

MEMORANDUM

To: Mr. A. Stermac,
Principal Foundation Engineer,
Room 107, Lab. Bldg.

From: G. C. E. Burkhardt

Date: April 5, 1963.

Our File Ref.

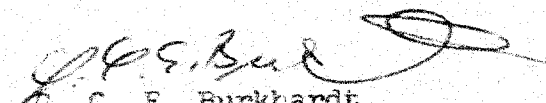
In Reply To

SUBJECT: Township of Woodhouse
Proposed Bridge over Black Creek,
Con. IV, Lots 18/19
County of Norfolk
Structure Site No. 21-85
Our File No. BA 1591

Attached please find one copy of the Foundation Report, by William A. Trow and Associates Ltd., and one copy of the Final Plans for your comments.

We would like to approve the plans not later than April 15th, 1963. We would appreciate it very much if we could have your comments within one week.

GCEB/et


G. C. E. Burkhardt,
Mun. Bridge Checking Engineer.

*Basically no comment.
Soil consultant suggests scour protection -
no measure is shown on bridge drawing.
He do not comment on scour possibility,
just mention the above fact.
By phone to G.C.E.B.*

April 22-1963.

A. Stermac

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WILLIAM A. TROW AND ASSOCIATES LTD.

SITE INVESTIGATIONS
LABORATORY TESTING
SOIL MECHANICS CONSULTATION

W. A. TROW, M.A.Sc., M.E.I.C., P.ENG.

1850 JANE ST.,
WESTON, ONT.
CH. 1-4644

Project: J1021

January 28, 1963

McDowell and Jewitt,
Engineering and Surveying,
92 Kent Street South,
Mississauga, Ontario

63 F 267 M

Attention: Mr. W.C. McDowell, P.Eng.

Re: Foundation Conditions - Bridge over Black Creek
Lots 18/19, Conc. IV, Twp. of Woodhouse, Co. Norfolk, Ontario

Dear Sirs:

This letter constitutes our report on the foundation conditions existing at the site of this proposed bridge replacement project. In view of the close proximity of bedrock to the ground surface, and the general absence of foundation problems, we take the liberty to be brief in this submission to you.

The proposed new bridge is to be located slightly to the east of an existing flexible steel truss and timber deck structure, on a gravel road running between Lot 18 and Lot 19 of the subject concession.

Our observations and recommendations arising out of this survey are briefly summarized as follows:

1. Refusal and assumed limestone bedrock lies at relatively shallow depth below the valley floor. The maximum depth to rock, as determined at the southwest end of the existing bridge is 25.5 feet below the existing bridge deck, or about 11 feet below the creek bed.

This bedrock is overlain by stiff, laminated, plastic clay, a deposit of glacial Lake Warren. The clayey fill of the roadway approaches to the bridge rises about 5 feet above the flood plain of Black Creek.

2. It is understood that a rigid frame structure will be installed at this site. Since the clay has a bearing value only in the order of 2000 paf, it is recommended that the bridge be carried on piles driven to refusal on bedrock. The use of Class B timber piles

is suggested. The permissible loading per pile will be determined by its safe structural capacity when considered as a short column. Care should be taken to stop driving as soon as bedrock has been reached. No driving difficulties in the overlying clay are envisaged.

3. Although the clay in the river bed will have a high resistance to scour, it will be disturbed locally, to some extent, during construction of the abutments, and therefore it will be more susceptible to erosion. In order to provide against the possibility of abrasion of the piles during spring break-up periods, the pile caps must either be extended 4 feet below the river bed or they must be protected by steel sheet piling driven along the faces exposed to the erosion forces. This sheeting could also be extended to protect the adjacent sections of approach fill which may be undermined, particularly after the sharp skew between the creek and the new road is put into effect. Alternatively, heavy rip-rap, backed by pit-run gravel, should be placed on the adjacent sections of road fill up to maximum flood level. Since the creek reportedly floods almost up to road level each year, it is apparent that protection must be provided for the full height of the fill.

4. Realignment and regrading of the roadway and bridge will result in the addition of some fill to the existing north embankment approach. On the south side, a considerable amount of new embankment fill will be required on the east flank of the existing approach. In part, this will amount to the full height of the embankment, and fill pressures approaching 1100 paf will be developed.

Although this value is well below the failure strength of the underlying clay, some minor settlement of the fills will occur. Such settlements will tend to be greater in the case of the completely new fill on the south side bridge approach than on the north side, but in both cases they are estimated to be of a small order.

