



DESIGN and CONSTRUCTION MANUAL for MUPB UTILITIES

SECTION 9: CONSTRUCTION OF SANITARY SEWER FACILITIES

9.1. PURPOSE

The purpose of this SECTION is to outline requirements for construction, inspection, and final acceptance of sanitary sewer mains (gravity/pressure) and appurtenances, LPS service connections, and manholes.

9.2. REQUIREMENTS

Sanitary Sewer system IMPROVEMENTS shall be installed in public rights-of-way or, upon MUPB approval, in a utility easement granted to MUPB. All easement information must be submitted as outlined in SECTION 1. Sanitary sewer mains shall not be closer than ten (10) to any permanent structures.

The CONTRACTOR shall install a force main marker post at the ends of all force mains, at the intersection(s) of roads, and as directed by MUPB. The location posts shall be white in color with a green sticker and marked so as to identify the line as a sanitary sewer pipe.

Sewage combination air valves shall be provided at all high points in the force main. Long horizontal runs and increases in slope may also require combination air valves. Clean-outs shall be provided at all low points and at additional critical locations. The design ENGINEER shall consider and review with MUPB the location of all sewage combination air valves and clean-outs. Thrust restraints and blocks shall be provided at bends. For slopes of 20 percent and greater, anchors shall be provided at each joint (at a minimum). A flexible through-wall connector shall be used at pipe penetrations through structures to allow for differential settlement.

Sanitary sewer mains under pressure (force mains) are to be installed between a pump station or laid for grinder pumps to be connected to the force main to transport sewage to the final discharge point. Force mains shall be designed for ultimate peak flow conditions. After installation, the force mains shall be field verified for initial operating conditions and initial ultimate peak flow conditions to insure the velocity ranges.

Force mains shall be a minimum of 4-inch diameter for applications with non-grinding pumps. Force mains incorporated into a low-pressure sewer system (LPS) or application with a grinding pump may be a minimum of 2-inch diameter. Any departure from minimum requirements shall be justified by hydraulic analysis and will only be considered in special circumstances.

Sanitary sewer mains that flow by gravity are to be installed at uniform grade and in straight alignment between manholes. Gravity sanitary sewer mains shall be laid to minimum grades as outlined in SECTION 6.

All gravity sanitary sewer pipe shall be PVC or D.I. unless a variance is requested at the sole discretion of MUPB.



DESIGN and CONSTRUCTION MANUAL for MUPB UTILITIES

9.3. PIPE MATERIALS

Force mains 18" and less in diameter shall be constructed of ductile iron, HDPE or polyvinyl chloride (PVC) pipe, unless otherwise approved by MUPB. Force mains larger than 18" in diameter shall be reviewed on a case-by-case basis by MUPB for the determination of the appropriate material.

Gravity sewer mains 18" and less in diameter shall be constructed of ductile iron (DI) or polyvinyl chloride (PVC) pipe, unless otherwise approved by MUPB. Gravity sewer mains larger than 18" in diameter shall be reviewed on a case-by-case basis by MUPB for the determination of the appropriate material. For gravity sanitary sewer pipes laid at depths in excess of 15 feet, all pipe shall be D.I.

9.3.1 POLYVINYL CHLORIDE PIPE (PVC), FITTINGS & JOINTS – GRAVITY

PVC pipe shall be extruded from Type 1, Grade 1, and polyvinyl chloride material designated as PVC 1120, meeting ASTM Specifications D 3034, Type PSM, and a standard dimension ratio of SDR 35.

The pipe shall be homogenous throughout and free from cracks, holes, foreign inclusions or other defects. The pipe shall be as uniform as commercially practical in color.

The pipe shall have a bell on one end. Spigot 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.

Pipe must be delivered to the 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 the pipe is not to be installed shortly after delivery to the job site, it must be in a shaded location or covered.

All buried force main sewer pipe shall have a non-metallic locator tape laid within two feet (2') from finished grade. The locator tape shall have the word "CAUTION – BURIED SEWER LINE BELOW" printed on it, green in color, and shall identify the pipe as a sewer pipe. The tape shall be a product manufactured for the purpose of warning of buried pipelines.

9.3.2. DUCTILE IRON PIPE (D.I.), FITTINGS AND JOINTS – GRAVITY

Ductile iron pipe shall conform to ASTM A746. Ductile iron pipe and fittings shall be bituminous coated exterior and receive an interior ceramic epoxy coating, Protecto 401 or equal. Thickness of the lining shall be as recommended by the



DESIGN and CONSTRUCTION MANUAL for MUPB UTILITIES

manufacturer. Fittings for ductile iron pipe shall be mechanical joint Class 250 gray iron conforming to ANSI A21.10 and AWWA C110 for short body ductile iron fittings.

Each piece of pipe shall bear the manufacturer's name or trademark, the year in which it was produced and the letters "D.I." or word "DUCTILE". Shop inspection and testing shall be in accordance with the ASTM specifications.

Where ductile iron pipe is to be installed in corrosive soil conditions the pipe shall be protected by an 8-mil thick polyethylene encasement meeting the requirements of ANSI A21.5. Such corrosive soils include, but are not limited to salt marshes, saturated alkaline soils; cinder fills, areas of decaying vegetation, and waste dumps. It is the responsibility of the ENGINEER to determine if corrosive soils are present in the scope of the proposed DEVELOPMENT. The ENGINEER shall note the presence or absence of corrosive soils on the DEVELOPMENT plans.

9.3.3. POLYVINYL CHLORIDE PIPE (PVC), FITTINGS AND JOINTS – PRESSURE

PVC pressure pipe shall conform, at a minimum to ASTM Specifications D-2241, and shall be pressure Class 200 (SDR 21) at minimum. Fittings for PVC pipe shall be mechanical joint Class 250 ductile iron conforming to ANSI A21.10 and AWWA C110 for short body ductile iron fittings. Fittings shall be bituminous coated exterior and shall receive Protect 401 or equal ceramic epoxy lining on the interior as specified herein.

Pipe joints shall be of the rubber gasketed type, conforming to ASTM D3139 and ASTM F477. All jointing material and lubricants shall be non-toxic.

All buried pipe shall have copper tracer wire taped to the line for the purpose of pipe location. See paragraph 9.4.5. for specifics of tracer wire requirements.

9.3.4. DUCTILE IRON PIPE (D.I.), FITTINGS AND JOINTS – PRESSURE

Ductile iron pipe shall conform to ASTM A746. Ductile iron pipe and fittings shall be receiving an interior ceramic epoxy coating, Protecto 401 or equal. Thickness of the lining shall be as recommended by the manufacturer. Pipe and fittings shall have a standard coal tar or asphalt based bituminous outside coating and minimum of 1 mil thick.

