U.S. DEPARTMENT OF THE INTERIOR

U.S. GEOLOGICAL SURVEY

LEVEL II BRIDGE SCOUR ANALYSIS FOR STRUCTURE 194023000300 ON ROUTE SC 230, CROSSING ANDERSON BRANCH IN EDGEFIELD COUNTY, SOUTH CAROLINA

By Andy W. Caldwell and J. Mike Sullivan

Prepared in cooperation with the
SOUTH CAROLINA DEPARTMENT
OF TRANSPORTATION

Columbia, South Carolina

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UNIT ABBREVIATIONS

cubic foot per second	ft^3/s
feet per second	ft/s
foot	ft
mile	mi
millimeter	mm
square foot	ft^2
square mile	mi^2

OTHER ABBREVIATIONS

downstream	D/S
upstream	U/S
flood plain	f/p
Water-Surface Profile computation model	WSPRO
median diameter of bed material	D_{50}
South Carolina Department of Transportation	SCDOT

In this report, the words "right" and "left" refer to directions that would be reported by an observer facing downstream.

Sea level: In this report, "sea level" refers to the National Geodetic Vertical Datum of 1929-- a geodetic datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929.

Level II bridge scour analysis for structure 194023000300 on Route SC 230, crossing Anderson Branch in Edgefield County, South Carolina

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This report provides the results of the detailed Level II analysis of scour potential at structure 194023000300 on Route SC 230, crossing Anderson Branch in Edgefield County, South Carolina (figure 1 in pocket; figures 4-6). The site is located in the Piedmont physiographic province near the city of North Augusta in the southern part of Edgefield County. The drainage area for the site is 4.59 mi^2, and is a predominantly rural drainage basin with little development in recent years. In the vicinity of the study site, the land is covered by moderate to dense hardwoods.

In the study area, Anderson Branch has a channel slope of approximately 0.0021 ft/ft (11.1 ft/mi), an average channel top width of 26 ft and an average channel depth of 1.8 ft. The predominant channel bed material is silty sand (D_{50} is 0.36 mm) and the channel banks also consist of a silty sand (D_{50} is 0.33 mm). In general, the banks have light woody vegetative cover and were noted to be relatively stable at the time of the Level I and Level II site visits, July 20, 1990, and May 4 and August 2, 1993, respectively.

The Route SC 230 crossing of Anderson Branch is a 120-ft-long, two-lane bridge consisting of four 30-ft concrete spans, supported by concrete bents with spillthrough abutments. The abutments are protected by riprap. In this report, the words "right" and "left" refer to directions that would be reported by an observer facing downstream. Additional details describing conditions at the site are included in the Scour Report Summary.

Scour depths were computed using engineering judgement and the general guidelines described in Hydraulic Engineering Circular 18 (Richardson and others, 1993) and the Transportation Research Board Draft Paper, "Evaluating scour at bridges using WSPRO" (Arneson and others, 1992). Scour depths were calculated assuming an infinite depth of erosive material and a homogeneous particle-size distribution. The results of the scour analysis are presented in tables 1 and 2 and a graph of the scour depths is shown on figure 2.

Pile penetration depths were obtained from the SCDOT bridge plans (docket number 19.349). The minimum remaining pile penetration depth for the 100-year discharge is 0.4 ft and occurs at bent 3. Maximum pile tip exposure of 1.8 ft occurs at bent 3 for the 500-year discharge.

It should be noted that the SCDOT bridge plan borings (docket number 19.349) show subsurface rock that could affect the scour depths shown in this study. For more information, see the SCDOT bridge plans in the pocket at the back of the report.

Table 1. --*Remaining pile/footing penetration at piers/bents for the 100- and 500-year discharges at structure 194023000300 on Route SC 230, crossing Anderson Branch in Edgefield County, South Carolina.*

Pier/bent [1] number	Station from [2] left end of bridge (feet)	Pile tip/ [3] footing elevation, SCDOT datum (feet)	Pile tip/ footing elevation, USGS datum (feet)	Ground elevation at pier/bent, USGS datum (feet)	Total [4] scour depth (feet)	Elevation of scour, USGS datum (feet)	Remaining [5] pile/footing penetration (feet)
100-year discharge is 1,240 cubic feet per second							
2	30	171.3	171.3	183.9	10.6	173.3	2.0
3	60	175.1	175.1	186.1	10.6	175.5	0.4
4	90	175.6	175.6	186.0	6.5	179.5	3.9
500-year discharge is 1,610 cubic feet per second							
2	30	171.3	171.3	183.9	12.8	171.1	-0.2
3	60	175.1	175.1	186.1	12.8	173.3	-1.8
4	90	175.6	175.6	186.0	8.2	177.8	2.2

[1] Pier/bent number corresponds to the South Carolina Department of Transportation (SCDOT) bridge plans (docket number 19.349).

[2] Stations are determined from left to right looking downstream.

[3] Pile tip/footing elevations obtained from the SCDOT bridge plans. The maximum elevation at each pier/bent is used.

[4] Total scour depth is the sum of the contraction and pier/bent scour depths.

[5] A negative number signifies undermining of pile tip/footing.

NOTE: The SCDOT bridge plan borings (docket number 19.349) show subsurface rock that could affect the scour depths shown in the above table. For more information, see the SCDOT plans in the report pocket.

Table 2. --*Cumulative scour depths at piers/bents for the 100- and 500-year discharges at structure 194023000300 on Route SC 230, crossing Anderson Branch in Edgefield County, South Carolina.*

Pier/bent number [1]	Station from left end of bridge (feet) [2]	Contraction scour depth (feet)	Pier/bent scour depth **without** debris (feet)	Total [3] scour depth **without** debris (feet)
100-year discharge is 1,240 cubic feet per second				
2	30	7.0	3.6	10.6
3	60	7.0	3.6	10.6
4	90	3.4	3.1	6.5
500-year discharge is 1,610 cubic feet per second				
2	30	9.0	3.8	12.8
3	60	9.0	3.8	12.8
4	90	4.9	3.3	8.2

[1] Pier/bent number corresponds to the South Carolina Department of Transportation (SCDOT) bridge plans (docket number 19.349).

[2] Stations are determined from left to right looking downstream.

[3] Total scour depth is the sum of the contraction and pier/bent scour depths.

NOTE: The SCDOT bridge plan borings (docket number 19.349) show subsurface rock that could affect the scour depths shown in the above table. For more information, see the SCDOT plans in the report pocket.

NOTE: The pier and contraction scour equations used in this scour analysis were those recommended in Hydraulic Engineering Circular 18 (Richardson and others, 1993). Scour depths were calculated assuming an infinite depth of erosive material and a homogeneous particle-size distribution.

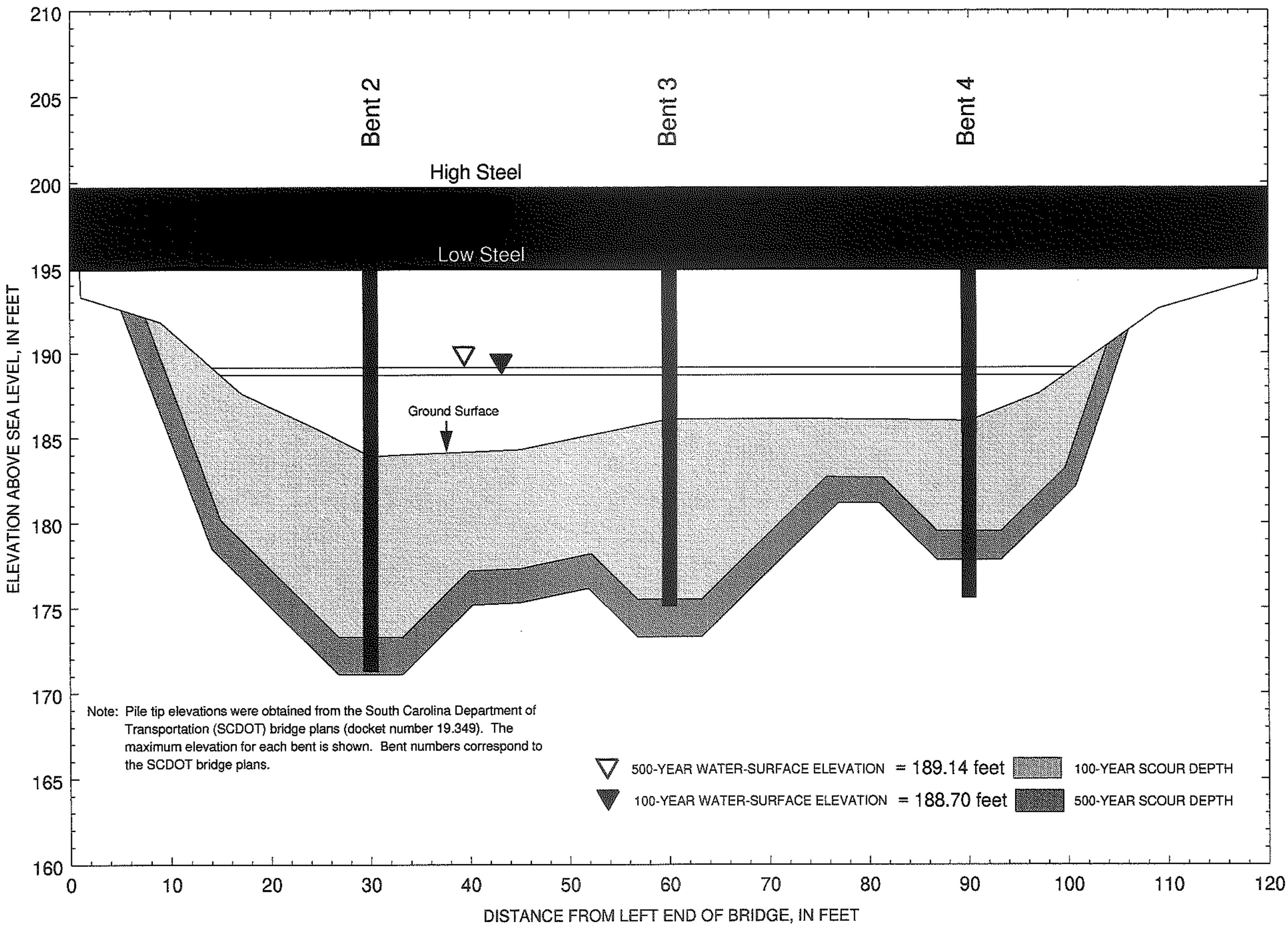

Figure 2.--Total scour depths for the 100- and 500-year discharges at structure 194023000300 on Route SC 230, crossing Anderson Branch in Edgefield County, South Carolina.

