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CLASSIFICATIONS		RATE AND FRINGE BENEFITS	
ASBESTOS/INSULATION WORKERS: (Mechanical only)		BASE RATE	$12.00
BOILERMAKERS:		BASE RATE	$23.95
		FRINGE BENEFITS	12.04
BRICKLAYERS:		BASE RATE	$12.50
CARPENTERS:			
Carpenters:	BUILDING	BASE RATE	$10.00
Piledrivermen:	BUILDING	BASE RATE	$18.13
		FRINGE BENEFITS	11.32
Carpenters:	HEAVY & HIGHWAY	BASE RATE	$24.84
		FRINGE BENEFITS	10.31
Piledrivermen:	HEAVY & HIGHWAY	BASE RATE	$25.09
		FRINGE BENEFITS	10.31
Divers:	HEAVY & HIGHWAY	BASE RATE	$31.05
		FRINGE BENEFITS	5.68
CEMENT MASONS:		BASE RATE	$8.75
LECTRICIANS:	BUILDING	BASE RATE	$21.31
		FRINGE BENEFITS	5.65
ELECTRICIANS:	HEAVY & HIGHWAY	*BASE RATE	$23.50
		FRINGE BENEFITS	7.73

*When electricians are required to work from Bosum chairs, trusses, stacks, tanks, scaffolds, or catwalks, radio and TV towers, structural steel-open, unprotected, unfloored raw steel, bridges, or similar hazardous locations where workmen are subject to a direct fall (except for work performed using JLG's and bucket trucks up to 75 ft.): 50' to 75' – add 25% above workman's straight time rate; over 75' -- add 50% above workman's straight time rate.

ELEVATOR CONSTRUCTORS:		BASE RATE	$16.00
		FRINGE BENEFITS	3.20

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CLASSIFICATIONS		RATE AND FRINGE BENEFITS	
BELL, HARLAN & PERRY COUNTIES:			
GLAZIERS:		BASE RATE	$7.39
LESLIE COUNTY:			
GLAZIERS:		BASE RATE	$9.05
IRONWORKERS:	BUILDING	BASE RATE	$8.65
Structural:	HEAVY & HIGHWAY	BASE RATE	$18.45
		FRINGE BENEFITS	5.80
Reinforcing:	HEAVY & HIGHWAY	BASE RATE	$18.25
		FRINGE BENEFITS	5.80

LABORERS:

BUILDING GROUP 1:
General laborers, asbestos abatement laborer, toxic waste removal laborer, water boys, tool room checker, carpenter tenders, (civil engineer helper, rodman, grade checkers excluding all field work performed by engineering firms), concrete pouring and curing, concrete form stripping and wrecking, hand digging and backfilling of ditches, clearing of right of ways and building sites, wood sheeting and shoring, signalman for concrete bucket and general cleaning, and environmental laborer - nuclear, radiation, toxic and hazardous waste - Level D:

BUILDING	*BASE RATE	$15.48
	FRINGE BENEFITS	7.12

BUILDING GROUP 2:
All air tool operators, air track drills, asphalt rakers, tampers, batchers plant and scale man, chain saw, concrete saw, electric hand grinder, all electric bush and chipping hammers, flagmen, forklift operators, form setter (street or highway), metal form setters, heaters, mesh handlers on walkways, streets and roadways outside building, gunnite laborers, hand spiker, introflax burning rod, joint makers, mason tenders, multi-trade tender, pipe layers, plaster tenders, powderman helpers, power driven Georgia buggies, power posthole diggers, railroad laborers, sandblaster laborers, scow man and deck hand, signal man, sweeper and cleaner machines, vibrator operators, walk behind trenching machines, mortar mixer machines, water pumpmen, and environmental laborers-nuclear, radiation, toxic and hazardous waste - Level C:

BUILDING	*BASE RATE	$15.88
	FRINGE BENEFITS	7.12

BUILDING GROUP 3:
Gunnite nozzleman and gunnite nozzle machine operator, sand blaster nozzleman, concrete or grout pumpman, plaster pumpman:

BUILDING	*BASE RATE	$16.08
	FRINGE BENEFITS	7.12

CLASSIFICATIONS RATE AND FRINGE BENEFITS

LABORERS: BUILDING (Continued)

BUILDING GROUP 4:
Powderman and blaster, and environmental laborer - nuclear, radiation, toxic and hazardous waste - Level B:

BUILDING	*BASE RATE	$16.18
	FRINGE BENEFITS	7.12

BUILDING GROUP 5:
Caisson holes (6 ft. and over) pressure and free air including tools, construction specialist, and environmental laborer-nuclear, radiation, toxic and hazardous waste - Level A:

BUILDING	*BASE RATE	$16.68
	FRINGE BENEFITS	7.12

BUILDING GROUP 6:
Tunnel man and tunnel sand miner, cofferdam (pressure and free air), sand hog or mucker (pressure or free air):

BUILDING	*BASE RATE	$16.98
	FRINGE BENEFITS	7.12

LABORERS ON BUILDING: *Employees handling chemically treated materials which are harmful to the skin shall receive an additional $.25 above base rate. Any employee working on high work such as towers or smoke stacks or any type of work putting the employee 50 feet above the ground or a solid floor shall receive an additional $.50 per hour above the base rate. Any employee working on boilers, kilns, melting tanks, furnaces, or when refractory is done using live fire, drying fires, heatups or any hot work shall receive an additional 25% premium above the base rate.

LABORERS/ HEAVY HIGHWAY:

HEAVY HIGHWAY GROUP 1:
Aging and curing of concrete (any mode or method), asbestos abatement worker, asphalt plant laborers, asphalt laborers, batch truck dumpers, carpenter tenders, cement mason tenders, cleaning of machines, concrete laborers, demolition laborers, dredging laborers, drill helper, environmental laborer - nuclear, radiation, toxic and hazardous waste - Level D, flagmen, grade checkers, all hand digging and hand back filling, highway marker placers, landscaping laborers, mesh handlers and placers, puddler, railroad laborers, rip-rap and grouters, right of way laborers, sign, guard rail and fence installers (all types), signal men, sound barrier installer, storm and sanitary sewer laborers, swampers, truck spotters and dumpers, and wrecking of concrete forms, general cleanup:

HEAVY & HIGHWAY	BASE RATE	$19.86
	FRINGE BENEFITS	9.55

CLASSIFICATIONS		RATE AND FRINGE BENEFITS	
HEAVY HIGHWAY LABORERS (continued):			
HEAVY HIGHWAY GROUP 2: Batter board men (sanitary and storm sewer), brickmason tenders, mortar mixer operator, scaffold builders, burner and welder, bushhammers, chain saw operator, concrete saw operators, deckhand scow man, dry cement handlers, environmental laborers - nuclear, radiation, toxic and hazardous waste - Level C, forklift operators for masonry, form setters, green concrete cutting, hand operated grouter and grinder machine operator, jack hammers, lead paint abatement, pavement breakers, paving joint machine, pipe layers-laser operators (non-metallic), plastic pipe fusion, power driven Georgia buggy or wheelbarrow, power post hole diggers, precast manhole setters, walk-behind tampers, walk-behind trenchers, sand blasters, concrete chippers, surface grinders, vibrator operators, wagon drillers:	HEAVY & HIGHWAY	BASE RATE FRINGE BENEFITS	$20.11 9.55
HEAVY HIGHWAY GROUP 3: Asphalt luteman and rakers, gunnite nozzleman, gunnite operators and mixers, grout pump operator, side rail setters, rail paved ditches, screw operators, tunnel laborers (free air), and water blasters:	HEAVY & HIGHWAY	BASE RATE FRINGE BENEFITS	$20.16 9.55
HEAVY HIGHWAY GROUP 4: Caisson workers (free air), cement finishers, environmental laborer - nuclear, radiation, toxic and hazardous waste - Levels A and B, miners and drillers (free air), tunnel blasters, and tunnel muckers (free air), directional and horizontal boring, air track driller (all types), powder man and blaster, troxler and concrete tester if laborer is utilized:	HEAVY & HIGHWAY	BASE RATE FRINGE BENEFITS	$20.76 9.55
MARBLE, TILE & TERRAZZO:		BASE RATE	$15.63
MILLWRIGHTS:	BUILDING	BASE RATE	$7.25
	HEAVY	BASE RATE FRINGE BENEFITS	$12.41 1.15
	HIGHWAY	BASE RATE FRINGE BENEFITS	$11.51 1.15

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CLASSIFICATIONS RATE AND FRINGE BENEFITS

OPERATING ENGINEERS:

Articulating Dump, auto patrol, batcher plant, bituminous paver, cableway, central compressor plant, clamshell, concrete mixer (21 cf or over), concrete pump, crane, crusher plant, derrick, derrick boat, directional boring machine, ditching and trenching machine, all types of loaders, forklift (regardless of lift height), GPS systems (on equipment within the classification), hoe-type machine, hoist (1-drum when used for stack or chimney construction or repair), hoistng engineer (2 or more drums), laser or remote controlled equipment (whtin the classification), locomotive, motor scrapper, carry-all scoop, bulldozer, heavy duty welder, mechanic, orangepeel bucket, piledriver, power blade, motor grader, roller (bituminous), scarifier, shovel, tractor shovel, truck crane, winch truck, push dozer, highlift, all types of boom cats, core drill, hopto, tow or push boat, a-frame winch truck, concrete paver, gradeall, hoist, hyster, pumpcrete, ross carrier, boom, tail boom, rotary drill, hydro hammer, muchking machine, rock spreader attached to equipment, scoopmobile, KeCal loader, tower cranes (French, German and other types, h6drocrane, backfiller, gurries, subgrader, tunnel mining machines including moles, shields, or similar types of tunnel mining equipment.

BUILDING	*BASE RATE	$20.50
	FRINGE BENEFITS	9.15

***Crane operators with CCO certification shall receive fifty cents (.50) above wage rate.Operators on cranes with boom one-hundred fifty feet (150') and over including jib, shall reeive seventy-five (.75) above wage rate. All cranes with piling leads will receive fifty cents (.50) above wage rate regardless of boom length. Combination rate shall mean fifty cents (.50) per hour above the basic hourly rate of pay.**

All air compressors over 900 cfm, bituminous mixer, joint sealing machine, concrete mixer under 21 cu ft, form grader, roller (rock), tractor (50 HP and over), bull float, finish machine, outboard motor boat, flexplane, firemen, boom type tamping machine, greaser on grease facilities servicing heavy equipment, switchman or brakeman, mechanic helper, whirley oiler, self-propelled compactor, tractair and road widening trencher and farm tractor with attachements (except backhoe, highlift and endloader), elevator (regardless of ownership when used for hoisting any building material), hoisting engineer (1-drum or buck hoist), Firebrick masonry excluded), well points, grout pump, throttle-valve man, tugger, electric vibrator compactor, and caisson drill helper.

BUILDING	BASE RATE	$17.76
	FRINGE BENEFITS	9.15

Bituminous distributor, cement gun, coveyor, mud jack, paving joint machine, roller (earth), tamping machine, tractors under 50 HP, vibrator oiler, concrete saw, burlap and curing machine, truck crane oiler, hydro-seeder, power form handling equipment, deckhand steersman, hydraulic post driver, and drill helper.

BUILDING	BASE RATE	$16.99
	FRINGE BENEFITS	9.15

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CLASSIFICATIONS RATE AND FRINGE BENEFITS

OPERATING ENGINEERS/ HEAVY HIGHWAY:

HEAVY HIGHWAY CLASS A:

Auto patrol, batcher plant, bituminous paver, cable way, clamshell, concrete mixer (21 cf or over), concrete pump, crane, crusher plant, derrick, derrick boat, ditching and trenching machine, dragline, dredge engineer, elevator (regardless of ownership when used for hosting any build material), elevating grader and all types of loaders, hoe-type machine, hoisting engine, locomotive, LeTourneau or carry all scoop, bulldozer, mechanic, orangepeel bucket, piledriver, power blade roller, (bituminous), roller (earth), roller (rock), scarifer, shovel, tractor shovel, truck crane, well points, winch truck, push dozer, grout pump, high lift, fork lift (regardless of lift height), all types of boom cats, multiple operator, core drill, tow or push boat, A-frame winch truck, concrete paver, gradeall, hoist, hyster, material pump, pumpcrete, ross carrier, sheep foot, sideboom, throttle valve man, rotary drill, power generator, mucking machine, rock spreader attached to equipment, scoopmobile, KeCal loader, tower cranes (French, German and other types), hydrocrane, tugger, backfiller gurries, self propelled compactor, self contained hydraulic percussion drill.

HEAVY & HIGHWAY	BASE RATE	$23.30
	FRINGE BENEFITS	8.30

HEAVY HIGHWAY CLASS B:

All air compressors 200 cfm or greater, bituminous mixer, concrete mixer under 21 cf, welding machine, form grader, tractor 50 HP & over, bull float, finish machine, outboard motor boat, brakeman, mechanic helper, whirly oiler, tractair and road widening wrencher, articulating trucks.

HEAVY & HIGHWAY	BASE RATE	$20.40
	FRINGE BENEFITS	8.30

HEAVY HIGHWAY CLASS B2:

Greaser on grease facilities service heavy equipment:

HEAVY & HIGHWAY	BASE RATE	$20.60
	FRINGE BENEFITS	8.30

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CLASSIFICATIONS		RATE AND FRINGE BENEFITS	
HEAVY HIGHWAY OPERATING ENGINEERS (continued)			
HEAVY HIGHWAY CLASS C:			
Bituminous distributor, cement gun, conveyor, mud jack, paving joint machine, pump, tamping machine, tractors (under 50 HP), vibrator, oiler, air compressors (under 200 cfm capacity), concrete saw, burlap and curing machine, hydro seeder, power form handling equipment, deckhand oiler, hydraulic post driver:			
	HEAVY & HIGHWAY	BASE RATE FRINGE BENEFITS	$19.99 8.30
PAINTERS:	BUILDING	BASE RATE	$11.00
	HEAVY & HIGHWAY	BASE RATE FRINGE BENEFITS	$17.30 3.80
BELL, HARLAN & PERRY COUNTIES:			
PLASTERERS:		BASE RATE	$13.30
LESLIE COUNTY:			
PLASTERERS:		BASE RATE	$8.25
PLUMBERS & STEAMFITTERS:		BASE RATE	$14.00
ROOFERS: (Excluding metal roofs)	BASE RATE	$13.00	
SHEETMETAL WORKERS: (Including metal roofs)		BASE RATE FRINGE BENEFITS	$10.88 .46
SPRINKLER FITTERS:		BASE RATE FRINGE BENEFITS	$27.05 12.90

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CLASSIFICATIONS		RATE AND FRINGE BENEFITS	
BUILDING TRUCK DRIVERS:			
Truck Drivers:	BUILDING	BASE RATE	$7.33
HEAVY & HIGHWAY TRUCK DRIVERS:			
Truck helper and warehouseman:	HEAVY & HIGHWAY	BASE RATE	$18.90
		FRINGE BENEFITS	8.30
Driver, winch truck & A-frame truck when used in transporting material:			
	HEAVY & HIGHWAY	BASE RATE	$19.00
		FRINGE BENEFITS	8.30
Driver, semi-trailer or pole trailer, dump truck, tandem axle, and driver of distributors:			
	HEAVY & HIGHWAY	BASE RATE	$19.10
		FRINGE BENEFITS	8.30
Driver on mixer trucks - all types:	HEAVY & HIGHWAY	BASE RATE	$19.15
		FRINGE BENEFITS	8.30
Truck mechanic:	HEAVY & HIGHWAY	BASE RATE	$19.20
		FRINGE BENEFITS	8.30
Driver, 3 tons & under, tire changer & truck mechanic helper:	HEAVY & HIGHWAY	BASE RATE	$19.23
		FRINGE BENEFITS	8.30
Driver of pavement breakers:	HEAVY & HIGHWAY	BASE RATE	$19.25
		FRINGE BENEFITS	8.30
Driver, over 3 tons & truck mounted rotary drill:			
	HEAVY & HIGHWAY	BASE RATE	$19.44
		FRINGE BENEFITS	8.30
Driver, Euclid & other heavy earth moving equipment & low boy:			
	HEAVY & HIGHWAY	BASE RATE	$20.01
		FRINGE BENEFITS	8.30

CLASSIFICATIONS		RATE AND FRINGE BENEFITS	
HEAVY HIGHWAY TRUCK DRIVERS (continued):			
Greaser on greasing facilities:	HEAVY & HIGHWAY	BASE RATE	$20.10
		FRINGE BENEFITS	8.30

END OF DOCUMENT CR-5-031
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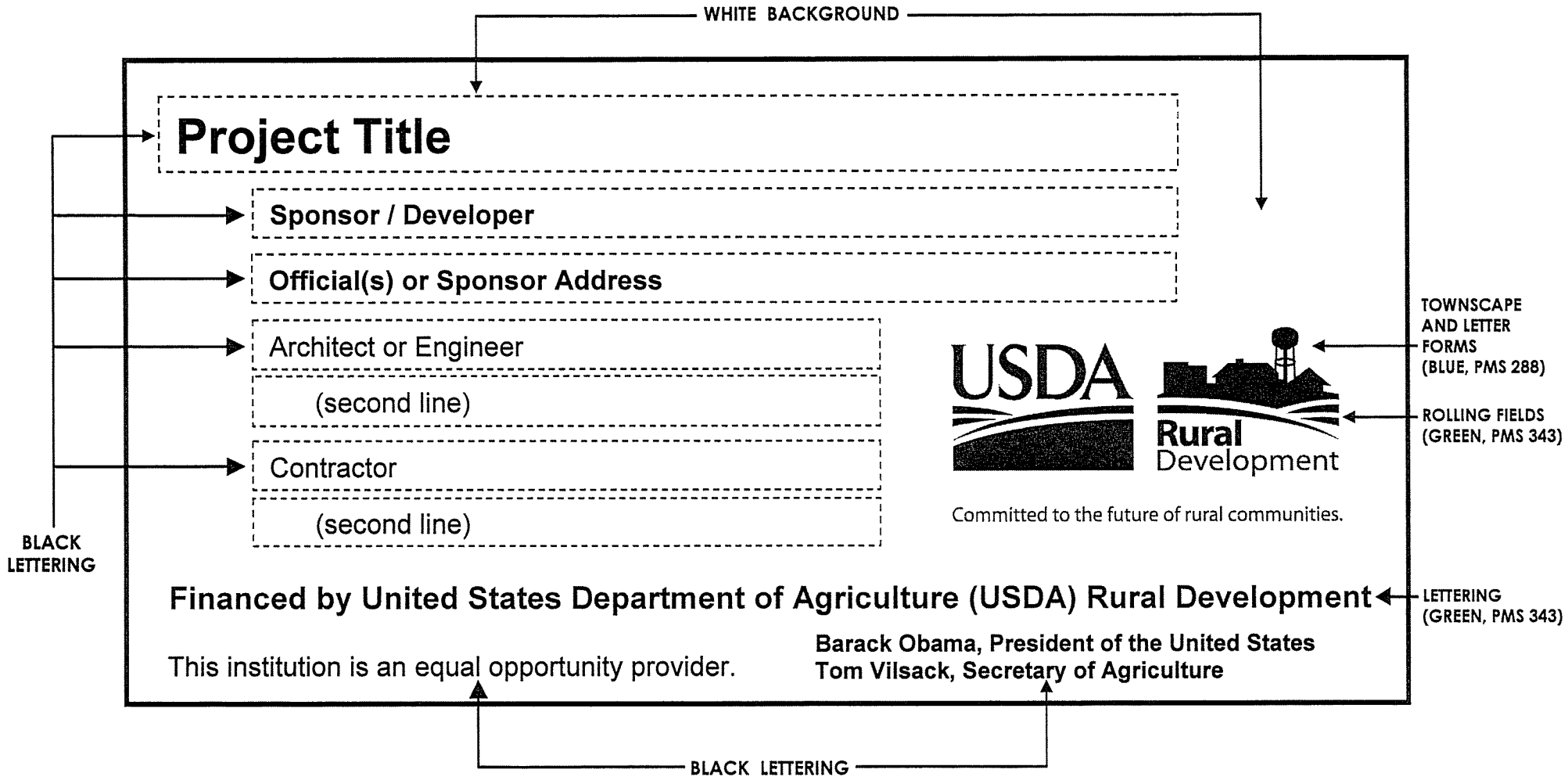
TEMPORARY CONSTRUCTION SIGN FOR RURAL DEVELOPMENT PROJECTS



SIGN DIMENSIONS: 1200 mm x 2400 mm x 19 mm (approx. 4' x 8' x ¾")
PLYWOOD PANEL (APA RATED A-B GRADE–EXTERIOR)

Project Title

Sponsor / Developer

Official(s) or Sponsor Address

Architect or Engineer

(second line)

Contractor

(second line)

Blue
Red
White
Green

KENTUCKY
AT WORK

Red
Blue

White and
Blue Star

Financed by the American Recovery and Reinvestment Act
and the United States Enviromental Protection Agency

This institution is an equal opportunity provider.

Barack Obama, President of the United States
Steven L. Beshear, Governor

SIGN DIMENSIONS: **1200 mm x 19 mm (approx. 4' x 8' x 3/4")**
PLYWOOD PANEL (APA RATED A-B GRADE-EXTERIOR)

White Background, Black Lettering, Emblems should be the colors represented above.

A color version of this sign will be supplied to the winning bidder.
A color version of this sign can be e-mailed to any bidder upon request.

TECHNICAL SPECIFICATIONS

KY 38 KLONDIKE WATER DISTRIBUTION PROJECT
CONTRACT 1: KY 38 KLONDIKE WATER LINE EXTENSIONS
Harlan County, Kentucky

FOR

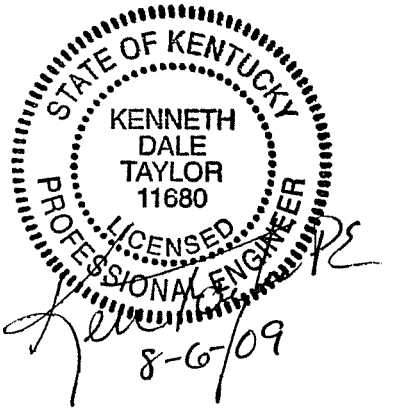
BLACK MOUNTAIN UTILITY DISTRICT
609 Four Mile Road
Baxter, KY 40806

PREPARED BY:

KENVIRONS, INC.
452 VERSAILLES ROAD
FRANKFORT, KY 40601

PROJECT NO. 2006176

February, 2009



SECTION 01001

SPECIAL CONDITIONS

1.0 DESCRIPTION OF THE WORK AND DESIGNATION OF OWNER

These Specifications and accompanying Drawings describe the work to be done and the materials to be furnished for the construction of the project entitled "KY 38 Klondike Water Distribution Project – Contract 1: KY 38 Klondike Water Line Extensions".

All references to the Owner in these Specifications, Contract Documents and plans shall mean the Black Mountain Utility District.

2.0 AVAILABLE FUNDS

The attention of all Bidders is directed to the fact that funds will be made available for the award of the contract through USDA Rural Development, the American Recovery and Reinvestment Act (ARRA) of 2009, and Coal Severance Funds.

3.0 TIME OF COMPLETION

The time allowed for completion of this contract is 210 calendar days.

The time allowed for completion shall begin at midnight, local time, on the date which the Owner, or his authorized representative, the Engineer, shall instruct the Contractor in writing to start work, but no later than 10 days after Notice to Proceed.

Additional time will be allowed the Contractor to cover approved over-runs or additions to the contract in the same proportion that the said over-run or addition in net monetary value bears to the original amount; the total of said additional time to be computed to the nearest whole calendar day.

4.0 LIQUIDATED DAMAGES

It is understood that time is the essence of this contract and that the Owner will sustain damages, monetary and otherwise, in the event of delay in completion of the work hereby contracted.

Therefore, if the said Contractor shall neglect, fail or refuse to complete the work within the time herein specified, or any proper extension thereof granted by the Owner, then the Contractor does hereby agree, as a part of the consideration for the awarding of these contracts, to pay to the Owner the amount specified in the

contract, not as a penalty but as liquidated damages for such breach of contract as hereinafter set forth, for each and every calendar day that the Contractor shall be in default after the time stipulated in the Contract for completing the work.

The said amount is fixed and agreed upon by and between the Contractor and the Owner because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages the Owner would in such event sustain, and said amount is agreed to be the amount of damages which the Owner would sustain and said amount shall be retained from time to time by the Owner from current periodical estimates.

Liquidated damages are fixed at $500 per calendar day of over-run beyond the date set for completion or authorized extension thereof.

5.0 INSURANCE

Insurance is to be furnished by the Contractor for the benefit of the Owner, Contractor, and Subcontractors as their interests may appear. The minimum amounts of insurance coverage to be furnished under these contracts, in accordance with the applicable provisions of the General Conditions, are listed in the Supplementary Conditions.

6.0 PERFORMANCE AND PAYMENT BOND

The Contractor shall furnish separate performance and payment bonds issued by an approved bonding company in an amount at least equal to one hundred percent (100%) of the contract price, as security for the faithful performance of this contract and for the payment of persons performing labor and furnishing materials in connection with this contract. These bonds shall be executed by a company authorized to do business in the State of Kentucky and shall be signed or countersigned by a Kentucky resident agent. Bonds shall remain in effect for one year after date of final acceptance of the work.

7.0 SITE DIMENSIONS

All Contractors furnishing materials and equipment for this contract shall obtain exact dimensions at the site. Scale or figure dimensions on the drawings and details show the correct size under ideal conditions and shall not, under any circumstances, be so construed as to relieve the Contractor from responsibility for taking measurements at the site and furnishing materials or equipment of the correct size.

8.0 DAMAGE TO EQUIPMENT STORED AND/OR IN PLACE PRIOR TO INITIAL OPERATION

Any equipment damaged or which has been subjected to possible damage by reason of inundation, improper storage and/or protection during the construction period of project, shall be handled only as follows:

a) Be replaced with new equipment.

b) With approval of the Engineer, be returned to the manufacturer of the equipment, or his authorized repair agency, for inspection and repair provided, however, that such repair after inspection will place the equipment in new condition, and restore the manufacturer's guarantee the same as for new equipment.

9.0 SALVAGED MATERIALS AND EQUIPMENT

The use of second hand and/or salvaged materials will not be permitted, unless specifically provided for in the detailed specifications. Materials and equipment shall be new when turned over to the Owner.

10.0 TEMPORARY FACILITIES

a) Build and maintain temporary offices and storage sheds as necessary for the work. Location of temporary buildings shall be subject to the approval of the Engineer.

b) Provide temporary heat, light and power required by the work. Temporary telephone service shall be provided in the job office paid for by the General Contractor, except that the party placing a long distance call shall pay the toll charge.

c) Each Contractor shall construct and maintain, in a sanitary condition, sanitary facilities for his employees and also employees of his subcontractors. At completion of the contract work these sanitary facilities shall be properly disposed of as directed by the Engineer.

d) Temporary construction for safety measures, hoists and scaffolds shall be erected in accordance with the General Conditions.

e) Construction yard shall be located on job site. Provide security and safety protection.

f) The obtaining of all utilities for construction, including power and water, shall be the responsibility of the Contractor, and he shall bear the cost of all utilities used for construction. Cost of all connections and facilities for use of utilities shall be borne by the Contractor.

11.0 PROPERTY PROTECTION

Care is to be exercised by the Contractor in all phases of construction to prevent damage and injury to the Owner's or other property.

In connection with work performed on "private property" (property other than that belonging to the Owner), the Contractor shall confine his equipment, the storage of materials, and the operation of his workmen to the limits indicated on the plans, or to lands and right-of-way provided for the project by the Owner, and shall take every precaution to avoid damage to the private property Owner's buildings, grounds and facilities.