Each piece of pipe shall bear the manufacturer's name or trademark, the year in which it was produced and the letters "D.I." or word "DUCTILE". Shop inspection and testing shall be in accordance with the AWWA Specifications.

Fittings for ductile iron pipe shall be mechanical joint Class 250 gray iron conforming to ANSI A21.10 and AWWA C110 for short body ductile iron fittings. Fittings for ductile iron pipe shall be mechanical joint Class 250 gray iron conforming to ANSI A21.10 and AWWA C110 for short body iron fittings. Fittings



DESIGN and CONSTRUCTION MANUAL for MUPB UTILITIES

shall be bituminous coated exterior and shall receive Protect 401 or equal ceramic epoxy lining on the interior as specified herein.

Where ductile iron pipe is to be installed in corrosive soil conditions the pipe shall be protected by an 8-mil thick polyethylene encasement meeting the requirements of ANSI A21.5. Such corrosive soils include, but are not limited to salt marshes, saturated alkaline soils; cinder filled areas of decaying vegetation, and waste dumps. It is the responsibility of the ENGINEER to determine if corrosive soils are present in the scope of the proposed IMPROVEMENTS. The ENGINEER shall note the presence or absence of corrosive soils on the IMPROVEMENT plans.

9.3.5 HIGH DENSITY POLYETHYLENE PIPE (HDPE) FITTINGS & PIPE – PRESSURE

HDPE pipe shall conform, as a minimum to AWWA C906 and shall be of a pressure class to provide a 2.5 safety factor of normal working pressure. Higher pressure rated HDPE pipe shall be considered on a case-by-case basis and the pipe material and classification shall be determined by MUPB.

Fittings shall be HDPE butt fused fittings, mechanical joint adapters, flanges, unions, grooved-couplers, transition fittings and some mechanical couplings conforming to AWWA Specifications and manufacturer recommendations. Pipe joints shall be butt fused.

All buried pipe shall have copper tracer wire taped to the line for the purpose of pipe location. See paragraph 9.4.5. for specifics of tracer wire requirements.

9.3.6. ENCASEMENT PIPE

Encasement pipe shall be steel, plain end, uncoated and unwrapped, have minimum yield point strength of 35,000 PSI and conform to ASTM Grade 2 of ASTM A130 Grade B without hydrostatic tests. The steel pipe shall have welded joints and be in at least 18-foot lengths.

The wall thickness of the pipe shall be a minimum of 0.375 inches for highway crossings and for railroad crossings. Refer to MUPB Standard Details for wall thickness and diameter requirements. The diameter of the pipe shall conform to the requirements of American Railway Engineering Association for railroad crossings, and the requirements of the Kentucky Department of Transportation, Bureau of Highways for highway crossings.

9.4. SANITARY SEWER MAIN APPURTENANCES – FORCE MAIN

9.4.1. GATE VALVES

All gate valves shall be resilient seat wedge, iron body, non-rising stem, fully bronze mounted and suitable for working pressures of 200 PSI. Valves shall be of



DESIGN and CONSTRUCTION MANUAL for MUPB UTILITIES

standard manufacture and of the highest quality both as to material and workmanship.

All gate valves shall have the name or monogram of the manufacture, the year the valve casting was made, the size of the valve, and the working pressure cast on the body of the valve.

Gate valves set with valve boxes shall be provided with a two-inch square operating nut and shall open by turning to the left (counterclockwise) and be marked "SEWER" on the lid. Gate valves for installation in meter vaults shall be flanged ANSI B16.1 Class 125 and hand wheel operated.

All valves shall conform to the latest revision of AWWA Standard for Gate Valves for Ordinary Water Works Service, AWWA C500.

9.4.2. TAPPING SLEEVES AND VALVES

Tapping sleeves for connection of new force mains to existing force mains shall be stainless steel and shall have a reduction of pipe diameter size. See MUPB approved manufacturers list. Tapping sleeves shall be tested according to the manufacturer's recommendations.

9.4.3. VALVE BOXES

Valve boxes shall be of 5.25-inch standard cast iron, two pieces, and screw type valve box with drop cover marked "SEWER". For force mains with cover greater than 5', 8" PVC pipe may be used to raise the valve box to grade. Valve boxes shall be accurately centered over valve operating nut, and backfill thoroughly tamped about them.

Valve box bases shall not rest on the valves but shall be supported on crushed stone fill. They shall be set vertically and properly cut and/or adjusted so that the tops of boxes will be at grade in any paving, walk or road surface. In non-paved areas an 18" round or 18" square concrete valve marker shall be installed around the valve box, minimum of 4" thickness.

9.4.4. COMBINATION AIR RELEASE VALVES AND BOXES

Combination air release valves shall be installed at the high point on the force mains as shown on the approved plans, unless directed by MUPB. The inlet pipe to the combination air release valve shall be ASTM B43 extra strong stainless-steel pipe with I.P.S. male threaded ends and full port ball valve.

Combination air release valves shall be per the approved equal manufacturer list of water and sewer parts and supplies. Valve shall have a threaded inlet and be suitable for 150 PSI normal working pressure.



DESIGN and CONSTRUCTION MANUAL for MUPB UTILITIES

The combination air release valve shall be installed as shown in MUPB Standard Details.

9.4.5. TRACING WIRE

A. Direct Burial

Tracer Wire shall be #12 AWG solid copper insulated with a 30 mil, high-density, high molecular weight polyethylene (HDPE) insulation and rated for direct burial use at 30 volts. Insulation color shall meet the APWA color code standard for identification of buried utilities. Insulated copper trace wire shall be attached to the top of the pipe with adhesive tape or other suitable devices. At each combination air release valve, curb box, flushing connection and end of new pipe installation, the trace wire shall be daylighted and the ends connected together with waterproof connectors covered with waterproof connectors. For long runs of pipe, the maximum length between tracing stations (above or below grade) shall be 500 feet. Underground splicing shall be made using waterproof connectors designed for direct bury and covered with waterproof tape or wrap.

B. Directional Drilled

Tracer wire shall be a #12 AWG (0.0808" diameter) fully annealed, high carbon 1055 grade steel, high strength solid copper clad steel conductor (HS-CCS), insulated with a 30 mil, high-density, high molecular weight polyethylene (HDPE) insulation, and rated for direct burial use at 30 volts. HS-CCS conductor must be at 21% conductivity for locate purposes. Break load of 452 lbs. HDPE insulation shall be RoHS compliant and utilize virgin grade material. Insulation color shall meet the APWA color code standard for identification of buried utilities. Manufacturers supplying copper clad steel tracer wire must have available detailed performance data including 5 years of underground testing in terms of durability related to damage of protective insulation and effects of potential corrosion of the specific copper clad steel used. Origin of copper clad steel manufacturer is required and steel core must be manufactured in the United States. If manufacturer has not completed 5-year corrosion testing, a 5-year warranty must be provided. Tracer wire shall be Copperhead® High Strength HS-CCS HDPE 30 mil or district pre-approved equal and made in the USA.

