

PART 1 –GENERAL

1.01 OUTLINE OF THE METHOD OF PRE-CHLORINATION OF HDPE PIPE

Assuming all qualifications for skill and materials are met, the Pipe Pulling of Potable Water Mains using Pre-Chlorinated Pipe will repeat the method, outlined below for each section of pipe being rehabilitated. These processes may be performed in series or in parallel with other sections of pipe within the job; however, each section will require these steps.

- A. Deliver notice of service outage to each affected property owner in advance of work.
- B. Chlorinate a length of product pipe that yields passing test results for potable water per AWWA, Texas Commission on Environmental Quality, and City standards.
- C. Hydrostatic test of the product pipe per City standards.
- D. Excavate a Pull Pit at one end of the section down to pipe grade for placement of the pipe pulling equipment.
- E. Excavate an Insertion Pit at the opposite end of the section down to pipe grade for entry of the product pipe.
- F. Excavate Service Connection Pits.
- G. Isolate the section to be rehabilitated from the rest of the system to maintain pressure integrity of the system as well as preventing any backflow of chlorinated solution or non-potable water into the system.
- H. Excavate and remove hydrant tees and valve tees from the existing host pipe.
- I. Rod string to be assembled as it is thrust through the host pipe from Pull Pit to Insertion Pit.
- J. Cutter tooling and product pipe attached to rod end at Entry Pit.
- K. Rod string pulled back and disassembled simultaneously while tooling and product pipe travels from Insertion Pit to Pull Pit.
- L. Service Connections shall be made to the newly installed main.
- M. Super-Chlorinate main for 15 minutes to 300 ppm. A de-chlorination unit will be used to neutralize the residual chlorine when flushing. Flush the newly installed main with potable water.
- N. Inspect for leaks at the new connections.
- O. Final inspection of the replaced section of pipe into the system.

It should be noted that items “D” through “O” are to be accomplished within a single 10 hour day to eliminate the need for any temporary services. The length of pipe to be Pull per run should be chosen to conform to this time frame. Items “D” through “F” (excavation items) may be performed one day prior to pulling operations to expedite process.

1.02 UNIT PRICES

- A. Measurement for installing replacement waterline using pre-chlorinated pipe pulling method, is on a per linear foot basis for each size of waterline installed.
- B. Insertion or access pits, embedment, disinfection and testing are included in the pipe pulling unit price and not paid for separately.

1.03 CONTRACTOR PRE-QUALIFICATIONS

In order to assure quality execution of the method, the contractor shall submit the following to the Owner’s Representative:

- A. Experience – The contractor shall provide documented evidence of:
 - 1. Performing 50,000 linear feet or more of water main replacement using the process of per-chlorinated pipe pulling in the United States of America over a minimum of 24-month period.
 - 2. Experience must be with the use of a per-chlorinated pipe pulling system with evidence of 2”, 4”, 6”, 8”, 10”, and 12” projects.

