SECTION 4 – SMALL DRAINAGE STRUCTURES

4.1 GENERAL *(Rev. 10-22-09)*

The construction of well built structures that will adequately take care of drainage, both surface and subsurface, is an important responsibility. Failure in our road surfaces and innumerable complaints from property owners along the highway will result if this part of the work is not given careful attention.

If time permits, the PE/S may obtain a copy of the drainage design calculations and check for errors or discrepancies in information such as land use. An examination of existing structures after a heavy rain or reviews of local inquiries as to the adequacy of the existing structures are two sources of valuable information.

Recommended changes should be reviewed with the designer, through the Project Manager, and any changes agreed upon should be implemented by a Change Order.

4.1.1 Structure Sump Requirements

The Indiana Department of Environmental Management (IDEM) requires small structures to be constructed so that after construction natural stream bed material will be naturally deposited along the flowline of the stream and within the structure limits.

To achieve this requirement, pipe structures, box culverts and 3-sided culvert structures are designed with a specified sump depth. The sump depth is a defined depth below the designed flowline at which the invert of a pipe structure and the top of scour protection for culverts is to be placed. Figure 4.1 shows a typical section through a 3-sided culvert that includes the sump depth. The PE/S should review the plans and Standard Drawings for a better understanding of the sump depth and for the specific depth requirement for each structure.

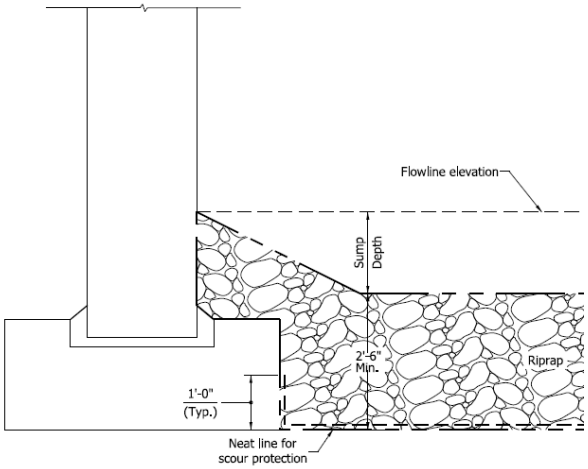

Figure 4.1 Sump Depth Indication for 3-Sided Culvert

Since the intention is that natural stream bed material is desired to be deposited along the stream channel, the PE/S should ensure that the sump of a structure is constructed correctly. Upon completion of the work, this will leave the structure in a condition that

accumulates water in the sump area. This is the intent and no material should be placed during the project to fill the sump unless otherwise directed.

4.2 COUNTY DITCHES *(Rev. 01-01-02)*
Legal drains, whether open ditches or piped, have legal flow lines that have been established by the county authorities.

Before any structures under the roadway are staked, the location of the county ditches and the legal flow lines thereof should be obtained from the County Surveyor. Where a legal flow line can be established, the datum on the county ditch should be equated to that on the road plans. The flow lines of pipes or boxes should be placed at or below the legal flow lines.

4.3 STAKING STRUCTURES *(Rev. 01-01-02)*
Structures should be staked at plan location and flow line. Minor changes are frequently necessary to fit existing ground conditions and should be approved by the PE/S prior to installation. The upstream end of structures under the roadway should be 0.2 ft to 0.5 ft below the lowest ground, ditch, or tile ditch to be drained. The grade then should be approximately straight to the point where the water will leave the right-of-way. The minimum distance from the edge of pavement to the inner face of headwalls on boxes, and under fill slab tops shall meet clear zone requirements. Headwalls and handrails should be parallel to the pavement, and if they are visible to traffic, the top should be parallel to the grade of the pavement. Pipe structures parallel to the centerline at intersecting roads shall be constructed according to the standards for the type of intersection shown on the plans.

4.4 FOUNDATIONS *(Rev. 01-01-02)*
Structures should be placed on stable foundations. Our specifications provide that unstable material excavated below the planned foundation of the structure be paid for at three times the bid price for the class of excavation involved providing the additional amount involved at the structure exceeds 10 cu yd. This additional excavation should usually be backfilled with B Borrow and paid for as a separate item. Tests should be made of foundations for slab top culverts, and if the foundation is unstable, piling will be required unless the unsuitable material is shallow enough that it may be excavated and the footing lowered. If large quantities of unstable material are encountered, the AE should be contacted for approval of the method required to stabilize the structure foundation.

