SECTION 1

INTRODUCTION

1.01 General

The Franklin Department of Public Works is responsible for the installation of all sanitary and storm sewer facilities constructed in the City of Franklin. All sanitary sewer collection facilities shall be designed and constructed in full accordance with these Standards, Indiana Department of Environmental Management (IDEM), and Ten States Standards for Sewage Works latest edition.

The purpose of these Standards is to establish a minimum criteria for design and workmanship. The jurisdiction of the Standards includes the entire sanitary system and its appurtenances from the point of connection with the building plumbing to the final point of discharge at the treatment facility.

It shall be the Owner's/Contractor'sresponsibility to comply with all requirements of the City or other authority having jurisdiction on work if such authority imposes greater requirements. Furthermore, the Owner shall be responsible for procuring all necessary permits and licenses, pay all charges and fees for acquiring and recording all easements, and giving all notices necessary and incidental to the work.

Addenda and/or revisions to these Standards may be issued periodically and will be distributed and made available to the public and contractor at the City Planning Department and the Wastewater Treatment Facility. Users shall be responsible to keep apprised of any changes and revisions to these Standards.

Any conflicts between these Standards and any other applicable Ordinance and State laws shall be superseded by such Ordinance or law. These Standards are approved and adopted by the City of Franklin, Board of Public Works and Safety.

SECTION 2

DEFINITIONS AND TERMS

2.01 Definitions and Terms

Whenever in these Standards or in any documents the following terms, abbreviations, or definitions are used, the intent and meaning shall be interpreted as follows:

A. Abbreviations

ASTM	American Society of Testing and Materials
AASHTO	American Association of State Highway and Transportation Officials
AWWA	American Water Works Association
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ACI	American Concrete Institute
NEMA	National Electrical Manufacturers Association
IDOT	Indiana Department of Transportation
DPW	Department of Public Works City of Franklin
OSHA	Federal Occupational Safety and Health Act

B. Definitions

1. **Acceptance**: The formal written acceptance by the DPW of an entire project which has been completed in all respects in accordance with the approved Plans, Specifications and these Standards including any previously approved modifications thereof.

2. **Backfill**: Earth and/or other material used to replace material removed from trenches during construction which is above the pipe bedding.

3. **Bedding**: That portion of the trench backfill which encases the sewer pipe to a minimum depth above and below the bell/barrel of the pipe, as provided in the **Bedding** section of these Standards, for the purpose of properly supporting the pipe.

4. **Building Sewer (lateral)**: The conduit for transporting waste discharged from the building to the public sewer commencing three (3) feet outside the building walls and ending at the exclusive of the wye or tee fitting at the connection to the public sewer.

5. **City Engineer**: Authorized Agent by the Board of Public Works and Safety.

6. **Contractor**: Any Contractor who meets the DPW requirements and is licensed to enter into contracts for and to perform the work of installing sewers.

7. **County**: The county of Johnson, State of Indiana.
8. **DPW**: Department of Public Works, City of Franklin.

9. **DPW Representative**: The authorized agent of the DPW assigned to make detailed observation of any or all portions of the work.

10. **Director**: Director of the Planning Department or his/her authorized representative.

11. **Easement**: Easements are areas along the line of all public sanitary and storm sewers which are outside of dedicated sewer or road easements or rights-of-way, and are recorded and dedicated to the City granting rights along the line of the sewer. Easements shall be exclusively for sanitary and storm seers and no other utilities shall be constructed or encroach upon the easement except with the expressed written approval of the DPW.

12. **Engineer**: The Engineer for the Owner.

13. **Infiltration/Inflow**: The total quantity of water from both infiltration and inflow without distinguishing the source.

14. **Inspector**: A direct employee of the DPW assigned to make detailed inspection of any or all portions of the work and materials. The inspector has full authority to reject materials and/or any portion of the work not supplied and installed in accordance with these Standards.

15. **Lift Station**: Any arrangement of pumps, valves and controls that lift and/or convey wastewater to a higher elevation.

16. **Other Specifications and Materials**: Wherever in these Standards other specifications or regulations are mentioned, it shall be understood that the materials and methods mentioned therewith shall conform to all requirements of the latest revision of the specifications so mentioned.

17. **Owner**: Any individual, partnership, firm, corporation or other entity who, as property owner, is initiating the work.

18. **Permits**: Clearance to perform specific work under specific conditions at specific locations. The Owner or his duly authorized representative shall furnish to the Director all necessary plans and documents required by the Director to make application for permits.

19. **Plans**: Construction plans, including system maps, sewer plans and profiles, cross sections, utility plans, detailed drawings, etc., or reproductions thereof, approved or to be approved by the Director and/or City Engineer which show location, character, dimensions and details of the work to be done.

20. **Record Drawing (As-Builts)**: Plans certified, signed and dated by a professional engineer registered in the State of Indiana, indicating that the Plans have been reviewed and revised, if necessary, to accurately show all as-built construction and installation details including, but not limited to, key elevations, locations and distances.

21. **Right-of-Way**: All land or interest therein which by deed, conveyance, agreement, easement, dedication or process of law is reserved for or dedicated to the use of the general public, within which the DPW shall have the right to install and maintain sewers.

22. **Sewer**: A pipe or conduit for carrying wastewater (sanitary sewer) and storm water (storm sewer).

23. **Standard Drawings**: The drawings of structures, sanitary and storm sewer lines or devices commonly used and referred to on the Plans and in these Standards.

24. **Standards**: The Standards for Sanitary and Storm Sewer Design and Construction within the City of Franklin as contained herein and all subsequent additions, deletions or revisions.

25. **Ten State Standards**: Recommended Standards for Sewage Works, latest edition, developed by the Committee of the Great Lakes - Upper Mississippi River Board of State Sanitary Engineers.

26. **Tree Board**: City Board responsible for preservation of trees in public areas.

27. **Uniform Plumbing Code**: The Uniform Plumbing Code adopted by the International Association of Plumbing and Mechanical Officials, current edition.

28. **Work**: All the work to be done under Director's permit, in accordance with the approved Plans, Specifications, these Standards and permit conditions.

Additional abbreviations and definitions are provided in Appendix A (Sewer Use Ordinance).

SECTION 3

GENERAL RULES AND REQUIREMENTS

3.01 General

This Section provides the general rules and policies as set forth in City Council Municipal Ordinances for the construction of sanitary sewer systems including permit requirements and inspection. The ordinances governing these Standards are provided in Appendix A.

3.02 Building Sewers (laterals)

The following paragraphs provide a highlight of the provisions contained in the applicable Ordinances. If any conflicts between these Standards and the Ordinances shall be superseded by the Ordinances.

A. Sewer Connection Permit (Section 4)

The DPW requires connection permits to be issued by the City Planning Department for all repairs and modifications to or connection of a building sewer to a public sewer. Four (4) classes of Building Sewer Permits are applicable based upon water service:

Class 1:	5/8" to 3/4" meter
Class 2:	1" meter
Class 3:	2" meter
Class 4:	all meters greater than 2"

B. Permit Fee (Section 4)

A fee per each connection to the sanitary sewer shall be charged for each new connection. Modifications or repairs of an existing service shall require a permit that will not be subject to any fee.

This fee shall cover the costs of mandatory inspection and any reinspection that may be necessary because of remedial construction. The City Council may revise the amount of such connection fees.

The fee schedule shall be as follows:

Class 1:	$ 1,000.00
Class 2:	$ 2,500.00
Class 3:	$10,000.00
Class 4:	$23,000.00

These fees shall be additive if more than one water meter is provided.

C. Application for Connection Permit (Section 4)

An application for a Connection Permit shall be made on the Form provided by the Director and available from the City Planning Department.

D. Prohibition Against Clean Water Discharges (Section 4)

No person shall discharge or cause to be discharged to any sanitary sewers either directly or indirectly:

Storm Water
Surface Water
Ground Water
Roof Runoff
Subsurface Drainage (gravity or pumped)
Cooling Water
Unpolluted Water
Unpolluted Industrial Process Water

E. Mandatory Inspection of Building Connections

It shall be the responsibility of the Holder of a Connection Permit to notify the DPW that the sewer work is available for inspection. The DPW will conduct inspections on connections from 7:00 AM to 4:00 PM Monday through Friday except on observed City holidays. The building sewer shall be fully exposed from the foundation to the point of connection with the public sewer.

The DPW shall take a minimum of two (2) construction "as-built" photos for City record prior to backfilling.

The DPW and its authorized representative shall have the right of entry upon or through any premises for purpose of inspection of sewer work and any other construction activity performed on or associated with the connection of the building sewer to the City sewer, including inspection for clear water discharges into the sewer.

F. Building Sewer Responsibility

It shall be the responsibility of the property owner(s) whose property is benefitted to provide for, install and make private connections for the use of their premises to an existing public or building sewer. Further, it shall be the responsibility of the Owner to make all necessary repairs, extensions, relocations, changes or replacements thereof, and of any accessories thereto. These requirements may be altered, modified or waived at the discretion of the DPW when it is shown that compliance is not possible due to extenuating circumstances.

3.03 Design/Construction Approval for Development

A. Requirements for Construction Permits

It shall be the responsibility of the Owner/Contractor to obtain a valid Construction Permit for the construction or modification of any sanitary sewer or sewer lift station from the Indiana Department of Environmental Management (IDEM) when required.

A copy of this permit shall be filed with the Director.

B. Technical Review Committee

The Owner/Contractor shall submit design drawings for review and approval of the City Technical Review Committee. For each project the Owner/Contractor shall request a presentation hearing before the Technical Review Committee through the City Planning Department. During this meeting the Committee may recommend approval of the project or request formal revisions. Revised drawings and specifications shall be resubmitted to the City Engineer and DPW for final approval.

C. Final Plan Approval

The City Engineer and DPW shall issue final approval for all projects after clearing the Technical Review Committee.

D. Posting of Bond

1. The DPW and City Engineer may, as a prerequisite to the issuance of project approval, require the posting of a performance bond from a company licensed by the State of Indiana to provide such surety. Such bond shall be equal to 100% of the contract amount or an amount established by the City to provide surety for the satisfactory completion of the improvements required by the Construction Permit, and shall name the City of Franklin who can enforce the obligations thereunder.

2. The DPW and City Engineer may as a prerequisite to acceptance of a sanitary sewer, storm sewer, or lift station require the posting of a maintenance bond in an amount not to exceed _____% of the contract amount or, subject to the approval by the City Engineer, provision for maintenance, for a period of three years from the date of acceptance by the DPW. Said bond shall name the City of Franklin who can enforce the obligations thereunder.

3. In instances where the DPW and City Engineer have required a bond pursuant to this section, the City may, as an alternative to the posting of such bond, accept other appropriate security such as properly conditioned irrevocable letter of credit which meets the same objective as the bonds described in this section, subject to approval of any other department or agency whose interests are protected by the same bonding requirement.

4. If the surety on any bond furnished to the City becomes a party to a supervision, liquidation, rehabilitation action pursuant to I.C. 27-9 et. seq. or its right to do business in the State of Indiana is terminated, it shall be required that, within thirty days thereafter, a substitute bond and surety be provided, both of which must be acceptable to the City. Failure to obtain a substitute bond within the stated time frame shall be cause for revocation or suspension of the project approval until such time that the bond is furnished to the City Engineer.

E. Construction Inspection

Prior to issuance of the final project approval and commencement of any construction activities pertaining to the installation of any sanitary sewer or storm sewer system, the Owner/Contractor shall execute an Agreement with the DPW, if required by DPW, which will provide that:

1. The DPW may contract for construction inspection service to insure that materials and workmanship meets the requirements of the approved plans and specifications.

2. The contracted engineer (DPW representative) will be responsible for submitting and certifying air pressure or infiltration test results for all pipe and deflection test results for all flexible and semi-rigid pipe.

3. The Owner/Contractor will reimburse the DPW for the cost of such services which shall be determined at the time of execution of the Agreement, and verified by the Owner or his representative throughout construction.

4. Upon completion of construction, the contracted engineer (DPW representative) shall execute and file with the DPW a Certificate of Completion and Compliance certifying to the DPW and the Owner/Contractor as to the compliance of such construction with the requirements of the approved construction plans and approved change orders.

5. No action with regard to the acceptance of the construction and release of the improvement bond pursuant to this section shall be taken until the Owner/Contractor has reimbursed the DPW in full for the inspection services.

All construction of sanitary sewers and storm sewers intended for dedication to the City shall be observed and certified pursuant to the Agreement.

The Owner/Contractor shall furnish the DPW with three (3) copies of the approved construction plans at the time the Agreement is executed.

F. Requirements for Project Acceptance and Dedication

Sanitary sewers, storm sewers and lift stations will not be accepted and building connection permits shall not be issued until all documents, as required by the City, are submitted to and approved by the DPW and City Engineer, including the following:

1. Three (3) Year Maintenance Bond;

2. Recorded Covenant and Easement Documents;

3. Certificate of Completion and Compliance;

4. The completion of a final inspection which confirms that the project has been constructed and tested in accordance with the DPW's Standards; and

5. As-Built/as constructed drawings on reproducible mylars.

SECTION 4

GENERAL DESIGN STANDARDS

4.01 General

The DPW and City Engineer shall issue final approval for the installation of all sanitary sewer facilities and storm sewers. All sanitary sewer facilities shall be designed and installed in accordance with the Indiana Department of Environmental Management (IDEM) and Ten States Standards for Sewage Works.

4.02 Sanitary Sewer Design Criteria

A. General

All sanitary sewers shall be designed to carry the estimated flow from the area ultimately contributing to the respective service area of the sanitary sewer. The required capacity shall be established by City Engineer or at the DPW's option by means of a study conducted by the Owner/Contractor or his authorized representative engineer.

1. Residential

For the purpose of design, the average family unit is considered to generate 310 gallons per day per single family home. Peak flows shall be determined by Ten States Standards.

2. Commercial/Institutional

The average daily flow for these facilities shall be based on Bulletin S.E. 13 from the Indiana State Board of Health, latest edition. These documents shall be used as a general guideline. The City Engineer may allow modification of these guidelines based upon information submitted by the Owner/Contractor or developed by the DPW or City Engineer.

Peak flow shall be determined by multiplying the average flow by a factor of 2.50.

3. Industrial

For those industries which do not have any process wastewater discharge, flows shall be calculated as stated above in "Commercial/Institutional". For industries which will have a process discharge, the Owner shall submit detailed flow estimates for each process, duration and frequency.

Peak capacity shall be determined by multiplying the average discharge by a factor of 2.0.

4. Infiltration

Sanitary sewer design capacity must include an allowance to carry unavoidable amounts of groundwater infiltration or seepage in addition to the peak sanitary flows. Collector and trunk sewers shall be designed to include an allowance of two hundred (200) gallons per day per inch diameter mile of pipe.

B. Pipe Capacities

1. Collector Sewers

Collector sewers shall be classified as any sewer ranging between 8" and 12". Peak design flow capacities shall be based upon sewer flowing full without head.

2. Trunk Sewers

Trunk sewers shall be classified as any sewer 15 inches and larger.

Peak design flow capacities for trunk or interceptor sewers shall be based on sewers flowing full, without head, using the design population density and appropriate land use determined by the DPW and City Engineer, and shall include an allowance for infiltration which will be reviewed on a case-by-case basis and is subject to the approval of the DPW and City Engineer.

C. Minimum Pipe Sizes and Standards

1. Pipe Diameter

The required diameter of gravity sewers shall be determined by Manning's formula using a roughness coefficient, "n", of 0.013 or required by the latest Ten States Standards. The minimum pipe diameter for gravity sanitary sewers shall be eight (8) inches.

2. Minimum Slopes and Velocities

All sanitary collector and trunk sewers shall be designed and constructed to provide a minimum velocity when flowing full of two (2) feet per second. The slope of the water pipe shall be such that these minimum velocity requirements are attained. The minimum acceptable slopes for the design and construction of sanitary sewers are as follows:

Pipe Size inches	Minimum Slope (ft. per 100 ft., %)
8	0.40
10	0.28
12	0.22
15	0.15
18	0.12

These slopes may be modified by the approval of the DPW and/or the Indiana Department of Environmental Management (IDEM).

3. Minimum Depth

For the protection of the sanitary sewer lines from damage caused by utilities installed after the sanitary sewer has been constructed, the minimum depth to crown of all gravity sanitary sewers shall be 2.5 feet, and the minimum depth to crown of all force main sanitary sewers shall be 4.0 feet.

4. Building Sewers

Building sewers shall conform to the latest edition of the Uniform Plumbing Code and to these Standards.

The building sewer shall connect to the public sewer at a mainline fitting. Direct connections to manholes shall not be allowed.

Building sewers within the right-of-way or easement shall be a minimum of six (6) inches in diameter. Building sewers shall have a wye cleanout located within three (3) feet of the building's exterior wall and extended to grade.

Cleanouts installed under concrete or asphalt paving shall be made accessible by yard boxes or extended flush with paving with approved materials and be adequately protected.

Building sewers installed for future connections shall be terminated at the right-of-way or easement and plugged to ensure 100 percent water tightness. A one-half (1/2) inch metal locator rod or a magnetic locator tape shall be installed at the end of the plugged line to within three (3) feet of the finished grade.

If approved by DPW a service may be cut into a public sewer using a mainline fitting and Fernco coupling.

D. Sewer Structures

1. Manholes

a. General

Manholes shall be installed at the end of each line; at all changes in grade, size, materials or alignment; at all sewer intersections and at the following intervals:

Max. Interval

Pipe Diameter inches	**Between MH's feet**
8" & 10"	400
12" to 18"	600
21" and larger	800

The minimum inside diameter of manholes shall be 48 inches.

Flow channels shall be shaped and formed in each manhole to provide a smooth transition of flow from all inlets to the outlet. The bench wall shall be formed to the crown of the inlet and outlet pipes to form a "U" as shown in the Standard Details (Figures 5-1 and 5-2).

At changes in sewer alignment and/or sizes, the energy gradient elevation shall not increase. This shall be accomplished by keeping the crown elevation continuous where possible for changes in sewer sizes.

Manholes proposed to be installed in unpaved areas shall be designed and constructed such that the top of the casting is a minimum of two (2) inches above the finished grade to prevent ponding of water over the casting. Positive drainage away from the manhole shall be provided.

Manholes receiving discharge force mains shall have an internal drop connection (see Figure 5-8). Manholes which have force main discharge lines shall have an internal epoxy coating to prevent corrosion.

b. Outside Drop Connections

Outside drop pipe connections shall be provided for all sanitary sewers entering a manhole at an elevation greater than twenty-four (24) inches above the invert of the manhole (see Figure 5-4).

In areas where future residential, commercial and/or industrial growth can occur, DPW shall determine which new manholes 15

feet deep or deeper shall be equipped with outside drop connections of a size and at an elevation to be determined by DPW at the time of design to allow for future connections at these points. The drops shall extend from the base to within 10 feet of the final graded surface elevation.

2. Lift Stations

If approved by DPW and City Engineer, all lift stations shall have pre-cast concrete wet wells and valve pits. All stations shall, as a minimum, have two (2) submersible pumps.

4.03 Storm Sewer Design Criteria

A. General

All storm sewers shall be designed to carry the estimated flow from the drainage area(s) ultimately contributing to the respective storm sewer. The minimum return period which shall be used is 10 years. This may be reduced by DPW and the City Engineer based upon downstream hydraulic conditions identified by the Owner/Contractor.

B. Manning Equation

The hydraulic capacity of storm sewers shall be determined by using Manning's Equation:

V = 1.486/N(R 2/3) (S1/2)
V = Mean Velocity of Flow in Feet or Second
R = The Hydraulic Radius in Feet
S = The Slope of the Energy Grade Line in Feet
N = Roughness Coefficient

C. Minimum Size

The minimum size of all storm sewers shall be 12 inches.

D. Grade

Storm sewer grade shall be such that, in general, a minimum of one foot of cover is maintained over the top of the pipe. If such condition occurs in a paved area, extra strength concrete pipe and granular backfill shall be used. Uniform slopes shall be maintained between inlets, manholes and inlets to manholes. Final grade shall be set with full consideration of the capacity required, sedimentation problems and other design parameters. Minimum and maximum allowable slopes shall be those capable of producing velocities of two and one-half and 15 feet per second, respectively, when the sewer is flowing full.

E. Alignment

Storm sewers shall be straight between manholes insofar as possible. Where long radius curves are necessary to conform to street layout, the minimum radius

of curvature shall be no less than 100 feet for sewers 42 inches and larger in diameter. Deflection of pipe sections shall not exceed the maximum deflection recommended by the pipe manufacturer. The deflection shall be uniform and finished installation shall follow a smooth curve.

F. Manholes

Manholes shall be installed to provide access to continuous underground storm sewers for the purpose of inspection and maintenance. Manholes shall be provided at the following locations:

1. Where two or more storm sewers converge;

2. At the point of beginning or at the end of a curve, and at the point of reverse curvature (PC, PT, PRC);

3. Where pipe size changes;

4. Where an abrupt change in alignment occurs;

5. Where a change in grade occurs; and

6. At suitable intervals in straight sections of sewer.

The maximum distance between storm sewer manholes shall be as follows:

Size of Pipe inches	**Maximum Distance feet**
12"	400
15" to 42"	600
48" and larger	800

G. Inlets

Inlets or drainage structures shall be utilized to collect surface water through grated openings and convey it to storm sewers, channels or culverts. Inlet design and spacing shall be in accordance with Section 7-400 of the Indiana Department of Highway's Road Design Manual - Volume 1 or other approved design procedure. The inlet grate opening provided must be adequate to pass the design 10 year flow.

H. Compute Model

1. Time of Concentration

All storm water management projects shall be done using the Time of Concentration Methodology outlined in the SCS TR20 Manual or the Stormwater Drainage Manual (H-94-6) by HERPICC.

2. Storm Sewer and Inlets

Storm sewer design shall utilize the SCS TR20 or the Rational Method using time of concentration curves of the Stormwater Drainage Manual (H-94-6) by HERPICC.

3. Alternative Methods

If approved by the DPW, TR55 may be used for runoff calculations.

4.04 Easements

A. General

Whenever possible, sanitary sewers and storm sewers shall be constructed within the public right-of-way. Should the construction be outside the limits of the public right-of-way, recorded sewer easements shall be acquired, dedicated and recorded solely for the benefit of the City of Franklin.

The minimum permanent easement widths to be dedicated to the City are as follows:

Depth of Sewer from Finished Grade	Minimum Easement (ft.)
up to 15 feet	20
> 15 feet to 25 feet	25
greater than 25 feet	30

All sewers shall be centered in the easement. For those sewers constructed in the public right-of-way, the easement shall extend the distance outside of the right-of-way necessary to provide the required easement width.

A minimum 30 foot by 30 foot easement shall be provided for all submersible lift stations with wet wells up to 30 feet deep.

The sewer easements shall be exclusively under the discretion and control of the DPW. Ingress and egress shall be available to the DPW's crew at all times. No utility companies are allowed to use the sewer easements for installation of their utility lines without the expressed written permission of the DPW. All plan sheets shall clearly identify the sanitary or storm sewer easement and the location of all other proposed utilities. The horizontal and vertical plans shall identify all utilities proposed to cross the sanitary sewer easement.

B. Right-of-Way Plan Sheet

1. Geographic location map showing the extent of the project and including where applicable:

   a. Directional North Arrow and Scale;
   b. County;
   c. Civil Township;
   d. Section, Township and Range Identification;

e. Subdivision Names, Recording Information and Lot Numbers;
f. Highway, Road and Street Identification;
g. Rivers, Creeks and Named Ditches;
h. Assigned Parcel Numbers Arranged in Ascending, Numerical Order from the Project Beginning to End; and
i. List of Apparent Owners (last deed of record) by Assigned Parcel Numbers.

2. In addition to the above, there should be sufficient information on the design drawings to properly correlate with the right-of-way plan sheet; i.e., property lines, subdivision information, parcel number or name, width of right-of-way, permanent or temporary and special conditions; for example, structures, trees, shrubs to be removed or replaced, sodding, riprap, etc.