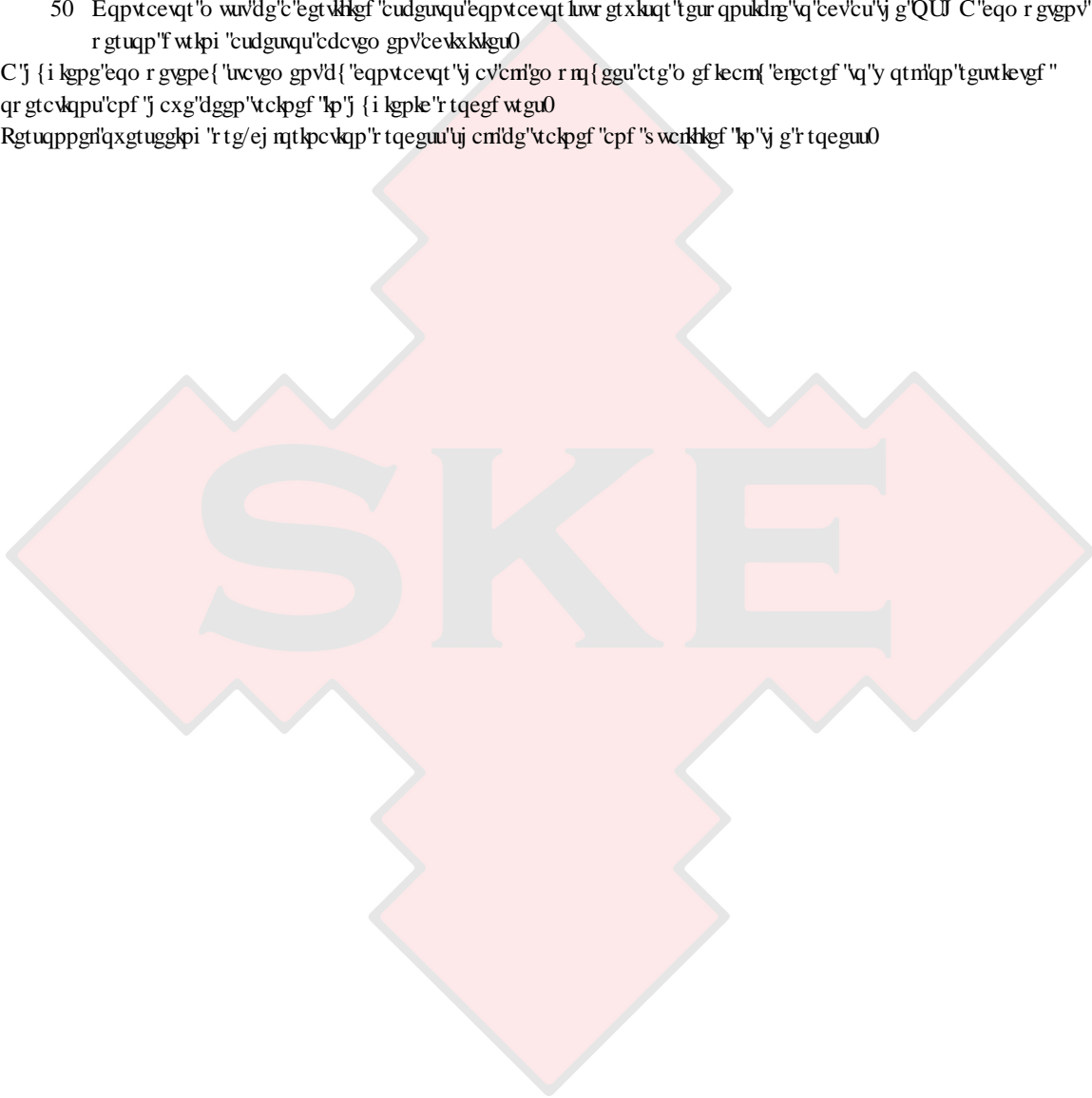
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PART 2 - PRODUCTS

2.01 PIPE SPECIFICATIONS

1. High Density Polyethylene Pipe shall be AWWA (HDPE) and per SKE Construction Specifications.
1. Pipe must conform to ASTM F714 and NSF 61.
1. HDPE resin shall be PE4900 characterized by ASTM D3350.
1. All pipe shall be made of virgin material, no rework except that obtained from manufacturers own production.
1. Pipe shall be a minimum of SDR 17 wall thickness or as directed by the Owner's Representative.
1. Cuts or gouges, per ASTM F585 are acceptable up to 10% of wall thickness. Beyond 10% of wall, damage must be removed by cutting the damaged section from the pipe string and butt fusing the ends.
1. Stripe along the length of the pipe shall be blue in color to identify the pipe as potable water.

2.02 OTHER PRODUCT SPECIFICATIONS

1. Fittings for pressure systems shall be ductile iron and comply with AWWA C110. The minimum pressure rating shall be 200 PSI and meet all SKE Construction standard specifications.
1. Stiffener inserts per ASTM 240 shall be used for all fittings and connections to HDPE pipe. Stiffeners shall be 304 stainless steel and be of wedge type design.
2. Service Connection Fittings shall be mechanical saddles with minimum working pressure of 100 PSI and per SKE Construction specification.
1. Pipe Connection Fittings shall meet AWWA standards and meet or exceed the pressure requirements of the HDPE Pipe.

