CHAPTER DR-03
DRAINAGE FOLDERS

CHAPTER DR-03
DRAINAGE FOLDERS

CHAPTER DR-03
DRAINAGE FOLDERS

DR-03.100 FUNDAMENTALS

DR-03.110 Purpose of Drainage Folders

The purpose of the drainage folder is to support the development of plans and to serve as a diary of the drainage design process for a highway project. The folder must contain the basis of the total proposed drainage plan for the project. The Transportation Cabinet's policies, specifications, and standards must be reflected through the most economical and hydraulically feasible alternatives for a proposed drainage plan presented in the drainage folder. Reports or minutes of all meetings concerning the drainage design process must be included.

Many folders are used long after projects are completed. Since they are legal documents, they provide information for drainage complaints and litigation. Other agencies and the private sector often use information from the folders to assist in acquiring encroachment permits and for other projects, which may or may not have a direct effect on a highway. For these reasons, the Drainage Section places a strong emphasis on accuracy and completeness of all drainage folder submissions.

Those persons initiating drainage design work who are not familiar with the Cabinet's drainage requirements should contact the District Office or Central Office, Division of Design, Drainage Section to familiarize themselves with the current drainage critera.

DR-03.120 When are Folders Required

Drainage folders are required for all drainage structures constructed on a project, regardless of the number. This includes any structure that is used to transport water directly through or delays the flow of water into or away from the highway system, and extensions to existing structures or improvement of those structures or drainage systems.

Any item related to a proposed drainage plan on any highway project, for which the Division of Design has responsibility, shall be coordinated through the Drainage Section for approval. This coordination takes the form of the submittal of a drainage folder. The list of possible drainage items that must be placed in a drainage folder includes, but is not limited to: bridges, box culverts, cross drain pipes, storm sewer systems, entrance pipes, ditches, channel changes, channel linings, extensions

to existing structures, retention basins, experimental and special drainage structures, floodplain and floodway encroachments, median drains, curb inlets, and catch basins.

DR-03.130 Types of Folders

There are two Division of Design drainage folders: the PRELIMINARY Folder and the FINAL Folder. There is a third folder, the Advance Situation Folder, a Division of Bridges document. This manual will discuss the Advance Situation Folder only in the context that, in some instances, this folder may be submitted as a combined Preliminary/Advance Folder. See the Division of Bridges Guidance Manual, Chapter 66-02, for the requirements of the Advance Folder. It should be noted here that all three folders share the same orange-colored binder. A box is checked on the binder to indicate Preliminary, Advance, or Final, as applicable.

The preliminary folder will be reviewed to insure that the proposed drainage plan is consistent with current procedures, accepted methodologies, policies, standards, and specifications. The final folder shall then reflect the recommendations of the review process and become the Record Legal Document for the project drainage plan. It shall contain all required information to support the selection of drainage items proposed on the plans. Where variations of current practices and standards are incorporated into the drainage plan, those variations shall be fully documented in the final folder.

DR-03.140 Extent of Folder Material

A preliminary drainage folder must provide sufficient information to allow the review of the design presented. This initial presentation must adequately address and support the choices and decisions made and give reason to the formulation of the drainage plan. The designer should keep in mind that this folder should mirror the final folder. It is, however, subject to change as a result of the review process.

The designer should feel free to provide innovations or suggestions to improve the folder presentations. There have been several designers who have made contributions in the past.

CHAPTER DR-03
DRAINAGE FOLDERS

DR-03.150 Items to Exclude from Folders

Over the years several items have been included in some drainage folders and eliminated from others. The items listed below, with exceptions, shall not be placed in Preliminary or Final Drainage Folders:

1. Layout Sheets,
2. Typical Section Sheets,
3. Drainage Summary Sheets,
4. Set of plans,
5. Full-size Plan/Profile Sheets,
   Exceptions: Plan sheets are used to outline drainage areas
6. Intermediate computer runs,
7. Plastic or manila pockets for folded sheets.

There may be instances where the Drainage Engineer requests some of the above items to be included in the folders. This may be done on projects where unusual circumstances demand more in-depth attention.

DR-03.160 Transmitting Folders

[Note: A set of plans through the pipe sheets shall accompany all Preliminary and Final Drainage Folder submissions to the Drainage Section.]

A letter of transmittal from the sender to the designated office shall accompany all drainage folder and/or routing submittals. The Designer may request a date for a drainage inspection in the letter. The Drainage Engineer will set a date for the inspection. Consultant firms shall send all folders to the District Office for review and signatures. Any folder arriving at the Central Office that is not endorsed at the District level will be returned to the sender as incomplete. A copy of all transmittal letters shall be placed in the correspondence section of the folder.

Two (2) preliminary drainage folders shall be submitted to the District Review personnel prior to the Preliminary Line and Grade Inspection (PLGI) for bridges, bridge size culverts, major channel changes, etc. or within a short period following the PLGI

for other projects. The District shall review the folder, retain one copy and transmit the other to the Drainage Section. This allows the Drainage Engineer ample opportunity to review the folder and coordinate the scheduling of the drainage inspection with all parties. Early submission of the preliminary folder for non-controversial minor impact projects also affords the drainage engineer the opportunity to conduct the drainage inspection with the PLGI for these project types.

Two (2) advance situation folders shall normally be submitted to the District Review personnel within a month of the Final-Plans-in-Hand Inspection. This folder shall not be submitted until the drainage inspection report is approved. This report will be issued after the formal drainage inspection or review is conducted. The District Office will review the folder. If there are problems with the folder, the District shall contact the designer prior to routing the folders to the Central Office to clear up those problems. When the District has determined the folders to be acceptable, both copies of the folder shall be endorsed and routed to the Division of Bridges.

One original final drainage folder and copy(ies), shall be submitted to the District Review personnel prior to the submittal of final plans to the Central Office. This should not be more than three months after the approval of the advance folder by the Division of Bridges, if there is an advance folder. Otherwise the final folder should be submitted within three months after the drainage inspection report is approved. The final folder must be routed to the District Office for approval and signatures prior to its arrival in the Drainage Section. The District will review the folder, endorse the front cover if the folder is acceptable. If there are problems with the folder, the District shall contact the designer, to eliminate those problems, prior to routing the folders to the Central Office. When the District has determined the folder to be acceptable, the original final folder shall be endorsed and routed to the Drainage Section. The District should retain the copy until the project is constructed. The Designer also should retain a copy of the folder.

NOTES AND COMMENTS

CHAPTER DR-03
DRAINAGE FOLDERS

DR-03.200 FIELD SURVEYS

DR-03.210 General

To assemble the material required for a complete drainage folder, it is vital to obtain correct and accurate data from the field. This data must then be converted to the various drawings, forms, and maps that make up the drainage folder components. Both the field and office operations are interdependent and require close coordination between the designer, survey party, and Drainage Engineer. The selection of the size and type of a structure depends on the accuracy and completeness of the field survey. All the required data must be gathered and recorded properly in field books or by electronic data collectors for conversion to folder components in the office. Obtaining sufficient information at a project site allows the drainage engineer to explore all possible design alternatives.

This section outlines the field data requirements of drainage surveys, how to record, and what to record in the field book, or data collector, for conversion in the office to the various drainage folder components. The conversion of the field information to a folder-ready format is discussed in Sections 3-300 and 3-400 of this manual.

Form TC 61-102 is a field book size form for entering most of the required information required for a drainage survey. See Exhibit 3-919 for a sample of this form.

DR-03.220 Drainage Area

The surface area of overland and/or channel flow, which contributes runoff to a drainage structure, is bounded on all sides by the drainage divide. The area within this traverse is known as the "watershed." Its calculated size is called the "drainage area." This area must be obtained either in acres or square miles, depending on its size and the discharge methods employed in the structure design. The drainage area may be determined in one of several ways with respect to its size:

1. 50 acres or less: Obtain closed traverse by bearing, stadia, or Total Station survey. Area also may be determined from aerial contoured manuscripts, if entire area is covered. Do not use enlargements of Quadrangle or other maps for displaying drainage area boundaries.

2. Over 50 acres: Determine closed drainage area from USGS Topographic Quadrangle Map, provided there are sufficient contours to do so. Otherwise, follow the steps in No. 1, above.

3. Over 10,000 acres: Use 15 min USGS quad sheets if appropriate. County maps may be used.

4. Major Streams: Use Gauging Station records, Flood Insurance Studies, and/or Corps of Engineers information. County maps may be used where these sources are not available. Old drainage folders may be a source to use for drainage areas at locations where an existing structure is being replaced.

If either the traverse or aerial manuscript methods are used, record the general topography of the area enclosed in the watershed, such as rolling, hilly or mountainous. Locate major channels, drains, sinkholes, etc. Locate and give percentages of timber, pasture, cultivation, etc. Exhibit 03.920 is an example of traverse field notes.

DR-03.230 Situation Survey

The situation survey is the accumulation of field data for "Situation-size" structures. Situation size structures are:

1. All bridges and bridge-size Box Culverts;

2. 54" and larger culvert pipes (including entrance locations) and their equivalents;

3. All pipes with improved inlets. This includes the following improvements, which are less than normal situation sizes:

   a. 36" improved to 30"
   b. 42" improved to 36"
   c. 48" improved to 42"
   d. 54" improved to 48"

4. All box culverts improved and unimproved; and

5. Channel Changes of Blue-Line Streams (200' and longer).

CHAPTER DR-03
DRAINAGE FOLDERS

The situation survey is divided into six (6) parts. Each component of the situation is a separate survey operation and will be treated as such in the field:

1. Site Plan and Baseline
2. Structure Sections
3. Channel Sections and Hydraulic Sections
4. Stream Profile
5. Soundings for Rock
6. Contour Map/Cross Sections

Record each of these components on a separate page(s) in the field book or as an individual entry in the electronic data collector.

SITE PLAN AND BASE LINE

The site plan should show the mainline centerline, the baseline of the situation survey and its skew relative to the mainline. The angle of skew is measured right or left of a line perpendicular to the mainline centerline, preferably in 5 degree increments.

The stream with all of its meanders should be shown for a distance of a minimum of 5 structure lengths upstream and downstream of the mainline centerline and even further if stream profile criteria so warrants. Include topography such as roads, fences, buildings, ponds, dams, existing structures, drains, power and telephone poles, etc. Locate any evidence of scour at both the upstream and downstream ends of all existing structures as well as at the proposed site. Floor and basement elevations of all buildings affected by highwater or possible highwater must be noted.

The plan sheet or a portion thereof may be used to depict this information.

STRUCTURE SECTIONS

The structure sections for bridges and for culverts are different. A bridge section is surveyed along the highway centerline. A culvert section is surveyed at the skew angle of the culvert as it crosses the centerline.

Bridge sections must be wide enough to delineate the limits of the proposed bridge.

CHAPTER DR-03
DRAINAGE FOLDERS

Culvert sections and pipe sections for Non-Situation size pipes should be surveyed, at a minimum, to the proposed right-of-way limits. These sections must be extended as needed to include any possible channel changes, channel bank improvements, or flow line improvements. The section must be of sufficient width to include the total limits of the proposed work. Proposed easements are considered as part of the working area.

Because of stream meanders, culvert sections may not align with the defined stream bed. When this happens, take shots in the stream and enter this in the field notes as, for example, 10 ft. Rt. +25, and mark as "flow line." These notes are to be carried with the culvert section notes, but are not to be used as a stream profile. An example of field notes for a culvert section is Exhibit 03.921.

The skew angle of the proposed structure must be established during the survey. This angle, is measured from a line perpendicular to the highway centerline. If the angle turns clockwise from the perpendicular line, it is said to be "skew right." If the angle turns counter-clockwise from the perpendicular line, it is said to be "skew left." The skew angle provides the positioning of a structure relative to the natural flow or, in some cases the desired position of the flow through a structure that transports water through or from the highway. It is recommended that the designer only use skew angles in even 5 degree increments, unless some field condition dictates that one degree increments are absolutely necessary. The use of finite angles with minutes and seconds is undesirable.

CHANNEL SECTIONS AND HYDRAULIC SECTIONS

There is a difference between CHANNEL SECTIONS and HYDRAULIC SECTIONS. Channel sections are cross sections that are surveyed perpendicular to the flow of a stream and referenced from the survey baseline. These sections shall be wide enough to contain the proposed structure, any proposed channel modification, and encroachments into the floodplain by the highway, itself. These sections are usually surveyed at 50 foot intervals (or closer), and are not nearly as wide as hydraulic sections.

Hydraulic sections are cross sections surveyed perpendicular to the flow of a stream and/or the flow over the floodplain. They are to be located at specific points along the channel for the purpose of analyzing the effect of the flow of floods of varying magnitudes through a floodplain. They will be used in water surface profile computer programs and for making of flood-

way analyses. These sections may be "bent," that is, angles can be turned in the sections to remain perpendicular to the flow pattern. See Exhibit 02-980.

All hydraulic sections must be closed, meaning, the section must be wide enough to contain the 100-year discharge stage elevations. In some cases, the section should extend above the record high water mark or the 500-Year flood, if they are factors in the design. In flat terrains, hydraulic sections which do not close within 2500 feet in each direction from the channel shall be field surveyed up to the 2500 foot mark each way and then closed using a USGS Quadrangle Map, provided the section can be closed within an additional 2500 feet beyond the field mark. If this is not possible then the section surveyed in the field shall be extended to 5000 feet in each direction from the channel and then closed using the Quad Map, regardless of the extent of the extra distance needed.

If there is to be a channel change or channel improvement proposed at any structure, then cross sections of the channel should be surveyed.

To prevent the possibility of taking field notes or translating the notes with rights and lefts reversed, stand on the mainline centerline facing the increasing roadway centerline stations. To the left is the channel baseline upstation, no matter which direction the channel flows.

Water surface profile computer programs view cross sections with the designer looking downstream in determining left and right. The stationing of these cross sections also differ in that the lowest stations begin downstream and proceed upstream. These facts are mentioned here because it may require reversing the field notes and distances in some cases in order to be consistent with the program requirements. In converting the field notes, remember that for the computer programs, zero (0) distance on the cross section is always on the left looking downstream.

An example of a Hydraulic Section is shown in Exhibit 03.912 of this manual.

STREAM PROFILE

For drainage areas over one square mile (640 acres) the stream profile shall be surveyed at least 1500 feet, or 5 structure lengths, whichever is greater, upstream and downstream of the centerline crossing.