Fences, hedges, shrubs, etc. within the construction limits shall be carefully removed, preserved, and replaced when the construction is completed. Where ditches or excavations cross lawns, the sod shall be removed carefully and replaced when the backfilling has been completed. If sod is damaged or not handled properly, it shall be replaced with new sod equal to existing sod at the Contractor's expense. Grassed areas, other than lawns, shall be graded, fertilized and seeded when construction is completed. When construction is completed the private property Owner's facilities and grounds shall be restored to as good or better condition than found as quickly as possible at the Contractor's expense.

12.0 CONFLICT WITH OR DAMAGE TO EXISTING UTILITIES AND FACILITIES

Insofar as location data is available to the Engineers, existing underground utilities (such as waterlines, sewer lines, gas lines, telephone conduits, etc.) are accurately located on the drawings. Due, however, to the approximate nature of much of this data, the location of any particular facility cannot be certified to be correct. In general, locations and elevations shown are approximate only.

Before proceeding with the work, the Contractor shall confer with all public or private companies, agencies, or departments that own and operate utilities in the vicinity of the construction work. The purpose of the conference is to verify the location of, and possible interference with, the existing utilities that are shown on the Plans, arrange for necessary suspension of service, and make arrangements to locate and avoid interference with all utilities that are not shown on the Plans.

13.0 CONTROL OF EROSION

The Contractor shall be responsible for control of siltation and erosion from the project work. Control shall include all necessary ditching, check dams, mulching, etc. to prevent deposition of materials in roadside ditches. The Owner shall incur no extra costs from such work.

14.0 MEASUREMENT AND PAYMENT

14.1. MEASUREMENT OF QUANTITIES

All Work completed under the Agreement will be measured by the ENGINEER according to United States standard measure.

14.1.1. Unless otherwise specified, measurement of concrete quantities will include only that volume within the neat lines as shown on the Plans or as altered by the ENGINEER to fit field conditions. The prismoidal formula will be used in computing the volumes of structures, or portions of structures, having end sections of unequal areas.

14.1.2. All items which are measured by the linear foot, such as pipe, will be measured along the centerline distance of the installed item with no allowance for connections, fittings or laps at connections.

14.1.3. In computing volumes of excavation, borrow and embankments, the average end-area method will be used. For the purpose of ascertaining quantities, it is agreed that the planimeter shall be considered an instrument of precision adapted to the measurement of areas.

14.2 LUMP SUM

When a complete structure or structural unit (in effect, "lump sum" work) is specified as the unit of measurement, the unit will be construed to include all necessary fittings and accessories.

14.3 PLAN QUANTITIES

When the plan quantities for a specific portion of the Work are designated as the pay quantities in the Contract Documents, they shall be the final quantities for which payment for such specific portion of the Work will be made, unless the dimensions of said portions of the Work shown on the plans are revised by the ENGINEER. When revised dimensions result in an increase or decrease in the quantities of such Work, the final quantities for payment will be revised in the amount represented by the authorized changes in dimensions.

14.4 ACTUAL QUANTITIES

When actual quantities for a specific portion of the Work are designated as the pay quantities in the Contract Documents, they shall be the final quantities for which payment for such specific portion of the Work will be made. The actual quantities will be determined by the difference in field measurements and cross sections before and after construction.

14.5 SCOPE OF PAYMENT

The contract unit prices whether based on lump sum, plan quantities or actual quantities for the various bid items of the Contract Documents shall be considered full compensation for all labor, materials, supplies, equipment, tools, and all things of whatever nature required for the complete incorporation of the item into the Work the same as though the items were to read "in Plan" unless the Contract Documents provide otherwise.

14.6 PAYMENTS

Estimates for payment, partial payments and final payments shall be in accordance with and follow procedures set forth in the General Conditions and Supplementary Conditions.

15.0 ACCESS ROADS

15.1 The CONTRACTOR, CONTRACTOR'S employees and all trucks delivering equipment, supplies or materials to the project shall use the access roads shown in the Plans for entering and leaving the project sites.

16.0 TESTING LABORATORY SERVICES

16.1 GENERAL

16.1.1 Work Included. From time to time during progress of the Work, the OWNER may require that testing be performed to determine that materials provided for the Work meet the specified requirements; such testing includes, but is not necessarily limited to:

1) Material Compaction
2) Cast-In-Place Concrete

16.1.2 Related Work Described Elsewhere. Requirements for testing may be described in various Sections of these Specifications; where no testing requirements are described, but the OWNER decides that testing is required, the OWNER may require testing to be performed under current pertinent standards for testing.

16.1.3 Selection of Testing Laboratory. The OWNER will select a testing laboratory.

16.1.4 Codes and Standards. Testing, when required, will be in accordance with all pertinent codes and regulations and with selected standards of the American Society for Testing and Materials.

16.1.5 Product Handling. The CONTRACTOR shall promptly process and distribute all required copies of test reports for which he is responsible and related instructions to ensure all necessary retesting and/or replacement of materials with the least possible delay in progress of the Work.

16.2 PAYMENT FOR TESTING SERVICES

16.2.1 Initial Services. The OWNER will pay for all initial testing services required by the OWNER unless specified differently in the specification related to that item.

16.2.2 Retesting. When initial tests indicate non-compliance with the Contract Documents, all subsequent retesting made necessary by the non-compliance shall be performed by a testing laboratory selected by the CONTRACTOR and approved by the ENGINEER and the costs thereof will be paid directly by the CONTRACTOR.

16.2.3 CONTRACTOR'S Convenience Testing. Inspection or testing performed exclusively for the CONTRACTOR'S convenience shall be the sole responsibility of the CONTRACTOR.

16.3 EXECUTION

16.3.1 Cooperation with Testing Laboratory. Representatives of the testing laboratory shall have access to the Work at all times. The CONTRACTOR shall provide facilities for such access in order that the laboratory may properly perform its functions.

16.3.2 Schedules for Testing.

16.3.2.1 Establishing Schedule. By advance discussion with the testing laboratory selected by the OWNER, the CONTRACTOR shall allow for the time required for the laboratory to perform its tests and to issue each of its findings. The CONTRACTOR shall allow for this time within the construction schedule.

16.3.2.2 Revising Schedule. When changes of construction schedule are necessary during construction, the CONTRACTOR shall coordinate all such changes of schedule with the testing laboratory as required.

16.3.2.3 Adherence to Schedule. When the testing laboratory is ready to test according to the determined schedule but is prevented from testing or taking specimens due to incompleteness of the Work, all extra costs for testing attributed to the delay may be back-charged to the CONTRACTOR and shall not be borne by the OWNER.

16.3.3 Taking Specimens. All specimens and samples for testing, unless otherwise provided in these Contract Documents, will be taken by the testing laboratory; all sampling equipment and personnel will be provided by the testing laboratory; and all deliveries of specimens and samples to the testing laboratory will be performed by the testing laboratory.

17.0 SUBMITTALS AND SUBSTITUTIONS

17.1 GENERAL

17.1.1 Work Included. Wherever possible throughout the Contract Documents, the minimum acceptable quality of workmanship and materials has been defined either by manufacturer's name and catalog number or by reference to recognized industry standards. To insure that the specified products are furnished and installed in accordance with design intent, procedures have been established for advance submittal of design data and for its review and approval or rejection by the ENGINEER.

17.1.2 Related Work Described Elsewhere.

17.1.2.1 Contractual requirements for submittals are described in the General Conditions and Supplementary Conditions.

17.1.2.2 Individual submittals required are described in the pertinent sections of these Specifications.

17.2 SUBSTITUTIONS

17.2.1 ENGINEER'S Approval Required. The Agreement is based on the materials, equipment, and methods described in the Contract Documents. The ENGINEER will consider proposals for substitution of materials, equipment, and methods only when such proposals are accompanied by full and complete technical data and all other information required by the ENGINEER to evaluate the proposed substitution. Do not substitute materials, equipment, or methods unless such substitution has been specifically approved for this Work by the ENGINEER.

17.2.2 "Or Equal". Where the phrase "or equal" occurs in the Contract Documents, do not assume that material, equipment, or methods will be approved as equal by the ENGINEER unless the item has been specifically approved for this Work. The decision of the ENGINEER shall be final.

17.2.3 Availability of Specified Items. The CONTRACTOR shall verify prior to bidding that all specified items will be available in time for installation during orderly and timely progress of the Work. In the event the specified item or items

will not be so available, the CONTRACTOR shall notify the ENGINEER prior to receipt of Bids.

17.3 IDENTIFICATION OF SUBMITTALS

The CONTRACTOR shall completely identify each submittal and resubmittal by showing at least the following information:

1) Name and address of submitter, plus name and telephone number of the individual who may be contacted for further information.

2) Name of project as it appears in these Specifications.

3) Drawing number and Specifications Section number to which the submittal applies.

4) Whether this is an original submittal or resubmittal.

17.4 COORDINATION OF SUBMITTALS

17.4.1 General. Prior to submittal for ENGINEER'S review, the CONTRACTOR shall use all means necessary to fully coordinate all material, including the following procedures:

1) Determine and verify all field dimensions and conditions, materials, catalog numbers, and similar data.

2) Coordinate as required with all trades and with all public agencies involved.

3) Secure all necessary approvals from public agencies and others and signify by stamp, or other means, that they have been secured.

4) Clearly indicate all deviations from the Contract Documents.

17.4.2 Grouping of Submittals. Unless otherwise specifically permitted by the ENGINEER, the CONTRACTOR shall make all submittals in groups containing all associated items; the ENGINEER may reject partial submittals as not complying with the provisions of the Contract Documents.

17.5 TIMING OF SUBMITTALS

The CONTRACTOR shall make all submittals far enough in advance of schedule dates of installation to provide all required time for reviews, for securing necessary approvals, for possible revision and resubmittal, and for placing orders and securing delivery. In scheduling, allow at least five full working days for the ENGINEER'S review following his receipt of the submittal.

18.0 INSTALLATION REQUIREMENTS

Manufactured articles, materials, and equipment shall be applied, installed, connected, erected, used, cleaned, and conditioned as directed by the respective manufacturers, unless otherwise specified.

19.0 PROOF OF COMPLIANCE

Whenever the Contract Documents require that a product be in accordance with Federal specification, ASTM designation, ANSI specification, or other association standard, the CONTRACTOR shall present an affidavit from the manufacturer certifying that the product complies therewith. Where requested or specified, the CONTRACTOR shall submit supporting test data to substantiate compliance.

20.0 PROJECT RECORD DOCUMENTS

20.1 As the Work progress, the CONTRACTOR shall keep a complete and accurate record of changes or deviations from the Contract Documents and the Shop Drawings, indicating the Work as actually installed. Changes shall be neatly and correctly shown on the respective portion of the affected document, using blackline prints of the Drawings affected, or the Specifications, with appropriate supplementary notes. This record set of Drawings, Shop Drawings, and Specifications shall be kept at the job site for inspection by the ENGINEER.

20.2 The records above shall be arranged in order, in accordance with the various sections of the Specifications, and properly indexed. Prior to application for final payment, and as a condition to its approval by the ENGINEER, deliver the record Drawings and Specifications, arranged in proper order, indexed, and endorsed as hereinbefore specified.

20.3 No review or receipt of such records by the ENGINEER or OWNER shall be a waiver of any deviation from the Contract Documents or the Shop Drawings or in any way relieve the CONTRACTOR from his responsibility to perform the Work in accordance with the Contract Documents and the Shop Drawings to the extent they are in accordance with the Contract Documents.

21.0 PROJECT MEETINGS

The CONTRACTOR'S Superintendent for the Work shall attend project meetings as required by either the OWNER or ENGINEER.

22.0 VIDEO TAPE

The line CONTRACTOR, before proceeding with any work, shall make or have made a video of all areas where work is to be performed and a copy of this video cassette shall be furnished to the ENGINEER to review for completeness. This video shall be utilized as backup and reference for claims and cleanup.

23.0 DAILY REPORTS

The project inspector, as designated by the OWNER and/or ENGINEER, will keep a daily record of materials installed. This daily report will be used by the OWNER and the ENGINEER to determine the payments due to the CONTRACTOR. The CONTRACTOR shall sign the inspector's daily report each day. Should the contractor disagree with the inspector's report, the differences shall be resolved before the end of the next day, with the Contractor signing the daily report.

24.0 FINAL ADJUSTMENT OF QUANTITIES

Upon completion of the project, a final adjusting change order will be written to reconcile the differences between the bid quantities and the actual quantities installed. This final adjusting change order will be determined based on the inspector's daily reports.

SECTION 02405

DIRECTIONAL DRILLING

1.0 GENERAL

Directional drilling construction methods shall be used as shown in the plans and as directed by the Engineer.

2.0 MATERIALS

2.1 POLYETHYLENE PIPE

The polyethylene base resin shall meet all requirements of ASTM D-1248 for type III, Class B or C, Grade P34, Category 5 and has a PPI rating of PE3408 by the Plastic Pipe Institute.

Polyethylene pipe shall conform with ASTM D-3350 "Polyethylene Plastic Pipe and Fitting Materials" for high density pressure pipe manufactured of grade P34 resin material with a hydrostatic-design basis (HDB) rating of 1,600 psi at 73.4 degrees F (23 degrees C).

High-density polyethylene pipe shall be manufactured and tested in conformance to the requirements of the latest revision of the American Society for Testing and Materials designation ASTM D-3350, "Polyethylene Plastic Pipe and Fitting Materials". High-density polyethylene pipe shall have a grade designation of PE 3408 and a cell classification designation of PE 345434C. No material shall be used in the pipe or fittings, which has been demonstrated to be detrimental to water quality.

All pipe shall meet AWWA C906 standards and shall be clearly marked on each joint of pipe.

High density polyethylene pipe shall be joined by means of butt fusion as per manufacturer's recommendations.

The high-density polyethylene pipe used as a carrier pipe shall be SDR-9 (or rated for higher pressures). Polyethylene pipe used as a casing pipe shall be SDR-11 (or rated for higher pressures). There shall be a minimum of ½" clearance in all directions between the outside diameter of the carrier pipe and inside diameter of the casing pipe. Polyethylene pipe shall be as manufactured by Phillips Driscopipe, Inc. or approved equal.

3.0 EXECUTION

The directional drilling shall use a bentonite type drilling fluid to act as a lubricant and to fill the void between the polyethylene casing pipe and the bore hole. The CONTRACTOR shall be careful in the depth and direction of the bore to not disturb the creek or river bottom or banks. Casing pipe will be required for all creek crossings. The casing pipe shall be pulled through the bore hole and the polyethylene carrier pipe will be pulled through the casing pipe.

4.0 PAYMENT

The unit price bid for directional drilling shall be full compensation for supplying the carrier pipe and casing pipe, and all material, labor, equipment, and tools for the construction of the sewer line by directional drilling. Payment will be made by the unit price bid for each Directional Bore Crossing entered on the Bid Schedule.

SECTION 11210

BLACK BOTTOM BOOSTER PUMP STATION

1.0 GENERAL

The Contractor shall furnish all labor, tools, equipment, materials, and perform all work and services necessary for or incidental to the furnishing and complete installation of the water booster pump station as shown on the drawings and as specified in accordance with provisions of the contract documents and completely coordinated with that of all other trades including the radio telemetry controls specified in Section 13850.

Although such work is not specifically shown or specified, all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure, complete, and compatible installation shall be furnished and installed as part of this work.

Where an "Or Approved Equal" clause is provided on the plans and/or in the specifications, it is intended that the approved equal or alternate material or equipment be approved in writing by the Engineer.

The Contractor shall submit complete manufacturers information on all individual items that make up the booster pump station and will provide 24" x 36" drawings with at least three (3) different views of vault. Submit six (6) individually bound booklets for approval.

The Contractor shall furnish and install the booster pump station, with all the necessary piping, controls, and appurtenances as shown on the plans and as specified herein. The booster pump station shall be complete with all necessary equipment.

The manufacturer of this equipment shall be one recognized and established in the design and production of water booster pump stations. The booster pump station manufacturer shall maintain regular production facilities at their place of business. Those facilities shall be open for inspection by a representative of the owner at the time during construction and testing of this equipment. Manufacturer shall have not less than five (5) similar installations in the U.S. and shall have been in business manufacturing water booster pump station under the same name for not less than five (5) years.

2.0 MATERIALS

2.1 BOOSTER PUMPS - GENERAL

The booster pumps employed within the water booster pumping station shall meet the hydraulic and drive data as set forth in the specification section titled, "Operating Conditions". The installation of the booster pumps shall be as shown on the plans covering this project.

Prior to acceptance of an equipment proposal covering the booster pumping station, detailed data shall be furnished to the Engineer or the Owner and shall include the following booster pump information:

1. A data sheet covering each pump completely filled in.

2. Performance Curve showing expected performance at points other than the design conditions. Curve shall show head, capacity, efficiency, and horsepower based on performance and shall cover the complete operating range of the pump from zero capacity to the maximum capacity. The curve is to also include a net positive suction head required curve.

3. Drawings of the proposed equipment giving general dimensions sufficient to determine how the equipment is to be supported and if it will fit within the space available.

2.1.1 Operating Conditions. Each pump station shall contain two (2) pumps. All pumps shall operate on three phase, 230/460 volt electrical service. Pumps shall be the indicated Grundfos model or approved equal pump.

	gpm	TDH	Hp	rpm	Model
Black Bottom	165	100	7 ½	3500	CR 32-2-2

2.2 PUMP STATION BUILDING

The building shall be of concrete block and shall have the dimensions as shown on the plans.

All concrete shall be Class "A" in accordance with KTC Specification 601. All reinforcing steel shall conform to KTC Specification 811. Non-matching corner blocks will not be accepted.

The 42 inch metal door shall be Ceco Regent or approved equal 1 ¾-inch flush metal door with vinyl closure to fit aluminum threshold. The door shall swing to the outside.

All interior piping, valves, pumps and metal surfaces shall receive one coat of primer if needed and two coats of Tnemec 66 HB Epoxoline or approved equal. Also, one coat of primer if needed. Finish coat shall be gray in color.

2.3 PIPING

All internal transmission piping and fitting shall be of Schedule 40 black, seamless steel pipe and will be manufactured in accordance with the dimensional tolerances and materials specifications of the AWWA C-200 for steel pipe and steel butt-weld fittings. Piping within the part of the unit shall be sized as shown on drawings.

2.4 GATE VALVES

See Section 15110, Article 2.2.

2.5 COMPRESSION COUPLINGS

Each pump suction and discharge pump run shall include a compression type, flexible coupling to prevent binding of the pump, pump suction or control valve. Each coupling shall consist of two (2) follower rings, a flared middle ring with end flares generous enough to provide adequate gasket seat areas, two (2) resilient rubber gaskets and steel bolts. The coupling when installed shall provide a permanent, leak-proof, flexible installation.

In lieu of a compression coupling, a restrained, removable flange such as Uni-Flange or a flanged coupling adapter (FCA) may be used to relieve strain on a pump or control valve. The flanged coupling adapter will be of the same manufacturer as the compression couplings used elsewhere in the building and shall be a regular product of that manufacturer. Flanged coupling adapters shall be complete on the flanged end with an integral rubber flange gasket and on the open end with a triangular section rubber follower gasket and follower ring. Bolts for the flanged coupling adapter will be individual to the FCA and be supplied with the FCA.

2.6 PRESSURE GAUGES

All pressure gauges within the booster pumping station shall have 4 1/2-inch minimum diameter faces. The case shall be black, cast aluminum, flanged back type with close type ring and clear glass face. The gauge connections shall be at the bottom of the gauge and will be 1/4-inch N.P.T. The gauge internal construction shall include phosphor bronze bourdon tube with a brass movement, bronze bushed independently mounted. Pressure gauge range and scale graduations shall be in feet of water and psi. Each gauge shall be protected by a combination pulsation dampener - shut off valve. Gauges shall be wall mounted

as detailed on the drawings. A total of two (2) gauges shall be installed as follows:

Suction: 0-160 pounds
Pump Discharge: 0-200 pounds

2.7 NON SLAM CHECK VAVLES

Each pump discharge pipe run shall include a wafer-type, non-slam check valve. The body of the check valve shall be semi-steel. The plug, seat and guide bushings shall be bronze and conform to ASTM Designation B-143. The valve spring and seat retainers shall be stainless steel and conform to ASTM Designation A-276. The valve plug shall be guided at both ends by a center shaft integral with the valve plug. Alignment of the center shaft shall be provided through the usage of guide bushings. The check valve shall be designed to prevent water hammer by returning the valve plug to the seat before reversal of flow occurs. The check valves shall be designed so as to be easly repaired in the field. Screwed in valve seats will not be accepted. The valves shall be as shown on drawing and be rated for 300 psi.

2.8 DEHUMIDIFER

A packaged dehumidifier with a sealed refrigeration type compressor rated at 1/5 h.p., 5.0 full load amps and 420 watts shall be wall mounted within the building in such a manner that the condensate shall drain to the outside. The dehumidifier shall operate on a 120 volt, single phase A.C. power source and be provided with a safety protected power cord of UL approved 3 wire construction with 3 spade plug. The dehumidifier shall be capable of removing twenty-seven (27) pints of water in twenty-four (24) hours when the room temperature is 80 degrees F and at 60 percent relative humidity (AHAM Standard DH-1). The dehumidifier shall be actuated by a dial-controlled adjustable humidistat which will automatically cycle the unit at preselected moisture levels. The humidistat shall also have "Off" and "Continuous Run" positions. The dehumidifier shall be listed by Underwriters Laboratories.

2.9 HEATER

The heater will have a rating of 1650 watts, 5,630 BTU-HR output when operating on a 240 volt, single phase A.C. power source. The heater will be equipped with a 600 rpm low speed axial vane blower designed to deliver 175 cfm of down flow air and be driven by a four (4) pole motor. The heating element shall be of the sealed tubular type with large parallel steel fins for quick heat transfer. The heater will be complete with a thermal overload cut off and a built in thermostat calibrated to provide a range of 55 degrees Fahrenheit to 85 degrees Fahrenheit.

The heater shall be wall mounted, hand wired and complete with an individual 240 volt circuit, protected by a 2-pole, 15 amp circuit breaker. The heater will be listed with Underwriters Laboratories, NEMA Standard 3-9-1967, HEZ-Z-02 Type 1.

2.10 EXHAUST FAN

There shall be one (1) exhaust fan. The fan capacity shall be 232 cfm at 0.2 inch static pressure (inches of water). The fan shall feature a shaded pole motor with a squirrel cage blower. The blower wheel shall be statically balanced to assure quiet performance and maximum air delivery. The fan motor will be complete with a conduit box. The exhaust fan shall operate on an independent 120 volt, single phase A.C. power source with single pole, 15 amp circuit breaker protection. Automatic control of the exhaust fan shall be by thermostat, air conditioning type (make on the rise) wired in parallel with a three (3) position maintained (H-O-A) selector switch located on the face of the main control panel. The exhaust fan control equipment shall be wall mounted in a receptacle box expressly designated for that purpose and in a location convenient for the use intended.

2.11 LIGHTING

There shall be two (2), two (2) tube, 40 watt per tube, rapid start, "OSHA" approved enclosed and gasketed fluorescent light fixture installed. If one (1) light fixture is installed, it shall be located directly over the main control panel and be of forty-eight inch (48") minimum length. The light switch shall be of the night glow type and be located by the entry door. This switch also turns on exhaust blower. Open or incandescent fixtures without OSHA approval will not be accepted.

2.12 GRATING

The grading bearing bars, cross bars, and band bars shall be aluminum alloy 6063-T6 conforming to ASTM B221.

A. Bearing Bar Spacing: 1-3/16 inches maximum

B. Cross Bar Spacing: 4 inches maximum

C. Top Surface: Plain

D. Finish: Mill finished

E. Maximum Deflection: 1/4-inch for the spans shown in the PLANS.

F. Walkway Design Loading: 100 lbf per square foot over the clear spans as shown in the PLANS.

Special Area Design Loadings: None

2.12.1 ALUMINUM GRATING FRAMES

A. Frames shall have mitered corners and welded joints and shall be sized to match grating depth.

B. Vertical and horizontal legs of frame shall have ¼" wall thickness. Frame shall be equipped with concrete anchoring pegs.

C. Surfaces coming in contact with concrete shall be painted with one coat of bituminous paint.

2.13 METER

The 3-inch meter shall be a Sensus Model W-350-DRS Meter or approved equal. The meter shall be equipped with a test plug. The meter shall read in U.S. gallons. All piping shall be ductile iron flange pipe.

3.0 EXECUTION

3.1 ELECTRICAL APPARATUS – SWITCH GEAR

The electrical apparatus shall consist of all equipment associated with motor control and motor starting, including the equipment used to protect the electrical facilities. All circuit breakers, motor starters, time delay relays and control relays, shall be incorporated into one (1) NEMA 1 control panel. The electrical service shall be 230 volt, 3 phase, 60 cycle 3 wire.

There shall be provided, thermal-magnetic trip circuit breakers as required in each pump station.

One (1) Main Breaker, 100 amp
Two (2) Branch Breakers, one each per pump, 20 amps
One (1) Transformer Breaker, Primary Size, 20 amps
Eight (8) Auxiliary Circuit Breakers, as follows:

1. Controls
2. Lights
3. Heater
4. Telemetry
5. Exhaust Fan
6. Convenience Outlets
7. Dehumidifier - Sump Pump
8. Spare

Pump starting equipment shall be three (3) phase, full voltage magnetic starters connecting the pump motor directly across the line complete with overload relay with correctly sized heater elements on each line.

All electrical work shall be done in accordance with applicable electric codes.

Elapsed run timers shall be provided for each pump mounted in the panel face, to indicate in hours, the amount of time each pump has been in operation. A phase/voltage sensing relay shall be provided.

3.2 ELECTRICAL APPARATUS - DEVICES

Two (2) time delay relays shall be provided to perform the following functions:

1. Low Suction Timer

The time delay relays shall be solid state plug in type. Interchangeability of the timers shall not disturb control wiring. Timers shall be provided with a red neon light to indicate timing cycle. The timers shall be adjustable.

Hand-off automatic switches shall be oil tight, 3 position maintained and be located on the main control panel door and control the following circuits:

1. Pump #1
2. Pump #2
3. Exhaust Fan
4. Telemetry Test (2)

Indicating lights to indicate equipment operation shall be oil tight, with a full voltage pilot light. Indicating lights shall be provided in the colors and functions as follows:

1. Red - Low Suction Pressure
2. Green - Pump #1 in Operation
3. Green - Pump #2 in Operation

Nameplates shall be furnished on all panels front mounted switches and lights. Name tags shall also indicate proper nomenclature of control panel internal parts.

The control panel door shall include a plastic pocket on the interior to hold one (1) copy of the panel wiring diagram. The wiring diagram shall be corrected "As-Built" copy and contain individual wire numbers, circuit breaker numbers, switch designations and control function explanations.

3.3 WIRING

It shall be the responsibility of the installing electrician to furnish and install the correct size service wires from the service pole to the connection terminals inside the power or control panel designated for that purpose. No splice will be allowed in the service wires. It shall also be the responsibility of the installing electrician to furnish and install, if required, any exterior disconnects or other switching mechanisms.

All wiring within the building and outside of the control panel or panels shall be run in conduit except for the watertight flexible conduit and fittings properly used to connect pump drivers, fan motors, solenoid valves, limit switches, etc., where flexible connections are best utilized. Such accessories as the sump pump and dehumidifier, when furnished by the original manufacturer with a UL approved rubber cord and plug, may be plugged into polarized receptacles designated for that purpose. All internal equipment conduit and wire will meet or exceed the conduit, wiring schedule and electrical codes set forth as follows:

3.3.1 Service Entrance. Rigid, heavy wall, hot dipped galvanized steel conduit with threaded watertight connections adequately sized to handle the type, number and size of the incoming service conductors - in compliance with Article 346 of the National Electrical Code.