Potential settlements would also be considerably reduced if all organic rich materials covering the parts of flood plain underlying the new embankment sections were removed prior to filling operations. Because of the snow cover and frost penetration at the time of the field investigation, it was not possible to determine the extent of possible organic rich layers, but it is not expected that more than 1 foot of stripping would be involved.

5. The underlying clay has ample strength to support the lateral thrust of fill exerted against the piles under the abutments. Consequently there will be no deep-seated lateral force applied to these piles. Similarly the characteristics of a rigid frame structure

tend to oppose the earth pressure exerted by the fill on the abutments. The resistance of the fill, in turn, should absorb traffic impact forces. Theoretically, therefore, all horizontal forces involved in this construction should be accounted for, but despite this situation, the provision of some batter piles may be considered desirable to support traffic impact.

6. No serious excavation problems are envisaged during construction, except for the possibility of a sudden flooding of the stream. Cut walls in the natural clay subsoil or clay fill should stand unsupported in a vertical face, although cut-back or light shoring may be necessary for the upper more pervious river alluvium.

The details of the investigation, which form the bases for the foregoing comments are considered in the sections that follow.

DESCRIPTION OF SITE

The site of the proposed 60 foot span replacement bridge over Black Creek is located some $4\frac{1}{2}$ miles upstream of the town of Port Dover, on a minor township road. The valley, eroded by this creek into the gently rolling terrain of this section of Norfolk County, is relatively shallow, flat bottomed, and well defined by relatively steep bluffs. Immediately to the south and southwest of the site, the valley widens out and the bordering bluffs are less defined.

Information obtained locally, indicates that the creek is normally subject to heavy spring flooding. At such times the valley floor is extensively flooded, and the river level rises to within 1 foot of the existing bridge deck. In the heavier spring flood of 1959, the approach fills were in fact almost overtopped.

FIELD SOILS AND SUBSOILS ENCOUNTERED

A total of three borings were completed during the investigation, using continuous flight machine auger equipment. A detailed log of each boring is presented in Dwg. 2 to 4, while the actual locations and interpreted subsoil profile, are indicated in Dwg. 1.

In hole 2 an alluvial cover consisting of silty brown clay was encountered overlying a more normal overburden of mottled, stiff brown clay. At a depth of approximately 9 feet, or El 84.0 feet, 71.24 on PL this clay becomes less stiff, grey, and more plastic. Essentially similar soils were encountered in hole 1, underlying about nine feet of roadway embankment fill.

Refusal and presumed bedrock was encountered in both borings at approximately the same elevation, El 74 feet. This bedrock is considered to be cherty limestone of the Onondaga, or Norfolk, formation. 61.44 ON PLAN

Shear strengths of the clay overburden were determined in the field by means of vane tests. The results are plotted on the boring logs and indicate a shear strength of about 1000 pcf in the soils below stream bed level.

No further testing was carried out, since it is understood that the structure will be supported on piles.

All borehole locations were referred to the existing bridge structure. Ground elevations were also referred by hand level to the deck elevation at centre/centre. This level was arbitrarily assumed as 100.30 feet.

87.34 ON PLAN

FOUNDATION REQUIREMENTS

The foundation requirements for this structure have been outlined in the opening paragraphs and therefore no purpose is served by a repetition of this information. Some explanation of some of the comments on settlement and embankment stability, however, are warranted.

The relocation of the road on the south side of the creek involves the installation of approximately 8 feet of fill to the east of the existing roadway. Taking a compacted unit weight for the fill of 133 pcf, the maximum pressure associated with this loading is 1040 pcf. In order to develop an undrained shear strength of 1000 pcf, the clay under the flood plain obviously must be in a heavily overconsolidated condition. It is consolidated at least under the equivalent weight of ground that existed over this area before Black Creek eroded the land to present levels. On the basis of this reasoning, and from visual examinations of the clay, its modulus of compressibility is estimated to be in the order of .007 sq.ft./kip

The settlement of an overconsolidated soil is given by the expression:

where:

S	=	$H \Delta v$
H	is the thickness of soil compressed	= 20 ft. approximately under the south bank
Δv	=	.007 sq.ft./kip (assumed)
P	is the average pressure transmitted into the clay by the fill, very conservatively assumed to be 1 knf	

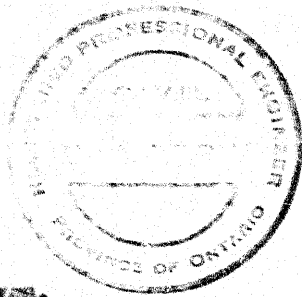
Solving in the above expression the settlement under the fill weight is estimated to be 1.7 inches.