C. Legal Description Sheets

The following shall be provided:

1. Parcel Number;

2. Project Number;

3. Project Name;

4. Identification as to permanent or temporary easement;

5. Separate descriptions on separate sheets are required where both permanent and temporary easements are to be taken;

6. Metes and bounds descriptions shall be clear, concise and complete with sufficient detail to positively establish from known and referenced points, monuments, lines, etc. Area of taking should be stated at end of description. Areas should be given in acres;

7. Descriptions of easements from platted subdivision lots, including strips off sides of lots should include name of subdivision and recording information for the subdivision as well as affected lot number(s). NOTE: These are usually small areas; therefore, area should be stated in square feet; and

8. Registered land surveyor's licensed in the State of Indiana, seal and signature.

D. Property Plats

1. Parcel Number;

2. Project Number;

3. Project Name;

4. County;
5. Civil Township;

6. Section;

7. Township;

8. Range;

9. Owner;

10. Permanent or Temporary Legends;

11. Permanent or Temporary Easement Areas;

12. Total area of property out of which easement is to be taken;

13. Drawn By;

14. Directional North Arrow;

15. Scale;

16. Unplatted properties: complete boundaries of property description out of which easements are to be taken, including properly identified referenced corners, P.O.B.'s, monuments, roads, bearings, distances, etc.;

17. Platted subdivisions: dimensions of lot(s) as well as the lot number(s) and including the subdivision name and recording information;

18. Easement boundaries as described in Item A. of this subsection, including referenced bearings, distances, etc., and identified as in legend; and

19. Registered land surveyor seal and signature.

4.05 Drafting Standards

A. General

These Standards have been established for the purpose of ensuring uniformity in the design and drafting techniques of projects to be submitted for review and acceptance.

1. All projects submitted, having more than two (2) sheets, shall have a title sheet which will include:

   a. General Overall Area Map;
   b. Vicinity Location Map;
   c. A Site Plan Map Detailing the Project;
   d. Name/Title of Project, including Section Number if applicable;
   e. Owner and Engineer's Name; and
   f. Professional Engineer's Seal and Signature.

2. All plan and profile sheets are to be certified and dated by a professional engineer of the State of Indiana.

3. All sheets are to be numbered, with total number of sheets included.

4. Include detail sheet(s)/specification sheet(s), as applicable.

5. Design drawings shall be 24-inch by 36-inch.

B. Scales

The following scales for drawings are required:

1. Plan and Profile: Variable; Not to Exceed 1" = 50' Horizontal and 1" = 5' Vertical

2. Cross Sections: 1" = 5' Horizontal and Vertical.

C. Materials

Mylar type drafting film shall be used for all reproduction "originals" to be submitted as record drawings. They shall be of a quality suitable for blue printing.

D. Plan and Profile Drawings

All plan sheets shall include the following information when applicable:

1. A North Arrow;

2. The Scales Used;

3. Project Name and Number, Sheet Number, Date Drawn, Date and Nature of Revisions;

4. All topography in the area affected by construction;

5. Right-of-Way lines, property lines and easements;

6. Locations of bench marks and their descriptions;

7. Locations of all existing and proposed utilities in the project area; and

8. Match lines shall be easily identifiable.

All profiles shall include the following:

1. Existing and finished grade lines;

2. Inverts at all manholes;

3. Length and size of pipe between manholes;

4. Slope of pipe in percent;

5. Elevations to USGS datum;

6. Top of casting elevations;

7. Types of materials used;

8. Profile of existing and proposed utilities; and

9. Special construction required due to unfavorable soil conditions.

E. Lift Station Drawings

Lift station plans shall, at a minimum, contain the following:

1. At least two views of the station, plan view and cross section;

2. Electrical panel detail;

3. Pump and alarm control elevations;

4. Inlet and outlet pipe elevations;

5. Finished grade and foundation elevations;

6. Special construction required due to unfavorable soil conditions;

7. Design pump capacity, rated horsepower, total dynamic head, manufacturer and model number;

8. Sump capacity and cycle time;

9. Also, the Owner's Engineer shall submit a copy of the head discharge curve and the complete design calculations for the lift station and force main; and

10. Fence and access drive detail.

F. Record Drawings

Sanitary sewer plans submitted as record ("as-built") drawings shall have all laterals shown on the plan view with their locations properly scaled. Lateral measurements shall be indicated by their distance from the downstream manhole in the form of stationing. Lateral stationing shall begin at 0+00 at each downstream manhole. All sheets shall have the phrase "as-built" or "record drawing" boldly printed on them with the date, and shall be stamped and signed by a professional engineer registered in the State of Indiana.

4.06 Sanitary Sewers Crossing Drainage Ways

Sanitary sewers shall be constructed of ductile iron pipe or shall be encased in a minimum of 6" of concrete wherever the sanitary sewer crosses under a naturally occurring drainage way (i.e., creeks, rivers, streams, etc.). Wherever applicable, the sanitary sewer crossing the drainage way shall be pressure tested to assure 100% water tightness prior to backfilling.

SECTION 5

MATERIALS

5.01 General

This section provides a description of the materials acceptable for the construction of sanitary sewer facilities and storm sewers. Use of other materials which are not specified herein shall only be permitted with the written approval by the DPW and City Engineer.

5.02 Gravity Sanitary Sewer

A. General

The DPW currently allows the use of the following pipe material:

Reinforced Concrete Pipe (RCP)
Ductile Iron Pipe (DIP)
Polyvinyl Chloride Pipe (PVC)
High Density Polyethylene Pipe (HDPE)
Composite Wall/Truss Pipe

All pipe shall be the bell and spigot type with elastomeric seal joints.

All pipe shall be required to withstand a hydrostatic pressure of twenty (20) feet of water (8.6 psi) for two (2) hours while being deflected to the maximum amount recommended by manufacturer. Continuing the hydrostatic pressure, a shear load of one hundred (100) pounds per inch of nominal pipe diameter shall be applied to an unsupported spigot immediately adjacent to joint. During testing period, there shall be no visible leakage at joint.

B. Sanitary Sewer Pipe Materials

1. Reinforced Concrete Pipe

Reinforced concrete pipe shall be Reinforced Concrete Culvert, Storm Drain and Sewer Pipe conforming to ASTM Designation C 76. Pipe shall be wall thickness "B" or "C" as required by site conditions. Class shall be as required by loading conditions, but shall not be less than Class III.

Reinforced concrete pipe shall be tested in accordance with ASTM Designation C 497.

Joints for sewer pipe manufactured of reinforced concrete shall be flexible watertight joints conforming to "Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible, Watertight, Rubber Gaskets" (ASTM Designation C443). Joints shall be made using rubber or rubber-like materials manufactured to fit tongue and groove or bell-and-spigot type concrete pipe. The joint shall be installed in accordance with the manufacturer's recommendations.

Lateral connections to the RCP sewer shall be subject to DPW approval. Where lateral connections must be made to the RCP sewer, a rubber connector with stainless steel clamp shall be used. The connector shall be the sole element relied on to assure a flexible watertight seal of the pipe.

The rubber for the connector shall comply with ASTM C 923 and shall be resistant to ozone, weather elements, chemicals including acids and alkalis and oils.

The stainless steel elements of the connector shall be totally non-magnetic Series 305 stainless steel. The stainless steel clamp shall be capable of sustaining applied torque in excess of eighty (80) inch-pounds. It shall be the responsibility of the Contractor to submit details of the

proposed connection to the DPW for approval. Connections not approved by the DPW shall be subject to removal and replacement with an approved adaptor.

2. Ductile Iron Pipe (DIP)

All ductile iron pipe shall conform to the ANSI A21.51 and AWWA C 151, latest revisions. Ductile iron pipe shall be Class 350 for 8" through 12". For 14" through 18" Class shall be 250. Pipe shall have a 40 mil polyethylene coating in accordance with ANSI/ASTM D1248.

Fittings shall be standardized for the type of pipe and joint specified and shall comply with ANSI A21.10 and AWWA C110. Fittings shall be either mechanical joint or push-on type. Pipe joints shall use O-ring gaskets in accordance with ANSI 21.11 and AWWA C 111.

3. Polyvinyl Chloride Pipe (PVC)

a. Smooth Wall PVC

All PVC pipe 15 inches or less in diameter shall meet the requirements of ASTM Designation D 3034. All PVC pipe greater than 15 inches in diameter shall meet or exceed the requirement of ASTM F 679. For diameters 15 inches or less, the pipe shall have a minimum cell classification of 12454-B and for diameters greater than 15 inches, the pipe shall have a minimum cell classification of 12454-C with all pipe having a minimum tensile strength of 7000 psi as defined in ASTM D 1784.

All PVC pipe shall be tested in accordance with Standard Method of Test for External Loading Properties of Plastic Pipe by Parallel - Plate Loading, ASTM Designation 2412. Minimum pipe stiffness shall be 46 psi.

b. Ribbed Polyvinyl Chloride Pipe (PVC)

All Ribbed PVC Pipe shall conform to ASTM Designation F 794 for sewer pipes 8 inch through 48 inch in diameter. All 8 inch through 18 inch pipe supplied under this contract shall have a minimum uniform pipe stiffness of 60 psi. All pipe 21 inch and larger shall have a minimum uniform pipe stiffness of 46 psi. The minimum cell classification shall be 12454-B as defined by ASTM D 1784.

c. Polyvinyl/Chloride Corrugated Pipe (PVCC)

All corrugated PVC pipe shall conform to ASTM F 949 for sewer pipes 6 inches through 18 inches. Minimum cell classification shall be 12454-B or 12454-C as defined by ASTM D 1784. PVC pipe shall have a minimum pipe stiffness of 50 psi in accordance with testing under ASTM D 2412.

Joints for plastic pipe shall be elastomeric gasket joints in accordance with ASTM Designation D 3212. Gaskets used in the push-on joints shall conform to ASTM Designation F 477. The pipe manufacturer shall provide "Home Marks" on the uncoupled end of each piece of pipe.

Fittings shall be manufactured of PVC housing a Cell Classification of 12454-B or 12454-C as defined by ASTM d 1784.

Only smooth exterior pipe shall be used at manhole connections.

4. High Density Polyethylene Pipe (HDPE)

All High Density Polyethylene Pipe shall be manufactured from materials meeting the requirements of Type III, Class C, Category 5, Grade P34, as defined in ASTM D 1248, Standard Specifications for Polyethylene Plastics molding and extrusion materials.

Pipe and fittings shall be made from high molecular weight high density polyethylene material meeting the requirements of ASTM D 3350, cell class PE 334433C. All HDPE shall have a minimum pipe stiffness of 46 psi when measured in complete accordance with ASTM D 2412. The Ring Stiffness Constant (RSC) classification value for pipe between bell and spigot shall comply with the minimum value of 36 lbs/ft.

This pipe shall be installed in accordance with the manufacturer's recommendations for this particular application.

The joints shall be manufactured with bell and spigot end construction with a rubber gasket to form a positive seal when assembled in the trench. The rubber gasket material and manufacture shall conform to ASTM F 477.

Only manufactured wyes, tees, adapters of the bell and spigot type shall be used. No saddle connections shall be permitted.

5. Composite Wall/Truss Pipe

All plastic truss pipe furnished shall meet the requirements of ASTM Designation 2680 and ASTM D 1784 for a minimum cell classification of 12454B or 12454C or ASTM D 1788 for all classification of 2-2-3. The fill material shall be Portland Cement, Perlite Concrete or other inert filler material exhibiting the same degree of performance.

All pipe shall be tested in accordance with the Standard Method of Test for External Loading Properties of Plastic Pipe by Parallel-Plate Loading, ASTM Designation 2412. Pipe stiffness shall be a minimum of 200 psi. All joints shall be gasketed and meet requirements of ASTM D 3212 and ASTM F 477.

Only manufactured fittings shall be used.

5.03 Sanitary Sewer Force Mains

A. General

The DPW currently allows the use of the following types of pipe for force mains:

Polyvinyl Chloride Pipe
Ductile Iron Pipe

B. Air/Vacuum Relief Valves

The design of sanitary force mains shall prevent the need for air vacuum relief valves. If high points cannot be eliminated an air relief valve shall be installed at each point. Each valve shall be installed in a manhole structure.

C. Force Main Materials

1. Polyvinyl Chloride (PVC) Force Main

Type 1

PVC plastic pipe shall conform to ASTM Specification D 2241, Standard Specification for Polyvinyl Chloride (PVC) Plastic Pipe (SDR PR). The material used shall conform to ASTM Specification D 1784, Standard Specification for Rigid Polyvinyl Chloride and Chlorinated Polyvinyl Chloride compounds, Class 12454-B (PVC 1120). Pipe O.D. shall conform with that of steel pipe (IPS).

The pipe fittings shall be pressure rated in accordance with recommendations of the Plastic Pipe Institute. Pressure Class and Standard Dimension Ratios (SDR) shall be as follows:

Class 200 - SDR 21
Class 250 - SDR 17

Type 2

This pipe and fittings shall be PVC 1120 pressure pipe made from Class 12454-A or B material and conform with O.D. dimensions of steel pipe (IPS) or cast iron (C.I.). Pressure class and dimension ratio shall be as follows:

Class 200 - DR 14

Type 2 PVC shall comply with AWWA Standard C 900.

All plastic pipe and couplings shall bear identification markings in accordance with Section 2.5.2 and 2.5.3 of AWWA C 900, which shall include the National Sanitation Foundation (NSF) seal of approval. In addition, the plain end of each pipe length shall have two (2) rings, one

(1) inch apart, painted around the pipe at the proper location to allow field checking of the correct setting depth of the pipe in the bell or coupling.

The Push-On Joint for PVC and joint components shall meet the requirements for ASTM Specification D 3139, Joint for Plastic Pressure Pipe Using Flexible Elastomeric Seals. The joint shall be designed so as to provide for the thermal expansion and contraction experienced with a total temperature change of seventy-five degrees fahrenheit (75 F) in each joint of pipe. Details of the joint design and assembly shall be in accordance with joint manufacturers standard practice.

Lubricant shall be non-toxic and shall not support the growth of bacteria and shall have no deteriorating effects on the gasket or the pipe. The lubricant containers shall be labeled with the manufacturer's name.

Gaskets shall meet all applicable requirements of ASA Standard A 21.11.

Gasket dimensions shall be in accordance with the manufacturer's standard design dimensions and tolerances. The gasket shall be made of such size and shape as to provide an adequate compressive force against the spigot and socket after assembly to effect a positive seal under all combinations of joint and gasket tolerances. The trade name or trademark, size, mold number, gasket manufacturer's mark, and year of manufacture shall be molded in the rubber on the back of the gaskets.

Gaskets shall be vulcanized natural or vulcanized synthetic rubber. No reclaimed rubber shall be used. When two (2) hardnesses of rubber are included in a gasket, the soft and hard portions shall be integrally molded and joined in a strong vulcanized bond. They shall be free of porous areas, foreign material, and visible defects.

2. Ductile Iron

All provisions of Section 5.02(B)(2) for Ductile Iron pipe for gravity sanitary sewers shall be the minimum criteria for material and specifications of Ductile Iron Force Main.

However, for force main the polyethylene coating is not required.

5.04 Building Services/Service Laterals

Building services shall be SDR 35 PVC pipe conforming to ASTM D 3034. Joints shall be gasket push-on, compression type conforming to ASTM D 3212. Gaskets shall conform to ASTM F 477.

5.05 Sanitary Sewer Manholes

A. General

Location of manholes shall be as required in Section 4.02(D)(1).

B. Types of Manholes

Manholes shall be either monolithic (cast-in-place) or precast. If monolithic manholes are to be used, the Contractor shall submit drawings showing all reinforcement, dimensions, and connections for DPW approval. All drawings shall be certified by a registered Professional Engineer.

C. PreCast Manholes

Manholes shall be constructed in accordance with the ASTM Specifications for "Precast Reinforced Concrete Manhole Risers and Tops", Designation C 478. The minimum wall thickness shall be five (5) inches for manholes four (4) feet in diameter. When the depth of the manhole exceeds twelve (12) feet, then the depth in excess of twelve (12) feet shall be reinforced with two cages of reinforcement the same as required for reinforced concrete sewer pipe of same diameter as the riser of the manhole per ASTM Specification Designation C 76 for Class III Pipe. The precast tops shall be of the eccentric cone type. Precast flat covers shall be not less than eight (8) inches thick and reinforced with two layers of steel with a minimum area of 0.39 square inches per linear foot in both directions in each layer. Precast flat bottoms of manholes shall also be reinforced the same as specified herein for precast flat top. Hoisting lugs or hooks shall be cast in place for handling and setting of the rings. Openings of proper sizes and suitable design shall be cast in place for receiving the sewer and/or drop pipes and connections. Adjusting riser rings shall be provided as approved by the DPW.

All manhole joints shall be tongue and groove and they shall be sealed with an O-ring and joint sealer conforming to Federal Specifications SS-S-00210 and similar to "Kent-Seal No. 2" as manufactured by the Hamilton Kent Manufacturing Co., of Kent, Ohio; "RAM-NEK" as manufactured by the K.T. Snyder Co. of Houston, Texas, or equal. Cracked or damaged barrel joints shall be rejected.

D. Manhole Steps

The steps provided shall be manufactured of reinforced plastic and shall be twelve (12) inches wide and one (1) inch square.

E. Manhole Bases

Manhole bases shall be of cast-in-place monolithic concrete or precast concrete. Where sewer lines pass through or enter manholes, the invert channels shall be smooth and semi-circular in cross section and may be formed directly in the concrete of the manhole base, may be half tile laid in the concrete, or may be constructed by laying the sewer lines continuously through the manhole and break-hardened and neatly trimming the edges. Changes of direction of flow within the manholes shall be made with a smooth curve with as long as a radius as possible. The floor of the manhole outside the channels shall be smooth and slope toward the channel not less than one (1) inch per foot.

No mortar or concrete shall be placed in water, and no water shall be allowed to flow over or against the concrete before it has set for a period of time deemed

sufficient by the DPW to prevent damage to the structure. The invert channel through manholes should be made to conform in shape and slope to that of the sewer. All invert channels are to have a properly mortared apron on either side, sloped to prevent solids deposition.

F. Adjusting Rings

Where one (1) solid riser or barrel section cannot be used, final adjustments in elevation of the frame and cover shall only be accomplished by the use of precast concrete adjusting rings conforming to ASTM C 478.

Rings shall be of a nominal thickness of not less than four (4) inches and not more than twelve (12) inches total of adjusting rings shall be allowed for adjustment of the manhole frame and cover to required elevation.

G. Sewer Pipe to Manhole Connections

To connect a sanitary sewer to a manhole, either a flexible boot KOR-N-SEAL 1 or 2, flexible connector, cast-in-place Dura-Seal gasket, "A"-lock gasket or an approved equal shall be used. Connections to an existing manhole shall be a flexible boot KOR-N-SEAL or approved equal.

If the flexible boot connection is used, it shall be placed in the reinforced concrete manhole base and secured to the pipe by a stainless steel clamp. Flexible connectors shall conform to ASTM C 923.

The cast-in-place inflatable gasket shall conform to ASTM C 923.

All connections shall provide for a watertight seal between the pipe and manhole. The connector shall be the sole element relied upon to assure a flexible watertight seal of the pipe to the manhole.

The rubber for the connector shall comply with ASTM C 923 and shall be resistant to ozone, weather elements, chemicals, including acids and alkalis, animal and vegetable fats, oils and petroleum products.

The stainless steel elements of the connector shall be totally non-magnetic Series 305 stainless steel. The stainless steel clamp shall be capable of sustaining applied torque in excess of eighty (80) inch-pounds. It shall be the responsibility of the Contractor to submit details of the proposed connection to the DPW for approval. Connections not approved by the DPW shall be subject to removal and replacement with an approved adapter.

H. Castings

Standard manholes shall have a R-1772 CVH frame and lid by Neenah Foundry, 1875-3 by East Jordan Iron Works, or approved equal. Material shall be in compliance with ASTM A 48, CL 35B. Each lid shall have 2 inch high letters indicating "City of Franklin Sanitary Sewer".

Where watertight castings are required, the manholes shall have a R-1916F frame and lid by Neenah Foundry, 1045 HD by East Jordan Iron Works, or approved equal. The frame shall be anchored to through the riser rings (if provided) to the cone section with four (4) galvanized rods.

I. Frame Chimney Seal

An internal or external rubber seal shall be installed on all sanitary manholes. A rubber seal extension, to cover any additional heights of chimney not covered by the seal itself, shall be used when required. The internal and external rubber seal and seal extensions shall be as manufactured by Cretex Specialty Products, or equal.

The sleeves shall be extruded from a high grade rubber compound conforming to the applicable requirements of ASTM C 923. The bands used for compressing the sleeve and extension against the manhole shall be fabricated from 16 gauge

stainless steel conforming to ASTM A 240 type 304, any screws, bolts or nuts used on this band shall be stainless steel conforming to ASTM F 593 and 594, type 304.

The joint between the manhole frame and chimney or cone shall be 3/4" thick and made using cement mortar. Any sealant used between the adjustment or grade rings of the chimney shall not be used in this joint. Installation of these rubber seals shall be in accordance with the manufacturer's recommendation.

5.06 Storm Sewers

A. General

The DPW currently allows the use of the following pipe materials:

Reinforced Concrete Pipe
Reinforced Concrete Horizontal Elliptical Pipe
Precast Reinforced Concrete Box Sections
Fully Bituminous Coated Fully Paved Corrugated Steel Pipe:
14 gauge aluminum coated Type II or precoated galvanized, 12"-36"
12 gauge aluminum coated Type II or precoated galvanized, 42" and larger
Fully Bituminous Coated, Half Paved Steel Helical Ribbed Pipe (Type IR):
14 gauge aluminum coated Type II, 12"-36"
12 gauge aluminum coated Type II, 42" and larger
16 Gauge Aluminum Alloy Helical Ribbed Pipe (Type IR)
High Density Polyethylene Pipe (HDPE), 12"-18"
Polyvinyl Chloride Pipe (PVC), 12"-18"

B. Materials

All pipe shall be in conformance to these specifications and all applicable sections of the latest edition of the Indiana Department of Transportation Standard Specifications, American Association of State Highway and Transportation Officials (AASHTO), and American Society for Testing and Materials (ASTM). RCP shall be used at all road crossings. HDPE and PVC pipe shall only be used in non-loading areas only with prior approval of the DPW.

C. Material Standard References

The following standard shall be used for materials used in the City:

Corrugated Steel Culvert Pipe and Pipe Anchors	IDOT
Bituminous Coated Corrugated Steel or Aluminum Pipe, Pipe-Arch, or Underdrain	908.07

Fiber Bonded Fully Bituminous Coated Corrugated Steel Culvert	908.08
Corrugated Aluminum Alloy Culvert Pipe and Pipe-Arches	908.04
Reinforced Concrete Pipe	907.02
	ASTM C 76 ASTM C 50
Acrylonitrile-Butadiene-Styrene (ABS) Composite Sewer Piping	907.15
Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings	907.16
Type PSM SDR-35 PVC Sewer Pipe	907.19
Rubber Gaskets	906.04
Precast Reinforced Concrete Box Sections	907.05
High Density Polyethylene Pipe (HDPE)	AASHTO M294
	ASTM F 714 & ASTM F 894
Polyvinyl Chloride Pipe (PVC)	AASHTO M 304
	ASTM F679

5.07 Storm Manholes

Storm manholes shall be in accordance with Section 5.05 (C), (D), (E) and (F). Castings shall be R-1972CVIT by Neenah Foundry, 1875-3 by East Jordan Iron Works, or approved equal. Where more than five castings are required, each shall have 2 inch high letters indicating "City of Franklin Storm Sewer".

5.06 Storm Inlets and Catch Basins

A. General

All standard inlets shall be constructed of reinforced precast concrete sections. Joints between sewer pipe and inlet walls shall be sealed with non-shrink grout.

B. Materials

1. Inlets/Basins

Precast concrete inlets shall be constructed in accordance with ASTM Standard C 478. Adjustment to final grade of inlet casting shall be accomplished by utilizing precast concrete adjusting rings. Adjusting rings when required should be sized to adjust to final grade by using a maximum of three (3) adjusting rings. Adjusting rings shall be limited to less than one (1) foot of inlet depth.

All inlet joints, along with the adjusting rings and top casting are to be sealed with 1/2 inch extrudable gasket (Kent Seal, or equal) to produce soil-tight joint.

Precast box inlets shall be constructed in accordance with Indiana Department of Transportation (IDOT) Standard Specifications.

2. Castings

Inlet castings shall be Neenah Type R-3501-TR, or equal for rolled curbs.