3.3.2 Interior Conduit. Rigid, heavy wall, Schedule 40 PVC with solvent weld moisture-proof connections adequately sized to handle the typed number and size of equipment conductors to be carried - in compliance with Article 347 of the National Electrical Code and NEMA TC-2, Federal WC-1094A and UL-651 Underwriters Laboratory Specifications.

3.3.3 Flexible Connections. Where flexible conduit connections are necessary, the conduit used shall be liquid-tight flexible metal conduit having an outer no-metallic, sunlight resistant jacket over an inner flexible metal cord, sized to handle the type, number and size of equipment conductors to be carried - in compliance with Article 351 of the National Electrical Code.

3.3.4 Motor Circuit Conductors. Sized for load. All branch circuit conductors supplying a single motor of one (1) h.p. or more full load current rating, type THHN, asset forth in Article 310 and 430-B of the National Electrical Code, Schedule 310-13 for flame retardant, heat resistant thermoplastic, copper conductors in nylon or equivalent outer covering.

3.3.5 Control and Accessory Wiring. Sized for load, type MTW/AWM (Machine Tool Wire/Appliance Wiring Material) as set forth in Article 310 and 670 of the National Electrical Code, Schedule 310-13 and NFPA standard 79 for flame retardant, moisture, heat and oil resistant thermoplastic, copper conductors in compliance with NMTBA and as listed by Underwriter's Laboratories (AWM),

except where accessories are furnished with a manufacturer supplied UL approved rubber cord and plug. Four (4) duplex, grounding type, three (3) wire, polarized convenience receptacles shall be furnished about the periphery of the building. One (1) duplex receptacle shall be adjacent to the main control panel. The equipment ground wire from each equipment ground post of the polarized receptacles shall be affixed at the main control panel terminal board solely designated for that purpose and separated from the neutral buss.

3.4 FACTORY START UP SERVICE

After the water booster pump station has been completely installed including the electrical service, and has been put under pressure by the installer, then a factory service representative will be scheduled to visit the job site and put the booster station into trouble free, automatic operation.

The service representative will spend one (1) full day at the job site. In addition to his start-up duties he shall explain and demonstrate the operation of the booster pump station to a representative of the Owner. Two (2) bound copies of the booster pump station Maintenance and Operation Manual shall be supplied.

3.5 POWER

The Contractor shall have the required power service installed in his name and said service shall be his responsibility until such time as the station is tested and accepted by the Engineer and Owner for use.

3.6 DISSIMILAR METALS

Where aluminum surfaces come into contact with dissimilar metals, surfaces shall be kept from direct contact by painting the dissimilar metal with two coats of bituminous paint or other approved insulating material.

Where aluminum surfaces come into contact with dissimilar materials such as concrete, masonry or lime mortar, exposed aluminum surfaces shall be painted with two coat of bituminous paint or other approved insulating material.

4.0 PAYMENT

The unit price for the lump sum item for the Black Bottom Pump Station shall constitute full payment for furnishing, installing, making fully operable, and furnishing the required power service for that pump station.

SECTION 11211

CLOVER-DARBY BOOSTER PUMP STATION

1.0 GENERAL

The Contractor shall furnish all labor, tools, equipment, materials, and perform all work and services necessary for or incidental to the furnishing and complete installation of the water booster pump station as shown on the drawings and as specified in accordance with provisions of the contract documents and completely coordinated with that of all other trades including the radio telemetry controls specified in Section 13850.

Although such work is not specifically shown or specified, all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure, complete, and compatible installation shall be furnished and installed as part of this work.

Where an "Or Approved Equal" clause is provided on the plans and/or in the specifications, it is intended that the approved equal or alternate material or equipment be approved in writing by the Engineer.

The Contractor shall submit complete manufacturers information on all individual items that make up the booster pump station and will provide 24" x 36" drawings with at least three (3) different views of vault. Submit six (6) individually bound booklets for approval.

The Contractor shall furnish and install the booster pump station, with all the necessary piping, controls, and appurtenances as shown on the plans and as specified herein. The booster pump station shall be complete with all necessary equipment.

The manufacturer of this equipment shall be one recognized and established in the design and production of water booster pump stations. The booster pump station manufacturer shall maintain regular production facilities at their place of business. Those facilities shall be open for inspection by a representative of the owner at the time during construction and testing of this equipment. Manufacturer shall have not less than five (5) similar installations in the U.S. and shall have been in business manufacturing water booster pump station under the same name for not less than five (5) years.

2.0 MATERIALS

2.1 BOOSTER PUMPS - GENERAL

The booster pumps employed within the water booster pumping station shall meet the hydraulic and drive data as set forth in the specification section titled, "Operating Conditions". The installation of the booster pumps shall be as shown on the plans covering this project.

Prior to acceptance of an equipment proposal covering the booster pumping station, detailed data shall be furnished to the Engineer or the Owner and shall include the following booster pump information:

1. A data sheet covering each pump completely filled in.

2. Performance Curve showing expected performance at points other than the design conditions. Curve shall show head, capacity, efficiency, and horsepower based on performance and shall cover the complete operating range of the pump from zero capacity to the maximum capacity. The curve is to also include a net positive suction head required curve.

3. Drawings of the proposed equipment giving general dimensions sufficient to determine how the equipment is to be supported and if it will fit within the space available.

2.1.1 Operating Conditions. Each pump station shall contain two (2) pumps. All pumps shall operate on three phase, 230/460 volt electrical service. Pumps shall be the indicated Grundfos model or approved equal pump.

	gpm	TDH	Hp	rpm	Model
Clover-Darby	120	140	7 ½	3500	CR 20-3

2.2 PUMP STATION BUILDING

The building shall be of concrete block and shall have the dimensions as shown on the plans.

All concrete shall be Class "A" in accordance with KTC Specification 601. All reinforcing steel shall conform to KTC Specification 811. Non-matching corner blocks will not be accepted.

The 42 inch metal door shall be Ceco Regent or approved equal 1 ¾-inch flush metal door with vinyl closure to fit aluminum threshold. The door shall swing to the outside.

All interior piping, valves, pumps and metal surfaces shall receive one coat of primer if needed and two coats of Tnemec 66 HB Epoxoline or approved equal. Also, one coat of primer if needed. Finish coat shall be gray in color.

2.3 PIPING

All internal transmission piping and fitting shall be of Schedule 40 black, seamless steel pipe and will be manufactured in accordance with the dimensional tolerances and materials specifications of the AWWA C-200 for steel pipe and steel butt-weld fittings. Piping within the part of the unit shall be sized as shown on drawings.

2.4 GATE VALVES

See Section 15110, Article 2.2.

2.5 COMPRESSION COUPLINGS

Each pump suction and discharge pump run shall include a compression type, flexible coupling to prevent binding of the pump, pump suction or control valve. Each coupling shall consist of two (2) follower rings, a flared middle ring with end flares generous enough to provide adequate gasket seat areas, two (2) resilient rubber gaskets and steel bolts. The coupling when installed shall provide a permanent, leak-proof, flexible installation.

In lieu of a compression coupling, a restrained, removable flange such as Uni-Flange or a flanged coupling adapter (FCA) may be used to relieve strain on a pump or control valve. The flanged coupling adapter will be of the same manufacturer as the compression couplings used elsewhere in the building and shall be a regular product of that manufacturer. Flanged coupling adapters shall be complete on the flanged end with an integral rubber flange gasket and on the open end with a triangular section rubber follower gasket and follower ring. Bolts for the flanged coupling adapter will be individual to the FCA and be supplied with the FCA.

2.6 PRESSURE GAUGES

All pressure gauges within the booster pumping station shall have 4 1/2-inch minimum diameter faces. The case shall be black, cast aluminum, flanged back type with close type ring and clear glass face. The gauge connections shall be at the bottom of the gauge and will be 1/4-inch N.P.T. The gauge internal construction shall include phosphor bronze bourdon tube with a brass movement, bronze bushed independently mounted. Pressure gauge range and scale graduations shall be in feet of water and psi. Each gauge shall be protected by a combination pulsation dampener - shut off valve. Gauges shall be wall mounted

as detailed on the drawings. A total of two (2) gauges shall be installed as follows:

Suction: 0-160 pounds
Pump Discharge: 0-200 pounds

2.7 NON SLAM CHECK VAVLES

Each pump discharge pipe run shall include a wafer-type, non-slam check valve. The body of the check valve shall be semi-steel. The plug, seat and guide bushings shall be bronze and conform to ASTM Designation B-143. The valve spring and seat retainers shall be stainless steel and conform to ASTM Designation A-276. The valve plug shall be guided at both ends by a center shaft integral with the valve plug. Alignment of the center shaft shall be provided through the usage of guide bushings. The check valve shall be designed to prevent water hammer by returning the valve plug to the seat before reversal of flow occurs. The check valves shall be designed so as to be easly repaired in the field. Screwed in valve seats will not be accepted. The valves shall be as shown on drawing and be rated for 300 psi.

2.8 DEHUMIDIFER

A packaged dehumidifier with a sealed refrigeration type compressor rated at 1/5 h.p., 5.0 full load amps and 420 watts shall be wall mounted within the building in such a manner that the condensate shall drain to the outside. The dehumidifier shall operate on a 120 volt, single phase A.C. power source and be provided with a safety protected power cord of UL approved 3 wire construction with 3 spade plug. The dehumidifier shall be capable of removing twenty-seven (27) pints of water in twenty-four (24) hours when the room temperature is 80 degrees F and at 60 percent relative humidity (AHAM Standard DH-1). The dehumidifier shall be actuated by a dial-controlled adjustable humidistat which will automatically cycle the unit at preselected moisture levels. The humidistat shall also have "Off" and "Continuous Run" positions. The dehumidifier shall be listed by Underwriters Laboratories.

2.9 HEATER

The heater will have a rating of 1650 watts, 5,630 BTU-HR output when operating on a 240 volt, single phase A.C. power source. The heater will be equipped with a 600 rpm low speed axial vane blower designed to deliver 175 cfm of down flow air and be driven by a four (4) pole motor. The heating element shall be of the sealed tubular type with large parallel steel fins for quick heat transfer. The heater will be complete with a thermal overload cut off and a built in thermostat calibrated to provide a range of 55 degrees Fahrenheit to 85 degrees Fahrenheit.

The heater shall be wall mounted, hand wired and complete with an individual 240 volt circuit, protected by a 2-pole, 15 amp circuit breaker. The heater will be listed with Underwriters Laboratories, NEMA Standard 3-9-1967, HEZ-Z-02 Type 1.

2.10 EXHAUST FAN

There shall be one (1) exhaust fan. The fan capacity shall be 232 cfm at 0.2 inch static pressure (inches of water). The fan shall feature a shaded pole motor with a squirrel cage blower. The blower wheel shall be statically balanced to assure quiet performance and maximum air delivery. The fan motor will be complete with a conduit box. The exhaust fan shall operate on an independent 120 volt, single phase A.C. power source with single pole, 15 amp circuit breaker protection. Automatic control of the exhaust fan shall be by thermostat, air conditioning type (make on the rise) wired in parallel with a three (3) position maintained (H-O-A) selector switch located on the face of the main control panel. The exhaust fan control equipment shall be wall mounted in a receptacle box expressly designated for that purpose and in a location convenient for the use intended.

2.11 LIGHTING

There shall be two (2), two (2) tube, 40 watt per tube, rapid start, "OSHA" approved enclosed and gasketed fluorescent light fixture installed. If one (1) light fixture is installed, it shall be located directly over the main control panel and be of forty-eight inch (48") minimum length. The light switch shall be of the night glow type and be located by the entry door. This switch also turns on exhaust blower. Open or incandescent fixtures without OSHA approval will not be accepted.

2.12 GRATING

The grading bearing bars, cross bars, and band bars shall be aluminum alloy 6063-T6 conforming to ASTM B221.

A. Bearing Bar Spacing: 1-3/16 inches maximum

B. Cross Bar Spacing: 4 inches maximum

C. Top Surface: Plain

D. Finish: Mill finished

E. Maximum Deflection: 1/4-inch for the spans shown in the PLANS.

F. Walkway Design Loading: 100 lbf per square foot over the clear spans as shown in the PLANS.

Special Area Design Loadings: None

2.12.1 ALUMINUM GRATING FRAMES

A. Frames shall have mitered corners and welded joints and shall be sized to match grating depth.

B. Vertical and horizontal legs of frame shall have ¼" wall thickness. Frame shall be equipped with concrete anchoring pegs.

C. Surfaces coming in contact with concrete shall be painted with one coat of bituminous paint.

2.13 METER

The 3-inch meter shall be a Sensus Model W-350-DRS Meter or approved equal. The meter shall be equipped with a test plug. The meter shall read in U.S. gallons. All piping shall be ductile iron flange pipe.

3.0 EXECUTION

3.1 ELECTRICAL APPARATUS – SWITCH GEAR

The electrical apparatus shall consist of all equipment associated with motor control and motor starting, including the equipment used to protect the electrical facilities. All circuit breakers, motor starters, time delay relays and control relays, shall be incorporated into one (1) NEMA 1 control panel. The electrical service shall be 230 volt, 3 phase, 60 cycle 3 wire.

There shall be provided, thermal-magnetic trip circuit breakers as required in each pump station.

One (1) Main Breaker, 100 amp
Two (2) Branch Breakers, one each per pump, 20 amps
One (1) Transformer Breaker, Primary Size, 20 amps
Eight (8) Auxiliary Circuit Breakers, as follows:

1. Controls
2. Lights
3. Heater
4. Telemetry
5. Exhaust Fan
6. Convenience Outlets
7. Dehumidifier - Sump Pump
8. Spare

Pump starting equipment shall be three (3) phase, full voltage magnetic starters connecting the pump motor directly across the line complete with overload relay with correctly sized heater elements on each line.

All electrical work shall be done in accordance with applicable electric codes.

Elapsed run timers shall be provided for each pump mounted in the panel face, to indicate in hours, the amount of time each pump has been in operation. A phase/voltage sensing relay shall be provided.

3.2 ELECTRICAL APPARATUS - DEVICES

Two (2) time delay relays shall be provided to perform the following functions:

1. Low Suction Timer

The time delay relays shall be solid state plug in type. Interchangeability of the timers shall not disturb control wiring. Timers shall be provided with a red neon light to indicate timing cycle. The timers shall be adjustable.

Hand-off automatic switches shall be oil tight, 3 position maintained and be located on the main control panel door and control the following circuits:

1. Pump #1
2. Pump #2
3. Exhaust Fan
4. Telemetry Test (2)

Indicating lights to indicate equipment operation shall be oil tight, with a full voltage pilot light. Indicating lights shall be provided in the colors and functions as follows:

1. Red - Low Suction Pressure
2. Green - Pump #1 in Operation
3. Green - Pump #2 in Operation

Nameplates shall be furnished on all panels front mounted switches and lights. Name tags shall also indicate proper nomenclature of control panel internal parts.

The control panel door shall include a plastic pocket on the interior to hold one (1) copy of the panel wiring diagram. The wiring diagram shall be corrected "As-Built" copy and contain individual wire numbers, circuit breaker numbers, switch designations and control function explanations.

3.3 WIRING

It shall be the responsibility of the installing electrician to furnish and install the correct size service wires from the service pole to the connection terminals inside the power or control panel designated for that purpose. No splice will be allowed in the service wires. It shall also be the responsibility of the installing electrician to furnish and install, if required, any exterior disconnects or other switching mechanisms.

All wiring within the building and outside of the control panel or panels shall be run in conduit except for the watertight flexible conduit and fittings properly used to connect pump drivers, fan motors, solenoid valves, limit switches, etc., where flexible connections are best utilized. Such accessories as the sump pump and dehumidifier, when furnished by the original manufacturer with a UL approved rubber cord and plug, may be plugged into polarized receptacles designated for that purpose. All internal equipment conduit and wire will meet or exceed the conduit, wiring schedule and electrical codes set forth as follows:

3.3.1 Service Entrance. Rigid, heavy wall, hot dipped galvanized steel conduit with threaded watertight connections adequately sized to handle the type, number and size of the incoming service conductors - in compliance with Article 346 of the National Electrical Code.

3.3.2 Interior Conduit. Rigid, heavy wall, Schedule 40 PVC with solvent weld moisture-proof connections adequately sized to handle the typed number and size of equipment conductors to be carried - in compliance with Article 347 of the National Electrical Code and NEMA TC-2, Federal WC-1094A and UL-651 Underwriters Laboratory Specifications.

3.3.3 Flexible Connections. Where flexible conduit connections are necessary, the conduit used shall be liquid-tight flexible metal conduit having an outer no-metallic, sunlight resistant jacket over an inner flexible metal cord, sized to handle the type, number and size of equipment conductors to be carried - in compliance with Article 351 of the National Electrical Code.

3.3.4 Motor Circuit Conductors. Sized for load. All branch circuit conductors supplying a single motor of one (1) h.p. or more full load current rating, type THHN, asset forth in Article 310 and 430-B of the National Electrical Code, Schedule 310-13 for flame retardant, heat resistant thermoplastic, copper conductors in nylon or equivalent outer covering.

3.3.5 Control and Accessory Wiring. Sized for load, type MTW/AWM (Machine Tool Wire/Appliance Wiring Material) as set forth in Article 310 and 670 of the National Electrical Code, Schedule 310-13 and NFPA standard 79 for flame retardant, moisture, heat and oil resistant thermoplastic, copper conductors in compliance with NMTBA and as listed by Underwriter's Laboratories (AWM),

except where accessories are furnished with a manufacturer supplied UL approved rubber cord and plug. Four (4) duplex, grounding type, three (3) wire, polarized convenience receptacles shall be furnished about the periphery of the building. One (1) duplex receptacle shall be adjacent to the main control panel. The equipment ground wire from each equipment ground post of the polarized receptacles shall be affixed at the main control panel terminal board solely designated for that purpose and separated from the neutral buss.

3.4 FACTORY START UP SERVICE

After the water booster pump station has been completely installed including the electrical service, and has been put under pressure by the installer, then a factory service representative will be scheduled to visit the job site and put the booster station into trouble free, automatic operation.

The service representative will spend one (1) full day at the job site. In addition to his start-up duties he shall explain and demonstrate the operation of the booster pump station to a representative of the Owner. Two (2) bound copies of the booster pump station Maintenance and Operation Manual shall be supplied.

3.5 POWER

The Contractor shall have the required power service installed in his name and said service shall be his responsibility until such time as the station is tested and accepted by the Engineer and Owner for use.

3.6 DISSIMILAR METALS

Where aluminum surfaces come into contact with dissimilar metals, surfaces shall be kept from direct contact by painting the dissimilar metal with two coats of bituminous paint or other approved insulating material.

Where aluminum surfaces come into contact with dissimilar materials such as concrete, masonry or lime mortar, exposed aluminum surfaces shall be painted with two coat of bituminous paint or other approved insulating material.

4.0 PAYMENT

The unit price for the lump sum item for the Clover-Darby Booster Pump Station shall constitute full payment for furnishing, installing, making fully operable, and furnishing the required power service for that pump station.

SECTION 11212

KY 38 BOOSTER PUMP STATION

1.0 GENERAL

The Contractor shall furnish all labor, tools, equipment, materials, and perform all work and services necessary for or incidental to the furnishing and complete installation of the water booster pump station as shown on the drawings and as specified in accordance with provisions of the contract documents and completely coordinated with that of all other trades including the radio telemetry controls specified in Section 13850.

Although such work is not specifically shown or specified, all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure, complete, and compatible installation shall be furnished and installed as part of this work.

Where an "Or Approved Equal" clause is provided on the plans and/or in the specifications, it is intended that the approved equal or alternate material or equipment be approved in writing by the Engineer.

The Contractor shall submit complete manufacturers information on all individual items that make up the booster pump station and will provide 24" x 36" drawings with at least three (3) different views of vault. Submit six (6) individually bound booklets for approval.

The Contractor shall furnish and install the booster pump station, with all the necessary piping, controls, and appurtenances as shown on the plans and as specified herein. The booster pump station shall be complete with all necessary equipment.

The manufacturer of this equipment shall be one recognized and established in the design and production of water booster pump stations. The booster pump station manufacturer shall maintain regular production facilities at their place of business. Those facilities shall be open for inspection by a representative of the owner at the time during construction and testing of this equipment. Manufacturer shall have not less than five (5) similar installations in the U.S. and shall have been in business manufacturing water booster pump station under the same name for not less than five (5) years.

2.0 MATERIALS

2.1 BOOSTER PUMPS - GENERAL

The booster pumps employed within the water booster pumping station shall meet the hydraulic and drive data as set forth in the specification section titled, "Operating Conditions". The installation of the booster pumps shall be as shown on the plans covering this project.

Prior to acceptance of an equipment proposal covering the booster pumping station, detailed data shall be furnished to the Engineer or the Owner and shall include the following booster pump information:

1. A data sheet covering each pump completely filled in.

2. Performance Curve showing expected performance at points other than the design conditions. Curve shall show head, capacity, efficiency, and horsepower based on performance and shall cover the complete operating range of the pump from zero capacity to the maximum capacity. The curve is to also include a net positive suction head required curve.

3. Drawings of the proposed equipment giving general dimensions sufficient to determine how the equipment is to be supported and if it will fit within the space available.

2.1.1 Operating Conditions. Each pump station shall contain two (2) pumps. All pumps shall operate on three phase, 230/460 volt electrical service. Pumps shall be the indicated Grundfos model or approved equal pump.

	gpm	TDH	Hp	rpm	Model
KY 38	63	250	7 ½	3500	CR-10-8

2.2 PUMP STATION BUILDING

The building shall be of concrete block and shall have the dimensions as shown on the plans.

All concrete shall be Class "A" in accordance with KTC Specification 601. All reinforcing steel shall conform to KTC Specification 811. Non-matching corner blocks will not be accepted.

The 42 inch metal door shall be Ceco Regent or approved equal 1 ¾-inch flush metal door with vinyl closure to fit aluminum threshold. The door shall swing to the outside.

All interior piping, valves, pumps and metal surfaces shall receive one coat of primer if needed and two coats of Tnemec 66 HB Epoxoline or approved equal. Also, one coat of primer if needed. Finish coat shall be gray in color.

2.3 PIPING

All internal transmission piping and fitting shall be of Schedule 40 black, seamless steel pipe and will be manufactured in accordance with the dimensional tolerances and materials specifications of the AWWA C-200 for steel pipe and steel butt-weld fittings. Piping within the part of the unit shall be sized as shown on drawings.

2.4 GATE VALVES

See Section 15110, Article 2.2.

2.5 COMPRESSION COUPLINGS

Each pump suction and discharge pump run shall include a compression type, flexible coupling to prevent binding of the pump, pump suction or control valve. Each coupling shall consist of two (2) follower rings, a flared middle ring with end flares generous enough to provide adequate gasket seat areas, two (2) resilient rubber gaskets and steel bolts. The coupling when installed shall provide a permanent, leak-proof, flexible installation.

In lieu of a compression coupling, a restrained, removable flange such as Uni-Flange or a flanged coupling adapter (FCA) may be used to relieve strain on a pump or control valve. The flanged coupling adapter will be of the same manufacturer as the compression couplings used elsewhere in the building and shall be a regular product of that manufacturer. Flanged coupling adapters shall be complete on the flanged end with an integral rubber flange gasket and on the open end with a triangular section rubber follower gasket and follower ring. Bolts for the flanged coupling adapter will be individual to the FCA and be supplied with the FCA.

2.6 PRESSURE GAUGES

All pressure gauges within the booster pumping station shall have 4 1/2-inch minimum diameter faces. The case shall be black, cast aluminum, flanged back type with close type ring and clear glass face. The gauge connections shall be at the bottom of the gauge and will be 1/4-inch N.P.T. The gauge internal construction shall include phosphor bronze bourdon tube with a brass movement, bronze bushed independently mounted. Pressure gauge range and scale graduations shall be in feet of water and psi. Each gauge shall be protected by a combination pulsation dampener - shut off valve. Gauges shall be wall mounted

as detailed on the drawings. A total of two (2) gauges shall be installed as follows:

Suction: 0-160 pounds
Pump Discharge: 0-200 pounds

2.7 NON SLAM CHECK VAVLES

Each pump discharge pipe run shall include a wafer-type, non-slam check valve. The body of the check valve shall be semi-steel. The plug, seat and guide bushings shall be bronze and conform to ASTM Designation B-143. The valve spring and seat retainers shall be stainless steel and conform to ASTM Designation A-276. The valve plug shall be guided at both ends by a center shaft integral with the valve plug. Alignment of the center shaft shall be provided through the usage of guide bushings. The check valve shall be designed to prevent water hammer by returning the valve plug to the seat before reversal of flow occurs. The check valves shall be designed so as to be easly repaired in the field. Screwed in valve seats will not be accepted. The valves shall be as shown on drawing and be rated for 300 psi.

2.8 DEHUMIDIFER

A packaged dehumidifier with a sealed refrigeration type compressor rated at 1/5 h.p., 5.0 full load amps and 420 watts shall be wall mounted within the building in such a manner that the condensate shall drain to the outside. The dehumidifier shall operate on a 120 volt, single phase A.C. power source and be provided with a safety protected power cord of UL approved 3 wire construction with 3 spade plug. The dehumidifier shall be capable of removing twenty-seven (27) pints of water in twenty-four (24) hours when the room temperature is 80 degrees F and at 60 percent relative humidity (AHAM Standard DH-1). The dehumidifier shall be actuated by a dial-controlled adjustable humidistat which will automatically cycle the unit at preselected moisture levels. The humidistat shall also have "Off" and "Continuous Run" positions. The dehumidifier shall be listed by Underwriters Laboratories.

2.9 HEATER

The heater will have a rating of 1650 watts, 5,630 BTU-HR output when operating on a 240 volt, single phase A.C. power source. The heater will be equipped with a 600 rpm low speed axial vane blower designed to deliver 175 cfm of down flow air and be driven by a four (4) pole motor. The heating element shall be of the sealed tubular type with large parallel steel fins for quick heat transfer. The heater will be complete with a thermal overload cut off and a built in thermostat calibrated to provide a range of 55 degrees Fahrenheit to 85 degrees Fahrenheit.

The heater shall be wall mounted, hand wired and complete with an individual 240 volt circuit, protected by a 2-pole, 15 amp circuit breaker. The heater will be listed with Underwriters Laboratories, NEMA Standard 3-9-1967, HEZ-Z-02 Type 1.

2.10 EXHAUST FAN

There shall be one (1) exhaust fan. The fan capacity shall be 232 cfm at 0.2 inch static pressure (inches of water). The fan shall feature a shaded pole motor with a squirrel cage blower. The blower wheel shall be statically balanced to assure quiet performance and maximum air delivery. The fan motor will be complete with a conduit box. The exhaust fan shall operate on an independent 120 volt, single phase A.C. power source with single pole, 15 amp circuit breaker protection. Automatic control of the exhaust fan shall be by thermostat, air conditioning type (make on the rise) wired in parallel with a three (3) position maintained (H-O-A) selector switch located on the face of the main control panel. The exhaust fan control equipment shall be wall mounted in a receptacle box expressly designated for that purpose and in a location convenient for the use intended.

2.11 LIGHTING

There shall be two (2), two (2) tube, 40 watt per tube, rapid start, "OSHA" approved enclosed and gasketed fluorescent light fixture installed. If one (1) light fixture is installed, it shall be located directly over the main control panel and be of forty-eight inch (48") minimum length. The light switch shall be of the night glow type and be located by the entry door. This switch also turns on exhaust blower. Open or incandescent fixtures without OSHA approval will not be accepted.

