. Proposal for <u>No Discharge Into</u>
Underground Mine | | |
| | 1. Insure that the MRP contains a map and written description that delineates the drainage plan and watershed in the vicinity of mine openings. Reviewer will verify drainage controls are proposed to prevent diversion into mine portals. | | |
| UMC 817.55 | 2. Does the MRP contain a written commitment from the applicant stating that no discharge into the mine will occur? | | |
| UMC 817.55 | B. Proposal for <u>Discharge Into</u> Underground Mine | | |
| | 1. Insure that the MRP contains a map and/or plan describing handling and treatment of drainage including storage and spatial requirements. | | |
| | 2. Insure the MRP contains records of the quality of any ground water receiving the surface discharge. | | |
| UMC 817.55(a) | 3. Insure the MRP provides evidence that the discharge of water into the mine will abate water pollution or eliminate a public hazard. | | |

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V. MINE DISCHARGE AND OPENINGS - CONTINUED			
UMC 817.55(b), 817.55(d)	4.		<p>Insure a plan is submitted that demonstrates a controlled flow of discharge into the mine including:</p> <ul style="list-style-type: none"> a. The method for flow control. b. The method for recording the rate of volumes per unit time. c. Insure a record of baseline water quality (pH and TSS) of inflow water that demonstrates the flow will meet the effluent limitations of UMC 817.42. d. Insure that a plan has been submitted for operational water quality monitoring of inflow for pH and TSS. The application must commit to no discharge of waters exceeding limitations for pH and TSS into mine. Refer to Division monitoring guidelines for sampling frequency.
UMC 817.55(c)	5.		<p>pH and TSS effluent limitations may be exceeded following Division approval for drainage from:</p> <ul style="list-style-type: none"> a. Coal processing waste.
UMC 817.55(c)(1)			

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V. MINE DISCHARGE AND OPENINGS - CONTINUED			
UMC 817.55(c)(2)	b.		Underground mine development waste.
UMC 817.55(c)(3)	c.		Fly ash from a coal fired facility.
UMC 817.55(c)(4)	d.		Sludge from an acid mine drainage treatment facility.
UMC 817.55(c)(5)	e.		Flue gas desulfurization sludge.
UMC 817.55(c)(6)	f.		Inert materials used for stabilizing underground mines.
UMC 817.55(d)	6.		Insure that the inflow is controlled, identifiable and ultimately treated by an existing treatment facility.
	a.		Insure the MRP contains: <ul style="list-style-type: none"> i A location map and designs for the inflow diversion to treatment facility. ii Storage or sump location.
	b.		Insure there is a description of type of treatment facility to be used.

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V. MINE DISCHARGE AND OPENINGS - CONTINUED

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| UMC 817.55(e) | <p>c. Insure that there is a commitment from the applicant to divert discharge into a treatment facility.</p> <p>7. Insure that the MRP includes a plan to prevent impact to surface waters from mine discharge.</p> | | |
| UMC 817.55(f) | <p>8. Insure that the MRP contains a plan that demonstrates the discharge of water into an underground mine minimizes disturbance to the hydrologic balance.</p> <p>a. Has the applicant included data documenting existing ground and surface water quality?</p> <p>b. Has the applicant included data documenting baseline surface water discharge including seasonal variations?</p> <p>c. Insure the applicant has included data documenting adjacent aquifer characteristics including rate and direction of flow, storage, water level trends, areal extent, transmissivity, location and amount of recharge.</p> | | |

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V. MINE DISCHARGE AND OPENINGS - CONTINUED

UMC 817.55(g)

9. Insure that the plan to discharge water into an underground mine is approved by MSHA.
 - a. Insure the applicant has included documentation (sign-off letter) of MSHA's approval.

UMC 817.50

- C. Proposal for No Discharge From Underground Mine
 - i. Insure that the MRP contains sufficient information to determine the location of water-bearing strata in the mine area.
 - a. Has the applicant included any borehole or other well data?
 2. Has the applicant included all historical mine records documenting water inflow into mine.
 3. Insure that the MRP contains maps, cross sections and narrative of site specific geology including stratigraphy, structure, lithology, springs, aquifers.
 4. Insure that the MRP contains a description of regional aquifer system in relation to underground workings.

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V. MINE DISCHARGE AND OPENINGS - CONTINUED			
	5.		Insure that the applicant has committed to comply with 817.50(b)(1) and (2) if water is encountered during mining operations.
UMC 817.50(c); 817.41(d)(2)(viii)	6.		Insure that the applicant has provided evidence that discharge is not from acid or iron producing coal seams.
UMC 817.50(a)	7.		Insure application includes a map, plan and cross section showing design, location and construction of portals, adits and slopes to prevent gravity drainage.
UMC 817.50(b)	D.		Proposal for Discharge <u>From</u> Underground Mine
	1.		Insure that the MRP provides evidence that untreated discharge satisfies UMC 817.42, state and federal water quality standards (if not, refer to item #3 below).
	a.		See UMC 817.42 for effluent limitations.
	2.		Insure that the MRP contains information to demonstrate that discharge from an underground mine will have minimal impact to the hydrologic balance such as:

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V. MINE DISCHARGE AND OPENINGS - CONTINUED

- a. Quantity and quality of existing surface water.
- b. Insure that applicant has committed to monitor quality and quantity of any potentially impacted receiving surface water.
- c. Insure that the applicant has submitted a description of existing ground water resource.
 - i Insure all aquifers in the permit area and adjacent areas been identified.
 - ii Insure aquifer characteristic including rate and direction of flow, transmissivity, water level trends, storage, recharge, and areal extent been identified to the extent possible.
 - iii Insure the existing ground water quality been documented.

UTAH DIVISION OF OIL, GAS AND MINING - HYDROLOGY GUIDELINES

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AUTHORITY	ITEM	PAGE	FINDINGS
V. MINE DISCHARGE AND OPENINGS - CONTINUED			
UMC 817.50(b)(2)(i)	<ul style="list-style-type: none"> iv Insure that the applicant has committed to monitor the quality and water levels of any potentially impacted aquifer. 		
	<ul style="list-style-type: none"> 3. Insure a plan demonstrates conveyance of mine discharge to treatment facility. 		
	<ul style="list-style-type: none"> a. Insure the applicant provided a description and designs for all proposed treatment facilities. 		
	<ul style="list-style-type: none"> i Sediment pond. 		
	<ul style="list-style-type: none"> ii Underground sump. 		
	<ul style="list-style-type: none"> iii Flocculation tank. 		
	<ul style="list-style-type: none"> iv Gel logs. 		
UMC 817.50(b)(2)(ii)	<ul style="list-style-type: none"> v Other methods designed to meet effluent limitations of UMC 817.42. 		
UMC 817.50(b)(2)(iii)	<ul style="list-style-type: none"> 4. Insure that the MRP contains a plan for maintenance of treatment facility. 		

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Last Revised - MARCH 1986

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AUTHORITY	ITEM	PAGE	FINDINGS
VI. SUBDRAINS			
UMC 817.83	A. Coal Processing Waste Banks		
UMC 817.83(a)(1)	1. Insure that the MRP contains a plan for subdrainage system.		
817.83(a)(1)(ii)	a. Does the subdrainage system include plan for adequate filter system?		
	i Does design of filter system insure that it will not clog?		
	ii Does filter system design allow drain to function as designed?		
UMC 817.83(a)(1)(iii)	b. Insure that MRP contains a plan to cover subdrain system.		
	i Does the plan demonstrate that the entrance of surface water and leachate from acid or toxic forming coal waste material will be prohibited from entering into the subdrain system?		

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AUTHORITY	ITEM	PAGE	FINDINGS
VI. SUBDRAINS - CONTINUED			
UMC 817.83(a)(2)	2. If subdrain system is not used, insure that the MRP contains an alternative plan that demonstrates the ability to ensure structural stability of waste bank and protect surface and ground water quality.		
UMC 817.73	B. Head of Hollow Fills		
UMC 817.73(a)	1. Insure that the MRP contains a plan for a rock core chimney drain.		
UMC 817.73(c)	a. Insure the applicant has submitted a determination of peak flow for a 100-year, 24-hour precipitation event.		
UMC 817.73(b)(3)	b. Insure the applicant has submitted a determination of design capacities for any impoundment structure.		
	c. Insure the applicant has submitted a determination of discharge velocities.		
	d. Insure the applicant has submitted a determination of erosive conditions downstream of fill.		

STATE of UTAH

ADMINISTRATIVE RULES for WATER WELL DRILLERS

Adopted July 15, 1987



STATE of UTAH

DIVISION of WATER RIGHTS

ROBERT L. MORGAN

State Engineer

STATE of UTAH

ADMINISTRATIVE RULES for WATER WELL DRILLERS

DIVISION of WATER RIGHTS

ROBERT L. MORGAN, P.E.

State Engineer

KENT L. JONES, P.E.

Directing Engineer

JERRY L. BRONICEL

Water Well Program Director

An Equal Opportunity Employer

STATE ARCHIVES NO. 8857

determine that it is necessary to publish notice, the advertising fee shall be paid in advance by the applicant.

The term "replacement well" as used herein means a new well drilled for the sole purpose of replacing an existing well which is impaired or made useless by structural difficulties and no new right in the use of water accrues. Upon completion of the new well the old well must be plugged by the applicant in a manner satisfactory to the state engineer.

73-5-9

POWERS OF STATE ENGINEER AS TO WASTE, POLLUTION OR CONTAMINATION OF WATERS

To prevent waste, loss, pollution or contamination of any waters whether above or below the ground, the state engineer may require the repair or construction of head gates or other devices on ditches or canals, and the repair or installation of caps, valves or casings on any well or tunnel or the plugging or filling thereof to accomplish the purposes of this section.

Any requirement made by the state engineer in accordance with this section shall be executed by and at the cost and expense of the owner, lessee or person having control of such diverting works affected. If within 10 days after notice of such requirement as provided in this section, the owner, lessee or person having control of the water affected, has not commenced to carry out such requirement, or if he has commenced to comply therewith but shall not thereafter proceed diligently to complete the work, the state engineer may forbid the use of water from such source until the user thereof shall comply with such requirement. Failure to comply with any requirement made by the state engineer in accordance with the provisions of this section shall constitute a misdemeanor. Each day that such violation is permitted to continue shall constitute a separate offense.

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ADMINISTRATIVE RULES FOR WATER WELL DRILLERS

73-3-27 REQUESTS FOR SEGREGATION OF PENDING APPLICATIONS

Upon request in writing and approval by the state engineer, applications to appropriate or to permanently change the point of diversion, place or purpose of use of water may be divided or segregated into two or more separate parts; provided such request shall be made upon blanks to be furnished by the state engineer and shall include the serial number of the application to be segregated, the name, post-office address of the owner of the application, a statement of the nature of the proposed division or segregation, the reasons therefor, and such other information as the state engineer may require.

Action taken by the state engineer on applications for appropriation or permanent change prior to segregation, shall be applicable in all respects to the segregated parts thereof. Upon segregation the original and each segregated part shall be treated as separate applications. The approval of a request for segregation shall not confirm the validity or good standing of the segregated application or extend the time for the construction of works. Action of the state engineer upon requests for segregation taken prior to the effective date of this act is approved and confirmed.

Requests for segregation shall be rejected if the approval thereof would impair rights or would prove detrimental to the public welfare.