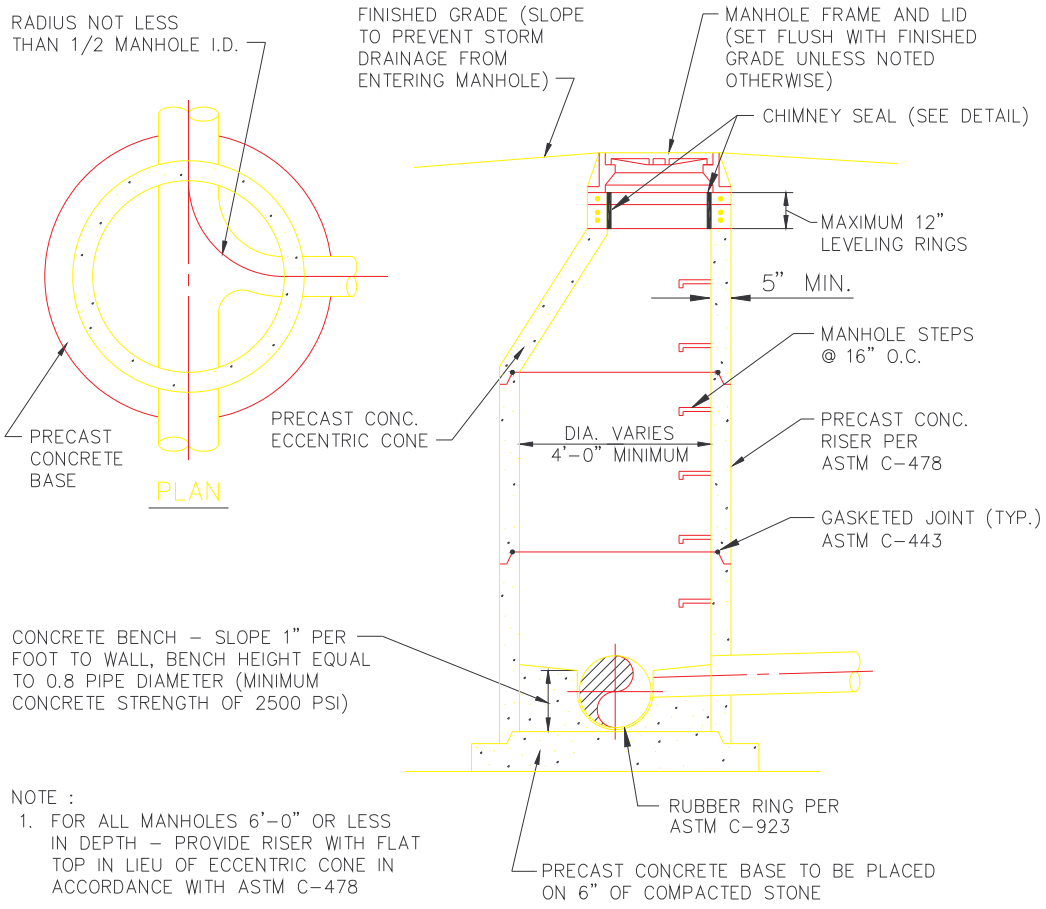
Inlet castings for vertical curb shall be Neenah Type R-3085-DL, or equal.

Inlet castings for round catch basins shall be Neenah Type R-2502-B-D, or equal.

5.09 Pipe End Sections

A. General

Pipe end treatment shall be either precast concrete with end footings, or prefabricated galvanized steel.



NOTE :

1. FOR ALL MANHOLES 6'-0" OR LESS IN DEPTH - PROVIDE RISER WITH FLAT TOP IN LIEU OF ECCENTRIC CONE IN ACCORDANCE WITH ASTM C-478
2. THE CROWN OF THE INFLUENT PIPE SHALL BE AT OR ABOVE THE CROWN OF THE OUTLET PIPE
3. DROP MANHOLES SHALL BE USED WHENEVER THE DISTANCE FROM THE INVERT OF THE INCOMMING LINE AND BOTTOM OF MANHOLE IS GREATER THAN TWO FEET.

STANDARD MANHOLE DETAIL

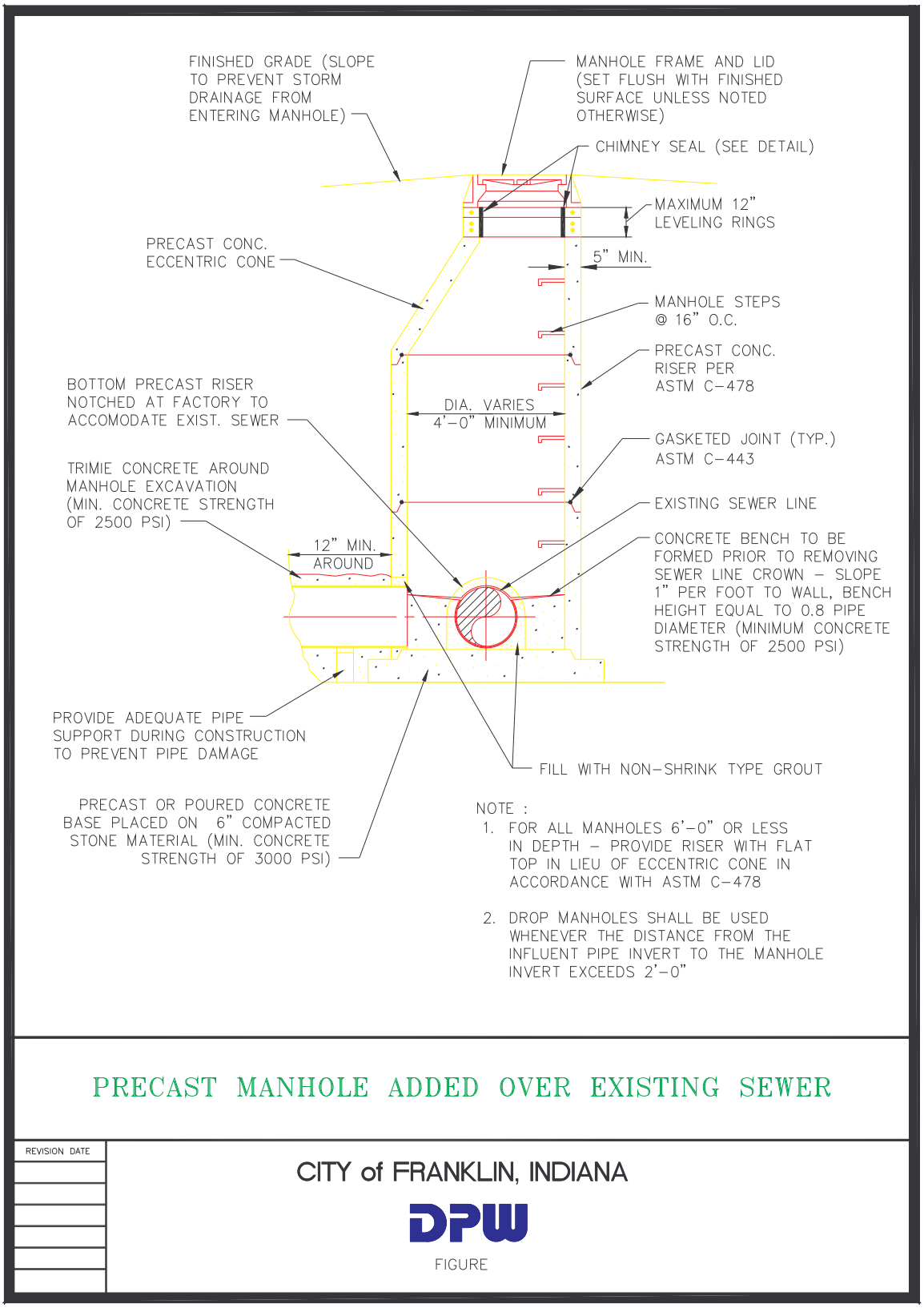
REVISION DATE

CITY of FRANKLIN, INDIANA

DPW

FIGURE

Illustration 5-1



PRECAST MANHOLE ADDED OVER EXISTING SEWER

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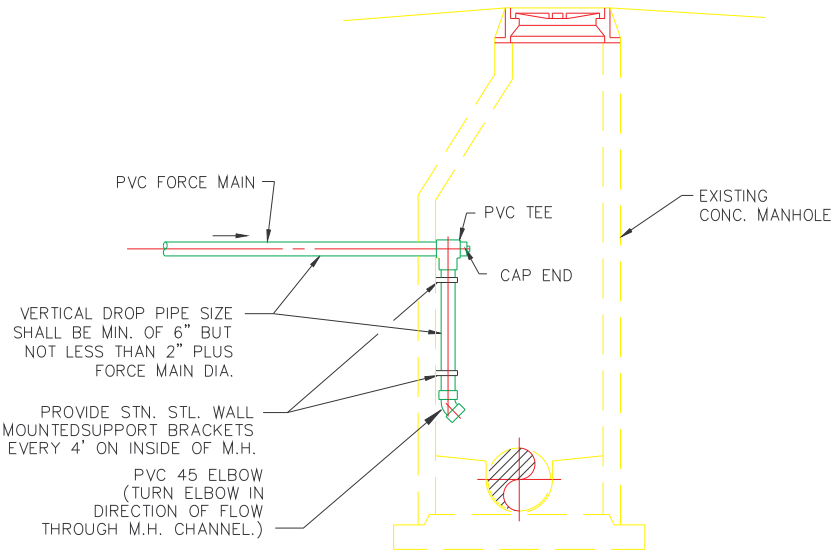
FIGURE

Illustration 5-2



FORCE MAIN DROP INTO EXISTING MANHOLE

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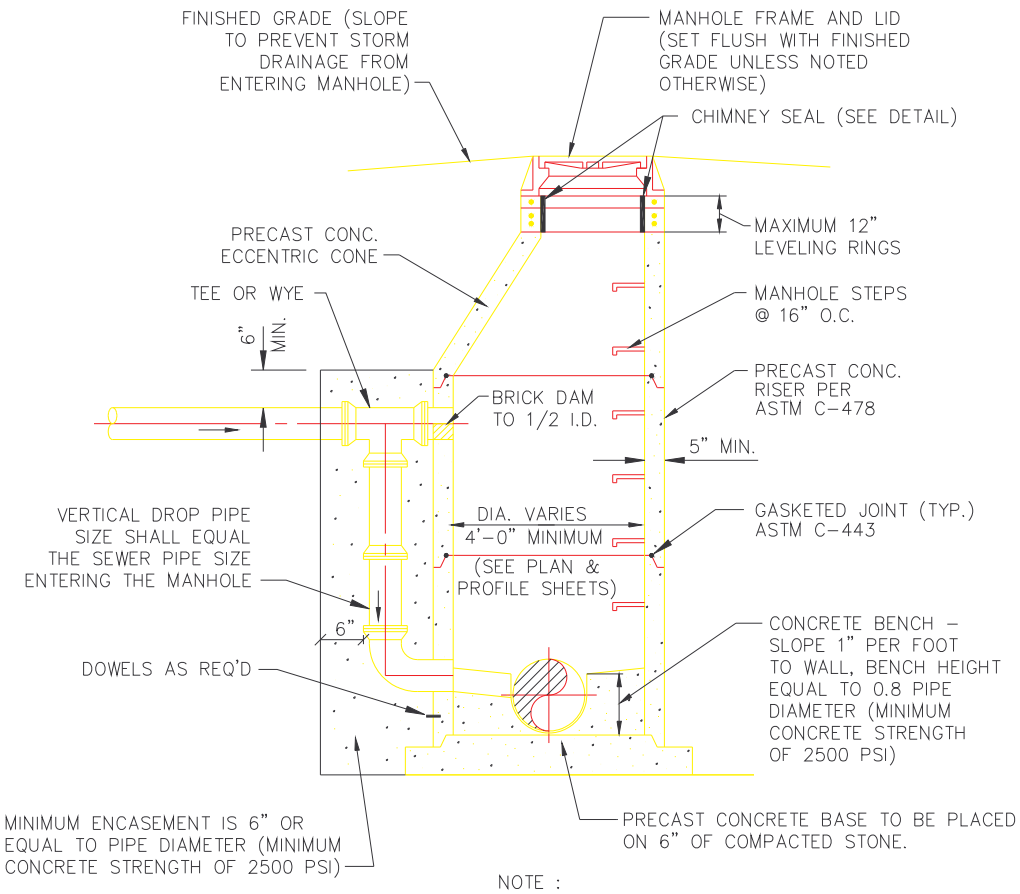
FIGURE

Illustration 5-3



NOTE :

1. FOR ALL MANHOLES 6'-0" OR LESS IN DEPTH - PROVIDE RISER WITH FLAT TOP IN LIEU OF ECCENTRIC CONE IN ACCORDANCE WITH ASTM C-478
2. THE CROWN OF THE INFLUENT PIPE SHALL BE AT OR ABOVE THE CROWN OF THE OUTLET PIPE
3. DROP MANHOLES SHALL BE USED WHENEVER THE DISTANCE FROM THE INVERT OF THE INCOMMING LINE AND BOTTOM OF MANHOLE IS GREATER THAN TWO FEET.

PRECAST DROP MANHOLE DETAIL

REVISION DATE

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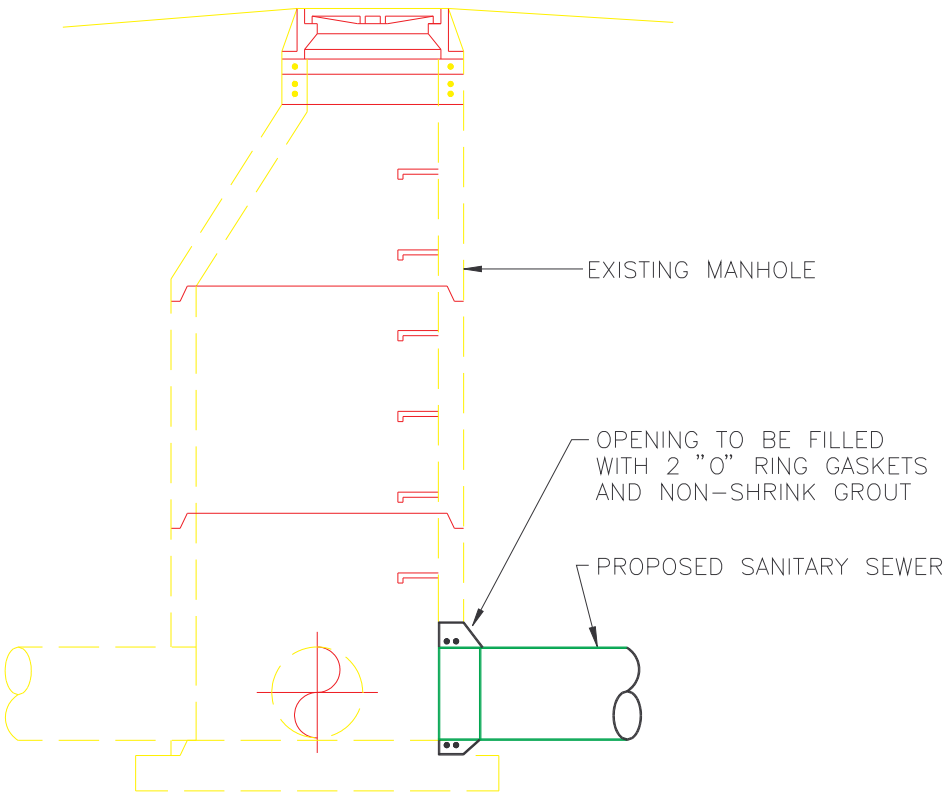
FIGURE

Illustration 5-4



TYPICAL EXISTING MANHOLE ENTRY DETAIL

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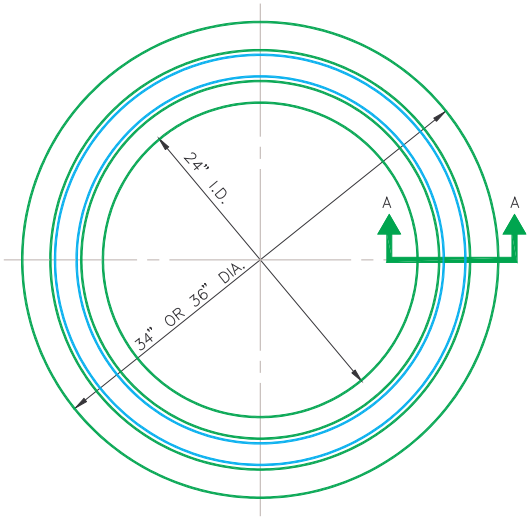
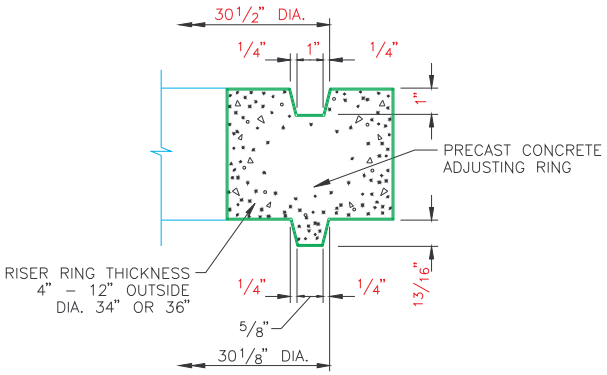
FIGURE

Illustration 5-5



PLAN VIEW



SECTION "A–A"

TYPICAL 5/8" ADJUSTING RING

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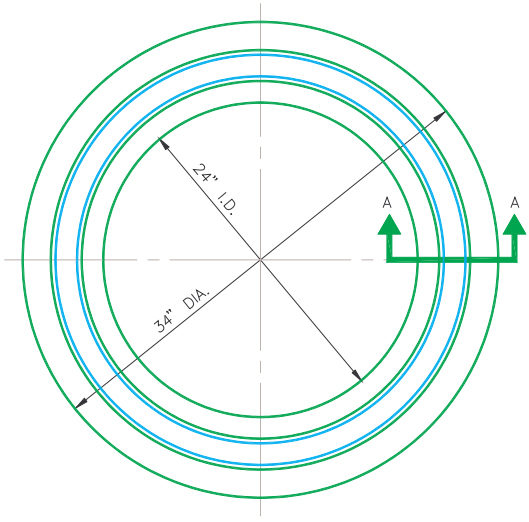
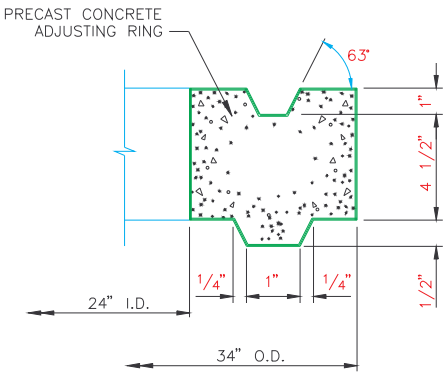
FIGURE

Illustration 5-6



PLAN VIEW



SECTION "A–A"

TYPICAL 1" ADJUSTING RING

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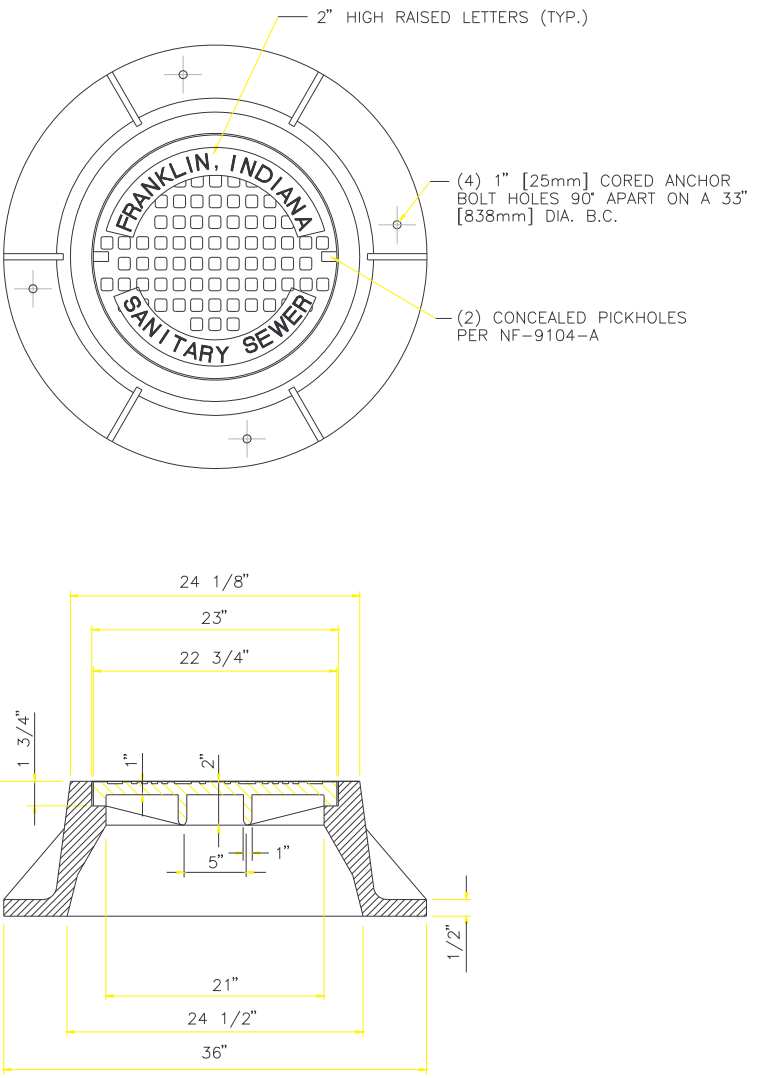
FIGURE

Illustration 5-7



LID: EAST JORDAN
1875 AVH
FRAME: EAST JORDAN
1875-22

NOTE: METAL: CAST GRAY IRON ASTM A-48 CL.358
FINISH: NOT PAINTED

STANDARD FRAME AND LID

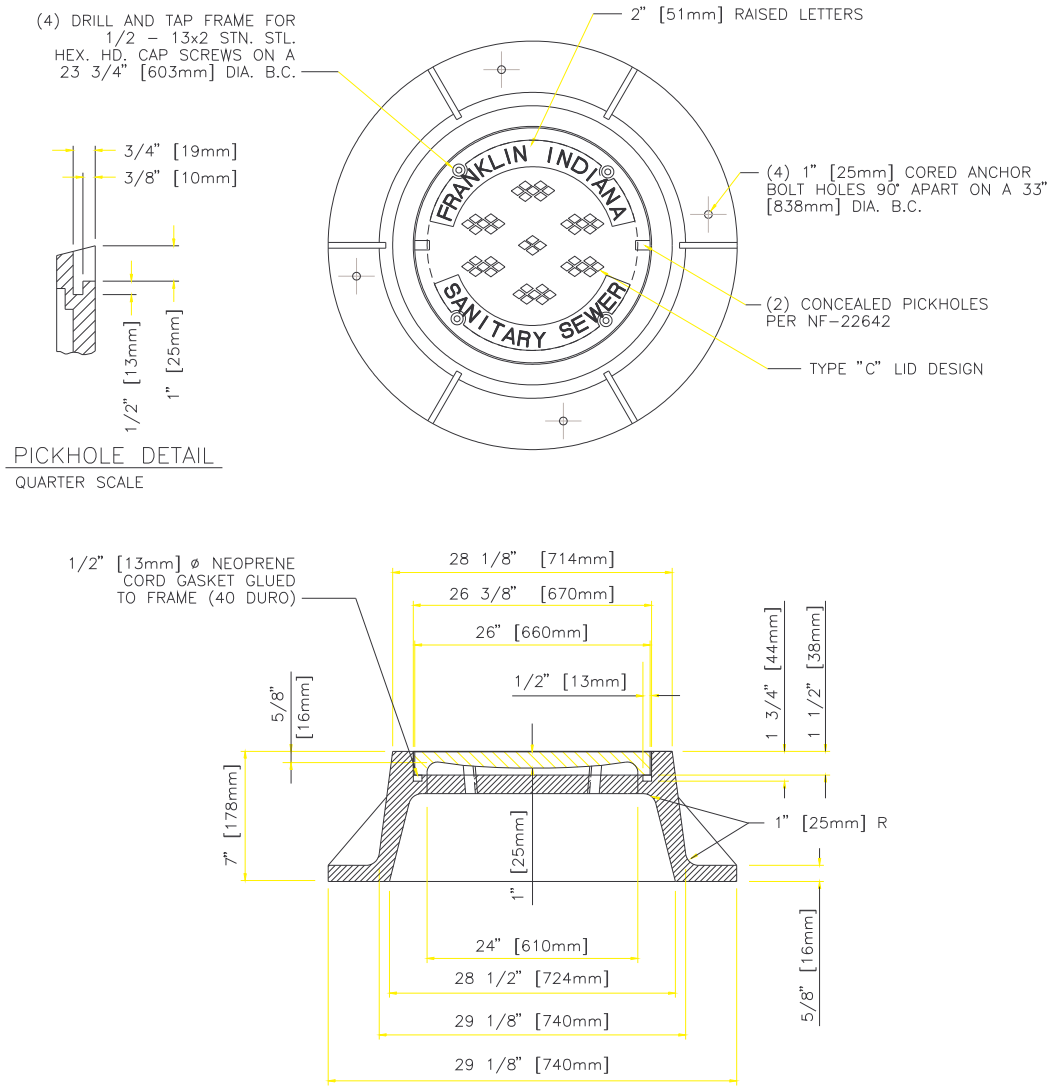
REVISION	DATE

CITY of FRANKLIN, INDIANA

DPW

FIGURE

Illustration 5-8



TYPICAL WATERTIGHT FRAME AND LID

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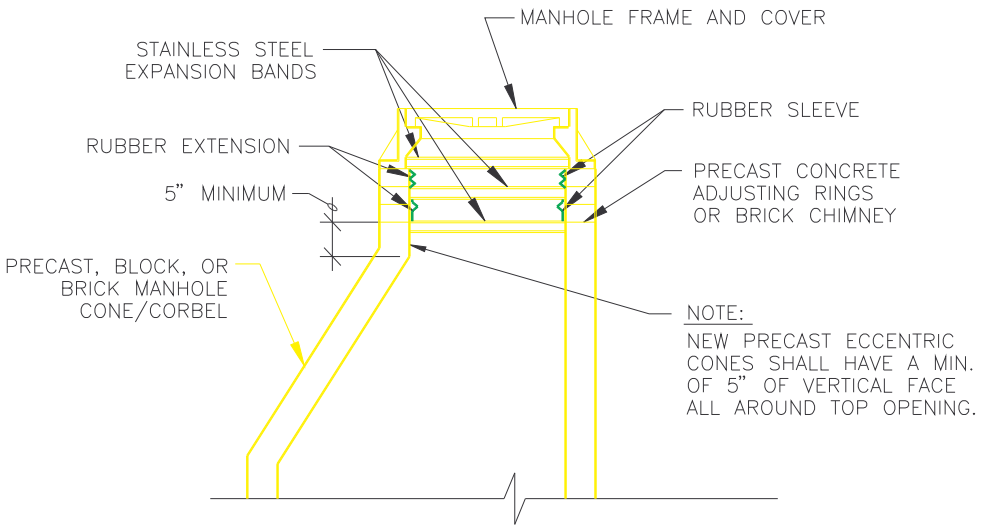
DPW