Use Copperhead High Strength Tracer Wire - Part # 1230*-HS-**

* = Color: B=Blue Water, G=Green Sewer, P=Purple Reclaim Water
R=Red Electric, N=Orange Communications, K=Black

** = Spool Size: 500', 1000', 2500'



DESIGN and CONSTRUCTION MANUAL for MUPB UTILITIES

9.5. SANITARY SEWER MAIN APPURTENANCES – GRAVITY

9.5.1. MANHOLES

Manholes shall be installed in accordance with standards herein and as shown in MUPB Standard Details. Type II cement shall be used except as otherwise permitted. In addition, all precast reinforced concrete manholes shall include the sidewall rings and base. At points of pipe inlet, the precast base manhole shall contain a pipe to manhole gasket or approved equal, which is sufficiently flexible to prevent shear of the pipe due to differential settling. Grouted joints alone between sections and cast in place bases are not acceptable. The tapping of house connections into manholes on newly constructed sewers will not be permitted, except as approved by MUPB.

The minimum diameter of manholes shall be 48-inches for pipe sizes 12-inch or less and 60-inches for pipe sizes 18-inch and larger than 12-inch. A minimum access opening of 21 inch shall be provided. The flow channel through manholes should be made to conform in shape, slope and smoothness to that of the sewers.

The base of the manhole shall have openings for the sewer pipe cast to the alignment and elevations as part of the base openings, so as to form a watertight connection. The channel and bench shall be integrally cast or formed as part of the manhole base. The manhole base shall be set on a six-inch (6") stone leveling pad. The stone material shall be the same as required for pipe bedding as specified elsewhere in this manual. All manholes shall be pre-cast with the exception of manholes for connections at existing sanitary sewer mains. Other types of manholes, cones, castings, steps, and bases may be used only after permission has been granted in writing by MUPB.

Manholes shall be installed at the end of each line; at all changes in grade, size or alignment; at all intersections; and at distances not greater than 400 feet. Manholes of the form and dimensions shown on the approved plans shall be built as directed. The manhole casting shall be raised via grade rings as specified per MUPB Standard Drawings. Manholes and lines shall be located in the street when possible. Locating manholes in sidewalks shall be avoided wherever possible. Manholes located in streets shall have the casting and cover installed at the street's final grade.

Manhole covers shall have "MUPB SANITARY SEWER" stamped on the lid. Manhole covers must sit flush with the frames, with contact edges machined for even bearing and the cover sit neatly and flush with the frame edge. The covers shall have two (2) concealed pick holes for removal. Lids shall be solid and no perforated lids will be permitted for sanitary sewers. Manhole frames and lids shall be Model 350 as manufactured by J.R. Hoe & Sons, CAP ONE Model-24 as manufactured by Composite Access Products or approved by MUPB. Manholes located within or below 100-year flood, shall be water tight manhole castings as described above with the addition of gasketed seals and bolted lids.



DESIGN and CONSTRUCTION MANUAL for MUPB UTILITIES

A. STANDARD MANHOLES

The standard manholes shall be four feet or more in depth, measured from, the top of the cover frame to the top of the concrete footing and shall be of eccentric cone-type construction.

B. SHALLOW MANHOLES

Manholes that are four feet or less are considered a shallow manhole, as measured from the top of the cover frame to the top of the concrete footing and shall be of flat top construction.

C. EXTERNAL DROP MANHOLES

External drop manholes shall be avoided, wherever possible. Where required, a drop pipe shall provide for a sewer entering a manhole at an elevation of 24 inches or more above the manhole invert. Drop manholes shall be constructed with an outside drop connection.

A drop pipe shall be provided for a sewer entering a manhole at an elevation of 24 inches or more above the manhole invert and shall be built as a part of the standard manhole. The pipe shall be laid in the manhole as shown on the plans and encased with concrete. The pipe which is laid to the drop portion of the manhole shall be supported with 3,500 psi concrete extending from the drop stack to the reinforced base of the manhole.

D. INTERNAL DROP MANHOLES

Internal drops shall only be used when connecting to an existing sewer main and upon approval of MUPB. Where the difference in elevation between the incoming sewer and the manhole invert is less than 24 inches, the invert should be filleted (45°) to prevent solids deposition.

9.5.2. TEES & WYES FOR LATERAL CONNECTION

Lateral connections to the sanitary sewer main shall only be located at existing "Y" or "T" connections on the main. When none exist on the main, an approved manufactured saddle wye with stainless steel bands shall be installed on the main and the connection rendered watertight by means of mastic seat. Concrete encasement shall only be permitted by special written authorization.

All connections between the sewer service lateral and the building connection shall be inspected by MUPB inspector prior to backfilling.



DESIGN and CONSTRUCTION MANUAL for MUPB UTILITIES

9.5.3. CLEANOUTS

Cleanouts of the sewer laterals shall be built at all horizontal or vertical changes of direction of sewer laterals. Cleanouts shall be a minimum of 4" and located at the right-of-way edge or permanent easement edge. A pipe lateral shall be connected to the building clean out by a commercial fitting; cement and grout shall not be used.

9.6. TRENCH EXCAVATION

Unless specifically directed otherwise by MUPB, not more than 50 feet of trench shall be opened ahead of gravity sanitary sewer pipe laying work of any one crew and not more than 50 feet of open trench shall be left behind the pipe laying work of any one crew.

Trenches in which pipes are to be laid shall be excavated in open cut to the depths shown on the approved plans.

Unless specifically authorized by MUPB, trenches shall in no case be excavated or permitted to become wider than two feet six inches (2'-6"), plus the nominal diameter of the pipe at the level of or below the top of the pipe. If the trench becomes wider than two feet six inches (2'-6") below the top of the compacted granular fill at top of the pipe, pipe material may need to be changed to account for soil loadings as determined by MUPB. This determination shall take into account the actual trench loads that may result and the strength of the pipe being used.

Trenches shall be kept free of water during the installation of pipe and until the pipeline has been backfilled. Backfilling shall be as specified herein.