73-3-28 REPLACEMENT WELLS - DEFINITION OF - REQUIREMENTS - STATE ENGINEER'S APPROVAL - APPLICATION TO DRILL - FILING - FORM - CONTENTS - NOTICE - FEES - PLUGGING OF OLD WELL

An existing well may be replaced with a replacement well within a radius of 150 feet from the existing well without the filing of a change application under section 73-3-3, upon approval first having been obtained from the state engineer.

Such request for permission to drill a replacement well shall be filed with the state engineer upon a blank to be furnished by the state engineer. Such blank shall contain, but need not be limited to, the name and postoffice address of the person, corporation or association making the request, the number of the claim or application filed with the state engineer covering the well which is being replaced, the number of the award if, in a decree, the reason for the replacement, the location of the replacement well with reference to the nearest United States land survey corner, and from the old well, and the name of the driller employed by the applicant to do the work.

No filing fee shall be required for the filing of such a request for permission to drill a replacement well, and the state engineer need give only such notice as, in his judgment, is necessary to protect existing rights, and in the event the state engineer shall

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because of information in his possession obtained either by his own investigation or otherwise, has reason to believe that an application to appropriate water will interfere with its more beneficial use for irrigation, domestic or culinary, stock watering, power or mining development or manufacturing, or will unreasonably affect public recreation or the natural stream environment, or will prove detrimental to the public welfare, it is his duty to withhold his approval or rejection of the application until he has investigated the matter. If an application does not meet the requirements of this section, it shall be rejected.

2) An application to appropriate water for industrial, power, mining development, manufacturing purposes, agriculture, or municipal purposes may be approved for a specific and certain period from the time the water is placed to beneficial use under the application, but in no event may an application be granted for a period of time less than that ordinarily needed to satisfy the essential and primary purpose of the application or until the water is no longer available as determined by the state engineer. At the expiration of the period fixed by the state engineer the water shall revert to the public and is subject to appropriation as provided by Title 73. The state engineer may extend any limited water right upon a showing that the essential purpose of the original application has not been satisfied, that the need for an extension is not the result of any default or neglect by the applicant, and that water is still available; except no extension shall exceed the time necessary to satisfy the primary purpose of the original application. A request for extension must be filed in writing in the office of the state engineer not later than 60 days before the expiration date of the application.

3) Before the approval of any application for the appropriation of water from navigable lakes or streams of the state which contemplates the recovery of salts and other minerals therefrom by precipitation or otherwise, the applicant shall file with the state engineer a copy of a contract for the payment of royalties to the state of Utah. The approval of an application shall be revoked in the event of the failure of the applicant to comply with terms of his royalty contract.

73-3-23

REPLACEMENT OF WATER

In all cases of appropriation of underground water the right of replacement is hereby granted to any junior appropriator whose appropriation may diminish the quantity or injuriously affect the quality of appropriated underground water in which the right to the use thereof has been established as provided by law. No replacement may be made until application in writing has been made to and approved by the state engineer. In all cases replacement shall be at the sole cost and expense of the application and subject to such as the state engineer may prescribe. The right of eminent domain is hereby granted to any applicant for the purpose of replacement as provided herein.

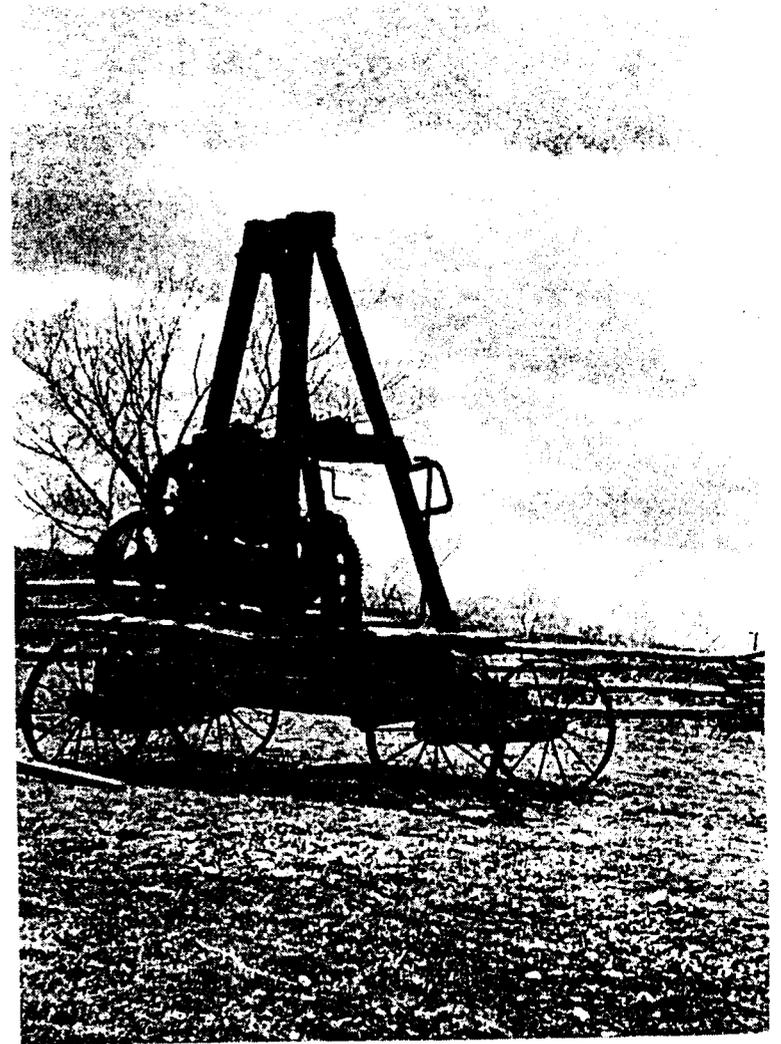
feet from the point of diversion from said existing well, and no such replacement well shall be drilled except upon compliance with the requirements of section 73-3-28.

73-3-5.5 TEMPORARY APPLICATIONS TO APPROPRIATE WATER - APPROVAL BY ENGINEER - NOTICE AND HEARING - EXPIRATION - PROOF OF APPROPRIATION NOT REQUIRED

- 1) The state engineer may issue temporary applications to appropriate water for beneficial purposes. The provisions of this chapter governing regular applications to appropriate water shall apply to temporary applications with the following exceptions:
 - a) The state engineer shall undertake a thorough investigation of the proposed appropriation, and if such temporary application complies with the provisions of section 73-3-8, may make an order approving the application. If the state engineer shall find that the appropriation sought might impair other rights, the state engineer shall give notice of the application to all persons whose rights may be affected thereby and shall give them an opportunity to be heard before approving the application. The notice may be given by regular mail five days before the hearing or by one publication in a newspaper of general circulation in the county in which the point of diversion is located.
 - b) The state engineer may issue a temporary application for a period of time not exceeding one year.
 - c) The state engineer, in the approval of a temporary application, may make approval subject to such conditions and provisions as the state engineer deems necessary to fully protect prior existing rights. If, in the judgment of the state engineer, it is necessary to have a water commissioner distribute the water under a temporary application for the protection of other vested rights, the state engineer may assess the distribution costs against the holder of the temporary application.
 - d) A temporary application does not vest in its holder a permanent vested right to the use of water, and a temporary application automatically expires and is cancelled in accordance with its terms.
 - e) Proof of appropriation required under this chapter shall not apply to temporary applications.

73-3-8 APPROVAL OR REJECTION OF APPLICATION - REQUIREMENTS FOR APPROVAL - APPLICATION FOR SPECIFIED PERIOD OF TIME - FILING OF ROYALTY CONTRACT FOR REMOVAL OF SALT OR MINERALS

1) It shall be the duty of the state engineer to approve an application if: (a) there is unappropriated water in the proposed source; (b) the proposed use will not impair existing rights or interfere with the more beneficial use of the water; (c) the proposed plan is physically and economically feasible, unless the application is filed by the United States Bureau of Reclamation, and would not prove detrimental to the public welfare; (d) the applicant has the financial ability to complete the proposed works; and (e) the application was filed in good faith and not for purposes of speculation or monopoly. If the state engineer,



of the water, the place, purpose and extent of the present use, and the place, purpose and extent of the proposed use and such other information as the state engineer may require. The procedure in the state engineer's office and rights and duties of the applicants with respect to applications for permanent changes of point of diversion, place or purpose of use shall be the same as provided in this title for applications to appropriate water; but the state engineer may, in connection with applications for permanent change involving only a change in point of diversion of 660 feet or less, waive the necessity for publishing notice of such applications. No temporary change shall be made except upon an application filed in duplicate with the state engineer upon forms to be provided by him, which shall set forth the name of the water user, a description of his water right, the nature and time of the change sought, the reason for the change, and such other information as the state engineer may require. The state engineer shall make an investigation, and if such temporary change does not impair any vested rights of others, he shall make an order authorizing the change. If he shall find that the change sought might impair such rights, he shall give notice of the application to all persons whose rights may be affected thereby and shall give them an opportunity to be heard before authorizing the change. Such notice may be given by regular mail five days before the hearing or by one publication in a newspaper of general circulation in the county in which the original point of diversion or place of use is located five days before such hearing. Before making an investigation or giving notice the state engineer may require the applicant to deposit a sum of money sufficient to pay the expenses thereof.

Applications for either permanent or temporary changes shall not be rejected for the sole reason that such change would impair vested right of others, but if otherwise proper, they may be approved as to part of the water involved or upon condition that such conflicting rights be acquired.

Any person holding an approved application for the appropriation of water may in like manner, either permanently or temporarily change the point of diversion, place or purpose of use, but no such change of approved application shall affect the priority of the original application; provided, that no change of point of diversion, place or nature of use set forth in an approved application shall operate to enlarge the time within which the construction of work shall begin or be completed. The determination of the state engineer shall be final, unless an action to review his decision is filed within the time and in the manner provided by section 73-3-14.

Any person who changes or who attempts to change a point of diversion, place or purpose of use, either permanently or temporarily without first applying to the state engineer in the manner herein provided, shall obtain no right thereby and shall be guilty of a misdemeanor, each day of such unlawful change constituting a separate offense, separately punishable.

The provisions of this section shall not apply to the replacement of an existing well by a new well drilled within a radius of 150

and the point of return of the water shall be designated with reference to the United States land survey corners, mineral monuments, or permanent federal triangulation or traverse monuments, when either the point of diversion or the point of return is situated within six miles of such corners and monuments. If the point of diversion or point of return is located in unsurveyed territory, such point may be designated with reference to a permanent, prominent natural object. The storage of water by means of a reservoir shall be regarded as a diversion, and the point of diversion in such cases shall be the point where the longitudinal axis of the dam crosses the center of the stream bed. The point where released storage water is taken from the stream shall be designated as the point of redirection. The lands to be inundated by any reservoir shall be described as nearly as may be, and by government subdivision, if upon surveyed land, the height of the dam, the capacity of the reservoir, and the area of the surface thereof when the reservoir is filled shall be given. If the water is to be stored in an underground area or basin, the applicant shall designate, with reference to the nearest United States land survey corner if situated within six miles thereof, the point of area of intake, the location of such underground area or basin and the points of collection therefrom.

Applications for the appropriation of water filed prior to the enactment thereof, by the United States of America, or any officer or agency thereof, or the state of Utah, or any officer or agency thereof, are validated, subject to any action thereon by the state engineer.