FIGURE

Illustration 5-9



TO SPAN CHIMNEY HEIGHTS OF:

0–4 1/2"	STD. CHIMNEY SEAL ONLY
2–7 1/2"	WIDE CHIMNEY SEAL ONLY
OVER 4 1/2"–10 1/2"	STD. SEAL + 7" EXTENSION
OVER 7 1/2"–13 1/2"	WIDE SEAL + 7" EXTENSION

NOTE: EXTERIOR SEAL IS ALSO ACCEPTABLE

TYPICAL CHIMNEY SEAL DETAIL

REVISION DATE

CITY of FRANKLIN, INDIANA

DPW

FIGURE

Illustration 5-10

SECTION 6

SANITARY LIFT STATIONS

6.01 General

This section pertains to the requirement for sanitary lift stations constructed as part of a private development. The DPW shall review and approve the use of any lift station. The Owner must show that it is not physically possible or economically feasible to provide gravity service into a public sewer.

All stations shall be designed for and operate on three (3) phase power. All stations shall be submersible type, including a minimum of two (2) pumps with a minimum capacity of 100 GPM and a minimum four inch force main. Voltage shall be 208 or 240, three phase.

6.02 General Requirements

A. All of the mechanical and electrical equipment shall be an integral package supplied by the pump manufacturer with local representation so as to provide undivided responsibility. The package shall be furnished by Flygt Pump, or approved equal.

B. The Contractor shall submit to the DPW for review and approval two (2) sets of shop drawings, detailed specifications, pump warranty and performance characteristics for all of the equipment and fixtures to be furnished and installed. The shop drawings and equipment data shall be submitted with a cover letter or Contractor's stamp of approval, indicating that he has reviewed, checked and approved the data submitted. The DPW and City Engineer will review the submittal and render a decision in writing as to the acceptability of the equipment.

C. Any exceptions to this Standard or associated approved Plans shall be submitted in writing and clearly stated. The exceptions must be approved by the City Engineer and the DPW prior to proceeding with the work.

D. All components of the lift station that are exposed to weather shall be constructed of material that is resistant to corrosion and will not require surface protection throughout the expected life of the lift station. In general, these materials are stainless steel, aluminum, fiberglass reinforced polyester (FRP) and ultraviolet stabilized PVC.

E. All valves and piping coming in contact with sewage or installed in the pump or valve chambers shall be coated as follows:

1. Primer - Aromatic Urethane Zinc-Rich 2.5 - 3.5 mil
2. Field Coats - Aliphatic Acrylic Polyurethane 2 coats @ 2.0 - 4.0 mil per coat

6.03 Operating Conditions

Prior to installation the Contractor shall submit the following information for each pump to the DPW for review and approval:

A. Pump Capacity in Gallons Per Minute;

B. Total Dynamic Head (TDH) and Operating RPM;

C. Motor Horsepower;

D. Motor RPM;

E. Motor Voltage, Phase and Cycle;

F. Make and Model Number; and

G. Pump Curves for the Pumps to be Provided.

6.04. Pump Design

A. Pump Construction

Major pump components shall be of gray cast iron, ASTM A 48, Class 30, with smooth surfaces devoid of blow holes or other irregularities. All exposed nuts or bolts shall be AISI Type 304 stainless steel or brass construction. All metal surfaces coming into contact with the pumpage, other than stainless steel or brass, shall be protected by a factory applied spray coating of alkyd primer with a chlorinated rubber paint finish on the exterior of the pump.

Sealing design shall incorporate metal-to-metal contact between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or Viton rubber O-rings. Fittings will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit.

Rectangular cross sectioned gaskets requiring specific torque limits to achieve compression shall not be considered as adequate or equal. No secondary sealing compounds, elliptical O-rings, grease or other devices shall be used.

B. Cooling System

Motors shall be sufficiently cooled by the surrounding environment or pumped media. A water cooling jacket is not required.

C. Cable Entry Seal

The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist of a single cylindrical elastomer grommet, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the body containing a strain relief function, separate from the

function of sealing the cable. The assembly shall provide ease of changing the cable when necessary using the same entry seal.

D. Motor

The pump motor shall be induction type with a squirrel cage rotor, shell type design, housed in an air or oil filled, watertight chamber, NEMA B type. The stator windings and stator leads shall be insulated with moisture resistant Class F insulation rated for 311 F (155 C). The stator shall be dipped and baked three times in Class F varnish and shall be heat-shrink fitted into the stator housing. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is not acceptable. The motor shall be designed for continuous duty handling pumped media of 104 F (40 C) and capable of up to 15 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of cast aluminum. Thermal switches set to open at 260 F (125 C) shall be embedded in the stator lead coils to monitor the temperature of each phase winding. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the control panel. The motor and pump shall be designed and assembled by the same manufacturer.

The combined service factor (combined effect of voltage, frequency and specific gravity) shall be a minimum of 1.15. The motor shall be designed for operation up to 104 F (40 C) ambient and with a temperature rise not to exceed 176 F (80 C).

The power cable shall be sized according to the NEC and ICEA standards and shall be of sufficient length to reach the junction box without the need of any splices. The outer jacket of the cable shall be chloroprene rubber. The motor and cable shall be capable of continuous submergence under water without loss of watertight integrity to a depth of 65 feet.

The motor horsepower shall be adequate so that the pump is non-overloading throughout the entire pump performance curve from shut-off through run-out.

E. Bearings

The pump shaft shall rotate on two bearings. Motor bearings shall be permanently grease lubricated. The upper bearing shall be a single deep groove ball bearing. The lower bearing shall be a two row angular contact bearing to compensate for axial thrust and radial forces. Single row lower bearings are not acceptable.

F. Mechanical Seal

Each pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The seals shall operate in an oil reservoir that hydrodynamically lubricates the lapped seal faces at a constant rate. The lower, primary seal unit, located between the pump and the oil chamber, shall contain one stationary and one positively driven rotating tungsten-carbide ring. The upper, secondary seal unit, located between the oil

chamber and the motor housing, shall contain one stationary tungsten-carbide ring and one positively driven rotating carbon seal ring. Each seal interface shall be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment nor depend on direction of rotation for sealing. The position of both mechanical seals shall depend on the shaft. Mounting of the lower mechanical seal on the impeller hub will not be acceptable.

The following seal types shall not be considered acceptable nor equal to the dual independent seal specified: shaft seals without positively driven rotating members, or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces. Cartridge type systems will not be acceptable. No system requiring a pressure differential to offset pressure and to effect sealing shall be used.

Each pump shall be provided with an oil chamber for the shaft sealing system. The oil chamber shall be designed to prevent overfilling and to provide oil expansion capacity. The drain and inspection plug, with positive anti-leak seal shall be easily accessible from the outside. The seal system shall not rely upon the pumped media for lubrication. The motor shall be able to operate dry without damage while pumping under load.

G. Pump Shaft

Pump and motor shaft shall be the same unit. The pump shaft is an extension of the motor shaft. Couplings shall not be acceptable. The pump shaft shall be AISI Type 420 stainless steel.

H. Impeller

The impeller(s) shall be of gray cast iron, Class 30, dynamically balanced, double shrouded non-clogging design having a long throughlet without acute turns. The impeller(s) shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in wastewater. Whenever possible, a full vaned, not vortex, impeller shall be used for maximum hydraulic efficiency; thus, reducing operating costs. Mass moment of inertia calculations shall be provided by the pump manufacturer upon request. Impeller(s) shall be retained with an Allen Head bolt and shall be capable of passing a minimum 3-inch diameter solid. All impellers shall be coated with alkyd resin primer.

I. Wear Rings

A wear ring system shall be used to provide efficient sealing between the volute and suction inlet of the impellers. The wear ring shall be stationary and made of brass, which is drive fitted to the volute inlet.

J. Volute

Pump volute(s) shall be single-piece grey cast iron, Class 30, non-concentric design with smooth passages large enough to pass any solids that may enter the impeller. Minimum inlet and discharge size shall be as specified.

K. Rail/Removal System

The pump mounting base shall include adjustable guide rail supports and a discharge connection with a one hundred twenty-five (125) pound standard flange. The base and the discharge piping shall be permanently mounted in place. The base plates shall be anchored in place utilizing epoxy type anchors with stainless steel studs and nuts as manufactured by HILTI Fasteners, Inc. or equal.

A rail system shall be provided for easy removal of the pump and motor assembly for inspection and service. The system shall not require a man to enter the wet well to remove the pump and motor assembly. Two (2) rails of two (2) inch galvanized or stainless steel pipe shall be provided for each pump. The guide rails shall be positioned and supported by the pump mounting base. The guide rails shall be aligned vertically and supported at the top by attachment to the access hatch frame. One (1) intermediate guide rail support is required for each fifteen (15) feet of guide rail length for pipe.

The pumps shall be equipped with sliding brackets or rail guides. To insure easy removal of the pumps, the rail guides attached to each pump shall not encircle the rails. A stainless steel lifting chain or manufacturer's pump removal system (similar to the Flygt Lift) of adequate length for the basin depth shall be provided for each pump. Each pump shall be equipped with a permanent, stationary lifting handle with a minimum clearance of 12" between the top of pump and bottom of handle.

The rails and the rail guides shall function to allow the complete weight of the pumping unit to be lifted on dead center without binding and stressing the pump housing. The rail system shall function to automatically align the pumping unit to the discharge connection by a simple downward movement of the pump. No twisting or angle approach will be considered acceptable. The actual sealing of the discharge interface may be of the hydraulically sealing diaphragm type assembly with removable Buna-N diaphragm as supplied by Hydromatic Pump or may be of the metal-to-metal contact as provided by Flygt Pump.

L. Pump Warranty

Pump warranty shall be provided by the pump manufacturer and shall warrant the units being supplied to the Owner against defects in workmanship and materials for a period of five (5) years under normal use, operation, and service. The warranty shall be in printed form and apply to all similar units. A copy of the warranty statement shall be submitted with the approval drawings.

6.05 Protection

All stators shall incorporate thermal switches in series to monitor the temperature of each phase winding. At 260 F (125 C) the thermal switches shall open, stop the motor and activate an alarm.

A leakage sensor shall be provided to protect water in the stator chamber. The Float Leakage Sensor (FLS) shall be a small float switch to detect the presence of water in the stator chamber. When activated, the FLS shall stop the motor and send an alarm. **USE OF VOLTAGE SENSITIVE SOLID STATE SENSORS AND TRIP TEMPERATURE ABOVE 260 F (125 C) SHALL NOT BE ALLOWED.**

6.06 Wet Well and Valve Pit

A. General

The walls of the pump station and valve pit structures shall be constructed of reinforced concrete pipe which shall conform to the latest ASTM Specifications C-76, with a minimum compressive strength of concrete equal to 4000 psi. Reinforcement of the pipes shall be of the circular type. All of the pipe for the pump chambers and the access tubes shall be Class III and of the diameter shown on the Plans. Handling or lifting lugs and/or devices shall be provided in the pipe shells for ease of unloading and setting in place. All joints between pipes and between ends of pipes and concrete slabs shall be made watertight.

The pipes utilized for the pump station wet well or valve pit shall be jointed with a rubber O-ring type seal conforming to the ASTM Standard C-443 (latest revision). The joint shall be designed to provide a maximum infiltration/exfiltration limit of .158 gallons (200 gpd/in-mile). The interior and exterior joint spaces shall be grouted to a smooth surface using a sand-cement mixture mortar. The mortar-grout shall have one part cement to two parts sand mix ratio. The completed interior and exterior joints shall have a smooth troweled waterproof finish.

The top concrete slab of the pump station and valve pit shall have cast into it a socket for receiving the end of each concrete pipe. The joint shall be made watertight. An access ladder shall be provided with rungs spaced 12 inches on center from top to bottom of the station and shall be of welded steel construction, and hot-dipped galvanized after fabrication or aluminum.

Concrete for the foundation and roof slabs shall be made of Class A concrete.

B. Access Hatches

The Contractor shall furnish and install for both the wet well and valve pit aluminum access doors complete with frames, hinged and hasp-equipped covers, upper guide holders, drain hole and cable holder. The frames shall be securely mounted above the pumps. The doors shall be torsion bar loaded for ease of lifting and shall have safety locking handles in the open position. The access doors shall be capable of withstanding a 300 lb. live load per square foot. The lift station wet wells are to be provided with two (2) separate access hatches or a two (2) door hatch. The valve pit access hatches are to be single door type.

C. Pipe, Valves and Fittings

The suction and discharge pipe and fittings shall be ductile and cast iron Class 150. Inside pipe and fittings shall be flanged. Bell end pipes or fittings with mechanical joints shall be provided at or near the outside face of the station well. Piping shall be supported independent of the sewage flanges. All inside plug valves shall be provided with handwheels. All check valves shall be rubber flapper type.

All metal piping other than cast or ductile iron and copper tubing shall be galvanized steel pipe.

6.07 Disconnect Switch

A. A single main fusible or breaker disconnect switch of adequate size to provide power for the "control center" and its related components shall be provided by the Contractor.

B. The disconnect switch shall be housed in a NEMA 4X stainless steel enclosure with an external operation handle capable of being locked in the ON position.

6.08 Control Center

A. The control center shall be built in a NEMA 4X stainless steel enclosure and shall be suitable for the specified horsepower and voltage for the pumping equipment. The outer door of the panel shall be hinged dead front with provisions for locking with a padlock. Inside shall be a separate hinged panel to protect all electrical components. H-O-A switches, run lights, circuit breakers, etc. shall be mounted such that only the faces protrude through the inside swing panel and no wiring is connected to the back side of the inside swing panel.

B. A circuit breaker and magnetic starter with three (3) leg overload protection and manual reset shall be provided for each pump. Starters shall have auxiliary contacts to operate both pumps on override condition. A separate circuit breaker shall be supplied for power to the control circuit. The control center shall include an extra circuit breaker of adequate size to provide 115 volt, single (1) phase power for a future remote monitor panel. The control center shall include a control voltage transformer to reduce supply voltage to 115 volt, single (1) phase to be used for all control functions except the level circuit and associated relays which shall be provided with 24 volt control voltage. An alternating relay shall be provided to alternate pumps on each successive cycle of operation. A green run light and H-O-A switch shall e provided for each pump. A terminal strip shall be provided to make field connections of pump power leads, float switches, seal sensor leads, heat sensor leads, and remote monitor panel interconnections.

C. A time delay relay shall be provided to delay start of second pump should power outage occur.

D. The control system shall incorporate the level monitoring system.

E. The control center shall incorporate connections for heat sensors which are installed in the pumps. The connection shall disconnect the starter upon high temperature signal and will automatically reconnect when condition has been corrected.

F. The control center shall incorporate connections for seal failure sensors which are installed in the pumps. The panel will have a seal failure alarm light for each pump. This alarm indicates failure of the lower mechanical seal in the pump. This will be an alarm light only and will not shut down the pump.

G. The control center shall include an hour meter for each pump to register the elapsed operating time of each pump.

H. The control center shall have a high and low water alarm built into the main enclosure. The alarms shall consist of a flashing alarm light with red Lexan plastic cover or red glass globe with metal guard mounted on top of the enclosure such that it is visible from all directions. An alarm horn shall be mounted on the side of the enclosure. A push to test horn and light button as well as a push to silence horn button shall be provided and mounted on the side of the enclosure.

I. The control center shall include a condensate heater to protect against condensation inside the enclosure. The heater shall be placed so as not to damage any other component or wiring in the control center.

J. The control center shall include lightning protection and a phase monitor relay to shut down the control circuit and protect the equipment due to loss of phase or phase reversal. The three phase sequence voltage relay shall be of the 8-pin connector type.

K. The control center shall incorporate an alternator selector switch to allow selection of automatic alternation or manual selection of the lead pump.

L. The control center shall include a GFI convenience outlet with 20 amp breaker and suitable transformer or power supply to provide 110 volt single (1) phase power to the convenience outlet.

M. The control center shall have an exterior, lockable 120V, 20 amp, waterproof, receptacle for use with a City furnished portable mixer. Receptacle cover shall have a slot or opening to "lock" plug into receptacle.

N. The control center shall be suitable for connection to a remote monitor package. The main control must include the following interconnections:

1. Circuit breaker to power remote monitor panel.

2. Relay contacts to signal high and low water alarms.

3. Relay contact to signal tripping of the overload of any of the pumps.

4. Relay contact to transmit signal of seal failure or heat sensor trip of any of the pumps.

O. A minimum four (4) inch PVC Schedule 40 wall conduit shall be provided from the wet well basin to the control center which will allow the pump power cables, sensor cables and level monitoring cables to be pulled through without difficulty and allow the use of one (1) piece cables from the pumps and level system to the control center. The conduit shall be sealed at the control center to avoid entrance of sewer gases into the control panel.

P. The control center and associated components shall be mounted on a non-maintenance type pedestal or mounting stand constructed of aluminum or pressure treated wood. The control center shall be located so as to provide safe access to the panel while wet well hatch doors are opened, and shall be positioned so as not to be between the access drive and the wet well.

Q. All components of the control center shall be available from local sources. In particular, items such as circuit breakers, overload protection, relays, etc. shall be available and in stock by local sources.

R. In order to maintain unit responsibility and warranty on the pumping equipment and control center, the control center must be furnished by the pump manufacturer as suitable for operation with the pumping equipment.

S. The DPW may require in specific cases, that a Series 500 Stow-Away panel be furnished and installed.

6.09 Level Monitoring System

A. Components

The wet well level shall be monitored by either:

1. Flexible bulb electrode type level controller by Warrick, or equal.

2. Electrode probe and controller by Multi Trode Model MTIPC 2.2, or equal.

A back-up high level mercury type float switch shall be provided for high level alarm.

B. System Operation

On sump level rise, the lower level 1 shall first be energized, then the upper level 2 shall next energize and start the lead pump. With the lead pump operating, sump level shall lower to lowest switch and turn off the pump. The alternating relay in the control center shall index on stopping of the pump so that the lag

pump will start on the next operation. If sump level continues to rise when lead pump is operating, the level 3 shall energize and start the lag pump.

Both lead and lag pumps shall operate together until low level turns off both pumps. If level continues to rise when both pumps are operating, alarm level 4 shall energize and signal the alarm. If one pump should fail for any reason, the second pump shall operate on the override switch. All levels shall be adjustable for level setting from the control panel.

6.10 Remote Monitoring Panel

The Owner/Contractor shall install one (1) remote monitoring telemetry panel to monitor the alarms listed in paragraph 6.08 "Control Center". The Contractor shall be responsible to install all power and control wiring between the pump control center and the remote monitoring panel. This panel shall be furnished by the City and the Owner shall reimburse the City based on direct costs.

6.11 Operation and Maintenance Manuals

A. Two (2) operation and maintenance manuals shall be submitted to the DPW.

B. Manuals shall include, at a minimum:

1. Operation Instructions
2. Maintenance Instructions
3. Recommended Spare Parts List
4. Lubrication Schedules
5. Structural Diagrams
6. As-Built Wiring Diagrams
7. Bill of Materials

6.12 Spare Parts

A. The Contractor shall supply one set of spare parts for each station, including at a minimum the following:

1. Wear Rings
2. O-Rings and Gaskets (two [2] sets)

6.13 Design Requirements

A. Sizing of Wet Basin

1. The wet well storage below the lowest inlet shall be a minimum of 5'0" and shall also meet the following criteria:

a. OFF level to be set at the pump manufacturer's recommended level but no less than 1'0" from the bottom of the wet well.

b. The distance between the OFF level and the lead pump ON level shall be set to provide storage capacity equal to:

$$\frac{15 \times \text{Rated Pump GPM}}{4}$$

(i.e. 15 minute cycle minimum)

c. The lag pump ON level shall be set a minimum of 6" above the lead pump ON level and a minimum of 6" below the lowest inlet invert.

d. The high water alarm float shall be set a minimum of 6" above the lag pump ON level and a minimum of 6" below the lowest inlet invert.

e. All levels shall be set below the lowest inlet invert.

B. Station Warranty

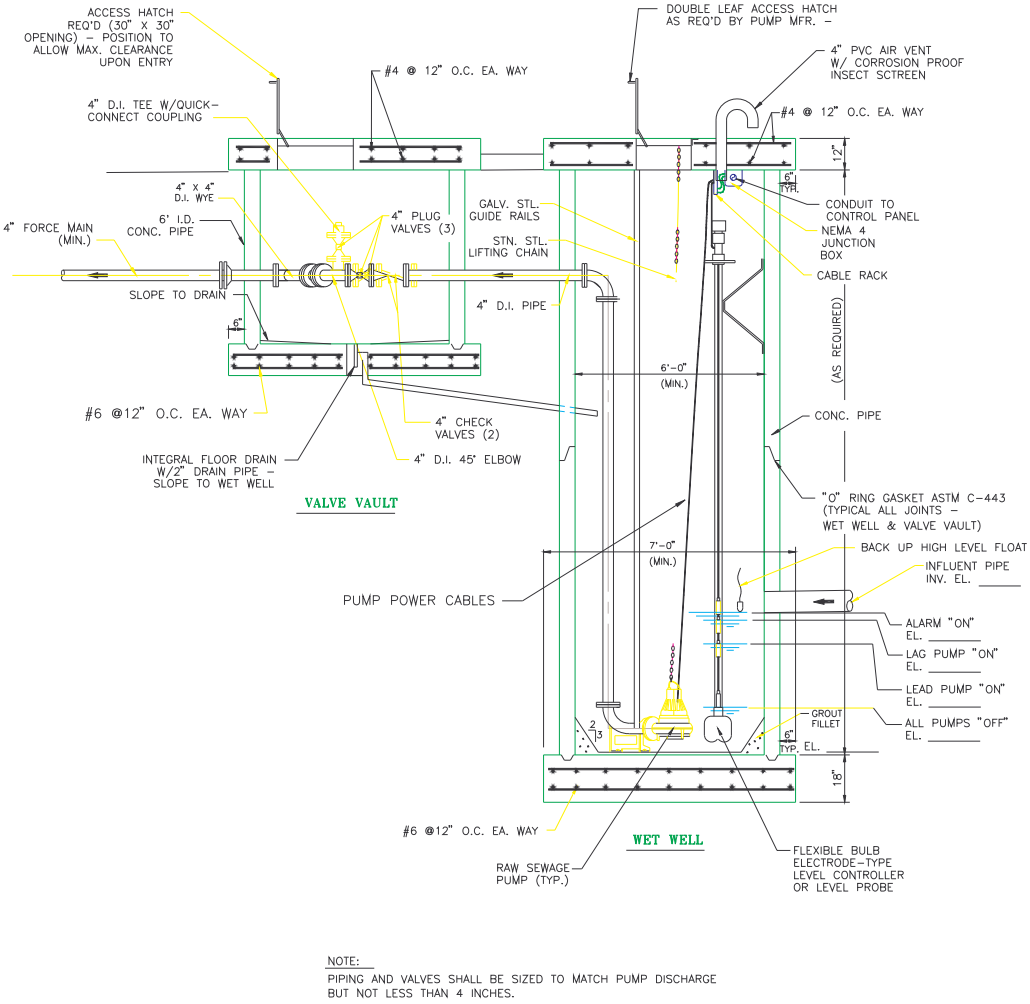
Station warranty shall be two (2) years from the date of acceptance per City maintenance bond requirements.