9.6.1 OBSTRUCTIONS

In cases where storm sewers, sanitary sewers, gas lines, water lines, telephone lines, and other utilities, or other underground structures are encountered, they shall not be displaced. All precautions shall be made to not damage any other utility. In the event that a utility is damaged (as defined by the owner of the said utility) all fines/repairs/damage fees associated with these damages will be incurred at the expense of CONTRACTOR/OWNER. See KY PSC rules on Natural Gas/Hazardous Liquids pipeline incidents.

The CONTRACTOR shall notify KY 811 prior to beginning construction work.

9.6.2. SHORING SHEETING AND BRACING

The shoring, sheeting, and bracing of excavation shall be performed by the CONTRACTOR in compliance with applicable codes and OSHA requirements. MUPB shall not be held responsible for job site safety. Safety is the responsibility of the OWNER/DEVELOPER and CONTRACTOR.



DESIGN and CONSTRUCTION MANUAL for MUPB UTILITIES

9.7. PIPE BEDDING

In all cases the foundation for pipes shall be prepared so that the entire load of the backfill on top of this pipe will be carried on the barrel of the pipe and, insofar as possible, where bell and spigot pipe are involved so that none of the load will be carried on the bells.

When undercutting and granular bedding are involved, the depth at the bottom of the bells of the pipe will be at least four inches above the bottom of the trench as excavated.

Supporting of the pipe shall be as set out hereinbefore, and in no case shall the supporting of pipe on blocks be permitted.

9.7.1. EARTH FOUNDATION

All gravity sewer main pipes shall be supported on a bed of No. 9 or No. 68 crushed stone as defined by KYTC-KDHSS. Bedding material shall be free from rock and be acceptable to MUPB. In no case shall pipe be supported directly on rock. Force main sewer pipe may be supported on excavated earth, if acceptable by MUPB.

9.7.2 ROCK FOUNDATION

If the trench bottom is in rock, the excavation shall be undercut to a minimum depth of six inches below the bottom of the pipe. The pipe shall be laid on a bed of granular material to provide continuous support for the lower section of the pipe. Granular bedding shall be size No. 9 or No. 68 crushed stone as defined by KYTC-KDHSS.

9.7.3. SPECIAL BEDDING

In wet, yielding, mucky locations, where pipe is in danger of sinking below grade or floating out of line or grade, or where backfill materials are of such fluid nature that such movements of the pipe might take place during the placing of the backfill, the pipe must be weighted or secured permanently in place by such means as will prove effective. When ordered by MUPB, yielding and mucky material in subgrades shall be removed below ordinary trench depth in order to prepare a proper bed for the pipe. No. 9, No. 68 or No. 57 crushed stone or approved equal shall be used to replace poor subgrade material and shall be classified as "Special Pipe Bedding."

9.8. INSTALLATION OF PIPE

All pipes shall be laid with ends abutting a true to line and grade as shown on the plans. Supporting of pipe shall be as specified under "Pipe Bedding" specified herein and in no case, shall be supported on blocks.



DESIGN and CONSTRUCTION MANUAL for MUPB UTILITIES

Fittings for the sanitary sewer force mains shall be provided and placed as shown on the plans. All open ends of pipes and of branches shall be sealed or plugged.

Before each piece of pipe is lowered into the trench, it shall be thoroughly cleaned and inspected for defects. Any piece of pipe or fitting which is known to be defective shall not be laid or placed in the lines. Any defective pipe or fitting discovered after the pipe is laid shall be removed and replaced with a satisfactory pipe or fitting. In case a length of pipe is cut to fit in a line, it shall be so cut as to leave a smooth and at right angles to the horizontal axis of the pipe.

Granular bedding material as specified herein, shall be used to correct irregularities in the earth trench sub-grade.

The interior of the pipe shall be maintained clean. Pipe shall be stored in a location where dirt, mud and debris cannot easily enter and contaminate the pipe. When laying of any pipe is stopped for any reason, the exposed end of such pipe shall be closed with a proper plug fitted into the pipe, so as to exclude earth or other material.

No backfilling (except for securing pipe in place) over pipe will be allowed until MUPB or their representative has made an inspection of the joints, alignment and grade in the section laid, but such inspection shall not relieve the CONTRACTOR of further liability in case of defective joints, misalignment caused by backfilling and other such deficiencies that are identified later.

9.8.1. PIPE INSTALLATION WITHIN FILL AREAS

Any gravity sewer main, force main or lateral to be installed in fill areas shall require the OWNER/DEVELOPER to provide inspection and testing services by a Registered Geotechnical Engineer to ensure that each lift in the proposed trench area was constructed and compacted to 95% Standard Proctor density from bottom of fill to 30" above top of pipe. Copies of all test reports shall be certified by the Geotechnical Engineer and submitted to MUPB prior to pipe installation.

9.9. BACKFILLING OF PIPELINE TRENCH

All backfilling shall be accomplished in accordance with the pipe manufacturer's published recommended installation and backfilling method for the pipe being buried and with the requirements of this SECTION. Any variances must be approved in writing by MUPB.

When directed by MUPB, the CONTRACTOR shall add water to the backfill material or dry out the material when needed to attain a condition near optimum moisture content for a maximum density of the material when it is tamped. The CONTRACTOR shall obtain a compaction of the backfill of at least 95 percent of standard Proctor density per ASTM D698 where mechanical tamping of backfill is required.

In all cases walking or working on the completed pipelines except as may be necessary in tamping or backfilling will not be permitted until the trench has been backfilled to a point



DESIGN and CONSTRUCTION MANUAL for MUPB UTILITIES

one foot above 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 pipeline will not be disturbed and injurious side pressures do not occur.

Whenever sanitary sewer lines are installed, the OWNER/DEVELOPER shall be responsible for any trench settlement which occurs within these right-of ways/easements within one year from the time of final acceptance of the work. If paving shall require replacement because of trench settlement within this time, it shall be replaced by the OWNER/DEVELOPER. Repair of settlement damage shall meet the approval of MUPB.

All backfilling shall be accomplished in accordance with the details shown on the Standard Drawings, manufacturers recommendations and the requirements of this SECTION. Any variances must be approved in writing by MUPB.

9.9.1. GRAVITY SEWER

There are three (3) types of trench backfill conditions where the method of final backfilling varies. The various types and trench situations are as follows:

1. PIPE LAID IN ROCK OR EARTH TRENCH: Areas not subject to vehicular traffic, no pavement including gravel.
2. ORIGINAL GRAVEL SURFACE: Gravel areas subject to light vehicular traffic such as residential driveways; church and commercial parking lots and entrances; and farm drives.
3. ORIGINAL BITUMINOUS or CONCRETE SURFACE: City, County and state roads; bituminous road shoulders; all bituminous surface areas such as residential driveways, church and commercial parking lots, and entrances.

See MUPB Standard Details (SS-001) for specific details for each case.