It is probable that actual settlements will be much less than this, as the conservative assumption for a completely new fill has been taken in the above calculation. It will also certainly be much less on the north approach, where very little additional fill will be added.

For a minimum shear strength of 1000 pcf there is no doubt that the clay is more than strong enough to support the weight of the approach fill safely. There will be no horizontal pressures transmitted into the piles.

No other foundation problems are envisaged at this site.

We shall be pleased to discuss the results of this investigation in more detail if you have any queries on this subject.



Yours very truly,

W. A. Trow



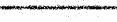
William A. Trow, P. Eng.

JTW/go
Encls. - 3 Encls.




LEGEND


BOREHOLE NO. 1
PROJECT Black Creek Bridge Reconstruction
LOCATION Twp. Woodhouse, Co. Norfolk, Ontario
HOLE LOCATION See Dwg. 1.
HOLE ELEVATION 98.8 ft.
DATUM See Dwg. 1.

PENETRATION RESISTANCE

2" O.D. SPLIT TUBE 
2" I.D. SHELBY TUBE 
2" DIA. CONE 

SHEAR STRENGTH




UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE 
UNCONFINED COMPRESSION 
VANE TEST AND SENSITIVITY IS:  ^s

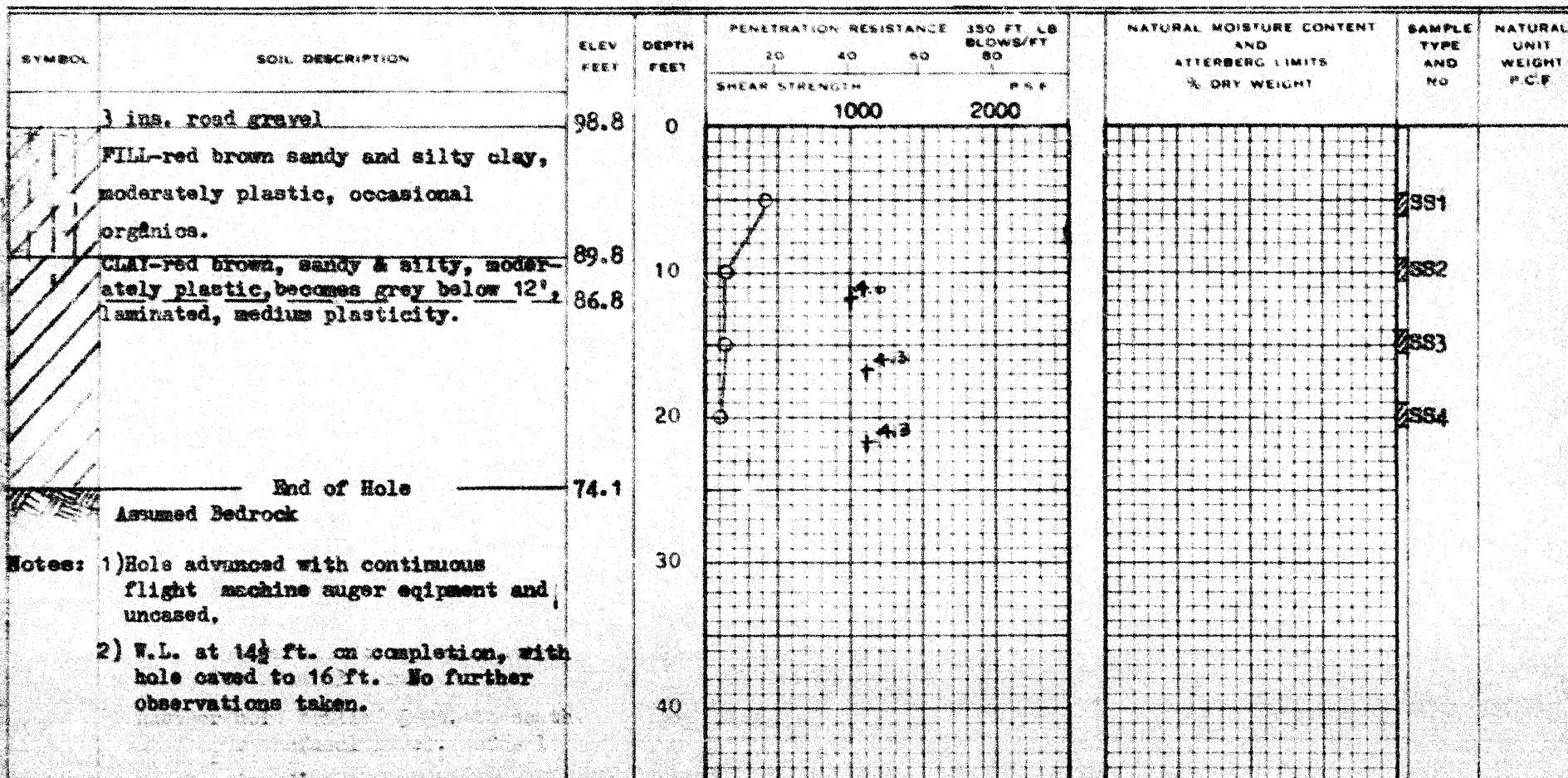
NATURAL MOISTURE CONTENT
AND LIQUIDITY INDEX 