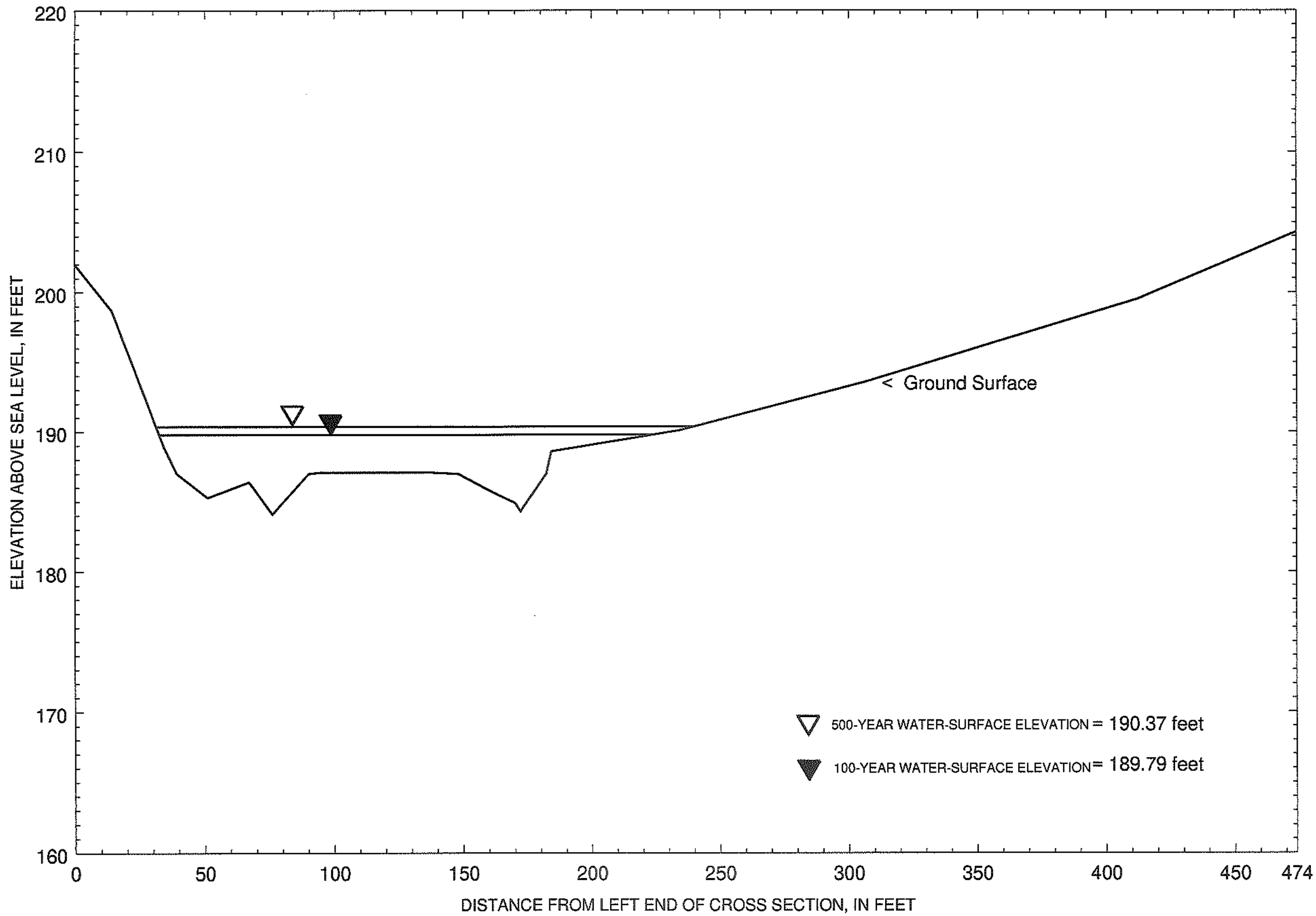

Figure 3.--Approach cross section at structure 194023000300 on Route SC 230, crossing Anderson Branch in Edgefield County, South Carolina.

Figure 4.--Structure 194023000300 on Route SC 230, crossing Anderson Branch in Edgefield County, South Carolina as viewed from the downstream right bank (May 4, 1993).

Figure 5.--Downstream channel as viewed from structure 194023000300 on Route SC 230, crossing Anderson Branch in Edgefield County, South Carolina (July 20, 1990).

Figure 6.--Upstream channel as viewed from structure 194023000300 on Route SC 230, crossing Anderson Branch in Edgefield County, South Carolina (July 20, 1990).

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SCOUR REPORT SUMMARY

Structure Number 194023000300 *Stream* Anderson Branch

County Edgefield *Road* SC 230 *District* 2

Description of Bridge

Bridge length 120 *ft* *Bridge width* 33 *ft* *Max span length* 30 *ft*

Alignment of bridge to road (on curve or straight) Straight

Abutment type Spillthrough *Embankment type* Sloping

Riprap on abutment? Yes *Date of inspection* 7-20-1990

Description of riprap Twelve- to 18-inch granite riprap protects the right and left abutments.

Brief description of piers/pile bents Three interior bents each consisting of four 1.4-ft-square concrete piles support the bridge.

Is bridge skewed to flood plain according to USGS topo map? No *Angle* 0

Is bridge located on a bend in channel? No *If so, describe (mild, moderate, severe)*

Debris accumulation on bridge at time of Level I or Level II site visit:

	Date of inspection	*Percent of channel blocked horizontally*	*Percent of channel blocked vertically*
Level I	7-20-1990	0	0
Level II	5-4-1993	0	0

Potential for debris Low: A dam is located approximately 495 ft upstream of the Route SC 230 crossing.

Describe any features near or at the bridge that may affect flow (include observation date).

There is a pond dam located approximately 495 ft upstream of the Route SC 230 bridge.

Flow of Anderson Branch is affected by backwater from the Stephens Creek Reservoir.

Description of Flood Plain

General topography Typical Piedmont topography

Flood-plain conditions at bridge site: downstream (D/S), upstream (U/S)

Date of inspection 5-4-1993

D/S left: Moderate to thick hardwoods with moderate undergrowth

D/S right: Moderate hardwoods with moderate undergrowth

U/S left: Moderate to thick hardwoods with moderate undergrowth

U/S right: Moderate hardwoods with moderate undergrowth

Description of Channel

Average top width 26 *ft* *Average depth* 1.8 *ft*

Predominant bed material Silty sand *Bank material* Silty sand

Stream type (straight, meandering, braided, swampy, channelized) Meandering

Vegetative cover on channel banks near bridge: Date of inspection 5-4-1993

D/S left: Light to moderate woody vegetative cover

D/S right: Light to moderate woody vegetative cover

U/S left: Light to moderate woody vegetative cover

U/S right: Light to moderate woody vegetative cover

Do banks appear stable? Yes *If not, describe location and type of instability and date of observation.*

Describe any obstructions in channel and date of observation. None observed.

Hydrology

Drainage area 4.59 *mi^2*

Percentage of drainage area in physiographic provinces:

Physiographic province	*Percent of drainage area*
Piedmont	100

Is drainage area considered rural or urban? Rural *Describe any significant urbanization and potential for development.* The basin is predominantly rural with little potential for future development.

Is there a USGS gage on the stream of interest? No

USGS gage description ______

USGS gage number ______

Gage drainage area ______ *mi^2*

Is there a lake/pond that will significantly affect hydrology/hydraulics? Yes

If so, describe A pond is located approximately 495 ft upstream of the Route SC 230 bridge. A flood hydrofraph routing was done and it was concluded that the pond would not affect the discharges. In addition, Anderson Branch is affected by backwater from Stevens Creek Reservoir.

Calculated Discharges

Q100 1,240 *ft^3/s* *Q500* 1,610 *ft^3/s*

Method used to determine discharges The USGS rural regression equations from WRIR 91-4157 "Techniques for estimating magnitude and frequency of floods in South Carolina, 1988" by Guimaraes and Bohman, were used to determine the discharges.

Brief Description of the Water-Surface Profile Model (WSPRO) Analysis

Datum for WSPRO analysis (USGS survey, sea level, SCDOT plans) sea level

Datum tie between USGS survey and SCDOT plans No datum tie is needed. The SCDOT plans and the USGS survey are on the same datum.

Description of reference marks used to determine USGS datum. BM WDK3 1961 is a bronze tablet on the upstream right abutment headwall of the Route SC 230 bridge with an established elevation of 198.00 ft. RM 1 is a chiseled square on the downstream left abutment headwall of the Route SC 230 bridge with a surveyed elevation of 197.89 ft.

Cross Sections Used in WSPRO Analysis

*Cross section ID	Section Reference Distance (SRD) in feet	**How cross section was developed	Comments
SEC.J	-23050	5	Cross sections on
to			Stevens Creek to the
SEC.A	-1500	5	mouth of Anderson Branch
EXITA	-800	1	Cross section at constriction
EXITB	-120	2	Exit cross section
FULV	0	1	Full-valley cross section
BRIDG	0	1	Upstream bridge face
APPR	153	1	Approach cross section

* For location of cross sections see topographic map included with report (figure 1). For more detail on how cross sections were developed see WSPRO input file.

** Cross section development: 1) survey at SRD 2) shift of survey data to SRD 3) modification of survey data based on topographic map 4) synthesized by combining channel survey data and topographic contours 5) from USGS bathymetric study of Stevens Creek

Description of data and assumptions used in developing WSPRO model.