Structures should never be placed on frozen ground.

4.5 BUILDING FORMS & PLACING STEEL *(Rev. 01-01-02)*
Before each concrete pour, both forms and steel should be carefully and thoroughly checked. Forms should be checked for stability and strength as well as dimension. All lumber in contact with the concrete shall be free from knot holes, splits, warps, and other defects. Forms for the portion of the structure that is to be finished by rubbing should be lined with plywood or other approved material that will leave a surface free of board marks. Exposed edges should be checked for correct size of bevel or chamfer strips.

The specifications provide that forms are tied together with a combination tie and strut, the outside 1 in. of which can be removed and its hole filled with mortar. A wall form properly tied will not need wood struts. Wire ties shall not be used.

Footings or floors should be thoroughly cleaned before abutment or wall concrete is placed on them.

Reinforcing steel should be secured so that it will not shift during the placing of concrete. Steel which has a detrimental scale or rust shall be cleaned, but in no case shall steel be used which is rusted deeply or pitted. New steel can be maintained in good condition by storing it on skids and covering it as provided by the specifications. Any dirt or other foreign material should be removed from the steel before placing concrete.

4.6 CONSTRUCTION JOINTS *(Rev. 01-01-02)*
Horizontal and vertical construction joints shall only be placed as shown on the plans or as approved by the designer.

4.7 PLACING STRUCTURAL CONCRETE *(Rev. 04-07-09)*
The contractor should not be allowed to start a concrete pour until forms and steel have been checked by the PE/S.

The specifications require a slump between 1 and 4 in. (except for foundation seal concrete or when using specialty concrete). Between these limits the concrete should have as low a slump as will flow into a mass free of honeycomb. A greater slump will be required for thin box walls than for footings of a slabtop.

In order that concrete can be properly consolidated, the specifications require that wall sections be placed in not more than 24 in. layers. Each succeeding layer should be placed before the previous one has initial set. The specifications require the use of vibrators. The vibrator should follow immediately behind the placing of each lift of concrete, being slowly lowered and directly lifted out at about one foot intervals. Vibrators should not rest against the forms or reinforcing steel. Vibrations transmitted to partially set concrete seriously impair its strength. Excess vibration is to be avoided.

A set of test beams should be made for each barrel pour of a box culvert and each floor pour of a slabtop culvert. The beams should be subjected to the same curing as the structure. Forms may be removed from vertical surfaces not less than 12 h after the concrete has been poured unless prevailing weather conditions require a longer period. Forms under floors are to remain in place for five days or until the flexural strength is 390 lb/sq in. Traffic will not be permitted on any structure for 15 days or until the test beams show a flexural strength of 550 lb/ sq in. All flexural strength results are obtained by third-point loading.

4.8 PLACING STRUCTURAL CONCRETE--COLD WEATHER *(Rev. 04-07-09)*
The specifications require that when concrete is placed at or below an atmospheric temperature of 35°F or when the temperature may fall below 35°F within the curing

period, the water, aggregates, or both shall be heated and suitable enclosures and heating devices shall be provided. This entails heating the concrete both before and after placing. The temperature to be maintained is specified in Section 702 of the SS.

The contractor should keep a watchman on the job, during the heating period, to insure the maintenance of proper temperature and to see that the concrete is not damaged by fire. Any concrete placed when the air temperature is at or below 35°F will be at the contractor's risk.

The use of admixtures to accelerate setting or to prevent freezing of the concrete are not permitted.

4.9 FINISHING *(Rev. 04-07-09)*
All concrete surfaces must be given a finish in accordance with the specifications after removal of forms. Attention should be paid to filling air holes and irregularities. All joints and chamfers must be power ground to a smooth finish.

4.10 SKEWED STRUCTURES *(Rev. 01-01-02)*
Where box culverts are placed on a skew, the dimensions of the box as shown on the plans are measured perpendicular to the centerline of the structure. On skewed slab top structures, the span as shown on the plans is measured parallel to the road centerline.