ATTERBERG LIMITS

LIQUID LIMIT 
PLASTIC LIMIT 

SAMPLE TYPE




2" O.D. SPLIT TUBE 
2" I.D. SHELBY TUBE 
3" O.D. SHELBY TUBE 






LEGEND

BOREHOLE NO. 2
PROJECT Black Creek Bridge Reconstruction
LOCATION Twp. Woodhouse, Co. Norfolk, Ontario
HOLE LOCATION See Dwg. 1.
HOLE ELEVATION 93.4 ft.
DATUM See Dwg. 1.

PENETRATION RESISTANCE

2" O.D. SPLIT TUBE 
2" I.D. SHELBY TUBE 
2" DIA. CONE 

SHEAR STRENGTH

UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE 
UNCONFINED COMPRESSION 
VANE TEST AND SENSITIVITY  \pm




NATURAL MOISTURE CONTENT AND LIQUIDITY INDEX

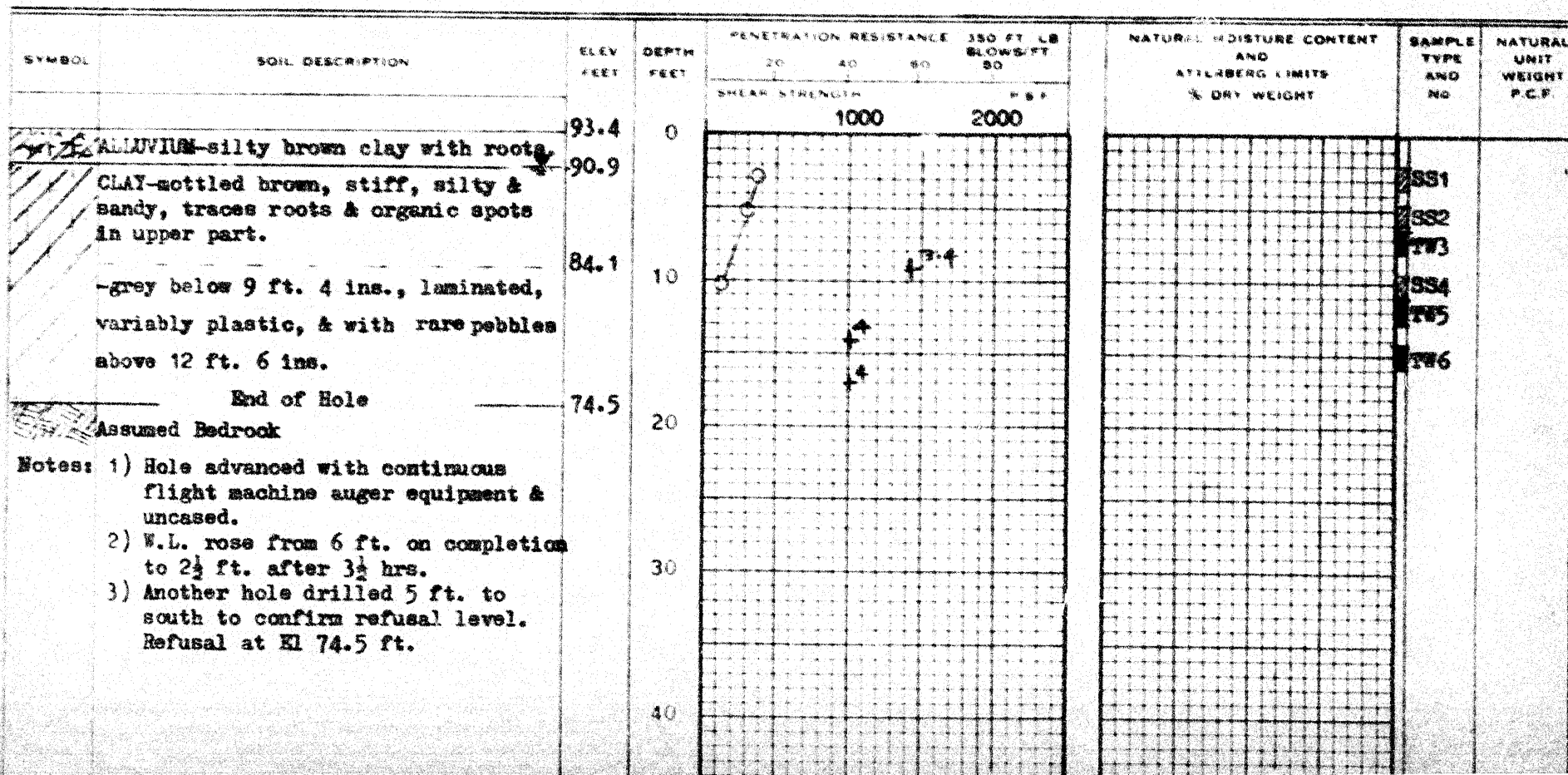
X^{LI}

ATTERBERG LIMITS

LIQUID LIMIT PLASTIC LIMIT 