73-3-3

CHANGE OF PLACE OF DIVERSION OR USE RIGHT TO - PERMANENT OR TEMPORARY - APPLICATION - CONTENTS - INVESTIGATION - NOTICE AND HEARING - DEPOSIT TO COVER EXPENSES - FINALITY OF DECISION - VIOLATION AS MISDEMEANOR - EXCEPTION AS TO REPLACEMENT WELLS

Any person entitled to the use of water may change the place of diversion or use and may use the water for other purposes than those for which it was originally appropriated, but no such change shall be made if it impairs any vested right without just compensation. Such changes may be permanent or temporary. Changes for an indefinite length of time with any intention to relinquish the original point of diversion, place or purpose of use are defined as permanent changes. Temporary changes include and are limited to all changes for definitely fixed periods of not exceeding one year. Both permanent and temporary changes of point of diversion, place or purpose of use of water including water involved in general adjudication or other suits, shall be made in the manner provided herein and not otherwise.

No permanent change shall be made except on the approval of an application therefor by the state engineer. Such applications shall be made upon blanks to be furnished by the state engineer and shall set forth the name of the applicant, the quantity of water involved, the stream or source from which the appropriation has been made, the point on the stream or source where the water is diverted, the point to which it is proposed to change the diversion

PART I

ADMINISTRATIVE RULES FOR WATER WELL DRILLERS

1 PURPOSE

These "Rules" are promulgated pursuant to Section 73-3-25 of the Utah Code Annotated 1953, as amended. The purpose of these rules is to assist in the orderly development of underground water, insure that minimum construction standards are achieved in the drilling and repairing of water wells, prevent pollution of aquifers within the state, prevent wasting of flowing wells, obtain accurate records of well drilling operations, and insure compliance with the state engineer's authority for appropriating water.

- 1.1 Construction standards outlined in this document are meant to serve as guidelines for minimum acceptable standards. In some cases more stringent standards would be called for if compliance with these standards would not result in a well which is free from pollution, or would be a source of subsurface leakage, or would result in contamination of the groundwater supply.
- 1.2 It is not intended that these rules govern the drilling of geothermal wells. Anyone contemplating drilling of geothermal wells is subject to Title 73 Chapter 22 of the Utah Code Annotated 1953 and the rules promulgated pursuant to that section. The State Engineer's Office can be contacted for information regarding drilling of geothermal wells.
- 1.3 It is not intended that the following rules govern the drilling of temporary exploratory holes that are drilled to obtain information on the subsurface strata on which an embankment or foundation is to be placed, or an area proposed to be used as a potential source of material for construction.
- 1.4 In order to provide for protection of the water resources of the state and obtain valuable information on the aquifers of the state, Section 73-3-22 Utah Code Annotated 1953 and the "Rules" have been amended to include the drilling of water monitoring wells.
- 1.5 Wells constructed to monitor man-made structures, house instrumentation to monitor structural performance, or dissipate hydraulic pressures on structures are exempt from the following rules, provided that the wells do not interfere with established aquifers, or their primary purpose is not for monitoring water quality.
- 1.6 Public water supply wells are subject to additional requirements established by the Utah Safe Drinking Water Committee, pursuant to their authority under Title 26 Chapter 12 of the Utah Code Annotated 1953. The Utah Bureau of Drinking Water/Sanitation may be contacted for additional information regarding public water supply wells. Generally, plans and specifications for a public supply well must be reviewed and approved by the Bureau before the well is drilled.

2 DEFINITIONS

- 2.1 ABANDONED WELL--a well whose purpose and use have been permanently discontinued or a well that is in such a state of disrepair that its purpose cannot be reasonably achieved.
- 2.2 ANNULAR SPACE--the space between the inner well casing and the outer well casing or borehole.
- 2.3 AQUIFER--a porous underground formation yielding usable amounts of water.
- 2.4 ARTESIAN AQUIFER--a water-bearing formation which contains underground water under sufficient pressure to rise above the zone of saturation.
- 2.5 ARTESIAN WELL--a well where the water level rises appreciably above the zone of saturation.
- 2.6 BENTONITE--a highly plastic, highly absorbent, colloidal clay composed largely of mineral montmorillonite.
- 2.7 CASING--a tubular retaining structure that is installed in the borehole to maintain the well opening.
- 2.8 CONSOLIDATED FORMATION--bedrock consisting of sedimentary, igneous, or metamorphic rock. A consolidated impermeable formation shall have sufficient thickness to form a geologic barrier in the vicinity of the well in order to be incorporated in the surface seal of a well.
- 2.9 DRAWDOWN--the difference in elevation between the static and pumping water levels.
- 2.10 GRAVEL-PACKED WELL--a well in which filter material is placed in the annular space to increase the effective diameter of the well and to prevent fine-grained sediments from entering the well.
- 2.11 GROUT--a fluid mixture of portland cement and water of a consistency that can be forced through a pipe and placed as required. Various additives, such as sand, bentonite, and hydrated lime, may be added.
- 2.12 MONITOR WELL--A "well" (as defined in 2.24) which is constructed for the purpose of determining water levels and/or monitoring chemical, bacteriological or other physical properties of groundwater or vadose zone water.
- 2.13 NEAT CEMENT GROUT--cement conforming to ASTM Standard C150, with no more than six gallons of water per sack of cement.
- 2.14 OPERATOR--a drilling-machine operator is an individual who is employed by a driller holding a current Utah Well Driller's license for the purpose of constructing water wells with equipment owned by the licensee.
- 2.15 PUBLIC SUPPLY WELL--a well, either publicly or privately owned, providing water for human consumption and other domestic uses which has at least 15 service connections or regularly serves an average of at least 25 individuals daily for at least 60 days out of the year.

no notice of intent to appropriate shall be recognized except application for such appropriation first be made to the state engineer in the manner hereinafter provided, and not otherwise. The appropriation must be for some useful and beneficial purpose, and, as between appropriators, the one first in time shall be first in rights; provided, that when a use designated by an application to appropriate any of the unappropriated waters of the state would materially interfere with a more beneficial use of such water, the application shall be dealt with as provided in section 73-3-8. No right to the use of water either appropriated or unappropriated can be acquired by adverse use or adverse possession.

73-3-2

APPLICATION FOR RIGHT TO USE UNAPPROPRIATED PUBLIC WATER
NECESSITY - FORM - CONTENTS - VALIDATION OF PRIOR APPLICATIONS
BY STATE OF UNITED STATES OR OFFICER OR AGENCY THEREOF

Any person who is a citizen of the United States, or who has filed his declaration of intention to become such as required by the naturalization laws, or any association of such citizens or declarants, or any corporation, or the state of Utah by the directors of the divisions of travel development, industrial promotion, fish and game, and state lands or the chairman of the state road commission for the use and benefit of the public, or the United States of America, in order hereafter to acquire the right to the use of any unappropriated public water in this state shall, before commencing the construction, enlargement, extension or structural alteration of any ditch, canal, well, tunnel or other distributing works, or performing similar work tending to acquire such rights or appropriation, or enlargement of an existing right or appropriation, make an application in writing to the state engineer. Such application shall be upon a blank to be furnished by the state engineer, and shall set forth the name and post-office address of the person, corporation or association making the application; the nature of the proposed use for which the appropriation is intended; the quantity of water in acre-feet or the flow of water in second-feet to be appropriated, and the time during which it is to be used each year; the name of the stream or other source from which the water is to be diverted; the place on such stream or source where the water is to be diverted and the nature of the diverting works; the dimensions, grade, shape and nature of the proposed diverting channel; and such other facts as will clearly define the full purpose of the proposed appropriation. If the proposed use is for irrigation, the application shall show the legal subdivisions of the land proposed to be irrigated, with the total acreage thereof and the character of the soil. If the proposed use is for developing power, the application shall show the number, size and kind of water wheels to be employed and the head under which each wheel is to be operated; the amount of power to be produced and the purposes for which and the place where it is to be used; also the point where the water is to be returned to the natural stream or source. If the proposed use is for milling or mining, the application shall show the name of the mill and its location or the name of the mine and the mining district in which it is situated, its nature, and the place where the water is to be returned to the natural stream or source. The point of diversion

at least ten days' notice to the licensee, by registered mail, that the licensee has failed to comply with these rules, the state engineer may revoke or suspend the license, and exact the bond and deposit the money in a nonlapsing dedicated credit. The state engineer may expend the funds to investigate or correct any deficiencies which could adversely affect the public interest resulting from noncompliance with the rules promulgated under this chapter by any well driller. The state engineer may refuse to issue a license to a well driller if it appears that there has been a violation of the rules or a failure to comply with Section 73-3-22.

(c) An order of the state engineer suspending, revoking, or refusing to issue a license is final unless an action to review his decision is filed within the time and in the manner provided by Section 73-3-14.

73-3-26

VIOLATION AND PENALTIES

- (1) Any person that does any of the following is guilty of a Class B misdemeanor:
 - (a) Constructs a well without first obtaining a license as required by this chapter;
 - (b) Advertises to be a well driller without first obtaining a license as required by this chapter;
 - (c) Constructs a well after suspension, revocation or expiration of his license;
 - (d) Constructs a well in violation of the rules promulgated under Subsection 73-3-25 (1);
- (2) Each day of failure to comply with the provisions of this section constitutes a separate offense.

73-1-1

WATERS DECLARED PROPERTY OF PUBLIC

All waters in this state, whether above or under the ground are hereby declared to be the property of the public, subject to all existing rights to the use thereof.

73-1-2

UNIT OF MEASUREMENT - OF FLOW - OF VOLUME

The standard unit of measurement of the flow of water shall be the discharge of one cubic foot per second of time, which shall be known as a second foot; and the standard unit of measurement of the volume of water shall be the acre foot, being the amount of water upon an acre covered one foot deep, equivalent to 43,560 cubic feet.

73-1-3

BENEFICIAL USE BASIS OF RIGHT TO USE

Beneficial use shall be the basis, the measure and the limit of all rights to the use of water in this state.

73-3-1

APPROPRIATION - MANNER OF ACQUIRING WATER RIGHTS

Rights to the use of the unappropriated public waters in this state may be acquired only as provided in this title. No appropriation of water may be made and no rights to the use thereof initiated and

- 2.16 PUDDLING CLAY--a mixture of bentonite, other expansive clays, or fine-grained material and water, in a ratio of not less than 7 pounds of bentonite or expansive clay per gallon of water.
 - 2.17 STATE ENGINEER--state engineer means the Director of the Utah Division of Water Rights or any employee of the Division of Water Rights designated by the state engineer to act in administering these rules.
 - 2.18 STATIC LEVEL--stabilized water level in a nonpumped well beyond the area of influence of any pumping well.
 - 2.19 TEST WELL--a well completed to obtain information on groundwater quality, quantity, and geologic conditions.
 - 2.20 TREMIE PIPE--a device that carries materials to a designated depth in a drill hole.
 - 2.21 UNCONSOLIDATED FORMATION--loose, soft, incoherent rock-material composed of sedimentary, igneous, or metamorphic rock which includes sand, gravel, and mixtures of sand and gravel.
 - 2.22 VADOSE ZONE--the zone containing water under less than atmospheric pressure, including soil water, intermediate vadose water and capillary water. The zone extends from land surface to the water table.
 - 2.23 VALID AUTHORIZATION TO DRILL--shall consist of any of the following:
 - a) An approved application to appropriate.
 - b) An approved "rush letter".
 - c) An approved permanent change application.
 - d) An approved exchange application.
 - e) An approved temporary change application.
 - f) An approved application to renovate or replace.
 - g) An approved "test well letter".
 - h) An approved "monitor well letter".
 - i) Any letter or document from the state engineer directing or authorizing work to be done on a well.
- Most of the above expire after predetermined periods of time. Items a) through f), inclusive, allow the applicant to contract with a well driller to drill or renovate exactly one well at each point of diversion listed on the approved form. When the work contemplated is completed or abandoned, the permission to drill terminates. An approved test well or monitor well letter is a special case permitting exploratory drilling but allowing only enough water to be diverted from the approved points to determine the characteristics of the groundwater source.
- 2.24 WELL--a horizontal or vertical excavation or opening into the ground made by digging, boring, drilling, jetting, or driving or any other artificial method for utilizing or monitoring underground waters.
 - 2.25 WELL DRILLER--any person duly licensed by the state engineer that constructs a well for compensation or otherwise.