CHAPTER DR-03
DRAINAGE FOLDERS

When the drainage area is less than one square mile, the stream profile shall be surveyed 500 feet, or 5 structure lengths, whichever is greater, upstream and downstream of the centerline crossing.

The elevations on the stream profile shall follow the meanderings of the stream flow line. It is mandatory that this procedure be followed.

At the time the stream profile is surveyed, obtain a high water profile from the drift. This high water profile should be taken in backwater area if possible as the current tends to push the drift to a higher elevation than normal high water surface. For an example of a stream profile see the Field Book Notes for a Stream Survey in Exhibit 03.922 and the Stream Profile in Exhibit 03.911.

Ordinary High Water (OHW) elevations should be determined during the stream profile survey. This low bank elevation, shelving, or vegetation line as defined in the Design Manual is used in determining the need to obtain a Department of the Army permit. OHW elevations should be obtained at the extremities of the stream profile survey and near the halfway point of the profile. This is usually adequate since the OHW does tend to follow the slope of the channel.

SOUNDINGS

CULVERTS - Preliminary rock line soundings at culvert locations shall be made by the survey crew at the time of the culvert survey. The preliminary rock line soundings shall be taken at 25′ intervals along the centerline of the culvert and at the inlet and outlet of the culvert. These soundings shall extend to a maximum depth of 5′ below the flow line or to refusal, whichever is higher. Either rod soundings or auger soundings may be provided.

If rock is not encountered with the 5′ soundings, note this in the drainage folder. If in the opinion of the field engineer, unstable soil is encountered while making these soundings, this should be noted in the drainage folder with a recommendation that further subsurface exploration is advisable.

If rock is encountered with the 5′ soundings, the rock line should be shown on the culvert section in the drainage folder. If a break in the rock profile is indicated, additional soundings shall be made to define the break. Areas, where boulders are

known to exist or expected to exist, should be defined in the drainage folder.

Additional rock line soundings or rock core borings may be requested for Reinforced Concrete Box Culverts and Arch Culverts by the Division of Bridges according to the Bridges Guidance Manual "Specifications for Soils and Subsurface Investigation."

The Soils Section, Division of Materials, shall review the culvert situation to determine if additional subsurface investigation is necessary on projects that have unusual situations, such as high fills, boulders and unstable soil in situations where rock is encountered within 5′ of the flow line. In normal situations where rock is not encountered, a memorandum listing the culverts in a project shall be sent to the Soils Section.

BRIDGES--Borings at proposed structure sites shall not be made until the Division of Bridges has approved the structure layout and the Division of Materials has approved the exact location and extent of borings required. When the structure layout has been approved, the T. E. B. M. for Preconstruction will be asked to stake the structure in accordance with the Bridge guidance Manual "Procedures for Structure Foundation Exploration."

Location where either a bridge or culvert may be used should be sounded as a culvert. An example of a Plan of Sounding Holes and Log of Test Holes is shown in Exhibit 03.917.

CONTOUR MAP/CROSS SECTIONS

A contour map of the area is required for all bridges and box culverts for the advance folder and final folder. Site contours may be field surveyed, obtained from aerial manuscripts, or other sources as approved by the Drainage Engineer. The survey should include major topographical features such as ponds, sinkholes, buildings, and drainage patterns.

Cross sections along the centerline of the proposed culvert showing the roadway grade, fill slopes, existing and proposed profile, including inlet and outlet elevations and the flow line should be surveyed for box culverts. See the Bridge Manual, Section 66-02.0211, for more details.

DR-03.240 Existing Structures

Although existing structures are not part of a situation survey, sufficient information must be obtained in the field on these structures. The data collected will be used to determine just what the existing conditions are, and the effect the existing structure has on those conditions. This allows the designer to select a replacement structure which either matches or betters the performance of the existing structure. The information also will allow for a determination of existing structural adequacy as well as give the designer enough data to determine alternative hydraulic designs.

Information for determining the structural adequacy of a structure should include but not be limited to the span, height and length, the thickness of walls and top and bottom slabs, and the length and thickness of wings. This information will be used in determining if the structure may be used with extensions where necessary.

Lengths and thicknesses on all existing pipe headwalls should be noted along with the type, length and condition of the existing pipe. A pipe section should be included in the drainage folder, for all existing pipes that require extension indicating any unusual or special feature of the proposed connection.

On large existing structures, record the length and width and indicate what the dimensions represent, such as the distance between hub guards or hand rails. Record the length, width, spacing and condition of the "I" beams. Show the type of abutments, and piers, noting the condition of each by stating any cracks and their extent that are visible. Note carefully the condition of mortar joints. If an existing structure is to be used, make every effort to obtain the depth of footings. Record the data from any name plates or the like including date of construction.

Observations of existing structures should be used to supplement the hydraulic design data. Obtain information through interviews with long-time residents concerning their personal observations during times of flooding at the site. Scour locations should be noted, as well as any other feature affecting the evaluation, such as alignment of the structure relative to the stream. Overflow of the existing structure and highway should be noted and defined as to depth of overflow and duration.

Provisions are made on the Design Summary Sheet (Form TC 61-100), for data pertaining to existing culverts and existing

bridges. These existing structures should be described in relation to the site under consideration, i.e., distance upstream or downstream. A section should be taken showing the roadway and structure as well as the extreme high water elevation and date of occurrence. For structures far removed from the site a stage or depth of flow will suffice for the high water elevation. See Section 03.430 for details on Existing Structures.

DR-03.250 High Water Data

Reliable, documented, high water data is a basic requirement for proper design. Its importance increases directly in proportion with the magnitude of the structure under consideration. In some instances in the past, a hasty investigation has resulted in serious problems. The cost of an extensive investigation is usually minor when compared to the overall project cost, risk of damage and liability involved.

For many isolated situations, it is very difficult to find witnesses to high water and, in these cases, the engineer is fortunate to find even one person who can testify to any high water. However, because so much is dependent on this information and because one individual's experience or memory could vary considerably from the actual event, it is important that whenever possible the high water data be verified by at least two other persons.

A reliable high water mark would consist of a physical mark either observed or placed by a long time resident. High water data should include the actual elevation tied to the project datum, the year and month of occurrence and the location of the mark obtained with respect to the structure under considerations. Those persons furnishing information should be identified by name, with the length of residence being noted. It is obvious that the longer the period of residence, the more useful the information will be. A person being interviewed who is not a long time resident can often furnish names of others who can provide information over a long period.

In the absence of residents in the immediate area, other sources might include commercial and school bus drivers, mail carriers, highway maintenance personnel, or other persons who travel through the area frequently.

High water marks as indicated by drift should always be obtained. Care should be taken in obtaining drift marks because there are conditions which create inaccurate high water marks.

One misleading condition would be where small trees are bent over by the flood water with drift being deposited on higher limbs than would have been on an erect tree. Another deceptive drift condition would be where a mass of drift settles to a lower elevation as the flooding subsides or is deposited by a lower stage. One cannot depend on drift marks to be of the greatest accuracy.

However, more high water mark accuracy can be obtained from a deposition of seed lines on trees or inside buildings.

Where the possibility of backwater exists, the high water mark described should be noted as either headwater or backwater. Often persons being interviewed are unfamiliar with the difference. Thorough questioning by the interviewer as to the nature of the high water will often indicate the type.

NOTES AND COMMENTS

CHAPTER DR-03
DRAINAGE FOLDERS

DR-03.300 FOLDER COMPONENTS

DR-03.310 Assembling a Folder

The drainage folder shall be assembled in a manner that will allow the various components to be found as readily as possible. The format should be as follows:

1. All pages in the folder shall be numbered in sequence, starting with the Bridge & Culvert Summary Sheet (Form TC 61-504), as PAGE 1.

2. Maximum allowable page size before folding is plan sheet size (36" x 22"). All pages larger than 8.5" x 11" shall be neatly folded and labeled to allow the contents of the page and its station(s) to be identified without unfolding the page. The quantity of folded pages should be kept to a minimum, especially folded, full-size plan sheets. Within the text of the individual components, the designer will discover suggestions of ways to steer away from the full-size sheet concept for folders.

3. Tabs are helpful, but are not mandatory.

4. It is recommended that the covers and folder material be bound with an 8 1/2", 3" capacity Acco-type fastener. The clasp of the fastener should be positioned in front of the folder. Other fasteners are acceptable provided they are not life-threatening.

5. Do not use manila or plastic inserts in the folders for folded sheets. All sheets should be bound by Acco-type fasteners. Plastic inserts are permitted to display photographs or computer disks.

DR-03.320 Format of Folder Material

The drainage folder components shall be assembled in the order shown in TABLE 3-1 below. Items 03.330 to 03.340 are applicable to all folders. The other items are to be included where applicable. Details of the requirements for each component are provided in the sections immediately following the table.

TABLE 3-1 SEQUENCE OF FOLDER COMPONENTS

Section	Item
03.330	Drainage Folder Binder
03.340	Table of Contents (optional)
03.350	Bridge & Culvert Summary (TC 61-504)
03.360	Pertinent Reports/Correspondence
03.370	Design Executive Summary
03.380	Quad Sheets and Other Drainage Area Maps
03.390	*Sequence of Individual Structures
03.400	Ditch and Small Channel Analyses
03.410	Inlet Spacing Calculations (TC 61-120)
03.420	Storm Sewer Calculations (TC 61-505)
03.430	Special Studies
03.440	Photographs
03.450	Computer Disks

* See Section 03.500 for the requirements and sequence of folder material for individual structures.

DR-03.330 Drainage Folder Binder

The standard Drainage Folder Binder is a bright orange 2-piece (front & back), 12" x 9" pressboard binder designed to be used for all three types of folders. The front cover is pre-printed with blanks to be filled in and boxes to be checked by the designer to describe the contents of the folder. See Exhibit 03.901 for a completed example of a front cover. The covers may be obtained from the Division of Property and Supply. Consultant firms may obtain folder covers from the District Offices. The Districts should maintain an ample supply of the covers for this purpose.

The designer should check the appropriate box at the top left to indicate the type of folder being submitted. The itemized boxes applicable to the contents of the folder also should be checked. Use blank spaces for items not listed. Both State and Federal project numbers are required. All other blanks on the cover are to be filled in and are self-explanatory. Lettering in the blanks shall be printed. Both signatures and lettering shall be done in black ink. Signatures at the District level are required for all folders.

CHAPTER DR-03
DRAINAGE FOLDERS

DR-03.340 Table of Contents

If the designer so chooses, a special Table of Contents page for the folder may be created instead of using the TC 61-504 form for this purpose. If this is done, and the folder is divided into more than one volume, a separate Table of Contents must be provided for the material in each volume.

DR-03.350 Bridge and Culvert Summary (Form TC 61-504)

This form is to be used to list all the material contained in the folder and also to serve as a Table of Contents for the folder. Several copies of this form will be required in most cases. The first TC 61-504 form in all folders shall be numbered as PAGE 1 for the folder. Where multiple volumes of a Drainage Folder are submitted, TC 61-504 forms are required for each volume and shall be the first pages of each volume. A separate Table of Contents may be used, but it is unnecessary if the TC 61-504 form is used for this purpose by providing the inclusive page numbers of each structure and "Group" items in the folder. See Exhibit 03.902 for a sample of the form.

The form contains blank spaces in the upper portion for denoting project identification and location, termini, names, and inventory of structures. The lower portion of the form has space for individual structures to be itemized. All drainage structures on a project shall be listed in the order they appear in the folder, exception for "Group" items explained below.

There are columns on the form to list the station, structure number, structure, drawing number, and remarks. All structures for which there is a Design Summary Sheet (Form TC 61-100) in the folder shall be listed on this form, followed by any Group items in the folder. The station sequence shall be as given in Section 03.390. The structure number column may be used to list the inclusive pages in the folder for a particular structure. The structure column is used to give the size and type of the proposed structure. The column for drawing number is reserved for use by the Division of Bridges only. The remarks column shall contain the drainage areas which are one square mile or greater. Other information may be placed in the remarks column as deemed necessary by the designer.

"Group" items in folders are those items that require several sheets (calculation sheets, forms, or computer printout sheets), that can be grouped together in the folder for review purposes. The most often used Group items are inlet spacing calculations, storm sewer calculations, ditch and small channel

analyses. There may be other items that occasionally fall into this category.

Individual inlets and pipes in a storm sewer system do not have to be listed separately on the form. They may be listed by the name of the group, such as "Inlet Spacing Calculations", along with the beginning page number of the group (see Exhibits 07.910, 07.921, and 07.922 for examples of forms used as Group items).

DR-03.360 Pertinent Reports / Correspondences

The pertinent reports and correspondences shall be located after the TC 61-504 Form. The pertinent items are:

Pre-design conference minutes, (where applicable);
Preliminary Line and Grade Inspection Report;
Drainage Inspection Report;
Joint Inspection Report;
Letter of Approval for No-Alternate Pipe;
Letter of Approval for Special Design Pipe;
Reports of other meetings concerning the project;
Other correspondence supporting the folder material; and
Copies of letters of transmittals.

DR-03.370 Design Executive Summary

The project Design Executive Summary (Form TC 61-9) is issued for every project. This sheet is required, since design discharges may be based on traffic counts.

DR-03.380 Quad Maps and Other Drainage Area Maps

QUADRANGLE AND COUNTY MAPS

A portion of an original USGS 7 1/2 Minute Quadrangle Map(s) covering the project is required for every folder. The proposed route and stationing should be plotted on the map. An 8 1/2"x11" or an 11"x17" portion of the Quad Map(s) should cover the project. Plot and label the boundaries of the drainage areas for all bridges, box culverts, cross drain pipes, and major channel changes. A table may be used for the station, drainage area, and size of a structure. The north arrow, Quad name, and Quad date should be included as well as some form of project identification. If drainage areas are too large to fit onto these portions, 15 Minute Quad(s), 30 Minute Quad(s) or county map(s) may be used to delineate the drainage.

Neither small drainage areas nor other areas where there are too few contour lines can be accurately determined on a Quad Map. Therefore, areas of 50 acres or less and larger areas with too few contours shall be either determined by a field run survey or taken from an aerial contoured manuscript (if available). If a manuscript is available, then a photocopy of the area of the manuscript containing the drainage area is acceptable. The plot of the field surveyed drainage area or portion of the manuscript shall be on 8 1/2 x 11 sheets. See Exhibit 03.920 for an example of a field survey plot. See Section 03.420 for the correct position of this map in the drainage folder.