SAMPLE TYPE

2" O.D. SPLIT TUBE 
2" I.D. SHELBY TUBE 
3" O.D. SHELBY TUBE 



#63-F-267M

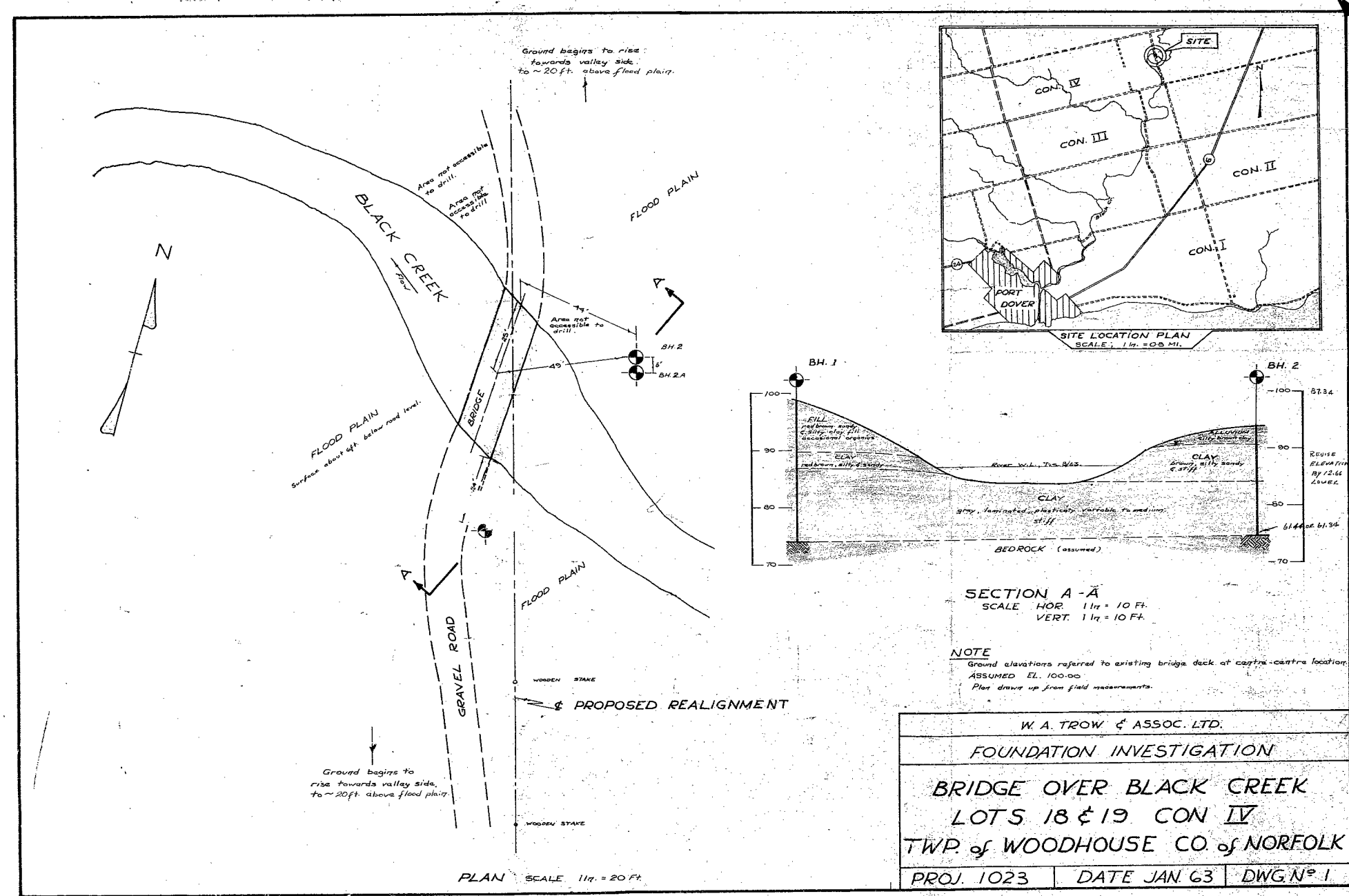
BRIDGE OVER

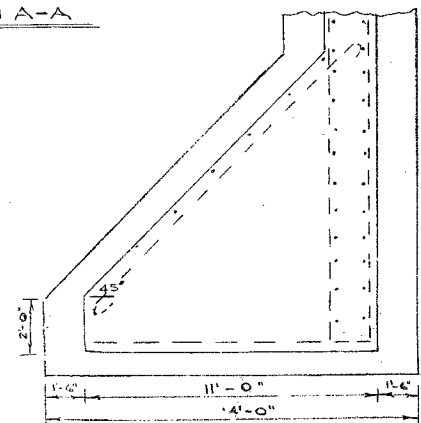
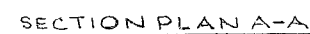
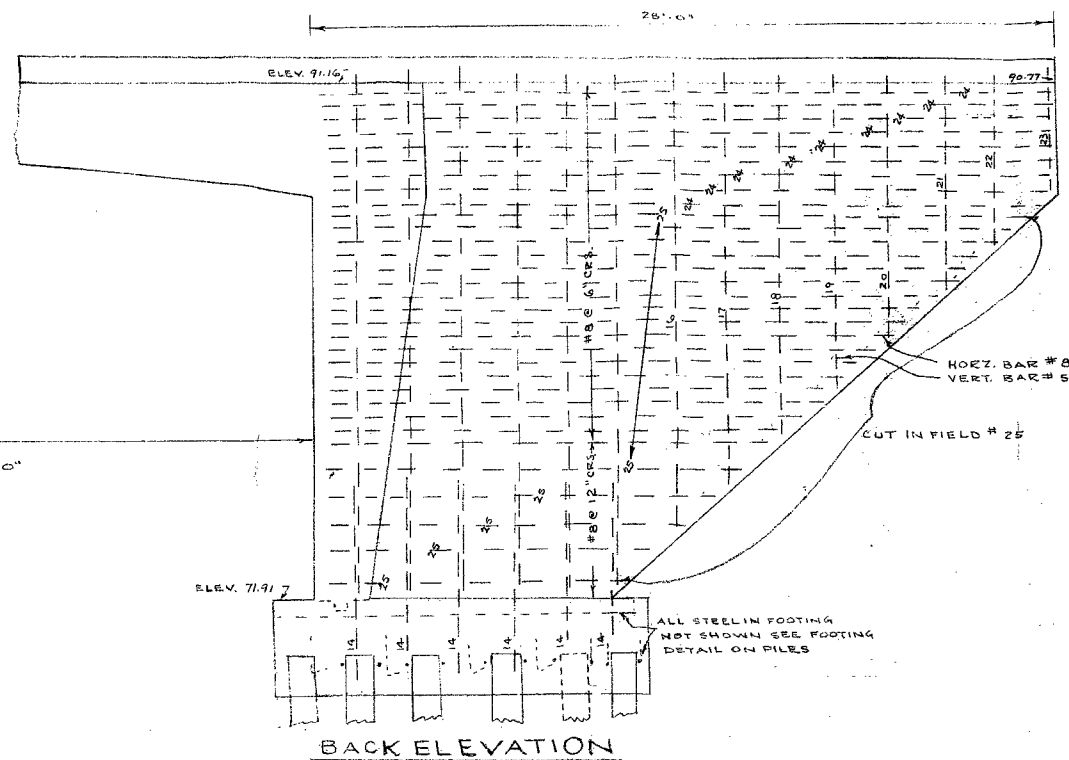
BLACK CREEK

LOTS #18/19, CON. IV.

WOODHOUSE

Twp.