2.12 GRATING

The grading bearing bars, cross bars, and band bars shall be aluminum alloy 6063-T6 conforming to ASTM B221.

A. Bearing Bar Spacing: 1-3/16 inches maximum

B. Cross Bar Spacing: 4 inches maximum

C. Top Surface: Plain

D. Finish: Mill finished

E. Maximum Deflection: 1/4-inch for the spans shown in the PLANS.

F. Walkway Design Loading: 100 lbf per square foot over the clear spans as shown in the PLANS.

Special Area Design Loadings: None

2.12.1 ALUMINUM GRATING FRAMES

A. Frames shall have mitered corners and welded joints and shall be sized to match grating depth.

B. Vertical and horizontal legs of frame shall have ¼" wall thickness. Frame shall be equipped with concrete anchoring pegs.

C. Surfaces coming in contact with concrete shall be painted with one coat of bituminous paint.

2.13 METER

The 3-inch meter shall be a Sensus Model W-350-DRS Meter or approved equal. The meter shall be equipped with a test plug. The meter shall read in U.S. gallons. All piping shall be ductile iron flange pipe.

3.0 EXECUTION

3.1 ELECTRICAL APPARATUS – SWITCH GEAR

The electrical apparatus shall consist of all equipment associated with motor control and motor starting, including the equipment used to protect the electrical facilities. All circuit breakers, motor starters, time delay relays and control relays, shall be incorporated into one (1) NEMA 1 control panel. The electrical service shall be 230 volt, 3 phase, 60 cycle 3 wire.

There shall be provided, thermal-magnetic trip circuit breakers as required in each pump station.

One (1) Main Breaker, 100 amp
Two (2) Branch Breakers, one each per pump, 20 amps
One (1) Transformer Breaker, Primary Size, 20 amps
Eight (8) Auxiliary Circuit Breakers, as follows:

1. Controls
2. Lights
3. Heater
4. Telemetry
5. Exhaust Fan
6. Convenience Outlets
7. Dehumidifier - Sump Pump
8. Spare

Pump starting equipment shall be three (3) phase, full voltage magnetic starters connecting the pump motor directly across the line complete with overload relay with correctly sized heater elements on each line.

All electrical work shall be done in accordance with applicable electric codes.

Elapsed run timers shall be provided for each pump mounted in the panel face, to indicate in hours, the amount of time each pump has been in operation. A phase/voltage sensing relay shall be provided.

3.2 ELECTRICAL APPARATUS - DEVICES

Two (2) time delay relays shall be provided to perform the following functions:

1. Low Suction Timer

The time delay relays shall be solid state plug in type. Interchangeability of the timers shall not disturb control wiring. Timers shall be provided with a red neon light to indicate timing cycle. The timers shall be adjustable.

Hand-off automatic switches shall be oil tight, 3 position maintained and be located on the main control panel door and control the following circuits:

1. Pump #1
2. Pump #2
3. Exhaust Fan
4. Telemetry Test (2)

Indicating lights to indicate equipment operation shall be oil tight, with a full voltage pilot light. Indicating lights shall be provided in the colors and functions as follows:

1. Red - Low Suction Pressure
2. Green - Pump #1 in Operation
3. Green - Pump #2 in Operation

Nameplates shall be furnished on all panels front mounted switches and lights. Name tags shall also indicate proper nomenclature of control panel internal parts.

The control panel door shall include a plastic pocket on the interior to hold one (1) copy of the panel wiring diagram. The wiring diagram shall be corrected "As-Built" copy and contain individual wire numbers, circuit breaker numbers, switch designations and control function explanations.

3.3 WIRING

It shall be the responsibility of the installing electrician to furnish and install the correct size service wires from the service pole to the connection terminals inside the power or control panel designated for that purpose. No splice will be allowed in the service wires. It shall also be the responsibility of the installing electrician to furnish and install, if required, any exterior disconnects or other switching mechanisms.

All wiring within the building and outside of the control panel or panels shall be run in conduit except for the watertight flexible conduit and fittings properly used to connect pump drivers, fan motors, solenoid valves, limit switches, etc., where flexible connections are best utilized. Such accessories as the sump pump and dehumidifier, when furnished by the original manufacturer with a UL approved rubber cord and plug, may be plugged into polarized receptacles designated for that purpose. All internal equipment conduit and wire will meet or exceed the conduit, wiring schedule and electrical codes set forth as follows:

3.3.1 Service Entrance. Rigid, heavy wall, hot dipped galvanized steel conduit with threaded watertight connections adequately sized to handle the type, number and size of the incoming service conductors - in compliance with Article 346 of the National Electrical Code.

3.3.2 Interior Conduit. Rigid, heavy wall, Schedule 40 PVC with solvent weld moisture-proof connections adequately sized to handle the typed number and size of equipment conductors to be carried - in compliance with Article 347 of the National Electrical Code and NEMA TC-2, Federal WC-1094A and UL-651 Underwriters Laboratory Specifications.

3.3.3 Flexible Connections. Where flexible conduit connections are necessary, the conduit used shall be liquid-tight flexible metal conduit having an outer no-metallic, sunlight resistant jacket over an inner flexible metal cord, sized to handle the type, number and size of equipment conductors to be carried - in compliance with Article 351 of the National Electrical Code.

3.3.4 Motor Circuit Conductors. Sized for load. All branch circuit conductors supplying a single motor of one (1) h.p. or more full load current rating, type THHN, asset forth in Article 310 and 430-B of the National Electrical Code, Schedule 310-13 for flame retardant, heat resistant thermoplastic, copper conductors in nylon or equivalent outer covering.

3.3.5 Control and Accessory Wiring. Sized for load, type MTW/AWM (Machine Tool Wire/Appliance Wiring Material) as set forth in Article 310 and 670 of the National Electrical Code, Schedule 310-13 and NFPA standard 79 for flame retardant, moisture, heat and oil resistant thermoplastic, copper conductors in compliance with NMTBA and as listed by Underwriter's Laboratories (AWM),

except where accessories are furnished with a manufacturer supplied UL approved rubber cord and plug. Four (4) duplex, grounding type, three (3) wire, polarized convenience receptacles shall be furnished about the periphery of the building. One (1) duplex receptacle shall be adjacent to the main control panel. The equipment ground wire from each equipment ground post of the polarized receptacles shall be affixed at the main control panel terminal board solely designated for that purpose and separated from the neutral buss.

3.4 FACTORY START UP SERVICE

After the water booster pump station has been completely installed including the electrical service, and has been put under pressure by the installer, then a factory service representative will be scheduled to visit the job site and put the booster station into trouble free, automatic operation.

The service representative will spend one (1) full day at the job site. In addition to his start-up duties he shall explain and demonstrate the operation of the booster pump station to a representative of the Owner. Two (2) bound copies of the booster pump station Maintenance and Operation Manual shall be supplied.

3.5 POWER

The Contractor shall have the required power service installed in his name and said service shall be his responsibility until such time as the station is tested and accepted by the Engineer and Owner for use.

3.6 DISSIMILAR METALS

Where aluminum surfaces come into contact with dissimilar metals, surfaces shall be kept from direct contact by painting the dissimilar metal with two coats of bituminous paint or other approved insulating material.

Where aluminum surfaces come into contact with dissimilar materials such as concrete, masonry or lime mortar, exposed aluminum surfaces shall be painted with two coat of bituminous paint or other approved insulating material.

4.0 PAYMENT

The unit price for the lump sum item for the KY 38 Booster Pump Station shall constitute full payment for furnishing, installing, making fully operable, and furnishing the required power service for that pump station.

SECTION 13850

RADIO TELEMETRY - SCADA SYSTEM

1.0 GENERAL

1.1 DESCRIPTION OF WORK

The work to be accomplished under this section shall consist of furnishing and installing the various equipment necessary for a complete control system to function as specified herein and as shown on the drawings. The manufacturer shall furnish and install a completely integrated all solid-state Radio Telemetry Supervisory Control and Data Acquisition (SCADA) system. It shall be the system manufacturer's responsibility to supply a system that is compatible with existing equipment. The original system was installed by EIC Systems Corporation, 101 Tower Circle Drive, Jackson, Missouri 63755 (phone: 573-243-1455). The complete system shall be supplied, installed, and warranted by the telemetry system manufacturer to insure a single source of responsibility.

1.2 SCOPE OF PROJECT

This section provides for the installation of a Radio Telemetry SCADA System. The project is to include three (3) new water tower remote units to monitor the new 47,000 gallon ground storage tanks (Mary Wynn and KY 38) and an existing tank (Closplint) and Booster Pump Station remote units to monitor and control the pumping of the three (3) Booster Pump Stations. The CONTRACTOR is responsible for insuring the Telemetry Controls are compatible with the booster pump station controls specified in Sections 11210–11212.

The Remote Units shall implement a peer-to-peer type control operation. Automatic switch-over to back-up pressure controls for the pump station in the event of "Telemetry Control" failure shall be provided by the telemetry contractor. It shall be the sole responsibility of the CONTRACTOR to plan and implement construction sequences, to follow the plans and specifications and to protect any portions of the work already completed.

1.3 CONTRACTOR SHALL SUPPLY:

A. Shop drawings prior to installation.
B. All the paper work and fees necessary to obtain a license for the Owner.
C. All equipment required by schedule.
D. All wiring and ancillary equipment, hardware, software, and appurtenances needed for proper installation and operation of equipment.

E. All labor for installation and start-up of the system.
F. Operations and maintenance manuals as detailed below.

1.4 POWER AT SITES

Electrical power to the storage tank will be supplied by the CONTRACTOR under this item. The CONTRACTOR shall have the required power service installed in his name and said service shall be his responsibility until such time as the system is tested and accepted by the ENGINEER and OWNER for use. All appurtenances, conduit and wiring for telemetering shall be furnished and installed under this contract. The CONTRACTOR shall coordinate the electrical work to assure appropriate power/wiring is provided to operate the telemetry.

1.5 LOCATION OF REMOTE UNITS

Pertinent location information for the remote units is shown on the plan layout sheet.

2.0 QUALITY ASSURANCE

2.1 MANUFACTURER'S QUALIFICATIONS

The system specified herein shall be the product of a manufacturer who can demonstrate at least five (5) years of satisfactory experience in furnishing and installing comparable radio telemetry/control systems for water and wastewater installations.

The manufacturer of this system shall maintain a 24 hour available inventory of all replaceable modules to assure the Owner of prompt maintenance service and a single source of responsibility. The manufacture shall certify this to the Engineer in writing at the time of bidder pre-qualification.

2.2 CODES & STANDARDS

The control system and its components shall comply with all applicable requirements of the following:

Electrical Code Compliance (National & Local)
NEMA Compliance
IEEE Compliance
EIA Compliance
FCC Compliance

3.0 SUBMITTALS

Complete electrical and dimensional drawings shall be provided for approval by the consulting Engineer prior to equipment fabrication. The submittal data shall include the following:

3.1 PRODUCT DATA

Provide product data sheets for each instrument and component supplied in the system. The data sheets shall show the component name as used on reference drawings, manufacturer's model number or other product designator, input and output characteristics, scale or ranges selected, electrical or mechanical requirements, and materials compatibility.

3.2 SHOP DRAWINGS

Provide drawings for each panel showing the wiring diagrams for control circuits and interconnections of all components. The drawings shall include wiring diagrams for all remote devices connected to the panel.

3.3 PANEL LAYOUT DRAWINGS

A front panel and sub-panel layout shall be included as part of each control panel drawing. Components shall be clearly labeled on the drawing.

3.4 INSTALLATION DRAWINGS

Typical installation drawings applicable to each site in the system shall be included.

4.0 DELIVERY, STORAGE, & HANDLING.

All items shall be stored in a dry sheltered place, not exposed to the outside elements, until ready for installation. All items shall be handled with appropriate care to avoid damage during transport and installation.

5.0 SEQUENCING & SCHEDULING

5.1 COORDINATE

Coordinate with other electrical and mechanical work including wires/cables, raceways, electrical boxes and fittings, controls supplied by others, and existing controls, to properly interface installation of the control system with other work.

5.2 SEQUENCE

Sequence installation and start-up work with other trades to minimize downtime and to minimize the possibility of damage and soiling during the remainder of the construction period.

6.0 MAINTENANCE

6.1 MAINTENANCE DATA

Submit maintenance manuals and "as built" drawings on all items supplied with the system. The manuals and drawings are to be bound into one or more books as needed. In addition to "as built" engineering submittal data and drawings, the manual shall include:

a) Trouble Shooting Guides.
b) Maintenance and calibration data for all adjustable items.
c) Specific tuning instructions for Radio Transceivers as per FCC frequency restrictions.

7.0 JOB CONDITIONS.

All instruments and equipment shall be designed to operate under the environmental conditions where they are to perform their service. The equipment shall be designed to handle lightning and transient voltages as normal environmental hazards. The environmental conditions are as follows:

7.1 OUTDOOR

The equipment will be exposed to direct sunlight, dust, rain, snow, ambient temperatures from -20 to +120 degrees F, relative humidity of 10 to 100 percent, and other natural outdoor conditions. The installations shall be hardened to withstand normal vandalism.

7.2 INDOOR

The equipment will be capable of operating in ambient temperatures of +32 to +130 degrees F and relative humidity of 20 to 100 percent.

8.0 CONTROL SYSTEM OPERATION

8.1 GENERAL

The control system shall use "smart" Remote Terminal Units (RTUs) with micro-processors at all locations to provide a "distributed intelligence" type control system. The software programs used at all locations shall be stored in non-

volatile "burned-in" type ROM memories. The system shall be "self-initializing" and not require operator intervention after power interruptions, transients from lightning storms, or component changes. All microprocessors in the system shall include "watch-dog" circuitry to insure automatic restarts of the system. Each remote site in the system shall be assigned a unique digital address.

The remote units shall use a Single Board Computer RTUs (SBC-RTU) type construction and be provided with software that is identical for all sites in the system. The SBC-RTUs shall "automatically" configure themselves, without operator intervention, from the site wiring. The SBC-RTUs shall be interchangeable without regard to station type (i.e. Water Towers, Booster Pump Stations, Sewage Lift Stations, etc.).

The control system shall use peer-to-peer (i.e. RTU to RTU) communications to provide a completely automatic control system. Each Water Tower remote shall be able to automatically interrogate its respective Booster Pump Station remotes with level data. Each pump station remote shall display this level data on a LCD display and compare the data to thumbwheel setpoint switches to generate its own pump stop/start commands. The pump station remote shall transmit its input data for the purpose of monitoring at the plant. Should a pump station RTU fail to be interrogated or experience an internal failure, it shall turn off its "Telemetry Control" output relay, causing the pump station controls to automatically shift control to back-up pressure controls provided by the telemetry contractor. All booster pump station (or well pump) sites in the system shall have a "Telemetry Control" lamp to indicate that the site is functioning normally and in communication with its controlling water tower.

The RTUs supplied shall be fully capable of operating under the control of a Central Unit in a full SCADA system. With a Central Unit present, the peer-to-peer control described above shall remain as an automatic back-up control. The ability of the system to operate in three levels of control (Central Unit, Peer-to-Peer, and Back-up pressure) shall be demonstrated to the Engineer on his request using a portable Central Unit or other Central simulating device.

9.0 VHF (154 - 173 MHz) RADIO CHANNEL DATA OPERATION

9.1 GENERAL

The control system shall be specifically designed for radio channel data communications. In addition to radio communications, the system shall be capable of simultaneous operation over hardwire, dedicated phone line, and radio communication channels. All of the equipment required for operation of the system shall be directly owned by the Owner and included as part of this contract. Systems using third party repeaters, trunking masters, or leased equipment will not be allowed.

9.2 COMMUNICATIONS

The control system shall operate in a half-duplex mode over a single VHF (154 - 173MHz) radio frequency using "point-to-point" communication techniques. The control system shall monitor for a clear channel to allow co-channel operation with other radio systems.

All data transmitted shall be in digital word form using FSK (frequency shift keying) transmission and the standard ASCII data format. All transmissions shall include the address of the sender, and be subject to check sum, parity, and framing error checks, to insure a minimum data reliability of 1 error in 1,000,000,000 bits. Any transmissions that fail the data checking will be retried until correct. No data correction methods will be allowed. A plug-in RS232C data port shall be provided at all locations in the system to allow the use of a standard data terminal to view data exchanges between the remote sites.

The system shall provide a complete data update at least once every three (3) minutes with some functions updating faster as required by local system conditions.

9.3 RADIO CHANNEL OPERATION

The system shall be capable of operation on the narrow band splinter frequencies of the Private Land Mobile Radio Services within the FCC's (Federal Communications Commission) rules and regulations regarding these telemetry channels. The manufacturer shall guarantee operation under co-channel conditions with other radio systems without interference to this system. FSK tones, data baud rates, transmitter output power, transmitter deviation, antenna gain, and antenna height shall be chosen to comply with the FCC requirements Part 90 - Subpart B (90.17) for Local Government or Part 90 - Subpart D (90.63) for Power Radio Service. The radio system shall specifically meet the operating requirement that the sum of the highest FSK frequency and the amount of deviation shall not exceed 1.7 kHz for 3F2 emission (or 2.8 kHz for 6F2 emission) as detailed by the FCC for the specific frequency assigned.

The overall system design and operation shall provide a 30db pad over the minimum required for operation on all primary control paths to insure a 99.9% reliability of communications. The 30db pad requirements and FCC rule compliance shall be demonstrated (at no additional cost) to the Engineer at his request. The testing shall be accomplished using an IFR AM/FM 1000S communications analyzer or equal equipment.

9.4 FCC LICENSING

The system supplier shall be responsible for collecting all information, generating all paper work, and paying all fees required to obtain a license on behalf of the Owner.

10.0 RADIO TRANSCEIVERS & ACCESSORIES (154 or 173 MHz)

10.1 GENERAL

The Radio Transceivers shall be standard business band units that can be tuned, aligned, and repaired at any two-way radio shop. The units shall be tuned to FCC specifications for the specific frequency assigned. The radio equipment shall be FCC type approved and the system capable of operation on the narrow band splinter frequencies (154 or 173 MHz) in the Power Radio or Local Government service.

10.2 RADIO TRANSCEIVER

The system manufacturer shall supply a 25 watt VHF radio transceiver to insure a high level of quality and reliability. The radios shall be adjustable to 4 watts output power as may be required for the FCC requirement of 20 Watts ERP (Effective Radiated Power). Radio transceivers without a 25 watt maximum output power will not be accepted. All connections to the radio shall be plug-in. The VHF radio transceiver shall have the following specifications:

Transmitter:	
RF output power	25 watts (adjustable to 10)
Spurious & Harmonics	-57db below carrier
Frequency stability	±0.0005% (-30 to +60 degrees C)
Emission (VHF)	6F2 (with 2.5kHz DEV max) or 3F2 (with 1.2kHz DEV max)
FM hum and noise	-60 db
Receiver:	
Sensitivity	.30 microvolt (.5uV @ 20db quieting)
Selectivity	-75 db
Spurious image rejection	-75 db
Intermodulation	-75 db
Frequency stability	±0.0005% (-30 to +60 degrees C)
Receive bandwidth	*6kHz (or 3kHz) as req'd to match the transmitter

* The receiver bandwidth shall be reduced to match the transmit bandwidth of the transmitter and provide a minimum adjacent channel rejection of -50db. The radio transceivers shall be Motorola Radius M100 or approved equal.

10.3 ANTENNA & COAXIAL CABLE

The radio antennas at all locations shall be a five element Yagi, constructed with 3/8" diameter aluminum rod elements and 1-1/16" diameter aluminum pipe element support. The antenna shall have 8.0db forward gain with a 20.0db front-to-back ratio. The antenna shall be wind rated for a 100 MPH wind speed. The antennas shall be MC-Yagi, Decibel Products DB292, or Celwave PD390.

Antennas shall be cabled to the transmitter enclosure connection by a RG/8U low loss (less than 1.8db per 100ft @ 100MHz) coaxial cable with cellular polyethylene (foam) dielectric. The coaxial cable shall have a braided copper shield coverage of 97% and a long life weather resistant polyvinylchloride jacket. The antenna coaxial cable connection shall be a constant impedance weatherproof Type N connector, taped with a weather resistant electrical tape, and coated with Scotchcote to insure a lifetime water tight assembly. The coaxial cable shall be Beldon 8214 type RG-8/U.

10.4 ANTENNA LIGHTNING PROTECTION

Coaxial connection to remote and central unit enclosures shall be by means of a coaxial type bulk-head lightning arrester. The units shall be rated at 1 kilowatt with a minimum 500V and maximum 2000V breakdown voltage. Coaxial lightning arrestors shall be a PD-593 or PolyPhaser IS-B50LU-CO.

10.5 ANTENNA MOUNTING SYSTEMS

Antennas shall be mounted at a height above ground that is consistent with FCC rules and regulations and provides adequate signal fade margin as described earlier. Antennas must be a minimum of 15 feet above ground and mounted as follows:

A) Water Towers: The antenna shall be mounted on the ladder or the water tower catwalk railing at a height consistent with FCC requirements. The coaxial cable shall be secured to the ladder or obstruction lighting conduit. A 3/4" rigid conduit with a weatherhead shall be provided from the transmitter to the ladder on the tower.

B) Above Ground Structures: The antenna shall be mounted on a 10' long X 1-1/2" diameter galvanized mast with top mounted weatherhead and bottom mounted LB fitting. The mast assembly shall be secured to the side of the structure with Uni-strut clamps. The coaxial cable shall feed through the mast assembly to the interior of the building.

C) Below Ground Structures: The antenna shall be mounted on a 20' high Class II power pole with a 10' long X 1-1/2" galvanized mast secured to the side of the pole and extending 5' above the pole. A 3/4" rigid conduit with a weatherhead shall be provided from the below ground vault to a location 10 feet up the power pole for the coaxial cable.

11.0 INSTRUMENTATION & ACCESSORIES

11.1 GENERAL

All items in the control system (electronic cards, power supplies, radios, time delays, relays, etc.) shall be of plug- in construction or make use of a plug-in wiring harness and be interchangeable without recalibration. To insure field repair-ability by non-technical personnel, equipment that must be un-wired for replacement will not be accepted.

The following instrumentation devices and techniques shall be used as specifically called for in the RTU input/output sections of this specification.

11.2 POWER SUPPLIES

The common 12 VDC power supply shall provide ±0.1% line and load regulation with ±10% input variations. It shall have a temperature coefficient of ±0.02% per degree C. The input/output isolation shall be 100 Mohms DC (900Volts AC) with output transient response of 50 microseconds maximum. The power supply shall be sized to operate the remote unit equipment with or without the back-up battery in place. Power Supplies shall be an ELPAC Series OLV, Sola SLS, or approved equal.

11.3 BATTERY BACK UP OPERATION

The remote units indicated shall be supplied with battery back-up operation. The rechargeable batteries shall be the sealed solid gelled electrolyte type, designed for float or standby service. Unless noted otherwise in the RTU descriptions, batteries shall be sized to maintain 24 hour service at water tower remotes. The remote shall include a plug-in charging module to recharge the battery when power is resumed, maintain the charge between outages, and provide a low voltage cut-off to protect the battery from excessive discharge during prolonged outages. Pressure and level inputs shall continue to function on battery back-up. Batteries shall be Globe Gel/Cell or approved equal.

11.4 SINGLE PHASE 120VAC POWER LINE LIGHTNING PROTECTION

Every site in the system shall be equipped with a combination AC line filter and lightning arrester. The unit shall provide 3 stage lighting/transient protection including inductive and capacitive filtering, MOV overvoltage protection, and

three terminal gas discharge tube lightning protection. The unit shall be a TT-LPU, TrippLite ISOBAR IB-2-0, or StediWatt Model 1120-3.

11.5 TIME DELAYS AND RELAYS

All control outputs from the telemetry system shall be via adjustable 0-5 minute electronic time delays with ±0.2% repeat accuracy. The time delays shall have both "timing" and "timed" LED indicators. All time delays and relays used in the system shall be of plug-in construction with rail or board mounted sockets and have pilot duty contacts rated for 3 amps resistive @ 240VAC (or 0.8 amps inductive) loads. Time delays and relays shall be IDEC series RTY-D, RY4S or approved equal.

11.6 PRESSURE/LEVEL TRANSDUCERS

Pressure and level transducers shall be of the all solid-state two-wire transmitter type and be powered from the common 12VDC power supply with a 4-20mA output. The transducers shall have a combined error (linearity and hysteresis) of ±0.2% full scale and be temperature compensated to ±2.5% per 100 degrees Fahrenheit. RFI (Radio Frequency Interference) effects shall be less than 1.0% from 27 to 500MHz for 5 V/m field intensity 1 meter from the device. Zero and span adjustments shall be standardized so that transducers are interchangeable without recalibration.

The transducers shall be mounted at the sensing point and wired to the enclosure. Transducers for above ground mounting shall have a 1/2" conduit connection for cable entry. Transducers at water towers (and other outside locations) shall be mounted below grade. Below grade mounted units shall have cabling connections and suitable for a minimum of 100' submerged duty. All exposed parts shall be series 304 stainless steel and wetted parts shall be 316 stainless steel. The units shall be capable of two times full scale over pressure with out damage or change of calibration. Pressure/Level transducers shall be Foxboro Model 1125 or approved equal.

11.7 PRESSURE SWITCHES

Pressure switches shall be of compact design with visual adjustment scales, a die cast aluminum frame, and Brass & Buna N wetted parts. The units shall have a repeatability of 1% of range, an adjustable deadband with 10-100% full scale adjustment, and withstand two times range overpressure without damage. Units mounted in control panels may be of open frame design. Units mounted at the sensing point shall have a NEMA 4 watertight enclosure. The pressure switches shall be ASCO Tri-Point Series PA or approved equal.

11.8 TWO WIRE LOW VOLTAGE DC CONTROLLERS

The pumps indicated shall be controlled by a two-wire low voltage DC controller consisting of a 120VDC power supply, a sender unit, and a receiver unit. The controller shall provide remote CALL of pumps with RUN report back and LINE FAIL indication over a single pair of 22 gauge wires. The controller shall operate from a 120VDC power source and be self adjusting for line resistances up to 10Kohms. Each pair of modules shall be provided with a Line Protection Unit consisting of a gas tube line protector and 1/4 amp fuses. The units shall be a TT-TWC or Healy-Ruff TSC.

11.9 BACK UP PRESSURE CONTROLS

The control panels at RTU sites where noted shall include back-up pressure controls. The pressure sensor shall be a mechanical devise providing independent start and stop switches operated from a single bellows sensor assembly. The pressure sensor shall be rated for water service and have a brass bellows and pressure connection. The unit shall have a repeat accuracy of ±1.0% of range. The start/stop settings shall be clearly visible on a calibrated scale on the front of the assembly. The start/stop switches shall be wired to electronic time delays and relays to provide "electronic" surge suppression. The action shall cause the controls to not change state unless the pressure is at or past the desired pressure setting for an adjustable time as set on the time delay. The pressure controls shall ignore momentary fluctuations in pressure that exceed the stop/start pressure settings for time periods less that the time delay setting, without the use of pressure snubbers. The pressure switch sensor shall be United Electric Series 300 or approved equal.

11.10 CIRCULAR CHART RECORDER

The circular chart recorder(s) shall be one or two pen, servo driven, 10" circular chart recorders with 0.50% accuracy and provide for a field configurable chart range and speed. Chart paper shall be provided to match the range (in engineering units) and chart speed of the recorder operation. The chart recorders shall be Honeywell Model DR 4200 GP or approved equal.