9.9.2. FORCE MAIN

There are three (3) types of trench backfill conditions where the method of final backfilling varies. The various types and trench situations are as follows:

1. PIPE LAID IN ROCK OR EARTH TRENCH: Areas not subject to vehicular traffic, no pavement including gravel.
2. ORIGINAL GRAVEL SURFACE: Gravel areas subject to light vehicular traffic such as residential driveways; church and commercial parking lots and entrances; and farm drives.
3. ORIGINAL BITUMINOUS or CONCRETE SURFACE: City, County and state roads; bituminous road shoulders; all bituminous surface areas such



DESIGN and CONSTRUCTION MANUAL for MUPB UTILITIES

as residential driveways, church and commercial parking lots, and entrances.

See MUPB Standard Details (GP-001) for specific details for each case.

9.10. CONCRETE CRADLE, ANCHORS, THRUST BLOCK OR ENCASEMENT

Concrete cradle, anchors, thrust block or encasement of sanitary sewer lines and/or fittings shall be placed as shown on the plans. Concrete cradle shall be utilized for areas of unsuitable subsurface. Concrete thrust blocks shall be utilized at all fittings of sanitary sewer pipe under pressure (force mains and low-pressure sewers). Concrete encasement shall be utilized in areas of less than minimum cover (with MUPB written approval), at creek crossings and drainage crossings and when 10' of horizontal separation is not available for potable water lines.

Concrete shall be 3,500 psi and shall be mixed sufficiently wet to permit it to flow under the pipe to form a continuous bed. In tamping concrete, care shall be taken not to disturb the grade or line of the pipe or injure the joints.

Concrete anchors shall be utilized for sanitary sewer pipe protection on slopes greater than 15%. Anchors shall be formed on site at distances per MUPB Standard Specifications or as required by MUPB.

Concrete thrust block shall be utilized at all fittings for pressure piping, a polyethylene (plastic) sheet having a minimum thickness of 8 mil, shall be wrapped around the fitting to prevent the concrete from coming in contact with the fitting's bolts and nuts. Volume of concrete shall be derived from MUPB Standard Details.

Concrete encasement provides additional field supporting strength. Wherever the strength of the pipe is not sufficient to support the external loads, the encasement should be designed to provide the necessary additional strength. Concrete encasement shall completely surround the pipe and shall have a minimum thickness at any point of one fourth (1/4) of the outside diameter of the pipe or four inches (4") whichever is greater. In addition, four (4) reinforcing bars of a size selected by the MUPB shall be evenly spaced around the pipe and have a length equal to the length of the encasement.

Sanitary sewer mains constructed under creeks or drainage waterways shall be constructed of ductile iron pipe to a point at least ten feet (10') beyond the edge of the creek or drainage waterway and shall be encased in concrete.

9.11. HIGHWAY & RAILROAD CROSSINGS

Steel encasement pipe for road and railroad crossings shall be bored and/or jacked in place to the elevations shown on the plans. All joints between lengths shall be solidly welded with a smooth non-obstructing joint inside. The encasement pipe shall be installed without bends. The water line pipe shall be installed after the encasement pipe is in place.



DESIGN and CONSTRUCTION MANUAL for MUPB UTILITIES

Installation of the sewer pipe in the encasement pipe shall be as per MUPB's recommendations and shall include manufactured casing spacers. After the sewer main has been installed, inspected, and tested as specified, both ends of the casing pipe shall be closed with proper fitting plug or cap in a manner acceptable to MUPB.

All street cutting, street boring, highway boring, or railroad boring permits will be the responsibility of the CONTRACTOR. All necessary permits must be approved by KDOH and/or Railroad companies prior to construction commencing.

9.12. PIPELINE CLEANING (PIGGING) PROCEDURES

After installation and prior to testing, the complete pressure system (including all mains, services laterals, blow-offs, air release valves and all other appurtenances) shall be thoroughly cleaned to remove all foreign matter. MUPB shall be notified at least 48 hours prior to cleaning activities. The cleaning of the piping system shall be accomplished by the controlled and pressurized passage through the system of a series of hydraulic or pneumatic polyurethane plugs.

A poly-pigging plan shall be approved by MUPB and all pigging of lines must be witnessed by MUPB inspector. The poly pigs shall be removed and discharged from the system at a point near to the end of the system. The contractor must demonstrate to MUPB that this work will be performed by experienced supervisors and personnel who have provided the cleaning service of comparable systems.

9.13. TESTING OF SANITARY SEWER LINES - GRAVITY

The intent of these specifications is to secure a sanitary sewer system with a minimum amount of infiltration. Sanitary sewer pipe joints shall be tight and all visible leakage shall be repaired in a manner approved by MUPB. All sanitary sewer mains constructed as part of the IMPROVEMENTS shall be tested for leakage by air testing and for pipe deflection. MUPB may require the CONTRACTOR to perform additional infiltration and/or exfiltration tests to demonstrate the quality of the sanitary sewer line IMPROVEMENTS.

After the IMPROVEMENTS have been completed but prior to performing any test herein specified, the CONTRACTOR shall clean the sanitary sewer line constructed in the IMPROVEMENTS by jetting, high pressure flushing or other approved method. All water utilized to clean sanitary sewer lines & lift stations shall not be discharged into the existing sanitary sewer collection system and shall be disposed of in accordance with Federal, State and Local regulations.

Prior to testing, the ENGINEER and MUPB representatives shall inspect each individual line, from manhole to manhole, via CCTV camera, laser and target and survey grade survey equipment (if available) or other means at their disposal to determine whether the completed lines are true to line and grade as laid out or shown on the plans.

All lines or sections of lines that are found to be laid improperly with respect to line or grade, that are found to contain broken or leaking sections of pipe, or are obstructed in



DESIGN and CONSTRUCTION MANUAL for MUPB UTILITIES

such a manner that they cannot be satisfactorily corrected otherwise, shall be removed and replaced.

9.13.1. PIPE DEFLECTION TEST

After the sanitary sewer line has been installed and backfilled for not less than 30 days, but prior to Final Inspection, the sewer pipe shall be checked for pipe deflection per ASTM D-21227 test procedure for sewer pipe deflection testing. If in the opinion of MUPB, sufficient rainfall has not occurred to allow for full settlement of the trench, then this time period may be extended, at MUPB's discretion. All deflection tests shall be conducted without mechanical pulling devices. Pipe having a deflection greater than 5% shall be rejected and the CONTRACTOR at their own cost shall perform repairs as required so that the maximum pipe deflection is not greater than 5% after burial for 30 days. All repairs shall be made in accordance with this MANUAL and retested in the manner specified herein.