SECTION PLAN C-C

BILL OF MATERIAL

BAR LOCATION NO	SIZE	LENGTH	SPACE	TYPE	①
1 EXTRADOS	17 #10	32'-6"	24" CRS	STR.	①
2 EXTRADOS	31 #11	28'-3 1/2"	12" CRS	1	②
2 1/2 EXTRADOS	31 #11	28'-3 1/2"	12" CRS	1	③
3 EXTRADOS	31 #11	25'-3 1/2"	12" CRS	2	④
3 1/2 EXTRADOS	31 #11	25'-3 1/2"	12" CRS	2	⑤
4 LEG	124 #11	14'-0"	6" CRS	STR.	⑥
5 INTRADOS	34 #9	18'-0"	24" CRS	STR.	⑦
6 INTRADOS	33 #9	38'-0"	12" CRS	STR.	⑧
7 INTRADOS	33 #9	28'-0"	12" CRS	STR.	⑨
8 LEG	64 #8	17'-6"	12" CRS	STR.	⑩
9 FOOT	64 #8	11'-1 1/2"	12" CRS	⑪	⑪
10 FOOT	48 #8	18'-0"	12" CRS	STR.	⑫
11 FRAME	92 #7	31'-2"	24" CRS	STR.	⑬
12 FOOT	36 #6	8'-6"	12" CRS	⑭	⑭
13 FOOT	32 #6	14'-0"	VAR	STR.	⑮
14 FOOT	88 #8	7'-0"	12" CRS	STR.	⑯
15 WINGWALL	44 #8	19'-8"	12" CRS	STR.	⑰
16 WINGWALL	8 #5	17'-6"	24" CRS	STR.	⑱
17 WINGWALL	8 #3	16'-3"	24" CRS	STR.	㉑
18 WINGWALL	8 #5	14'-0"	24" CRS	STR.	㉒
19 WINGWALL	8 #5	12'-0"	24" CRS	STR.	㉓
20 WINGWALL	8 #5	11'-0"	24" CRS	STR.	㉔
21 WINGWALL	8 #5	9'-0"	24" CRS	STR.	㉕
22 WINGWALL	8 #4	7'-0"	24" CRS	STR.	㉖
23 WINGWALL	16 #5	5'-0"	24" CRS	STR.	㉗
24 WINGWALL	36 #8	27'-0"	6" CRS	STR.	㉘
25 WINGWALL	56 #8	38'-0"	6 1/2" CRS	STR.	㉙
26 WINGWALL	12 #3	27'-0"	24" CRS	STR.	㉚
27 WINGWALL	16 #5	35'-0"	24" CRS	STR.	㉛
28 WINGWALL	84 #8	16'-2"	12" CRS	S.	㉜
29 CURB	30 #5	24'-0"	VAR.	STR.	㉝
30 CURB	252 #4	3'-2"	12" CRS	G.	㉞

BILL OF MATERIAL

BAR NO.	LOCATION	NO	SIZE	LENGTH	SPACE	TYPE	②
31 STIRRUPS	64	#3	5'-6"	VAR	7		③
32 STIRRUPS	32	#3	5'-0"	VAR	7		④
33 STIRRUPS	32	#3	4'-6"	VAR	7		⑤
34 STIRRUPS	32	#3	4'-2"	VAR	7		⑥
35 STIRRUPS	64	#3	4'-0"	VAR	7		⑦
36 STIRRUPS	64	#3	4'-0"	VAR	7		⑧
37 STIRRUPS	64	#3	3'-9"	VAR	7		⑨
38 STIRRUPS	96	#3	2'-6"	VAR	7		⑩
39 STIRRUPS	64	#3	3'-2"	VAR	7		⑪
40 ABUT.	64	#5	8'-6"	12 CRS	8		⑫
41 ABUT.	6	#5	3'-2"	VAR	STR.		⑬
42 FOOT	56	#6	19'-6"	VAR	9		⑭
43 POST	48	#6	6'-0"	VAR	10		⑮
44 ABUT	64	#6	6'-6"	12" STR.			⑯
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Diagram of a hook for a bar, showing a 180-degree turn with a 1/2 inch hook length and a 1/2 inch bend radius.

Diagram of a hook for a bar, showing a 180-degree turn with a 1/2 inch hook length and a 1/2 inch bend radius.