12.0 SINGLE BOARD COMPUTER REMOTE TERMINAL UNITS (SBC-RTUs)

12.1 GENERAL

The Single Board Computer Remote Terminal Units (SBC-RTU) shall use micro-processors at all locations. The software programs used at all locations shall be stored in non-volatile "burned-in" type ROM memories. The system shall be "self-initializing" and include "watch-dog" circuitry. The software used shall be identical for all sites and interchangeable without regard to station type (i.e. Water Towers, Booster Pump Stations, Sewage Lift Stations, etc.).

12.2 CONSTRUCTION

The remote units shall contain three major components: a Radio Transceiver, a SBC-RTU, and a single (common) 12VDC power supply. The SBC-RTU module shall have a plastic shroud to provide complete protection of all components and internal adjustments during handling. All connections to the SBC-RTU module shall be via gold flashed plug-in connectors. The remote station addressing shall be accomplished via this end mounted connector and not be affected by changing of SBC-RTU modules.

The SBC-RTU shall plug to a "passive" wiring interface board. The wiring interface board shall have plug-in connectors for the radio and power supply. All external input and output wiring connections to the RTU panel shall be by barrier type terminal strips. LED lamps shall indicated the status of all discrete inputs and outputs.

Each SBC-RTU shall be capable of controlling a local LCD display, reading BCD thumbwheel assemblies, inputting and outputting analog data (with zero and span adjustments to be part of the remote unit enclosure), and have 110 VAC inputs and outputs with 1000 volts of optical isolation. The RTU inputs shall be as follows:

A) Discrete Inputs - The RTU discrete inputs shall be 110 VAC with optically isolated couplers providing 1500 volts of isolation.

B) Discrete Outputs - The RTU discrete outputs shall be 400 VAC rated triac outputs providing 1500 volts of isolation. The output connections to other panels shall be further isolated by wiring to Time Delays or Relays as specified below.

C) Analog Inputs - Analog inputs shall be capable of processing a wide range of instrumentation signals (i.e. 4-20mA, 1-5VDC, 0-100mV, etc) from the various sensors required. The inputs shall have suppressed zero capability sufficient to suppress 85% of the incoming signal and transmit the remaining signal with a combined ±0.5% accuracy and resolution. The inputs must be implemented so that zero and span adjustments are a part of the remote site enclosure allowing the RTU cards, signal converters, and transducers to be changed without recalibration.

D) Analog Outputs - The analog outputs shall be 0-5 volt DC with ±0.3% accuracy. Analog signals that are provided to other control panels shall be optically isolated from the RTU signal with a universal wide-ranging signal converter. The isolated signal converter shall be capable of providing voltage or current signals with ±0.25% accuracy and 1000V of isolation. The signal isolator shall be Action Instruments model AP4380 or equal.

E) Digital Displays - Digital displays of data shall be by means of a 1/2" high LCD or LED readout. Data shall be displayed in standard engineering units (i.e. psi, gpm, ft, etc).

F) Digital Setpoint Assemblies - Digital Setpoints shall be by 1/8" high thumbwheel setpoint assemblies providing settings of 000 through 999 directly in standard engineering units (i.e. psi, gpm, ft, etc). The thumbwheel assemblies shall have gold plated circuit board contacts and gold flashed wipers.

12.3 ENCLOSURES

The remote unit enclosures for indoor mounting shall meet all the requirements for NEMA Type 12 enclosures. The enclosures shall be made of a minimum 14 gauge steel with continuously welded seems, have a 14 gauge steel hinge, and be furnished with external mounting feet. Subpanels shall be 14 gauge steel for 16x14 enclosures and 12 gauge for larger enclosures. Enclosures larger than 16x14 shall have a rolled lip on 3 sides of the door for added strength. The door opening shall have a rolled edge on 4 sides to protect the door gasket. The gasket shall be heavy neoprene attached to the door with oil resistant adhesive. The enclosure and subpanel finish shall be gray polyester powder coating inside and out over phosphatized surfaces. NEMA 12 enclosures shall be Hoffman Bulletin A-51 or A-12.

Remote site installations requiring equipment to be mounted outside shall have the remote unit NEMA 12 enclosure described above mounted inside a vented (and screened), lockable NEMA 3R enclosure. The double enclosure shall be required to control vandalism, provide complete weather protection, reduce the heating effects of the sun, and prolong the life of the equipment. The NEMA 3R enclosure shall be constructed of 14 gauge galvanized steel, with a drip shield top and seem free sides front and back. The NEMA 3R enclosures shall be finished with a dark gray enamel inside and out. The NEMA 3R enclosure shall be Hoffman Bulletin A-3.

13.0 WATER TOWER REMOTE UNIT

13.1 GENERAL

The Water Tower Remote Unit shall use a new Single Board Computer RTU. The water tower remote shall transmit a suppressed head type signal representing only the upper usable range of the storage tank. The remote shall include a battery for 24 hour back-up operation as specified.

13.2 CONSTRUCTION

The tower transceiver NEMA 12 enclosure shall be mounted inside a vented, lockable, NEMA 3R enclosure as specified. The tower remote equipment shall include an internal power switch, bulk-head coaxial cable lightning arrester, and a power line lightning arrester as specified earlier. The level transducer shall be a two-wire transmitter suitable for below ground mounting as specified earlier.

13.3 INSTALLATION

The level transducer shall be installed at a point below freezing in the altitude vault (if available) or in a 24" fiber meter vault with a freeze proof lid. The pressure connection shall be equipped with a corporation stop providing a 1/4" NPT female connection for the transducer. The contractor shall run 3/4" rigid conduit from the vault or meter box to the transceiver enclosure for the transducer signal cable.

The antenna shall be as specified and mounted on the water tower at a height consistent with FCC requirements. The contractor shall provide a 3/4" rigid conduit with a weatherhead from the transmitter to the ladder on the tower.

13.4 WATER TOWER REMOTE UNIT INPUT/OUTPUT REQUIREMENTS

The Water Tower remotes shall send the following information:

Discrete Inputs -
1) Power Failure

Analog Inputs -
AI-1) Water Level 0-25.0 ft (upper usable range)

14.0 BOOSTER PUMP STATION REMOTE UNIT

14.1 GENERAL

The Booster Pump Station Remote Unit shall use a Single Board Computer RTU module. The controlling device shall come from the existing portable monitor and all other equipment, material and appurtenances shall be new. The booster pump station remote shall display its respective water tower's level data on a LCD display and compare the data to thumbwheel setpoint switches to generate its own pump stop/start commands to maintain its water tower's level. When the pump station is not being controlled by another site or its respective water tower, it shall turn off its "Telemetry Control" output causing pump control to revert to back-up pressure controls provided by the telemetry contractor.

14.2 CONSTRUCTION

Telemetry Control and Pump Command outputs to other panels shall be dry isolated contacts on plug-in 0-3 minute delays as specified. Indicating lamps shall display the status of these outputs on the front of the enclosure.

Local pressure inputs shall be by two-wire transducers as specified with the transducer located at the sensing point.
The booster pump station equipment shall be housed in a NEMA 12 enclosure. The booster station equipment shall include an internal power switch, bulk-head coaxial cable lightning arrester, and a power line lightning arrester as specified earlier.

14.3 INSTALLATION

The pressure sensors shall be mounted at the sensing point with 1/2" conduit run to the remote unit enclosure.

The antenna shall be mounted on a 10' long X 1-1/2" diameter mast secured to the side of the structure for an above ground pump stations or on a 20' power pole with 3/4" rigid conduit and a weatherhead run to the station for a below ground pump stations as previously specified.

14.4 BOOSTER PUMP STATION REMOTE UNIT INPUT/OUTPUT REQUIREMENTS

The Booster pump station remote shall generate the following output and send the following data:

Discrete Inputs:
DI- 1) Pump #1 RUNNING
2) " #2 "
3) Power Failure
4) Station Flooding
5) High Discharge Cut-off
6) Low Suction Cut-off

Discrete Outputs:
DO-1) Lead Pump CALL
2) Lag " "
3) Telemetry Control Active

Front Panel Display and Control Devices
LCD Display (3 digit) of Tank Level (to read in feet)
Lead Pump Stop/Start thumbwheel setpoint assembly
Lag " " " " "
Lead Pump CALL lamp
Lag " " "
High Discharge Pressure Alarm lamp
Low Suction " " "

Telemetry Control lamp

15.0 EXECUTION

15.1 FACTORY TESTING.

The control system shall be completely tested prior to shipment. The entire control system shall be "Burned In" at the factory for a period of at least 20 days. The component equipment shall be computer tested and temperature cycled at zero degrees and at fifty degrees centigrade.

15.2 FCC LICENSING.

The system manufacturer/supplier shall be responsible for collecting all information, generating all paper work, and paying all fees required to obtain a license on behalf of the Owner.

15.3 STARTUP AND TRAINING.

The manufacturer shall supply "Factory" start-up service and operator training as required to insure satisfactory operation. The OWNER shall be contacted a minimum of two weeks in advance prior to scheduling the training session to allow proper coordination.

15.5 WARRANTY.

The control system manufacturer shall supply a five (5) year parts and labor warranty for all items supplied under this section as part of the control system (except as noted below). Power surges lightning damage shall be included as part of the warranty.

The warranty shall begin from the time of "substantial completion" as issued by the Owner's Representative. The manufacturer shall provide a 24-hour response to calls from the Owner. The manufacturer, at his discretion, may dispatch replacement parts to the Owner by next-day delivery service for field replacement by the Owner. Any damage to the control system caused by the actions of the Owner in attempting these field replacements shall be the sole and full responsibility of the manufacturer. If, during the warranty period, satisfactory field repair cannot be attained by field replacement of parts by the Owner, the manufacturer shall dispatch "factory" personnel to the jobsite to complete the repairs at no cost to the Owner.

16.0 PAYMENT

The unit price for the lump sum item, Telemetry (for a pump tank set) shall constitute full payment for furnishing, installing, making fully operable and

providing all appurtenances required for the water storage tank and booster pump station. Electrical service to the booster pump station will be provided under Sections 11210-11212, however, electrical service to the water storage tank will be included in this item.

SECTION 15100

WATER LINES

1.0 GENERAL

The CONTRACTOR shall furnish all labor, materials, and equipment to install the water lines as shown on the plans and as specified herein.

The water lines may be either pressure-rated plastic pipe (PVC) using the ASTM or AWWA C-900 standard, or ductile iron (DI), all as specified hereinafter and as noted on the plans. The bid documents shall show the amounts of each type and class of pipe to be provided by the CONTRACTOR.

The OWNER will obtain all rights-of-way for operations through private property. It will also secure building permits and the permits for all pipe laid in highway rights-of-way. Any charges for inspections or other fees required will be the responsibility of the CONTRACTOR since the amounts of these are dependent upon the operation of the CONTRACTOR.

1.1 KENTUCKY TRASPORATION CABINET BONDING

The Kentucky Transportation Cabinet will require that the OWNER post a bond for all work accomplished on their right-of-way. Each contract on which work is to be performed will be a separate application and will require a separate bond. Each permit will have conditions attached and these conditions will vary depending on the area where work is to be performed. In areas where traffic control may pose a problem, working hours may be limited. A copy of the encroachment permit will be provided to the CONTRACTOR. The CONTRACTOR will be responsible for knowledge of the permit's content and conditions in order that the construction may be accomplished in accordance with the specified requirements.

Should any additional bonds or requirements be imposed by the Kentucky Transportation Cabinet, the OWNER shall also be responsible for the bonding of the additional requirements.

2.0 MATERIALS

2.1 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

This specification covers rigid, pressure-rated, polyvinyl chloride pipe and fittings, hereinafter called PVC pipe and PVC fittings, for sizes 1/2 inch through 12-inch. Pipe shall be as manufactured by North American or approved equal.

2.1.1 General.

2.1.1.1 Pipe Markings. Depending on the type of PVC pipe being used, the following shall be marked along the length of each joint of pipe: manufacturer's name, nominal pipe size and size base, material code (PVC 1120), dimension ratio or standard dimension ratio, pressure class or rating, production record code, certification seal (NSF logo), and, for C-900 PVC pipe, specification designation (i.e., AWWA C-900).

2.1.1.2 Underground Marking for PVC Pipe. Underground marking for either ASTM or C-900 PVC pipe shall be both of the following types.

2.1.1.2.1 *Underground Marking Wire.* At all locations where PVC pipe is utilized, a detectable underground marking wire shall be placed in the trench approximately 12-inches above the pipe. The wire used shall be No. 12 insulated copper wire. Extreme care shall be exercised in connecting and taping splices and joints to assure continuity. At each valve box the wire shall be looped to the surface extending 12-inches above the concrete valve box pad (see Std. Dwg. for valve). When the entire project or pipeline segment is complete, including meter installation and leak repairs, the locating wire system shall be checked for continuity.

2.1.1.2.2 *Underground Marking Tape.* At all locations where PVC pipe is utilized, a detectable underground marking tape shall be placed in the trench approximately twelve inches below the finished grade. The tape used shall be mylar encased aluminum foil with the printing "CAUTION - Buried Water Line Below". Printing shall be readable through the clear mylar and surface printing is not acceptable. Tape size shall be 2 inch width as provided by Lifeguard, Inc. or approved equal. Color of the tape shall be blue.

2.1.2 Polyvinyl Chloride (PVC) Pipe—ASTM Standard.

2.1.2.1 PVC Pipe. PVC pipe shall be extruded from Type 1, Grade 1, polyvinyl chloride material with a hydrostatic design stress of 2,000 psi for water at 73.4°F, designated as PVC 1120, meeting ASTM Specifications D-1784 for material and D-2241 for pipe, latest revisions. Pipe shall also meet all applicable provisions of the Product Standards and shall bear the National Sanitation Foundation (NSF) seal of approval in compliance with NSF Standard No. 14. PVC pipe having a maximum hydrostatic working pressure of 160 psi (SDR-26), 200 psi (SDR-21), 250 psi (SDR-17), or 315 psi (SDR-13.5) shall be used as shown in the Bid Documents and Plans.

Samples of pipe and physical and chemical data sheets shall be submitted to the ENGINEER for review and determination of compliance with these specifications before pipe is delivered to job. The pipe shall be homogeneous throughout and free from cracks, holes, foreign inclusions or other defects.

The workmanship, pipe dimensions and tolerances, outside diameters, wall thickness, eccentricity, sustained pressures (ASTM D-1598), burst pressures (ASTM D-1599), flattening, extrusion quality (ASTM D-2152), marking and all other requirements of the Product Standard PS 22-70 shall be conformed with in all respects. No pipe, 2 inches in diameter or larger, with a wall thickness less than 0.090 inches may be used.

Pipe shall be furnished in 20 feet or 40 feet lengths. The pipe may be double plain end or with bell on one end. Male ends of pipe must be beveled on the outside. Pipe shall have a ring painted around the male end or ends in such a manner as to allow field checking of setting depth of pipe in the socket. This requirement is made to assist construction superintendents and inspectors in visual inspection of pipe installation.

Pipe must be delivered to job site by means which will adequately support it, and not subject it to undue stresses. In particular, the load shall be so supported that the bottom rows of pipe are not damaged by crushing. Pipe shall be unloaded carefully and strung or stored as close to the final point of placement as is practical. Pipe must not be exposed to the direct rays of the sun for an extended period of time. If pipe is not to be installed shortly after delivery to the job site, it must be stored in a shaded location and strung as needed.

2.1.2.2 PVC Pipe Jointing. Pipe shall be joined with slip-type joints with rubber gaskets. Pipes with bells shall have all parts of the bell, including the gasket groove, made from the same extruded piece, integral with the pipe, and shall be thickened to meet standard dimension ratios of wall thickness to outside diameter. This manufacturing procedure shall be the normal practice of the pipe manufacturer and proven by past performance of pipe in service. The gasket groove shall be constructed such that gasket rollout will not occur. Rubber gasketing shall conform to ASTM D-3139.

Joint lubricant shall be of a type recommended by the manufacturer for their pipe subject to the Engineer approval. Lubricant shall be water soluble, non-toxic and have no objectionable properties.

Due to special requirements for special gaskets for use within 200 feet of underground fuel tanks, gas lines, and/or oil transport lines, PVC pipe shall not be used under these circumstances.

2.1.2.3 PVC Couplings. Where PVC couplings are used, they shall be of the same material as the pipe and may be of the moulded, or extruded type. PVC couplings shall have a minimum rating of 200 psi for continuous operation at 73.4 degrees F.

2.1.2.4 Fittings Ductile iron mechanical joint fittings shall be used with PVC pipe. All such fittings shall be approved by the pipe manufacturer, and complete data sent to the ENGINEER, including the manufacturer's approval, for review. Fittings shall comply with AWWA C-110 or C-153 and shall be manufactured for the size and pressure class of the line on which they are used. Coatings and lining shall be in accordance with section 2.2.7 of the Specifications.

2.1.2.5 Service Connections. All service connections on PVC lines shall be made by means of a bronze service clamps, manufactured specifically for use with PVC pipe and appropriate corporation stop.

2.1.3 Polyvinyl Chloride (PVC) Pipe—AWWA C-900 Standard.

This specification covers the requirements for AWWA approved Polyvinyl Chloride Pressure Pipe for water supply and distribution systems.

2.1.3.1 PVC Pipe—AWWA C-900 Standard. PVC pipe shall meet the requirements of AWWA C-900 or C-905, latest revision and shall be furnished in cast-iron pipe equivalent outside diameters with rubber gasketed joints.

C-900 PVC pipe shall be made from Class 12454-A or Class 12454-B virgin compounds as defined in ASTM D-1784. The standard code designation shall be PVC 1120. The PVC compounds shall be tested and certified as suitable for potable water products by the NSF Testing Laboratory and shall carry the NSF approval marking.

Solvent-cement couplings or joints shall not be used. PVC joints using elastomeric gaskets shall be tested as assembled joints and shall meet the laboratory performance requirements specified in ASTM D-3139.

Pipe shall be DR (Dimension Ratio) 18, or DR 14 as shown on the plans or the bid form.

Pipe and couplings shall meet or exceed the following test requirements:

Hydrostatic Integrity - Each standard and random length of pipe shall be proof-tested at four times its rated class pressure for a minimum of 5 seconds. Bells or couplings shall be tested with pipe. The pipe and couplings shall further meet or exceed the pressure test requirements of ASTM D-1598 and D-1599.

Flattening - The pipe shall not split, crack, or break when tested by the parallel-plato method as specified by ASTM D- 2241.

Extrusion quality - The pipe shall not flake or disintegrate when tested by the acetone-immersion method as specified in ASTM D-2241.

Standard length - Pipe shall be furnished in standard laying lengths of 20 ft. ± 1 in. A maximum of 15 percent of each pipe size may be furnished in random lengths of not less than 10 ft. each.

2.1.3.2 C-900 PVC Pipe Jointing. Pipe shall be joined with slip-type joints with rubber gaskets. Manufacturing and installation procedures shall be as recommended by the manufacturer and as described for PVC pipe in section 2.1.2 of this specification.

2.1.3.3 Fittings. Fittings for municipal PVC shall be ductile iron only. Fittings shall be mechanical joint. Fittings shall be manufactured for the size and pressure class of the line on which they are used and shall comply with AWWA C-110 or C-153. Coatings and lining shall be in accordance with section 2.2.7 of the Specifications.

2.1.3.4 Service Connections. Service connections shall be made by means of bronze service clamps manufactured specifically for use with C-900 PVC pipe and appropriate corporation stops.

2.2 DUCTILE IRON PIPE

These specifications cover ductile iron pipe (3-inch diameter and greater) to be used in water transmission systems with mechanical joints, rubber ring slip type joints or flanged joints.

2.2.1 General. Ductile iron pipe shall be designed in accordance with AWWA and for pressures and conditions as stated in these specifications or called for on the plans. Ductile iron pipe shall conform to AWWA C-151.

2.2.2 Minimum Nominal Thickness. The specified thickness will be determined for the given internal and external loading requirements in accordance with AWWA C-150. The class of pipe, wall thickness, and coatings required will be shown on the plans or the bid form and/or as specified herein for all ductile iron pipe installation.

2.2.3 River Crossing Pipe. River crossing pipe shall be ductile iron, Flex-Lok as manufactured by the American Cast Iron Pipe company or equal conforming to the appropriate requirements of AWWA C150/ANSI A21.50 and AWWA C151/ANSI A21.5 with a minimum thickness class of 54.

2.2.4 Lengths. Pipe may be furnished in 12, 16, 16 1/2, 18 or 20 feet nominal laying lengths.

2.2.5 Marking. The net weight, class or nominal thickness and sampling period shall be marked on each pipe.

2.2.6 Pipe Joints for Ductile Iron Pipe. Joints for buried pipe shall be either mechanical joint or push-on joint conforming to the requirements of AWWA C-111. Mechanical joint bolts and nuts shall be the low-alloy steel type conforming to AWWA C-111.

Interior piping of vaults, plants, etc. shall be supplied with flanged joints meeting the requirements of AWWA C-115. Special joints, such as the "locked" or "restrained" type, shall be as shown on the plans and/or called for in the bid schedule.

Gaskets resistant to hydrocarbon penetration shall be used within 200 feet of underground fuel tanks, gas lines, and/or oil transport lines. The gaskets shall be approved by the ENGINEER.

2.2.7 Coatings and Lining. All buried ductile iron pipe shall have manufacturer's outside coal tar or asphaltic base coating and a cement lining and bituminous seal coat on the inside. Cement mortar lining and a bituminous seal coat inside shall conform to AWWA C-104 latest revision.

Where specifically called for on the plans, pipe and fittings housed and in vaults shall be lined and coated on the inside as specified herein for buried ductile iron pipe and fittings, but shall be left uncoated on the outside so that it may be painted without the use of tar stop.

2.2.8 Fittings for Ductile Iron Pipe. Ductile iron mechanical, push-on and flanged joints shall conform to AWWA C-110 for centrifugally cast iron water pipe. Mechanical joints shall also conform in all respects to AWWA C-111. All fittings shall be manufactured for the size and pressure class of the pipeline in which they are to be used. All fittings shall be furnished complete with all joint accessories. All ductile iron pipe fittings for water, sewer, air, gas and force main service shall be coated outside and lined on the inside the same as the line on which they are installed.

3.0 EXECUTION

3.1 HAULING AND STORAGE

The CONTRACTOR shall notify the ENGINEER when pipe will be received on the job so that proper arrangements may be made for inspecting the unloading and stringing, as well as inspecting and examining the pipe materials.

All pipe shall be covered with tarpaulin during hauling from the manufacturer to the job site. It is acceptable for the front end only to be covered. The intent is to prevent diesel exhaust residue from coating the pipe and/or contaminating the gaskets.

Care must be exercised in the handling of all materials and equipment. The CONTRACTOR will be held responsible for all breakage or damage to items caused by his workmen, agents, or appliances for handling or moving. Pipes and other castings shall in no case be thrown or dropped from cars, trucks, or wagons to the ground, but shall be lowered gently and not allowed to roll against or strike other castings and unyielding objects violently.

Valves, castings, fabricated metal, reinforcing steel, etc. shall be yarded or housed in some convenient location by the CONTRACTOR and delivered at the construction site as required. All equipment and materials subject to damage from the weather, dampness, changes in temperature, or exposure shall be protected by a dry, weatherproof enclosure until ready for installation or use. The cost of all hauling, handling, and storage shall be included in the prices bid for equipment and materials in place. The OWNER takes no risk or responsibility for fire, flood, theft, or damage until after the final acceptance of the work.

3.2 LINES AND GRADES

The CONTRACTOR will be required to accomplish any detailed layout, including that required for establishing the grade of the pipe line.

3.3 TRENCH EXCAVATION

3.3.1 General. This section describes the acceptable methods of trenching for the installation of pressure pipe and casing pipe in an open trench.

Trenching may be accomplished by means of a backhoe, trenching machine or by hand depending on the construction area.

At the CONTRACTOR'S option, trenching, by a trenching machine or by backhoe is acceptable except as noted below:

Where the pipe line is being constructed close to other utilities, structures, building, or large trees, and it is reasonable to anticipate possible damage from the use of a backhoe, then trenching shall be made by hand methods.

The CONTRACTOR shall include in his unit price bid, all trenching necessary for installation of all pipelines as planned and specified. Trenching shall include all clearing and grubbing, including all weeds, briars, trees, stumps, etc. encountered in the trenching. The CONTRACTOR shall dispose of any such material by burning, burial, or hauling away (or as noted on the drawings), at no extra cost to the OWNER. It shall be the CONTRACTOR'S responsibility to notify the appropriate State and local Air Pollution Control agencies when he conducts open burning of refuse. Ornamental shrubs shall be removed, protected, and replanted. Trenching also includes such items as minor street, road, sidewalk, pipe and small creek crossings, and cutting, moving or repairing

damage to fences, poles, gates and/or other surface structures regardless of whether shown on the plans.

The CONTRACTOR shall protect existing facilities against danger or damage while pipeline is being constructed and backfilled, or from damage due to settlement of this backfill. In case of damage to any existing structures, repair and restoration shall be made at once and backfill shall not be replaced until this is done. In all cases, restoration and repair shall be such that the damaged structures will be in as good condition and serve its purpose as completely as before and such restoration and repair shall be done without extra cost to the OWNER. The use of trench-digging machinery will be permitted except where its operations will cause damage to trees, buildings or existing structures above or below the ground. At such locations hand methods shall be employed to avoid such damage. All excavated material shall be piled in a manner that will not endanger the work and will avoid obstructing sidewalks and driveways. Gutters shall be kept clear or other satisfactory provisions made for street drainage.

All excavation shall be open trenches, except where the drawings call for tunnelling, boring, or jacking under structures, railroads, sidewalks and roads. The construction procedure for these types of excavation is described elsewhere in these specifications.

All trench excavation shall be termed unclassified and costs shall be included in the unit price bid for the pipe.

3.3.2 Clearing. The CONTRACTOR shall accomplish all clearing and/or grubbing as required for the construction under this contract. Clearing and grubbing shall include the cutting and removal of trees, stumps, brush, roots, logs, fences and other loose or projecting material and natural obstructions which, in the opinion of the ENGINEER, must be removed to properly construct and operate the facilities. Ornamental shrubs, plantings, fences, walls, etc. shall be removed and replanted or replaced or protected from the construction activity. Clearing and/or grubbing shall be incidental to the various bid items and no additional compensation will be paid for same.

3.3.3 Trench Depth. Trenches shall be excavated to the line and grade required for the installation of pipe at the elevations indicated on the plans. The minimum depth of cover shall be 30 inches above the top of the pipe, unless shown otherwise on the plans or on the Standard Details. When the pipe is laying in or on solid rock, the minimum depth of cover shall also be 30 inches above the top of the pipe. No additional compensation will be made for extra depth where required by the plans or due to CONTRACTOR error. Excavation, except as required for exploration, shall not begin until the proposed work has been staked out. Materials which are not required for backfill and site grading shall be removed and disposed of as directed by the ENGINEER. Hauling, bedding, and backfilling shall be considered incidental to the various bid items and will not be

paid for directly. Excavation shall be of sufficient depth to allow the piping to be laid on the standard pipe bedding in accordance with the section 3.4. The trenches shall be excavated to a minimum of six inches below the bottom of the pipe barrel in rock. In all cases where lines are under traffic a minimum cover of forty-two inches (42") shall be provided. Should it be necessary to avoid existing utilities, culverts, outlets, or other structures, the water line shall be carried deeper at no additional expense to the OWNER.

Where the plans call for extra trench depth, this extra depth shall be provided at no extra cost.