6.14 Residential Grinder Stations

A. General

Small diameter pressure sewer systems incorporating the use of individual home grinder pump units will be allowed on a case-by-case basis subject to the written approval of the DPW and the Indiana Department of Environmental Management (IDEM). In general, these systems shall only be considered in areas where the surrounding areas are currently served by sanitary sewers and the site cannot be sewered by gravity.

The maintenance of the grinder pump station and building force main to the point of connection with the collector force main shall be the responsibility of the homeowner. The DPW shall only be responsible for the maintenance of the collector force main.



TYPICAL PUMP STATION SECTION

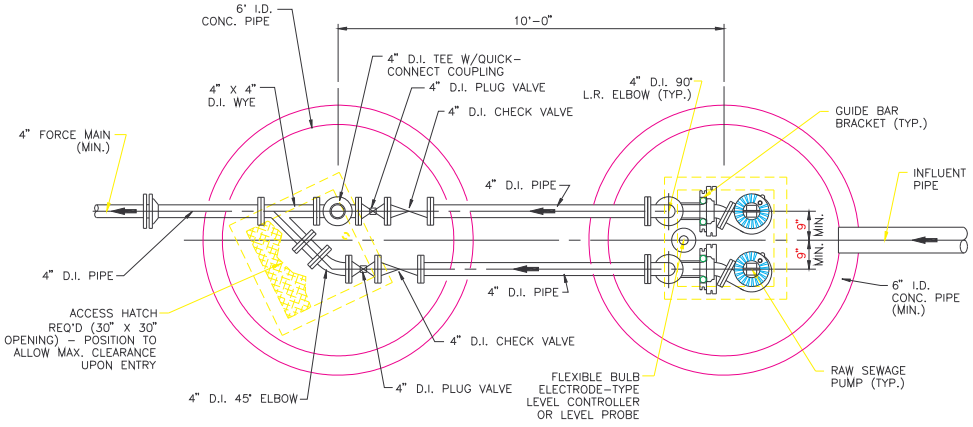
REVISION DATE

CITY of FRANKLIN, INDIANA

DPW

FIGURE

Illustration 6-1



NOTE:

PIPING AND VALVES SHALL BE SIZED TO MATCH PUMP DISCHARGE, BUT NOT LESS THAN 4 INCHES.

TYPICAL PUMP STATION PLAN

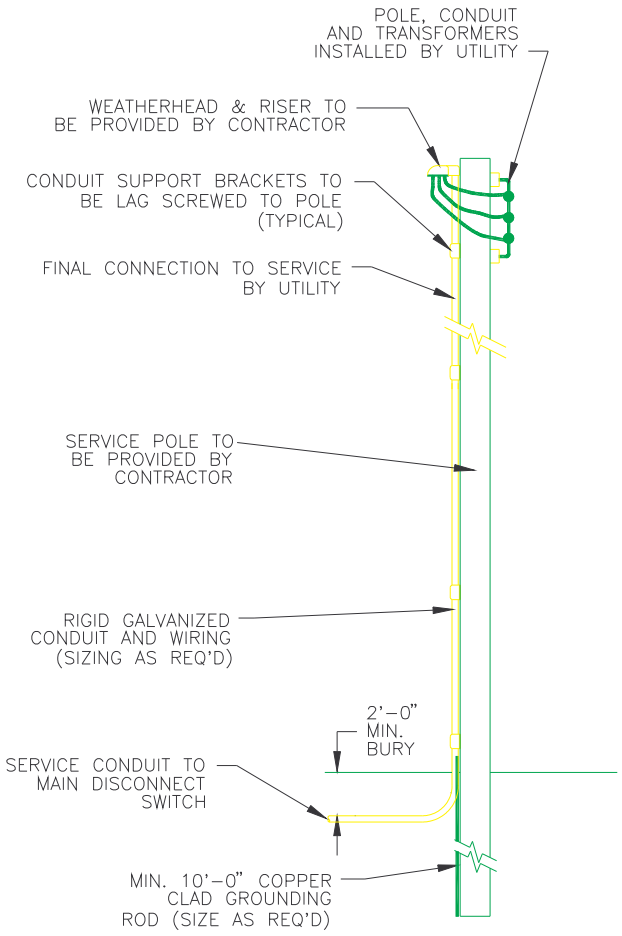
REVISION DATE

CITY of FRANKLIN, INDIANA

DPW

FIGURE

Illustration 6-2



SERVICE POLE ELECTRIC DETAIL

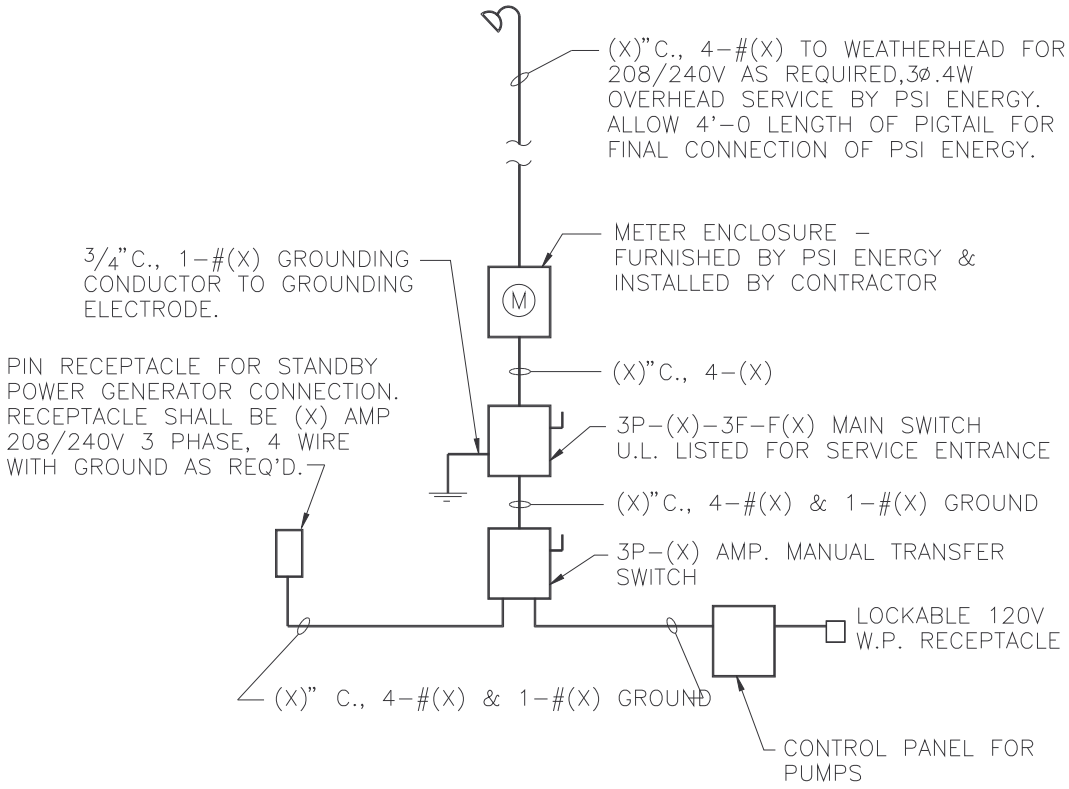
REVISION DATE

CITY of FRANKLIN, INDIANA

DPW

FIGURE

Illustration 6-3



NOTES:

MAIN SWITCH, MANUAL TRANSFER SWITCH AND PUMP CONTROL PANEL SHALL BE MOUNTED IN NEMA 3R OR 4X STAINLESS STEEL ENCLOSURES.

(X) - INDICATES VARIABLE SIZING REQUIREMENTS.

TYPICAL LIFT STATION
POWER DISTRIBUTION SCHEMATIC DETAIL

REVISION DATE

CITY of FRANKLIN, INDIANA

DPW

FIGURE

Illustration 6-4

SECTION 7

INSTALLATION/CONSTRUCTION

7.01 General

This section shall provide general, minimum requirements for the installation and construction for DPW service area.

7.02 Dewatering and Control of Surface Water

Where groundwater is encountered, the Contractor shall make every effort necessary to secure a dry trench bottom before laying pipe. The Contractor shall provide, install and operate sufficient trenches, sumps, pumps, hose, piping, well points, etc. necessary to depress and maintain the groundwater level below the base of the excavation. If the Contractor is unable to remove the standing water in the trench, the Contractor shall over-excavate the proposed bottom grade of the sewer bedding, and place not less than three (3) inches of Class No. 2 crushed stone (Indiana Department of Highway aggregate Classification) in the over-excavated area.

The Contractor shall keep the site free of surface water at all times and shall install drainage ditches, dikes, pumps and perform other work necessary to divert or remove rainfall and other accumulation of surface water from excavations. The diversion and removal of surface and/or groundwater shall be performed in a manner which will prevent the accumulation of water within the construction area.

UNDER NO CIRCUMSTANCES SHALL SURFACE WATER AND/OR GROUNDWATER BE DISCHARGED TO, DISPOSED OF, OR ALLOWED TO FLOW INTO THE CITY'S SANITARY SEWER SYSTEM.

A. Clearing

Preparatory to excavation, the site of all open cut excavations, embankments, and fills shall be first cleared of obstructions and existing facilities (except those which must remain temporarily or permanently in service). On all public or private property where grants or easements have been obtained, and on the property of the City, the Contractor shall remove and keep separate the top soil, and shall carefully replace it after the backfilling is completed.

B. Pavement Cutting

Prior to excavating paved areas all excavation edges falling within the pavement shall be saw cut in a neat, straight manner. Cutting shall be performed with a saw designed specifically for this purpose. The cut shall penetrate the entire pavement thickness where possible. If the existing pavement is more than 6 inches thick, then a cut of not less than 6 inch depth shall be made. If pavement cuts are make in streets which are opened to traffic prior to excavation, then the cuts shall be thoroughly filled with sand and maintained full until the excavation is performed.

C. Protection of Existing Improvements

Before any excavation is started, adequate protection shall be provided for all existing utilities and City structures.

D. Protection of Trees and Shrubs

No existing trees or shrubs in street right-of-ways and easements shall be damaged or destroyed. Where branches of trees or shrubs interfere with the Contractor's operations, they shall be protected by tying back wherever possible. No limbs or branches shall be cut. If his operations will not permit saving certain trees, the Contractor shall be wholly responsible for satisfying all claims for restoration or restitution resulting from their damage or removal.

If small trees and shrubs are moved or pruned to permit more working space, pruning shall be done in accordance with Home and Garden Bulletin No. 83, U.S. Department of Agriculture, "Pruning Shade Trees and Repairing Their Injuries". However, the Contractor shall obtain, in writing, the City's permission to move or prune trees or shrubs. All such work shall be authorized by the Tree Board.

E. Maintenance of Public Travel

The Contractor shall carry on the WORK in a manner which will cause a minimum of interruption to traffic, and may close to through travel not more than two (2) consecutive blocks, including the cross street intersected. Where traffic must cross open trenches, the Contractor shall provide suitable bridges to street intersections and driveways. The Contractor shall post suitable signs indicating that a street is closed and necessary detour signs for the proper maintenance of traffic. Prior to closing of any streets the Contractor shall notify responsible municipal authorities.

F. Utility Interruption

The Contractor shall proceed with caution in the excavation and preparation of the trench or pit so that the exact location of underground structures may be determined. Prior to proceeding with trench excavation the Contractor shall contact all utility companies in the area to aid in locating their underground services.

The Contractor shall take all reasonable precautions against damage to existing utilities. However, in the event of a break in an existing water main, gas main, sewer or underground cable, he shall immediately notify the responsible official of the organization operating the utility interrupted. The Contractor shall lend all possible assistance in restoring services and shall assume all costs, charges, or claims connected with the interruption and repair of such services.

G. Open Cut Excavation

Open cut excavation shall be safely supported and of sufficient width and depth (and only to such width and depth) to provide adequate room for the construction or installation of the work to the lines, grades and dimensions.

1. Trench Dimensions

The bottom width of the trench at and below the top of the pipe and inside the sheeting and bracing, if used, shall not exceed the recommendations as contained in the applicable ASTM Standard for the pipe being used.

Trench sheeting and bracing or a trench shield or box shall be used as required by the rules and regulations of OSHA. The bottom of the trench shall still meet the above standards.

If the trench widths are exceeded without the written permission of the City Engineer and DPW, the pipe shall be installed with a concrete cradle or with concrete encasement or other ASTM approved methods as approved by the City Engineer and DPW.

2. Excavations With Sloping Sides, Limited

The Contractor may, at his option, where working conditions and right of way permit (as determined by the City Engineer and DPW), excavate pipe line trenches and pits for structures with sloping sides, but with the following limitations:

a. In general, only braces and vertical trenches will be permitted in traveled streets, alleys, narrow easements and for pit excavations more than 10 feet deep.

b. Where pipe line trenches with sloping sides are permitted, the slopes shall not extend below the top of the pipe, and trench excavations below this point shall be made with near-vertical sides with widths not exceeding those specified herein before.

c. Slopes shall conform to all OSHA regulations.

H. Earth Excavation

Earth materials shall be excavated so that the open cuts conform with the required lines, grades and dimensions.

1. Unsuitable Foundation: When the bottom of the excavation is unsuitable as a foundation, it shall be excavated below grade and then refilled with concrete or crushed stone to the grade as the DPW or its representative may direct. The crushed stone refill shall be mechanically compacted in six (6) inch layers or as directed by the DPW.

2. Unauthorized Excavation: Unauthorized excavation below grade shall be filled with crushed stone or concrete and compacted as ordered and directed by the DPW or its representative.

3. Excavated Earth For Backfill: Excavated earth materials may be used for backfill subject to the approval of the City Engineer and DPW. Such material may be used only where its class is allowed. For example: Excavated material conforming to "Class II" description may be used where "Class II" material is required.

I. Boring and Jacking

Construction of the pipeline by boring and jacking methods will be permitted unless otherwise specified on the plans.

1. Backstop: The backstop shall be of sufficient strength and positioned to support the thrust of the boring equipment without incurring any vertical or horizontal displacement during such boring operations.

2. Guide Rails: The guide rails for the boring equipment may be of either timber or steel. They shall be laid accurately to line and grade and maintained in this position until completion of the boring operations.

3. Casing Pipe: Steel casing pipe shall be new, conform to ASTM A 139 and shall be of the size (diameter) shown on the plans. The lengths of pipe shall be welded as they are installed. Where lengths of casing pipe are joined during the boring operations, care shall be taken to insure that the proper line and grade is maintained.

The minimum wall thickness for casing pipes under highways, railroads and streams shall be 0.375 inches. Steel shall be Grade B under railroads and Grade A at all other locations.

7.04 Bedding and Backfill

A. General

All trenches or excavations shall be backfilled to the original surface of the ground or such other grades as required or directed. In general the backfilling shall be carried along as speedily as possible.

B. Backfill Materials

The following materials shall be used for backfill in accordance with and in the manner indicated by the requirements specified herein.

Class I - Angular, 6 to 40 mm (1/4 to 1 1/2 inch), graded stone such as crushed stone.

Class II - Coarse sands and gravel with maximum particle size of 40 mm (1 1/2 inch), including various grades of sands and gravel containing small percentages of fines, generally granular and non-cohesive, either wet or dry. Soil types GW, GP, SW and SP are included in this class.

Class III - Fine sand and clayey gravel including fine sands, sand-clay mixtures and gravel-clay mixtures. Soil types GM, GC, SM and SC are included in this class.

Class IV - Silt, silty clays and clays, including inorganic clays and silts of medium to high plasticity and liquid limits. Soil types MH, ML, CH and CL are included in this class. These materials are not recommended for bedding. This class shall also include any excavated material free from rock (3 inches and larger), concrete, roots, stumps, rubbish, frozen material and other similar articles whose presence in the backfill would cause excessive settlement.

C. Backfill of Trench Excavations for Pipes and Conduits

Bedding and Backfill materials samples shall be submitted to the City Engineer and DPW prior to start of construction.

D. Bedding

1. Rigid Pipe and Conduit Bedding

For purposes of this specification, rigid pipe and conduits shall include those made of steel, ductile iron, concrete, RCP, PVC/ABS Truss and other materials as determined by the City Engineer and DPW.

All rigid conduit and pipe shall be laid to the lines and grades unless otherwise directed by the DPW. All rigid conduit and pipe shall be bedded in compacted Class I or II material, placed on a flat trench bottom. The bedding shall have a minimum thickness of 4" or one-fourth (1/4) the outside pipe diameter below the pipe and shall extend halfway up the pipe barrel at the sides. All material shall be placed in the trench in approximately six (6) inch layers. Each layer, shall be leveled and evenly distributed on both sides of the pipe so as not to disturb, displace or damage the pipe and shall be thoroughly compacted. When Class I or II materials is used compaction may be accomplished by hand or mechanical tamping or by "walking" the material in. Bedding from the

halfway point on the pipe to a point twelve (12) inches above the top of the pipe shall be a Class I, II, III, or IV material placed in six (6) inch layers and thoroughly compacted to prevent settlement. Class III and IV material shall not be used when the trench is located in an area subject to vehicular traffic.

2. Flexible and Semirigid Conduit Bedding

For purposes of this specification, flexible and semirigid conduits and pipes shall include those made of PVC, HDPE, and other materials as determined by the City Engineer and DPW.

All flexible and semirigid pipe shall be laid to the lines and grades unless otherwise directed by the DPW. All flexible and semirigid conduit shall be bedded in compacted Class I or Class II material, placed on a flat trench bottom. The bedding shall have a minimum 4" thickness or one-fourth (1/4) the outside pipe diameter below the pipe and shall extend to twelve (12) inches above the top of the pipe level the full width of the trench. All material shall be placed in the trench in a maximum of six (6) inch layers (before compaction). Each layer, shall be leveled and evenly distributed on both sides of the pipe so as not to disturb, displace or damage the pipe and shall be adequately compacted. When Class I materials are used compaction may be accomplished by hand or mechanical tamping or by "walking" the material in. When Class II materials are used compaction shall be accomplished only by hand or mechanical tamping to a minimum eighty-five percent (85%) Standard Proctor Density.

E. Backfill Above Pipe

1. Method A - Backfill in Areas Not Subject to Vehicular Traffic

For purposes of this specification, trenches shall be considered subject to vehicular traffic if all or any portion of the excavation is located within four (4) feet of a roadway or alley which is routinely traveled by powered vehicles. In the event of any question regarding the susceptibility of an area to traffic, the City Engineer's and DPW decision shall govern.

The trench between a level twelve (12) inches above the top of the pipe and the ground surface shall be backfilled with Class I, II, III or IV materials, as described above, deposited with mechanical equipment in such a manner that it will "flow" onto the bedding and not free fall. The Contractor shall consolidate the backfill by the back and forth travel of a suitable roller, wheeled device or other similar heavy equipment until no further settlement is obtained. Heavy equipment shall not be used until there is a cover of not less than three (3) feet over the pipes. To assist in promoting maximum settlement, the surface of the trench shall be left in a slightly rounded condition. Periodical dressing of the backfill in the trench to promote the drainage and safety conditions shall be made during the course of the work.

2. Method B - Backfill in Areas Subject to Vehicular Traffic (Mechanical Compaction)

The trench between a level of twelve (12) inches above the top of the pipe and the surface, which are located in areas subject to or possibly subject to vehicular traffic, shall be backfilled with Class I or II materials, deposited in uniform horizontal layers of two (2) feet +/- six (6) inches. Each layer shall be thoroughly compacted by mechanical tamping utilizing a crane mounted hydraulic vibratory compactors. Each layer shall be thoroughly compacted before the next succeeding layer is placed. This procedure shall be followed where trench walls remain stable during compaction. If in the opinion of the City Engineer and DPW, and/or their representative (inspector), the trench walls become unstable during compaction, then the City Engineer, DPW, and/or their representative (inspector) may authorize the Contractor to push from the back of the trench the Class I or II material into the trench the full depth, not to exceed twenty (20) lineal feet horizontally along the trench bottom and compact using the vibratory compactor in two (2) foot diagonal lifts.

The crane mounted vibratory compactors shall be capable of producing 1900 cycles per minute and have a compaction plate with the minimum dimensions of twenty-three by thirty-one (23 x 31) inches. The compactor shall be similar to those as manufactured by Allied, Ho-Pac, or equal.

When Class I or II materials do not contain sufficient moisture to obtain proper compaction, in the opinion of the City Engineer, DPW and/or their representative, it shall be moistened or wetted as directed by the City Engineer, DPW and/or their representative.

3. Method C - Backfill in Areas Subject to Vehicular Traffic (Jetting and Watersoaking)

In lieu of the Mechanical Compaction described in Method B above, the Contractor may compact the Class I or II materials by jetting and watersoaking in the manner described below. Except for compaction procedures of the Class I or II materials, all provisions of Method B described above shall apply to this Method C. The trench compaction shall be started at the point of lowest elevation of the trench and work up along the trench. Jetting and watersoaking shall not begin until the trench has been backfilled to within eight (8) inches of the finished surface. Jetting and water soaking is not allowed when the groundwater table is above the spring line of the pipe.

The holes through which water is injected into the backfill shall be centered over the trench backfill and at longitudinal intervals of not more than six (6) feet. Additional holes shall be provided if deemed necessary by the City Engineer to secure adequate settlement. All holes shall be jetted and shall be carried to a point one (1) foot above the top of the pipe. Drilling the holes by means of augers or other mechanical means will not be permitted. Care shall be taken in jetting so as to prevent contact with, or any disturbance of the pipe.

The water shall be injected at a pressure and rate just sufficient to sink the holes at a moderate rate. After a hole has been jetted to the required depth, the water shall continue to be injected until it begins to overflow the surface. An approved soil auger shall be used for boring test holes. As soon as the jetting and watersoaking has been completed, all holes shall be filled with soil and compacted. Surface depressions resulting from backfill subsidence caused by jetting and watersoaking shall be filled and recompacted by tamping or rolling to the satisfaction of the City Engineer.

The Contractor shall provide all piping, fittings, etc., necessary to deliver the water along the site of the work and shall arrange with the Water Company for making the necessary taps and metering.

E. Temporary Surfaces Subject to Traffic

The Contractor shall open streets to traffic immediately after completing the backfill operation. He shall accomplish this by installing the compacted aggregate base immediately after granular backfill. The use of class II backfill as a temporary surface is specifically prohibited. When using Method C backfilling, the Contractor may elect to delay the jetting operation until just prior to installing the permanent pavement. This shall not relieve the Contractor from the responsibility of maintaining the temporary surface in accordance with these specifications.