2.26 WELL DRILLING--the act of constructing, repairing, or deepening a well, including all incidental work.

3 WELL DRILLER'S LICENSES

- 3.1 GENERAL. State law requires every person that constructs a well in Utah to obtain an annual well driller's license from the state engineer and to file with him a bond in the penal sum of \$5000 (Payable to the Office of the State Engineer) conditioned upon proper compliance with the law and rules for well drillers. Applications for well driller's licenses shall be made on forms furnished by the state engineer. All licenses expire on the 31st day of December following their issuance and are not transferable.
- 3.2 APPLICATION FOR LICENSE. Before a Utah well driller's license will be issued, the applicant must do all of the following:
- 3.2.1 Make application to the state engineer on forms provided for that purpose, including documentation of prior well drilling experience.
- 3.2.2 Pay an application fee of \$45.00. (Annual renewal fee thereafter is \$22.50.)
- 3.2.3 File a bond in the penal sum of \$5000 with the state engineer, conditioned upon compliance with the law and these rules, and effective for the calendar year in which the license is to be issued.
- 3.2.4 Obtain a score of at least 70% on the written or oral examination administered by the state engineer to test the applicant's knowledge of:
- a) Utah Water Law as it pertains to underground water;
 - b) Land description by section, township, and range;
 - c) Geologic formations and proper names used in describing underground material types;
 - d) Groundwater geology and the occurrence and movement of groundwater;
 - e) The rules for water well drillers;
 - f) The minimum standards for well construction;
 - g) The proper construction methods and techniques for the various types of well drilling rigs, and equipment the applicant proposes to use to construct wells in the state.
- 3.2.5 If the applicant fails to obtain the minimum passing score on the written/oral examination, he may make re-application to the state engineer for a license and re-examination 90 days from the date of the previous application.
- 3.2.6 Have reached the age of majority.
- 3.2.7 The state engineer may issue a restricted or conditional license to an applicant based on his drilling performance and compliance with established rules and construction standards for a time period prescribed by the state engineer.

APPENDIX III

SELECTED WATER LAWS OF UTAH DEALING WITH GROUNDWATER AND APPROPRIATION

Utah Code Annotated 1953, Title 73,
Selected Sections

Sections 73-3-22 to 73-3-26 inclusive, Utah Code Annotated, 1953, have been amended by House Bill 1 1987 (Statutes are effective April 27, 1987) to read as follows:

73-3-22 WELL DRILLER REPORTS

- (1) Any person constructing a well or tunnel for the purpose of utilizing or monitoring underground waters shall, within 30 days after the completion or abandonment of the construction, report to the state engineer data relating to each well or tunnel. The report shall be made on forms furnished by the state engineer and shall contain information required by the state engineer.
- (2) Any person who fails to comply with the provisions of this section is guilty of a class B misdemeanor.

73-3-23 DEFINITIONS

As used in this chapter:

- (1) "Well" means an excavation or opening into the ground made by digging, boring, drilling, jetting, or driving or any other artificial method for utilizing or monitoring underground waters.
- (2) "Well driller" means any person that constructs a well for compensation or otherwise.
- (3) "Well drilling" means the act of constructing, repairing, or deepening a well, including all incidental work.

73-3-25 LICENSE AND BONDING REQUIREMENTS

- (1) Every person that constructs a well in the state shall obtain a license from the state engineer. The application for a license shall be in a form prescribed by the state engineer. All well driller's licenses expire on the 31st day of December following their issuance and are not transferable. The state engineer is authorized and directed to prepare and keep on file in his office rules for well construction.
- (2)(a) No person may construct a well in this state without first obtaining a license as provided in this section. No well driller's license will be issued without the applicant filing a \$5000.00 penal bond with the state engineer. The bond shall be made payable to the Office of the State Engineer. Proper compliance with the provisions of this section are required to obtain or renew a license.
- (b) Well drillers are required to comply with the rules promulgated by the state engineer under this chapter. If the state engineer determines, following an investigation and a hearing upon

If the well has a proper surface seal and any polluted groundwater has been sealed out, the system should remain sanitary until it is repaired or otherwise disturbed. A laboratory can analyze a water sample taken at this time to determine if dangerous levels of contamination still exist.

Table 3 gives the amount of hyperchlorite needed to disinfect wells of various diameters.

NOTE: Further information on disinfecting wells is available in AWWA specification A-100, AWWA Standard for Deep Wells.

3.3 OPERATOR REGISTRATION.

- 3.3.1 An operator may become registered with the State Engineer's Office in order to substantiate claims of experience when applying for his own well driller's license at some future date.
- 3.3.2 An operator may become registered with the State Engineer's Office by doing all of the following:
 - 3.3.2.1 Filing an application with the state engineer on forms provided for that purpose.
 - 3.3.2.2 Obtaining a score of at least 70% on a written and/or oral examination to test the applicant's knowledge of:
 - a) Land description by section, township, and range;
 - b) Geologic material and proper names used in describing underground material types;
 - c) The rules for water well driller's; and
 - d) The minimum standards for well construction.
 - 3.3.2.3 An operator must be under the supervision of a well driller holding a current Utah Well Driller's license. Such supervisor need not be continually present at the drilling site but must be available to provide supervision as the work progresses.

- 3.4 DRILLING WITHOUT A LICENSE. Any person found to be drilling a well without a valid well driller's license will be ordered to cease and desist by the state engineer. Such order may be made verbally but must be followed by a written order. The order may be posted at an unattended well site. A person found drilling without a license will be prosecuted under Title 73-3-26, Utah Code Annotated 1953. (See Section 5.8)

4 GENERAL REQUIREMENTS

- 4.1 All drillers, as a condition of the continuation of their license to drill wells in Utah shall do all of the following:
 - 4.1.1 Prior to commencing any work on a well, file written notice of that intention on a card furnished by the state engineer. The notice shall include the following:
 - a) The date on which it is proposed to commence work;
 - b) The nature of the work to be performed;
 - c) The owner's name for whom the well is to be drilled, or renovated.
 - d) The area code number, application number, change application number, exchange number, or underground water claim number on file in the State Engineer's Office shall be indicated. If the well is to be drilled under an approved test well or monitor well letter, the approval date and approval number.
 - e) The diameter of casing to be used;

- f) The location of the well by section, township and range;
- g) The card shall be signed by the licensed well driller.

When authorization is given to drill wells at more than one point of diversion, notice shall be given for each location to be drilled.

- 4.1.2 Comply with the minimum well construction standards as adopted by the state engineer and hereinafter included.
- 4.1.3 Have a qualified operator at the well site at all times during the actual work of construction, development or abandonment of the well. All persons operating under a well driller's license shall be employees of the well driller and use the licensed well driller's equipment. All wells, when unattended during construction or renovation, shall be securely covered.
- 4.1.4 Not allow any person to engage in the well drilling business under the authorization of their license without prior review and written consent of the state engineer.
- 4.2 The well driller's license number must be prominently displayed on every well drilling rig they operate in the state.
- 4.3 Within thirty (30) days of the completion or abandonment of any well, the driller shall file a report with the state engineer giving the data relating to that well. The report shall be made on forms furnished by the state engineer and shall contain such information as he may require, including but not limited to the following:
 - a) The name and post-office address of the driller;
 - b) The name and post-office address of the well owner;
 - c) The area code number of the valid authorization to drill or in the case of a well drilled under a test well or monitor well letter, the date of the letter and designated approval number;
 - d) The location of the well;
 - e) The size and type of casing, perforations, packers, seals, etc.;
 - f) The depth of the well;
 - g) The log of the well;
 - h) The beginning and completion dates for construction, renovation or abandonment of the well;
 - i) The temperature and quantity of water issuing, drawn, or pumped therefrom;
 - j) The location of all water-bearing strata.
 - k) The static water level in the well at the time of completion.
 For the purposes of these rules, a well will be considered completed or abandoned when the well driller removes his drilling rig from the well site, unless the well driller provides written notice to the state engineer that he plans to continue work at some later date.
- 4.4 The well driller shall have the required penal bond continually in effect during the term of the well driller's license.

APPENDIX II

RECOMMENDATIONS FOR WATER WELL SYSTEM DISINFECTION

A new well or one that has been repaired or modified should be assumed to be contaminated. This contamination must be removed prior to placing the well into use to protect the health of those who may use the well. The entire well system, casing, pumps, distribution system, etc., must be disinfected.

Well cleaning is a necessary part of well construction. Grease, oil, soil, and other foreign substances can harbor and protect bacteria from subsequent disinfection. Generally mechanical extraction, swabbing, and pumping have proven effective for cleaning most wells in most situations.

After the well has been cleaned, the two most important factors in disinfecting a well system are the concentration of the disinfectant and the duration of the contact of the disinfectant with any contaminated surface. Generally, the stronger the disinfectant solution is, the shorter the contact can be.

Any and all parts of the water well system may be contaminated. Therefore, all parts of the system must be exposed to the disinfectant solution for a sufficient amount of time to insure that the contamination has been neutralized.

Below is one method of disinfecting a water well system.

1. The well system should be completely assembled and in a fully operable condition.
2. Run the system to waste long enough to remove all stagnant or cloudy water. All taps should be opened to flush out the plumbing system. Turn off the pump.
3. Introduce the concentrated solution directly into the well. Some scheme must be used to insure uniform vertical distribution below the water level. Dry chemicals shall be placed in a mechanical carrier and slowly raised and lowered from the bottom of the well to the static water surface until the chemical has dissolved. Liquids or dry chemicals mixed with water to form a concentrated liquid shall be introduced by use of a hose or pipe from the bottom of the well to the static water surface.
4. Circulate the water with the disinfectant in it throughout the well system. Most of the flow should be returned to the well for recirculation. When returning water to the well, the flow should be directed to the well casing so as to completely wet that portion above the static water level. Make certain that water containing the disinfectant has been introduced throughout the system including all pipelines, storage tanks and taps.
5. All taps should be closed and the pump turned off. The disinfectant should be allowed to remain in the system as long as practical, at least 8 hours is recommended.
6. After the disinfectant solution has been in the system at least 8 hours, the water and disinfectant can be pumped to waste.

Kynar	*Greater strength & water resistance than Teflon *Lower cost than Teflon	*Not readily available *Poor resistance to acetone & ketones
Mild Steel	*Strong, rigid, temperature sensitivity not a problem *Low cost, readily available *Lower cost than stainless steel or Teflon	*Heavier than plastics *May react & leach constituents into groundwater *Not as chemically resistant as stainless steel
Stainless Steel	*High strength & temperature range *Resistant to corrosion & oxidation *Readily available *Moderate cost	*Heavier than plastics *May leach chromium in highly acidic water *May be catalyst in some organic reactions *Screens higher cost than plastic

SEALING MATERIALS

Bentonite pellets are commonly used above the filter or gravel pack with a bentonite slurry or cement grout filling the annulus above to within a few feet of the surface. A concrete seal is then placed at the surface which slopes away from the well casing. The final well should be equipped with a vented locking protective cap or cover.