3.3.4 Trench Width. Trench widths shall exceed the minimum width that will provide free working space on each side of the pipe and to permit proper backfilling around the pipe as shown in the accompanying table and unless specifically authorized by the ENGINEER, shall not be excavated to wider than two feet (2') plus the nominal diameter of the pipe at the top of the trench. Before laying the pipe, the trench shall be opened far enough ahead to reveal any obstruction that may necessitate changing the line and grade of the pipe. Should the CONTRACTOR fail to accomplish this, and changes are required, they shall be at his sole expense. In rock, all ledge rocks, boulders and large stones shall be removed to provide six inches (6") of clearance on each side and below all pipe and fittings.

Minimum Trench Width

Size	Width
Up to 4" Pipe	1'-6"
6" Pipe	2'-0"
8" Pipe	2'-0"
10" Pipe	2'-4"
12" Pipe	2'-6"
14" Pipe	2'-6"

Size	Width
15" Pipe	2'-8"
16" Pipe	2'-8"
18" Pipe	3'-0"
20" Pipe	3'-2"
21" Pipe	3'-4"
24" Pipe	3'-8"

3.3.5 Shoring, Sheeting, and Bracing of Excavation. Where unstable material is encountered, or where the depth of the excavation in earth exceeds five feet (5'), the sides of the trench or excavation shall be supported by substantial sheeting, bracing, or shoring. The design and installation of all sheeting, sheet piling, bracing or shoring shall be based on computations of pressure exerted by the materials to be retained under retaining conditions. Adequate and proper shoring of all excavations will be the entire responsibility of the CONTRACTOR. The Standards of the Federal Occupational Safety and Health Act and the Kentucky Department of Labor shall be followed.

The ENGINEER will not be responsible for determining requirements for bracing or sheeting.

3.3.6 Removal of Water. The CONTRACTOR shall provide for adequate removal of all water and the prevention of surface water from entering the excavation. The CONTRACTOR shall maintain dry conditions within the excavations until the backfill is placed. No additional compensation will be paid for replacement and/or stabilization of prepared excavations due to flooding and/or deterioration from extended exposure. All water pumped or drained from the excavation shall be disposed of in a suitable manner without damage to adjacent property or to other work under construction.

3.3.7 Pavement Removal. Pavement removal shall be as indicated on the plans or directed by the ENGINEER. When so required, or when directed by the ENGINEER, only one-half (1/2) of the street crossings or road crossings shall be excavated before placing temporary bridges over the side excavated, for the convenience of the traveling public. All backfilled ditches shall be maintained in such a manner that they will offer no hazard to the passage of traffic. The convenience of the traveling public and the property OWNERS abutting the improvements shall be taken into consideration. All public or private drives shall be promptly backfilled or bridged at the direction of the ENGINEER. Pavement replacement shall be in accordance with Section 15120 of these specifications. Excavated materials shall be disposed of so as to cause the least interference and in every case the disposition of excavated materials shall be satisfactory to the ENGINEER.

3.3.8 Traffic Maintenance. The CONTRACTOR shall be held responsible for any damage that may occur to persons or property by reason of the failure of the CONTRACTOR to properly guard and flag all open trenches or obstructions along the routes of the water lines. The CONTRACTOR at his own expense shall maintain warning signs, barricades and watchmen or flag men to control traffic at such times as his work would interfere with the flow of traffic. No excavation shall begin that may present a safety hazard unless the signs, barricades, lights, etc. are available to protect the open excavation at the conclusion of the day. The CONTRACTOR will comply with all Federal and State Occupational Safety and Health requirements for this type of construction. The CONTRACTOR shall also comply with all local and Kentucky Department of Highways requirements for signing and traffic control.

3.3.9 Line Location. The location of pipelines and their appurtenances as shown are those intended for the final construction. However, conditions may present themselves before construction on any line is started that would indicate desirable changes in location. In such cases, the OWNER reserves the right to make reasonable changes in line and structure locations without extra cost, except as may be determined by extra units of materials and construction actually involved. The OWNER is under no obligation to locate pipelines so they can be excavated by machine.

3.4 BEDDING OF PIPELINE

In all cases the foundation for pipe shall be prepared so that the entire load of the backfill on top of the pipe will be carried uniformly on the barrel of the pipe. The bells of the pipe shall not carry any of the load of the backfill. The CONTRACTOR should refer to the Standard Details for pipe bedding shown in the plans. The bedding specifications shall govern the backfill from the bottom of the trench up to the centerline or spring line of the pipe.

3.4.1 Stable Earth Foundation. On all PVC pipelines, the trench bottoms shall be smooth and free of frozen material, clodded dirt and stones over 1/2" diameter. Bottom dirt left by trenching equipment will usually provide adequate material to level the trench bottom and provide bedding support for the pipe barrel. If the trench bottom is free of dirt, soft material may be shoveled off the side walls or shoveled under the pipe to insure proper pipe barrel bedding. In areas where the trench bottom is hard, a layer of soft backfill must be provided to insure the pipe barrel is properly cushioned. See the plans for proper bedding material depth.

If the foundation is good firm earth the pipe may be laid directly on the undisturbed earth provided the pipe barrel is supported for its full length.

Bedding of No. 9 stone, fine gravel, sand or compacted finely graded select earth shall be used to correct irregularities in the subgrade.

As an alternative to the above method, excavation may be undercut to a depth below the required invert elevation that will permit laying the pipe on a bed of granular material or finely graded select earth to provide continuous support for the pipe barrel. Bedding depth shall be as shown on the plans.

The bedding is not a separate pay item and shall be included as incidental expense in the unit price for the pipe bid per foot of pipe.

3.4.2 Trenches In Rock. All installation in rock will utilize the undercutting method. Bedding will be with 6 inches crushed stone or suitable earth material.

3.5 PIPE LAYING

3.5.1 General. Proper instruments, tools and facilities satisfactory to the ENGINEER shall be provided and used by the CONTRACTOR for the safe and convenient prosecution of the work. Each pipe manufacturer shall have an experienced representative on the job for at least one day at the commencement of jointing and laying operations.

Before any length of pipe is placed in the trench, a careful inspection shall be made of the interior of the pipe to see that no foreign material is in the pipe. In

order to properly remove any foreign materials, a swab of necessary length is to be available at all times.

All pipe shall be lowered carefully into the trench, properly aligned and properly jointed by use of suitable tools and equipment, in such a manner as to prevent damage to water line materials and protective coatings and linings. Excessive scratching of the exterior surface of the pipe will be cause for rejection of the pipe.

Under no circumstances shall pipeline materials be dropped or dumped into the trench. The pipe and fittings shall also be inspected for the purpose of determining if they are sound and free from cracks. Laying of pipe shall be commenced immediately after excavation is started. Pipe shall be laid with bell ends facing in the direction of laying.

When pipe laying is not in progress, the open ends of pipe shall be closed by approved means to prevent entrance of trench water into the line. Whenever water is excluded from the interior of the pipe, adequate backfill shall be deposited on the pipe to prevent floating. Any pipe which has floated shall be removed from the trench and relaid as directed by the ENGINEER. No pipe shall be laid in water or on frozen trench bottom, or whenever the trench conditions or the weather are unsuitable for such work.

If any defective pipe and fittings shall be discovered after the pipeline is laid, they shall be removed and replaced with a satisfactory pipe or fitting without additional charge to the OWNER. Open ends of unfinished pipe lines shall be securely plugged or closed at the end of each day's work or when the line is left temporarily at any other time.

3.5.2 Laying Ductile Iron Pipe. Ductile iron pipe shall first be thoroughly cleaned at joints, then joined according to instructions and with tools recommended by the manufacturer. Three (3) copies of instructions shall be furnished to the ENGINEER and one (1) copy shall be available at all times at the site of the work. The lining inside ductile iron pipe must not be damaged by handling.

All pipes must be forced and held together, or "homed" at the joints, before sealing or bolting. Pipe must be aligned as each joint is placed, so as to present as nearly true, straight lines and grades as is practical, and all curves and changes in grades must be laid in such a manner that the manufacturer's recommended maximum deflection is not exceeded at any joint.

Cutting of pipe may be done by wheeled pipe cutters or saws as the CONTRACTOR may elect, but the CONTRACTOR will be held responsible for breakage or damage caused by careless cutting or handling.

All ductile iron pipe shall be installed per AWWA C150 Laying Condition Type 3 unless otherwise noted, six inches (6") crushed stone bedding or suitable earth shall be used in rock. No pipe shall be laid resting on rock, blocking, or other unyielding objects. Jointing before placing in trench, and subsequent lowering of more than one section jointed together may be allowed, subject to the ENGINEER approval and direction.

When using pipe with push-on joints care must be exercised to make certain that the correct gasket is being used for the type of joint installed and that the gasket faces the proper direction. Before inserting the gasket, the groove and bell socket should be carefully cleaned of all dirt. If sand or dirt is permitted to remain in the groove, leaks may occur. Lubricant must be applied to bell socket, gasket and plain-end of pipe as required by manufacturer. Plain-end must be beveled before joint is made. Deflection required at the joint shall be obtained after the joint is made.

3.5.3 Laying Plastic Pipe. The trench bottom must be smooth and uniform and the alignment must conform with the plans. Bedding and cover as specified herein and shown in the Standard Details is required.

To make a clean and unobstructed joint, it is necessary to wipe the ring, groove and pipe spigot free from all foreign materials at the time of assembly. The ring must be positioned properly in the fitting to receive the pipe by a worker who is not in contact with the lubricant. In general, the lubricant is applied to the spigot (not the ring or groove). However, the manufacturer's instructions are to be followed in all cases. Only an approved lubricant may be used in accordance with the manufacturer's recommendations. All plastic pipe shall be joined by hand.

Where good bedding conditions are obtained PVC pipe smaller than 4 inches may be assembled outside the trench in longer sections (as conditions allow) and then lowered into the trench. At any time when improper bedding is discovered or the pipe is severely deflected the pipe will be removed from the trench and the condition corrected. Pipe in sizes 4 inch and above may be assembled outside the trench but must be lowered into the trench as each joint is assembled. Regardless of installation methods all joints must be inspected after laying in trench for proper insertion and alignment. Field cuts and bevels will be allowed in accordance with the manufacturer's recommendations for these operations. A new reference mark shall be installed before joining any field cut pipe. The same requirements for clearance from rock or other objects, thrust blocking and deflections shall apply to PVC pipe as for other pipe materials.

C-900 PVC pipe of all sizes must be assembled in the trench in strict accordance with the manufacturer's requirements.

3.5.4 Installation of River Crossing Pipe. The ball joint pipe shall be assembled and installed in accordance with manufacturer's recommendations. Installation shall be made at time of low flow, using cofferdams as necessary to divert stream flow. The ball joint pipe shall be laid and allowed to settle before joining to the pipe on each side of the stream. The ball and joint pipes shall be tested separately once in place to detect any leaks or bad joints. After connecting to the land pipe, it shall be tested the same as specified for the other water mains. See the DRAWINGS for additional installation requirements.

3.6 BACKFILLING

Backfilling must be started as soon as practicable after pipe has been laid. The ENGINEER shall be given a minimum of 8 hours for inspection before backfilling. The backfill shall be crushed rock, sand, or finely divided earth free from debris, organic material and stones, places simultaneously on both sides of pipe to the same level by hand.

In backfilling of the lower part of the trench beginning at the top of the bedding, the backfill material shall be carefully selected and walked-in around the pipe in 6" layers to a point 8 inches higher than the top of the pipe. The filling of the trench and the tamping of the backfill shall be carried on simultaneously on both sides of the pipe in such a manner that the completed pipe line will not be disturbed and injurious side pressures do not occur.

After the above specified backfill is hand placed, rock may be used in the backfill in pieces no larger than 18 inches in any dimension and to an extent not greater than one-half (1/2) the backfill materials used. If additional earth is required, it must be obtained and placed by the CONTRACTOR. Filling with rock and earth shall proceed simultaneously, in order that all voids between rocks may be filled with earth. Above the hand placed backfill, machine backfilling may be employed without tamping, (if not contrary to specified conditions for the location) provided caution is used in quantity per dump and uniformity of level of backfilling. Backfill material must be uniformly ridged over trench and excess hauled away, with no excavated rock over 1-1/2 inch in diameter or pockets of crushed rock or gravel in top 6 inches of backfill. Ridged backfill shall be confined to the width of the trench and not allowed to overlap onto firm original earth and its height shall not be in excess of needs for replacement of settlement of backfill. All rock, including crushed rock or gravel from construction, must be removed from yards and fields. Streets, roadways and walks shall be swept to remove all earth and loose rock immediately following backfilling.

In the case of street, highway, railroad, sidewalk and driveway crossings or within any roadway paving or about manholes, valve and meter boxes, the backfill must be machine tamped in not over 4-inch layers, measured loose in accordance with the standard details. Where backfill is under paved driveways, streets, highways, railroads, sidewalks, paved parking areas and other areas where settlement is

not allowed, crushed stone or coarse sand backfill only shall be used up to the paving surface. Crushed stone shall be Kentucky Department of Highways Standard Specification No. 57. Coarse sand backfill shall be spread in layers not over 4 inches thick and thoroughly compacted. Sand may be moistened to aide compaction. Tunnels shall be backfilled in not over 3-inch layers, measured loose, with selected material suitable for mechanically tamping. If material suitable for tamping cannot be obtained, sand, gravel or crushed rock shall be blown, packed or sluiced to complete fill all void spaces.

Where local conditions permit, pavement shall not be placed until 30 days have passed since placing backfill. Crushed stone is specified for roads and parking areas and sidewalks or their bases, shall be placed and compacted to the top of trench. Backfills shall be maintained easily passable to traffic at original ground level, until acceptance of project or replacement of paving or sidewalks.

Where the final surfacing is to be crushed stone, compacted earth backfill may be used in the trench to within 6 inches of the top as shown in the Standard Details.

The Kentucky Transportation Cabinet requires that water and sewer lines—when placed within the limits of the roadway embankment and/or beneath the roadway itself—be backfilled with sand, limestone sand (11's or smaller), or "flowable fill" as defined by Section 601.03.03.B(5) of their "Standard Specifications for Road and Bridge Construction". The Cabinet typically requires that sand, limestone sand, or flowable fill be used to backfill the trench and/or bore pit up to the subgrade elevation and extending to the outside edge of the shoulder.

Railroad Company and Highway Department requirements in regard to backfilling will take precedence over the above general specification where they are involved.

The CONTRACTOR shall protect all sewer, gas, electric, telephone, water and drain pipes or conduits, power and telephone poles and guy wires from danger of damage while pipelines are being constructed and backfilled, or from danger due to settlement of his backfill.

In case of damage to any such existing structures, repair and restoration shall be made at once and backfill shall not be replaced until this is done. In all cases, restoration and repair shall be such that the damaged structure will be in as good condition and serve its purpose as completely as before uncovering and such restoration and repair shall be done without extra charge.

No extra charge shall be made for backfilling of any kind, except as provided in the Bid. Backfilling shall be included as a part of the unit price bid for which it is subsidiary. No extra charge shall be made for supplying outside materials for backfill.

Before completion of contract, all backfills shall be reshaped, holes filled and surplus material hauled away, and all permanent walks, street, driveway and highway paving, and sod, replaced and reseeding performed.

The line CONTRACTOR shall be responsible for clean-up, grading, seeding, sodding or otherwise restoring all areas that he disturbs.

Any deficiency in the quantity of material for backfilling the trenches or for filling depressions caused by settlement, shall be supplied by the CONTRACTOR.

3.7 TIE-INS TO EXISTING PIPELINES

This work shall consist of connecting new water pipes to the existing system where shown on the plans and shall include the necessary fittings, tapping sleeves, valves and necessary equipment and material required to complete the connection.

Knowledge of pipe sizes in the existing system may not be accurate, therefore, it is recommended that the CONTRACTOR check outside diameters of existing pipe and types of pipe prior to ordering the required accessories. No additional payment will be allowed for matching pipe and/or accessories when the proper size is not ordered.

Neither the OWNER nor the ENGINEER can guarantee the location of the existing lines. The CONTRACTOR shall verify the location of all existing water mains and valves pertaining to the proposed improvements before excavation is started.

The necessary regulation or operation of the valves on existing mains, to allow for the connections being made, shall be supervised by the ENGINEER. Before shutting down an existing water main or branch main for a proposed connection, prior approval for a specific time and time interval shall be obtained from a representative of the OWNER. At no time shall an existing main be shut down without the OWNER'S knowledge and permission.

Excavation to existing water mains shall be carefully made, care being exercised not to damage the pipe. The excavation shall not be of excessive size or depth beneath the pipe. The sides of the excavation shall be as nearly vertical as possible.

The CONTRACTOR shall be responsible for any damage to the existing system and any such damage shall be repaired to the satisfaction of the ENGINEER at the CONTRACTOR'S expense.

The CONTRACTOR shall verify, by field inspection, the necessary sizes, lengths and the types of fittings needed for each inter-connection. Typical connections

are shown on the plans and any modifications or changes shall be subject to the approval of the ENGINEER. The exact length of the proposed water main needed for this work shall also be determined by field measurement as required.

The probing required to locate existing mains is not a separate pay item.

3.8 PIPE ENTERING STRUCTURES

Ductile iron, steel or PVC pressure pipe, 4-inch diameter or larger, entering structure below original earth level, unsupported by original earth for a distance of more than six feet (6'), shall be supported by #57 crushed stone. Costs for the support shall be included in the unit price for the pipe.

3.9 OWNERSHIP OF OLD MATERIALS

All fittings, valves, hydrants and other appurtenances that are removed as a result of new construction shall be removed by the CONTRACTOR but shall become the property of the OWNER. All such items shall be delivered to a point by the CONTRACTOR. Said point shall be on the OWNER'S property and shall be designated by the ENGINEER.

3.10 THRUST BLOCKS AND ANCHORAGE

Thrust blocks shall be installed whenever the pipe line changes direction, as at tees, bends, crosses, stops, as at a dead end; or at valves. The locations of thrust blocks depend on the direction of thrust and type of fitting. Their size and type depends on pressure, pipe size, kind of soil, and the type of fitting. Where thrusts act upward (as at vertical curves) the weight of the pipe, the water in the pipe and the weight of the soil over the pipe should be determined to make certain that the total weight is sufficient to resist upward movement. If there is not enough soil or if it will not compact over the pipe or it is too soft to resist movement, then ballast or concrete may be placed around the pipe in sufficient weight and volume to counteract the thrust. Where a fitting is used to make a vertical bend, the fitting may be anchored to a concrete thrust block designed to key in to undisturbed soil and to have enough weight to resist upward and outward thrust, since the newplaced backfill may not have sufficient holding power.

Thrust blocks shall be constructed of not less than Class B concrete conforming to KTC Specification 601 and placed between the fitting and the trench wall. It is important to place the concrete so it extends to undisturbed (freshly cut) trench wall.

3.11 MAINTENANCE OF FLOW OF DRAINS AND SEWERS

Adequate provision shall be made for the flow of sewers, drains and water courses encountered during construction. Any structures which are disturbed shall be satisfactorily restored by the CONTRACTOR.

3.12 INTERRUPTION OF UTILITY SERVICES

No valve, switch or other control on any existing utility system shall be operated for any purpose by the CONTRACTOR without approval of the ENGINEER and the Utility. All consumers affected by such operations shall be notified by the CONTRACTOR as directed by the ENGINEER and utility before the operation and advised of the probable time when service will be restored.

3.13 FENCING

Where water supply line is being constructed in fields where stock is being grazed, CONTRACTOR shall provide temporary fence as approved by the ENGINEER around open trenches to prevent stock from falling in trenches. Where trenching operations should isolate grazing stock from their source of water, CONTRACTOR will either provide temporary bridging over trench or else provide water for such stock.

Where trench crosses near sound existing corner posts and existing fence is in good condition, fence may be taken loose, rolled back and stored until pipe line is completed at this point, then replaced by stretching tightly and thoroughly stapling. Additional posts will be provided and additional new fence shall be provided when it is necessary to place the fence crossed by the water line in a condition equal to existing fence before water line was constructed.

Where it is necessary to cut existing fence, new end posts shall be installed on each side of the water line and the old fence thoroughly stapled to these new posts before cutting. After pipe line is completed at this point, a new fence of galvanized wire (No. 9 gauge with No. 11 filler wires) shall be stretched between these new end posts and thoroughly stapled to existing posts and any new intermediate posts necessary to provide a good fence. Replacement of fences shall be on a replacement in-kind basis, and shall be considered incidental to laying of the lines and any additional cost shall be included in the unit price bid per lineal foot of pipe.

3.14 PROTECTION OF ADJACENT LANDSCAPE

Reasonable care shall be taken during construction of the water lines to avoid damage to vegetation. Ornamental shrubbery and tree branches shall be temporarily tied back, where appropriate, to minimize damage. Trees which receive damage to branches shall be trimmed of those branches to improve the

appearance of the tree. Tree trunks receiving damage from equipment shall be treated with a tree dressing.

In the course of construction, the CONTRACTOR may deflect horizontal alignment of the water line to avoid trees and to keep from damaging their roots. The CONTRACTOR shall be fully responsible for settling all claims by private property owners concerning damage to trees and shrubs.

3.15 COORDINATION WITH UTILITIES

Prior to construction, the CONTRACTOR shall arrange to meet with representatives of all utilities, and provide them with his anticipated work schedule. The CONTRACTOR shall have the utilities make their best determination of utility locations in the areas in which he is working. Throughout the progress of the work, such field markings of utilities shall be kept current.

Repairs to any utilities damaged by the CONTRACTOR shall normally be performed by the utility at the CONTRACTOR'S expense, unless the CONTRACTOR and the utility negotiate other understandings and/or procedures.

3.16 BLASTING AND ROCK EXCAVATION

The CONTRACTOR shall make his own investigation as he deems necessary to ascertain the sub-surface conditions to be encountered in the work.

All blasting operations shall be conducted in accordance with municipal ordinances, state and federal laws and Section 9, Explosives, of the "Manual of Accident Prevention in Construction", published by the Associated General Contractors of America, Inc. Soil particle velocity shall not exceed limit set by Kentucky law. All explosives shall be stored in conformity with said ordinances, laws and safety regulations. No blasting shall be done within five feet of any water mains, sewer lines, natural or manufactured gas lines, liquid petroleum product lines or other utilities. Any damage done by blasting is the responsibility of the CONTRACTOR and shall be promptly and satisfactorily repaired by him.

The CONTRACTOR shall use delay caps or other approved methods to reduce earth vibrations and noise. Mud capping, as defined in the above manual, will not be permitted as a method of breaking boulders. No blasting shall be permitted on Sundays or after dark.

Prior to commencing with the work, the CONTRACTOR shall, during a preconstruction conference with the OWNER and the ENGINEER, state clearly his approach to performing the excavations on the project. He shall be familiar with the laws and ordinances covering blasting and shall also give consideration to the use of hydraulically operated rock breaking devices in lieu of blasting where considered necessary. If blasting is not handled in an expert manner at all

times, the ENGINEER reserves the right to suspend blasting and require the work to proceed without it.

Prior to blasting, the CONTRACTOR shall make his own detailed preblast survey of adjacent walks, curbs, retaining walls, house foundations, etc. to determine conditions prior to the work. Such a file of information, including photographs, may be certified in such a manner as the CONTRACTOR believes necessary since this information that may stand in his defense.

4.0 PAYMENT

Payment for supplying, transporting and storing pipe, trenching, standard bedding, pipe installation, fittings, thrust-blocking, pipe locating wire and tape, testing, backfilling (including flowable fill, if required), disinfection, seeding, crop damage, regular stream crossings, clean-up, tie-ins to other structures and other incidental items in this section shall be made on the basis of the unit price per lineal foot for the type and size of pipe installed. Payment will include all those items not specifically covered by another proposal. Pipe will be measured along the centerline of the pipe as installed with no deduction for valves and fittings.

SECTION 15101

TESTING AND STERILIZATION

1.0 TESTING

1.1 After the pipe has been laid, all newly laid pipe or any valved section thereof shall be subjected to a hydrostatic pressure test of at least 1.5 times the working pressure at the point of testing, but in no case less than that required by other sections herein. In addition, a leakage test shall be conducted concurrently with the pressure test.

1.2 PRESSURE TEST

1.2.1 Test pressure shall:

1.2.1.1 Not be less than 1.25 times the working pressure at the highest point along the test section.

1.2.1.2 Not exceed pipe or thrust restraint design pressures at the lowest point along the test section.

1.2.1.3 Be of at least six (6) hour duration unless otherwise stipulated by owner.

1.2.1.4 Not vary by more than plus or minus 5 psi.

1.2.1.5 Not exceed twice the rated pressure of the valves or hydrants when the pressure of the test section includes closed gate valves or hydrants.

1.2.1.6 Not exceed the rated pressure of resilient seat butterfly valves when used.

1.2.2 Each valved section of pipe shall be filled with water slowly and the specified test pressure, based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the ENGINEER.

1.2.3 Before applying the specified test pressure, air shall be expelled completely from the pipe, valves, and hydrants. If permanent air vents are not located at all high points, the contractor shall install corporation cocks at such points so that the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall be closed and the test pressure applied. At the conclusion of the pressure test, the corporation cocks

shall be removed and plugged, or left in place at the discretion of the ENGINEER.

1.2.4 All exposed pipe, fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damage or defective pipe, fittings, valves or hydrants that are discovered following the pressure test shall be repaired or replaced with sound material and the test shall be repeated until it is satisfactory to the ENGINEER.

1.3 LEAKAGE TESTING

1.3.1 Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain pressure within 5 psi of the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water.

1.3.2 No pipe installation will be accepted if the leakage is greater than that determined by the following formula:

$$L = ND(P \text{ exp } 1/2)/133{,}200$$

in which L is the allowable leakage, in gallons per hour; N is the length of pipeline tested in feet; D is the nominal diameter of the pipe, in inches; and P is the average test pressure during the leakage test, in pounds per square inch gauge.

1.3.2.1 Allowable leakage at various pressures is shown in TABLE K-1.

1.3.2.2 When testing against closed metal-seated valves, an additional leakage per closed valve of 0.0078 gal/hr/in of nominal valve size shall be allowed.

1.3.2.3 When hydrants are in the test section, the test shall be made against the closed hydrant.

1.3.3 Acceptance shall be determined on the basis of allowable leakage. If any test of pipe laid discloses leakage greater than that specified in Section 1.3.2 the contractor shall, at his own expense, locate and repair the defective material until the leakage is within the specified allowance.