2.03 PRODUCT COMPLIANCE

1. Certificate of compliance shall be supplied to the Owner's representative that the Product Pipe is per specification 2.01 and as specified in the General Requirements Section.
1. All materials (in excess of those specified above in 2.02A.) used with the coupling or connecting HDPE water main must be submitted and approved by the Owner's representative.

2.04 PRODUCT HANDLING

1. Pipe transport and handling shall be per manufacturer's recommendation.
1. Product other than pipe must be stored and handled per manufacturer's recommendations.

2.05 DOCUMENTATION AND PLANNING

1. SKE Construction shall submit a plan to the Owner's representative on a marked-up copy of the Project Drawings showing SKE Construction's construction phasing and plans at the Pre- Construction Meeting. Plan details should include:
 1. Pit locations for pipe insertion and Pull machine location.
1. Pit locations for service re-connects.
1. Schedule of when various sections are to be rehabilitated.
1. Distances of each pull.
1. Isolating points used to seal the system during the pipe Pull.
1. Chlorination/De-chlorination logs for each pipe section.
1. The Project Construction drawings provided by the Owner shall be marked by SKE Construction to show actual locations of services, fittings, fire hydrants and other re-connects. These markups shall be done the day of the actual placement. A set of marked up plans shall be returned to the Owner's representative.
1. Chlorination Submission Documents, pipes Pre-Chlorinated with intent to install under this specification must have a log sheet placed in a sealed waterproof envelope attached to the pipe at the start of the Chlorination process. This sheet makes up the Chlorination Submission Documents and shall be delivered to the Owner's Representative at the same

time as the marked-up construction drawing. Information on the log sheet shall at a minimum include:

1. Date of Swabbing
1. Date of Chlorinating and amount of chlorine used
1. Date of samplings
1. Results of Sample tests
1. Date of pipe installation
1. Date of Pressure Test
1. Makeup of water details (if any)
1. End pressure test
1. Final pressure test results
1. Location of installation

2.06 INTERRUPTION OF SERVICE TO END USERS

1. Interruption of service to end users shall be minimized through the efforts of SKE Construction and use of the method outlined within. Outages shall be limited to 8:00 AM to 6:00 PM Monday through Friday. No interruption shall be permitted between 6:00 PM and 8:00 AM or on Saturday, Sunday or legal holidays without the approval of the owner.
2. Only one (1) line segment may be shut down for rehabilitation at any one moment.
3. End users shall be notified in writing (door hanger, flier, etc.) by SKE Construction in a manner approved by the District. General notice shall be provided (7) days in advance if possible. Detailed Notice shall be provided at minimum permissible advance of 24 hours prior to service interruption.

2.07 JOINING OF PIPE

1. Fusing per Butt fusion methods in strict conformance to the pipe and/or fusing equipment manufacturers recommendations shall be used to join sections of High-Density Polyethylene Pipe.
2. Fusing of 'sticks' of pipe shall be performed in the general vicinity of the pipe insertion pit or lay down yard (staging area).
3. Pipe supplied by the pipe manufacturer in a coil may be fused remote from the pipe insertion pit.
4. Solvent cement joints performed by anyone other than the manufacturer is unacceptable for any HDPE pipe or fitting.

2.08 PRE-CHLORINATION OF PRODUCT PIPE

Chlorination of pipes prior to pulling shall be carried out per ANSI/AWWA C651-99 Standard for Disinfecting Water Mains and in cooperation with the District. Any information here shall facilitate that method when performed on pipes not yet placed on grade. In general, the method includes the following:

1. Disinfect all equipment, tools, end caps, pipe fittings or product that may contact pipe.
2. Disinfection shall be carried out by immersing or rinsing items in a hypochlorous solution containing 1 to 5 percent chlorine measured by weight. See details of Chlorination solution in section 2.09.
3. Product pipe shall be fused into a string of sufficient length to complete the designated section or be coiled in a manner suitable for delivery on a pipe reel. Maximum allowable length is 800 feet.
4. The surface upon which the product pipe rests during Chlorination shall be relatively impervious and free from visible contamination. Coiled pipe must be laid horizontally to allow all air to be expelled.
5. Swabbing, Chlorination and testing of the inside diameter of the pipe shall be accomplished by:
6. Swab being inserted at the lowest end of the pipe.
7. Calcium Hypochlorite tablets or granules as described in section 2.09. shall be placed behind the swab.
8. Pressure tight end cap shall be mounted to the low end of the pipe either by fusing or mechanically assembled to the pipe.