MAPS FOR INLET SPACING AREAS

Drainage area maps for urban and urban-like projects may employ one of several acceptable alternatives. The most ideal alternative is to use a contoured aerial manuscript with the roadway and drainage structures plotted. The manuscript can be used for all drainage areas, including ditches, where most other maps cannot. The next acceptable alternative is a strip map. All drainage areas should be outlined. Within each area, or through some type of table on the map, the drainage area should be provided in acres and the runoff coefficient (C-factor) should be noted.

Most other mapping methods that provide all the required information will be acceptable if approved by the Drainage Engineer. The maximum sheet size is plan sheet size. There is no one rigid format to follow. A north arrow and project identification should be on each map.

DR-03.390 Sequence of Individual Structures

In this section, the term individual structure refers to bridges, cross drain pipes and box culverts, inlet structures to storm sewer systems, outfall structures from storm sewer systems, large channel changes, retention or detention basins, median or bridge end drain outlet structures, entrance pipes, extensions or reconstruction of any of these structures, and any other structure which has the potential to pond water off the right-of-way.

Section 03.420 provides the folder sequence of information required for individual structures. Details for each component of this material are also given.

The material required for all individual structures shall be placed in the folder relative to their sequence in the plans, regardless of the size or structure type. Sheets or pages for the

approach structures shall be labeled giving the approach station first, then the mainline station. For example:

Sta. 51+83 (Appr.Rt. Sta. 125+50)

DR-03.3100 Ditch and Small Channel Analyses

All ditches on the project shall be analyzed hydraulically. This includes roadway cut ditches, surface ditches, special ditches, interceptor ditches, inlet and outlet ditches, and small channel changes. See Exhibit 03.924 for an example. See Chapter Five for more information.

DR-03.3200 Inlet Spacing Calculations (Form TC 61-120)

This form is required primarily for projects involving roadside curbs to verify the spacing of the inlets that capture the surface runoff from the highway. The form can be used to space inlets located in medians and ditches. This form is also used to determine the lengths of slotted drain pipe. See Exhibit 07.910.

This form is not required where an approved computer program generates very near the same required information. Computer output sheets used in the folder must be 8 1/2" x 11". For drainage folder purposes, inlet spacing calculations, either Form TC 61-120 or approved computer-run sheets are considered to be a "Group" item.

DR-03.3300 Storm Sewer Calculations (Form TC 61-505)

Storm sewer calculations are required on projects where the inflow for the second inlet in a connected series may influence the outflow pipe size. See Chapter Seven for more information. The TC 61-505 form is not required where an approved computer program generates the same required information. Computer output sheets used in the folder must be 8 1/2" x 11". See Exhibit 07.921.

DR-03.3400 Special Studies

Special studies take the form of research, reports, and analyses which distinctly deviate from the normal drainage design on a highway project. This includes: Risk Analysis, Detention Basin Analysis, modification of a Flood Insurance Study, performing a Finite Element Study, and others.

DR-03.3500 Photographs

Color photographs of project sites have proven to be very beneficial in supporting the folder documentation over the years, especially where controversies have arisen after the project is constructed. Photographs also serve as a historical "before" view of the site. Photographs may be inserted into plastic pages and included in the folder. Although not a mandatory part of the folder, photographs afford the best way to date for persons who work on plans and never get to visit the project site to at least have some sense of knowing what the project location looks like. They also can alert the designer to problems which can be eliminated by a proposed design.

DR-03.3600 Computer Disks

The Designer shall include the Disk(s) containing the Input Files for all the structures designed using Department Programs. Both Input and Output Files shall be required for other programs.

NOTES AND COMMENTS

CHAPTER DR-03
DRAINAGE FOLDERS

DR-03.400 FOLDER SPECIFICS

DR-03.410 General

This section provides the designer with more detailed information on assembling folder material for individual structures.

DR-03.420 Folder Format for Individual Structures

The items in TABLE 3-2 are required for all individual structures according to Section 03.390. The numerical sequence is the order these items shall appear in the folder when applicable to an individual structure. Picture this group of items as an individual structure "packet." The general makeup of the packet is that the TC 61-100 form always comes first, followed by the 8 1/2" x 11" sheets; then followed by the folded sheets (if any). Each item is discussed in detail in the section noted.

TABLE 3-2 SEQUENCE OF INDIVIDUAL STRUCTURE MATERIAL

Section	Item
03.530	Design Summary Sheet (Form TC 61-100)
03.540	Site Specific Documentation
03.550	Site Plan
03.560	Small Drainage Area Map
03.570	Computer Output, Calculations, Forms, etc.
03.580	Risk Assessment
03.590	Structure/Pipe Sheet
03.600	Channel/Hydraulic Sections
03.610	Contour Map
03.620	Existing Structure Section
03.630	Detour or Temporary Drainage Sheet

DR-03.430 Design Summary Sheet (Form TC 61-100)

Design Summary Sheet (Form TC 61-100) is a two page, ten part summary of the steps and calculations the designer should make in recommending a particular size and type of drainage structure. It is important to view this form as an outline which guides the designer through a series of operations and provides a means of recording the results in a consistent manner for all structures on a project. The form also requires the designer to describe the existing conditions that give reason to the

recommendation. See an example of TC 61-100 form in Exhibit 03.903 of this manual.

The 10 parts of the TC 61-100 form are:

Identification
Existing Conditions
Proposed Structure
Existing Structure
Remarks and/or Controls
Record Highwater Data
Proposed Channel Lining
Proposed Detour
Proposed Box Culvert or Special Wingwall Angles
Other Site Specific Information

This form should be used in the initial stages of drainage design and updated as the final plan evolves. The original form must be included in the final folder and copies retained by the designer.

IDENTIFICATION

The project identification, structure station, etc. shall be given.

EXISTING CONDITIONS

This part of the form is to be used to identify existing conditions prior to installing the existing and the recommended structure. It is a "BEFORE" view of the channel near the structure site. The paragraphs which follow are instructions for each space on this part of the form:

"Stream" is for the stream name, if known. Where a unnamed stream is a tributary of a known stream, it should be identified as such. If the stream is a drain that is not part of a tributary system, it should be labeled here as a "Drain."

"Drainage Area" is for the size of the drainage area. The area should be given in acres up to 640 acres. Above this the area should be shown in square miles.

"OHW" means Ordinary High Water. It used to assist in making the determination of the need to obtain a Department of the Army permit. OHW elevations should be obtained at the extremities of the stream profile survey and near the halfway point of the profile. This should be adequate since the OHW does

tend to follow the slope of the channel. For more information, see also Section 03.240.

"Drift" size and potential should be provided to give reasons for designing a trash guard near the inlet of a structure or to give maintenance an idea of what to expect after construction in the way of determining the frequency of unstopping grates, cleaning out culvert barrels, unblocking channels, etc.

"Bed Material" and "D50" shows that the type and size of material in a stream has a bearing on the structure type selected due to the abrasive effect it may possess.

The Abrasion and Acid potential help determine the possible alternates for the culverts.

"Discharge (cfs)" is the quantity of water runoff (for a given return interval) to the site that is obtained from methods discussed in Chapter Four. Provide values for the 2 through 500-Year storms for situation size structures.

"Flow Depth or Elevation" is a normal depth elevation or a constricted depth or elevation due to a downstream structure. These depths should be obtained based on the channel section located one structure length upstream from the inlet or face of the structure.

"Velocity" is the speed of the flow in feet per second (fps) required as a companion value to the discharge and depth of flow. This value is compared with the velocity created by a proposed structure to determine any increase in velocity and to assist in making decisions regarding a means to offset the effect of the velocity increase.

PROPOSED STRUCTURE

This part of the form is used to display selected information pertaining to the proposed structure and work related to that structure. It is the companion "AFTER" view of the results of the proposed construction.

The information for the proposed structure and possible alternates is self-explanatory. The WSEL's are the values for Headwater (HW) at the culvert face or one bridge length upstream. This information shall be used for the FLOOD EVALUATION DATA to be placed on the profile portion of the plans, structure section sheets, and pipe sheets for all structures.

The outlet velocities for the structure are necessary to determine the need for channel lining and/or energy dissipators to offset increases in water speed caused by the proposed structure.

The roadway overflow is shown for comparison purposes.

EXISTING STRUCTURE

Site data for the existing structure shall be given similar to that for the proposed.

The "net opening" shall be that below the low beam for a bridge or crown of multicell box culvert.

REMARKS AND/OR CONTROLS

Indicate any control features that may influence the horizontal or vertical placement of the proposed structure or its size. Controls could be such things as the shoulder elevation, stage in the natural stream, existing, proposed or potential development upstream from the site, utilities, etc. Give a return interval when describing an Allowable Highwater Elevation (e.g. 18" below shoulder for 100-year flood). Use this part to display controlled discharges used in the design when obtained from regulated streams, from Flood Insurance Studies, or other sources, especially when these discharges differ from the calculated values.

RECORD HIGHWATER DATA

There is space for information from three witnesses to the high water observed. This data is collected by the field survey party. See Section 03.250 for the information to transfer from the field notes to this part of the summary.

PROPOSED CHANNEL LINING

The portion on channel lining asks the designer to decide if channel lining is necessary and to provide a thickness, type, depth to protect and a volume of material. The depth to protect is measured vertically from the flow line or invert of the channel to the top of the proposed lining. Do not measure along the side slope of the channel. This information must also be placed on the plans in inlet and outlet ditch notes and in channel change notes. Use D = _____ for the depth to protect and T = _____ for the thickness of the lining in the plan notes.

PROPOSED DETOUR

Detours are temporary highways that allow continuous traffic flow around a construction site. The detours are constructed across bodies of water using either temporary fills, temporary bridges, or a combination of the two. One of the major problems with past detour designs is that the tailwater or backwater from the existing channel, existing structures, or proposed structure have not been considered in the detour design. Another concern in detour design is the amount of cover over the detour structures. Often the grade is set too low to allow for the installation of guardrail posts across the detour.

The openings and detour grade shall be designed so a 2-year flood will not overtop the detour. The 5-year flood shall be used to check damage by the overflow to the surrounding area. These are minimum requirements. Higher grades and larger openings may be used according to the following:

5-year opening--use 10-year overflow
10-year opening--use 25-year overflow
25-year opening--use 50-year overflow

The designer shall provide a minimum allowable opening size on the plans (profile of Detour Sheet). The type of detour structure may be recommended by the designer. The choice of a structure type that meets the minimum opening size shall be left up to the contractor.

PROPOSED BOX CULVERT or SPECIAL WINGWALL ANGLES

The designer shall provide the angles of proposed wingwalls as shown by the diagram for all box culverts and arch culverts. The slots "Normal End" and "Skewed End" are to indicate the skew of the barrel. There are instances when one end of a culvert is skewed and the other is normal (Zero degree skew). The values entered for these two slots shall indicate both the skew angle and the direction of the skew (Lt. or Rt.), if applicable.

Other Site Specific Information

A summary of the specific information used to size the culvert or bridge may be shown in the area. Use this part of the form to show "weighted" C calculations.

DR-03.440 Site Specific Documentation

Site specific documentation is information that is provided by the designer to give specific information that supports the selection of a particular structure design. This may include Bridge Inspection Reports, Flood Insurance Maps, portions of aerial photographs, Legal Precepts pertinent to the site, etc. The documentation may be an explanation of unusual circumstances where the designer must deviate from "normal" design criteria. It could be an explanation of the use of a new product, or any other material that justifies some previously unaccounted or unforeseen reasoning that is pertinent to the design at a particular site.

DR-03.450 Site Plan

The site plan used in the drainage folders may be an 8 1/2" by 11" photocopy of the portion of the plan sheet that contains the structure. The designer may also make a separate drawing for the site plan if so desired. The intention here is not to require duplicated efforts. One thing that enhances the photocopy site plan concept is to use a highlighter pen to emphasize the structure.

Where the structure presented is situation size, the survey baseline, stationing, and skew angle shall appear on the site plan. See Section 3.230 and Exhibit 3.907.

DR-03.460 Small Drainage Area Map

These maps shall be 8 1/2" x 11" size. There shall be a map made for all structures on the project whose drainage areas are less than 50 acres. These maps may be made from field survey information or traced from aerial photography manuscripts.

DR-03.470 Bridge Inspection Form (TC 71-118)

This form is available from the Division of Maintenance files for individual bridges. It contains pertinent information related to the condition of all existing bridges and their features. Hydraulic and scour effects weigh into the rating for the bridges.

DR-03.480 Computer Output, Calculations, Forms, etc.

Hard copies of computer calculations require both the input files and computer output. There are many approved computer programs that use the Input File/Main Program method of

performing hydraulic calculations. Also include in the folder(s) a disk copy of the input for computer calculations.

Sheets that contain manual calculations, non-departmental forms, and any other material which support the hydraulic results should be located in this position within the individual structure packet in the folder.

DR-03.490 Risk Assessment/Analysis

A Risk Assessment form shall be completed for bridge projects and may be used for major storm sewers and channel work. A copy of the form may be found in Exhibit 02.970. The assessment form shall be placed in the Preliminary and Final Drainage Folders.

DR-03.4100 Structure / Pipe Sheet

This information is required for plans and drainage folders.

SITUATION-SIZE STRUCTURE SHEET

The structure sheet is the plans representation of the situation survey. The information collected in the field is transposed on a full-size cross-sectional grid sheet. A standard format has been developed for situation-size structure sheets. This format requires that one structure section be plotted per sheet with the channel sections, hydraulic sections, stream profile and existing structure section. Where all the required data will not fit on one sheet, extra sheets may be used. Careful positioning of the required material on the sheet(s) will result in the fewest number of sheets required for the folder and plans. Use the fewest number of sheets possible, even if the required information is somewhat crowded but will still be legible when reduced to half-size plans.

A title block should be made below the pre-printed "County" block in the upper right hand corner of the sheet. The title block should contain the words "Situation Survey," the station, skew, structure type, and structure size and length.

A folded PRINT copy of structure sheets is required for all drainage folder submissions. SEPIAS are no longer required for final folders. Use the following procedure to fold full size sheets for a folder:

CHAPTER DR-03
DRAINAGE FOLDERS

1. With the printed side of the sheet up, cut a 2" x 11" strip on the left side of the sheet starting at the bottom. This is the binder line of the sheet. It allows the sheet to be unfolded when secured in the folder.

2. Fold the sheet from bottom to top. Also fold along the 2" x 11" strip. Next fold down a triangular flap on the right side to expose the county block and part of the Situation Survey Title Block.

3. By folding the 34" x 11" portion of the folded sheet over to the binder line, and making 4 equal folds, accordion style; the sheet will then fit the folder cover. The triangular flap should end up on top right of the completely folded sheet.