WELL DEVELOPMENT

Hydraulic efficiency is generally not an overriding consideration in monitor well construction as it is with high capacity production water wells. However, development of monitor wells is necessary, especially in low permeability formations, to allow free movement of water into the sampling areas. The development process for monitor wells is best accomplished by causing the natural formation water inside the screened or perforated area to move vigorously in and out in order to agitate and remove silt, clay, and fines. The use of water other than natural formation water is not recommended as results of sampling may become altered.

Several suitable methods for developing monitor wells include using a surge block or bailer or surging by pumping or air lift.

SUMMARY

These guidelines and recommended practices dealing with the installation of monitor wells are not meant to represent a complete authority. There are several excellent sources of information available concerning monitor well installations and requirements. One additional recommended information source is the EPA's Resource Conservation & Recovery Act (RCRA) Ground Water Monitoring Enforcement & Compliance Document available from EPA's regional office in Denver, Colorado or the National Water Well Association's Publication Department.

4.5 The well driller shall make certain that a valid authorization or approval exists to drill before beginning drilling. The authorizations to drill listed in Section 2.23, allow the applicant to contract with a well driller to drill, or renovate exactly one well at each location listed on the approved form. When the work is completed or abandoned, the permission to drill is terminated. An approved test well or monitor well letter is a special case permitting exploratory drilling but allowing only enough water to be diverted to determine the characteristics of the ground water source.

5 PENALTIES

5.1 The state engineer, upon investigation and after a hearing, on at least ten days' notice given to the licensee by registered mail, may revoke or suspend any well driller's license either permanently or for a fixed period determined by the state engineer, if he finds that the well driller has done any of the following:

- a) Intentionally made a material misstatement of facts in his application for a license;
- b) Intentionally made a material misstatement of fact in a well driller's report;
- c) Been found to be incompetent as a well driller;
- d) Willfully violated any of the prescribed rules;
- e) Failed to submit notice of intention to drill in accordance with these rules;
- f) Failed to submit a report of well driller, completed in accordance with these rules.
- g) Allowed any person to operate under their license without prior written approval by the state engineer.

5.2 If the state engineer determines, following an investigation and a hearing upon at least ten days notice to the licensee, by registered mail, that the licensee has failed to comply with the rules, the state engineer may exact the bond and deposit the money as a non-lapsing dedicated credit.

5.3 The state engineer may expend the funds to investigate or correct any deficiencies which could adversely affect the public interest resulting from non-compliance with the rules by any well driller.

5.4 After the period set by the state engineer under a revocation or suspension has expired, a well driller may make application for a new license.

5.5 A well driller who has had his license revoked or suspended will be prohibited from operating well drilling equipment during the revocation or suspension period set by the state engineer.

5.6 The state engineer may, upon investigation and after a hearing, refuse to issue a license to an applicant if it appears:

- a) That he has not had sufficient training or experience to qualify him as a competent well driller or;
- b) That he has intentionally violated the Utah Statutes governing well drillers or these rules relating to well drilling or;
- c) That he has intentionally made a material misstatement of fact in an

application for a license, in a well driller's report, or in any other document filed in the State Engineer's Office.

- 5.7 Lack of knowledge of the law or the rules relating to well drilling shall not constitute an excuse for violation thereof.
- 5.8 Title 73 Chapter 3 Section 26 of the Utah Code Annotated 1953 provides that:
- (1) Any person that does any of the following is guilty of a Class B misdemeanor:
 - (a) Constructs a well without first obtaining a license as required by this chapter;
 - (b) Advertises to be a well driller without first obtaining a license as required by this chapter;
 - (c) Constructs a well after suspension revocation or expiration of his license;
 - (d) Constructs a well in violation of the rules promulgated under Subsection 73-3-25 (1).
 - (2) Each day of failure to comply with the provisions of this section constitutes a separate offense.

6 RENEWAL OF WELL DRILLER'S LICENSE AND QUALIFICATION OF OPERATORS

6.1 ACTIVE LICENSES.

- 6.1.1 All well driller's licenses expire on December 31 of the year in which they are issued. Renewal of license will be made upon payment of a \$22.50 fee, written application to the state engineer, submission of proof of \$5000 penal bond for the next year, and proper submission of all start cards and well logs for the current year. Renewal of an operator's registration will be made upon written application to the state engineer.
- 6.1.2 Having met all requirements as set forth in 6.1.1 on or before December 31, the licensee shall be authorized to operate as a well driller until his new license is issued.
- 6.1.3 License renewal applications not meeting the requirements of section 6.1.1 and/or received after their December 31 expiration date will be assessed an additional \$22.50 administrative late fee before the state engineer will consider license renewal.

6.2 RENEWAL OF INACTIVE LICENSES.

- 6.2.1 Drillers who have held an active license within the previous 24 months shall make application under provisions of Section 6.1.
- 6.2.2 Drillers who have not held an active license within the previous 24 months shall make application under the provisions of Section 3.2.

MATERIALS USED

Casing & Screens

There are several materials currently approved for the use in the installation of monitor wells. Most of the monitor project contracts will specify which materials are to be used based on the anticipated pollutants being monitored. The cost of the materials varies greatly, and it may be realistic to balance sample accuracy with overall cost, especially in regard to casing and intake portions of well construction. There are some exotic materials being developed for monitor well use; however, the more common casing and screen materials now being used and their advantages and disadvantages can be compared in Table 7.

TABLE 7
MONITOR WELL CASING
& SCREEN MATERIALS

Type	Advantages	Disadvantages
PVC	<ul style="list-style-type: none"> *Lightweight, readily available *Lower cost than Teflon or stainless steel *Good resistance to mineral or oxidizing acids & alkalis 	<ul style="list-style-type: none"> *Weaker, less rigid, more temperature sensitive than metallic materials *May react & leach constituents from groundwater *Poor resistance to ketones, esters, & aromatic hydrocarbons
Polypropylene	<ul style="list-style-type: none"> *Lightweight, chemically resistant to mineral acids, alkalies, ketones, alcohols, esters, oils *Fair resistance to oxidizing acids, aliphatic hydrocarbons, & aromatic hydrocarbons *Lower cost than Teflon & stainless steel 	<ul style="list-style-type: none"> *Same as PVC and may leach constituents into groundwater *Poor machinability - cannot be slotted because it melts rather than cuts
Teflon	<ul style="list-style-type: none"> *Lightweight, high impact strength *Outstanding chemical resistance, insoluble in all organics but few fluorinated solvents 	<ul style="list-style-type: none"> *Low tensile strength & low wear resistance *Expensive relative to other plastics & stainless steel

Cable Tool	<ul style="list-style-type: none"> *Small amounts of water required-no fluid additives *Used in consolidated & unconsolidated formations *No depth restrictions *Good formation samples *Observed water level changes *Good seal between casing & formation *inexpensive operation 	<ul style="list-style-type: none"> *4-inch minimum casing size *Limited geophysical logs *Relatively slow
Reverse Circulation (Dual Wall Pipe)	<ul style="list-style-type: none"> *Formation water not contaminated by drilling water *Excellent formation samples *With air - immediate information on water bearing zones *Reduced caving of hole 	<ul style="list-style-type: none"> *Rare - expensive to operate *Difficult grout placement outside casing - above screen
Hollow-Stem (Continuous Flight Auger)	<ul style="list-style-type: none"> *Mobile, fast, inexpensive to operate in unconsolidated formations *No drilling fluid-reduced contamination *Reduced caving problems-casing & screen placement inside of augers *Gamma Ray logging inside hollow stem-nature & thickness of formations *Continuous placement of grout seal as augers are removed. 	<ul style="list-style-type: none"> *Limited depth - usually 100 - 150 ft. *Not used in consolidated, rock formations *Limited accuracy of samples *Depth to water table difficult to determine in deep borings
Solid Stem Auger	<ul style="list-style-type: none"> *Mobile, fast, inexpensive to operate in unconsolidated formations *No drilling fluid-reduced contamination 	<ul style="list-style-type: none"> *Not used in rock formations *Limited depth, 100-150 ft. *Difficult to maintain open hole, especially below water table *Limited accuracy of samples

Part II

MINIMUM CONSTRUCTION STANDARDS

7 GENERAL

7.1 GENERAL. The failure of a water well driller to abide by these minimum standards can result in any of the following:

- (1) the revocation or suspension of his well driller's license.
- (2) a finding that he is guilty of a misdemeanor.
- (3) the exacting of his bond by the state engineer. In some locations, the compliance with the following minimum standards will not result in a well being free from pollution or from being a source of subsurface leakage, waste, or contamination of the groundwater supply. Since it is impractical to attempt to prepare standards for every conceivable situation, the well driller shall use his judgement to construct wells under more stringent standards when such precautions are to protect the groundwater supply and those using the well in question.

7.2 WELL CASING. It shall be the sole responsibility of the well driller to determine the suitability of any type of well casing for the particular well he is constructing, in accordance with these minimum requirements. The well casing shall extend a minimum of 18 inches above ground level and the natural ground surface should slope away from the casing.

7.2.1 Steel Casing. All steel casing installed in Utah shall be in new or like-new condition, being free from pits or breaks, and shall meet the minimum specifications listed in Table 1.

TABLE -1-

MINIMUM WALL THICKNESSES FOR STEEL WELL CASING

Nominal Casing Diameter (In)	D E P T H							
	0 to 200 (Ft)	200 to 300 (Ft)	300 to 400 (Ft)	400 to 600 (Ft)	600 to 800 (Ft)	800 to 1000 (Ft)	1000 to 1500 (Ft)	1500 to 2000 (Ft)
2	.154	.154	.154	.154	.154	.154
3	.216	.216	.216	.216	.216	.216
4	.237	.237	.237	.237	.237	.237	.237	.237
5	.250	.250	.250	.250	.250	.250	.250	.250
6	.250	.250	.250	.250	.250	.250	.250	.250
8	.250	.250	.250	.250	.250	.250	.250	.250
10	.250	.250	.250	.250	.250	.250	.313	.313
12	.250	.250	.250	.250	.250	.250	.313	.313
14	.250	.250	.250	.250	.313	.313	.313	.313
16	.250	.250	.313	.313	.313	.313	.375	.375
18	.250	.313	.313	.313	.375	.375	.375	.438
20	.250	.313	.313	.313	.375	.375	.375	.438
22	.313	.313	.313	.375	.375	.375	.375	.438
24	.313	.313	.375	.375	.375	.438
30	.313	.375	.375	.438	.438	.500

DRILLING METHODS

Monitor wells may be installed using a variety of commonly recognized drilling methods. The method used should minimize the disturbance of subsurface materials and consequently reduce possible cross-contamination of groundwater zones. The drilling method is a function of the site specific geologic conditions which may make one method more suitable than another. Regardless of the method used, the well rig and support equipment should be steam cleaned and decontaminated before use and between borehole locations to prevent cross-contamination of wells.

All methods employed in monitor well construction have inherent advantages and disadvantages which can be compared in Table 6.