1.3.3.1 All visible leaks are to be repaired regardless of the amount of leakage.

Table K-1
Allowable Leakage Per 1,000 Ft. Of Pipeline (GPH)

Avg. Test Pressure psi	Nominal Pipe Diameter (Inches)								
	2	3	4	6	8	10	12	14	16
450	0.32	0.48	0.64	0.95	1.27	1.59	1.91	2.23	2.55
400	0.30	0.45	0.60	0.90	1.20	1.50	1.80	2.10	2.40
350	0.28	0.42	0.56	0.84	1.12	1.40	1.69	1.97	2.25
300	0.26	0.39	0.52	0.78	1.04	1.30	1.56	1.82	2.08
275	0.25	0.37	0.50	0.75	1.00	1.24	1.49	1.74	1.99
250	0.24	0.36	0.47	0.71	0.95	1.19	1.42	1.66	1.90
225	0.23	0.34	0.45	0.68	0.90	1.13	1.35	1.58	1.80
200	0.21	0.32	0.43	0.64	0.85	1.06	1.28	1.48	1.70
175	0.20	0.30	0.40	0.59	0.80	0.99	1.19	1.39	1.59
150	0.19	0.28	0.37	0.55	0.74	0.92	1.10	1.29	1.47
125	0.17	0.25	0.34	0.50	0.67	0.84	0.01	1.18	1.34
100	0.15	0.23	0.30	0.45	0.60	0.75	0.90	1.05	1.20

Avg. Test Pressure psi	Nominal Pipe Diameter (Inches)							
	18	20	24	30	36	42	48	54
450	2.87	3.18	3.82	4.78	5.73	6.69	7.65	8.60
400	2.70	3.00	3.60	4.50	5.41	6.31	7.21	8.11
350	2.53	2.81	3.37	4.21	5.06	5.90	6.74	7.58
300	2.34	2.60	3.12	3.90	4.68	5.46	6.24	7.02
275	2.24	2.49	2.99	3.73	4.48	5.23	5.98	6.72
250	2.14	2.37	2.85	3.56	4.27	4.99	5.70	6.41
225	2.03	2.35	2.70	3.38	4.05	4.73	5.41	6.03
200	1.91	2.12	2.55	3.19	3.82	4.46	5.09	5.73
175	1.79	1.98	2.38	2.98	3.58	4.17	4.77	5.36
150	1.66	1.84	2.21	2.76	3.31	3.86	4.41	4.97
125	1.51	1.68	2.01	2.52	3.02	3.53	4.03	4.53
100	1.35	1.50	1.80	2.25	2.70	3.15	3.60	4.05

2.0 STERILIZATION

2.1 GENERAL

It is the intent of this section to present essential procedures for disinfecting new and repaired water mains. The section is patterned after AWWA C651. The basic procedure comprises:

2.1.1 Preventing contaminating materials from entering the water mains during construction or repair and removing by flushing materials that may have entered the water main.

2.1.2 Disinfecting any residual contamination that may remain.

2.1.3 Determining the bacteriologic quality by laboratory test after disinfection.

2.2 PREVENTIVE MEASURES DURING CONSTRUCTION

2.2.1 Precautions shall be taken to protect pipe interiors, fittings, and valves against contamination. Pipe delivered for construction shall be strung so as to minimize entrance of foreign material. When pipe laying is not in progress, as, for example, at the close of the day's work, all openings in the pipe line shall be closed by water tight plugs. Joints of all pipe in the trench shall be completed before work is stopped. If water accumulates in the trench, the plugs shall remain in place until the trench is dry.

If dirt, that, in the opinion of the ENGINEER, will not be removed by the flushing operation (section 2.3) enters the pipe, the interior of the pipe shall be cleaned and swabbed as necessary, with a five (5%) percent hypochlorite disinfecting solution.

2.2.2 Packing Materials and Joints—No contaminated material or any material capable of supporting prolific growth of micro-organisms shall be used for sealing joints. Packing material shall be handled in such a manner as to avoid contamination. Where applicable, packing materials must conform to AWWA standards. Packing material for cast iron pipe must conform to AWWA C600. Yarning or packing material shall consist of molded or tubular rubber rings, rope of asbestos or treated paper. Materials such as jute or hemp shall not be used. The lubricant used in the installation of sealing gaskets shall be suitable for use in potable water. It shall be delivered to the job in enclosed containers and shall be kept clean.

2.3 PRELIMINARY FLUSHING

The main shall be flushed prior to disinfection unless disinfected by the method in section 2.4.2.1. It is recommended that the flushing velocity be not less than

2.5 ft/sec. The rate of flow required to produce this velocity in various diameters is shown in Table K-2. No site for flushing should be chosen unless it has been determined that drainage is adequate at the site.

Table K-2
Required Openings To Flush Pipelines
(40-PSI Residual Pressure)

Pipe Size (in)	Flow Required to Produce 2.5 fps Velocity (gpm)	Orifice Size (in)	Hydrants Required	
			Number of Hydrants	Nozzle Size (In)
4	100	15/16	1	2 1/2
6	220	1 3/8	1	2 1/2
8	390	1 7/8	1	2 1/2
10	610	2 5/16	1	2 1/2
12	880	2 13/16	1	2 1/2
14	1,200	3 1/4	2	2 1/2
16	1,565	3 5/8	2	2 1/2
18	1,980	4 3/16	2	2 1/2

2.4 FORM OF CHLORINE FOR DISINFECTION

The most common forms of chlorine used in the disinfecting solutions are liquid chlorine (gas at atmospheric pressure), calcium hypochlorite granules, sodium hypochlorite solutions.

2.4.1 Liquid Chlorine

2.4.1.1 *Use*: Liquid chlorine shall be used only when suitable equipment is available and only under the direct supervision of a person familiar with the physiological, chemical, and physical properties of this element and who is properly trained and equipped to handle any emergency that may arise. Introduction of chlorine-gas directly from the supply cylinder is unsafe and shall not be permitted.

NOTE: The preferred equipment consists of a solution fed chlorinator in combination with a booster pump for injecting the chlorine-gas water mixture into the main to be disinfected. Direct feed chlorinators are not recommended because their use is limited to situations where the water pressure is lower than the chlorine cylinder pressure.

2.4.2 Hypochlorites

2.4.2.1 *Calcium Hypochlorite*: Calcium hypochlorite contains seventy (70%) percent available chlorine by weight. It is either granular or tabular in form. The tablets, 6-8 to the ounce, are designed to dissolve slowly in water. Calcium hypochlorite is packaged in containers of various types and sizes ranging from small plastic bottles to one hundred (100) pound drums.

A chlorine-water solution is prepared by dissolving the granules in water in the proportion requisite for the desired concentration.

2.4.2.2 Sodium Hypochlorite: Sodium hypochlorite is supplied in strengths from five and one-quarter (5.25%) to sixteen (16%) percent available chlorine. It is packaged in liquid form in glass, rubber, or plastic containers ranging in size from one (1) quart bottles to five (5) gallon carboys. It may also be purchased in bulk for delivery by tank truck.

The chlorine-water solution is prepared by adding hypochlorite to water. Product deterioration must be reckoned with in computing the quantity of sodium hypochlorite required for the desired concentration.

2.4.2.3 *Application*: The hypochlorite solutions shall be applied to the water main with a gasoline or electrically powered chemical feed pump designed for feeding chlorine solutions. For small applications, the solutions may be fed with a hand pump, for example, a hydraulic test pump. Feed lines shall be of such material and strength as to withstand safely the maximum pressures that may be created by the pumps. All connections shall be checked for tightness before the hypochlorite solution is applied to the main.

2.5 METHODS OF CHLORINE APPLICATION

2.5.1 Continuous Feed Method: This method is suitable for general application.

2.5.1.1 Water from the existing distribution system or other approved sources of supply shall be made to flow at a constant, measured rate into the newly-laid pipe line. The water shall receive a dose of chlorine, also fed at a constant, measured rate. The two rates shall be proportioned so that the chlorine concentration in the water in the pipe is maintained at a minimum of 50 mg/L available chlorine. To assure that this concentration is maintained, the chlorine residual should be measured at regular intervals in accordance with the procedures described in the current edition of Standard Methods and AWWA M12—Simplified Procedures for Water Examination.

NOTE: In the absence of a meter, the rate may be determined either by placing a pitot gauge at the discharge or by measuring the time to fill a container of known volume.

TABLE K-3 gives the amount of chlorine residual required for each one hundred (100) feet of pipe of various diameters. Solutions of one (1%) percent chlorine may be prepared with sodium hypochlorite or calcium hypochlorite. The latter solution requires approximately one pound (1 lb.) of calcium hypochlorite in eight and five tenths (8.5) gallons of water.

Table K-3
Chlorine Required To Produce 50 mg/L Concentration
In 100 Ft. Of Pipe (By Diameter)

Pipe Size (in)	100 Percent Chlorine (lb)	1 Percent Chlorine Solutions (gal)
4	0.027	0.33
6	0.061	0.73
8	0.108	1.30
10	0.170	2.04
12	0.240	2.88

2.5.1.2 During the application of the chlorine, valves shall be manipulated to prevent the treatment dosage from flowing back into the line supplying the water. Chlorine application shall not cease until the entire main is filled with the chlorine solution. The chlorinated water shall be retained in the main for at least twenty-four (24) hours during which time all valves and hydrants in the section treated shall be operated in order to disinfect the appurtenances. At the end of this twenty-four (24) hour period, the treated water shall contain no less than 25 mg/L chlorine throughout the length of the main.

2.5.2 Slug Method: This method is suitable for use with mains of large diameter for which, because of the volumes of water involved, the continuous feed method is not practical.

2.5.2.1 Water from the existing distribution system or other approved source of supply shall be made to flow at a constant, measured rate (see section 2.5.1.1) into the newly laid pipe line. The water shall receive a dose of chlorine also fed at a constant, measured rate. The two rates shall be proportioned so that the concentration in the water entering the pipe line is maintained at no less than 300 mg/L. The chlorine shall be applied continuously and for a sufficient period to develop a solid column or "slug" of chlorinated water that will, as it passes along the line, expose all interior surfaces to a concentration of at least 300 mg/L for at least three (3) hours. The application shall be checked at a tap near the upstream end of the line by chlorine residual measurements.

2.5.2.2 As the chlorinated water flows past tees and crosses, related valves and hydrants shall be operated as to disinfect appurtenances.

2.6 FINAL FLUSHING

After the applicable retention period, the heavily chlorinated water shall be flushed from the main until the chlorine concentration in the water leaving the main is no higher than that generally prevailing in the system, or less than 1 mg/L. Chlorine residual determination shall be made to ascertain that the heavily chlorinated water has been removed from the pipe line.

2.7 BACTERIOLOGIC TESTS

2.7.1 After final flushing, and before the water main is placed in service, a sample or samples shall be collected from the end of the line and tested for bacteriologic quality and shall show the absence of coliform organisms. If the number and frequency of samples is not prescribed by the public health authority having jurisdiction, at least one sample shall be collected from chlorinated supplies where a chlorine residual is maintained throughout the new main. From unchlorinated supplies at least two samples shall be collected at least twenty-four (24) hours apart.

2.7.2 Samples for bacteriologic analysis shall be collected in sterile bottles treated with sodium thiosulphate. No hose or fire hydrant shall be used in collection of samples. A suggested sampling tap consists of a standard corporation cock installed in the main with a copper tube gooseneck assembly. After samples have been collected, the gooseneck assembly may be removed, and retained for future use.

2.8 REPETITION OF PROCEDURE

If the initial disinfection fails to produce satisfactory samples, disinfection shall be repeated until satisfactory samples have been obtained. The tablet method cannot be used in these subsequent disinfections. When the sample tests indicate that disinfection has been effective, the main may be placed in service.

2.9 PROCEDURE AFTER CUTTING INTO OR REPAIRING EXISTING MAINS

The procedures outlined in this Section apply primarily when mains are wholly or partially dewatered. Leaks or breaks that are repaired with clamping devices while the mains remain full of water under pressure present little danger of contamination and require no disinfection.

2.9.1 Trench "Treatment": When an old line is opened, either by accident or by design, the excavation will likely be wet and may be badly contaminated from nearby sewers. Liberal quantities of hypochlorite applied to open trench areas will lessen the danger from such pollution. Tablets have the advantage in such a situation because they dissolve slowly and continue to release hypochlorite as water is pumped from the excavation.

2.9.2 Main Disinfection: The following procedure is considered as a minimum that may be used.

2.9.2.1 *Swabbing With Hypochlorite Solution*: The interior of all pipe and fittings used in making the repair (particularly couplings and tapping sleeves) shall be swabbed with a five (5%) percent hypochlorite solution before they are installed.

2.9.2.2 *Flushing*: Thorough flushing is the most practical means of removing contamination introduced during repairs. If valving and hydrant locations permit, flushing from both directions is recommended. Flushing shall be started as soon as the repairs are completed and continued until discolored water is eliminated.

2.9.2.3 *Slug Method*: Where practicable, in addition to the procedures of section 2.9.2.1, a section of main in which the break is located shall be isolated, all service connections shut off, and the section flushed and chlorinated as described in section 2.5.2, except that the dose may be increased to as much as 500 mg/L, and the contact time reduced to as little as one-half (1/2) hour. After chlorination, flushing shall be resumed and continued until discolored water is eliminated.

2.9.3 Sampling: Bacteriologic samples shall be taken after repairs to provide a record by which the effectiveness of the procedures used can be determined. If the direction of flow is unknown, samples shall be taken on each side of the main break.

3.0 PAYMENT

No separate payment shall be made for testing and sterilization of water lines. Items described in this section shall be incidental to the cost of installing the water line.

SECTION 15104

METERS AND SERVICES

1.0 GENERAL

The CONTRACTOR shall furnish all labor, tools, equipment, and materials necessary for installing meter services as shown on the plans and as directed.

2.0 MATERIALS

2.1 Meters. It is the intent of these specification to obtain water meters which are cold water rotating disc type with hermetically-sealed and magnetically-driven registers. Meter shall be first line quality of the manufacturer. The latest specifications of the AWWA shall be complied with, except in the cases of conflict with these specifications. Any type or make of meter offered must have been manufactured and marketed in the U.S. for at least five (5) years and evidence will be required to indicate the name of places where meters have established satisfactory service records of five (5) years or more.

The main case shall be high grade waterworks bronze, with hinged, single lid cover and raised characters cast on them to indicate the direction of flow. Each meter must have a manufacturer's serial number stamped on both the lid and meter body. They must have a working pressure of 150 PSI. Interchangeable bottom plates shall be synthetic polymer as supplied by Sensus or equal. Non-ferrous strainers shall be provided which fit tightly against the main case.

The measuring chamber shall be bronze alloy composition and stainless steel or monel trimmed. The chamber shall be of the two piece design, equipped with a disc made of hard rubber and as near to the specific gravity of water as possible.

The register shall be straight reading U.S. Gallon type. The register unit shall be completely encased and hermetically sealed and driven by permanent magnets. Registers shall be guaranteed by the manufacturer for a period of at least 15 years.

Meters for regular services shall be equal to the Sensus SR II 5/8" x 3/4" unless otherwise shown on the plans. Large service connections shall have a disc meter similar and equal to the 5/8" x 3/4" meters and shall include the tap and connection, a gate valve or corporation stop the same size as the line pipe, sufficient unions and a meter box of sufficient size to house the meter as shown in the Standard Details. Meters two inches (2") and larger in size shall be compound type meters.

2.2 CORPORATION STOPS, SETTERS AND SADDLES

The corporation stops shall be equal to the Mueller 300 Ball Valve Corporation Stop. The meter setter shall be equal to the Mueller B2404-2 5/8x3/4x7with ¾" H14222 Multi-Purpose end connections. A tandem coppersetter to accommodate a pressure reducer and meter shall be used where specified. Saddles shall be equal to Mueller H13000 Series Bronze Saddle x ¾" cc.

Service line connections are to be made with flared fittings only.

2.3 METER BOXES

Meter boxes for 5/8" x 3/4" meters shall be of plastic construction equal to Midstates Model No. MS-1824B with a flat C.I. reader lid and locking device. Extensions shall be utilized as necessary.

2.4 INDIVIDUAL PRESSURE REGULATING VALVE

Where called for the individual pressure regulating valve shall be equal to the ¾" Wilkins Model 600 Series.

2.5 SERVICE LINES

Unless indicated otherwise on the plans, all Service Lines shall be 3/4" polyethylene plastic tubing using a corporation stop in accordance with the Standard Details. Service pipe shall meet all AWWA Specifications with a minimum pressure rating of 200 psi. Polyethylene service tubing shall be ultra high density type equal to DRISCOPIPE Series 5100, CTS.

3.0 EXECUTION

3.1 RECONNECT METER SERVICE

This item covers meter settings, which can remain in place, but need to be connected to a new water line. The Contractor shall supply all items to connect the meter to the new line. The Contractor shall close the corporation stop at the existing line if the existing line is not abandoned.

3.2 METER SERVICE

Meter settings shall include meter box and cover, coppersetter (including angle valve and check valve), saddle and corporation stop iron pipe or rod to hold meter plumb, and plug or cap on the customer's side of meter. (This latter item is to prevent the customer or his plumber from disarranging or loosening the meter after the CONTRACTOR has already set the meter in its proper position.) Where the main line is in the highway right-of-way, meters shall be set as close to the

right-of-way fence as practicable but no meter on the same side of the road as the main line shall be set with more than six feet (6') of service line unless prior approval has been obtained from the ENGINEER or his representative or as directed on the plans. The standard details show the required meter setting.

Meter settings shall be made in a workmanlike manner with backfill neatly compacted in place. In yards, pastures and other grassed areas, top of meter box may be placed no higher than 1/2 inch above original ground and no lower than flush with original ground. Boxes in sidewalks or other concrete areas shall be flush with surface. In areas which have not been sodded top of box shall be two inches (2") above grade. The service line must meet the same cover requirements as the main line as described in these specifications except that the service line may be brought up to a depth of approximately twenty-four inches (24") within five feet (5') of each side of the meter installation when a twenty-four inch (24") deep meter box is used. In all other cases the service pipe will be brought up to a depth which accommodates installation at the bottom of the meter box in accordance with the Standard Details. As shown in the Details, after five feet (5') from box, service pipe must return to thirty inch (30") cover (forty-two inches (42") in traffic). If meter box area is subject to traffic a deeper box will be required to maintain forty-two (42") inches of cover over the service pipe.

3.2.1 Existing Line Connection. If the meter installation is a replacement for an existing meter, the Contractor shall locate and close the corporation stop at the existing line if the existing line is not abandoned.

3.3 SERVICE LINES

Service lines shall be installed from the water main to the reconnection with existing service line. Any service tubing installed on the customer's side of the meter shall be performed by a licensed plumber.

3.3.1 Service Lines Crossing a Road. Services on the opposite side of the road shall be provided as stated above. In general, all pipe shall be jacked beneath paved or blacktopped city streets or county roads, unless solid rock prevents using this method, in which case the open trench method may be used. The open trench method generally will be used on all unpaved city streets, county roads and private driveways. In general, blacktopped and concrete private driveways shall also be jacked under. In all cases where lines are under traffic, a minimum cover of forty-two inches (42") shall be provided. All backfill shall be compacted by air tampers in layers no greater than six inches (6") deep. In cases of open trench construction, crushed stone, blacktop and concrete paving shall be replaced according to the Standard Drawings. All service lines crossing a road shall be cased with PVC casing pipe. Open trench construction will not be permitted through state or federal highways.

4.0 PAYMENT

Service Tubing shall be paid at the Unit Price Bid for each foot of service tubing installed and shall include all labor, materials, equipment incidentals, etc. No extra shall be paid for service tubing bored, jacked and/or encased.

The Unit Price Bid for Reconnect Meter Service shall constitute full compensation for all labor, materials, equipment, etc. required in reconnecting the existing meter setting, to the new water line including locating and shutting off corporation stops for any existing meter services when necessary.

The Unit Price Bid for Meter Service shall constitute full compensation for furnishing and installing the saddle, corporation stop, meter box, meter, cover, meter setter and valve, holding rod, and service tubing extension as shown and specified. This shall include locating and shutting off corporation stops for any existing meter services when necessary.

The Unit Price Bid for Meter Service w/Ind. PRV shall constitute full compensation for furnishing and installing the saddle, corporation stop, meter box, meter, pressure reducing valve, cover, meter setter and valve, holding rod, and service tubing extension as shown and specified. This shall include locating and shutting off corporation stops for any existing meter services when necessary.

SECTION 15110

INSTALLATION OF WATER LINE ACCESSORIES

1.0 GENERAL

The CONTRACTOR is to supply and install all valves, hydrants, blowoffs and other equipment at the locations shown on the plans in complete accordance with these specifications.

2.0 MATERIALS

2.1 Fire Hydrant. All fire hydrants shall have a six inch bell connection, shall have two hose outlets and one pumper connection, shall be designed for 250 pounds working pressure or 300 pounds hydrostatic pressure and shall conform to the latest specifications of the AWWA C502. All working parts shall be bronze. Both hose outlets shall be 2 1/2 inch with NST threads and the pumper outlet shall be 4 1/2 inch with NST thread. Hydrants shall be designed so that no water will be lost when they are broken off and so they can be repaired with a repair kit. Design, materials, and workmanship shall be similar and equal to the latest stock pattern ordinarily produced by the manufacturer. Length of barrel shall be such to provide a 3 1/2 foot bury depth. Working drawings and full description of hydrants shall be submitted to the ENGINEER before ordering. All hydrants shall have a 5 1/4 inch valve opening against pressure. The hydrants shall be equal to Mueller Model A423 or equal. All hydrant extensions will be the responsibility of the CONTRACTOR.

2.1.1 Paint. Hydrants shall be painted one coat of red paint and two finish coats of approved paint of color directed by the ENGINEER. All hydrants are to receive the final coat of paint after field installation.

2.2 GATE VALVE

All gate valves shall be the resilient seat-type, iron body, non-rising steam, fully bronze mounted, and suitable for working water pressures of not less than 200 psi for installations on PVC pipe and not less than 250 psi for installations on DI pipe. Valves shall be of standard manufacture and of the highest quality both of materials and workmanship and shall conform to the latest revision of AWWA Specification C-509. Valves shall be furnished with flanged connections for exposed piping and push-on or mechanical joint connections for buried service. Gate valves shall have a clear water way equal to the nominal diameter, and shall be opened by turning counter-clockwise. The operating nut or wheel shall have an arrow cast in the middle, indicating the direction of opening. Each valve shall have the maker's initials, pressure rating and the year in which manufactured, cast on the body. Prior to shipment from the factory each valve shall be tested by hydraulic pressure of at least 300 pounds per square inch.

2.3 BUTTERFLY VALVE

All butterfly valves shall be of tight closing, resilient seat type with seats securely fastened to valve body. No metal-to-metal seating surfaces will be permitted. Valves shall be bubble tight at the rated pressure in either direction and shall be satisfactory for applications involving throttling service and/or frequent operation and for applications involving valve operation after long periods of inactivity.

Valves shall be suitable for working water pressure of 200 psi unless otherwise specified or noted on the plans.

Cast Markings: valve size, manufacturer's name, class, direction of opening, and year of casting.

The valve discs shall rotate 90^{o} from the full open position to the tight shut position.

The valve discs shall be cast/ductile iron with a welded nickel edge free of ribbing or protrusions which may collect solids. The disc-to-shaft connections shall be via polished 316 SS pins. Sprayed or plated discs are not acceptable. All disc seating edges shall be smooth and polished.

The shafts shall be turned, ground and polished, and be of one-piece construction. The shafts shall also be constructed from stainless steel with diameters per AWWA C504, Class 75B.

The shaft seals shall be of Hycar or Hypalon and shall be provided to prevent leakage into the bearing chest areas.

The valve bearings shall be Teflon coated, self-lubricating, stainless steel design and construction.

The valve seats shall be Neoprene or Hypalon and shall be simultaneously molded, vulcanized and bonded to the valve body or a rigid reinforcing ring.

2.3.1 Operators. The valve operating mechanisms shall be for counterclockwise opening. There shall be no external moving parts on valve or operator except the operator input shaft. Input shaft is to be operated by a 2-inch square operating nut. Maximum required input force on the operator shaft to open and close the valve shall be 40 pounds. The total number of turns applied to the operating nut required to completely open the valve from a completely closed position shall be not less than twice the nominal valve diameter. An extension stem shall be furnished if required to bring the operating nut within 3 1/2 feet of finished grade. Extension stems shall be securely fastened to the valve stem. A stainless steel collar, 6-inches high, shall be welded to the operating gear box housing centered on the operating nut to hold

the valve box in place and seal it against dirt. The diameter of the collar shall be such that it will accept the valve box.

The valves shall be manufactured by M & H, Dresser, Dezurik or approved equal.

2.4 AIR RELEASE VALVES

A valve designed to allow exhaust of small pockets of air from the water main while in use shall be installed where shown on the plans or where directed by the ENGINEER. The air release valve shall have a 3/4" iron pipe thread inlet, cast iron body construction, bronze trim, with all internal parts of stainless steel. The valve shall have a minimum orifice size of 3/32". Valves shall be suitable for a working water pressure of 150 PSIG. The air release valve shall be mounted on 3/4" bronze riser pipe. The riser pipe shall be connected to the water main by use of a service clamp and a corporation stop. The riser shall also have a 3/4" bronze ball valve with stainless steel handle and be suitable for a 150 PSIG working water pressure. Air release valves shall be as manufactured by APCO Models 65 or 50, or approved equal.

Air release valves will be installed in the same type of box used for meter installation. The box must allow for adequate cover over the pipe at the installation.

In locations where the air release valve can not be placed directly above the water main, such as roadway drainage ditches, then a section of service tubing shall be used to locate the valve as directed by the ENGINEER. The service tubing shall be installed with a continuous upward slope to eliminate air pockets. Additional payment for the tubing shall be made based on the linear foot bid for service tubing. Tubing shall also be rodded through the box to support the valve. No additional payment will be made for the tubing supports.

2.5 VALVE BOXES

All valves (gate, air release, check, etc.) installed underground shall be installed in an approved valve box. Each gate valve shall be installed in a vertical position with a valve box. Valve boxes shall be of a cast iron, two or three-piece, slip-type consisting of a base, a center section and a top section with a cover marked "water". Where valve box is constructed in a paved area the box shall be a screw type box. The entire assembly shall be adjustable for elevation and shall be set vertically and be properly adjusted so that the cover will be in the same plane as the finished street surface (no more than 1/2" above ground in yards or pastures or 2" in unsodded areas). The assembly must provide for the required cover over the pipe at the installation site and shall rest on concrete pads as shown in the Standard Details. The CONTRACTOR shall furnish two (2) valve wrenches for the project.

2.6 BLOW-OFF VALVES

Blow-off valves shall be installed in accordance with the details and the specifications at locations shown on the plans and in other locations as directed by the ENGINEER. The CONTRACTOR should refer to the Standard Details for blow-off installation.

The blowoff pipe from the main to the flush valve shall be connected to the main by means of a tee. Do not use a corporation stop for this connection. The gate valve for the blow-off connection shall be a resilient seat gate valves in conformance with AWWA C509.

2.7 TAPPING SLEEVE AND VALVE

Tapping sleeves shall be as manufactured by Ford Meter Box Company, Inc., Model FTSC, or approved equal, and shall be rated for a minimum working water pressure of 150 psi. CONTRACTOR shall ascertain the type and size of pipe to which the connection is to be made prior to selection. The valve shall be as specified under section 2.2 or 2.3 of this specification.

3.0 EXECUTION

3.1 FIRE HYDRANTS

Under this Item, the CONTRACTOR shall provide all labor, tools, equipment and materials to furnish and install hydrants with gate valves as shown on the drawing and as directed by the ENGINEER.

Hydrants shall be set at such elevations that the connecting pipe will have the same depth of cover as the distribution main. The back of the hydrant opposite the pipe connection shall be firmly wedged against one and one-half square feet or enough of the vertical face of the trench with concrete to prevent the hydrants from blowing off the line. In addition, all fittings, valves and hydrants shall be joined by the use of all-thread rods, nuts and "DUC-LUG" offsets as shown on the attached drawing to prevent movement of the hydrant. If the character of the soil is such, in the opinion of the ENGINEER, that the hydrant cannot be securely wedged, bridle rod collars shall be used which shall be not less than three-fourths inch stock and shall be protected by a coat of acid resistant paint.

Not less than seven cubic feet of No. 9 stone shall be placed around the base of the hydrant to insure drainage. Before the No. 9 stone is placed and before it is backfilled the drain hole shall be inspected and thoroughly cleaned if necessary. The backfill around the hydrant shall be thoroughly compacted to the grade line in a manner satisfactory to the ENGINEER. Hydrants shall have the interior cleaned of all foreign matter before installation.

All hydrants will be installed with the pumper connection facing the main access road or as directed by the ENGINEER.