F. Maintaining Trench Surfaces

All surface settlement of the backfill along trenches located beneath streets, roads, alleys, driveways and parking lots which are subject to traffic shall be kept filled level with or slightly above the original paved surface at all times with compacted aggregate base material until the permanent pavement is satisfactorily restored. When temporary asphalt pavement is used, depressions and "pot holes" shall be promptly filled with the temporary asphalt material. Special attention shall be given by the Contractor to the timely and proper maintenance, leveling and grading of the surface of all backfilled trenches, especially those subject to traffic and especially following rains. The surface of streets, roads and alleys shall be maintained smooth and free of ruts and water trapping depressions by periodic power blading, scarifying; and/or filling settled areas, ruts, pockets, or holes with compacted aggregate base material or temporary asphalt where used.

As a dust preventive, the Contractor shall apply, calcium chloride over the surface of the compacted aggregate base in such amounts and at such times as are necessary to avoid or eliminate dust complaints from nearby residents. In event of any question regarding the existence or nonexistence of a dust nuisance, the City Engineer's and DPW's decision on the matter will govern. The material used shall be Regular Flake Calcium Chloride having a minimum chemical content of Calcium Chloride of seventy-seven percent (77%). Unless otherwise specified or ordered by the City Engineer and DPW, the rate of application shall be one and one half (1 1/2) pounds per square yard of surface covered.

Wherever surface settlement is not important, unless otherwise specified or directed, the backfill shall be neatly rounded over the trench to a sufficient height to allow for settlement to grade after consolidation. Just prior to the completion of all work under the contract, any surface settlement below original ground surface shall be refilled in a satisfactory manner, and reseeded as specified if required.

7.05 Laying of Sewers

A. General

This section on the Laying of Sewers shall be divided into two (2) classifications - rigid and nonrigid conduit. Pipe materials such as concrete, steel, PVC/ABS truss, and ductile iron pipe are considered rigid conduits. Thermoplastic (PVC) shall be considered nonrigid or flexible conduits.

B. Rigid Conduit Installation

All rigid conduit for sewer pipe shall be laid to the lines and grades, unless otherwise directed by the City Engineer and DPW. All rigid pipe shall be laid in accordance with the details for the First Class Pipe Laying Method. This First Class Pipe Laying Method may be achieved by Class B bedding methods as shown in the ASCE Manual of Practice No. 37, latest edition. Under this Class B bedding Method, the pipe shall be bedded in compacted granular material (Class I or Class II) placed on a flat trench bottom. The bedding shall have a minimum thickness of one-fourth (1/4) the outside pipe diameter below the pipe and shall extend halfway up the pipe barrel at the sides. All granular bedding material shall be placed in the trench in approximately six (6) inch layers. Compaction shall be accomplished by hand or mechanical tamping or by "walking" the granular material in. From the halfway point on the pipe (Springline) to a point twelve (12) inches above the top of the pipe, backfilling methods A or B or C shall be used depending on the trench location. In addition, all rigid conduit shall be installed in accordance with "Standard Recommended Practice for Installing Vitrified Clay Sewer Pipe" (ASTM Designation C 12 and ASTM D2321).

The laying of pipe in finished trenches shall be commenced at the lowest point, proceeding upstream, with the spigot ends pointing the direction of flow.

No blocking under pipes will be permitted, except as approved by the City Engineer or DPW for pipe to be encased in concrete or laid in concrete cradles.

The practice of blocking pipe up to grade with bedding material, then backfilling under is prohibited. The entire length of the bed section is to be at proper grade before installing pipe.

The supporting strength of the pipe is dependent upon its foundation and trench width. To develop normal strength, the pipe shall have a firm uniform foundation under the entire lower quadrant of the barrel. No weight should be supported by the bell. The maximum trench width as recommended by ASTM at the level of the top of the pipe shall be maintained as narrow as possible, taking into consideration the limitation of the excavation equipment except as may be

permitted by the City Engineer upon investigation of the soil conditions, laying methods and earth loadings.

All pipes and specials shall be carefully inspected before being laid, and no cracked, broken or defective pipe or special shall be used in the work. All pipe shall be carefully inserted in the bell in such a manner that there will be no unevenness of any kind along the bottom half of the pipes and so that there is a uniform joint space all around.

All pipe that is field cut shall have the homing-marks reestablished, insuring for proper seating depths. Pipes that are field cut shall have the cut ends retapered, by grinding or filing, as close to the original taper provided by the manufacturer as possible. When homing pipe with a spud-bar or other mechanical equipment, other than by hand, place a piece of wood between pipe and tool to prevent damage to bell end-section.

Pipe laid in open cut shall have all trench spaces and voids solidly and completely filled with suitable earth materials from the excavations which shall be thoroughly and solidly rammed into place, unless otherwise specified.

The ends of the pipes shall be protected to prevent the entrance of dirt or other foreign substances. Such protection shall be placed at night or whenever pipe laying is stopped for any reason. Suitable plugs designed for use with the pipe material shall be provided and properly secured and used to cap all slants and branches.

C. Flexible Conduit Installation

Plastic sewer pipe (PVC) and other flexible pipe shall be carefully installed in accordance with the above specification for Rigid Conduit Installation, except where the following paragraphs modify those specifications.

Flexible conduit for sewer pipe shall be installed in accordance with "Underground installation of Flexible Thermoplastic Sewer Pipe" ASTM Designation C 2321.

The Contractor shall take special precautions when homing PVC pipe not to over-seat past the home-marks. The pipe installation must include adequate bedding to hold its proper placement, prior to installing the next section.

The Contractor shall use caution when stringing thermoplastic pipe. Excessive spans, in sunlight, will cause bowing damage; and said damaged spans will be rejected.

In addition to the construction and testing procedures outlined in other sections of these specifications, the Contractor shall be required to install the flexible pipe in such a manner so that the diameter deflection of the pipe shall not exceed five percent (5%) when tested in accordance with the Final Acceptance Test. Bedding materials surrounding the pipe shall be compacted to the densities required to meet the five percent (5%) maximum deflection requirement. The area requiring compaction shall be included in the bed and side fill material and

also the material placed above the pipe for a distance of twelve (12) inches over the top of the pipe.

The First Class Pipe Laying Method for Flexible conduit may be achieved by Class B Bedding Methods as shown in the ASCE Manual of Practice No. 37, latest edition. Under this class B Bedding Method, the pipe shall be bedded in compacted granular material (Class I or II) placed on a flat trench bottom. The bedding shall have a minimum thickness of one-fourth (1/4) the outside pipe diameter below the pipe and shall extend twelve (12) inches above the top of the pipe level and full width of the trench. All granular bedding material shall be placed in the trench in approximately six (6) inch layers.

Compaction shall be accomplished by hand or Mechanical Tamping or by "Walking" the granular material in for Class I materials only. When Class II materials are used compaction shall be accomplished by hand or mechanical tamping only to a minimum eighty-five percent (85%) Standard Proctor Density. Backfill from a point twelve (12) inches above the top of the pipe to the trench surface shall be in accordance with "backfilling Methods A or B or C" depending on the trench location.

Plastic pipe shall not be blocked, except where the plans or specifications call for concrete encasement or concrete cradles for the pipe. Blocks shall be encased in concrete also, or removed. Where plastic pipe is to be installed below maximum ground water table, adequate weights shall be provided to prevent flotation of the pipe.

Pipe and fittings shall be carefully inspected before being installed. Cracked, broken or otherwise defective pipe, shall not be used.

7.06 Laying of PVC Force Mains

A. Installation of Buried PVC Pipe

In general, the installation of buried mains shall conform to the requirements of the manufacturer or the AWWA standard for the pipe being installed.

PVC pipe shall generally be installed to conform with Laying Condition F as defined by ANSI A 21.1 and conform with the backfilling and trench maintenance requirements as specified under these specifications.

Plastic pipe shall be firmly bedded in Class II or Class II materials and the bedding thoroughly compacted. Bedding shall be carefully formed by hand to provide complete support of full length of pipe barrel and shall extend to a point 12 inches above the top of pipe. Bell holed shall be formed as necessary. No gravel or stones larger than three sixteenths (3/16) inch shall be permitted within three (3) inches of outer surface of pressurized plastic pipe. Plastic pipe fittings shall be blocked as required. Backfill above the bedding zone shall be as required.

Pipe and fittings shall be carefully inspected before being installed. Cracked, broken, bent or otherwise defective pipe shall not be used in work. Exposure to sunlight will be avoided where possible.

Jointing of PVC pipe shall be performed in the ditch, in accordance with recommendations of manufacturer.

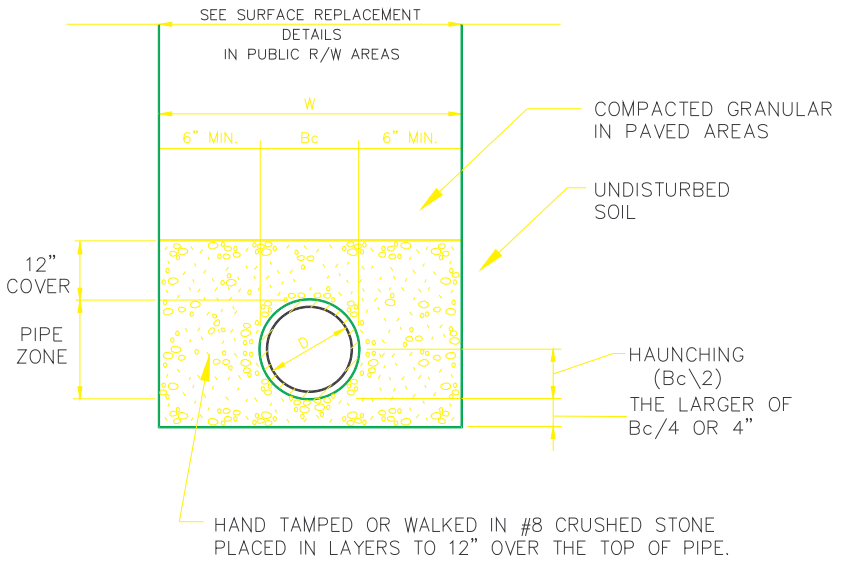
Where metal harnesses for thrust protection are necessary, only cast iron fittings with slotted hydrant lugs, specially made for use with plastic pipe shall be used.

B. Fittings

All fittings of 22½ degree bends and greater, including tees shall be properly anchored by concrete thrust blocks of sufficient size not to exceed a soil pressure of two (2) tons per square foot. This blocking shall be installed prior to backfilling and testing.

7.07 Structure Installation

All manholes, inlets and catch basins shall be installed on a minimum of a 6" No. 8 stone base. This material shall be compacted.



W = MAXIMUM ALLOWABLE TRENCH WIDTH FOR PIPE AS PER ASTM
NOT TO EXCEED FOUR (4) FEET FOR 6" THROUGH 24" PIPE
NOR SIX (6) FEET FOR 27" THROUGH 48" PIPE
D = PIPE DIAMETER (INTERNAL)
Bc = PIPE DIAMETER (EXTERNAL)

NOTES:

1. BEDDING STOPS AT A POINT 12" ABOVE THE TOP OF THE PIPE. BACKFILLING ABOVE THIS POINT SHALL BE IN ACCORDANCE WITH THE SPECIFICATIONS.

2. WORK FALLING UNDER THE JURISDICTION OF THE INDIANA STATE HIGHWAY COMMISSION SHALL UTILIZE COMPACTED GRANULAR BACKFILL MATERIAL FOR INITIAL AND FINAL BACKFILL ANYWHERE WITHIN 12 FEET OF THE EDGE OF PAVEMENT. OTHERWISE, COMPACTED GRANULAR BACKFILL MATERIAL SHALL ONLY BE USED UNDER PAVEMENT SURFACES OR OTHER SPECIFICALLY DESIGNATED AREAS.

FIRST CLASS PIPE LAYING METHOD FOR:
1) FLEXIBLE (PVC, RPVC, ABS & HDPE PIPE) AND
2) DUCTILE IRON WITHIN PVM'T LIMITS

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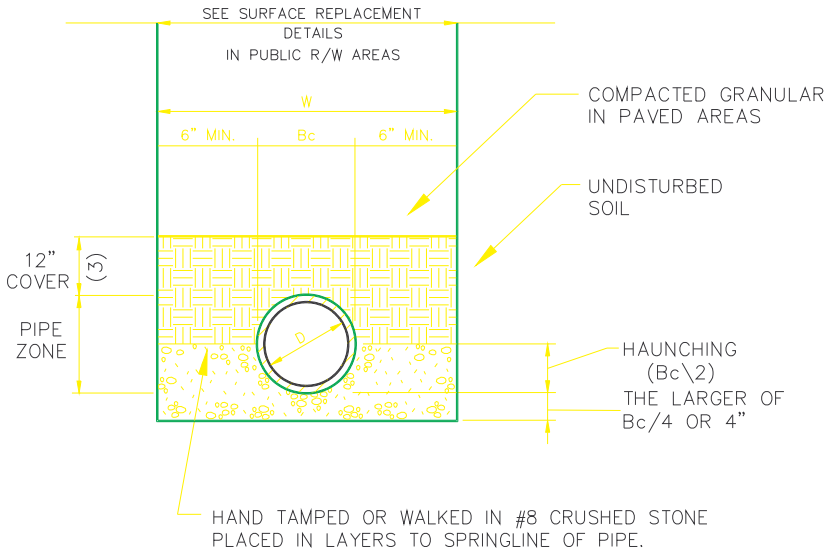
FIGURE

Illustration 7-1



W = MAXIMUM ALLOWABLE TRENCH WIDTH FOR PIPE AS PER ASTM NOT TO EXCEED FOUR (4) FEET FOR 6" THROUGH 24" PIPE NOR SIX (6) FEET FOR 27" THROUGH 48" PIPE
D = PIPE DIAMETER (INTERNAL)
Bc = PIPE DIAMETER (EXTERNAL)

NOTES:

1. BEDDING STOPS AT SPRINGLINE OF THE PIPE. BACKFILLING ABOVE THIS POINT SHALL BE IN ACCORDANCE WITH THE SPECIFICATIONS.

2. WORK FALLING UNDER THE JURISDICTION OF THE INDIANA STATE HIGHWAY COMMISSION SHALL UTILIZE COMPACTED GRANULAR BACKFILL MATERIAL FOR INITIAL AND FINAL BACKFILL ANYWHERE WITHIN 12 FEET OF THE EDGE OF PAVEMENT. OTHERWISE, COMPACTED GRANULAR BACKFILL MATERIAL SHALL ONLY BE USED UNDER PAVEMENT SURFACES OR OTHER SPECIFICALLY DESIGNATED AREAS.

3. GRANULAR FILL IN PAVED AREAS

FIRST CLASS PIPE LAYING METHOD FOR: RIGID CONDUITS (RCP & CMP)

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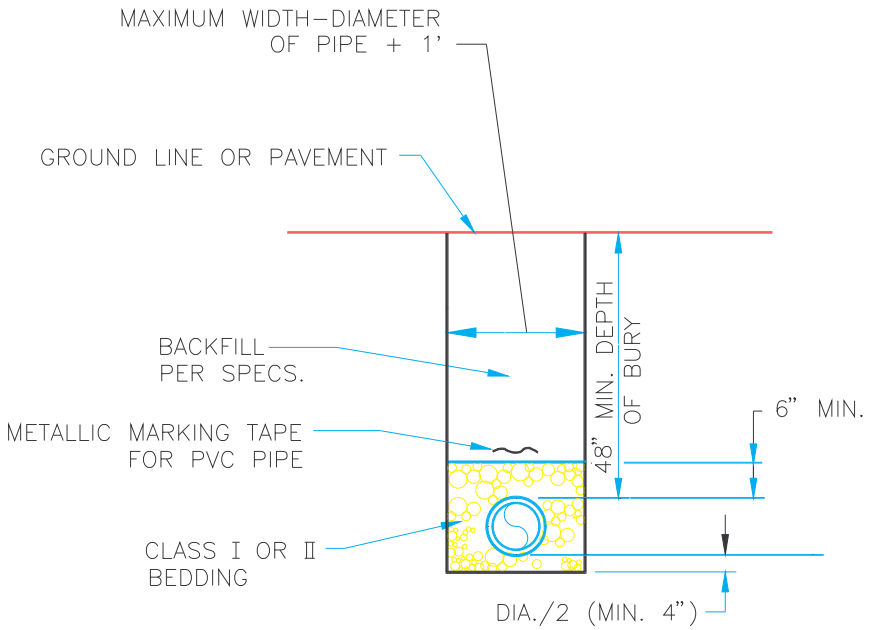
FIGURE

Illustration 7-2



FORCE MAIN PIPE TRENCH DETAIL

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FIGURE

Illustration 7-3

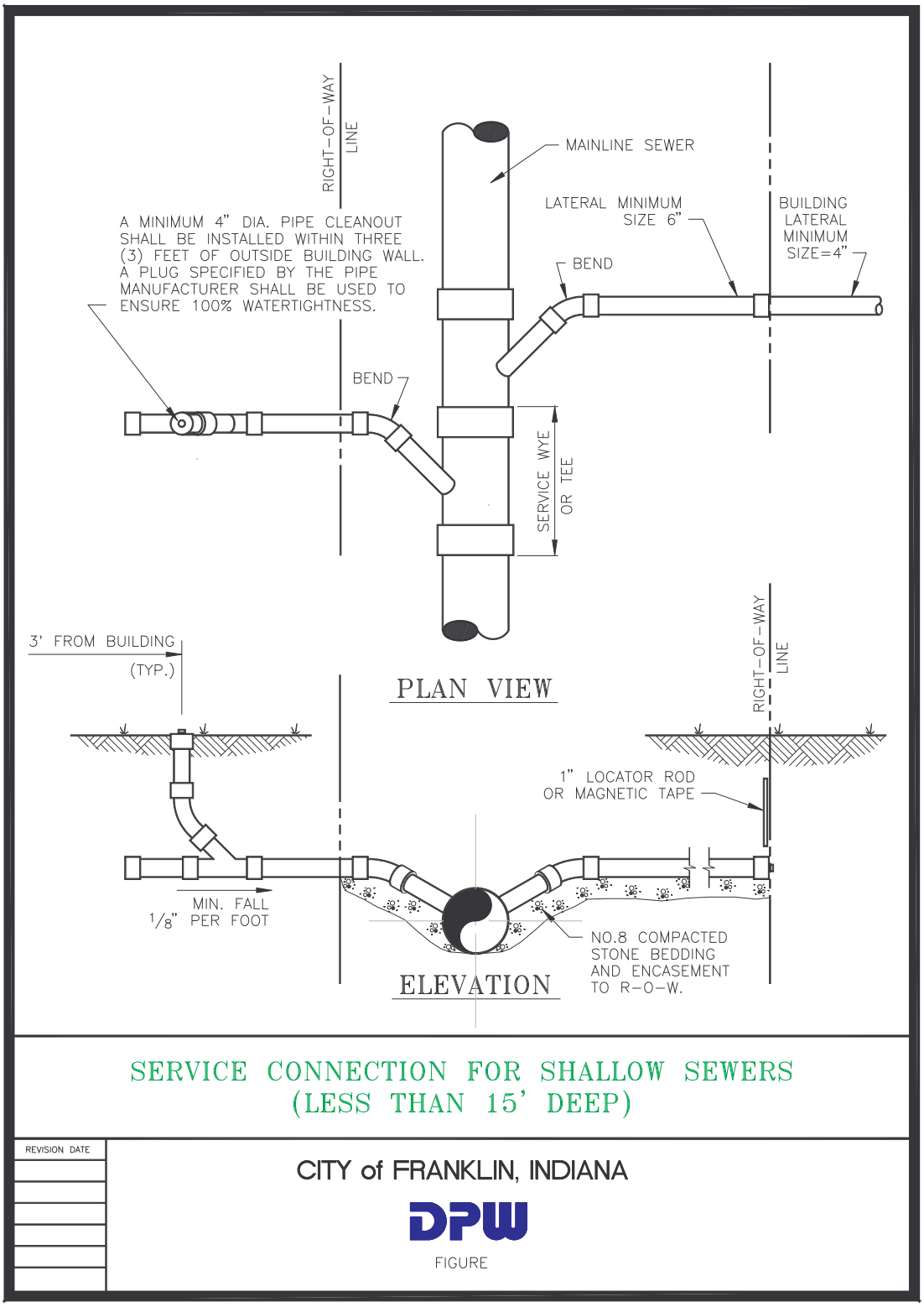
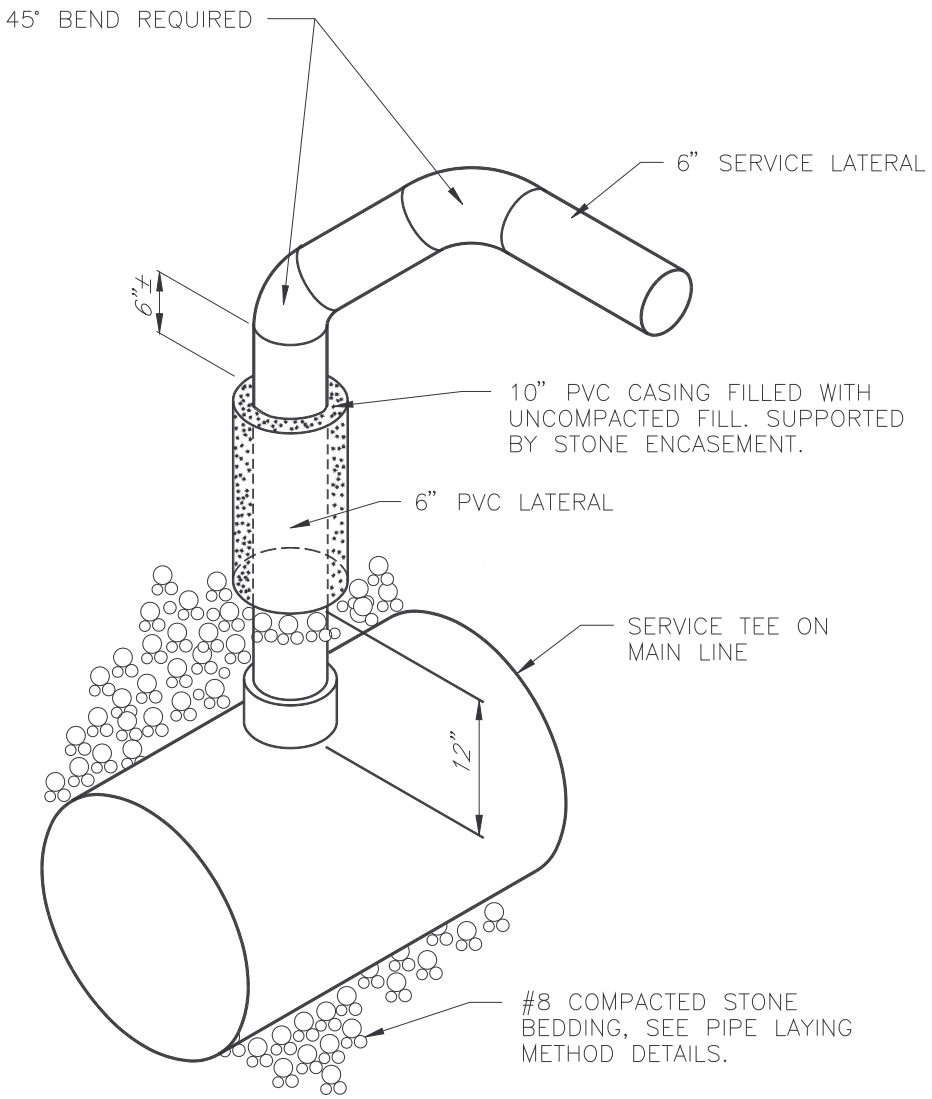


Illustration 7-4



DEEP LATERAL INSTALLATION OVER 15' DEEP (ALT. #1)