4. With the sheet completely folded, fold the 2" x 11" strip to 1" x 11", then punch holes in the strip for binding. The fold in the strip will help offset the variation in thickness from one side of the folded sheet to the other.

A natural scale should be used. 1" = 10′ is preferred, but 1" = 20′ may be used for longer sections that may not fit on the sheet.

Flood evaluation data shall be put on the sheet. Any other hydraulic data or clarifying notes or sketches regarding the structure may also be used.

All sections should be extended to include the work proposed for inlet and outlet ditches or channels to the point where they tie back into original ground. Match lines and section extensions may be used for this purpose.

Inlet and outlet elevations and other control elevations should be shown. The slope of the structure in a ft/ft ratio is required. Show the location left and right of centerline for headwalls and wingwalls. Indicate headwall types.

The only difference in a structure sheet for a pipe and a box culvert is that the breakouts for the pipe class, gage, alternates, headwall concrete and steel, etc., must be shown. Also B-1 bedding is required for Concrete Culvert Pipe when the fill height is 36 feet or greater. See the current Standard Drawings for more information.

Since the proper application of B-1 bedding significantly affects the strength of the pipe installation, and since considerable extra work is required by the contractor, it is important that the limits of B-1 bedding are properly indicated on the plans. Also, the quantity of trench excavation must be included in the Roadway Excavation quantity. Therefore, when required, the horizontal and vertical limits of B-1 bedding shall be indicated on the pipe section as shown on Exhibit 03.915, in accordance with the guidelines given on Standard Drawing RDI-030. The exhibit also indicates how to show excavation of unsuitable material, paid for as Structure Excavation, according to the current edition of the Standard Specifications.

Since B-1 bedding is required only if Reinforced Concrete Pipe (RCP) is used, an inequitable situation is created when payment on design quantities is specified and metal pipe is permitted as an alternate to RCP. When this situation occurs, a plan note shall be used. This note has been assigned to Code No. 630 for the computer plotter.

See Exhibit 3.909 for an example of a situation pipe sheet.

NON-SITUATION SIZE PIPE SHEET

Sections for pipes less than 54" in diameter, or equivalents, are plotted on cross section sheets. More than one pipe section may be plotted per pipe sheet. The sections shall be evenly spaced on the sheet and not overcrowded. Legibility should not be sacrificed. Flood Evaluation shall be shown for each pipe section. Breakouts for the individual items shall be located between sections. Breakout headings shall run across the top of the sheet. Stations, skews, slopes, lengths of pipe, type, and location of headwalls or other culvert ends should be shown on the section itself. See Exhibit 03.914 for an example. Natural scales should be used.

DR-03.4200 Channel/Hydraulic Sections

The channel cross sections shall be plotted on the structure section sheet provided they fit. When plotted on the structure section sheet, the sections should run from increasing to decreasing station from left to right across the top of the sheet, turned perpendicular, to correspond with the profile. The 50+00 station of the channel must always correspond to the roadway centerline. For an example of the channel sections on a structure section sheet, see Exhibit 03.912.

The hydraulic sections may be plotted on 8 1/2" x 11" sheets. These sections shall be closed to contain the limits of the 100-year stage elevation or higher if necessary. The limits of the channel survey shall include the limits of the proposed work. Office extensions of hydraulic cross sections are permitted only based on some reliable source such as a manuscript, quad map, etc. Field run, cross sectional extentions are required when this information is not available or when extensions are excessive and require more accuracy.

Channel change cross sections should depict 3:1 side slopes except where excessive excavation or right-of-way considerations require steeper slopes. Channel lining slope protection, if used, shall be plotted on the channel sections.

DR-03.4300 Contour Map

The contour map shall be placed on a full-size plan sheet. The normal contour interval shall be two feet. Exceptions to this rule may occur on occasion, where the interval would be one foot. The map should include a title block giving the station, type, size, and skew. Also provide a scale and north arrow. The map should include the project centerline and stationing, situation survey baseline and stationing, major topographical features, and any control features.

The plan of the proposed structure should be superimposed on the map. Use a scale 1" = 20′ for large bridges and 1" = 10′ for small bridges and box culverts. See Exhibit 03.913.

DR-03.4400 Existing Structure

Where possible, the section of the existing structure shall be placed on the situation survey structure sheet or on a sheet with the channel sections. A separate sheet may be used if absolutely necessary.

The values for Net Opening and Low Beam Elevation shall be shown. Flood Evaluation Data is also required. Other notes or information relative to the existing structure may be used.

DR-03.4500 Detour or Temporary Drainage Sheet

The recommended opening size for the detour stream crossing should be shown in the profile of the detour. Do not depict any structure type in the plan or profile. Also show the flood evaluation data for the crossing.

It is not mandatory to provide the entire limits of the detour in the folder. A photocopy of the plan portion of the crossing and the profile portion of the crossing will be sufficient.

NOTES AND COMMENTS

CHAPTER DR-03
DRAINAGE FOLDERS

DR-03.500 FOLDER CONTENTS

DR-03.510 General

The material in preliminary and final folders will vary in content on a project to project basis. This section provides the list of possible items that could be included in each folder. The listings are intended to help eliminate possible omissions and enhance the review process.

DR-03.520 List of Required Items

The following is a list of required items for preliminary and final drainage folders. The listing is also the order in which the material should be bound in the folders:

Drainage Folder Cover
Table of Contents (Optional)
Bridge and Culvert Summary (TC 61-504 form)
Pertinent Reports/Correspondence
Design Executive Summary (TC 61-9 form)
Original Quad Maps and other Drainage Area Maps
Individual Structure Packets. (See Section 3-420.)
Ditch and Small Channel Analyses
Inlet Spacing Calculations (TC 61-120 form)
Storm Sewer Calculations (TC 61-505 form)
Special Studies
Photographs (Optional)
Computer Disks

DR-03.530 Individual Structure Packets

The following is a list of required items for preliminary and final drainage folders. The listing is also the order in which the material should be bound in the folders:

Drainage Design Summary (TC 61-100 form)
Site Specific Documentation
Bridge Inspection Sheet (TC 71-118 form)
Risk Assessment
Others
Site Plan
Small Drainage Area Map
Computer In/Output, Manual Calculations
Structure/Pipe Sheet

CHAPTER DR-03
DRAINAGE FOLDERS

Channel/Hydraulic Sections
Contour Map(Final)
Existing Structure Section
Detour Drainage Sheet
Special Drawings (Final)
Other Forms

NOTES AND COMMENTS

CHAPTER DR-03
DRAINAGE FOLDERS

DR-03.900 CHAPTER 3 EXHIBITS

Number	
03.901	Drainage Folder Cover
03.902	Culvert and Bridge Summary Sheet
03.903 to	
03.904	Design Summary Sheet (2 pages)
03.907	Site Plan
03.908	Drainage Area Sheet
03.909	Culvert Situation Sheet
03.910	Bridge Section
03.911	Stream Profile
03.912	Channel/Hydraulic Sections
03.913	Contour Map
03.914	Pipe Sheet
03.915	Pipe Sheet Depicting B-1 Bedding Details)
03.916	Storm Sewer Pipe sheet
03.917	Plan of Sounding Holes and Log of Test Holes
03.918 to	
03.919	Field Book Form for Drainage Survey
03.920	Field Book Notes for Drainage Area
03.921	Field Book Notes for Culvert Section
03.922	Field Book Notes for Stream Survey
03.923	Site Contouring Method
03.924	Channel Analysis Form

CHAPTER DR-03
DRAINAGE FOLDERS

■ Preliminary
☐ Advance
☐ Final

DRAINAGE DESIGN/SITUATION SURVEY FOLDER

FOR ITEM(S) CHECKED BELOW

County ADAIR **Project No.** 5JP001 0061 001-005 001D

Road BURKESVILLE - COLUMBIA ROAD US 61 (ROUTE NO)

Sta. to Sta. 100+00 to 500+00 **Approved** _____ (DISTRICT OFFICE) _____ (DATE)

Designed By DISTRICT 8 **Approved** _____ (C. O. DRAINAGE) _____ (DATE)

Item No. 8-100.00 **Approved** _____ (DIV. OF BRIDGES) _____ (DATE)

- ■ BRIDGE
- ☐ BOX CULVERT
- ☐ ARCH CULVERT
- ■ PIPE CULVERT
- ☐ _____

- ☐ INLET SPACING
- ☐ STORM SEWER
- ■ CHANNEL CHANGE
- ☐ DRY STRUCTURE
- ■ CHANNEL LINING

KENTUCKY
TRANSPORTATION CABINET
DEPARTMENT OF HIGHWAYS

DIVISION OF BRIDGES
RECEIVED _____
FROM _____
RETURN _____
FILE _____
TO _____
NO _____
REFERENCE _____

DIVISION OF DESIGN
DRAINAGE SECTION
RECEIVED _____ DATE
TRANSMITTED _____ DATE
REVIEWED _____ COORDINATOR
FOLDER CONTENTS DETERMINED TO MEET SECTION 404 PERMIT CRITERIA :
☐ NATIONWIDE ☐ GENERAL OR INDIVIDUAL
☐ CATEGORICAL EXCLUSION ☐ NONAPPLICABLE

01-01-93 | DRAINAGE FOLDER COVER | EXHIBIT DR-03.901

BRIDGE AND DRAINAGE SUMMARY SHEET : TC 61-504 (Rev. 1-93) 1 of 1

County Jefferson	Route	Item No. 5-0280.00
Road Name Blankenbaker Parkway		
UPN SSP 056 8556 113D	FPN	Folder No.
Type of Work GDS	Section	
Designer Presnell	Reviewer HTH	
Termini		

Bridges 0	Box Culverts 0	Pipe Culverts 1
Arch Culverts 0	Entrance Pipes 0	Box Inlets 84
Channel Changes 0	Other 2 Manholes, 1 Junction Box	

Station	Structure Number	Structure	Drawing No.	Remarks	Page No.
132+30	1	18" Pipe			6
136+16	2	30" Pipe			10
145+50	3	24" Pipe			15
147+81.40	4	24" Pipe			19
159+83.63	5	36" Pipe			23
Inlet Spacing					27
Storm Sewer					40

DRAINAGE DESIGN SUMMARY : TC 61-100 (Rev. 6-93)							1 of 2
County Lincoln			Route US 127				Station 262+10
UPN SSP 0127 003-012 017D			FPN				Item No. 8-111.03
EXISTING CONDITIONS							
Stream Name Unnamed			Drainage Area 43 Ac.				Slope 0.019
OHW Elev. 1056.00	Drift Light		Bed Material Stones				D50 2.5
Abrasion Level B	pH 6.0		Restivity				Date Taken 2-10-93
Return Interval (Years)	2	5	10	25	50	100	500
Discharge (cfs)				64		77	
Flow Depth or Tailwater (ft)				1.3		1.4	
Velocity (fps)				3.7		3.9	
PROPOSED STRUCTURE							
Type Pipe Culvert			Length, Size, Spans, Skew 188' of 48" Pipe @ 30 degree Sk Lt				
Lt. Abut. or Inlet Type 48" Pipe Culv. Hdwl.			Rt. Abut. or Outlet Type 48" Pipe Culv. Hdwl.				
Coating	Cover Height 22'				Low Road Elev. 1082.00		
Net Opening	Low Beam Elev.				Grate Elev.		
Slope 0.019	Inlet Elev. 1058.50				Outlet Elev. 1055.00		
Alternates	1. RCP		2. BCCSP		3. BCCAP		
WSEL w/Structure				1062.00		1062.40	
WSEL w/o Structure							
Velocity w/Structure (fps)				14.7		15.6	
Q over Road Lt / Rt (cfs)	/	/	/	/	/	/	/
EXISTING STRUCTURE							
Type N/A			Length, Size, Spans, Skew				
Lt. Abut. or Inlet Type			Rt. Abut. or Outlet Type				
Condition					Low Road Elev.		
Net Opening	Low Beam Elev.				Grate Elev.		
Slope	Inlet Elev.				Outlet Elev.		
WSEL w/Structure							
WSEL w/o Structure							
Velocity w/Structure (fps)							
Q over Road Lt / Rt (cfs)	/	/	/	/	/	/	/

DRAINAGE DESIGN SUMMARY : TC 61-100 (Rev. 1-93) **2 of 2**

REMARKS and /or CONTROLS

HW 100 < 1062.60'

RECORD HIGHWATER DATA

Source	1. Joe White	2. Bill Ray	3. John Doe
Elevation	1063.00	1063.00	1063.00
Date	April, 1984	April, 1984	April, 1984
Location	Resident	Resident	Resident

PROPOSED CHANNEL LINING

Location	Class	Thickness	Depth Protect	Length	Quantity (Tn)
Upstream	III	24"	18"	90'	73
Downstream					