9. Potable water shall be introduced through this end cap at a controlled rate such that the swab is propelled at a velocity less than or equal to one foot per second. All air is to be dispelled from the pipe.
10. Upon discharge of the swab from the elevated end of the pipe, the elevated end shall be capped with a pressure tight seal. This seal having a tapped access hole of size at least 1.25" NPT or incorporating the ability to leak (purge) air or water at will by adjustment of clamping bolts. Additional potable water should be added after capping to ensure that no air remains between the caps.
11. Chlorinated solution should be maintained in the pipe for a minimum of 24 hours prior to flushing when water temperature is above 41°F (5°C), 48 hours when water temperature is 41°F (5°C) or less. Time for retention of the chlorinated solution shall not be significantly over designated holding time to prevent damage to the pipe or end caps.
12. After designated holding time, the pipe shall be drained, flushed and filled with potable water to expel the highly chlorinated solution. The spent Chlorinated solution shall not be allowed to enter any water shed, a sanitary sewer or any other area where environmental damage may occur without neutralizing it in an industry acceptable manner. Flushing water shall be from a source known to be of drinking water standard.
13. Test samples shall be taken from each end of the pipe on consecutive days, 24 hours apart. Samples shall be tested by a state certified lab within 30 hours of being taken.
14. Failure of any sample to pass a bacteriological test should result in the related section of pipe being re-flushed and retested. Should any sample again fail, the section must be chlorinated before retest.
15. Time before re-connection of a passing pipe section shall be limited to 14 days from the last sampling. After this time the pipe must be retested to be acceptable for use.
16. Drain the section of pipe prior to pipe pulling. The pipe shall be drained on the day of the pipe pulling and sealed after draining and for the pipe pulling process.
17. Swabs should be designated by the manufacturer as suitable for potable water system use. Swabs are to be manufactured by Knapp Industries or be of equivalent design.

2.09 CHLORINATION SOLUTIONS

1. Acceptable forms of chlorine include Calcium Hypochlorite conforming to ANSI/AWWA B300, preferably in 5-gram tablets, alternately in granular form. Material must be stored per manufacturer's recommendations.
2. Unacceptable forms of chlorine include Calcium Hypochlorite intended for swimming pool use.
3. Calcium Hypochlorite tablets shall be placed behind the swab in quantity based on pipe size and length per ANSI/AWWA C651-99 AWWA Standard for Disinfecting Water Mains.
4. Calcium Hypochlorite in granular form shall be placed behind the swab in quantity based on pipe size and length per ANSI/AWWA C651-99 AWWA Standard for Disinfecting Water Mains.
5. Solutions acceptable for pipe chlorination shall be acceptable for disinfection of equipment, tools, and caps, pipe fitting or product that may contact pipe.
6. Dilute Chlorinated solutions over 7 days old shall be disposed of properly and not used as a disinfection agent.

2.10 HYDROSTATIC PRESSURE TESTING

- A. Maximum allowable test pressure as referenced by PPI TR-31 shall be 1.5 times the pipe rated operating pressure (min. test pressure 125 psi) at the lowest point in the section under test or that of the lowest rated pressure component such as flanges, valves, fittings, etc.
- B. Air trapped in the product pipe must be purged before test.
- C. At the discretion of the Owner's Representative, the test method used may be either a Monitored Make-up Water Test or a Non-monitored Make-up Water Test. Either test shall be performed above ground

without fittings prior to pipe pulling. If damage to the product pipe occurs during pulling that requires a fused joint repair, the Owner's Representative may require re-test, with or without fittings after pulling.