The confluence of Anderson Branch and Stevens Creek is approximately 1,500 ft downstream of the Route SC 230 bridge. It was concluded from information obtained during the Level I and Level II site visits that Anderson Branch is affected by backwater from the Stevens Creek Dam located downstream on the Savannah River. Therefore, to properly analyze the Route SC 230 bridge at Anderson Branch, the WSPRO analysis was initiated at the mouth of Stevens Creek (at the Savannah River) and concluded at the approach cross section upstream of the Route SC 230 bridge.

The 100- and 500-year discharges for Stevens Creek (1,800 cubic feet per second and 2,170 cubic feet per second, respectively) were determined by adding the average daily discharge at the mouth of Stevens Creek (557 cubic feet per second) to the 100- and 500-year discharges on Anderson Branch. The average daily discharge at the mouth of Stevens Creek was determined by shifting the average daily discharge from USGS station 01296000, Stevens Creek near Modoc, SC, by the ratio of the drainage areas. The above discharges were used in the WSPRO analysis from the mouth of Stevens Creek up to the confluence with Anderson Branch. At this point, the 100- and 500-year discharges were changed to 1,240 cubic feet per second and 1,610 cubic feet per second, respectively.

The starting water-surface elevation for the WSPRO analysis was set at full-pool elevation of Stevens Creek Reservoir, 187.5 ft above sea level, at the Stevens Creek Dam for the 100- and 500-year floods. Full-pool elevation was obtained from Carl Mason of South Carolina Electric and Gas (oral communication, 1994).

For this study, the WSPRO model requires a cross section at the constriction 800 ft downstream of the bridge, an exit cross section one bridge width downstream of the bridge, a full-valley cross section at the downstream bridge face, the bridge cross section, an approach cross section one bridge width upstream of the bridge to model the flow of Anderson Branch, and cross sections A through J to model the flow of Stevens Creek. Cross sections at the upstream and downstream faces of the bridge were directly surveyed and the more constricted (upstream) bridge face was used in the WSPRO model. The section reference distance (SRD) at the downstream face of the bridge was set to zero. An approach cross section was surveyed 143 ft upstream of the upstream bridge face and a downstream toe-of-fill cross section was surveyed. In addition, an exit cross section was surveyed at the constriction 800 ft downstream of the downstream bridge face and represents the EXITA cross section. The toe-of-fill cross section was shifted by the channel slope to the appropriate SRD to represent cross sections EXITB and FULV. The data for the cross sections on Stevens Creek were developed from the USGS bathymetric study of Stevens Creek and Neal Shoals Reservoirs (Whitney Stringfield, USGS, written communication, 1993)

Bridge Hydraulics

Average embankment elevation 197.3 *ft*

Average low steel elevation 194.9 *ft*

100-year discharge 1,240 ft^3/s

Water-surface elevation at D/S bridge face 188.70 *ft*

Area of flow at D/S bridge face 254 ft^2

Average velocity in bridge opening 4.88 *ft/s*

Maximum WSPRO tube velocity at bridge 5.73 *ft/s*

Water-surface elevation at Approach section with bridge 189.79 *ft*

Water-surface elevation at Approach section without bridge 189.50 *ft*

Amount of backwater caused by bridge 0.29 *ft*

500-year discharge 1,610 ft^3/s

Water-surface elevation at D/S bridge face 189.14 *ft*

Area of flow at D/S bridge face 292 ft^2

Average velocity in bridge opening 5.51 *ft/s*

Maximum WSPRO tube velocity at bridge 6.43 *ft/s*

Water-surface elevation at Approach section with bridge 190.37 *ft*

Water-surface elevation at Approach section without bridge 190.02 *ft*

Amount of backwater caused by bridge 0.35 *ft*

Scour

Describe any special assumptions or considerations made in bridge scour analysis.

Scour depths were computed using engineering judgement and the general guidelines described in Hydraulic Engineering Circular 18 (Richardson and others, 1993) and the Transportation Research Board Draft Paper, "Evaluating scour at bridges using WSPRO" (Arneson and others, 1992). Scour depths were calculated assuming an infinite depth of erosive material and a homogeneous particle-size distribution. The results of the scour analysis are presented in tables 1 and 2 and a graph of the scour depths is shown on figure 2.

The local pier scour was determined using the Colorado State University pier scour equation (Richardson and others, 1993). Bent 4 is located on the right overbank and was analyzed using the maximum right overbank WSPRO tube velocity and the depth of flow at the bent. Bents 2 and 3 are located in the channel and were analyzed using 90 percent of the maximum WSPRO tube velocity and the maximum depth within the channel at the bridge. The maximum depth within the channel was used to account for possible changes in the thalweg during a flood.

The right overbank at the bridge was analyzed for contraction scour using Laursen's clear-water contraction scour equation (Richardson and others, 1993).

The pond located just upstream of the Route SC 230 bridge will probably minimize sediment transport during low and high flows. Therefore, it was decided that clear-water scour would best represent the contraction scour processes at the bridge, and the potential contraction scour was determined using Laursen's clear-water contraction scour equation (Richardson and others, 1993).

No abutment scour computations were made because the abutments are protected by riprap.

It should be noted that the SCDOT bridge plan borings (docket number 19.348) show subsurface rock that could affect the scour depths shown in this study. For more information, see the SCDOT bridge plans in the pocket at the back of the report.