4.11 PIPE CULVERTS *(Rev. 11-14-16)*
The trench in which the pipe is to be laid shall be cut to conform to the bottom of the pipe thus insuring a uniform even bearing on solid compact earth being sure to "recess" for all bells so there will be no bearing on the bell.

The contractor must use proper construction methods when laying pipe culverts. It is important that the State personnel inspecting this work is familiar with the requirements of the specifications and see that the methods outlined therein are complied with.

Under certain conditions, corrugated metal pipe must be strutted. Refer to the SS to determine the applicable provisions for strutting. This strutting is done prior to shipment of pipe and should be left in place until the entire fill over the pipe is compacted.

Before the final inspection of the project, all pipe structures must be inspected for damage to the bituminous coating or paved invert.

4.11.1 Inspection of Pipes
All pipes, except underdrains, must be visually inspected no sooner than 30 days after completion of the backfill for indications of joint failures, excessive deflection or other damage. If a pipe cannot be visually inspected, then the contractor must provide for video inspection of the pipe.

The PE/S should review the contract quantity for the video inspection pay item and use the quantity to provide inspection for those sections of pipe that present the most risk if they should have joint failures, excessive deflection or other damage. Section 715 of the

SS covers video inspection of pipes.

For more information regarding the below items and pipe inspection, refer to the Inspection Manual for Pipe found on the Materials and Management website.

- Pipe Structures
- Pipe Placement
- Measurements of Pipe Items
- Manholes, Inlets, and Catch Basins
- Structure Backfill and Inspection
- Relining Existing Pipe Structures
- Calculating Pipe Lengths
- Concrete Pipe
- High Density Polyethylene (HDPE) Pipe
- Metal Pipe
- Metal Pipe Structures
- Polypropylene Pipe
- Polyvinylchloride (PVC) Pipe
- Reinforced Thermosetting Resin Pipe
- Utility Pipe.

4.11.2 Mandrel Testing of Thermoplastic Pipe

For the purposes of these instructions as well as the SS, the terms nominal diameter, pipe pay item diameter, and pipe pay diameter are synonymous. The SS require that thermoplastic pipe be in accordance with either AASHTO or ASTM specifications. The nominal pipe size or nominal pipe diameter, the AASHTO or ASTM designation, as well as other identifying information, (the product marking line) is required to be stamped on the pipe at regular intervals. The PE/S should use this information to ensure that the correct material is being used on the contract.

Thermoplastic pipe (HDPE or smooth wall PVC) that is 36 in. or less in nominal/pipe pay diameter must be mandrel tested after the visual or video inspection has been completed and reviewed. The pipe materials that fall into the thermoplastic pipe category are polyethylene and smooth wall polyvinyl chloride pipes that are in accordance with SS 907.19, 907.20, 907.21, 907.22, or 907.23, with the following exception: mandrel testing is not required for profile wall polyvinyl chloride pipe that is in accordance with both 907.22 and ASTM F 949 unless visual or video inspection indicates possible deformation.

A mandrel is a device with arms or prongs that is pulled by hand through a pipe to check that the pipe does not exceed the maximum deflection criteria allowed by the specifications. Prior to a mandrel test, the inspector must check the mandrel to ensure that the diameter of the mandrel should be 95% of the nominal pipe diameter that is stamped on the pipe. The mandrel test is a pass or fail test.

Form IC 715, Mandrel Testing of Pipe Structures, is to be used by field personnel to document mandrel testing of thermoplastic pipes. A copy of this form is included at the end of this section and is also available on the Department's website.

The following procedure is to be followed for mandrel testing:

- Determine which pipe structures will require mandrel testing and note them on an IC 715 along with the pipe material specification reference (i.e. – 907.19), nominal/pipe pay diameter and pipe structure length.
- Note the date that the backfill is completed for each structure.
- Visually inspect the pipe no sooner than 30 days after backfill is completed. Look for obvious damage, such as excessive deflection or joint failures.
- If the pipe cannot be visually inspected, require the contractor to perform a video inspection of the pipe. Review the results of the video inspection for damage.
- After the visual or video inspection, require the contractor to perform the mandrel test. Note the mandrel requirements in the specifications and check the mandrel to ensure that it has a diameter that is no less than 95% of the nominal/pipe pay diameter.
- Note the date of the mandrel test on the IC 715.
- Have the contractor pull the mandrel through the pipe by hand.
- Record the result, either pass or fail, on the IC 715 for each structure tested.