PROPOSED DETOUR

Flooding	Return Interval	Discharge	Elevation
Design N/A			
Overflow			

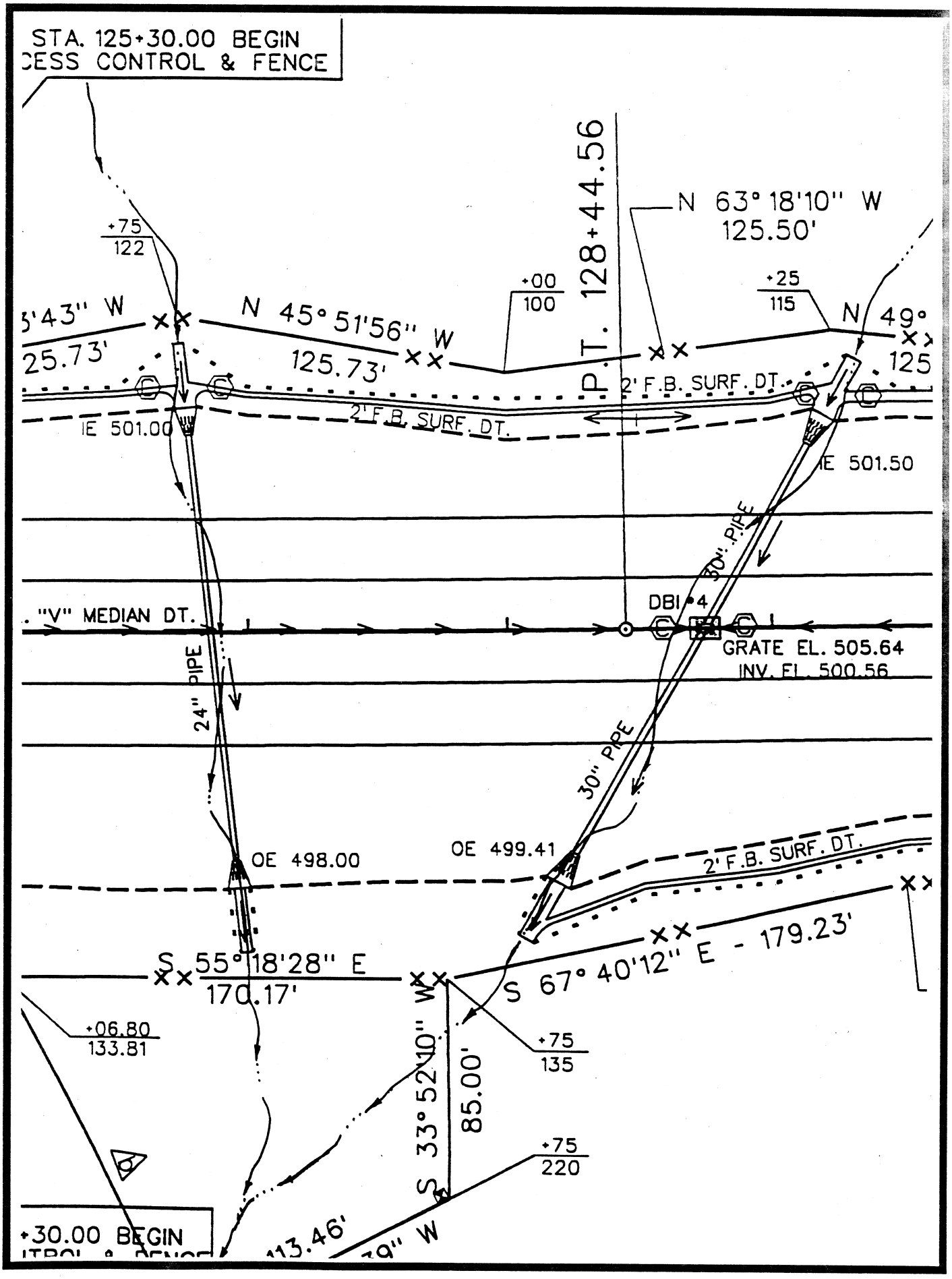
Recommended Size and Type of Opening(s)

PROPOSED BOX CULVERT OR SPECIAL WINGWALL ANGLES

	Normal End ?		Skewed End ?	
Location	1	2	3	4
30 Degree				
Skewed				
Special				

OTHER SITE SPECIFIC INFORMATION

01-01-93	SITE PLAN	EXHIBIT DR-03.907



DRAINAGE AREA STA. 12+50

County Menifee

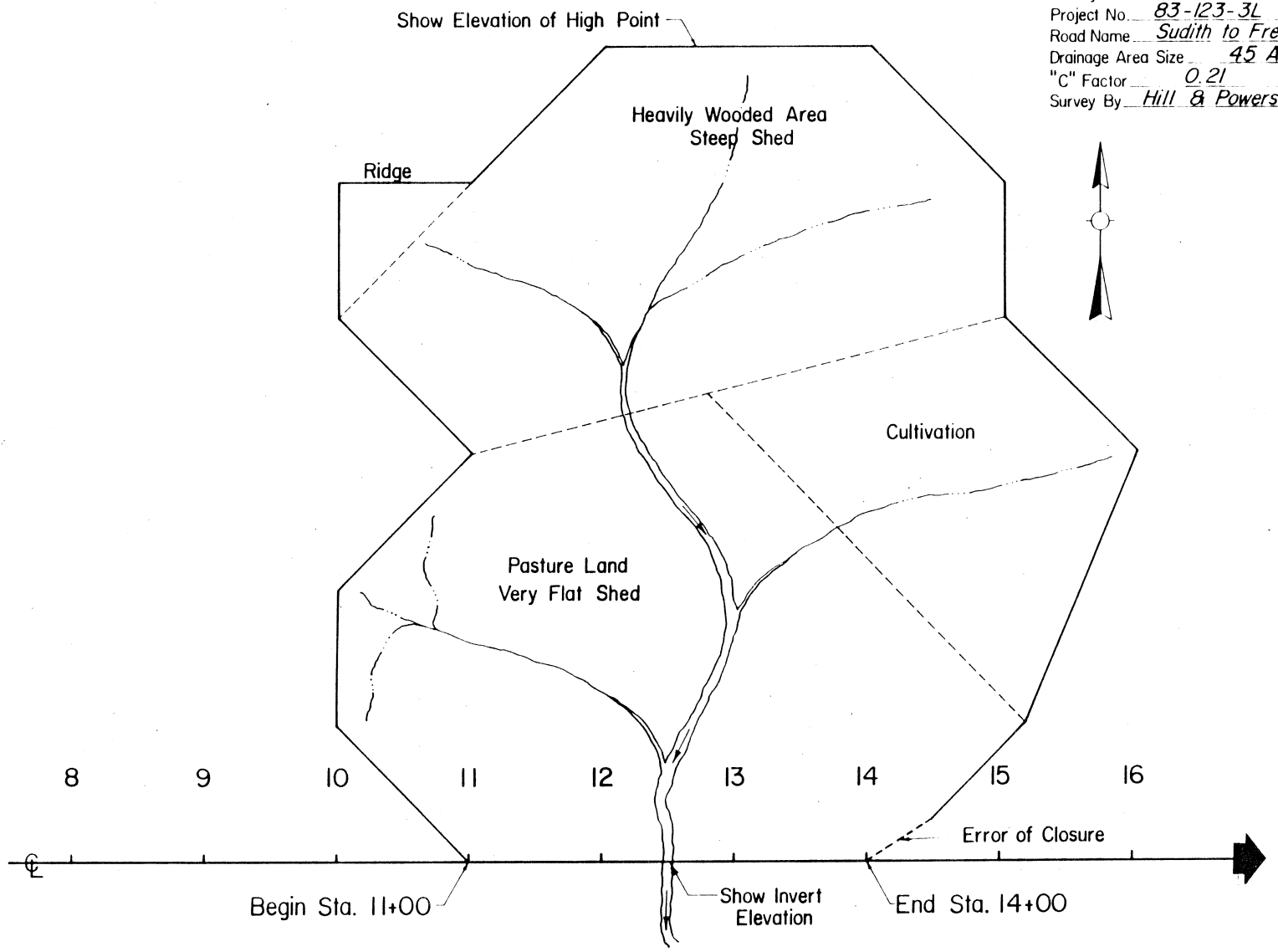
Project No. 83-123-3L

Road Name Sudith to Frenchburg (Ky. 36)

Drainage Area Size 45 Acres

"C" Factor 0.21

Survey By Hill & Powers Date 7-7-76



* Scale: 1" = 40'

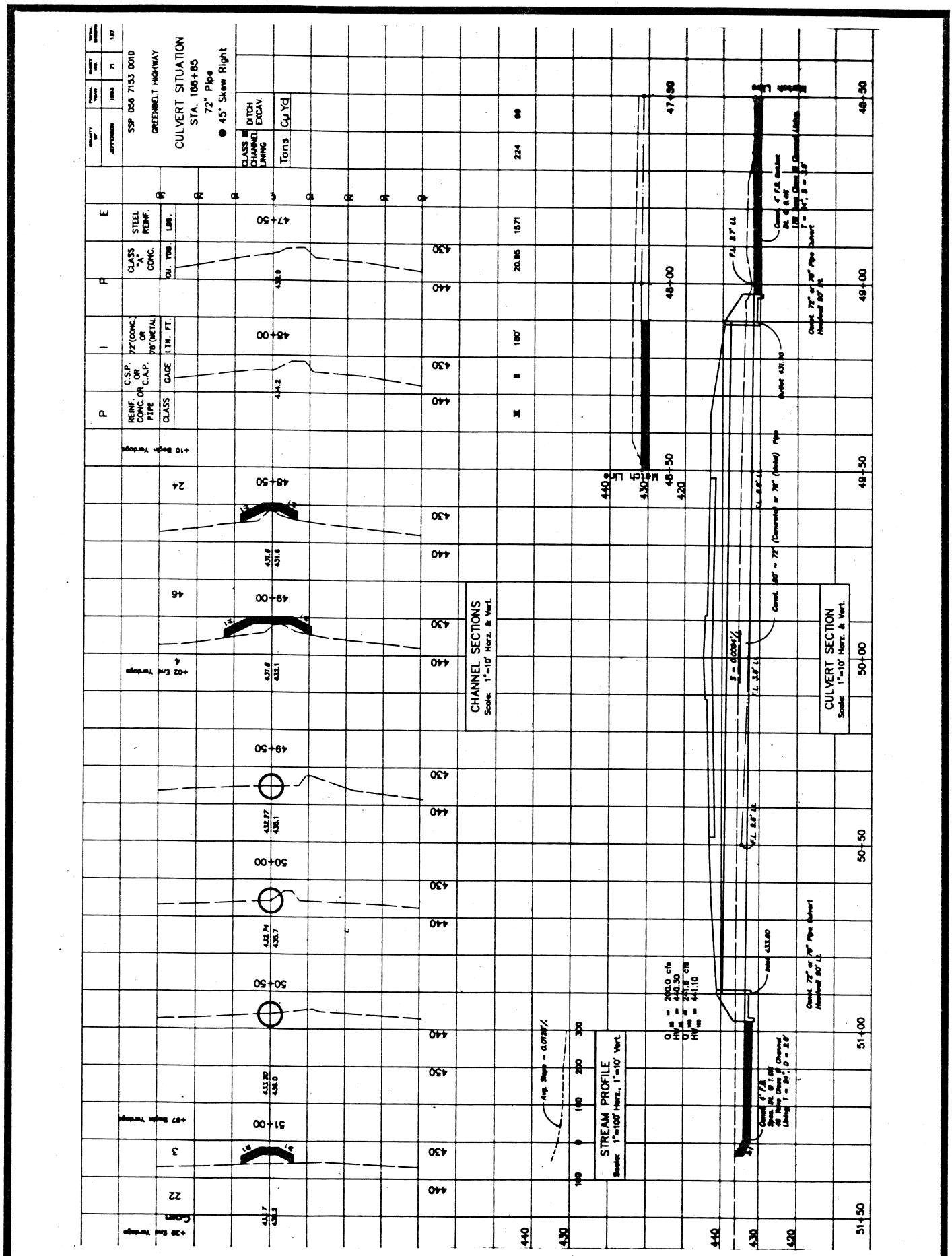
* Other Scales may be used to fit size of area on sheet.

01-01-93

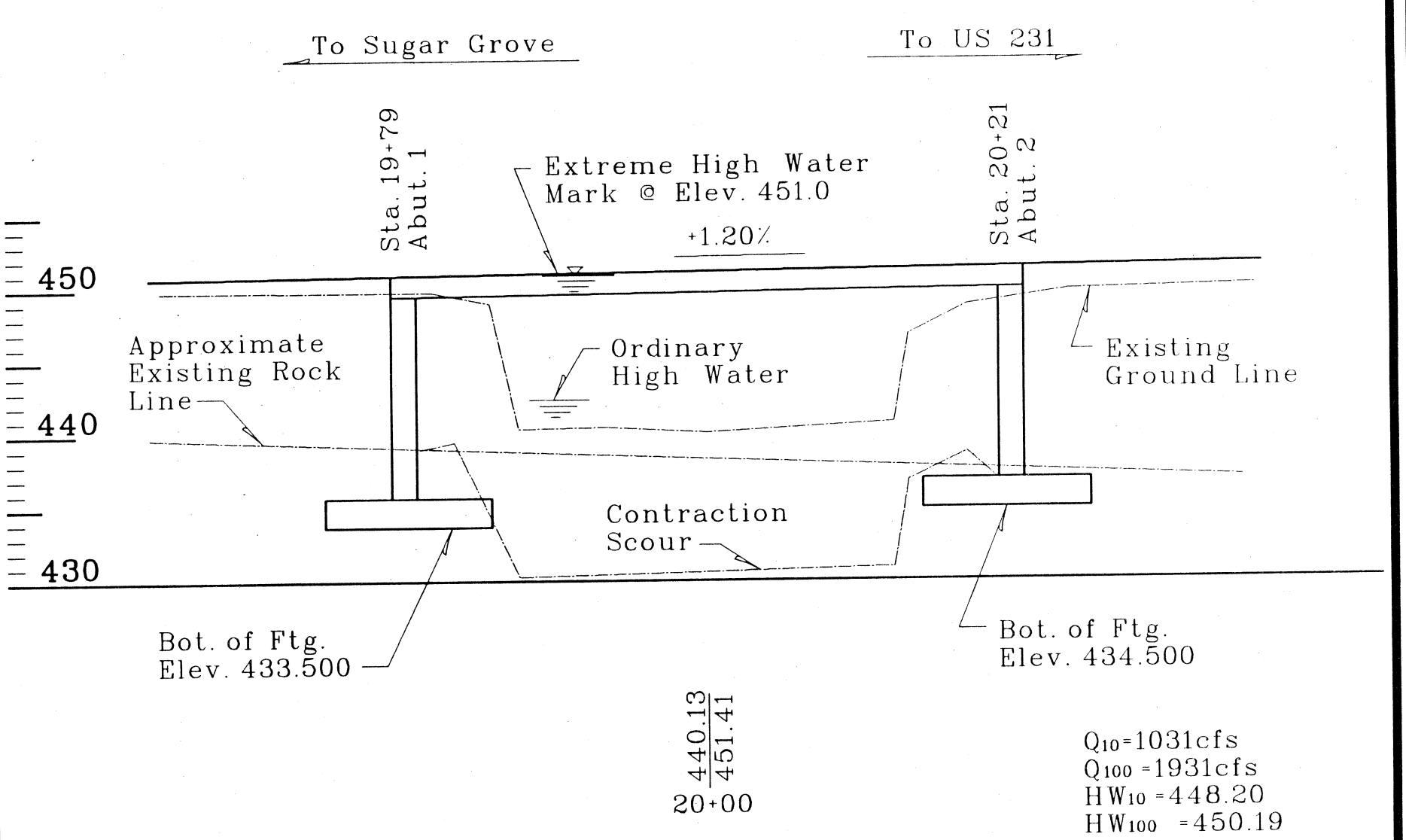
DRAINAGE AREA SHEET

EXHIBIT DR-03.908

01-01-93	CULVERT SITUATION SHEET	EXHIBIT DR-03.909



Butler County
Browning-Needmore Road
Bridge Survey Sta. 20+00
Const. 42' PPCDU Span @ 0° Skew
Wing Abutments