WSPRO INPUT FILE

```
T1        Structure # 194023000300          (120 ft bridge)
T2        Anderson Branch @ SC 230             File:  anderson.sc230
T3        Edgefield County, South Carolina    AWC     3-1-1995
*
*
*
*         The starting discharge at the mouth of Stevens Creek represents
*         the daily average discharge (557 cusic feet per second) plus the
*         discharge from Anderson Branch.  The daily average discharge on Stevens
*         Creek was determined by using gaging ststion data at station 02196000
*         Stevens Creek near Modoc, SC and adjusting it by the drainage area.
*         The startingwater surface elevation was set at full pool elevation
*         (187.54 ft above sea level).
*
*
*
*
*
*         Q100      Q500
Q         1800      2170
WS        187.5     187.5
*
*         The following cards are channel cross sections determined from a
*         bathymetric study of Stevens Creek by the USGS in
*         1990.  The flood plain data were determined from a USGS topo map.
*         The first cross section begins at the mouth of Stevens
*         Creek and the last cross section is at the confluence with Anderson
*         Branch.  Because Stevens Creek is pooled by the Stevens Creek Dam
*         and there is little vegetation in the pooled area, a low Manning's
*         'n' value of 0.04 was used for the cross sections.  An average flood
*         plain value of 0.15 is used on the left and right overbanks.
*
*
*
*
*           Mouth of Stevens Creek before entering the Savannah River
XS    SEC.J       -23050
GR            0  200    50  190    150  187.5   255  177.5   300  172.5
GR          360  167.5   650  167.5   710  172.5   825  177.5   1050  187.5
GR         1100  190.0   1300  200
N          0.15        0.04        0.15
SA               150        1050
*
XS    SEC.I       -19250
GR            0  200   100  190    150  187.5   375  177.5   440  172.5
GR          540  167.5   600  167.5   675  172.5   730  177.5   860  187.5
GR          940  190   1140  200
N        0.15    0.04     0.15
SA             150      860
*
XS    SEC.H       -16000
GR            0  200    40  190    90  187.5   180  177.5   240  172.5
GR          300  167.5   350  167.5   420  172.5   500  177.5   590  187.5
GR          630  190   690  200
N        0.15    0.04     0.15
SA              90      590
*
```

```
XS   SEC.G      -13000
GR            0  200    40  190    90  187.5   240  177.5   310  172.5
GR          390  167.5   430  172.5   465  177.5   530  187.5   630  190
GR          830  200
N        0.15   0.04     0.15
SA            90      530
*
XS   SEC.F      -10500
GR            0  200    30  190    80  187.5   210  177.5   360  172.5
GR          480  172.5   530  177.5   680  187.5   720  190    760  200
N        0.15   0.04     0.15
SA            80      680
*
XS   SEC.E      -8500
GR            0  200    150  190    220  187.5   370  177.5   520  172.5
GR          630  172.5   690  177.5   840  187.5   890  190    940  200
N        0.15   0.04     0.15
SA           220      840
*
XS   SEC.D      -7250
GR            0  200    200  190    850  187.5   1300  187.5   1340  177.5
GR         1375  172.5   1420  172.5   1450  177.5   1490  187.5   1510  190
GR         1540  200
N        0.15   0.04     0.15
SA          1300     1490
*
XS   SEC.C      -4750
GR            0  200    50  190    200  187.5   240  177.5   290  172.5
GR          360  172.5   390  177.5   450  187.5   670  190    750  200
N        0.15   0.04     0.15
SA           200      450
*
*
*          Confluence of Anderson Branch and Stevens Creek
*
XS   SEC.B      -3000
GR            0  200.5   100  190    180  187.5   240  177.5   330  172.5
GR          430  177.5   720  187.5   760  190    820  200
N        0.15   0.04     0.15
SA           180      720
*
XS   SEC.A      -1500
GR            0  199    100  189    400  186.5   460  176.5   570  176.5
GR          625  186.5   1125  189   1225  199
N        0.15   0.04     0.15
SA           400      625
*
*
*
*
*
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*        ******************************************************************
*                       Beginning of Anderson Branch
*        ******************************************************************
*
*
*
*        Survey data for EXITA cross section was surveyed 800 ft D/S
*        of the Route SC 230 D/S bridge face. Distance was determined
*        from the USGS topographic map.
*
XS   EXITA  -800
GR          0  201.1    27  196.4    38  191.2    56  187.8    62  187.8
GR         63  185.6   169  182.6   234  181.7   267  182.3   315  179.1
GR        386  184.1   400  187.5   458  193.9   501  203.1
N         0.17  0.045   0.15
SA            62      400
PX
*
*
*        Q100    Q500
Q        1240    1610
*
*
*        Survey data for EXITB cross section were surveyed at the downstream
*        toe-of-fill of the Route SC 230 bridge. The data were then shifted
*        by the channel slope of Anderson Branch to the appropriate SRD.
*
XT   SURV1  0    0.0021
GR          0  199.4    6  196.2    92  193.6    177  193.6    222  191.0
GR          329  186.9   359  185.9   389  185.8   404  185.9   441  185.3
GR          442  184.2   447  183.5   449  183.4   456  183.6   461  184.2
GR          465  185.8   524  186.2   599  189.8   721  192.6   807  194.7
GR          897  199.3
*
XS   EXITB  -120
GT
N           0.17   0.045   0.15
SA              441     465
PX
*
XS   FULV   0
GT
PX
*
*
```

```
*        Upstream bridge face
*
BR    BRIDG  0   194.9
GR           0   194.9    1   194.9    1.1   193.3    9   191.8    17   187.6
GR           25   185.4    30   183.9    45   184.3    60   186.1    75   186.1
GR           90   186.0    97   187.6    109   192.6    118.9  194.3    119   194.9
GR           120   194.9    0   194.9
N            0.045  0.045
SA               60
PW 1         183.9  1.4    186.0  1.4    186.0  2.8    186.1  2.8    186.1  4.2
PW           194.9  4.2    194.9  0
CD           3  33   1.9  197.3
KD           * * *  67   184
PX
*
*
*
*        Survey data for the APPR cross section were surveyed 143 ft upstream
*        of the upstream bridge face. The distance was determined from
*        the USGS survey.
AS    APPR   153
GR          0   202.0    14   198.7    34   188.9    39   187.0    51   185.3
GR          67   186.4    76   184.1    90   187.0    95   187.1    138   187.1
GR          148   187.0    160   185.8    170   184.9    172   184.3    182   187.0
GR          184   188.6    234   190.1    307   193.6    360   196.6    412   199.5
GR          474   204.3
*
N           0.17  0.06  0.15   0.06   0.15
SA              67     95     138     184
BP          121
PX
*
*
HP 1 BRIDG  188.70   0   188.70
HP 2 BRIDG  188.93   0   188.93   1240
HP 1 APPR   189.79   0   189.79
HP 2 APPR   189.79   0   189.79   1240
HP 1 BRIDG  189.14   0   189.14
HP 2 BRIDG  189.39   0   189.39   1610
HP 1 APPR   190.37   0   190.37
HP 2 APPR   190.37   0   190.37   1610
*
EX
ER
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WSPRO OUTPUT