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FIGURE

Illustration 7-5

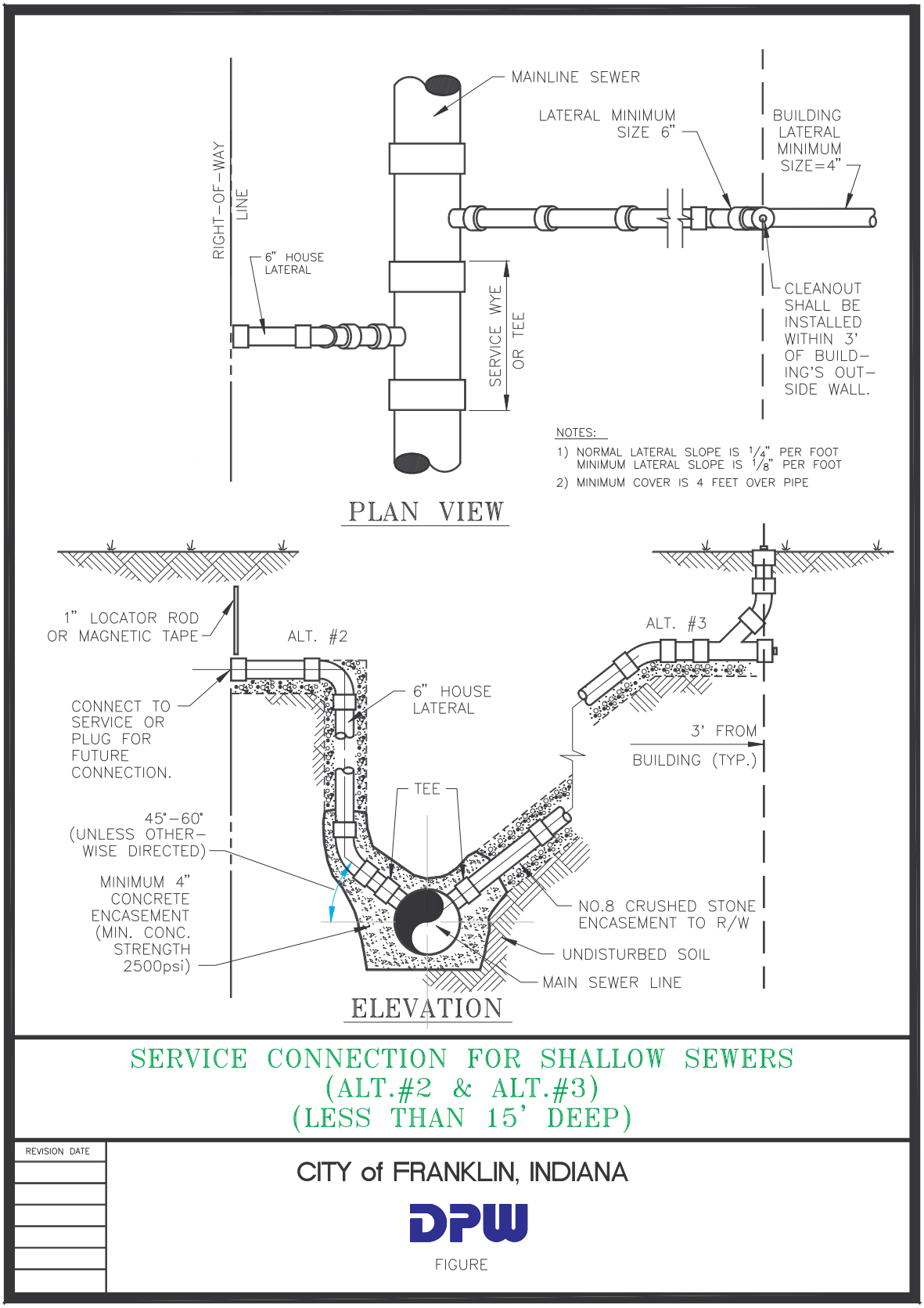
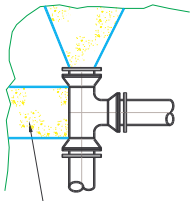
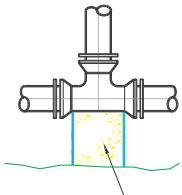


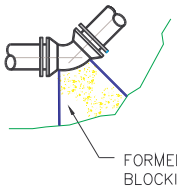
Illustration 7-6



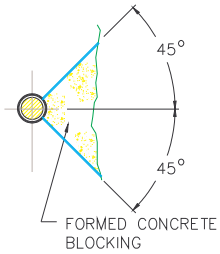
DETAIL A



DETAIL B



DETAIL C



DETAIL D

AREA IN SQUARE FEET REQUIRED FOR CONCRETE THRUST BLOCKING

SIZE	TEE & PLUG	90° BEND	45° BEND	22-1/2° BEND	11-1/4° BEND
4"	2.0	2.5	1.5	1.0	1.0
6"	4.0	5.5	3.0	1.5	1.0
8"	6.5	9.0	5.0	2.5	1.5
10"	10.0	14.0	7.5	4.0	2.0
12"	14.0	20.0	11.0	5.5	3.0

NOTES:

1. THRUST BLOCK AREAS ARE BASED ON A SOIL BEARING LOAD OF 2,000 lb./SQ. FT.
2. GREASE ALL PIPE SURFACES PRIOR TO PLACEMENT OF CONCRETE

THRUST BLOCKING DETAILS FOR FORCE MAIN

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FIGURE

Illustration 7-7

SECTION 8

RESTORATION OF SURFACES

8.01 General

Restoration of surfaces within the public right-of-way and easements shall include the removal of the existing surface, the disposal of the surplus material and the construction of new surfaces and adjusting all new and existing structures for proper grade prior to paving as indicated on the plans and/or as specified in these Specifications.

8.02 Restoration of Paved Surfaces

A. Restoration

After all excavations within the limits of paved surfaces have been properly backfilled and compacted, the paved surfaces shall be restored to a condition as good as or better than existed prior to the beginning of the work, in accordance with the following specifications.

Paved Surfaces: Streets, alleys, sidewalks, driveways, curbs and gutters, not constructed or maintained by the State Highway Department, but paved with asphalt, concrete, cinders, crushed stone, waterbound macadam, oil-bound macadam, or heterogenous paving materials, which are wholly or partially removed, damaged, or disturbed by the Contractor's operations, shall be restored with like or better materials, acceptable to the City Engineer and DPW, to a condition as good as or better than existed prior to the beginning of the work, so that movement of traffic, both vehicular and pedestrian, through the restored way shall be as free, safe and unimpeded as before.

B. Temporary Surface

Temporary trench surfaces shall be installed and maintained in accordance with these specifications. This temporary surface shall be maintained by the Contractor until the permanent pavement is placed. Before placing permanent pavement, all or parts of the temporary surface shall be removed, as necessary, and hauled from the site of the work.

C. Temporary Pavement Replacement

Trench surfaces of highly traveled streets and roads may be, at the direction of DPW, required to receive a temporary pavement replacement of cold mixed bituminous pavement. This temporary pavement shall be surface mixture Class A or B prepared and placed in accordance with Section 406 - Cold Mixed Bituminous Pavement of the latest edition of the Indiana State Highway Department Specifications. Prime and tack coats shall not be required. All temporary pavement shall be maintained by the Contractor to proper grade so as not to impede the safe flow of traffic until the permanent pavement replacement is made.

D. Permanent Paving

Permanent paved surfaces shall be restored in accordance with the following requirements, unless otherwise set forth by the City Engineer, in all cases, the methods and materials of restoration shall meet the requirements of the Indiana State Highway Department, as applicable.

1. Class "B" Concrete Pavement

   Existing local streets, roads, alleys, driveways and parking areas consisting of concrete pavement shall be restored according to the following requirements.

   Areas subjected to excavation or damage by the Contractor are to be replaced as a whole. Sidewalks to be replaced in complete sections, streets and driveways as complete sections or replaced with sections that coincide with the original pattern, and to the DPW's and/or City Engineer's satisfaction.

   Prior to placing concrete, the existing edges are to be saw-cut in a neat straight manner, sub-base compacted, wetted down and edges swept clean. The use of flexible joint material is required as needed. All chunks of existing material larger than three by three (3 x 3) inches are to be removed.

   Class "B" concrete pavement shall consist of a cast in place, layer of Class A concrete with one (1) layer of woven wire fabric (6 x 6 - W1.4 x W1.4) meeting ASTM Designation 497. The concrete layer shall be six (6) inches thick. All rigid concrete pavement work and materials shall meet the latest specifications of the Indiana State Highway Department.

2. Class "C" Asphalt Pavement

   Existing local streets and roads consisting of asphalt paving shall be restored with binder and surface of the thickness specified and as follows:

   Areas subject to Class C asphalt pavement replacement shall have the existing edges (those created by cutting prior to excavation) re-cut in a neat straight manner as to remove irregularities and damaged areas. Manholes, service line trenches and existing valve areas are to be boxed out in a neat manner. All cuts shall be parallel or perpendicular to the trench. Curved or diagonal cuts shall not be allowed. All chunks of existing material larger than three by three (3 x 3) inches are to be removed.

   The aggregate base course, including the previously placed temporary surface or pavement, shall have the upper portions removed to allow placement of the binder and surface. After the base is cutback, it shall be re-compacted with a ten (10) ton roller or other suitable equipment if approved by the City Engineer. Care shall be taken to assure that not less then six (6) inches of compacted aggregate base remains below the permanent pavement.

The binder course(s) shall consist of compacted Hot Asphaltic Concrete, Type A, Size No. 9 as defined by the latest edition of the Indiana State Highway Specifications. Compaction shall be accomplished with suitable smooth wheel rollers. Generally, conventional self-propelled rollers of not less than 10 tons gross weight shall be used. The City Engineer may allow other specialized rollers for narrow trenches or lighter rollers with vibratory action. The City Engineer shall consider alternate equipment only if Contractor requests same in writing and includes technical data on the specific equipment to be considered.

The quantity and thickness of binder courses required shall match the existing pavement, but not less than one (1) course, two (2) inches in thickness.

The surface course shall consist of compacted Hot Asphaltic Concrete Surface Type A, (Size No. 11 or 12)' as defined by the latest edition of the Indiana State Highway Specifications and placed in the same manner as described above for binder. The surface thickness shall match the existing pavement, but not less than one (1) inch.

3. Adjustments of Shoulders Necessitated by Resurfacing

The shoulders of the road shall be adjusted to the elevation of the resurfacing with all materials (i.e., earth, sod, gravel, crushed stone, asphalt, etc.) necessary. The transition may be made within a distance of one (1) foot to one and one-half (1 & 1/2) feet from the edge of paving except in unusual cases where a greater distance is required. Existing driveways shall be primed and wedged from a featheredge to the final height of the resurfaced street paving.

8.03 Restoration of Ground Surfaces

All ground surfaces in public Rights of Way and easements that have been damaged or destroyed by the Contractor's operations shall be restored in accordance with the following specifications. All surplus material, rock, trees, shrubs, concrete pipe, asphalt, crushed stone, etc., not to be used in the Contractor's restoration operations shall be removed from the site and disposed of in an acceptable manner.

1. Restoration of Grassed Areas with Sod

Where shown on the plans or required by the DPW or City Engineer, established grassed areas shall be restored with sod containing grasses of comparable quality. Sod shall be placed and rolled so that the final elevations of the area being restored are the same as existed prior to the beginning of construction. Sod shall be pegged where necessary, and shall be watered and cared for to assure its survival.

2. Restoration of Grassed Areas with Seed and Mulch

The Contractor shall seed and mulch in one of the following manners:

a. The ground shall be loosened approximately three (3) inches deep with a disc or a harrow and fertilized with twenty-five (25) pounds of 10-10-10, or equivalent, and one hundred (100) pounds of agricultural lime per one thousand (1,000) square feet.

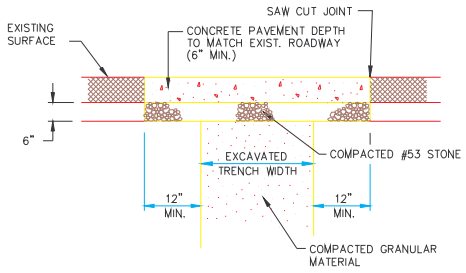
The mixture of seed applied shall be as follows:

35% Kentucky Bluegrass
30% Perennial Rye Grass (Lolium Perenne)
30% Kentucky 31 Fescue
5% Inert Matter

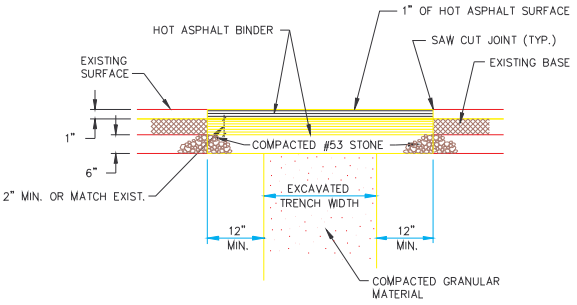
The seed shall be applied at a rate of four (4) pounds per one thousand (1,000) square feet and shall be well raked or boarded into the soil and mulched with straw of sufficient thickness to hold the seed until it has germinated.

b. Mulching Material: Materials for mulching shall be wheat, oats, barley or rye straw only. All materials shall be reasonably free from weed seeds, foreign material, and other grasses and chaff, and shall contain no Johnson Grass. The straw shall be reasonably bright in color and shall not be musty, moldy, caked, or of otherwise low quality. The straw shall be dry on delivery, and spread evenly.

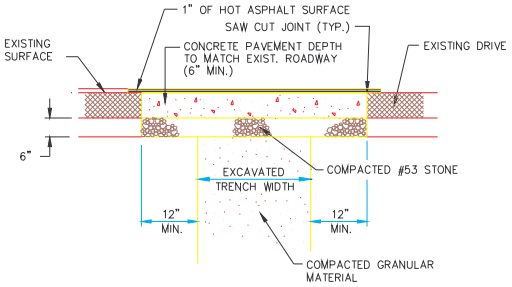
Mulch net may be required on special areas designated by the DPW to hold mulch in place until turf is established. The net shall be made of a tightly twisted craft paper yarn, leno woven with a wrap count of one (1) pair of yarns per two (2) inches and a filling count of two (2) per inch. Salvage edges and center shall be reinforced with polyethylene filament. The material shall have a minimum width of forty-five (45) inches.



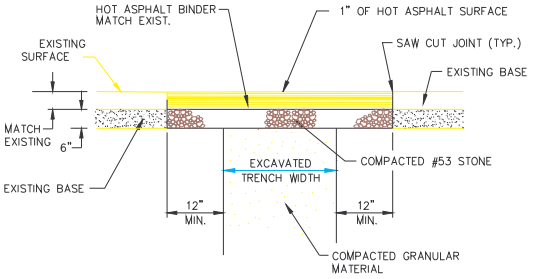
CONCRETE ROAD



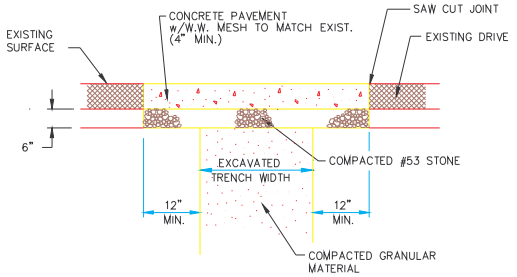
ASPHALT ROAD REPAIR



ASPHALT OVER CONCRETE
(ROAD OR DRIVE)



ASPHALT DRIVE REPAIR



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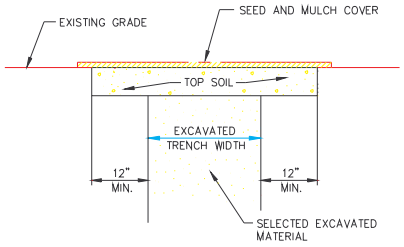


GRASSED AREA

TYPICAL SURFACE REPLACEMENT DETAILS

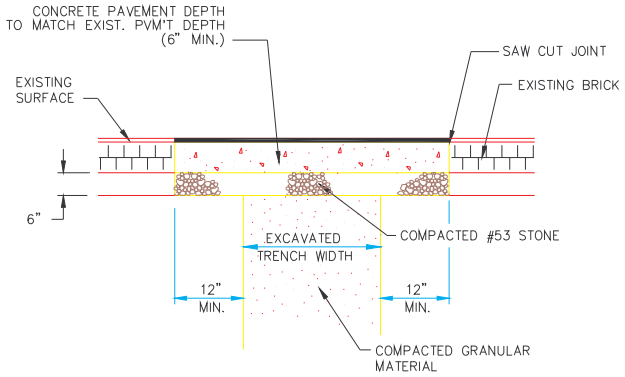
REVISION DATE

CITY of FRANKLIN, INDIANA

DPW

FIGURE

Illustration 8-1



ASPHALT OVER BRICK REPLACEMENT

FORCE MAIN DROP INTO EXISTING MANHOLE

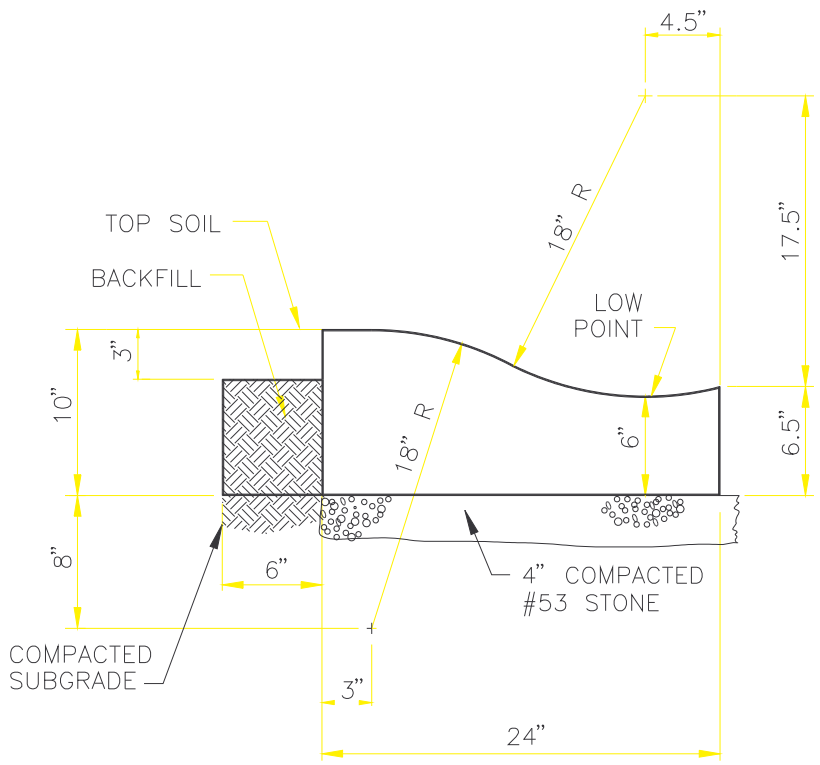
REVISION DATE

CITY of FRANKLIN, INDIANA

DPW

FIGURE

Illustration 8-2



TYPICAL CONCRETE ROLL CURB AND GUTTER

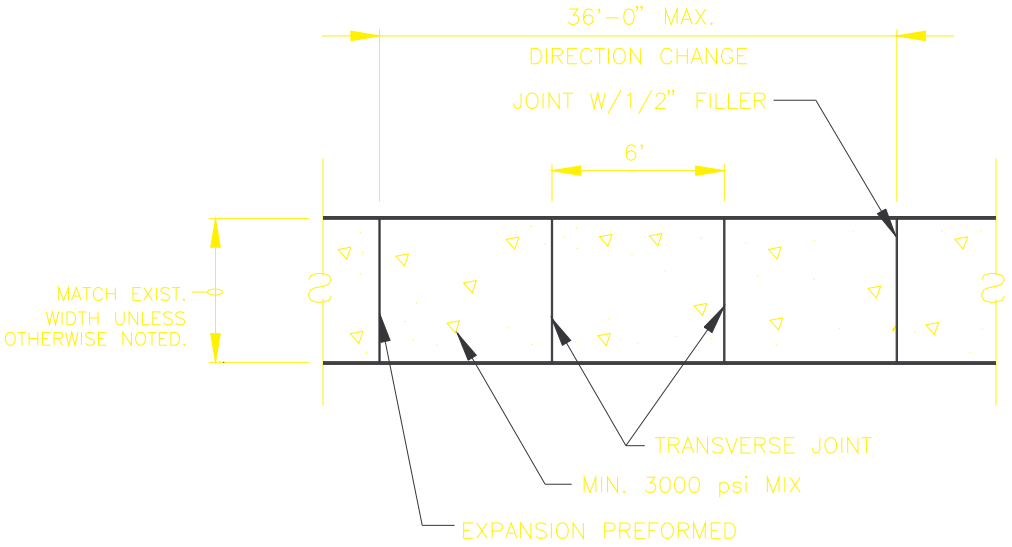
REVISION	DATE

CITY of FRANKLIN, INDIANA

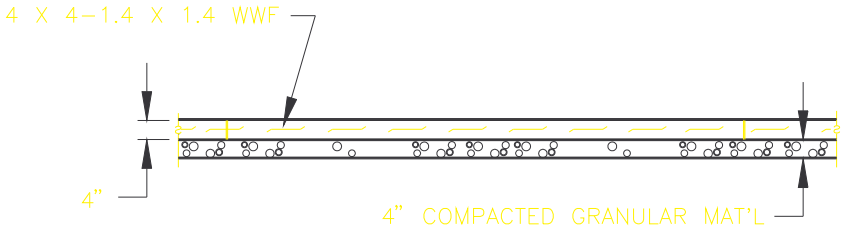
DPW

FIGURE

Illustration 8-3



SIDEWALK PLAN



SIDEWALK SECTION

TYPICAL SIDEWALK REPLACEMENT DETAIL

REVISION DATE

CITY of FRANKLIN, INDIANA

DPW

FIGURE

Illustration 8-4

SECTION 9

INSPECTION, TESTING AND ACCEPTANCE

9.01 General

This section describes the minimum requirement and general procedures for the inspection, testing and acceptance of systems dedicated to the DPW.

Connection Permits for sanitary service will not be issued until all the requirements of this section are fulfilled.

9.02 Inspection

Inspection of the construction shall occur for the duration of the project, including the installation of service laterals. The Owner shall execute the Agreement with DPW for such services if the DPW does not have staff available to perform such inspections.

A. Estimated Cost

The DPW shall send a letter to the Owner stating the estimated manhours and amount of the inspection fee to be paid to the City for services performed by representatives of the DPW. The amount provided in the letter shall be 75% of the total estimated cost of the inspection services based upon the estimated payment manhours multiplied by the base hourly rate.

The estimated manhours shall be based upon the following assumptions:

Average daily production = 250 ft./day
Final inspection + Verification of As-Builts = 8 hours
Inspection Time = 20 - 30 hrs/week

Where a lift station is required, additional time for the inspection during construction and final start-up shall be added.

The fee provided is a pre-construction estimate only. The actual inspection time may vary for project to project and may exceed or be less than the estimate based upon the actual project duration. Inspection time at the site shall be verified by the Owner or a representative of the Owner.

The remaining cost, 25%± shall be paid prior to final acceptance by the DPW.

B. General Requirements

1. Contractor and/or Owner shall provide notice to the DPW and his representative of the planned commencement of construction forty-eight (48) hours prior to such commencement.

2. Once the construction starts, the Contractor shall be responsible for informing and/or notifying the inspection representative assigned of the following:

a. Daily work schedule, including any changes in schedule;
b. Prior notification if work is to be performed on weekends and/or holidays;
c. Date tests are to be performed; and
d. Date as-built verification is to be performed.

3. The DPW, upon request of the Contractor and/or Owner, will schedule the Final Inspection.

All testing required shall be performed under the observation of the DPW or DPW's representative. It shall be the Contractor's responsibility to schedule the testing with the DPW representative and/or DPW. Test results obtained in the absence of the presence of the DPW will not be accepted.

9.03 Testing

A. Leakage Testing

1. General

All sanitary sewers shall be tested for infiltration and exfiltration.

Contractor shall furnish all labor, materials and equipment required for making tests. Tests shall be made at times arranged with the DPW and his representative. Sections of sewers shall be isolated and measurements of infiltration and exfiltration shall be made by approved means. The DPW or his representative must be present during all final tests.

Sewers whose crowns are below ground water level at time of testing shall be tested for infiltration. Where crown of pipe is above ground water level, sewer shall be tested for exfiltration. If ground water level varies during period of construction, sewers may be tested for both. Spans are not to be tested for Final Acceptance until complete.

Immediately preceding all leakage tests (exfiltration, infiltration and air) the sewer to be tested shall be cleaned by flushing a ball through the pipe. The Contractor shall furnish an inflatable rubber ball of a size that will inflate to fit snugly into the pipe to be tested. The ball may, at the option of the Contractor, be used without a tag line; or a rope or cord may be fastened to the ball to enable the Contractor to know and control its position at all times. The ball shall be placed in the last cleanout or manhole on the pipe to be cleaned, and water shall be introduced behind it. The ball shall pass through the pipe with only the pressure of the water impelling it. All debris flushed out ahead of the ball shall be removed at the first manhole where its presence is noted. In the event cemented or

wedged debris, or a damaged pipe shall stop the ball, the Contractor shall remove the obstruction.