TABLE 6
DRILLING METHODS FOR MONITOR WELLS

Type	Advantages	Disadvantages
Mud Rotary	<ul style="list-style-type: none"> *Readily available *Capable of drilling hard or soft formations. *Core sampling available *No depth restrictions *Small rigs for accessibility *Logging fairly reliable *Relatively inexpensive 	<ul style="list-style-type: none"> *Drilling fluid invades formation; hard to remove *Bentonitic fluids absorb metals *Organic fluids interfere with bacterial/organic analysis *Limited information on water zones *Drilling fluids circulate contaminants
Air Rotary	<ul style="list-style-type: none"> *No drilling fluid-reduced contamination *Used in consolidated & unconsolidated formations *No depth restrictions *Excellent sampling in hard, dry formations *Easy collection & field analysis of blown water *Fast & readily available. 	<ul style="list-style-type: none"> *Casing required in soft, caving formations *Multiple water zones-difficult to properly case and grout off different zones *Relatively expensive
Air Rotary with Casing Hammer	<ul style="list-style-type: none"> *Caving formations can be drilled *Multiple levels can be penetrated & sampled 	<ul style="list-style-type: none"> *Limited availability *Higher operating costs *Casing pull-back is difficult

APPENDIX I
MONITOR WELL INSTALLATION GUIDELINES
AND RELATED INFORMATION

GENERAL

Most, if not all, monitor well projects are the result of compliance with EPA, Federal Regulations such as the Resource Conservation & Recovery Act (RCRA) or specific State Solid and Hazardous Waste requirements. The contracts governing their installation are tightly written containing specific requirements as to site location, materials used, sampling procedures and overall objectives. The following monitor well guidelines address only the procedures required to obtain actual approval to drill and the commonly acceptable construction and installation practices for monitor wells.

All monitor wells constructed in the state will be installed by a currently licensed Utah Water Well Driller.

APPROVAL

Approval for monitor well projects are issued by the state engineer following review of written requests from the owner/applicant, federal or state agency or engineering representative. The requests for approval should include the following information:

- 1) General location or common description of the monitoring project.
- 2) Specific course and distance locations of all requested locations (or location by 1/4, 1/4 section)
- 3) Total anticipated number of wells to be installed.
- 4) Diameters, approximate depths, materials used, in the wells.
- 5) Projected start and completion dates.
- 6) Name and license number of driller contracted to install the wells.

Upon written approval by the state engineer, the project will be assigned an approved authorization number which will be referenced by the licensed driller on all start cards and well drillers reports as required by Sections 4.1.1 and 4.3 of these Rules.

INSTALLATION

All material used in the installation of monitor wells should be sterile and contaminant free when placed in the ground. During construction contaminated water should not be allowed to enter contaminant-free geologic formations or water bearing zones. Some minor cross-contamination may occur during drilling, but the integrity of the borehole and individual formations must then be safeguarded. The well casing should be perforated or screened and filter packed with sand or gravel where necessary to provide adequate sample collection at depths where appropriate aquifer flow zones exist. The annular space between the borehole and casing should be adequately sealed using bentonite-slurry, pellets or cement grout. The gravel or filter pack should generally extend 2 ft. to 10 ft. above the screened or perforated area to prevent the migration of the sealing material from entering the zones being sampled. Drill cutting should not be placed into the open borehole annulus.

7.2.2 Plastic Casing. PVC, SR, ABS, etc. casing may be installed in Utah upon obtaining permission of the well owner. Plastic well casing shall be manufactured and installed to conform with ANSI/ASTM F 480-81, SDR 21 or the most recent revision thereof. The casing is normally marked "WELL CASING" and with the ANSI/ASTM designation "F 480-81, SDR-21". All plastic casing for use in potable water supplies shall be manufactured to be acceptable to the National Sanitation Foundation Testing Laboratory, Inc. Other types of plastic casings may be installed upon manufacturers certification that such casing meets or exceeds the above described ASTM/SDR specification. Minimum specifications are given in Table 2.

TABLE -2-

WALL THICKNESS FOR THERMOPLASTIC WATER WELL CASING PIPE		
Nominal Casing Diameter (In.)	Minimum Thickness (In.)	SDR
2	0.133	21
2.5	0.137	21
3	0.167	21
3.5	0.190	21
4	0.214	21
5	0.265	21
6	0.316	21
8	0.410	21
10	0.511	21
12	0.606	21
14	0.667	21
16	0.762	21
ASTM Specification, F480-81		

- 7.3 CASING JOINTS. All well casing joints shall be made water tight. In instances in which a reduction in casing diameter is made, there shall be enough overlap of the casings to prevent misalignment and to insure the making of an adequate seal in the annular space between casings to prevent the movement of unstable sediment into the well, in addition to preventing the degradation of the water supply by the migration of inferior quality water through the annular space between the two casings.
- 7.3.1 Steel Casing. All steel casing shall be screw-coupled or welded. If the joints are welded, the weld shall be at least as thick as the wall thickness of the casing and shall consist of at least two beads for the full circumference of the joint.
- 7.3.2 Plastic Casing. All plastic well casing shall be either screw coupled or chemically welded as per ANSI/ASTM F480-81 standards. Metal screws driven into casing joints shall not be long enough to penetrate the inside surface of the casing. Metal screws should be used only when cold (below 50 deg. F) temperatures retard the normal setting of the cement.
- 7.4 MINERALIZED OR POLLUTED WATER. Whenever a water bearing stratum that contains nonpotable mineralized or polluted water is encountered, the stratum shall be adequately sealed off so that contamination of the overlying or underlying groundwater zones will not occur.
- 7.5 EXPLOSIVES. Explosives used in well construction shall not be detonated within the section of casing designed or expected to serve as the surface seal of the completed well, whether or not the surface seal has been placed.
- 7.6 CHLORINATION OF WATER. No contaminated water shall be placed in a well during construction. Water should be obtained from a chlorinated municipal system. Where this is not possible, the water must be treated to give 100 ppm free chlorine residual. Table 3 gives the amount of bleach or dry powder required per 100 gallons of water to mix a 100 ppm solution.

FIGURE 5: CONSTRUCTION OF DUG WELLS

- 8.1 WELL CASING. All well casing installed shall meet the minimum standards given in Sections 7.2.1 and 7.2.2. Plastic casing is not recommended for use in wells drilled by the Cable Tool method.
- 8.2 SEALING OF CASING. All drilled wells shall have a surface seal installed in accordance with the provisions of Table 4. Neat cement grout, sand cement grout, bentonite or expansive clays may be used in the surface seal. All grout placed deeper than 30 feet or under water shall be placed by tremie line, pumping, or pressure. Portland Cement grouts must be allowed to cure a minimum of 72 hours for Type I cement or 36 hours for Type III cement before construction or pump testing may be resumed.

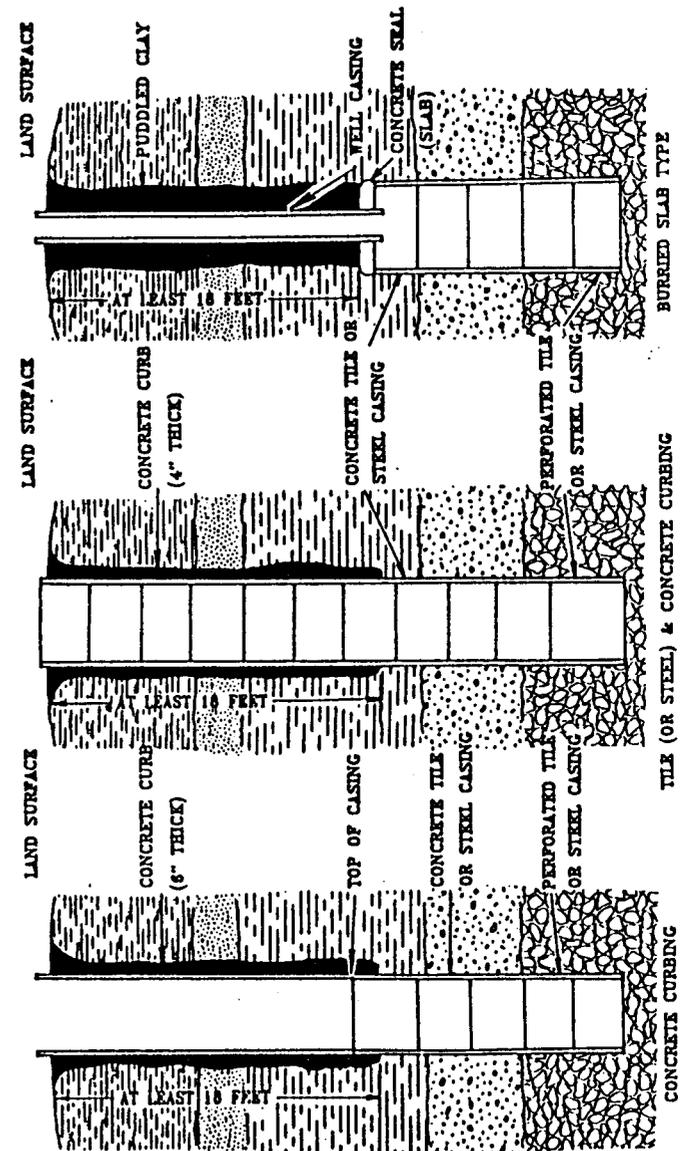
TABLE -4-

CASING GROUTING TABLE		
Overburden	Minimum Grouting Depth	Minimum Non-Perforated Casing Depth
Unconsolidated, Permeable Formations	18 Feet to Surface	Below Lowest Pumping Level
Clay or Stratified Deposits of Sand, Gravel, and Clay	18 Feet to Surface and Driven 5 Feet Into an Impervious Clay Layer	Top of the Uppermost Producing Zone
Consolidated Rock	18 Feet to Surface and Grouted 5 Feet Into a Rock Formation	18 Feet or 5 Feet Into the Rock Formation

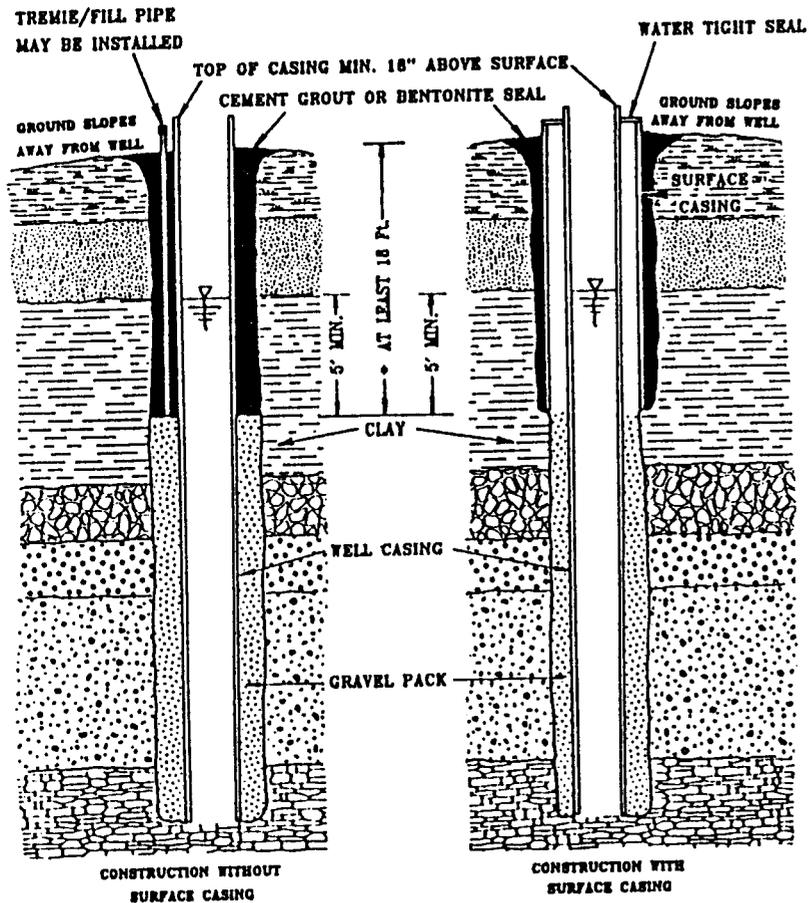
8.2.1 Casing. Non-perforated casing shall be installed to the minimum depths given in Table 4. A perforated liner, well screen, or smaller casing may be installed below the well casing, if necessary, to complete the well. The annular space between the two casings shall be sealed water-tight with grout, expansive clay, or a mechanical packer. Figures 1, 2, 3, and 4 illustrate typical well completions in the various formations listed in Table 4.