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WSPRO          FEDERAL HIGHWAY ADMINISTRATION - U. S. GEOLOGICAL SURVEY
V042094              MODEL  FOR  WATER-SURFACE  PROFILE  COMPUTATIONS

        Structure # 194023000300            (120 ft bridge)
        Anderson Branch @ SC 230               File:  anderson.sc230
        Edgefield County, South Carolina    AWC     3-1-1995
           *** RUN DATE & TIME: 03-09-95  07:56
    CROSS-SECTION PROPERTIES:  ISEQ = 14;  SECID = BRIDG;  SRD =        0.

     WSEL  SA#      AREA         K   TOPW    WETP  ALPH    LEW     REW       QCR
             1       161     12226     45      46                           1718
             2        94      5449     40      40                            815
   188.70            254     17675     85      86  1.05     15     100      2441



    VELOCITY DISTRIBUTION:  ISEQ = 14;  SECID = BRIDG;  SRD =        0.

         WSEL      LEW     REW    AREA        K         Q     VEL
       188.93     14.5   100.2   273.6   19789.     1240.   4.53

X STA.        14.5       24.8       28.3       30.9       33.1       35.4
  A(I)            20.4       13.9       12.5       11.4       11.3
  V(I)            3.04       4.45       4.96       5.45       5.50

X STA.        35.4       37.7       40.0       42.3       44.6       47.1
  A(I)            11.1       10.9       11.1       10.8       11.2
  V(I)            5.60       5.68       5.61       5.73       5.56

X STA.        47.1       49.9       53.1       57.0       62.0       67.2
  A(I)            11.8       12.2       13.5       14.7       14.7
  V(I)            5.27       5.08       4.59       4.21       4.23

X STA.        67.2       72.6       77.9       83.3       88.8      100.2
  A(I)            15.2       15.0       15.4       16.1       20.6
  V(I)            4.08       4.13       4.03       3.86       3.01
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WSPRO          FEDERAL HIGHWAY ADMINISTRATION - U. S. GEOLOGICAL SURVEY
V042094            MODEL  FOR  WATER-SURFACE  PROFILE  COMPUTATIONS

        Structure # 194023000300               (120 ft bridge)
        Anderson Branch @ SC 230                  File:  anderson.sc230
        Edgefield County, South Carolina    AWC     3-1-1995
          *** RUN DATE & TIME: 03-09-95  07:56
    CROSS-SECTION PROPERTIES:  ISEQ = 15;  SECID = APPR ;  SRD =      153.

     WSEL   SA#      AREA          K   TOPW    WETP  ALPH     LEW     REW       QCR
              1       117       2261     35      36                            1213
              2       114       7111     28      29                            1304
              3       116       2222     43      43                            1077
              4       168       9762     46      47                            1826
              5        24        166     40      40                             103
   189.79             538      21521    191     194  1.81      32     224      3807


    VELOCITY DISTRIBUTION:  ISEQ = 15;  SECID = APPR ;  SRD =      153.

        WSEL      LEW      REW     AREA         K         Q     VEL
      189.79     32.2    223.7    538.2    21521.     1240.    2.30

X STA.        32.2        52.5        65.5        71.0        74.3        76.9
  A(I)            60.4        51.3        20.8        15.9        14.4
  V(I)            1.03        1.21        2.98        3.90        4.31

X STA.        76.9        79.8        83.4        88.9       101.3       121.9
  A(I)            15.1        16.4        19.4        33.9        55.6
  V(I)            4.11        3.79        3.19        1.83        1.11

X STA.       121.9       139.9       148.3       154.8       159.8       163.9
  A(I)            48.4        22.9        20.6        18.7        17.1
  V(I)            1.28        2.71        3.01        3.31        3.64

X STA.       163.9       167.5       170.7       173.7       177.6       223.7
  A(I)            16.0        15.6        15.5        17.7        42.6
  V(I)            3.87        3.96        4.01        3.51        1.46
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WSPRO          FEDERAL HIGHWAY ADMINISTRATION - U. S. GEOLOGICAL SURVEY
V042094            MODEL  FOR  WATER-SURFACE  PROFILE  COMPUTATIONS

        Structure # 194023000300               (120 ft bridge)
        Anderson Branch @ SC 230                  File:  anderson.sc230
        Edgefield County, South Carolina       AWC     3-1-1995
           *** RUN DATE & TIME: 03-09-95  07:56
    CROSS-SECTION PROPERTIES:  ISEQ = 14;  SECID = BRIDG;  SRD =         0.

     WSEL  SA#      AREA         K    TOPW    WETP  ALPH     LEW     REW       QCR
             1       181     14672      46      47                            2031
             2       111      7137      41      41                            1043
   189.14            292     21809      87      88  1.04      14     101      2984


    VELOCITY DISTRIBUTION:  ISEQ = 14;  SECID = BRIDG;  SRD =         0.

          WSEL      LEW      REW     AREA        K         Q     VEL
        189.39     13.6    101.3    313.5    24327.     1610.   5.14

X STA.       13.6        24.4        28.0        30.8        33.2        35.6
  A(I)            23.6        16.1        14.4        13.2        13.1
  V(I)            3.41        5.00        5.59        6.11        6.16

X STA.       35.6        38.1        40.5        42.9        45.4        48.0
  A(I)            12.8        12.7        12.5        12.7        12.9
  V(I)            6.27        6.36        6.43        6.33        6.22

X STA.       48.0        51.0        54.5        58.7        63.7        68.8
  A(I)            13.7        14.2        15.8        16.7        16.5
  V(I)            5.87        5.66        5.11        4.83        4.87

X STA.       68.8        73.9        79.0        84.1        89.4       101.3
  A(I)            17.0        16.8        16.9        18.0        23.9
  V(I)            4.74        4.80        4.76        4.48        3.37
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WSPRO          FEDERAL HIGHWAY ADMINISTRATION - U. S. GEOLOGICAL SURVEY
V042094            MODEL  FOR  WATER-SURFACE  PROFILE  COMPUTATIONS

         Structure # 194023000300             (120 ft bridge)
         Anderson Branch @ SC 230                File:  anderson.sc230
         Edgefield County, South Carolina    AWC     3-1-1995
           *** RUN DATE & TIME: 03-09-95  07:56
     CROSS-SECTION PROPERTIES:  ISEQ = 15;  SECID = APPR ;  SRD =      153.

      WSEL  SA#      AREA         K   TOPW    WETP  ALPH    LEW    REW      QCR
              1       137      2891     36      37                         1521
              2       130      8879     28      29                         1592
              3       141      3077     43      43                         1443
              4       195     12476     46      47                         2277
              5        52       490     56      56                          283
    190.37            655     27813    209     211  1.90     31    240     4778