9.13.2. AIR TEST

All air tests shall be done prior to Final Inspection and in the presence of MUPB's inspector who will determine if the tested pipe span is acceptable. The air test is conducted between two consecutive manholes. All pipe outlets must be plugged in the section being tested using suitable test plugs. Low pressure air tests shall be in accordance with ASTM F 1417, except as specified otherwise herein. Air shall be slowly supplied until the internal pressure of the test section reaches four (4) psi over the back pressure on the sewer line that would be caused by ground water. In no case shall air pressure exceed 8 psi. After stabilization period of two minutes, the low-pressure air supply hose shall be disconnected from control panel and timing shall begin.

At the time of the test, each manhole shall be inspected by MUPB inspector to determine possible leaks. Manholes which are questionable shall be water tested.

The air test shall, as a minimum, conform to the test procedure described in ASTM C-828-76T. The air test will be made after backfilling has been completed and compacted.

All ties and end of sewer services shall be plugged with flexible joint plugs or caps securely fastened to withstand the internal test pressures. Such plugs or caps shall be readily removable, shall provide a socket suitable for making a flexible jointed lateral connection or extension.

The test shall be passed provided that the time required, in seconds, for the pressure to decrease from 4.0 to 3.0 pounds per square inch greater than the average back pressure of any ground water that may submerge the pipe is not less than shown in the " Minimum Holding Time for Low Pressure Air Test" listed below. Pipe failing the air test shall be rejected and the CONTRACTOR, at their own cost,



DESIGN and CONSTRUCTION MANUAL for MUPB UTILITIES

shall perform repairs as required so that the pipe passes the air test as herein defined. All repairs shall be retested in the manner specified herein.

Minimum Holding Time for Low Pressure Air Test

Nominal Pipe Size (inches)	Time per 100 ft (seconds)
8	72
10	90
12	108
15	126
18	144
21	180
24	216

9.13.3. EXFILTRATION/INFILTRATION TEST

Sewer line exfiltration and/or infiltration test shall be conducted to ensure that the water tightness of the gravity sanitary sewer main to keep out/in wastewater being transported. Sewer line exfiltration and/or infiltration shall not exceed 50 gallons per inch of pipe diameter per mile per 24 hours for any section of the system. As exfiltration or infiltration test shall be performed with a minimum positive head of 2 feet.

9.14. TESTING OF MANHOLES – VACUUM TESTING

Vacuum testing (negative air testing) concrete sewer manholes, shall conform to the test procedures described in ASTM C-1244, latest revision. Manholes shall not be backfilled around the manhole.

Manholes shall be tested after installation with all connections in place. Lift holes, if any, shall be plugged with an approved, non-shrinkable grout prior to testing. Drop connections shall be installed prior to testing. The vacuum test shall include testing of the seal between the cast iron frame and the concrete cone, slab or grade rings. The manholes shall be backfilled and finished to design grade.

9.14.1. TESTING PROCEDURE

- A. Temporarily plug, with the plugs being braced to prevent the plugs or pipes from being drawn into the manhole, all pipes entering the manhole at least eight inches into the sewer pipe(s). The plug must be inflated at a location past the manhole/pipe gasket.
- B. The test head shall be placed inside the frame at the top of the manhole and inflated, in accordance with the manufacturer's recommendations.
- C. A vacuum of 10 inches of mercury shall be drawn on the manhole. The



DESIGN and CONSTRUCTION MANUAL for MUPB UTILITIES

valve on the vacuum line to the manhole shall be shut and the vacuum line disconnected.

- D. The pressure gauge shall be liquid filled, having a 3.5-inch diameter face with a reading from zero to thirty inches of mercury.
- E. The manhole shall be considered to pass the vacuum test if it holds at least 9 inches of mercury for the following time durations:

Minimum Vacuum Test Times for Manholes (seconds)

Depth of Manhole (feet)	Diameter of Manhole (inches)		
	48	60	72
<4	10	13	16
6	15	20	25
8	20	26	33
10	25	33	41
12	30	39	49
14	35	46	57
16	40	52	67
18	45	59	73
20	50	65	81

- F. If a manhole fails the vacuum test, the manhole shall be repaired with a non-shrinkable grout or other suitable material based on the material of which the manhole is constructed and retested, per the above procedures.
- G. All temporary plugs and braces shall be removed after each test.

9.15. TESTING OF SANITARY SEWER – FORCE MAINS

Upon completion of the construction of force mains but prior to FINAL INSPECTION, all force mains and appurtenances shall be tested for leaks as specified herein. MUPB shall be notified at least 48 hours in advanced of the scheduled test time and, at its own discretion, have an inspector present during the performance of the test.

Where practicable, pipelines shall be tested between line valves, temporary valves or temporary plugs in lengths of not more than 1,500 feet or between isolation valves. The



DESIGN and CONSTRUCTION MANUAL for MUPB UTILITIES

CONTRACTOR may request, in writing, the testing of a section of line greater than 1,500 feet with MUPB's approval. Testing shall proceed from the source of discharge toward the lift station or termination of the line. The line shall be tested upon the completion of the first 1,500 feet or the first isolation valve.

9.15.1. TEST RESTRICTIONS

Force mains shall be tested at a minimum of 150 pounds per square inch in compliance with AWWA C600/C605 but not less than the pressure specified in the sub-paragraphs below. The CONTRACTOR shall furnish a recording pressure gauge which shall be used for the continuous measurement and recording of test pressures and test time.

Test pressure shall not be less than 1.5 times the working pressure at the point of testing or 150 psi, whichever is the greater, but not less than 1.25 times the normal working pressure at the highest elevation along the test section. Test pressure shall not exceed pipe or thrust-restraint design pressures. The hydrostatic test shall be at least a 4-hour duration. Test pressure shall not vary by more than ± 5 psi for the duration of the test. Test pressure shall not exceed the rated pressure of the valves when the pressure boundary of the test section includes closed, resilient-seated gate valves.

Valves shall not be operated in either direction at differential pressure exceeding the rated valve working pressure. For test pressures, the test setup should include provision, independent of the valve, to reduce the line pressure to the rated valve pressure on completion of the test. The valve can then be opened enough to equalize the trapped pressure with the line pressure, or fully opened if desired.

9.15.2. PRESSURIZATION

Each valved section of pipe shall be slowly filled with water, and the specified test pressure. Valves shall not be operated in either the opening or closing direction at differential pressures above the rated pressure. It is good practice to allow the system to stabilize at the test pressure before conducting the leakage test.

Before applying the specified test pressure, air shall be expelled completely from the pipe and valves. If permanent air vents are not located at all high points, the Contractor shall install corporation stops 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 stops shall be closed and the test pressure applied. At the conclusion of the pressure test, the corporation stops shall be removed and plugged or left in place at the discretion of MUPB.