D. Monitored Make-up Water Test shall be comprised of two stages:

1. Initial expansion and stabilization stage. The initial test pressure is applied, and the system is allowed to stand without make-up water during a 2 to 3 hour period. During this time the pipe is allowed to expand and stabilize.
2. Test stage, after the stabilization is complete, the system is pumped back to test pressure and allowed to sit for 2 additional hours. Water is then added until the test pressure is attained. Water added shall not exceed that of Table 3.15 (A).

E. Non-monitored Make-up Water Test shall be comprised of two stages.

1. Initial expansion and stabilization state. The initial test pressure is applied, and the system is allowed to stand without make-up water during a 2 to 3 hour period. During this time the pipe is allowed to expand and stabilize.
 2. Test stage. After the stabilization is complete, the system is pumped back to test pressure and then reduced by 10 PSI. The pressure shall remain steady, not falling more than 5% from reduced pressure during a one hour test period.
 3. Total time allotted for test shall not exceed 8 hours. If successful test cannot be completed in this period, then the test section must be depressurized and allowed to relax for a minimum of 8 hours before retest.
1. Re-test after repair. Should the Owner's Representative require test after repair, refer to Equation 3.15 (B) for Leakage Allowance due to fittings for the Monitored Make-up Water Test.
 1. Manifest shall be filled out with all pressure test results.



SKE

PART 3 - EXECUTION

1. PIPE PULLING OPERATION

The pipe pulling operation described within provides guidance on the basic process. It is to be understood that the need to make exceptions or additions to this process are common. These changes are made to accommodate nonstandard conditions. SKE Construction experience requirements make it reasonable to put the responsibility of devising these exceptions upon SKE Construction.

3.02 PIT LOCATION AND EXCAVATION

1. Pull pit and insertion pit locations shall be placed such that excavations are minimized. This may be accomplished by placing either or both pits at the point of a service connection.
2. Pull length shall not be longer than 400' in length for first 2 bursts. After soil pipe friction is evaluated longer Pull runs may be performed.
3. All pits shall be shored to ensure worker safety per OSHA or other local regulations.
4. All pits shall be roped off and or covered when not active per OSHA or local regulations to ensure public safety.
5. Traffic control shall be accommodated for by SKE Construction as per the Contract specifications. Safe traffic passage around pit excavations that are located in or adjacent to streets or highways shall meet requirements of Harris County. Parking of related employee vehicles, trucks and auxiliary and equipment shall be such that congestion and traffic delays are minimized.
6. Utilities intersecting the host pipe shall be exposed using an excavation technique appropriate for the utility. This Utility Crossing Pit shall exist prior to commencement of pulling. Man entry shoring is not required however appropriate safety precautions should be made.

3.03 PULLING MACHINE LOCATION AND SHORING

pulling machines of the static pull style require preparation and planning for the pulling pit that they are to operate from.

1. Pull pit shall be shored in accordance to 3.02 (C).
2. Forward face of the Pull Pit or the surface that the machine bears against while pulling back, shall be shored in workman like manner. This shoring shall maintain perpendicular Pull machine alignment to the pipe during pullback. Any loss of perpendicular alignment during pull shall result in stopping of the pulling process and improvement of the forward face shoring.
3. Rearward shoring shall be provided to react rod thrust forces during payout. While these forces are substantially lower than pullback forces, shoring must be used to stabilize the pulling machine to maintain perpendicular alignment of the machine during payout. The weight of the machine cannot be depended on to react thrust forces. Host pipe at rear face of pit may only be utilized for rearward shoring if scheduled for replacement.
4. Pipe face for Cast Iron, Ductile Iron or PVC shall be cut off using a saw or similar device to produce a square face for the pulling machine forward face to bear against. Final separation of cast iron pipe with a wedge may provide a clean face. Host Pipe shall be removed in sufficient length to accommodate Pull machine.
5. Pull machine must be positioned to have rod centerline at approximate centerline of host pipe.
6. Rod Box delivery and removal between temporary rod storage location and Pull Pit must be accommodated for with appropriate lifting equipment and techniques. Additionally, movement and or placement of lifting machine must be included in Traffic Control plans.