     VELOCITY DISTRIBUTION:  ISEQ = 15;  SECID = APPR ;  SRD =      153.

          WSEL      LEW     REW    AREA        K        Q     VEL
        190.37     31.0   239.6   654.7   27813.    1610.   2.46

 X STA.        31.0        52.6        65.6        71.2        74.7        77.5
   A(I)             73.0        58.5        24.8        18.9        17.3
   V(I)             1.10        1.38        3.24        4.25        4.65

 X STA.        77.5        80.7        84.9        91.2       105.4       124.7
   A(I)             18.2        20.1        24.2        46.3        63.3
   V(I)             4.43        4.01        3.32        1.74        1.27

 X STA.       124.7       140.6       148.3       154.7       159.7       163.9
   A(I)             51.8        25.8        24.0        21.1        20.3
   V(I)             1.55        3.12        3.35        3.82        3.97

 X STA.       163.9       167.7       171.2       174.4       178.8       239.6
   A(I)             19.3        18.8        18.6        21.4        69.0
   V(I)             4.18        4.27        4.34        3.76        1.17
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WSPRO          FEDERAL HIGHWAY ADMINISTRATION - U. S. GEOLOGICAL SURVEY
V042094              MODEL  FOR  WATER-SURFACE  PROFILE  COMPUTATIONS

        Structure # 194023000300           (120 ft bridge)
        Anderson Branch @ SC 230               File:  anderson.sc230
        Edgefield County, South Carolina    AWC     3-1-1995
           *** RUN DATE & TIME: 03-09-95  07:56

 XSID:CODE   SRDL    LEW     AREA   VHD    HF     EGL    CRWS       Q    WSEL
       SRD   FLEN    REW        K  ALPH    HO     ERR     FR#     VEL

SEC.J:XS   ******    150    11550  0.00 *****  187.50  168.56    1800  187.50
    -23049 ******   1050  2355698  1.00 ***** *******    0.01    0.16

 ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                             "SEC.I"     KRATIO =  0.58

SEC.I:XS     3800    150     7540  0.00  0.00  187.50 *******    1800  187.50
    -19249   3800    860  1355318  1.00  0.00    0.00    0.01    0.24

SEC.H:XS     3250     90     5930  0.00  0.01  187.51 *******    1800  187.51
    -15999   3250    590  1145956  1.00  0.00    0.00    0.02    0.30

 ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                             "SEC.G"     KRATIO =  0.69

SEC.G:XS     3000     90     4496  0.00  0.01  187.52 *******    1800  187.52
    -12999   3000    531   786246  1.00  0.00    0.00    0.02    0.40

SEC.F:XS     2500     79     5719  0.00  0.01  187.53 *******    1800  187.53
    -10499   2500    681   956624  1.00  0.00    0.00    0.02    0.31

SEC.E:XS     2000    219     5799  0.00  0.01  187.54 *******    1800  187.54
     -8499   2000    841   958005  1.00  0.00    0.00    0.02    0.31

 ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                             "SEC.D"     KRATIO =  0.34

SEC.D:XS     1250    838     1917  0.01  0.01  187.56 *******    1800  187.55
     -7249   1250   1490   323781  1.02  0.01    0.00    0.10    0.94

SEC.C:XS     2500    194     2578  0.01  0.06  187.62 *******    1800  187.61
     -4749   2500    459   451361  1.00  0.00    0.00    0.04    0.70

SEC.B:XS     1750    176     4197  0.00  0.02  187.64 *******    1800  187.63
     -2999   1750    722   612393  1.00  0.00    0.00    0.03    0.43

 ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                             "SEC.A"     KRATIO =  0.49

SEC.A:XS     1500    262     2148  0.01  0.03  187.67 *******    1800  187.65
     -1499   1500    856   302385  1.21  0.01    0.00    0.09    0.84

 ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                             "EXITA"     KRATIO =  0.56
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```
EXITA:XS       700     62      1724  0.01  0.03  187.70 *******     1240  187.69
      -799     700    402    168498  1.00  0.00    0.00    0.06     0.72

  ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                               "EXITB"     KRATIO =  0.08

EXITB:XS       680    297       529  0.50  0.44  188.37 *******     1240  187.87
      -119     680    564     14135  5.90  0.25   -0.02    0.71     2.34

FULV :FV       120    281       706  0.29  0.66  189.03 *******     1240  188.74
         0     120    577     19676  5.96  0.00    0.00    0.49     1.76
          <<<<<THE ABOVE RESULTS REFLECT "NORMAL" (UNCONSTRICTED) FLOW>>>>>

APPR :AS       153     33       484  0.18  0.64  189.68 *******     1240  189.50
       153     153    214     18698  1.77  0.00    0.01    0.37     2.56
          <<<<<THE ABOVE RESULTS REFLECT "NORMAL" (UNCONSTRICTED) FLOW>>>>>


             <<<<<RESULTS REFLECTING THE CONSTRICTED FLOW FOLLOW>>>>>

 XSID:CODE    SRDL    LEW      AREA   VHD    HF     EGL    CRWS        Q     WSEL
       SRD    FLEN    REW         K  ALPH    HO     ERR     FR#      VEL

BRIDG:BR       120     15       254  0.40  0.74  189.11  187.69     1240  188.70
         0     120    100     17713  1.09  0.00    0.00    0.52     4.88

     TYPE PPCD FLOW       C     P/A    LSEL   BLEN   XLAB   XRAB
       3.   1.   1.  0.958   0.056  194.90 ****** ****** ******

 XSID:CODE    SRDL    LEW      AREA   VHD    HF     EGL    CRWS        Q     WSEL
       SRD    FLEN    REW         K  ALPH    HO     ERR     FR#      VEL

APPR :AS       120     32       538  0.15  0.60  189.94  187.82     1240  189.79
       153     148    224     21518  1.81  0.23    0.01    0.33     2.30

       M(G)   M(K)        KQ   XLKQ   XRKQ    OTEL
      0.532  0.113   19024.    67.   184.   189.39

                   <<<<<END OF BRIDGE COMPUTATIONS>>>>>
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WSPRO OUTPUT --Continued

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WSPRO          FEDERAL HIGHWAY ADMINISTRATION - U. S. GEOLOGICAL SURVEY
V042094             MODEL  FOR  WATER-SURFACE  PROFILE  COMPUTATIONS

         Structure # 194023000300           (120 ft bridge)
         Anderson Branch @ SC 230                File:  anderson.sc230
         Edgefield County, South Carolina    AWC     3-1-1995
            *** RUN DATE & TIME: 03-09-95  07:56

 XSID:CODE   SRDL     LEW     AREA    VHD     HF     EGL    CRWS       Q    WSEL
       SRD   FLEN     REW        K   ALPH     HO     ERR    FR#      VEL

SEC.J:XS    ******    150    11550   0.00 *****  187.50  168.68    2170  187.50
    -23049 ******    1050  2355698   1.00 ***** *******    0.01    0.19

 ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                                "SEC.I"     KRATIO =  0.58

SEC.I:XS      3800    150     7541   0.00   0.01  187.51 *******    2170  187.51
    -19249    3800    860  1355662   1.00   0.00    0.00    0.02    0.29

SEC.H:XS      3250     90     5932   0.00   0.01  187.52 *******    2170  187.51
    -15999    3250    590  1146688   1.00   0.00    0.00    0.02    0.37

 ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                                "SEC.G"     KRATIO =  0.69

SEC.G:XS      3000     89     4500   0.00   0.02  187.53 *******    2170  187.53