Any exposed pipe, fittings, valves and joints shall be examined carefully during the test. Any damaged or defective pipe, fittings, valves, hydrants or joints 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 MUPB.



DESIGN and CONSTRUCTION MANUAL for MUPB UTILITIES

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 pipe has been filled with water and the air has been expelled. Leakage shall not be measured by a drop-in pressure in a test section over a period of time.

Loss of water pressure during the test shall not exceed 10 psi in a 24-hour time period or 5 psi in a two (2) hour time period. Duration of test shall be not less than two (2) hours. Where leaks are visible at exposed joints and/or evident on the surface where joints are covered, the joints shall be recaulked, repoured, bolts retightened or re-laid, and leakage minimized, regardless of total pressure drop shown by the test.

9.15.3. ALLOWABLE LEAKAGE

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 pipe has been filled with water and the air has been expelled. Leakage shall not be measured by a drop-in pressure in a test section over a period of time.

Only after the water main has successfully passed the hydrostatic pressure test, shall the leakage test be used to determine if the water main has passed. No pipe installation will be accepted if the leakage is greater than that determined by the following formula:

$$L = \frac{SD\sqrt{P}}{133,200}$$

Where:

- L = Allowable leakage, in gallons per hour
- S = Length of pipe tested, in feet
- D = Nominal diameter of the pipe, in inches
- P = Average test pressure during the leakage test, in pounds per square inch (gauge)

If loss exceeds L, the Contractor shall locate and repair to MUPB's satisfaction all leaks until the pipe section will pass another leakage test.

For the pipe line to be accepted, the following will be required:

1. Pass the pressure test.
2. Pass the leakage test, unless waived under the pressure test.
3. All evidence of leakage identified and repaired.



DESIGN and CONSTRUCTION MANUAL for MUPB UTILITIES

Should the sections under test fail to meet the requirements, the Contractor shall do all work of locating and repairing the leaks and retesting as MUPB may require without additional compensation.

If in the judgment of MUPB, it is impracticable to follow the foregoing procedures for any reason, modifications in the procedures shall be made as required and as acceptable to MUPB, but in any event, the Contractor shall be responsible for the ultimate tightness of the line within the above test requirements.

9.15.4. PRESSURE GAUGES

Pressure gages shall be sized accordingly to normal operating pressures (average pressures). Gauge ranges shall be no more than twice the operating pressure. Gauge assemblies shall be furnished with shutoff stops diaphragm seals and pulsation dampers, which shall be constructed of brass or stainless steel. Gauges shall be 4 ½-inch in diameter. Gages shall have the following graduations:

<u>Pressure Gauges (psi)</u>			
<u>Maximum Indications</u>	<u>Figure Intervals</u>	<u>Intermediate Graduations</u>	<u>Minor Graduations</u>
15	1	0.5	0.1
30	5	1	0.2
60	5	1	0.5
100	10	5	1
160	20	5	1
200	20	10	2
300	30	10	2

9.16. CONNECTING TO SANITARY SEWER SYSTEM

Connections to the existing sanitary sewer system shall be directed by MUPB, to the location of connection point. Gravity sanitary sewer connection shall be made at an existing manhole. Existing manhole shall be cored with a flexible connector and manhole bench and channel shall be shaped for positive flow from new sanitary sewer line.

New force main connection to an existing force main shall be made via a D.I. mechanical fitting "tee" or a stainless-steel tapping sleeve and valve with isolation valves located on all sides of the connection. New connections of force mains may be made at existing manholes, wet wells or force mains, at the discretion of MUPB. New force main connections to existing manholes or wet wells, shall be made by coring structure (manhole/wet well) with a water tight connection. CONTRACTOR is responsible for all labor, materials & equipment for connecting to the existing wastewater system.



DESIGN and CONSTRUCTION MANUAL for MUPB UTILITIES

The CONTRACTOR shall notify MUPB when the connection is to be made so that representatives of MUPB may operate existing valves and witness the connection. A minimum notice of at least 48 hours in advance of the connection shall be given to MUPB.

9.17. RESPONSIBILITY FOR MAINTENANCE

Prior to formal acceptance of the IMPROVEMENTS by MUPB, the CONTRACTOR and/or OWNER/DEVELOPER shall be responsible for the maintenance and repair of the IMPROVEMENTS in compliance with this manual, which shall include routine maintenance, cleaning, flushing, debris removal and general operation of force main(s), grinder(s), gravity sewer(s), lift stations and appurtenances.

After formal acceptance of the IMPROVEMENTS by MUPB, MUPB will maintain and repair the sanitary sewer mains and appurtenances. The limit of MUPB maintenance and repair responsibilities is at the sanitary sewer main. The property owner is responsible for the maintenance and repair of the property's service lateral or building sewer.

9.18. PLACEMENT OF TRACING WIRE

9.18.1. Direct Burial

Tracer wire shall be #12 AWG solid copper insulated with a 30 mil, high-density, high molecular weight polyethylene (HDPE) insulation and rated for direct burial use at 30 volts. Insulation color shall meet the APWA color code standard for identification of buried utilities. Detectable underground copper tracing wire shall be installed with all sanitary sewer pressure lines. Tracer wire shall be attached to the top of the pipe with adhesive tape or other suitable devices. At each lateral, service force main, and end of new pipe installation, the trace wire shall be daylighted and the ends connected together with waterproof connectors. For long runs of pipe, the maximum length between tracing stations (above or below grade) shall be 500 feet. Underground splicing shall be made using waterproof connectors designed for direct bury and covered with waterproof tape or wrap.

9.18.2. Directional Drilled

Tracer wire shall be a #12 AWG (0.0808" diameter) fully annealed, high carbon 1055 grade steel, high strength solid copper clad steel conductor (HS-CCS), insulated with a 30 mil, high-density, high molecular weight polyethylene (HDPE) insulation, and rated for direct burial use at 30 volts. HS-CCS conductor must be at 21% conductivity for locate purposes. Break load of 452 lbs. HDPE insulation shall be RoHS compliant and utilize virgin grade material. Insulation color shall meet the APWA color code standard for identification of buried utilities. Manufacturers supplying copper clad steel tracer wire must have available detailed performance data including 5 years of underground testing in terms of durability related to damage of protective insulation and effects of potential corrosion of the specific copper clad steel used. Origin of copper clad steel manufacturer is required and steel core must be manufactured in the United States. If



DESIGN and CONSTRUCTION MANUAL for MUPB UTILITIES

manufacturer has not completed 5-year corrosion testing, a 5-year warranty must be provided. Tracer wire shall be Copperhead® High Strength HS-CCS HDPE 30 mil or district pre-approved equal and made in the USA.