440.13
451.41
20+00

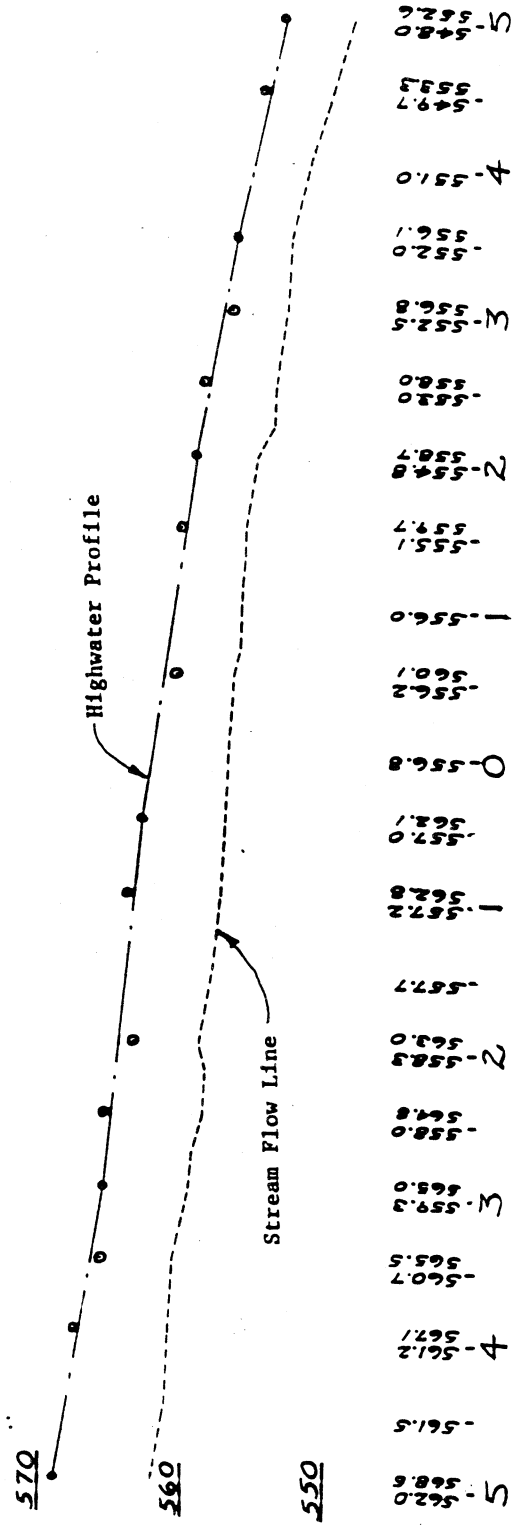
Q_{10}=1031cfs
Q_{100} =1931cfs
HW_{10} =448.20
HW_{100} =450.19

01-01-93

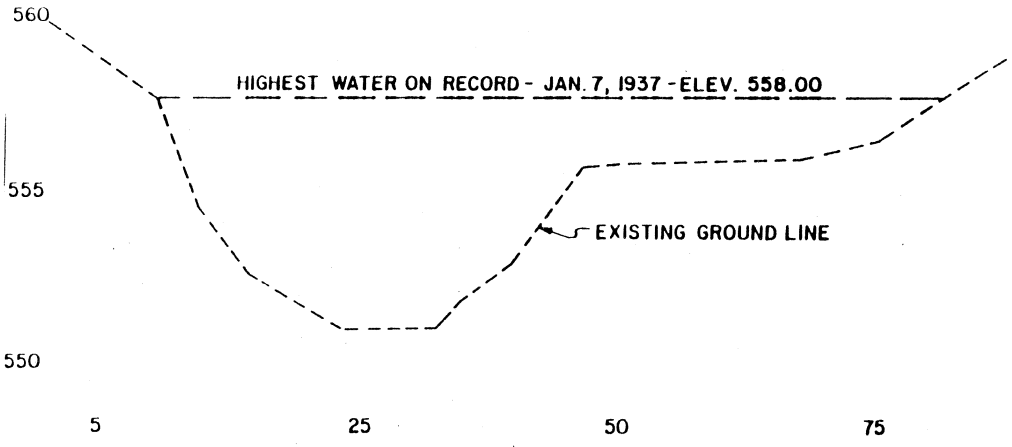
BRIDGE SECTION

EXHIBIT DR-03.910

01-01-93	STREAM PROFILE	EXHIBIT DR-03.911



NOTE : Stream slopes are best determined by calculating the depth of flow at several sections up and down the stream for the 5-year return interval, which is considered to be the "Channel Forming Storm.



0+00

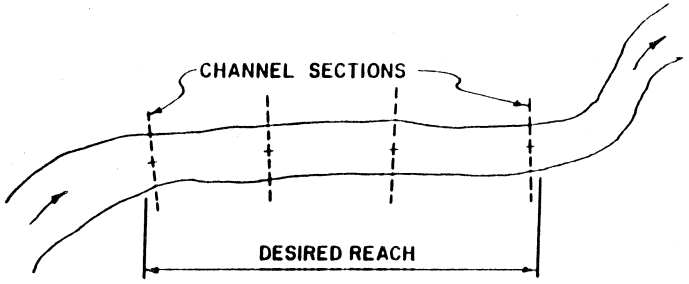
CHANNEL SECTION

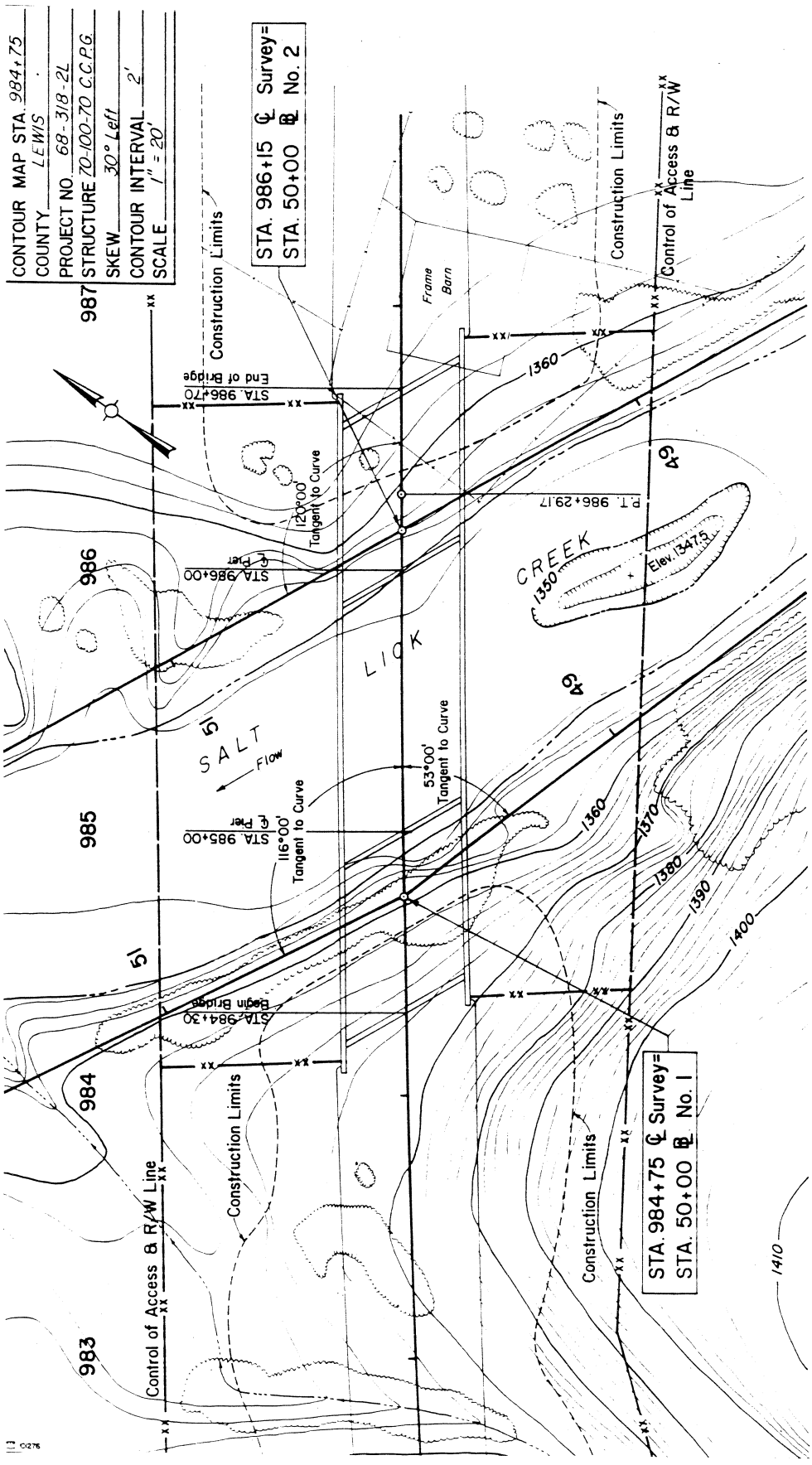
SCALE: 1" = 5' HORIZ. VERT.

300' UPSTREAM

NOTE: THE CHANNEL SECTION MAY BE PLOTTED ON ANY SCALE DESIRED.

THESE SECTIONS ARE TO BE TAKEN AT RIGHT ANGLES TO THE STREAM (SEE DIAGRAM BELOW). TAKE A MINIMUM OF FOUR CROSS-SECTIONS OF THE CHANNEL IN ANY SINGLE REACH. OBTAIN HIGH WATER INFORMATION. EXAMINE THE STREAM BED & BANKS FOR SUGGESTING AN "N" VALUE FOR USE IN MANNINGS EQUATION FOR VELOCITY. NOTE TYPE OF STREAM BED, SOLID ROCK, ETC.

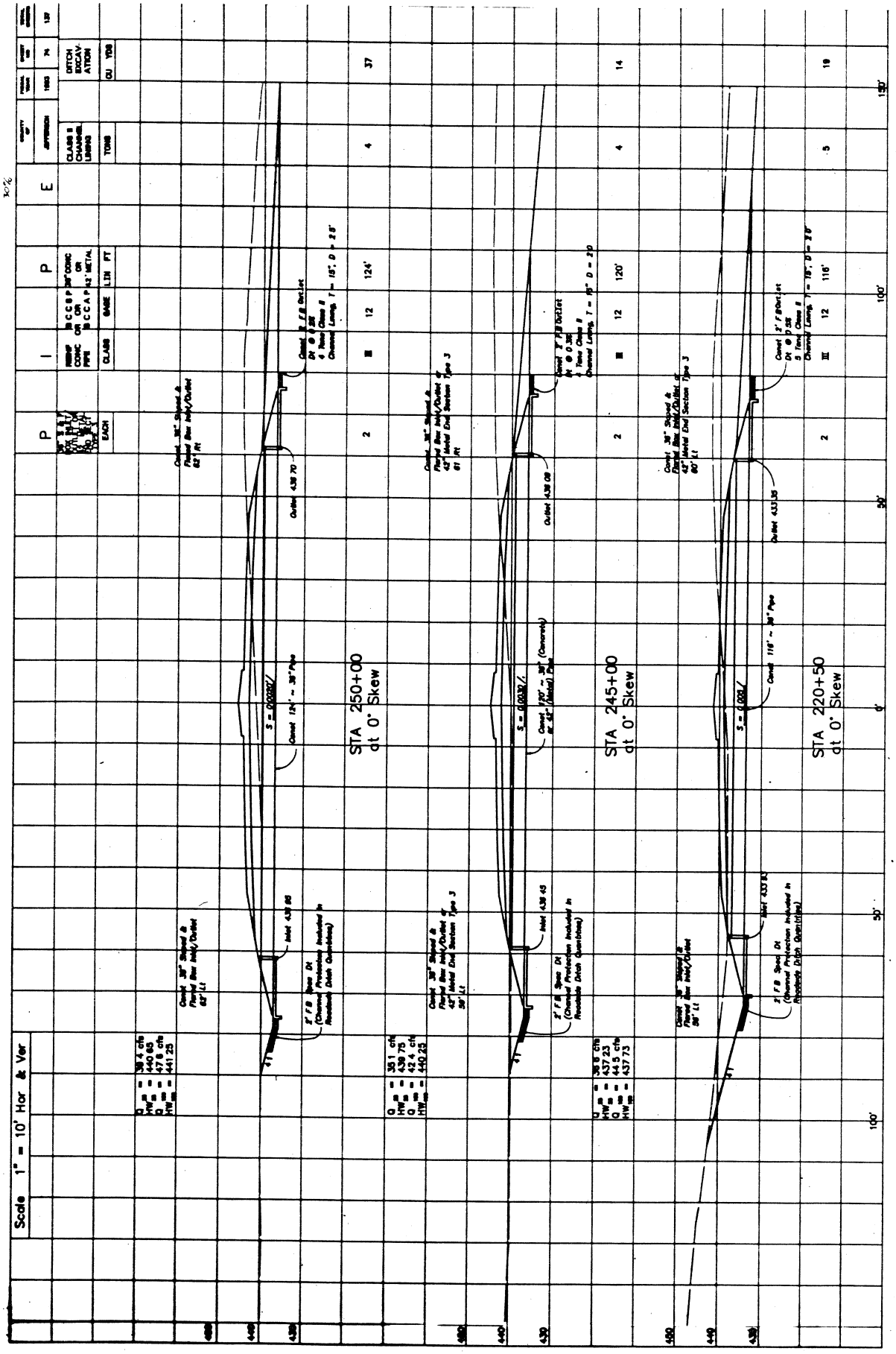




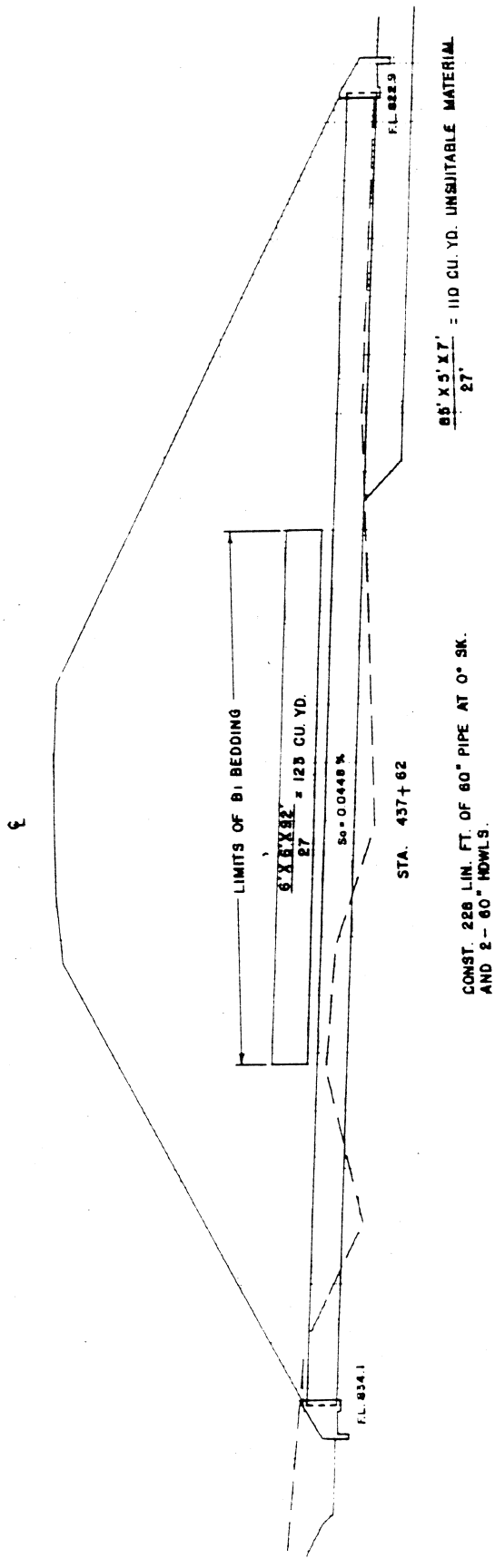
NOTES:

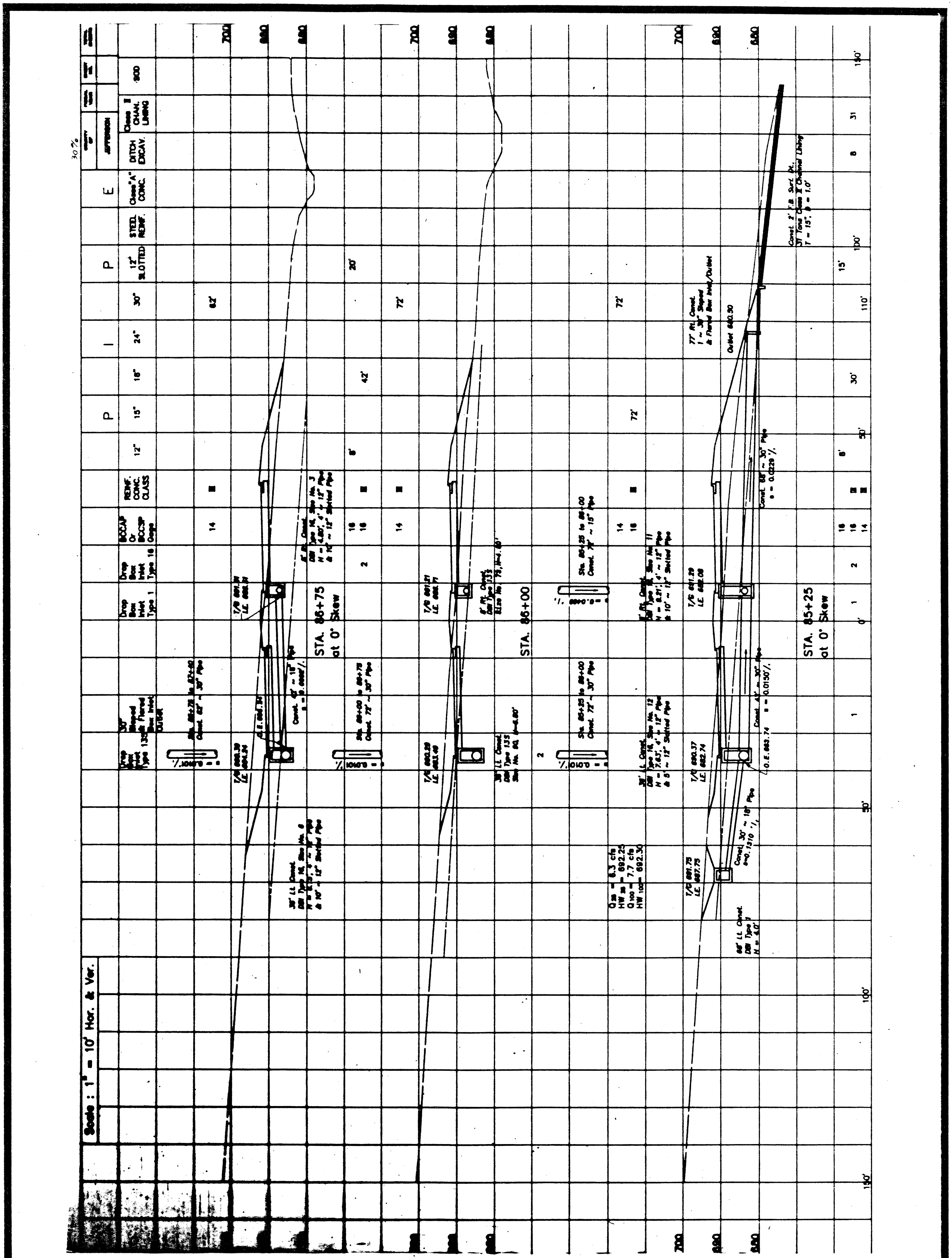
1. Dual Base Lines are used at large stream locations to insure the accuracy and ease of locating contours and topography.

01-01-93	PIPE SHEET	EXHIBIT DR-03.914



01-01-93	PIPE SHEET DEPICTING B-1 BEDDING DETAILS	EXHIBIT DR-03.915



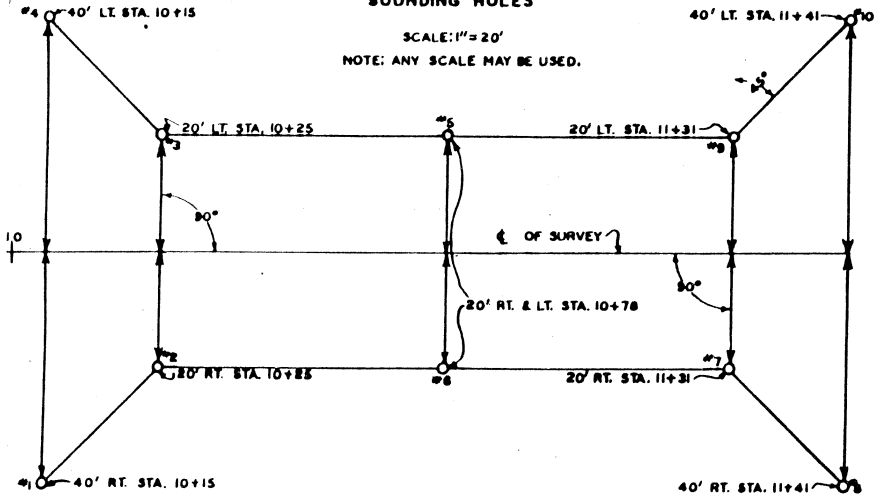

Scale : 1" = 10' Hor. & Ver.
STA. 86+75 at 0' Skew
STA. 86+00
STA. 85+25 at 0' Skew

FAYETTE CO. S.P. 34-304-LI
LINWOOD DRIVE ROAD

PLAN OF SOUNDING HOLES

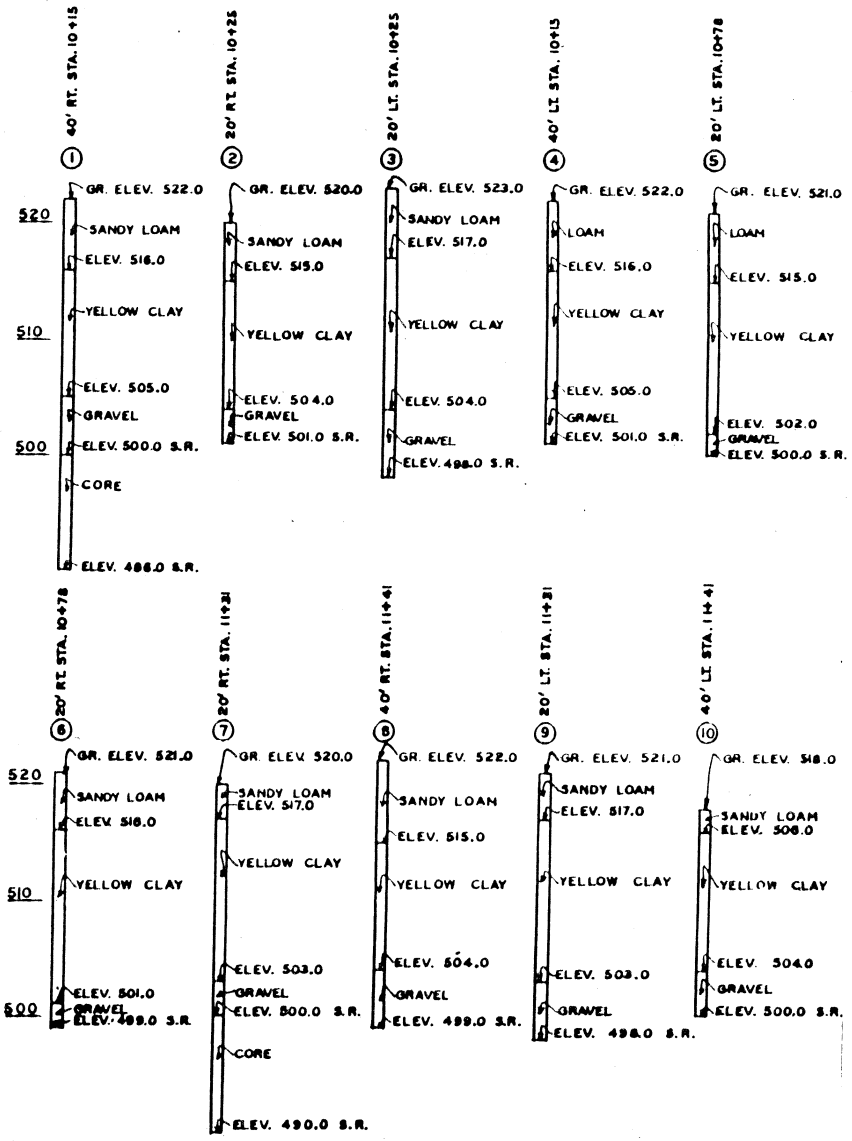
SCALE: 1" = 20'

NOTE: ANY SCALE MAY BE USED.



BRIDGE SURVEY STA. 10+78 at 90°

··LOG OF TEST HOLES··



~NOTES TO FIELD ENGINEER~

THE PROCURING OF A FIRM AND ACCURATE FOUNDATION FOR STRUCTURES IS OF GREAT IMPORTANCE. THIS CAN BE DONE ONLY BY UNDERGROUND EXPLORATION BY MEANS OF A SUITABLE DRILL OR BY PICK AND SHOVEL. IT IS NOT POSSIBLE TO DECIDE IN ADVANCE THE NUMBER OF HOLES NEEDED FOR ANY PARTICULAR SITE, SINCE THIS WILL BE DEPENDENT UPON THE CONDITIONS FOUND TO EXIST. WHEN HARD MATERIAL IS ENCOUNTERED, DO NOT STOP AT ONCE BUT MAKE AN EFFORT TO PENETRATE IT. SOLID ROCK SHOULD BE CORED WHEN POSSIBLE, AND ALL MATERIAL ENCOUNTERED SHOULD BE CAREFULLY LOGGED.
IN SOME SECTIONS, THERE IS LITTLE PROBABILITY OF FINDING SOLID ROCK WITHIN A REASONABLE DEPTH. IN SUCH CASES THE FIRST HOLE SHOULD BE CARRIED DOWN TO A DEPTH OF ABOUT 25' BELOW THE STREAM BED, BUT THE REMAINDER OF THE HOLES NEED NOT BE SO DEEP.

01-01-93 | PLAN OF SOUNDING HOLES - LOG OF TEST HOLES | EXHIBIT DR-03.917

KENTUCKY TRANSPORTATION CABINET
Division of Design

TC 61-102
Rev. 10/91

HYDRAULIC SITE DESCRIPTION

Date 5-20-1993 Weather SUNNY, MILD
Personnel KRB, HTH

1. County ADAIR 2. Road Name BURKESVILLE - COLUMBIA
3. UPN 55P001 0061 001-005 3a. Federal Number
4. Station 210+50 5.

6. **CHANNEL DESCRIPTION**
Straight ☐ Twisting ☒ Banks Lined With Trees ☐ Islands ☐ Rock Bottom ☐
Suggested mannings "n" value *(See Drainage Manual)* 0.040 Channel appears Clear ☒ Restricted ☐
Remarks:

7. **SOIL DESCRIPTION**
Clay (*Hard and Non-Porous*) ☐ Loam (*Soft and Porous*) ☒ Rocky ☐
If rocky, what type (*limestone, sandstone, etc.*) Apparent rock depth

8. **DRIFT**
Is drift present? Yes ☒ No ☐ If so, is it: Light ☒ Heavy ☐ Would multiple barrel structure pick up drift? Yes ☐ No ☒
Remarks:

9. **HIGH WATER**
Annual Average Extreme 810.00
Date Name source of information
Pool stage Is there backwater at the outlet? Yes ☐ No ☒
Explain:

Elevation at which high water causes damage 820.00 Houses ☒ Buildings ☐ Other ☐
Explain:

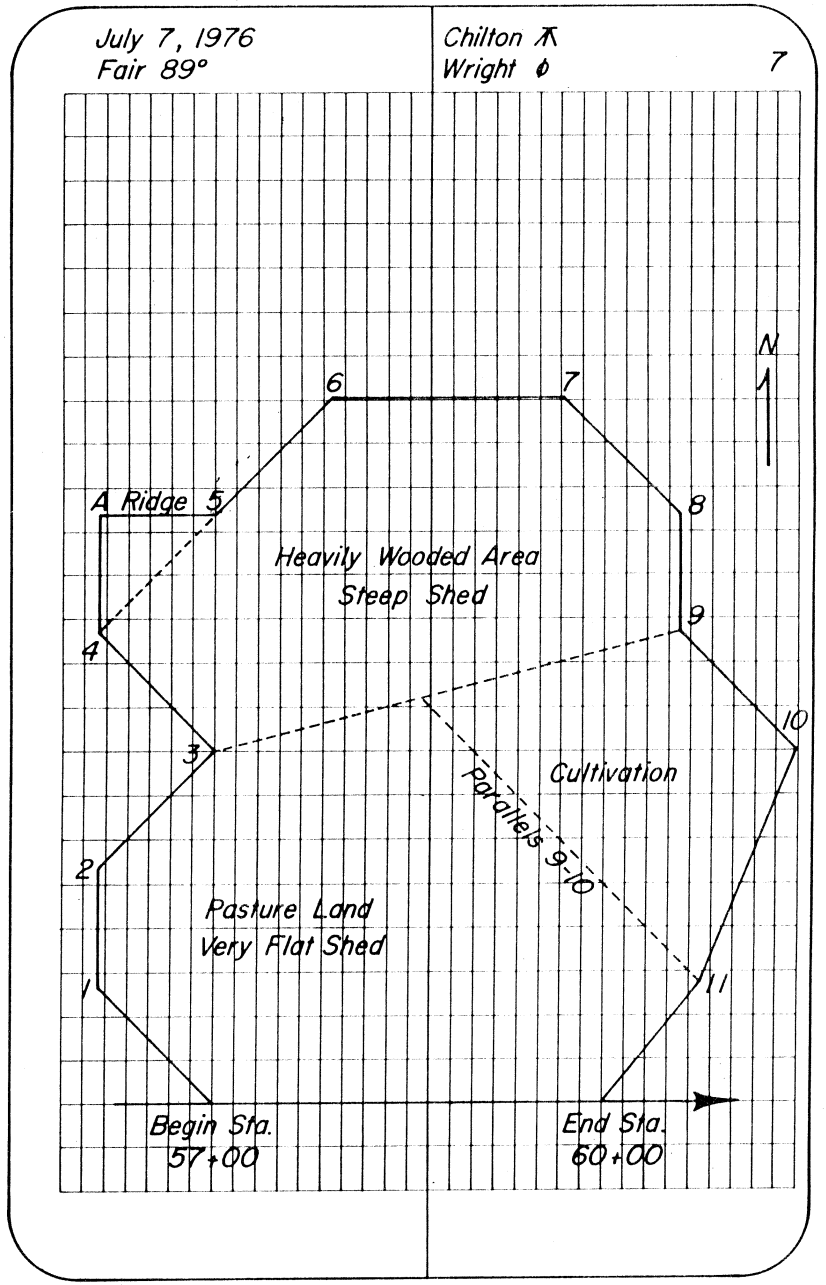
Elevation of ground at building 819.00 Elevation of basement floor
Elevation of ground floor 819.40 Other elevations

10. **EXISTING STRUCTURE** N/A
Elevation inlet flood level Elevation outlet flood level
Elevation inlet high water Elevation outlet high water
Width or Span Height Length or Roadway Width (*Show sketch*)
Is existing structure Too small ☐ Too large ☐ Does water go over road? Yes ☐ No ☐
Description of existing structure (*Bridge, pipe, box, concrete, steel, stone, etc.*)

Name of stream RENOX
Remarks:

DRAINAGE AREA STA. 58+12.3

Station	Bearing	Distance
57+00		
	N45°W	142
1		
	North	100
2		
	N45°E	141
3		
	N45°W	142
4		
	North	100
A		
	East	142
5		
	N45°E	142
6		
	East	200
7		
	S45°E	142
8		
	South	100
9		
	S45°E	142
10		
	S22°30' W	215
11		
	S45°W	100
60+00		



01-01-93

FIELD BOOK NOTES FOR DRAINAGE AREA

EXHIBIT DR-03.920

CULVERT SECTION - STA. 58+12.3

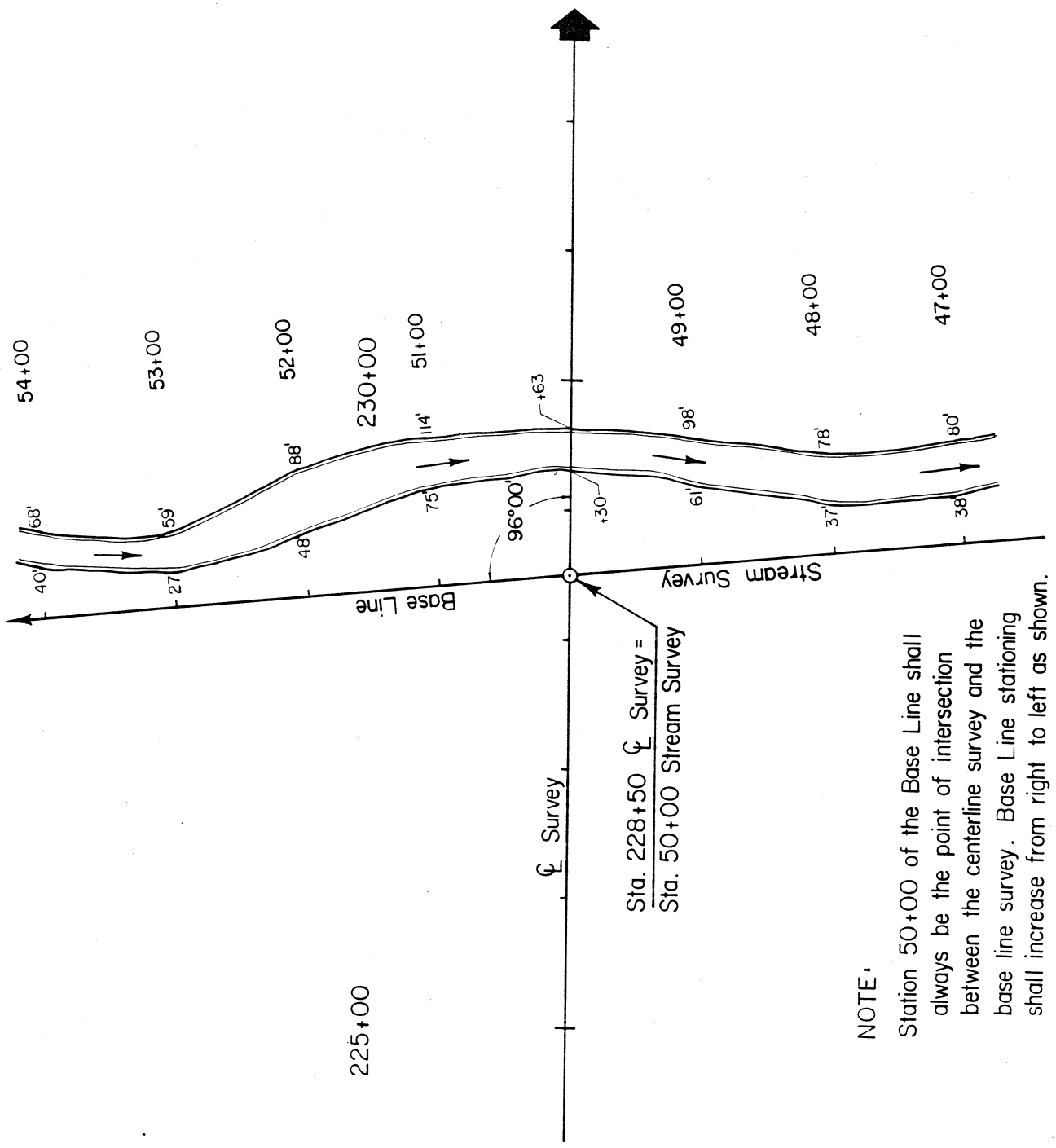
BM# 6	10.85	790.85			780.00
47+50			1.9		789.0
48+00			2.9		788.0
+50			2.4		788.5
49+00			2.5		788.4
+50			2.4		788.5
50+00	=58+12.3	℄ Survey	2.9		788.0
+50			2.9		788.0
51+00			3.9		787.0
+50			3.4		787.5
52+00			4.9		786.0
+50			5.7		785.2
53+00			6.5		784.4

May 6, 1976
Fair 78°

McBee ⋀
Tucker ϕ

6

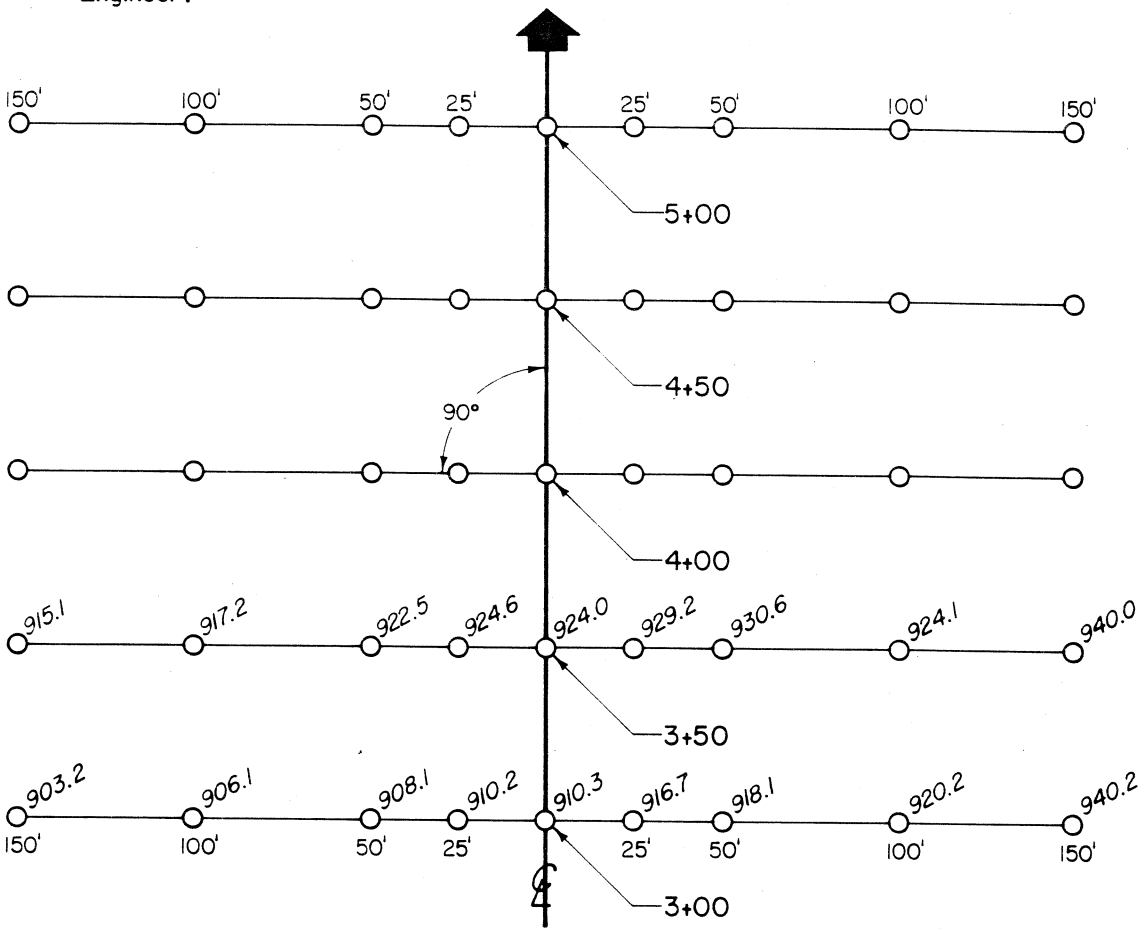
+1.5 / 15	0.2 / 10	0.2 / 5	1.0 / 5	0.0 / 8	+1.5 / 12
	1.5 / 8	1.0 / 3	0.9 / 2	0.0 / 6	+1.0 / 15
	1.0 / 15	0.6 / 2	1.2 / 3	0.6 / 6	+1.5 / 15
0.5 / 15	1.0 / 6	2.5 / 2	1.5 / 3	0.5 / 15	
+1.0 / 15	0.0 / 10	0.8 / 3	2.8 / 2	1.4 / 4	0.6 / 15
0.5 / 15	1.0 / 9	2.0 / 3	1.0 / 3	1.0 / 8	0.1 / 15
1.0 / 15	1.0 / 8	2.7 / 2	0.6 / 3	0.0 / 10	0.6 / 15
1.0 / 15	1.0 / 10	3.0 / 3	3.0 / 2	1.0 / 6	0.8 / 15
1.0 / 15	1.1 / 8	3.2 / 2	2.1 / 3	1.5 / 11	1.0 / 15
1.1 / 15	2.0 / 10	3.6 / 4	3.9 / 1	1.8 / 6	1.0 / 15
1.1 / 15	2.1 / 11	5.1 / 3	2.2 / 3	1.2 / 10	1.0 / 15
1.1 / 15	4.0 / 7	6.0 / 1	5.4 / 3	4.3 / 8	2.2 / 15



NOTE:

Station 50+00 of the Base Line shall always be the point of intersection between the centerline survey and the base line survey. Base Line stationing shall increase from right to left as shown.

The site contouring method depicted and described below is one of several acceptable methods that may be used. This and other methods such as transit-stadia, plotting from cross section notes, aerial photography, etc., shall be approved by the Drainage Engineer.



1. Set transit on even one hundred and plus fifty stations along centerline of survey.
2. At each set up, turn 90° left and right from centerline, measure and set stakes at 25', 50', 100', and 150' as shown above.
3. Using a level and rod, determine ground elevation at each stake and at each significant change of slope.
4. Mark elevation on each stake.
5. Locate contours with a hand level and rod by traversing in blocks at right angles to, parallel with, and diagonally from centerline of survey, or interpolate contours between stakes if hand level method is inappropriate.
6. The field engineer may set stakes at intervals other than those depicted above as necessary to get intermediate elevations at significant changes in slope.

CHANNEL ANALYSIS : TC 61-YYY (Rev. 6-93) Page 1 of 1

County ADAIR Route US 61 Proj. No. SSP 001 0061-001-005 Item No. 8-100.00

Location	Σ Acres	C	Tc	I	Q	Chan. Sect. ss _w_/ ss	n	So	dn	V	Remarks
						___/					
						___/					
RT. 1+00	1.7	0.8	25	3.4	4.6	3___/3 (2)		0.004			GRASS
			11			___/	0.3		1.9	0.3	τ_p = 2.1 τ = .2 OK
RT. 3+00			36	2.8	5.6	3___/3 (2)					
						___/	0.3	0.003	2.2	0.3	τ = .19 OK
						___/					
						___/					
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