    -12999    3000    531   787421   1.00   0.00    0.00    0.03    0.48

SEC.F:XS      2500     79     5728   0.00   0.02  187.55 *******    2170  187.55
    -10499    2500    681   959034   1.00   0.00    0.00    0.02    0.38

SEC.E:XS      2000    218     5810   0.00   0.01  187.56 *******    2170  187.56
     -8499    2000    841   961007   1.00   0.00    0.00    0.02    0.37

 ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                                "SEC.D"     KRATIO =  0.34

SEC.D:XS      1250    833     1931   0.02   0.02  187.59 *******    2170  187.57
     -7249    1250   1491   324915   1.03   0.01    0.00    0.12    1.12

SEC.C:XS      2500    191     2591   0.01   0.08  187.67 *******    2170  187.66
     -4749    2500    464   454850   1.00   0.00    0.00    0.05    0.84

SEC.B:XS      1750    174     4229   0.00   0.03  187.70 *******    2170  187.69
     -2999    1750    723   620101   1.00   0.00    0.00    0.03    0.51

 ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                                "SEC.A"     KRATIO =  0.49

SEC.A:XS      1500    253     2188   0.02   0.04  187.74 *******    2170  187.72
     -1499    1500    869   306560   1.24   0.01    0.00    0.10    0.99

 ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                                "EXITA"     KRATIO =  0.56
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```
EXITA:XS       700      62       1753  0.01  0.05  187.79 *******    1610  187.77
      -799     700     402     173085  1.00  0.00    0.00    0.07    0.92

 ===125 FR# EXCEEDS FNTEST AT SECID "EXITB":  TRIALS CONTINUED.
             FNTEST,FR#,WSEL,CRWS =  0.80     0.82      188.06      187.72

 ===110 WSEL NOT FOUND AT SECID "EXITB":  REDUCED DELTAY.
                  WSLIM1,WSLIM2,DELTAY =   187.27      199.15    0.50

 ===115 WSEL NOT FOUND AT SECID "EXITB":  USED WSMIN = CRWS.
                  WSLIM1,WSLIM2,CRWS =   187.27     199.15     187.72

 ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                              "EXITB"     KRATIO =  0.09

EXITB:XS       680     292        585  0.70  0.64  188.77  187.72    1610  188.07
      -119     680     568      15844  5.93  0.34    0.00    0.81    2.75

 ===135 CONVEYANCE RATIO OUTSIDE OF RECOMMENDED LIMITS.
                              "FULV "     KRATIO =  1.56

FULV :FV       120     268        856  0.33  0.79  189.56 *******    1610  189.23
         0     120     587      24703  5.97  0.00    0.00    0.49    1.88
         <<<<<THE ABOVE RESULTS REFLECT "NORMAL" (UNCONSTRICTED) FLOW>>>>>

APPR :AS       153      32        584  0.22  0.67  190.24 *******    1610  190.02
       153     153     231      23947  1.85  0.00    0.01    0.39    2.76
         <<<<<THE ABOVE RESULTS REFLECT "NORMAL" (UNCONSTRICTED) FLOW>>>>>


            <<<<<RESULTS REFLECTING THE CONSTRICTED FLOW FOLLOW>>>>>

 XSID:CODE    SRDL     LEW       AREA   VHD    HF     EGL    CRWS       Q    WSEL
       SRD    FLEN     REW          K  ALPH    HO     ERR     FR#     VEL

BRIDG:BR       120      14        292  0.52  0.90  189.67  188.08    1610  189.14
         0     120     101      21850  1.11  0.00    0.00    0.56    5.51

     TYPE PPCD FLOW      C    P/A    LSEL   BLEN   XLAB   XRAB
       3.   1.   1.  0.949  0.055  194.90 ****** ****** ******

 XSID:CODE    SRDL     LEW       AREA   VHD    HF     EGL    CRWS       Q    WSEL
       SRD    FLEN     REW          K  ALPH    HO     ERR     FR#     VEL

APPR :AS       120      31        655  0.18  0.63  190.55  188.14    1610  190.37
       153     147     240      27807  1.90  0.25    0.01    0.34    2.46

      M(G)    M(K)       KQ   XLKQ   XRKQ    OTEL
     0.564   0.121   24368.    67.   184.  189.97

                 <<<<<END OF BRIDGE COMPUTATIONS>>>>>
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PIER SCOUR COMPUTATIONS
FOR
Anderson Branch at Str. 194023000300 in Edgefield Cty., SC
Q100 AWC 3-13-1995

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HYDRAULIC VARIABLES USED IN CSU EQUATION

PIER NUMBER	2	3	4
PIER STATION (FT)	30	60	90
LOCATION OF PIER	mcl	mcm	rfp
Y1: DEPTH (FT)	5.0	5.0	2.9
V1: VEL. (FPS)	5.2	5.2	4.2
a: PIER WIDTH (FT)	1.4	1.4	1.4
L: PIER LENGTH (FT)	5.6	5.6	5.6
PIER SHAPE	1	1	1
ATTACK ANGLE	0	0	0
K1 (SHAPE COEF.)	1.10	1.10	1.10
K2 (ANGLE COEF.)	1.00	1.00	1.00
FROUDE NO.	0.41	0.41	0.44

COMPUTED SCOUR DEPTHS USING CSU EQUATION

SCOUR DEPTH (FT)	3.27	3.27	2.79
MAX SCOUR DEPTH (FT)	3.59	3.59	3.06

"MAX SCOUR DEPTH" includes an additional 10 percent of the computed CSU scour depth as recommended in HEC 18

CONTRACTION SCOUR COMPUTATIONS
FOR
Anderson Branch at Str. 194023000300 in Edgefield Cty., SC
Q100 AWC 3-13-1995

RIGHT OVERBANK IN BRIDGE OPENING
CLEAR-WATER CONTRACTION SCOUR COMPUTATIONS

DISCHARGE IN CONTRACTED SECTION (CFS)	=	382.
WIDTH OF CONTRACTED SECTION (FT)	=	37.0
MEDIAN GRAIN SIZE (FT)	=	0.0013
COMPUTED DEPTH OF CONTRACTED SECTION (FT)	=	6.3
AVERAGE FLOOD PLAIN DEPTH (FT)	=	2.9
DEPTH OF CONTRACTION SCOUR (FT)	=	3.4

MAIN CHANNEL IN BRIDGE OPENING
CLEAR-WATER CONTRACTION SCOUR COMPUTATIONS

DISCHARGE IN CONTRACTED SECTION (CFS)	=	858.
WIDTH OF CONTRACTED SECTION (FT)	=	40.2
MEDIAN GRAIN SIZE (FT)	=	0.0015
COMPUTED DEPTH OF CONTRACTED SECTION (FT)	=	11.4
AVERAGE FLOOD PLAIN DEPTH (FT)	=	4.4
DEPTH OF CONTRACTION SCOUR (FT)	=	7.0

PIER SCOUR COMPUTATIONS
FOR
Anderson Branch at Str. 194023000300 in Edgefield Cty., SC
Q500 AWC 3-13-1995

HYDRAULIC VARIABLES USED IN CSU EQUATION

PIER NUMBER	2	3	4
PIER STATION (FT)	30	60	90
LOCATION OF PIER	mcl	mcm	rfp
Y1: DEPTH (FT)	5.5	5.5	3.4
V1: VEL. (FPS)	5.8	5.8	4.9
a: PIER WIDTH (FT)	1.4	1.4	1.4
L: PIER LENGTH (FT)	5.6	5.6	5.6
PIER SHAPE	1	1	1
ATTACK ANGLE	0	0	0
K1 (SHAPE COEF.)	1.10	1.10	1.10
K2 (ANGLE COEF.)	1.00	1.00	1.00
FROUDE NO.	0.44	0.44	0.47

COMPUTED SCOUR DEPTHS USING CSU EQUATION

SCOUR DEPTH (FT)	3.48	3.48	3.02
MAX SCOUR DEPTH (FT)	3.82	3.82	3.33

"MAX SCOUR DEPTH" includes an additional 10 percent of the computed CSU scour depth as recommended in HEC 18

CONTRACTION SCOUR COMPUTATIONS
FOR
Anderson Branch at Str. 194023000300 in Edgefield Cty., SC
Q500 AWC 3-13-1995

RIGHT OVERBANK IN BRIDGE OPENING
CLEAR-WATER CONTRACTION SCOUR COMPUTATIONS

DISCHARGE IN CONTRACTED SECTION (CFS)	=	527.
WIDTH OF CONTRACTED SECTION (FT)	=	37.0
MEDIAN GRAIN SIZE (FT)	=	0.0013
COMPUTED DEPTH OF CONTRACTED SECTION (FT)	=	8.3
AVERAGE FLOOD PLAIN DEPTH (FT)	=	3.4
DEPTH OF CONTRACTION SCOUR (FT)	=	4.9

MAIN CHANNEL IN BRIDGE OPENING
CLEAR-WATER CONTRACTION SCOUR COMPUTATIONS

DISCHARGE IN CONTRACTED SECTION (CFS)	=	1083.
WIDTH OF CONTRACTED SECTION (FT)	=	40.2
MEDIAN GRAIN SIZE (FT)	=	0.0015
COMPUTED DEPTH OF CONTRACTED SECTION (FT)	=	13.9
AVERAGE FLOOD PLAIN DEPTH (FT)	=	4.9
DEPTH OF CONTRACTION SCOUR (FT)	=	9.0

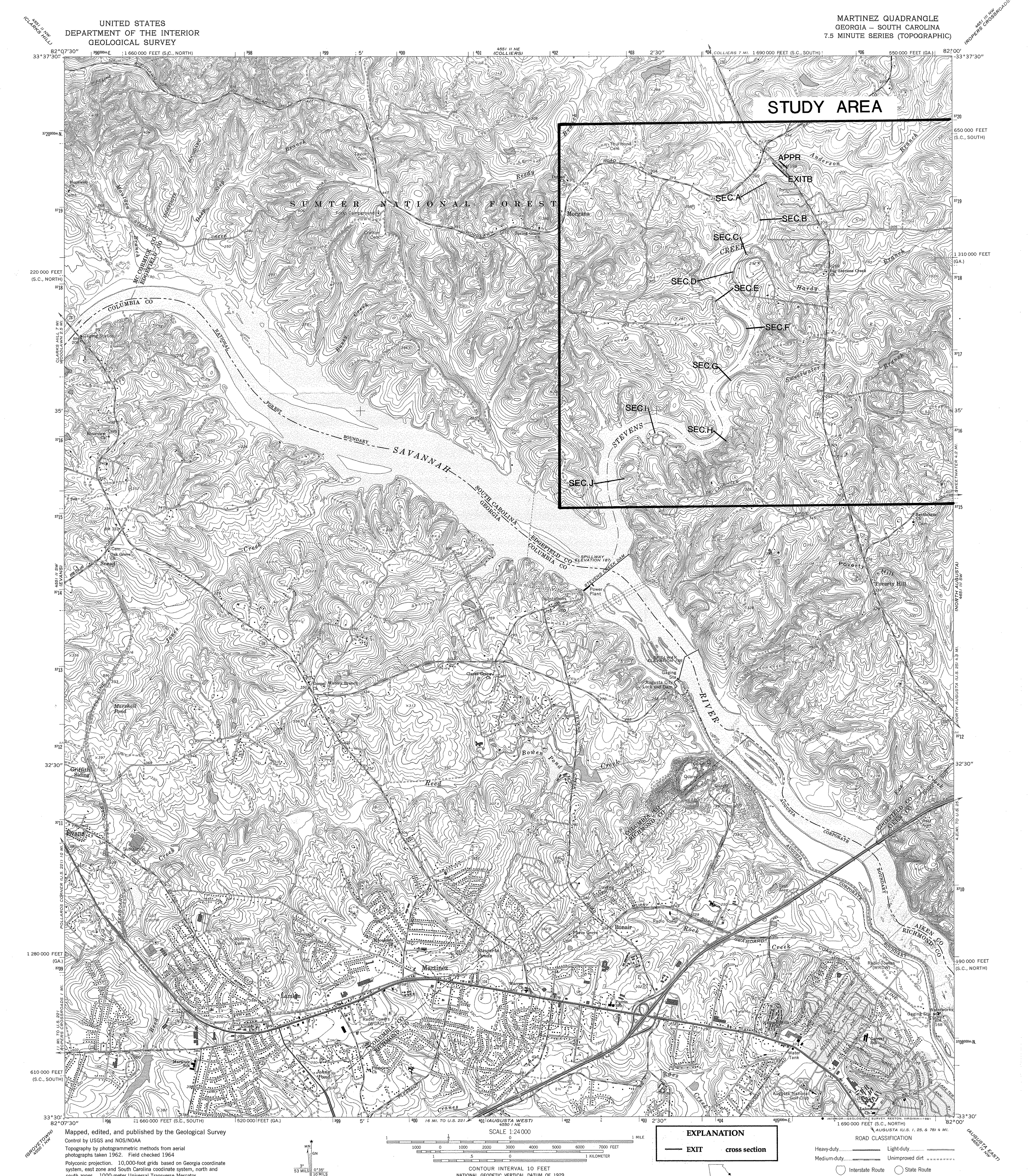


Figure 1.--Topography of study area and location of cross sections used in WSPRO analysis for structure 194023000300 on Route SC 230, crossing Anderson Branch in Edgefield County, South Carolina.

194023c

FED. ROAD DIV. NO.	STATE	COUNTY	DOCKET NO.	F.A. PROJ. NO.	ROUTE NO.