3.04 ROD PAYOUT OPERATION

1. Rod payout is the process of assembling a string of rods and pushing them in a step wise manner from Pull Pit, through the interior of the host pipe to Insertion Pit.
2. Lifting of rod boxes into or out of the Pull Pit shall be performed per OSHA or other applicable requirements with respect to equipment and method.
3. Threads shall be cleaned of foreign matter before assembly.
4. Counting of Rods during payout, or quantity of rods per box shall be monitored such that the operator is aware of the distance between the Pull machine and the lead end of the rod string.
5. Thrust force should be monitored by the operator. Should an unexpected sudden and significant increase in thrust force be experienced, the process shall be halted. The operator or SKE Construction shall review the results of 3.04 (EA) with the Owner's Representative to remedy per

- 3.04 (E.2) in an attempt to determine if offsets, valves or other features or obstruction exist that may cause the rod string to leave the pipe.
6. Front end of the rod string should be located by distance from the Pull Pit. Location should be painted and compared to as built plans.
 7. Appropriate action should be taken to remedy the cause. This action may include an additional pit at the obstruction to determine the cause and remove or accommodate for the obstruction. The decision may be to continue thrusting if the obstruction is believed to be encrustation.

Host pipe in the Insertion Pit shall be cut or broken prior to arrival of the rod string. Sufficient length shall be removed to allow the Pull Tooling to enter the host pipe and bend the product within the allowable radius specified by the pipe manufacturer. The second end of the host pipe in the Insertion Pit shall be positioned or worked so as not to damage the product pipe as it travels through the Insertion Pit. Workmen shall not enter the Insertion Pit when the rod string is nearing the Pit. A workman shall be in visual or radio contact with the Pull machine operator to have the payout halted in a position that allows attachment of the Pull tooling. Pull tooling style shall be chosen based on anticipated properties of host pipe and host pipe repairs.

1. Cast Iron or Asbestos Concrete host pipe anticipated to be free of either Ductile Iron repair sections or Dresser Style Couplings may use a simple conical Pull head with a single or double longitudinal blade.
2. Ductile Iron, PVC or host pipe with Ductile Iron repair sections or Dresser Style Couplings require use of a rolling blade cutter (slitter) ahead of the conical expander.

3.05 TOOLING AND ATTACHMENT

1. The Product Pipe shall be moved into position for attachment to the rod string. Appropriate traffic or pedestrian control will be exercised along the path of the Product Pipe.
2. The lead and second rod shall be painted orange or yellow to give notice to the Pull machine operator position of the Pull Tooling.
3. Attachment of the Pull Tooling to the rod shall be through the use of removable pin joint allowing the tooling to pivot at least 46 degrees to the rod axis.
4. Pull head diameter must be a minimum of 15% over size to the outside diameter of the Product Pipe. Actual size is left to the discretion of SKE Construction. A greater outside diameter allows for reduced pipe friction and increases pulling forces pushed and increases solid pipe placement.
5. Attachment of the Product pipe to the Pull Tooling shall be with a swivel that permits rotation to relieve torsional (twist) stress on the Product pipe.
6. Pull Head shall slide on the rod string such that the rear of the Pull head overlaps the forward end of the Product Pipe to eliminate the chance of damage to the Product Pipe.

3.06 PULLBACK OPERATION

1. Prior to commencement of pullback, there will be visual or radio contact between observers stationed adjacent to the Insertion Pit, the Pull Machine operator and a Product Pipe Observer stationed strategically along the length of the product pipe to watch for product pipe entanglement with above ground obstructions.
2. The Pull Machine operator will begin the pullback with the OK of the Insertion Pit Observer. Progress will be made at a slow rate until the Observer sees the Pull Tooling has completely entered the Host Pipe.
3. Pipe progress will be monitored for the first 20 linear feet of pullback by the Insertion Pit Observer and the Product Pipe Observer.
4. As the Pull Tooling nears any Utility Crossing Pit, an observer in radio or visual contact with the Pull Machine Operator will monitor and control movement of the Pull Tooling past the utility.
5. Should the forward shoring upon which the pulling machine bears yield sufficiently to bring the pulling Machine out of square to the host pipe, the shoring will be reworked according to 3.03 (B).