8.3 GRAVEL PACKED WELLS.

8.3.1 Oversize Hole. The diameter of the borehole shall be at least four inches larger than the diameter of the casing to be installed to allow for proper placement of the gravel/filter pack and adequate clearance for tremie pipe for grout/surface seal installations (Figure 4).



**FIGURE 4: CONSTRUCTION OF GRAVEL PACKED WELLS
INSTALLED WITH AND WITHOUT
SURFACE CASINGS**



• ALL GROUT PLACED DEEPER THAN 30' OR UNDER WATER
SHALL BE PLACED BY TREMIE, PUMPING OR PRESSURE
PUBLIC SUPPLY WELLS MUST BE GROUTED TO 100'.

- 8.3.2 Filter Material. The filter material shall consist of clean, well rounded grains that are smooth and uniform. The filter material should not contain more than 2% by weight of thin, flat, or elongated pieces and should not contain organic impurities or contaminants of any kind. In order to assure that no contamination is introduced into the well, the gravel pack should be washed with a 100 ppm solution of chlorinated water (Table 3) or dry chlorine should be mixed with the gravel pack at the surface before it is introduced into the well.
- 8.3.3 Placement of Filter Material. All filter material shall be placed using a method that through common usage has been shown to minimize 1) bridging of the material between the borehole and the casing, and 2) excessive segregation of the material after it has been introduced into the annulus and before it settles into place.
- 8.3.4 No Surface Casing Used. If no permanent surface casing is installed, a cement grout or puddling clay seal shall be installed to at least 5 feet into a clay layer or other tight formation overlying the producing zone. The well seal shall extend down at least 18 feet from the land surface.
- 8.3.5 Surface Casing Used. If permanent surface casing is installed, it shall be unperforated and installed in accordance with Table 4. After the gravel pack has been installed, the inner casing may be sealed by either welding a water-tight steel cap between the two casings at land surface or filling the annular space between the two casings with cement grout, bentonite, or puddling clay from 18 feet to the surface.
- 8.4 SPECIAL ADDITIONAL STANDARDS FOR ARTESIAN WELLS.
- 8.4.1 Sealing of Casing. Unperforated well casing shall extend into the confining stratum overlying the artesian zone, and shall be adequately sealed into the confining stratum so as to prevent both surface and subsurface leakage from the artesian zone.
- 8.4.2 Elimination of Leakage. If leaks occur around the well casing or adjacent to the well, the well shall be completed with the seals, packers, or casing necessary to eliminate the leakage.
- 8.4.3 Control Valves. If a well flows, it shall be equipped with a suitable control valve. The control valve, must be available for inspection at all times.

FIGURE 3: CONSTRUCTION OF A DRILLED WELL
 THE AQUIFER IS OVERLAIN BY
 STRATIFIED FORMATIONS

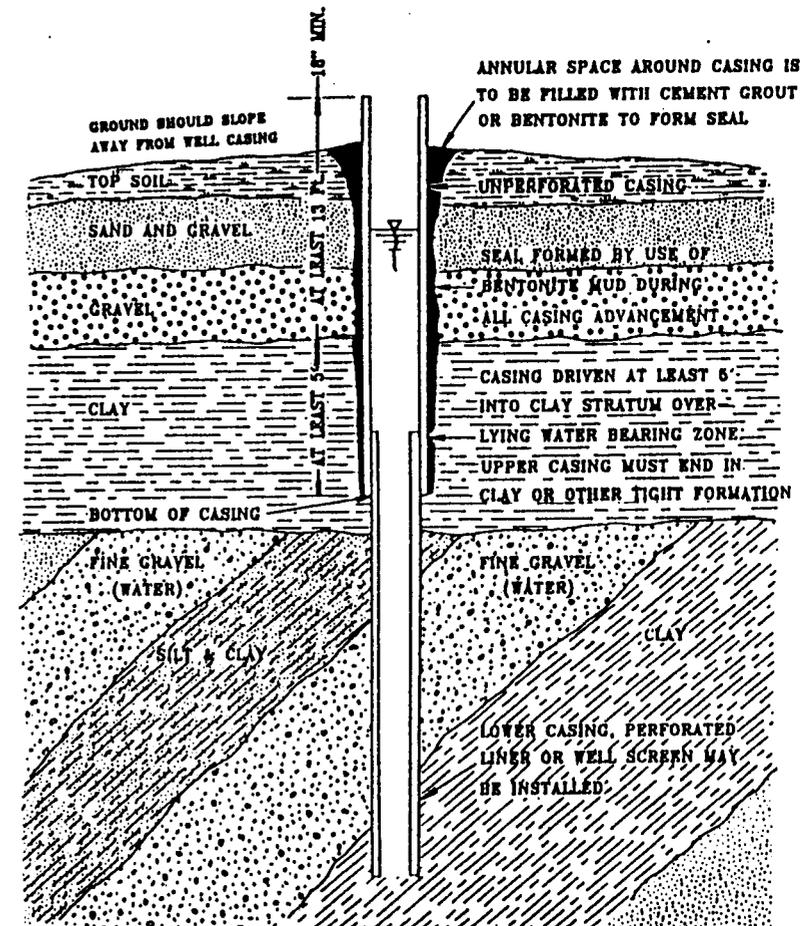
9 DUG WELLS

9.1 SURFACE CURBING.

- 9.1.1 All dug wells greater than 12 feet in depth shall be constructed with a water-tight surface curbing extending to a depth of 18 feet, or to within 3 feet of the bottom of the well in the case of wells ranging from 12 to 21 feet in depth. The surface curbing shall be of concrete, concrete tile, or steel. If concrete is used, the wall thickness shall not be less than 6 inches. In the case of the buried slab type of well, well casing meeting the minimum specifications given in Sections 7.2.1 and 7.2.2 must be installed (Figure 5).
- 9.1.2 If precast concrete tile or steel is used for the surface curbing, the well diameter to the bottom of the surface curbing shall be 8 inches greater than the outside diameter of the tile or steel and the annular space shall be filled with concrete.
- 9.1.3 Well Seal. In a buried-slab type of well, the slab shall be at least 18 feet below land surface. The slab shall be sealed with cement grout and the well bore backfilled with puddled clay (Figure 5).

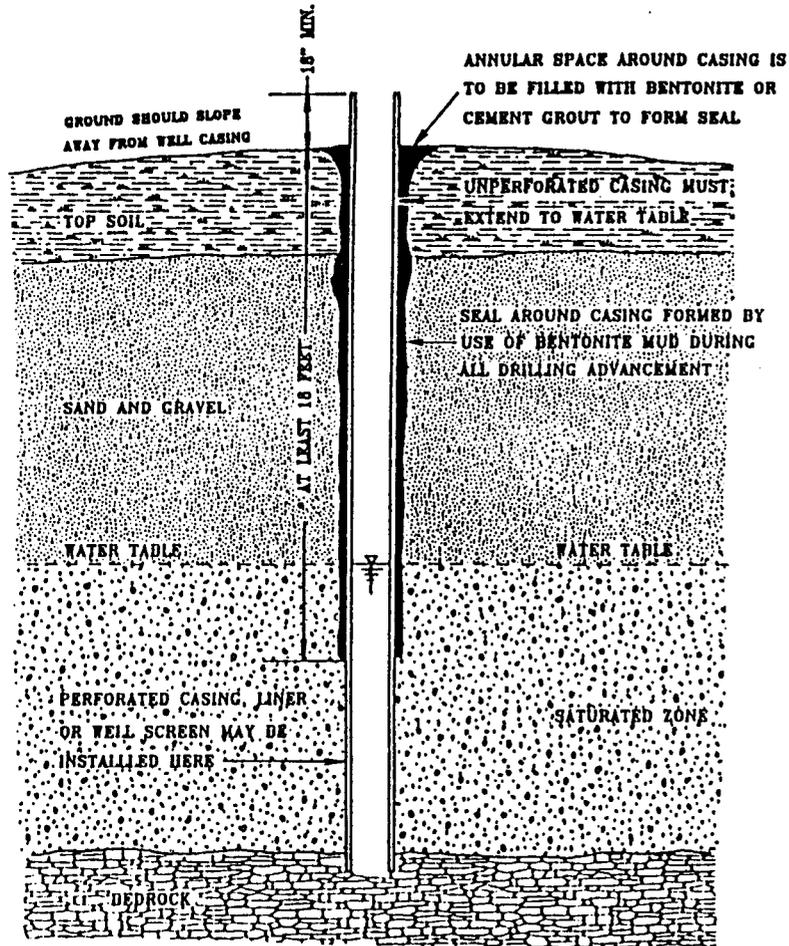
10 DEEPENING OR RENOVATION OF WELLS

- 10.1 SEALING OF CASING. If in the repair of a drilled well, the old casing is withdrawn, the well shall be recased in accordance with the rules set forth in Section 8.
- 10.2 INNER CASING. If an inner casing is installed to prevent leakage of undesirable water into a well, the space between the two well casings shall be completely sealed using packers, casing swedging, pressure grouting, etc., so as to prevent the movement of water between the casings.
- 10.3 OUTER CASING. If the "over-drive" method is used to eliminate leakage from the existing well, the casing driven over the well shall meet the minimum specifications listed in Section 7.2.1.
- 10.4 ARTESIAN WELL. If upon deepening an existing well, an artesian zone is encountered, the well shall be cased and completed as set forth in Section 8.
- 10.5 DRILLING IN A DUG WELL. A drilled well may be constructed through an existing dug well provided that:
- 10.5.1 An unperforated section of well casing extends from a depth of at least 10 feet below the bottom of the dug well and at least 20 feet below land surface to above the maximum water surface in the dug well, and



* IF THE WELL IS TO BE USED FOR PUBLIC SUPPLY AND CLAY LAYER ABOVE PRODUCING ZONE IS AT LEAST 30 FT. THICK, THE GROUT MUST EXTEND FROM THE SURFACE TO A POINT 6 FEET INTO THE CONFINING CLAY LAYER.