Use Copperhead High Strength Tracer Wire - Part # 1230*-HS-**

* = Color: B=Blue Water, G=Green Sewer, P=Purple Reclaim Water R=Red Electric, N=Orange Communications, K=Black

** = Spool Size: 500', 1000', 2500'

9.19. SECOND HAND & SALVAGED MATERIALS

The use of second hand or salvaged materials will not be permitted unless authorized by MUPB. All materials and/or equipment specified to be salvaged from existing structures shall remain the property of the MUPB. Such materials and/or equipment shall be delivered by the CONTRACTOR and stored on sites as directed by MUPB.

9.20. CONTRACTORS GUARANTEE & UNDERSTANDING

All work that has been rejected shall be repaired, or if it cannot be repaired satisfactorily, it shall be removed and replaced at the CONTRACTOR's expense. Defective materials shall be immediately removed from the site of the work. Work done without line and grade having been given, work done beyond the lines or not in conformity with the grades shown on the plans or as given, same as herein provided, work done without written authority and prior agreement in writing as to process, shall be done at the CONTRACTOR's risk and shall be considered unauthorized and, at the option of the Engineer and MUPB, may be ordered removed at the CONTRACTOR's expense.

9.21. PROTECTION OF WORK, PERSONS & PROPERTY

During performance and up to the date of final acceptance, the CONTRACTOR shall be under the absolute obligation to protect the finished work against any damage, loss or injury. All risk of loss or damage to the work shall be borne solely by the CONTRACTOR until completion and acceptance of all work by the Engineer and MUPB, as evidenced by the MUPB's issuance of a Letter of Acceptance.

The CONTRACTOR shall have the full responsibility to provide and maintain all warning devices and take all precautionary measures required by law or otherwise to protect persons and property. Minimum standards for safeguarding pedestrian and vehicular traffic are contained in the "Manual of Uniform Traffic Control Devices," Federal Highway Administration of the U.S. Department of Transportation, and the "Kentucky Manual of Uniform Traffic Control Devices," Kentucky Transportation Cabinet. The CONTRACTOR shall be responsible for complying with state laws and federal regulations relating to trench safety.



DESIGN and CONSTRUCTION MANUAL for MUPB UTILITIES

The OWNER/DEVELOPER shall provide normal routine maintenance on all items including booster stations, flushing and fire hydrants prior to formal acceptance. Maintenance shall be documented and provided to MUPB prior to final acceptance of IMPROVEMENTS.

9.22. MATERIALS & WORKMANSHIP

The work shall be performed according to the best modern practice with materials and construction of the highest quality and suitable for the purpose. The Engineer and MUPB shall judge and determine the CONTRACTOR's compliance with these requirements. The CONTRACTOR shall promptly correct or replace all work rejected by the Engineer or MUPB as defective or as failing to conform to the construction documents. If a defective material(s) or workmanship within one year of final acceptance by MUPB, as evidenced by the final Certificate of Acceptance or within such longer or shorter period as may be prescribed by law or by the terms of any other applicable special warranty on designed equipment or portions of work as required by the construction documents, the CONTRACTOR shall correct it promptly after receipt of a written notice from MUPB or the ENGINEER to do so. The MUPB shall give notice promptly after discovery of such condition. The CONTRACTOR shall remove from the site all portions of the work that are defective or nonconforming which have not been corrected unless removal is waived in writing by the MUPB.

9.23. SUBSTITUTIONS

Whenever materials or equipment are specified or described in this Manual by using the name of a proprietary item or the name of a particular supplier, the naming of the item is to be intended to establish the type, function and quality desired. Unless the name is followed by words "or Equal" indicating that a substitution is permitted, materials and equipment of other suppliers will not be accepted by the MUPB. Request for review of substitute items or material and equipment will not be accepted by the MUPB from anyone other than the ENGINEER. If the ENGINEER wishes to furnish or use a substitute item of material or equipment, the ENGINEER shall make written application to the MUPB General Manager and/or Designee for acceptance thereof, certifying that the proposed substitute will perform adequately the functions and achieve the results called for by the general design, be similar and of equal substance to that specified and be suited to the same use as that specified. MUPB will be the sole judge of acceptability, and no substitute will be ordered, installed, or used without MUPB's prior written acceptance.

9.24. LIFT STATION STARTUP

9.24.1. Successful test shall include the confirmation of the following:

- A. All major equipment operated, as specified.
- B. The control systems worked, as specified.
- C. The SCADA systems worked, as specified.



DESIGN and CONSTRUCTION MANUAL for MUPB UTILITIES

- D. Adjustments of control settings within the normal operating parameters are allowed as long as the lift station remains operational and no unplanned alarm signals are generated.

9.24.2. Substantial Completion

- A. All successful start-up tests shall be performed by the Contractor, certified by the Engineer, and accepted by the Owner prior to the Certificate of Substantial Completion.
- B. MUPB shall be provided with sufficient spare parts for all major equipment. See MUPB's Spare Parts Checklist, APPENDIX K. Special tools may also be required for a given station that uses special (non-standard) equipment, that has been preapproved by MUPB. Special tools shall be specified during the review of the lift station plans by MUPB.
- C. Five copies of the approved Operations and Maintenance Manual and one digital copy on CD will be supplied to MUPB prior to completion of the station. The Operations and Maintenance Manual will contain a reduced set of the lift station plans, including as-built electrical and control schematics, equipment model and serial numbers, installation instructions, maintenance schedules, names, and telephone numbers for local representative for each item of equipment.

9.25. FINAL INSPECTION & ACCEPTANCE

The CONTRACTOR shall furnish MUPB with every reasonable facility for ascertaining whether or not the work performed was according to the requirements and intent of the construction documents. Any work done or materials used without suitable inspection by MUPB may be ordered removed and replaced at the CONTRACTOR's expense. The OWNER/CONTRACTOR and MUPB shall make final inspection of all work included in the construction documents, and provisions provided in the Division of Water approval letter when practicable after the work is completed and ready for acceptance. If the work is not acceptable to MUPB at the time of such inspection, MUPB shall inform the OWNER/DEVELOPER/CONTRACTOR as to the particular defects to be remedied before final acceptance shall be made.

When the project is completed, the ENGINEER shall submit a written certification to the Division of Water that the project has been constructed and tested according to the approved construction plans and specifications, and the provisions listed in the Division of Water approval letter. The certification must be sealed, signed, and dated by a Professional Engineer licensed in the Commonwealth of Kentucky. One (1) digital and Two (2) original copy of the certification shall be submitted to MUPB General Manager and/or Designee.