2. Infiltration Tests

Sanitary sewers which are constructed with ground water level above Crown of pipe shall be tested for infiltration after sewers have been installed and backfilling has been substantially completed. A convenient section of sewer shall be selected between manholes. The upper section of sewer shall be plugged watertight with temporary bulkhead. A suitable measuring device shall be installed at the lower end.

The amount of water flowing through the outlet shall be measured periodically through the next twenty-four (24) hours. The flow thus measured shall then be converted by gallons per day per inch diameter per mile and compared with the maximum allowable limit of two hundred (200) gpd/in./mile.

3. Exfiltration Tests

A section or sections of sanitary sewer between manholes shall be isolated by water tight bulkheading. Isolated sections shall then be filled with water to a level three (3) feet above the crown of the pipe at the upstream end of the section; water level at the downstream end of the section shall not be more than six (6) feet above the crown of the pipe. After allowing the system to stabilize overnight, the section shall be refilled with water to the original level. After one (1) hour more, the volume of water lost in the section shall be determined by measuring the drop in the water level.

4. Allowable Leakage

Infiltration or exfiltration of any given segment of sewer pipe shall not be permitted to exceed a rate of two hundred (200) gallons per twenty-four (24) hours per mile of sewer per inch of pipe diameter (0.158 gph/in./100 ft.).

5. Low Pressure Air Testing

For gravity sanitary sewers installed with the pipe crown above the ground water level, air pressure testing may be used in lieu of the exfiltration test. Low pressure air testing is used to determine the existence of pipe leaks; however, it does not indicate water leakage limits.

Prior to the low pressure air testing, all wyes, tees, or end of side sewer stubs shall be plugged with flexible-joint caps, or acceptable alternate, securely fastened to withstand the internal test pressures. Such plugs or caps shall be readily removable, and their removal shall provide a socket suitable for making a flexible-jointed lateral connection or extension.

All plugs shall be securely braced to prevent possible blowout due to internal air pressure. One plug shall have an inlet tap, or other provision for connecting a hose to a portable air supply source. Air hose shall be connected to the inlet tap and a portable air supply source.

Air equipment shall consist of all necessary valves and pressure gages to control rate of air flow into the test section and to enable monitoring of air pressure within the test section. Testing apparatus shall also be equipped with pressure relief device to prevent the possibility of loading test section with full capacity of compressor.

Air shall be slowly added to test section until pressure inside pipe is raised to 4.0 psig. After a pressure of 4.0 psig is obtained, air supply shall be regulated such that pressure is maintained between 3.5 and 4.0 psig for a period of two (2) minutes, to allow air temperature to stabilize in equilibrium with temperature of pipe walls. Pressure will normally drop slightly until equilibrium is obtained. During this period, all plugs shall be checked with soap solution to detect any plug leak.

After this two (2) minute air stabilization period, air supply shall be disconnected and test pressure allowed to decrease. Time required for test pressure to drop from 3.5 psig to 2.5 psig is determined by means of stop watch, and this time interval is then compared with required time to determine if rate of air loss is within the allowable limit. Required time to arrive at the allowable air loss is calculated by means of following formula:

$$T = \frac{0.0850\ DK}{Q}$$

Where: T = time in seconds
K = .000419 DL but not less than 1.0
Q = Rate of loss (=0.003 cfm/sq. ft. of internal surface)
D = Diameter of pipe in inches
L = length of pipe tested in feet

Upon completion of test, the bleeder valve shall be opened and all air allowed to escape. Plugs shall not be removed until all air pressure in test section has been released. Also, no one shall be allowed in trench or manhole while test is being conducted.

All pipe lines thirty (30) inch diameter and over shall be tested one joint at a time with joint testing apparatus. Joint shall be isolated with an expanding shield equipped with gaskets which fit tightly against pipe walls on each side of joint to be tested. Allowable leakage for such a test is equal to that which would occur on the basis of allowable leakage for one length of pipe.

If measured time interval for the pressure to drop from 3.5 psig to 2.5 psig is less than the required time as calculated, sewer section shall be deemed to have failed test. Contractor shall then proceed to repair pipe at

his cost as necessary until the sewer section passes the test. All testing shall be conducted in presence of DPW or his representative (inspector).

6. Excessive Leakage

If infiltration or exfiltration rate of sewer exceeds maximum rate specified, contractor shall make all necessary repairs to reduce leakage below the allowable. Such repairs shall be made at Contractor's expense. Under no circumstances will grouting be considered an acceptable means of repair. When repairs have been completed, but not more than thirty (30) days after first test, sewer section shall be subjected to a second leakage test as specified above.

If the second test should again indicate leakage in excess of the allowable amount, the Contractor shall, at his own expense, provide complete internal inspection of entire section in question, by means of videotape recording of television inspection or by color photography with exposures every two (2) to four (4) feet along the sewer. Contractor shall employ an independent sewer testing service to inspect pipe. Inspection service shall prepare a written report and shall review videotape or films with DPW, Contractor, and DPW's representative. Contractor shall then submit a written plan for correction of leakage. Contractor, DPW, and DPW's representative shall meet as necessary to develop actual program for inspection and repair. Contractor shall not proceed to repair line until he receives written authorization to proceed from City Engineer, DPW or DPW's representative. All inspections, reports, repair, replacement, and compensation for additional professional expense shall be paid by the Owner/Contractor.

B. Deflection Testing of Installed Flexible Plastic Pipe

1. Final Acceptance Test

Prior to the final deflection test, the DPW or his representative may, at his option, order the lamping of certain or all sections. Lamping must show a "full moon" and no excessive puddling effects in the span.

The main line shall be flushed prior to the vertical ring deflection tests. The vertical ring deflection tests shall not be performed prior to successful completion of leakage testing requirements.

All main line plastic pipe and PVC/ABS Truss sewers eight (8) inch in diameter and greater shall be measured for vertical ring deflection at least thirty (30) days after installation, but no later than thirty (30) days prior to final acceptance of the project. Maximum ring deflection of the pipeline under load shall be limited to five percent (5%) of the vertical internal pipe diameter. All pipe exceeding this deflection shall be considered to have reached the limit of this serviceability and shall be relaid or replaced by the Owner/Contractor.

The cost of all deflection testing shall be borne by the Contractor and shall be accomplished by using a deflectometer, which will produce a continuous record of pipe deflection, or by pulling a mandrel, sphere, or pin-type go/no-go device through the pipeline. The diameter of the go/no-go device shall be ninety-five percent (95%) of the undeflected inside diameter of the flexible pipe. The mandrell shall be pulled through the sewers by one man, by hand and specifically without the aid of mechanical devices.

C. Sanitary Manhole Testing

All manhole vacuum tests shall be conducted in the presence of a representative of the DPW.

The vacuum test equipment shall consist of: inflatable plugs for all incoming and outgoing sewer lines; an inflatable test collar to seal the manhole at the manhole frame; and a vacuum pump. A vacuum gauge shall be located in-line between the test collar and the pump to accurately indicate the vacuum in inches of mercury within the manhole. The vacuum gauge shall have a range to no more than thirty (30) inches of mercury, with scale markings of no greater than one-half (1/2) inch of mercury vacuum and an accuracy to within ± two percent (2%) of true vacuum.

The vacuum test shall be conducted by plugging all incoming and outgoing sewer lines in the manhole at a location beyond the connection of the sewer pipe with the manhole. All plugs shall be blocked in place so as not to move during the test. The vacuum testing collar shall be inflated in the frame in accordance with the equipment manufacturer's recommendations. A vacuum of ten (10) inches of mercury shall be drawn and the vacuum pump turned off and the valve between the vacuum pump and the vacuum gauge shall be turned off.

The time period which is taken for the vacuum to fall from ten inches (10") of mercury to nine inches (9") of mercury shall be determined. If the time taken for the vacuum to reduce the ten inches (10") of mercury to nine inches (9") of mercury is less than the time indicated in the following Table, then the manhole work shall be considered not acceptable and shall be rejected. If the time is equal to or exceeds the time indicated below, the manhole work shall be accepted.

Manhole Depth (ft.)	Time (sec)		
Diameter =	48"	60"	72"
8	20	26	33
10	25	33	41
12	30	39	49
14	35	46	57
16	40	52	65
18	45	59	73
20	50	65	81
22	55	72	89
24	59	78	97
26	64	85	105
28	69	91	113
30	74	98	121
For each add'l 2' add:	5	7	8

Contractor shall submit to the DPW the results of each manhole vacuum test. Such reports shall include a description of the location of the manhole, the time, date and weather of the test, a list of all persons present, the diameter and depth of the manhole and the allowable test results, and the actual test results.

All manholes shall be repaired by Contractor and retested as described above until a successful test is made. After each test, the temporary plugs shall be removed.

Once all manholes have been tested, the manholes will be given a field visual inspection. The inspection shall be performed at the discretion of the DPW during the warranty period following a rainfall sufficient enough to raise the groundwater table above the problem areas. All leakage problems determined by this inspection shall be corrected by the Contractor within an agreed upon time to the satisfaction of the DPW. Where necessary to complete the work, the Contractor shall be responsible for the bypassing and/or blocking of the flow in the manholes and must have prior approval by the City Engineer or DPW. It will be the Contractor's responsibility to supply his own traffic control as required by the particular location and/or jurisdiction.

D. Storm Sewer Testing

All rigid pipe shall be lamped; any misalignment shall be repaired.

All flexible pipe shall receive a deflection test as required by paragraph B. Deflection test shall be limited to 7% of the vertical, internal pipe diameter.

E. Force Main Testing

1. General

After the pipe has been laid and partially backfilled, all newly laid pipe or any valved sections of it shall be subjected to a hydrostatic pressure tests. The duration of each pressure test shall be for a period of not less than two hours and not more than six hours. The basic provisions of AWWA C-600, Section 4 shall be followed for all pressure testing.

The test pressure shall not exceed pipe and/or thrust resistant design pressures. The test pressure shall not vary by more than plus or minus 5 psi for the duration of the test.

All newly laid pipe or any valved section thereof shall be subjected to a hydrostatic pressure of at least 1.5 times the working pressure at the point of testing or 50 psig whichever is greater.

2. Pressurization

Each valved section of pipe shall be slowly filled with water 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 DPW. The pump pipe connection and all necessary apparatus, including gauges and meters shall be furnished by the Contractor. Before applying the specified test pressure, air shall be expelled completely from the test section.

Any exposed pipe, fittings, valves, and joints shall be examined carefully during the test. Any damaged or defective pipe, fittings, valves, 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 the DPW or his representative.

3. Leakage Test

After the completion of the pressure test a leakage test shall be conducted to determine the quantity of water lost by leakage under the specified test pressure. 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 be measured by a drop in pressure in a test section over a period of time.

For sanitary pressure lines, no leakage shall be permitted during the 2 hour test period.

F. Lift Station Pump Testing

Lift station pump test will be performed by the DPW or his representative during the lift station's final inspection. The Contractor shall be responsible for providing the clean water to run the pumps and perform the test(s).

1. Manufacturer's Start-Up

   Prior to the DPW's final inspection of the lift station equipment, the Contractor shall be responsible for coordinating start-up activities with the pump manufacturer's representative in accordance with the manufacturer's requirements. The DPW or his representative must be present at the time of manufacturer's start-up.

   Any deficiencies in equipment and/or workmanship noted during the manufacturer's start-up shall be remedied by the Contractor prior to final inspection.

   Upon successful completion of the manufacturer's start-up, the manufacturer shall deliver to the Contractor:

   a. Three (3) copies of a letter certifying that all pumping and electrical equipment has been installed and is operating in accordance with manufacturer's requirements;
   b. Two (2) sets of Operation and Maintenance Manuals; and
   c. One (1) complete set of Spare Parts as specified.

2. Final Inspection

   The Contractor shall provide the following pump test equipment and materials:

   a. Water to conduct test;
   b. Amp/volt meter;
   c. Stop watch;
   d. Tape or level rod to measure float settings;
   e. Keel to mark float settings on lift station wall;
   f. Calibrated test gauge to measure operating head. The gauge shall be calibrated in feet of water from 0 to 100 feet in one foot increments; and
   g. Manufacturer's pump performance curves.

   The DPW's representatives attending the final inspection shall re-check any deficiencies. The DPW's representatives shall then complete a cursory final inspection checklist and perform pump down tests which shall include the following:

   a. Manual check of all level ON-OFF operation, alarm and run lights;
   b. Determination of inflow rate (if any);
   c. Determination of pump capacity for each pump individually and both/all pumps simultaneously;

d. Determination of pump capacity with force main full. Verification of full force main shall be determined by pressure gauge provided by Contractor. Force main shall be considered full when the line pressure stabilizes; and

e. Plot performance of each pump or pump curves provided by Contractor.

Contractor shall provide all water necessary to conduct the pumping tests, and shall provide a connection for the test gauge on the blind flanged tee in the valve vault. The stem connection shall be equipped with a plug valve to close the connection after testing is complete. The connection shall be left in place and shall be suitable for use as an air bleed off.

The pumping test results must meet or exceed the design pumping criteria approved by the DPW to successfully pass the final inspection. Any deficiencies noted during the final inspection shall be repaired/replaced by the Contractor to the satisfaction of the DPW and reinspected/retested prior to final acceptance.

9.04 Lateral Location Forms

The Owner/Contractor shall submit a lateral location form for each lot. The form shall be completed and signed by the Contractor, the DPW or his representative during lateral inspection. This form shall include one (1) Polaroid type photo taken from the point of connection to the public sewer, looking back along the lateral to the building.

9.05 Acceptance

In order for the DPW to issue final acceptance, the following items shall be submitted, completed or on file:

A. Copies of all testing reports and data;
B. Copies of all O & M Manuals for lift station(s) (if applicable);
C. Pump manufacturer's certification letter (if applicable);
D. Lift station final inspection checklist (if applicable);
E. Final payment for inspection services;
F. Lateral location forms;
G. As-Built drawings;
H. Maintenance bonds; and
I. Daily inspection reports.

SECTION 10

EROSION CONTROL

10.01 General

This section provides the general guidelines for the control of erosion and sediment for construction sites. Control of sedimentation for construction site may be accomplished through utilization of a variety of control practices. The complexity of the erosion and sediment control plan will vary depending upon individual site conditions. The goal of such a plan is to limit the quantity of sediment leaving the construction site. The Contractor's plan must be approved by the DPW and City Engineer.

In addition, the Contractor must also comply with Rule 5 327 IAC 15-5 for land alteration which disturbs 5 acres or more.

10.2 Permitting Requirements

If the Owner/Contractor is required to submit a soil erosion control plan to the State under Rule 5 (327 IAC 15-5), such plan shall be deemed in compliance with DPW requirements. In this case all applicable State and Federal permits or notices for land disturbing activities shall be obtained or filed prior to beginning land disturbing activities. Copies of all applications, letter of intent, submittals, plans and other erosion and sediment control related information shall be submitted to the DPW and City Engineer.

10.3 Design Guidelines

In order to fully achieve an acceptable level of erosion and sediment control on the construction site, the following design principles shall be fully adhered to during site analysis and development of the erosion and sediment control plan:

A. Existing site contours should be followed as close as reasonably possible in order to minimize cut and fill.

B. Existing natural vegetation should remain undisturbed for as long as possible during the construction activities. Naturally vegetated areas along property lines, jurisdictional wetlands, lakes, and watercourses, both natural and man-made, should be left undisturbed during all phases of the site construction. These vegetative filter strips will be required at the discretion of the DPW.

C. A logical sequencing of site construction activities must be provided in order to minimize the size of exposed land areas, and the length of time land areas are left without some form of temporary or permanent soil protection.

D. Soil stockpiles shall be stabilized utilizing either vegetative establishment, sediment trapping barriers, or erosion control measures such as tarping or mulching, singly or in combination.

E. Storm sewer inlets which are made operable either before or during the construction phase of development shall be provided with protection from siltation.

F. Stable, properly maintained construction traffic access routes and stream crossings shall be identified on the site erosion and sediment control plan as needed. These construction access routes shall be installed as part of the site perimeter sediment control barriers, prior to the initiation of on-site land alteration activities. Where sediment is transported onto public street or road surfaces, these streets or roads shall be cleaned thoroughly at the end of each day. Sediment shall be removed by either scraping, shoveling or sweeping and be transported to a controlled fill area. Street washing will be allowed only if wash water flows to a controlled sediment trapping area.

G. Runoff velocities shall be kept as low as possible.

H. A thorough maintenance and follow-up program, and identification of the person(s) responsible for its implementation will be required.

The latest edition of the Indiana Handbook for Erosion Control in Developing Areas (HECDA) shall be used for detailed technical guidance for all erosion and sediment control practices. The following general practice guidance applies to the development of all control plans:

A. Perimeter Control - Perimeter control measures shall be installed as specified on the approved plan, including: construction access drives, straw bale dams and fabric fencing, temporary sediment traps, sediment basins, and diversions.

B. Vegetative Control - Disturbed areas which are at finish grade shall be permanent seeded within seven (7) days. At the discretion of the DPW; barren areas to be rough graded and left undisturbed for more than thirty (30) days shall be established with temporary vegetation; and dormant seeding will be required during seasonal periods (October through February) for those barren areas to be left undisturbed for one hundred and twenty (120) days or longer.

C. Slope Protection - Slope protection shall be provided by use of temporary and permanent diversion levees, vegetative cover, and slope drains. Concentrated stormwater flows shall not be allowed to flow down cut or fill slopes without proper slope stabilization.

D. Sediment Trapping - To achieve the goal of preventing sediment from leaving the construction site, the DPW will require the use of sediment barriers such as fabric fencing, straw bale dams, and sediment basins.

E. Protection of Outlet Channel - Concentrated stormwater runoff leaving a development site shall be outletted to an open channel, storm sewer pipe or culvert which is capable of receiving this discharge. Runoff velocities shall be controlled during all storm events so that the peak runoff velocity during and after the completion of the land alteration approximates existing conditions.

The principles and practices provided by the State in Rule 5 are to be followed in the development of all control plans. Rule 5 does not give specific requirements for use of various practices leaving that to the localities. Individual practices can be modified or waived upon request to the DPW based on special site characteristics and conditions.

The designer should rely on the Indiana Handbook for Erosion Control in Developing Areas (HECDA) for detailed design, construction and maintenance criteria for all erosion control practices. Such criteria shall be required by the DPW unless waived in writing. The manual can be obtained from:

Urban Conservation Program
Division of Soil Conservation
Indiana Department of Natural Resources
402 West Washington Street, Rm. W-265
Indianapolis, Indiana 46204-2748

FINAL INSPECTION

SUBMERSIBLE LIFT STATION CHECK LIST

Job No.:
Address:
Contractor:
Engineer:
Pump Supplier:
KW Meter No.:
Date:

I. ELECTRIC

A. Is the power system 3 phase or 1 phase?
B. If 3 phase, is grounded neutral provided? YES ( ) NO ( )
C. If above answer is "No", is transformer installed? YES ( ) NO ( )
D. Voltage Readings:
   1. Between phases: L1, L2 _____ L1, L3 _____ L2, L3
   2. High phase to ground:
   3. Other legs to ground:
E. High leg (L_3) is connected to motor only and not to any auxiliary circuits:
   YES ( ) NO ( )
F. Do latches on control panel work smoothly? YES ( ) NO ( )

Remarks

II. PUMP AND MOTOR CONTROLS

A. Breaker switches operate properly:
   1. No. 1 Pump YES ( ) NO ( )
   2. No. 2 Pump YES ( ) NO ( )
   3. Control Circuit YES ( ) NO ( )
   4. Remote Monitor Circuit YES ( ) NO ( )
B. Hand-Off-Automatic Switches:
   1. No. 1 Pump Hand Position Operates YES ( ) NO ( )
   2. No. 2 Pump Hand Position Operates YES ( ) NO ( )
C. Amperage:
   1. Name Plate Rating (amps) No. 1 Motor
   2. Amps Pulled By No. 1 Motor
   3. Name Plate Rating (amps) No. 2 Motor
   4. Amps Pulled By No. 2 Motor

D. Automatic Operation:

1.	No. 1 Pump Automatic Position Operates	YES ( )	NO ( )
2.	No. 2 Pump Automatic Position Operates	YES ( )	NO ( )
3.	Do the level controls sequence pumps properly properly with relation to lead pump on, lag pump on, and alternation?	YES ( )	NO ( )

E. Seal Failure/Heat Sensor:

1.	Seal failure wires connected properly to seal failure circuit?	YES ( )	NO ( )
2.	Test seal failure circuit OK:	YES ( )	NO ( )
3.	Heat sensor wires connected properly to heat sensor circuit?	YES ( )	NO ( )
4.	Test heat sensor circuit OK:	YES ( )	NO ( )

F.

1.	High water alarm light and horn activate with test button:	YES ( )	NO ( )
2.	Horn silence with silence button?	YES ( )	NO ( )
3.	High water alarm light and horn activate with float?	YES ( )	NO ( )

G. Level Setting:

1. Lead pump kicks **on** at EL ____ (____' _____") from wet well bottom.
2. Lead pump kicks **off** at EL ____ (____' _____") from wet well bottom.
3. Lag pump kicks **on** at EL ____ (____' _____") from wet well bottom.
4. Lag pump kicks **off** at EL ____ (____' _____") from wet well bottom.
5. Height of influent sewer above floor of wet well _____' _____".
6. Height of high water above floor of wet well _____' _____".
7. Top of basin EL _____.
   Total basin depth _____' _____".

Remarks

III. PUMPS AND MOTORS

A. Operation

1. Are pumps running quietly?

a.	No. 1	YES ( )	NO ( )
b.	No. 2	YES ( )	NO ( )

2. Are motors running quietly?
   a. No. 1 YES ( ) NO ( )
   b. No. 2 YES ( ) NO ( )
3. Is excessive vibration noticed?
   a. No. 1 YES ( ) NO ( )
   b. No. 2 YES ( ) NO ( )

Remarks

IV. REMOTE MONITOR PANEL (if required)

A. Verify start-up procedure completed properly and put "On Line" by remote monitor panel supplier: YES ( ) NO ( )

V. VALVES

A. Check Valves
   1. Do clappers swing freely? YES ( ) NO ( )
   2. Does packing leak? YES ( ) NO ( )
   3. Are counter weights adjusted properly? YES ( ) NO ( )

B. Plug Valves
   1. Do valves open and close properly? YES ( ) NO ( )
   2. Does packing leak? YES ( ) NO ( )
   3. During operation, are all gates completely open? YES ( ) NO ( )

Remarks

VI. PUMP DOWN TEST

A. Diameter of wet well _____' _____".
(Re: 6'0" = 212 gallon/ft) (7'0" = 288 gallon/ft) (8'0" = 376 gallon/ft)

ITEM	LEVEL	LEVEL DIFFERENCE	GAL.	TIME	TIME DIFFERENCE	GPM
Pump #___ ON	______	____________	____	____	___________	
Pump #___ OFF	______	____________	____	____	___________	
Pump #___ ON	______	____________	____	____	___________	
Pump #___ OFF	______	____________	____	____	___________	
Pump #___ ON	______	____________	____	____	___________	
Pump #___ OFF	______	____________	____	____	___________	
Pump #___ ON	______	____________	____	____	___________	
Pump #___ OFF	______	____________	____	____	___________	
Pump #___ ON	______	____________	____	____	___________	
Pump #___ OFF	______	____________	____	____	___________	

Pump # _____ Average GPM
Pump # _____ Average GPM
Pump # _____ Average GPM
Pump # _____ Average GPM

VII. ALARM SYSTEM

A. Code Indication - Functioning

1. Pump overload trip: YES ( ) NO ( )
2. Wet well high water: YES ( ) NO ( )
3. Submersible seal failure: YES ( ) NO ( )
4. Power failure: YES ( ) NO ( )
5. Open: YES ( ) NO ( )
6. Restore to normal: YES ( ) NO ( )
7. Low battery: YES ( ) NO ( )

Remarks

VIII. EQUIPMENT

	Manufacturer	Model	Size	Serial #
A. Pumps:				
B . Motors:				
C. Pump Circuit Breaker:				
D. Starters:				
E. Heaters:				
F. Control Circuit Breaker:				
G. Remote Monitor:				
H. Circuit Breaker:				
I. Alternator:				
J. H-O-A Switches:				
K. Plug Valves:				
L. Check Valves:				
M. Other:				
1.				
2.				

Remarks