Stuffing boxes shall be tightened and the hydrants shall be inspected in open and closed position to see that all parts are in working condition.

3.2 VALVES

Underground valves shall be nut operated, unless otherwise shown on the plans. Valve supplier shall furnish two standard stem iron wrenches for turning nut operated valves. All underground valves which have nuts deeper than 30 inches below the top of valve box shall have extended stems with nuts located within 2 feet of valve box cap. Buried service valves shall have either epoxy-coated or tar-coated exteriors.

Exposed service valves shall be equipped with an AWWA approved handwheel operator. The exterior of exposed valves shall be epoxy-coated, tar-coated, or as specified on the DRAWINGS.

3.3 TIE IN CONNECTIONS

All tie in connections shall include a tapping sleeve and valve per Section 2.7 of this specification and any fittings suitable to make the required connection. The fittings shall be mechanical joint, ductile iron type as specified in other sections.

4.0 PAYMENT

Payment of the unit price bid for fire hydrants shall constitute full compensation for furnishing and installing the fire hydrants with associated tees, gate valve and incidental items as specified.

Payment for gate valves, air release valves, check valves and other special valves installed underground shall include all work necessary for a complete installation and shall include all valve stem boxes or other valve boxes and box covers. Payment will be made at the unit price bid for the type and size of valve installation.

Blowoff Assemblies will be paid for under their respective bid prices and such payment is to include the gate valve setting, boxes and six feet (6') of pipe. Any additional pipe required will be paid under bid price for pipe installed.

SECTION 15120

SPECIAL ITEMS OF CONSTRUCTION IN WATER LINE INSTALLATION

1.0 GENERAL

These specifications govern special crossings, installations and construction procedures required to deal with unusual construction items or special requirements of governing agencies.

2.0 MATERIALS

2.1 CASING PIPE

In general, the diameter, thickness, style, joints and materials selected for casing pipe shall be as shown on the plans or as specified herein and shall be considered as "minimum" requirements, all subject to prior approval of the ENGINEER. In all cases, the approval for construction by agreement with the private company and/or construction permit issued by the State, County, or Municipal agency will be required before construction starts.

Steel casing pipe for road and railroad crossings using the boring and jacking method shall be steel, plain end, uncoated and unwrapped, and shall be furnished in at least 18-foot lengths. Steel pipe shall meet the requirements of ASTM Specification A-120 and AWWA C200. Pipes up to and including 4 inches in diameter shall be Schedule 40. Pipe larger than 4 inches and less than 18 inches shall have a wall thickness equal to or greater than 0.312 inches under railroads and 0.250 for all other uses. Pipe larger than 18 inches under roads shall have a wall thickness as indicated in the table below.

Minimum Thickness (Inches)	Nominal Diameter (Inches)
Use Schedule 40	less than 4
0.250	4 thru 18
0.281	20
0.312	22
0.344	24
0.375	26
0.406	28 thru 30
0.438	32
0.469	34 thru 36
0.500	38 thru 42

The inside diameter of all casing pipes shall be a minimum of four inches (4") greater than the largest outside diameter of the carrier pipe, joint or coupling.

The pipe shall be steel, new material, with a minimum yield of 35,000 psi. The steel casing pipe shall be bored and/or jacked in place at the locations as shown on the plans or as directed by the ENGINEER. All joints between lengths shall be solidly welded with a smooth non-obstructing joint inside. Any field welding shall be performed by a certified welder and shall be in accordance with AWWA C206. The casing pipe may be extended beyond the boring limits by open trenching as shown in the Standard Details. This would apply when the casing is required from right-of-way to right-of-way or ditch line to ditch line. Open trenching at jacked or bored locations will be allowed no closer than 3 feet from the edge of pavement or toe of the slope embankment.

Positioning guides (insulators) shall be utilized on all carrier pipe which is within the casing pipe. Positioning shall be accomplished by the use of prebuilt spacers such as those manufactured by CALPICO or an approved equal. The CONTRACTOR shall submit the type of position guide proposed for use for the approval of the ENGINEER. Spacing of the positioning guides shall be in accordance with the Standard Drawings. The carrier pipe shall not be permitted to rest on bells or couplings. The spacers shall be sized to fit the carrier pipe and the walls of the encasement pipe.

The ends of the casing pipe shall be plugged and made watertight in a manner acceptable to the ENGINEER prior to backfilling. Casing seals as manufactured by Pipeline Seal & Insulator, Inc. (PSI), Advance Products & Systems, Inc. (APS) or equal shall be used.

Where road crossings are made using plastic pipe or copper, the location of joints under the roadway should be avoided by using lengths of adequate dimension for the crossing. This principle also applies to other types of pipe where sufficiently long lengths are available.

2.2 PAVEMENTS

2.2.1 Concrete Pavement Replacement. This pavement replacement shall be Portland cement concrete construction in accordance with the requirements shown in the Standard Details. It shall include all pavement replacement on concrete surfaced roads, concrete driveways, concrete sidewalks and concrete parking areas, both public and private.

2.2.2 Heavy-Duty Bituminous Pavement Replacement. This type of asphalt pavement replacement shall be bituminous concrete surface over concrete base in accordance with the details. This type of pavement replacement shall be used on all heavily trafficked roads having an existing pavement greater than 2", whether public or private, or in other locations as directed by the ENGINEER.

2.2.3 Light-Duty Bituminous Pavement Replacement. This type of pavement replacement shall be bituminous concrete constructed in accordance with the details. This item shall include all light-duty bituminous concrete roadways, bituminous driveways and bituminous parking lots, both public and private.

2.2.4 Crushed Stone Surface Replacement. This type of surface replacement shall include all graveled roadways, driveways, parking areas, or other gravel surfaced areas, both private and public. This type of surfacing may also be required as a base course for other pavement replacement.

2.3 CRUSHED STONE

The crushed stone backfill as noted on the drawings shall be dense #57 aggregate per Kentucky Department of Highways Specifications. The CONTRACTOR shall continuously be responsible for the maintenance of the aggregate and the surface of the trenches until the pavement replacement is completed.

2.4 PORTLAND CEMENT CONCRETE

Portland cement concrete for pavement replacement shall contain a minimum of 6 sacks of cement per cubic yard, the maximum free water content shall be 6 gallons per sack of cement, the slump shall be between 2 and 4 inches, and the concrete shall have minimum 28-day compression strength of at least 3,500 PSI. Cement, aggregate and water shall be described in these specifications for Class "A" concrete. A set of cylinders shall be made and tested for each 25 cubic yards of concrete placed, or fraction thereof, to supply representative sampling and testing of the concrete, upon the direction of the ENGINEER. The CONTRACTOR shall produce a broomed, or burlaped uniformly smooth and nonskid surface, consistent with the existing pavement.

Bituminous materials and mixes shall be consistent with the recommended practice of the asphalt institute and it shall conform to the requirements of the Kentucky Department of Highways for prime coat and Class 1 bituminous concrete. The bituminous concrete shall consist of a binder or base course and a surface course.

3.0 EXECUTION

3.1 ROAD CROSSINGS

In all cases, these crossings will be made in compliance with the requirements of the State Highway Department or the appropriate county or city office. State requirements will normally be described by the appropriate District Highway Office. In general, unless otherwise shown on the plans or directed otherwise by

the ENGINEER, the crossing of all State Highways shall be accomplished by boring under the roadway. In addition, the crossing of service lines 1-1/2 inches and greater under rigid and flexible surfaced paved roads shall be accomplished by boring and jacking a casing pipe under said roadway. In certain cases, as shown on the plans, service lines of all sizes will require casing pipe installed with the crossing.

Under state roads, requirements of the Kentucky Transportation Cabinet shall apply. Unless stated otherwise by the ENGINEER, all pipe crossing a state road shall be cased with casing pipe bored under the road. Pipe crossing under county roads or city streets shall be cased with casing pipe, and crossed in the manner as directed on the plans.

3.1.1 OPEN TRENCH CROSSINGS

The trench shall be excavated to a minimum width that will allow the pipe installation. The trench walls shall be kept as nearly vertical as possible. The minimum specified cover above the pipe shall be maintained. The Standard Details section shows the requirements for open trench crossings.

The backfill in the trench under any roads, driveways, or parking areas where the open trench method is used shall be of the type shown in the Standard Details and shall be deposited and compacted in uniform layers not to exceed the depth shown in the Standard Details.

The surface of the road, driveway, or parking area shall be replaced with the same type of material as specified under pavement replacement.

3.1.2 BORING AND JACKING

The work is herein defined as the operations in which both the boring by auger and the jacking of the casing pipe are done mechanically and in which the diameter of the casing pipe is too small to permit hand working at the heading of the casing pipe. Two basic methods are: (1) pushing the casing pipe into the fill or earth simultaneously as the boring auger drills out the ground and (2) drilling the hole through the fill or earth and pushing the casing or carrying pipe into the hole after the drill auger has completed the bore.

A suitable approach trench shall be opened adjacent to the slope of the embankment, or adjacent to point of bored and jacked section as shown on the plans. The approach trench shall be long enough to accommodate the selected working room. Guide timbers or rails for keeping the casing pipe on line and grade shall be accurately set and maintained in the bottom of the approach trench and with heavy timber back-stop supports installed at the rear of the approach trench to adequately take thrust of the jacks without any movement or distortion. It is paramount to the securing of acceptable tolerance limits of

workmanship in the boring and jacking operation that extreme care be taken in the setting of all guides, rails and jacks to the end that the casing pipe in final position be within the limits of acceptability for the placing and laying of the carrier pipe. The minimum cover of forty-two inches (42") under the roadway must be maintained. Additional depth may be required as shown on the plans.

3.2 RAILROAD CROSSINGS

At all railroad crossings, cover pipe (casing) for water lines (carrier pipe) shall be jacked or pushed beneath tracks and the carrier pipe jointed and pushed through the cover pipe. Detailed drawings of railroad crossings including the length of casing and depth below track are shown in the plans. CONTRACTOR shall obtain and pay for services of a representative of the railroad to direct the CONTRACTOR's operations while on the railroad property when required by the railroad.

3.3 FREE BORE

At locations indicated in the plans, the CONTRACTOR shall provide a jacking pit and bore through the earth at the proper line and grade. The augured hole shall be as small as practical to allow the carrier pipe to pass through.

This bid item does not apply to service tubing.

3.4 CREEK CROSSINGS

3.4.1 Special Creek Crossing. Where required on the plans or instructed by the ENGINEER, the CONTRACTOR shall construct a special creek crossing as shown in the Standard Details. Crossings shall be scheduled for construction in times of low flow, if practicable, otherwise cofferdams of sand bags or clay shall be used to divert the stream flow while crossing is made. Concrete shall not be placed under water and CONTRACTOR shall provide suitable pumps to keep water out of trench excavation during stream crossing construction.

3.4.2 Normal Earthen Creek Crossing. Where the stream crossing is made in earth or other beds which are stable, then the pipe will be laid in a narrow trench at the depth specified in the Standard Details to maintain the required cover between pipe and stream bed. Initial backfill will be mechanically compacted. Trench backfill in any stream crossing area from one foot (1') above the top of the pipe shall consist of trench excavated rock, if available. No extra payment will be made above normal construction for this type of creek crossing.

3.4.3 Bypass Test Meter. At locations as indicated on the plans, where a new creek crossing is installed, a bypass test meter shall be installed. The meter shall be installed as a normal water meter with taps on each side of a valve, as shown on the Standard Drawing.

3.5 RIVER OR LAKE CROSSINGS

Crossings in rivers or lakes where the pipe cannot be laid in a trench shall normally be made with ductile iron pipe having ball and socket joints or polyethylene pipe as indicated on the DRAWINGS. Details for any required installations of this type including pipe required, anchors (number, size and location), and installation technique are shown in the plans.

3.6 BRIDGE CROSSINGS

Wherever possible bridges will not be utilized for stream crossings. However, where it is necessary for the water line to be attached to bridges, the pipe shall be securely fastened to bridge stringers or beams using supports as dimensioned and located in the plans. The carrier pipe shall be insulated with Vermiculite or other approved material to prevent freezing. Expansion joints to allow for movement of the bridge will be required as shown on the plans.

3.7 WATER LINES AND SEWER LINES SEPARATION

3.7.1 General. Wherever sewer lines cross, or are adjacent to, each other, special precautions shall be taken.

3.7.2 Parallel Water and Sewer Lines. Water lines must, if possible, be located a minimum lateral distance of 10 feet from any existing or future sewer lines measured from outside diameters. Where water lines and sewer lines must be placed in the same trench, the water line must be located on a shelf, two feet (2') above and two feet (2') to the side of the sewer line. Whenever this condition cannot be met, and upon direction from the ENGINEER, the water line shall be uncovered and encased with concrete per the standard encasement detail.

3.7.3 Crossing Water and Sewer Lines. Wherever sewer lines and water lines cross, it is desirable, if practical, that the sewer line be at least twenty-four inches (24") below the water line.

Where it is not practical to provide such a separation, care shall be taken to ascertain that the existing water line or existing sewer line is in good sound condition and that no evidence of joint leakage is known in that vicinity. If any such evidence does exist, the existing line shall be exposed by the CONTRACTOR at least ten feet (10') each side of the new pipe crossing, carefully examined and any defects positively corrected. The OWNER will arrange for examining and correcting any defects in the existing lines, but the CONTRACTOR shall cooperate in every way possible.

When the water line must be below or less than two feet (2') above the sewer line, the CONTRACTOR shall encase the water line five feet (5') in each direction from the crossing as directed by the ENGINEER. This encasement

should only be accomplished when directed by the ENGINEER and shall be accomplished in accordance with the details shown on the drawings. The encasement is a separate pay item.

3.8 SEEDING AND SODDING

Upon completion of the installation of the work, the CONTRACTOR shall remove all debris and surplus construction materials resulting from the work. The CONTRACTOR shall fine grade all the disturbed surfaces around the area of the work in an uniform and neat manner leaving the construction area in a condition as near as possible to the original ground line or to the lines as directed by the ENGINEER.

All graded areas shall be left smooth and thickly sown with a mixture of grasses. The mixture of grasses shall consist of one-third (1/3) Rye grass, one-third (1/3) Kentucky Fescue and one-third (1/3) Kentucky Bluegrass by weight, and shall be applied to the graded areas at a rate of not less than 1 pound of seed per one thousand square feet of area. When the final grading has been completed, the entire graded area to be seeded shall be fertilized with 12-12-12 fertilizer, applied at the rate of 6 pounds per one thousand square feet of area. After the seed and fertilizer have both been applied, the CONTRACTOR shall then lightly cover the seed by use of a drag or other approved device. The seeded area shall then be covered with straw to a depth of approximately one inch (1").

Where existing lawns have been disturbed, the existing sod will be removed and stored and replaced to its original position once the work is in place. If the CONTRACTOR damages or destroys the original sod, it shall be replaced with a sod having at least 60% good quality Kentucky Bluegrass, strongly rooted and free of pernicious weeds and shall be so laid that no voids occur between strips. When placing sod, it shall be tamped or rolled immediately after it is laid and the finished surface shall be true to grade, even and equally firm at all points. Well screened top soil shall be lightly sprinkled over the sodded areas and shall be raked to insure sealing the sod joints. The sodded areas shall be thoroughly watered. Sod damaged by the CONTRACTOR shall be replaced with new sod by the CONTRACTOR at no cost to the OWNER.

The fine grading, seeding, sodding and clean-up shall be considered as incidental expense and shall not be separate pay items.

Meadows and hay fields will require replacement in kind unless the CONTRACTOR secures a release from the property OWNER agreeing to no replacement or alternate replacement.

3.9 PAVEMENT AND OTHER STRUCTURE REPLACEMENT

The CONTRACTOR shall replace all pavement cut or disturbed, with pavement similar in all respects to existing pavement in accordance with the Standard Details and at those locations approved by the ENGINEER. Every effort shall be made to avoid cutting the pavement. In restoring pavement, new pavement is required, except that granite paving blocks, sound brick or sound asphalt paving blocks may be reused. No permanent paving shall be placed within thirty (30) days after the backfilling has been completed. All concrete and asphalt paving materials shall be in conformance with the Standard Details shown in the plans. The pipeline trench through all paved areas (parking lots, driveways, roads, etc.) shall be fully backfilled with crushed stone.

3.9.1 Installation of Pavement Replacement. The CONTRACTOR shall cut back the surfacing adjacent to the trench for twelve inches (12") on both sides of the trench and shall cut down the dense graded aggregate he has placed to a depth required for either type of pavement replacement. The resulting surface shall be rolled to yield a smooth, dense surface and a uniform depth.

The concrete shall be placed in accordance with standard practice, with the welded wire mesh if required in proper position and thoroughly vibrated into place. The CONTRACTOR shall produce a surface consistent with the existing pavement. The CONTRACTOR shall apply a liquid curing component, sprayed on the surface of the concrete, and shall provide adequate protection to the pavement until it has set.

For bituminous concrete, the CONTRACTOR shall clean and broom the prepared surface, then apply the prime coat at the rate of 0.20 to 0.25 gallons per square yard, with a pressure distributor or approved pressure spray method. When the prime coat has become tacky but not dry and hard, the bituminous binder course, or base course, whichever applies, shall be placed and compacted. The CONTRACTOR shall then apply the surface course. It is recommended, but not required, that the base course remain in place for approximately one week before placing the surface course. The finished course shall be compacted and the completed surface shall match the grades and slopes of the adjacent existing surfacing and be free of offsets, depressions, raised places and all other irregular surfaces.

3.9.2 Seasonal and Weather Limitations for Pavement Replacement. In the event the progress and scheduling of the work is such that the bituminous pavement replacement would occur in the winter months, during adverse cold weather and/or during such times the asphalt plants are not in operation, then the final pavement replacement shall be postponed until favorable weather occurs in the spring and the asphalt plants resume normal operations. No bituminous concrete shall be laid when the temperature is below 40^{o}F except by written permission of the ENGINEER.

Concrete pavement shall not be placed when the temperature is such that the pavement placed will freeze before it has had adequate time to set and shall be placed in conformance with the temperature conditions specified in this section of these specifications.

The CONTRACTOR shall be responsible for replacement of pavement which he has placed which has been damaged by cold weather or freezing without additional compensation.

In the meantime, the CONTRACTOR will be required to maintain the temporary surfacing until the permanent pavement is placed. Such labor, materials and equipment as is required for temporary maintenance of the streets, roadways and driveways shall be provided at the CONTRACTOR'S expense and is not a pay item. The CONTRACTOR will be required to use a cold mix asphaltic concrete as a temporary surface for trenches under heavy traffic use.

3.9.3 Guarantee. The one year guarantee as specified in the contract documents is also applicable to trench settlement and pavement replacement.

3.10 SIDEWALK AND DRIVEWAY REPLACEMENT

Sidewalks and driveways will be replaced if damaged by the CONTRACTOR in any way. Payment will be made for those pavements necessarily damaged by the line installation in accordance with the Standard Details. No pavements are to be replaced over a backfilled trench for at least thirty (30) days after filling. Pavements damaged otherwise are to be replaced immediately at the CONTRACTOR'S expense.

Materials and dimensions are to be at least equal to existing pavement and are to conform with the Standard Details.

3.11 PAYMENT FOR WATER

All water used from the UTILITY shall be metered with meters supplied by the CONTRACTOR. The CONTRACTOR shall pay for such water monthly at the rates published by the UTILITY. Unmetered water lost through water line breakage shall also be paid at the rates published by the UTILITY. The quantity lost shall be computed on the basis of a discharge velocity of 7 feet/second, the diameter of the line, and the estimate duration of free uncontrolled discharge.

3.12 FINAL CLEAN-UP

The CONTRACTOR shall provide effective cleanup of the work as it progresses. Procrastination of cleanup will not be tolerated. At the time of final inspection, no trenchs shall show any undue evidence of the previous construction. All areas shall be left free of ruts due to construction equipment and shall have a clean

and neat appearance without rubble or debris. The areas shall not be mounded up and shall be completely restored, and all yards and fields shall be reseeded so land may be cultivated, mowed, etc. Straw and fertilizing shall accompany the seeding in accordance with Section 3.8—Seeding and Sodding of this section. If necessary to hasten proper restoration of terraces, principally along ditch lines, the CONTRACTOR shall sod such areas at the ENGINEER'S direction. For all line segments, final cleanup shall be performed within 30 days from day of installation.

3.13 PROTECTION OF ADJACENT LANDSCAPE

Reasonable care shall be taken during construction of the water lines to avoid damage to vegetation. Ornamental shrubbery and tree branches shall be temporarily tied back, where appropriate, to minimize damage. Trees which receive damage to branches shall be trimmed of those branches to improve the appearance of the tree. Tree trunks receiving damage from equipment shall be treated with a tree dressing.

In the course of construction, the CONTRACTOR may deflect horizontal alignment of the water line to avoid trees and to keep from damaging their roots. The CONTRACTOR shall be fully responsible for settling all claims by private property owners concerning damage to trees and shrubs.

4.0 PAYMENT

Casing pipe will be paid according to the unit bid price for boring or open cutting, as appropriate. The price shall include, as necessary, the cost of the casing pipe, the cost of boring or cutting, and the cost of special requirements for the road or railroad crossing. Carrier pipe will be paid according to Section 15100.

The unit price bid per linear foot for free boring, as measured from edge of pavement to edge of pavement, regardless of size of bore, shall constitute full compensation for the work specified.

Payment for special creek crossings will be at the unit price bid per linear foot for that item and shall include encasement pipe, crushed stone, concrete, solid rock excavation and all other work necessary for a satisfactory installation. The carrier pipe installed in the casing shall be paid separately under the unit price bid for pipe installed.

Payment for Bypass Test Meter or Leak Detection Test Meter shall include a meter setting (5/8" x ¾") and taps on both sides of a gate valve. The gate valve, sized for the line, is a separate pay item, covered in Section 15110.

Additional costs for normal earth creek crossings shall be included in the unit price bid for pipe installation and no special payment will be made for these crossings.

Payment for asphalt and concrete pavement replacement will not be based on the quantities purchased by the CONTRACTOR. Payment for surfacing will be paid on the basis of linear feet installed in accordance with the STANDARD DRAWINGS with a maximum width of pipe diameter plus twenty-four inches (24"). Crushed stone sub-grade under paving shall be included in paving price and not paid for separately. Any additional cost estimated by the CONTRACTOR must be included in the cost of pipe in place.

Sidewalk /driveway crossings when included as a bid item shall include the extra cost of free-boring or the removal and disposal of existing pavement and replacement with new construction. Payment for pavement replacement will be on the basis of linear feet installed. Width for payment for a standard trench crossing is shown in the Standard Details. When sidewalk/driveway crossings or replacement are not included as a bid item, their costs shall be considered subsidiary to the bid for pipe installation.

Where required by the Special Provisions or the Bid Proposal, the cost of pavement replacement, boring, crossings of all types and other incidental construction shall be included in the unit price bid for pipe line installation and shall comprise total compensation for all such work.

All clean-up associated with installing water lines is incidental to the cost of installing the water lines. There is no separate pay item for clean-up.

ENVIRONMENTAL AND PUBLIC PROTECTION CABINET

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General Certification--Nationwide Permit # 12
Utility Line Activities

This General Certification is effective March 19, 2007, in conformity with the requirements of Section 401 of the Clean Water Act of 1977, as amended (33 U.S.C. §1341), as well as Kentucky Statute KRS 224.16-050.

Agricultural operations, as defined by KRS 224.71-100(1) conducting activities pursuant to KRS 224.71-100 (3), (4), (5), (6), or (10) are deemed to have certification if they are implementing an Agriculture Water Quality Plan pursuant to KRS 224.71-145.

For all other operations, the Commonwealth of Kentucky hereby certifies under Section 401 of the Clean Water Act (CWA) that it has reasonable assurances that applicable water quality standards under Kentucky Administrative Regulations Title 401, Chapter 5, established pursuant to Sections 301, 302, 304, 306 and 307 of the CWA, will not be violated for the activity covered under NATIONWIDE PERMIT 12, namely Utility Line Activities, provided that the following conditions are met:

1. This general Water Quality Certification is limited to the crossing of intermittent and perennial streams by utility lines. The length of a single utility line stream crossing shall not exceed twice the width of the stream. This document does not authorize the installation of utility lines in a linear manner within the stream channel or below the top of the stream bank.

2. The construction of permanent or temporary access roads will impact less than 300 linear feet of intermittent and perennial streams and less than one acre of jurisdictional wetlands.

3. The provisions of 401 KAR 5:005 Section 8 are hereby incorporated into this General Water Quality Certification. Namely, "Sewer lines shall be located at least 50 feet away from a stream which appears as a blue line on a USGS 7 ½ minute topographic map except where the sewer alignment crosses the stream. The distance shall be measured from the top of the stream bank. The cabinet may allow construction within the 50' buffer if adequate methods are used to prevent soil from entering the stream. Gravity sewer lines and force mains that cross streams shall be

constructed by methods that maintain normal stream flow and allow for a dry excavation. Water pumped from the excavation shall be contained and allowed to settle prior to re-entering the stream. Excavation equipment and vehicles shall operate outside of the flowing portion of the stream. Spoil material from the sewer line excavation shall not be allowed to enter the flowing portion of the stream." The provisions of this condition shall apply to all types of utility line stream crossings.

4. The activities do not result in any permanent changes in pre-construction elevation contours in waters or wetlands or stream dimension, pattern or profile.

5. Utility line construction projects through jurisdictional wetlands shall not result in conversion of the area to non-wetland status.

6. Stream impacts covered under this nationwide permit and undertaken by those persons defined as an agricultural operation under the Agricultural Water Quality Act must be completed in compliance with the Kentucky Agricultural Water Quality Plan.

7. The activity will not occur within waters of the Commonwealth identified by the Kentucky Division of Water as Outstanding State or National Resource Waters, Cold Water Aquatic Habitat, or Exceptional Waters.

8. Activities that do not meet the conditions of this general certification require an individual Section 401 water quality certification.

9. Activities qualifying for coverage under this general water quality certification are subject to the following conditions:

   - Measures shall be taken to prevent or control spills of fuels, lubricants, or other toxic materials used in construction from entering the watercourse.

   - Removal of riparian vegetation in the utility line right-of-way shall be limited to that necessary for equipment access. Effective erosion and sedimentation control measures must be employed at all times during the project to prevent degradation of waters of the Commonwealth. Site regrading and reseeding will be accomplished within 14 days after disturbance.

   - To the maximum extent practicable, all in stream work under this certification shall be performed during low flow.

- Heavy equipment, e.g. bulldozers, backhoes, draglines, etc., if required for this project, should not be used or operated within the stream channel. In those instances where such in stream work is unavoidable, then it shall be performed in such a manner and duration as to minimize turbidity and disturbance to substrates and bank or riparian vegetation.

- Any fill shall be of such composition that it will not adversely affect the biological, chemical, or physical properties of the receiving waters and/or cause violations of water quality standards. If riprap is utilized, it is to be of such weight and size that bank stress or slump conditions will not be created because of its placement.

- If there are water supply intakes located downstream that may be affected by increased turbidity and suspended solids, the permittee shall notify the operator when work will be done.

- Removal of existing riparian vegetation should be restricted to the minimum necessary for project construction.

- Should evidence of stream pollution or jurisdictional wetland impairment and/or violations of water quality standards occur as a result of this activity (either from a spill or other forms of water pollution), the Kentucky Division of Water shall be notified immediately by calling 800/928-2380.

Non-compliance with the conditions of this general certification or violation of Kentucky state water quality standards may result in civil penalties.

This general certification will expire on March 19, 2012, or sooner if the USACE makes significant changes to this nationwide permit.