If the pipe fails the mandrel test or the mandrel causes obvious damage to the pipe, require the contractor to remove and replace the deficient portion of the pipe. The deficient portion should be removed and replaced to the nearest pipe joint or structure, such as a manhole or inlet.

Lengths of pipe replaced must be mandrel tested in accordance with the procedure outlined above. A note should be made on the IC 715 that the test is being made for a replacement pipe.

Forms IC 715 are to be kept in the project file and a copy sent to the Division of Construction Management.

4.11.3 Thermoplastic Slip Lining Existing Pipe

In certain situations, the plans may indicated that existing pipes be rehabilitated by slip lining with a thermoplastic liner rather than replacing the structure. The plans will indicate whether a circular or deformed liner will be used as well as the maximum number of joints and the corresponding maximum length of each section of liner pipe. The contractor may submit a written request to use a liner pipe that is longer than indicated in the plans. The contractor's written request must also address the change in the number of joints associated with the requested liner length. The contractor must select the liner pipe from the Department's list of approved Plastic Pipe and Pipe Liner Sources, or provide a certification, in accordance with 907.25 and ITM 804 sections 4.23 or 4.24, for liner pipes not on the approved sources list. All liner pipe must be submitted for review prior to installation.

(a) Materials

When circular liner pipe is shown on the plans, the choices for lining the existing pipe structure include solid wall HDPE liner pipe; profile wall HDPE liner pipe; or profile wall PVC liner pipe.

When deformed liner pipe is shown on the plans, the only choices for lining the existing pipe are solid wall HDPE liner pipe or profile wall HDPE liner pipe.

The cellular grout used for the filling of the annular space between the inside of existing pipe and the outside of the liner is accepted in accordance with the Frequency Manual under the heading of Cellular Concrete Grout.

(b) Quality Control

The contractor is required to submit a quality control plan (QCP), in accordance with ITM 803, for acceptance by the PE/S prior to the start of the lining operation. The QCP should be contract specific and contain a description of the proposed work in the lining operation including the following:

1. Name of the QCP Manager, their qualifications, contact information, and duties
2. Sequence of the pipe lining operations
3. Equipment and method to deform liner pipe
4. Destructive test method for welded, butt-fused, or joined liners
5. Method to calibrate the cellular grout pump gauges
6. Methods to achieve proper placement of the cellular grout
7. Identification of potential problems with the lining operations, including possible grout leakage, and the proposed resolutions.

A quality control representative is required to be on-site for the initial testing of the first welding or fusing of the liner pipe at each installation location and for the joining, welding, or fusing of the liner pipe at each location.

(c) Joints

Liner pipes have the option to be joined using a variety of methods including:

- Bell and spigot
- Screw type
- Grooved press-on
- Butt fused
- Extrusion weld
- Other joint as recommended by the liner pipe manufacturer.

Welded liners shall have a continuous weld bead both inside and out. The welding bead shall be smooth, protrude no more than 3/8 in. into the interior of the liner, and not adversely affect the hydraulic capacity of the liner.

The operators performing welding, butt-fusing, or joining for the liner pipe shall be

trained and certified by either the liner pipe manufacturer or the welding, butt-fusing, or joining equipment manufacturer. The PE/S shall be provided a copy of the operator's current and valid certification prior to the beginning of any joint work.

A demonstration of the method described within the QCP for destructive testing of the joint should be performed by the operator for all welded, butt-fused, and joined liner pipe. The operator shall perform the destructive test at the beginning of each day's joint operations.

All pipe liner joints shall be in accordance with the manufacturer's recommended procedures, and be visually inspected before acceptance. Any joints that do not pass the visual inspection should be removed and a new joint should be fabricated. The re-fabricated joint will be visually inspected prior to acceptance.

(d) Installation

Installation of the liner pipe begins with the cleaning of the interior of the existing structure and the repair of all deformities. After cleaning, a walk through should be performed in order to visually assess the condition of the existing structure. If a walk through cannot be performed, the contractor shall perform a video inspection. The PE/S should receive a copy of the video. If the contractor believes that the work cannot be performed as planned after the visual inspection, the PE/S must be informed immediately and discussions with the designer must occur.