3.07 TOOLING REMOVAL

1. Pull Machine Operator shall note rod count and anticipate entry of painted rods into the Pull Pit. As the Pin Joint Connection nears the Pull Machine forward face, the Pull is to be halted. Load on the forward face is relieved by reversing the rod direction slightly.
2. The Pull Machine Shore Plate is to be removed, allowing the tooling to enter a cage or the hull of the Pull Machine. The tooling string will be disassembled and removed, in sections if necessary

until the Product Pipe face has been pulled beyond the face of the Pull Pit. The distance past the face of the Pull Pit shall be at the discretion of SKE Construction anticipating the length required for connection/fusing.

3.08 AFTER PIPE PULLING

Upon completion of the pipe pulling, certain tasks must be followed through in order to complete the overall process.

3.09 PIT CONDITION PRIOR TO TAPS OR JOINING SYSTEM

1. Maintaining sanitary conditions within the product pipe after pipe pulling must take high priority. Should any foreign matter, including ground water be allowed to enter the pipe interior, the condition of the pipe is no longer suitable for connection to the system. For this reason, connections may not be made in standing water. Such water must be pumped or bailed prior to making the connection or unsealing the pipe. Areas under connections should be excavated below the pipe invert.
2. Before joining a surface and before any special surface preparation to accommodate that joining, external surfaces should be clean and dry. Dust may be removed by wiping with clean, lint free cloth. Heavier deposits must be washed from the surface with soap and water and dried with a clean, lint free cloth.
3. Incidental exposure of the interior of the pipe to any foreign matter shall require that one of the two following remedies be carried out:
4. Complete chlorination per AWWA specifications for buried pipe.
5. Localized contamination at the end of the pipe may be removed and the contaminated interior surface of the pipe wiped with a solution of 1 to 5% hypochlorite disinfecting solution.

3.10 SERVICE TAPS AND SERVICE LINES

Service taps shall be of a type approved by SKE Construction and must meet AWWA standards. Construction of taps shall be per the manufacturer's recommendation. Acceptable choices include:

1. Electro-fusion type and/or mechanical saddles with a minimum working pressure of 100psi.
2. Socket Fusion.
3. Replacement or rehabilitation of service lines, if required, shall be according to contract.

3.11 POST CHLORINATION

The section of main will be super-chlorinated to 300 ppm by inserting a swab at one end. The swab shall travel the entire length of the pipe section.

3.12 SERVICE REINSTATEMENT

Prior to connection of the newly installed pipe, the section of pipe shall be fully flushed with the use of a de-chlorination unit and ascorbic acid to neutralize the residual chlorine. Following flushing, the newly installed section may be connected to the main at both ends and service reinstated.

3.13 BACKFILL AND SURFACE REINSTATEMENT

1. Backfill used to restore pits shall be per SKE Construction Standard Specification - 02317.
2. Lawn restoration shall be per SKE Construction Standard Specification - 02922.
3. Asphalt, concrete or other roadway surface restoration shall be per Harris County Standard Specification - 361.

3.14 DOCUMENTATION FINALIZATION

Upon completion of the project, all records including manifests, marked up construction plans or documents pertinent to describing the system as installed shall be provided to the Owner's Representative.

3.15 TABLES AND EQUATIONS

1. A. MAKEUP Water Allowance Table

Nominal Pipe Size in Inches	2	4	6	8	10	12	14	16	18	20	22	24	30
Makeup Water Allowance (Gallon/100 ft.)	.1	.2	.6	1.0	1.3	2.3	2.8	3.3	4.3	5.5	7.0	8.9	12

1. B. ALLOWANCE FOR LEAKAGE DUE TO FITTINGS EQUATION

$$L = [ND(P^{.50})]/[7,400]$$

Where:

L = Maximum allowable leakage, Gallons/Hour

N = Number of joints in the tested pipe (connections for pipes or fitting, not fuse joints)

D = Nominal inside diameter of pipe, Inches

P ---- Test Pressure, PSI

END OF PIPE PULL SPECIFICATIONS FOR SKE CONSTRUCTION