FIGURE 2: CONSTRUCTION OF A DRILLED WELL
 THE AQUIFER IS OVERLAIN BY A
 PERMEABLE SAND OR GRAVEL



* IF THE WELL IS TO BE USED AS A PUBLIC SUPPLY WELL
 THE GROUT MUST EXTEND TO A MINIMUM OF 2" AROUND THE
 CASING & TO A MINIMUM OF 100 FL. BELOW THE SURFACE

- 10.5.2 A 2 foot thick seal of concrete or puddled clay is placed in the bottom of the dug well so as to prevent the direct movement of water from the dug well into the drilled well, and
- 10.5.3 The drilled well shall be pumped or bailed to determine whether the seal described above is adequate to prevent movement of water from the dug well into the drilled well. If the seal leaks, additional sealing and testing shall be performed until a water tight seal is obtained.

11 SPECIAL STANDARDS FOR PARTICULAR WELLS

- 11.1 UNUSUAL CONDITIONS. If unusual conditions occur at a well site and compliance with these rules and standards will not result in a satisfactory well or protection to the water supply, a licensed water well driller may request that special standards be prescribed for a particular well. The request for special standards shall be in writing and shall set forth the location of the well, the name of the owner, the unusual conditions existing at the well site, the reasons that compliance to the rules and minimum standards will not result in a satisfactory well, and the proposed standards that the licensed water well driller believes will be more adequate for this particular well. If the state engineer finds that the proposed changes are in the best interest of the public, he will approve the proposed changes by assigning special standards for the particular well under consideration.
- 11.2 SPECIAL STANDARDS. If in the course of investigating the groundwater resources of Utah, the state engineer finds that special standards are required for the development of groundwater from any particular groundwater reservoir or area, special standards for the construction and maintenance of wells may be prescribed.
- 11.2.1 Special Water Well Casing Standards for the 71, 73, 75, and 77 Drainage Areas.
- 11.2.1.1 During the course of his investigations of groundwater in the previously mentioned drainages, the state engineer has found that a variance in water well casing wall thicknesses is warranted. This special standard shall apply only in those specific areas hereinafter defined. The casing specifications adopted in Section 7.2.1 and 7.2.2 of these rules shall govern in all other parts of the affected drainage areas.
- 11.2.1.2 It shall be the sole responsibility of the water well driller to install casing suitable to the conditions encountered at the well site, in accordance with these minimum specifications.
- 11.2.1.3 Steel Casing. All steel casing installed under this section shall be new or in like-new condition free from pits or breaks and shall meet the minimum specifications listed in Table 5.

FIGURE 1: CONSTRUCTION OF A DRILLED WELL
 THE AQUIFER IS OVERLAIN BY A
 CONSOLIDATED FORMATION

TABLE -5-

WALL THICKNESS FOR STEEL WATER WELL PIPE

Nominal Casing Diameter (Inches)	Minimum Wall Thickness (Inches)
4	0.188
6	0.188
8	0.188
10	0.250
12	0.250
14	0.250
16	0.250
18	0.250
20	0.250

- 11.2.1.4 Casing Joints. All casing joints shall be made in conformance to Sections 7.3, 7.3.1, and 7.3.2.
- 11.2.1.5 Applicable Areas. This special standard shall apply only in the specific areas listed below.

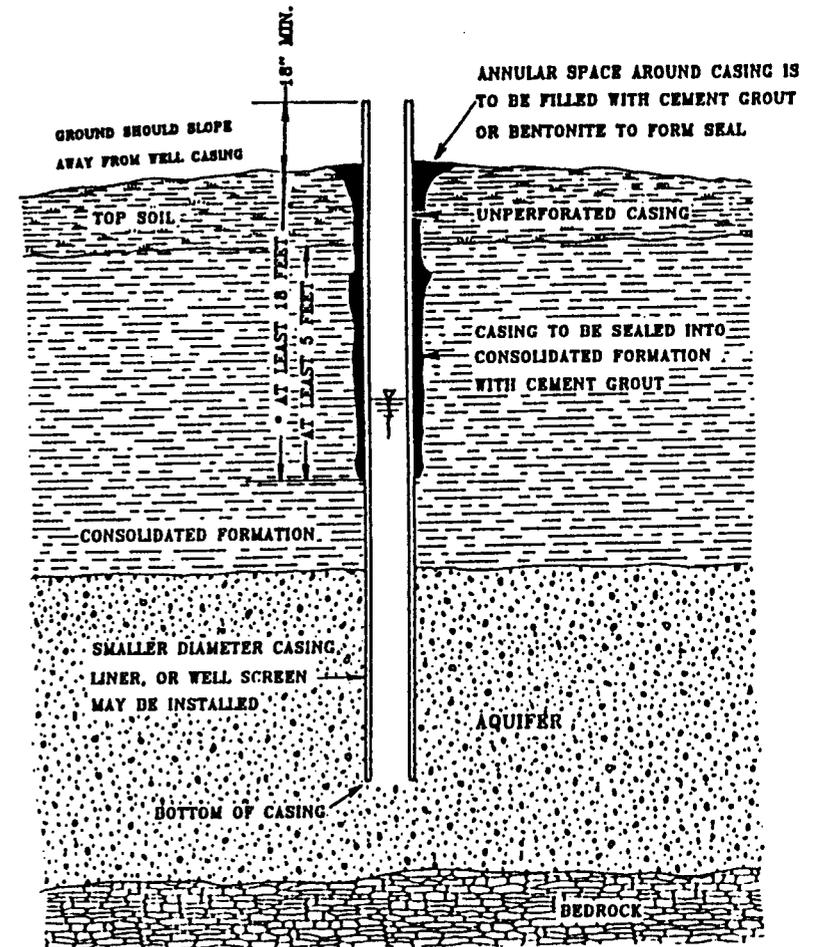
71 Area. Those parts of the 71 drainage area in Washington, Iron, and Beaver Counties below an elevation of 6,000 ft. MSL. Those parts of the 71 drainage area in Millard County below an elevation of 5,200 ft. MSL.

73 Area, 75 Area. Those parts of the 73 and 75 drainage areas in Iron County below an elevation of 6,000 ft. MSL.

77 Area. Those parts of the 77 drainage area in Beaver County below an elevation of 6,000 ft. MSL.

12 ABANDONMENT OF WELLS

- 12.1 TEMPORARY ABANDONMENT. When any well is temporarily removed from service, the top of the well shall be sealed with a water-tight cap or seal. If the well is temporarily abandoned during construction, it shall be assumed that the well is permanently abandoned after 90 days, and a well driller's report will be submitted in compliance with Section 4.3 of these rules.
- 12.2 PERMANENT ABANDONMENT. Any well that is to be permanently abandoned shall be completely filled in such a manner as to prevent vertical movement of water within the borehole as well as preventing the annular space surrounding the well casing from becoming a conduit for possible contamination of the groundwater supply.
- 12.3 LICENSE REQUIRED. Well abandonment shall be accomplished under the direct supervision of a currently licensed water well driller who shall be responsible for verification of the procedures and materials used.



* IF THE WELL IS TO BE USED AS A PUBLIC SUPPLY WELL THE GROUT MUST EXTEND A MINIMUM OF 2" AROUND THE CASING & TO A MINIMUM OF 100' BELOW THE SURFACE

12.4 MATERIALS USED. The following materials may be used in the permanent abandonment of wells:

- 1) Neat Cement conforming to ASTM standard C150 of sufficient weight (not less than 15 lbs/gallon) to prevent the flow of any water into the hole from any aquifer penetrated.
- 2) Cement grout consisting of equal parts of cement conforming to ASTM standard C150 and sand/aggregate with no more than 6 gallons of water per sack of cement.
- 3) Bentonite-based products specifically designed for permanent well abandonment, which are mixed and placed according to manufacturer's recommended procedures (i.e. Plug-Gel, Shur-Gel, etc.).
- 4) The liquid phase of the abandonment fluid shall be non-saline water containing no chemicals or toxic materials or other substances which may decompose or possibly contaminate the groundwater supply.

12.5 PLACEMENT OF MATERIALS.

- 1) Neat cement and cement grout shall be introduced at the bottom of the well or required sealing interval and placed progressively upward to the top of the well. Said sealing material shall be placed by the use of a grout pipe, tremie line or dump bailer in order to avoid segregation or dilution of the materials.
- 2) Bentonite-based products shall be mixed and placed according to manufacturer's recommended procedures.

12.6 TERMINATION OF CASING. The casings of wells to be abandoned shall be severed a minimum of 2 feet below either the natural ground surface adjacent to the well or at the collar of the hole, whichever is the lower elevation. A minimum of 2 feet of compacted native material shall be placed above the abandoned well upon completion.

12.7 REPORT OF ABANDONMENT. Within 30 days of the completion of well abandonment procedures, a report must be submitted to the state engineer by the responsible licensed driller giving data relating to the abandonment of the well. The report shall be made on forms furnished by the state engineer and shall contain such information as he may require, including but not limited to the following:

- 1) Name of licensed driller or other person(s) performing abandonment procedures.
- 2) Name of well owner at time of abandonment.
- 3) Address or location of well by section, township and range.
- 4) Abandonment materials, equipment and procedures used.
- 5) Water right or file number covering the well.
- 6) Final disposition of the well.
- 7) Date of completion.

12.8 ABANDONMENT OF ARTESIAN WELLS. A cement grout or concrete plug shall be placed in the confining stratum overlying the artesian zone so as to prevent subsurface leakage from the artesian zone. The remainder of the well shall be filled with cement grout, concrete, bentonite products, or puddled clay.

12.9 ABANDONMENT OF DRILLED AND JETTED WELLS. A cement grout or concrete plug shall be placed opposite all perforations or openings in the well casing. The remainder of the well shall be filled with cement grout, concrete, bentonite products, or puddled clay.

12.10 ABANDONMENT OF GRAVEL PACKED WELLS. All gravel packed wells shall be pressure grouted throughout the perforated section of the well casing. The remainder of the well shall be filled with cement grout, concrete, bentonite products, or puddled clay.

12.11 PLUGGED WELLS. If it is desired to remove the well casing during abandonment, the well shall be plugged as the casing is removed. The well shall be plugged with cement grout, concrete, bentonite products, or puddled clay. In the case of gravel packed wells, the entire gravel section shall be pressure grouted.

12.12 REPLACEMENT WELLS. Wells which are to be removed from operation and replaced by the drilling of a new well, under an approved replacement application, shall be abandoned in a manner consistent with the provisions of this section before the rig is removed from the site.

13 WELLS INTENDED FOR PUBLIC DRINKING WATER SUPPLIES

13.1 Each driller shall be familiar with the requirements of the Utah State Department of Health, Bureau of Drinking Water/Sanitation and with respect to public supply wells. Rules governing public drinking water supplies are given in the "State of Utah Public Drinking Water Regulations" available from the Utah State Bureau of Drinking Water/Sanitation and (State Department of Health).

When drilling wells intended for public drinking water use, the driller should be familiar with and acquaint his client with local or state health department rules which require, among other things:

- a) Plans and specifications for the well to be reviewed and approved by the Bureau of Drinking Water/Sanitation before construction begins.
- b) Minimum grouting distances below the surface.
- c) Minimum distances between the well and any concentrated sources of pollution (e.g. septic tanks, septic tank drainfields, garbage dumps, pit privies, drain lines, sewer lines, corrals, feedlots, etc.).

13.2 A representative of the State Engineer's Office or the Bureau of Drinking Water/Sanitation and must be present at the time the surface seal is placed in all public supply wells so that the placement of the seal can be certified. In order to assure that a representative will be available, and to avoid down-time waiting for a representative, notice should be given several days in advance of the projected seal placement. When the time and date are finally set, a definite appointment should be made with the representative.