The contractor may desire additional area for their installation operations beyond the right-of-way limits provided in the contract. In this situation, the contractor should pursue agreements from adjacent property owners in accordance with 107.14.

After cleaning of the existing pipe, the contractor should check the size of the liner pipe to verify that the required cross-sectional area can successfully be placed inside the existing structure. If problems are found to exist before the installation, the contractor must submit a substitute liner pipe plan to the PE/S for approval. If problems are not discovered until installation has begun, the contractor is required to remove the portion of the liner pipe already installed and submit a substitute liner pipe plan to the PE/S for approval.

All visible and obvious cavities outside the existing structure should be filled with non-removable backfill in accordance with 213 prior to the start of the lining operation. If the contractor's QCP indicates that the cavities are to be filled in conjunction with the grouting operation, cellular concrete grout should be used in lieu of non-removable backfill.

Prior to filling the annular space between the existing structure and the liner pipe with cellular grout, bulkheads should be built on each end of the structure. The bulkheads should be free of leaks and should be strong enough to withstand the pressure of the injected grout. The bulkheads should extend from the end of the existing structure inward to a minimum thickness of 18 in. The exterior surfaces of the bulkheads should be given a smooth troweled finish.

The injection method used to place the cellular grout shall be explained within the contractor's QCP and should be monitored during placement so that the grout completely fills the annular space between the existing structure and the liner pipe. The grout injection methods must not cause distortion of the liner pipe, nor cause the liner pipe to float. Within the QCP, the contractor shall explain the methods to be used to regulate and maintain injection pressure. These methods should be based on the liner pipe manufacturer's recommendations.

Any storm water management features installed, including pump arounds, should be monitored during the cellular grout injection operation. Grout will follow the path of least resistance in its attempt to fill existing voids and reduce injection pressure. If the grout is found to be leaking into any adjacent body of water or other potential problematic areas, operations should be stopped, and the leakage identified and corrected prior to re-starting the operation. After the restart, all adjacent areas should continue to be monitored for grout leakage.

Any existing drainage structures connected to the structure being lined must be perpetuated and kept free of the injected cellular grout.

(e) Payment

Payment for the total length of thermoplastic liner pipe will include the measured length of the existing pipe that has been lined plus a maximum of 8 in. beyond the end of the existing structure. For example, if a thermoplastic liner pipe is used to line an existing 20 ft cross structure, the total payment for the liner would include the measured length of the existing cross structure plus the 8 in. length extending beyond each end of the existing pipe [20' + (2 x 8")].

In some cases, the design may indicated that specific types of end sections are to be installed on the liner pipe. These specific end sections may be indicated as a separate pay item. For the special situations in which a separate pay item has been included for the end sections, payment should be made for the specified end sections in addition to the payment of the liner pipe.

Payment for the liner pipe is intended to be all inclusive, except when end sections are identified to be installed as described above. The payment should take into account all necessary work and all incidentals for the work required. Perpetuation of existing structures connected to the existing pipe are required to be paid separately for each pipe perpetuated.

4.12 PRIVATE ENTRANCE STRUCTURES *(Rev. 04-07-09)*

Private entrance structures shall be placed where such structures are shown on the plans or wherever private entrances or drives definitely existed prior to the award of the contract and drainage structures are needed.

Approaches shall not be graded at private drives or entrances beyond the right-of-way at State expense unless specifically called for on the plans. Approach grading is discussed

further in Section 19 of these instructions. It is the policy of the Department to perpetuate access to all properties although the plans may not provide for the same number or same location of drives. If any property is not being given access or existing drives are shown to be eliminated, contact your AE to determine how to proceed. Any changes in locations of private drives to satisfy the property owner should be requested in writing by the property owner. Discuss such requests with the AE and, if the change is in contradiction with the special provisions of the right-of-way grant, or could otherwise become a controversial matter.

4.13 TILE DRAINS *(Rev. 04-07-09)*

Accurately locate all tile drains crossing the project or affected by the construction, and make adequate provision for taking care of them. This can be accomplished only by consulting with the property owners and by making a careful study of the ground. The latter is very necessary because property owners frequently do not know the tile location, particularly when tile drains were placed by former owners.