[illegible]	S.C.	EDGEFIELD	19.349	S-114(6)	230

INDEX OF SHEETS

SHEET NO.	
1	TITLE SHEET
2	TRAFFIC BARRICADE STANDARD
3	FLARED CURB AND GUTTER STANDARD
4	METAL PIPE SLOPE DRAINS
5	RIP RAP STANDARD
6	STANDARD NOTES
7	ROAD PLAN AND PROFILE
8	BRIDGE PLAN AND PROFILE
9	SUBSTRUCTURE
10	16" SQUARE PRESTRESSED CONCRETE PILES
11	SUPERSTRUCTURE

SOUTH CAROLINA
STATE HIGHWAY DEPARTMENT
COLUMBIA

PLAN AND PROFILE OF PROPOSED STATE HIGHWAY

F.A. PROJ. NO. S-114(6)
DOCKET NO. 19.349
ROUTE NO. 230

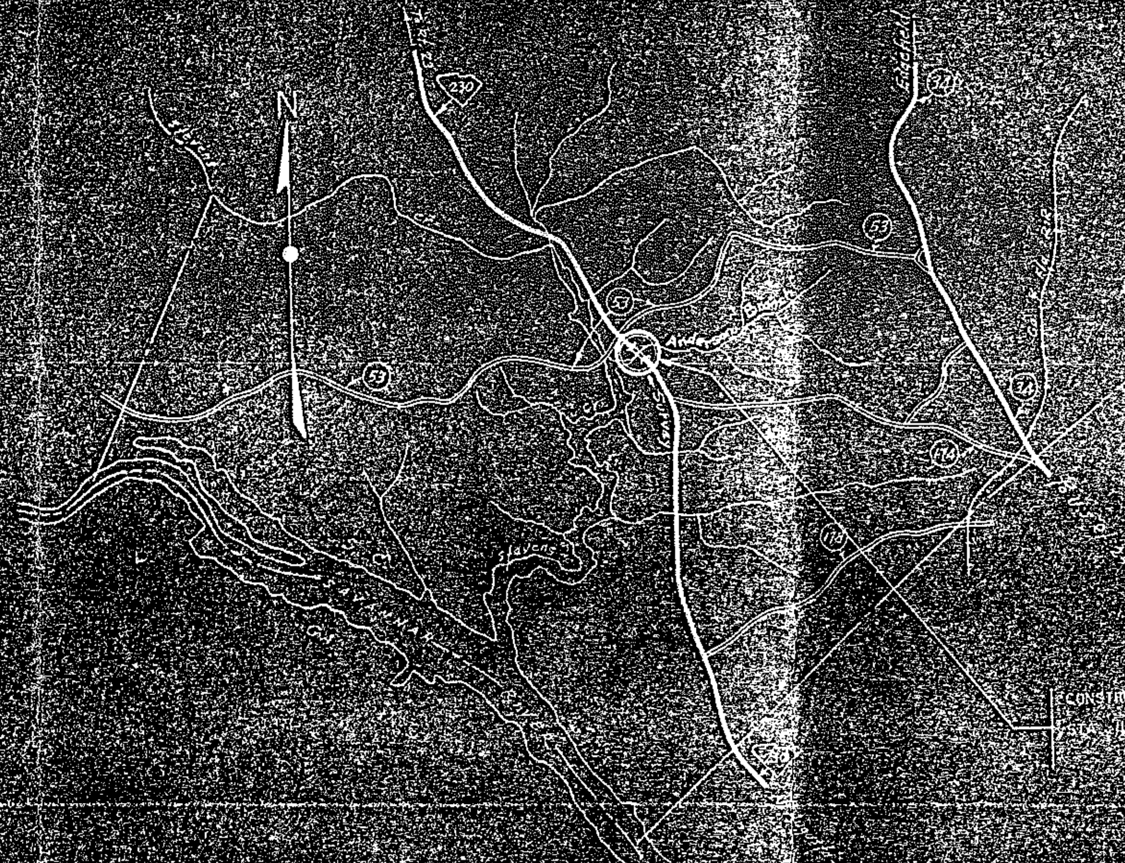
EDGEFIELD COUNTY

BRIDGE OVER ANDERSON BRANCH

SCALES: PLAN AND PROFILE 1 INCH = 100 FEET HORIZONTAL, 1 INCH = 10 FEET VERTICAL

SUMMARY OF ESTIMATED QUANTITIES

CLASS "A" CONCRETE	[illegible]
REINFORCING STEEL	386[illegible]
RIP RAP	[illegible]
16" SQUARE PRESTRESSED CONCRETE PILING	[illegible]
8" C.M. PIPE SLOPE DRAIN	[illegible]
METAL DRAIN INTAKE SPILLWAY ASSEMBLY	[illegible]



LAYOUT

5280

Net Length of Roadway	0.000 Mile
Net Length of Bridges	0.023 Mile
Net Length of Project	0.023 Mile
Length of Exceptions	0.000 Mile
Gross Length of Project	0.023 Mile

CONVENTIONAL SIGNS

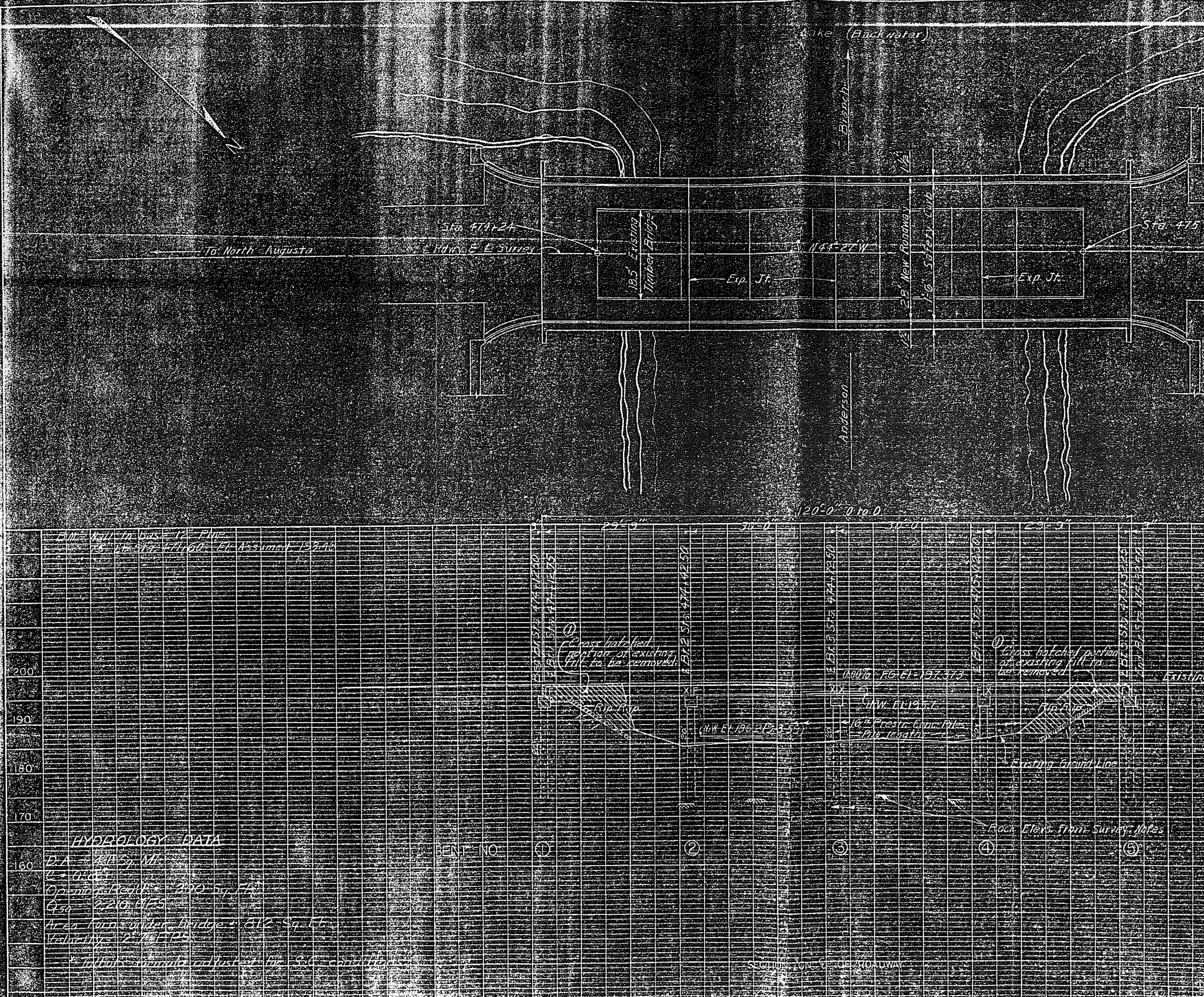
State Line
County Line
City or Town Lines
Property Line
Fence
Retaining Wall
Existing Road
C and R.O.W. Lines
Proposed Road
Railroad
Toe of Fill or Embankment
Guard Rail
Point of Intersection P.I.
Power Poles
Telephone or Telegraph Poles
Trees
Church
Buildings
Bridges
Concrete Box Culvert
Pipe Culvert
Drop Inlet and Culvert
Hub on Center Line

LEGEND
PROPOSED PROJECT
OTHER ROADS

APPROVED
STATE HIGHWAY ENGINEER

DEPARTMENT OF CO[illegible]
BUREAU OF PUBLIC [illegible]
APPROVED:
DISTRICT ENGINEER

FED. RD. DIV. NO.	STATE	COUNTY	DOCKET NO.	ROUTE NO.
5	S.C.	EDGEFIELD	19349	230



SUMMARY OF QUANTITIES

ITEM	NO.	CLASS "A" CONCRETE	REINF. STEEL	8" C.M. Pipe Slope Dr.	RIP RAP	16" SQ. PREST. CONCRETE PILING
		C.Y.	LBS.	L.F.	Tons.	L.F.
Bents 1-5	5	23.5	3060	—	See Total	400
30' End Span	2	75.6	17,298	—	—	—
30' Int. Span	2	73.0	17,556	—	—	—
Flared Curb & Gutter	2	1.8	130	61	—	—
Total		173.9	38,044	61	250	400

NOTES:

Construct Flared Curb & Gutter on both sides of roadway at both ends of bridge. For details see Sheet No. 3.

Construct Metal Pipe Slope Drains on both sides of roadway at both ends of bridge. For details see Sheet No. 4.

Place 250 Tons of Rip Rap at ends of bridge as directed by the Engineer.

① Contractor shall remove existing fill and construct end fills as shown on plans. The embankment material removed shall be placed as directed by the Engineer. All cost of this work shall be included in the unit price bid for Class A Concrete.

B.M. Nail in base 12" Pine 75' Lt. Sta. 474+00 El. Assumed 193.42

HYDROLOGY DATA

D.A. = 4.11 Sq. Mi.

C = 0.66*

Opening Req'd. = 200 Sq. Ft.

Q_{50} = 2210 CFS

Area Furnished under bridge = 812 Sq. Ft.

Velocity = 2.7 FPS

* Talbot's Formula adjusted for S.C. conditions

SECTION ON E OF ROADWAY

REV.	
REV.	
REV.	
REV.	
REVIEWED	W.Z.
IN CHARGE	
QUAN.	
TR.	
DR.	
DES.	

S.C. STATE HIGHWAY DEPARTMENT
BRIDGE DIVISION
COLUMBIA, S.C.

PLAN & PROFILE
FOR BRIDGE OVER
ANDERSON BRANCH

DOCKET NO.	COUNTY	ROUTE NO.
19349	EDGEFIELD	230

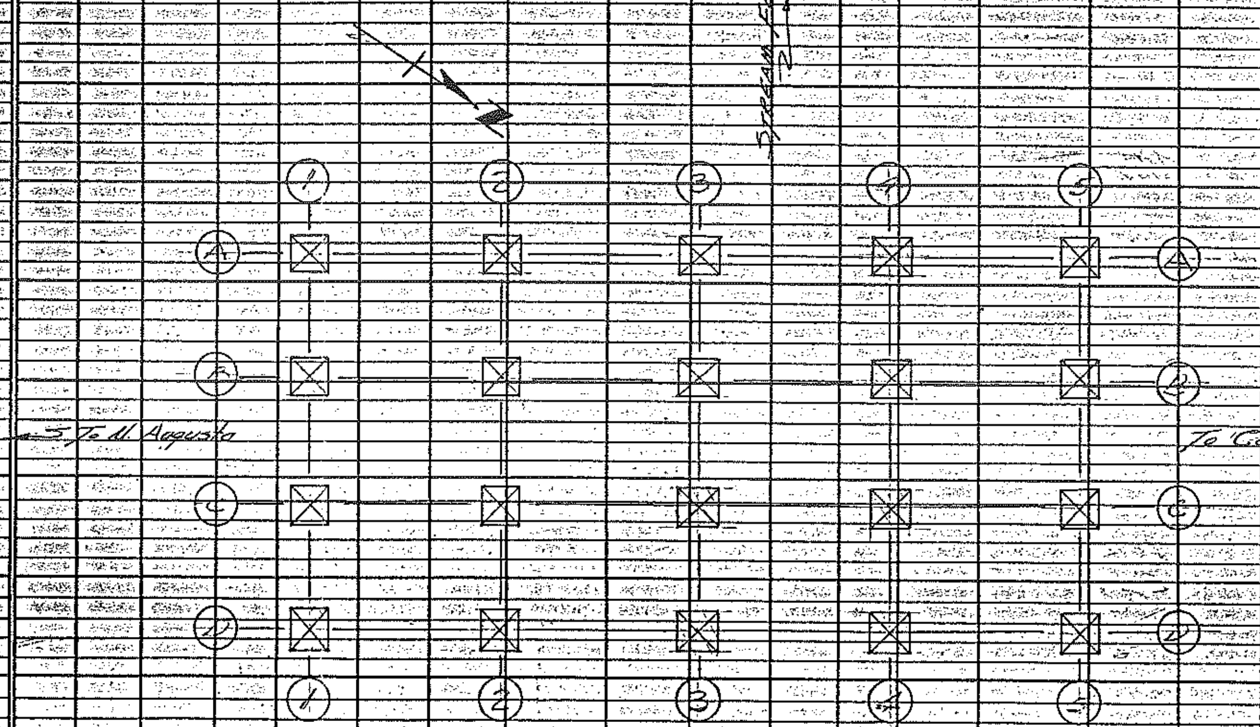
$P = \frac{2WH}{S+1} = \frac{2 \times 4235 \times 8}{(S+1)\,2000} = \frac{33.88}{S+1}$

PILE RECORD ON DOCKET NO. 19349

FED. ROAD DIV. NO.	STATE	COUNTY	DOCKET NO.	ROUTE NO.
3	S.C.	Edgefield	19.349	230

WEIGHT OF HAMMER 4235 lbs TYPE Gravity

DATE	BENT NO.	FOOTING	PILE NO.	DIAM. AT BUTT.	DIAM. AT TIP	ORIG. LENGTH	BUILD-UP OR SPLICE	TOTAL LENGTH	LENGTH C. O.	NET LENGTH	ELEV. C. O.	ELEV. PILE TIP	ELEV. ORIG. GROUND OR BOTTOM OF FOOTING	PEN. IN GROUND OR BELOW FOOTING	PEN. PER BLOW	FALL OF HAMMER	BEARING VALUE	PAY LENGTH	C.O.@ 40 %	C.O.@ 25 %
5-16-60	1	No Footing	1-A	16"	16"	20'-0"	0	20.0'	0	20.0'	192.78	172.78	192.78	20.0'	.0234	8.0'	33.10	20.0'		
5-16-60	1	"	1-B	16"	"	"	0	20.0'	0	20.0	"	"	"	20.0'	.0317	"	32.85	20.0'		
5-16-60	1	"	1-C	"	"	"	0	20.0'	0	20.0'	"	"	"	20.0'	.0312	"	32.85	20.0'		
5-16-60	1	"	1-D	"	"	"	0	20.0'	0	20.0	"	"	"	20.0'	.0297	"	33.06	20.0'	90	
											Av. =	"								
5-17-60	2	"	2-A	"	"	"	1.52'	21.52	0	21.52'	"	171.20	184.76	13.50'	.0234	"	33.10	21.52		
5-17-60	2	"	2-B	"	"	"	1.48'	21.48	0	21.48	"	171.30	184.63	13.33'	.0221	"	33.14	21.48		
5-17-60	2	"	2-C	"	"	"	1.50'	21.50'	0	21.50	"	171.28	184.20	12.92'	.0234	"	33.10	21.50		
5-17-60	2	"	2-D	"	"	"	1.50'	21.50	0	21.50	"	171.28	184.70	13.42'	.0156	"	33.35	21.50	90	
											AV. =	171.28								
5-17-60	3	"	3-A	"	"	"	0	20.0'	0.93'	19.07	"	173.71	186.38	12.67'	.0208	"	33.18	20.0		
5-17-60	3	"	3-B	"	"	"	0	20.0	2.28'	17.72	"	175.06	186.39	11.33'	.0234	"	33.10	20.0		
5-17-60	3	"	3-C	"	"	"	0	20.0'	1.96'	18.04	"	174.74	186.66	11.92'	.0156	"	33.35	20.0		
5-17-60	3	"	3-D	"	"	"	1.15'	21.15	0	21.15	"	171.65	185.30	13.67'	0	"	Refusal	21.15	81.1	
											AV. =	173.79								
5-18-60	4	"	4-A	"	"	"	0	20.0'	2.16'	17.84	"	174.94	184.94	10.0'	.0288	"	33.18	20.0		
5-18-60	4	"	4-B	"	"	"	0	20.0'	2.81'	17.19	"	175.59	185.59	10.0'	0	"	Refusal	20.0		
5-18-60	4	"	4-C	"	"	"	0	20.0'	1.53'	18.47	"	174.31	186.23	11.92'	.0208	"	33.18	20.0		
5-18-60	4	"	4-D	"	"	"	0	20.0	1.47'	18.53	"	174.25	186.08	11.83'	.0234	"	33.10	20.0	80	
											AV. =	174.77								
5-19-60	5	"	5-A	"	"	"	0	20.0'	2.78'	17.22	"	175.56	192.31	16.75'	0	"	Refusal	20.0		
5-19-60	5	"	5-B	"	"	"	0	20.0'	2.97'	17.05	"	175.75	192.50	16.75'	0	"	"	20.0		
5-19-60	5	"	5-C	"	"	"	0	20.0'	2.14'	17.86	"	174.92	192.67	17.75'	0	"	"	20.0		
5-19-60	5	"	5-D	"	"	"	0	20.0'	3.45'	16.55	"	176.23	192.98	16.75'	.0104	"	33.53	20.0	80	
											Av. =	175.61								
TOTAL								407.15	24.48	382.67								407.15		



TOTAL

GRAND TOTAL

NOTES CONCERNING ANY UNUSUAL FOUNDATION CONDITIONS

BENT NO.	FOOTING	PILE NO.	REMARKS

NOTES:

PAY LENGTH SHOULD IN... ALLOWANCE FOR SPLICING PILES AND ANY OTHER AL... ALLOWANCES.

NUMBERING PILES: A SKETCH OF BENT OR F... BE DRAWN ON THIS SHEE... TO BE NUMBERED, ALSO F... STREAM TO BE SHOWN.

PENETRATION PER BLOW: GIVE THIS INFORMATION IN... OF AN INCH.

United States Department of the Interior

U.S. GEOLOGICAL SURVEY
Water Resources Division
Stephenson Center, Suite 129
720 Gracern Road
Columbia, SC 29210-7651

March 16, 1995

William H. Hulbert, P.E.
Hydraulic Engineer
South Carolina Department of Transportation
955 Park Street
Columbia, South Carolina 29202

Dear Mr. Hulbert:

We are pleased to transmit to you another report of the Level II Bridge Scour Program titled, "Level II bridge scour analysis for structure 194023000300 on Route SC 230, crossing Anderson Branch in Edgefield County, South Carolina," by Andy W. Caldwell and J. Mike Sullivan. The technical aspects of the report have been reviewed by the South Carolina District Surface-Water Specialist and the editorial aspects of the report have been reviewed and approved by the South Carolina District Hydraulics Section Chief.

If you have any questions concerning this report please contact me (750-6101) or J. Mike Sullivan (750-6165) and we will be glad to assist you.

Sincerely,

Andy W. Caldwell

Andy W. Caldwell
Civil Engineer

Enclosure