Where farm drains cross the road, every precaution should be taken to preserve them in at least their original state of efficiency. Tile drains shown on the plans, which are to be left in place, but are damaged by carelessness on the contractor's part, must be replaced by the contractor. Tile drains, which are discovered before any work is done, but which are not shown on the plans, should be marked on the As-Built plans. In general, farm tile 6 to 10 in. in size, which are 4 ft or less under the ground surface, should be replaced with sewer pipe when the tile lays under the roadway. Farm tiles 12 in. or larger crossing under the pavement should always be replaced with pipe that meets current standards for structures under pavement.

Drain tile paralleling the roadway, but not under it, may be replaced in kind.

When a farm tile is intercepted by ditches that provide adequate drainage for the tile, at least two sections of sewer pipe and a sod collar should be placed on the outlet end. The balance of the tile under the road shall be removed if they are 12 in. in diameter or larger.

If necessary to excavate for locating underground drainage, the accepted cubic yards involved will be paid for as per Section 203 of the SS.

Sometimes tile will be intercepted which appears to be abandoned or no longer used as a drainage medium. Do not assume that such tile is "abandoned" or need not be replaced until a thorough investigation has been made to determine its status.

4.14 SUBSURFACE DRAINAGE *(Rev. 04-07-09)*

The locations of subsurface drains are shown on the plans. The grades for these drains may or may not be shown on the plans. In any event, it is necessary to coordinate the grades with the grades of culverts under the pavement. Wherever practicable the cross structures should be low enough to outlet the drains. Otherwise the drain should be low enough that the culvert will not lay directly upon it.

On some projects the OGE makes specific recommendations for subsurface drainage,

other than the subbase drains through cuts referred to above. These recommendations along with the conditions observed as cuts are opened up should be reviewed with the AE relative to modification with respect to actual field conditions.

Perforated pipe is placed with the perforations down. This assists in the prevention of infiltration of silts, gravel and other solids that might clog the line and destroy the effectiveness of the system. It is very important that the perforated lower segment is placed in a manner that the rows of holes are symmetrical with respect to the vertical axis of the pipe.

The laying of pipe or tile and its backfilling is adequately covered in the SS and these provisions should be carefully followed. In addition, care must be taken to insure that the top of the backfill is clean and free of any foreign material when the subbase material is placed over the subsurface drain aggregate.

4.15 GEOTEXTILES USED WITH UNDERDRAINS *(Rev. 04-07-09)*

A filter fabric (geotextile) is normally used where silty soil is encountered within the immediate subgrade. The fabric, when specified, should be placed along the sides and bottom of the trench before placing any aggregate backfill. Fabric should not be used on the top of the trench.

Storage and handling of geotextiles should be in accordance with the manufacturer's recommendations, except that in no case should the geotextile be exposed to direct sunlight, ultraviolet rays, temperature greater than 140°F, mud, dirt, dust and debris, to the extent that its strength, toughness or permeability requirements are diminished. Each geotextile roll shall be labeled or tagged to provide product identification sufficient for inventory and quality control purposes. At the time of installation, the geotextile should be rejected and replaced with no additional payment if defects, rips, flaws, deterioration or damage incurred during manufacture, transportation, or storage is evident.

The surface on which the geotextile is to be placed should be excavated to design grade to provide a smooth, graded surface free of debris and large cavities. After excavating to design grade, the geotextile should be cut to a width to provide for "non-tight" placement in trenches and overlaps of the ends of adjacent rolls.

The geotextile should be placed with the machine direction (length) in the direction of water flow in the drainage system. It should be placed loosely, but with no wrinkles or folds. The ends and edges of subsequent rolls and parallel rolls should be overlapped a minimum of 1 ft. The upstream geotextile should always be overlapped over the downstream. Either sewing or overlapping shall join seams required in the longitudinal direction. Overlapped seams shall have a minimum overlap equal to the width of the trench.

Care should be taken during construction to avoid contamination of the geotextile. If it becomes contaminated, it must be removed and replaced with new material.

Placement of drainage aggregate should proceed immediately following the placement of

the geotextile, if required, and the underdrain.

4.16 SEWERS *(Rev. 04-07-09)*

In general, manholes are placed at the junction of sewers and at every change in grade or alignment of the sewer. This means that sewers should ordinarily be straight between manholes to facilitate inspection and repairs.

Due to the fact that in all instances the survey party cannot determine the exact location and elevation of existing sewers, utilities, and other underground installations, it is desirable that the PE/S make investigations as may be necessary. It is often possible thereby to avoid costly delays or revisions in sewer installation. Do not postpone investigating the underground installations until sewer construction actually starts.

Catch basins and curb inlets are provided for admitting storm water from the streets to the sewer. In general, curb inlets are placed where they may drain into a catch basin, and the catch basin may drain into a manhole. DO NOT PLACE CATCH BASINS IN THE LINE OF A SEWER, OR DRAIN CURB INLETS INTO A MANHOLE.

4.17 SEPTIC TANK DRAINS *(Rev. 04-07-09)*

In small towns and rural communities, frequent requests are made from property owners for the privilege of connecting septic tank drains to our highway drainage system, underground or surface. In some instances, our improvement eliminates an open ditch formerly used for such purpose, and the property owner assumes they have the right to perpetuate the arrangement.

The normal type of septic tank used in residential applications does little more than liquefy the sewage. A filter bed or soil filter is needed before the effluent is safe in an open ditch. However, the local public health official is usually better qualified to pass judgment on the efficiency of such treatment and the purity of the effluent. We do not permit septic tank drainage into our storm sewers or side ditches. If you find that sewage is drained onto State highway right-of-way, contact the appropriate local public health official for further investigation and action.

4.18 EARTH DITCH TYPE CATCH BASINS AND INLETS *(Rev. 01-01-02)*

On rural projects earth ditch type catch basins or standard pipe catch basins are often specified.

Except in special cases such catch basins should not be located in the line of tile, but should be offset to one side of the tile and connected to the tile by means of a “Y” or “T” connection.

The outlet of pipe catch basins should be of smaller diameter than the catch basin. The outlet for a 2 ft x 2 ft concrete catch basin should not be larger than 15 in. Where a larger outlet pipe is required a 4 ft x 4 ft concrete catch basin should be used.

It is not our policy to place catch basins or inlets on private tile lines, nor to carry surface drainage into private tile systems. When special cases are encountered requiring deviation

from this policy, they should be discussed with the AE.

4.19 STRUCTURE REMOVAL *(Rev. 01-01-02)*
Normally no payment is made for removal of existing structures unless the contract contains an item of "Removal of Structures and Obstructions." If a contract price is not listed in the proposal, the cost of removal is included in the various pay items of the contract.

4.20 RECORD OF STRUCTURES *(Rev. 04-07-09)*
Complete notes of a structure will consist of a sketch showing the exact location of the structure, and stakes set for it, elevations of stakes, cuts furnished by the contractor and a record of all pay quantities placed in the structure. These notes are recorded by the contractor if they are performing construction engineering, otherwise they must be done by the PE/S. A record of the concrete required and the concrete used should be included. The amount of structure backfill used and paid for should be entered in the structure notes although the documentation for payment is kept elsewhere. See Section 3, Article 15 of these instructions pertaining to payment of structure backfill. Sketches should be made of all structures or parts of structures that are not built to standard designs.

Allow ample space in the structure book for each structure so that complete data may be entered pertaining to it. This data should include structure number, stationing, type of pipe, kind of pipe, sizes, and quantities placed.

In order for Department maintenance personnel to have a record of underdrain outlet locations, the PE/S is to prepare a table when the project is complete that shows the stationing of each underdrain outlet. The best method for preparing the table is to use the underdrain table in the plans and indicate the as-built locations of the outlets. A copy of the as-built table is to submitted to the District Operations Engineer when the Final Construction Record is submitted.

INDIANA DEPARTMENT OF TRANSPORTATION
Mandrel Testing of Pipe Structures

Contract No. _____ Sheet _____ of _____

Prime Contractor _____ Pipe Contractor _____

Pipe Str. No.	Pipe Mat'l. Spec.	Pipe Pay Dia. (in)	Str. Length (ft)	Date Backfill Completed	Date of Mandrel Test	Pass (P) or Fail (F)	Remarks (Note if this is a "Replacement" pipe)

Inspector's Name: _____ Title: _____

Inspector's Signature: _____

REFERENCE: General Instructions to Field Employees, Section 4.11.2