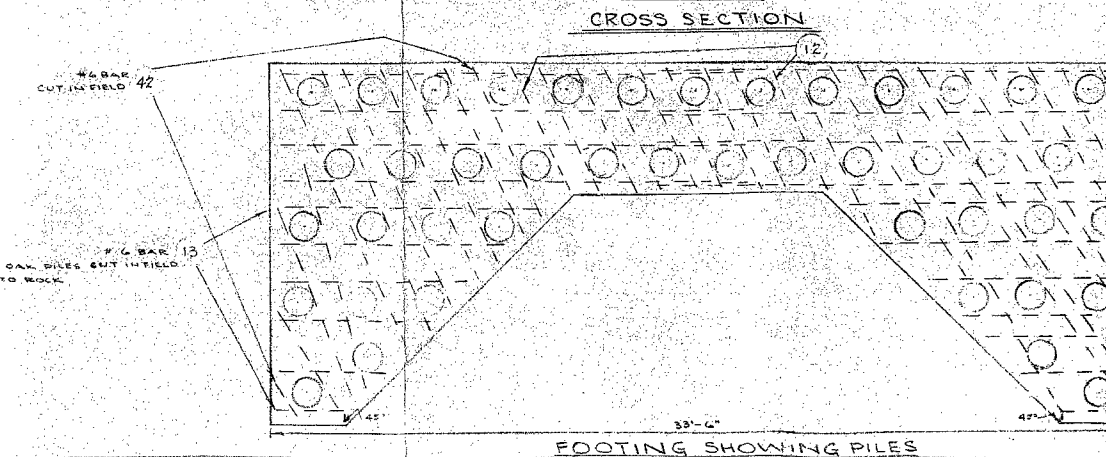
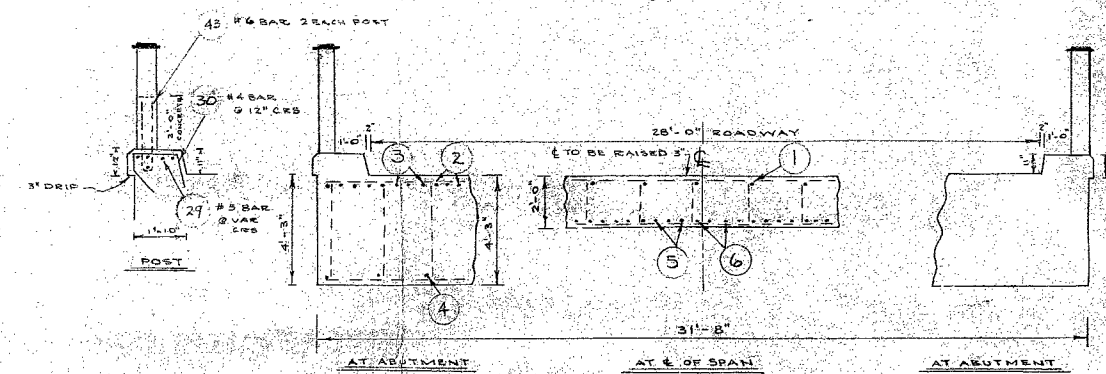
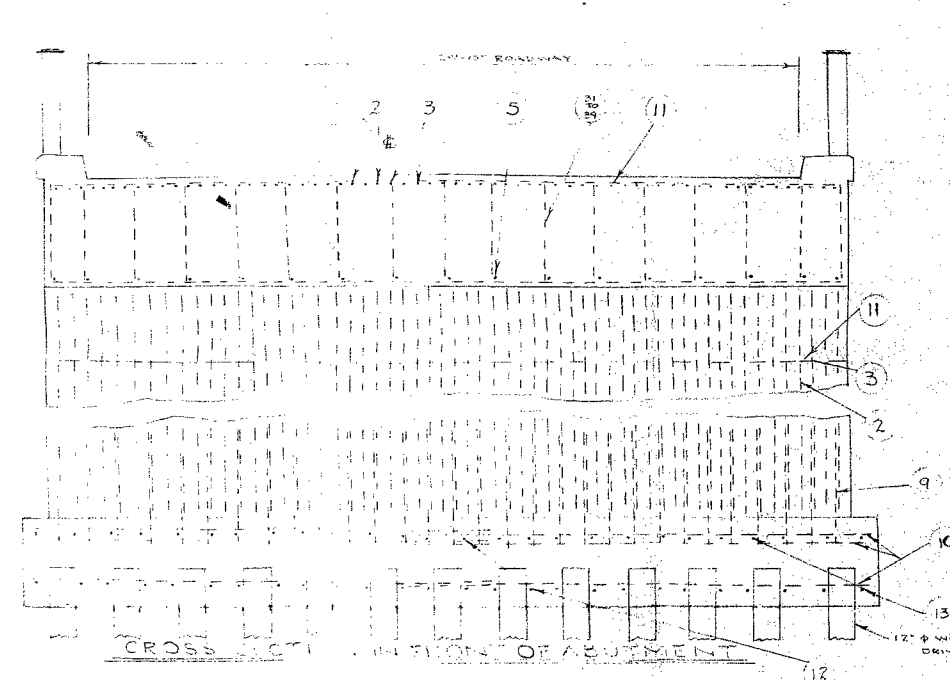
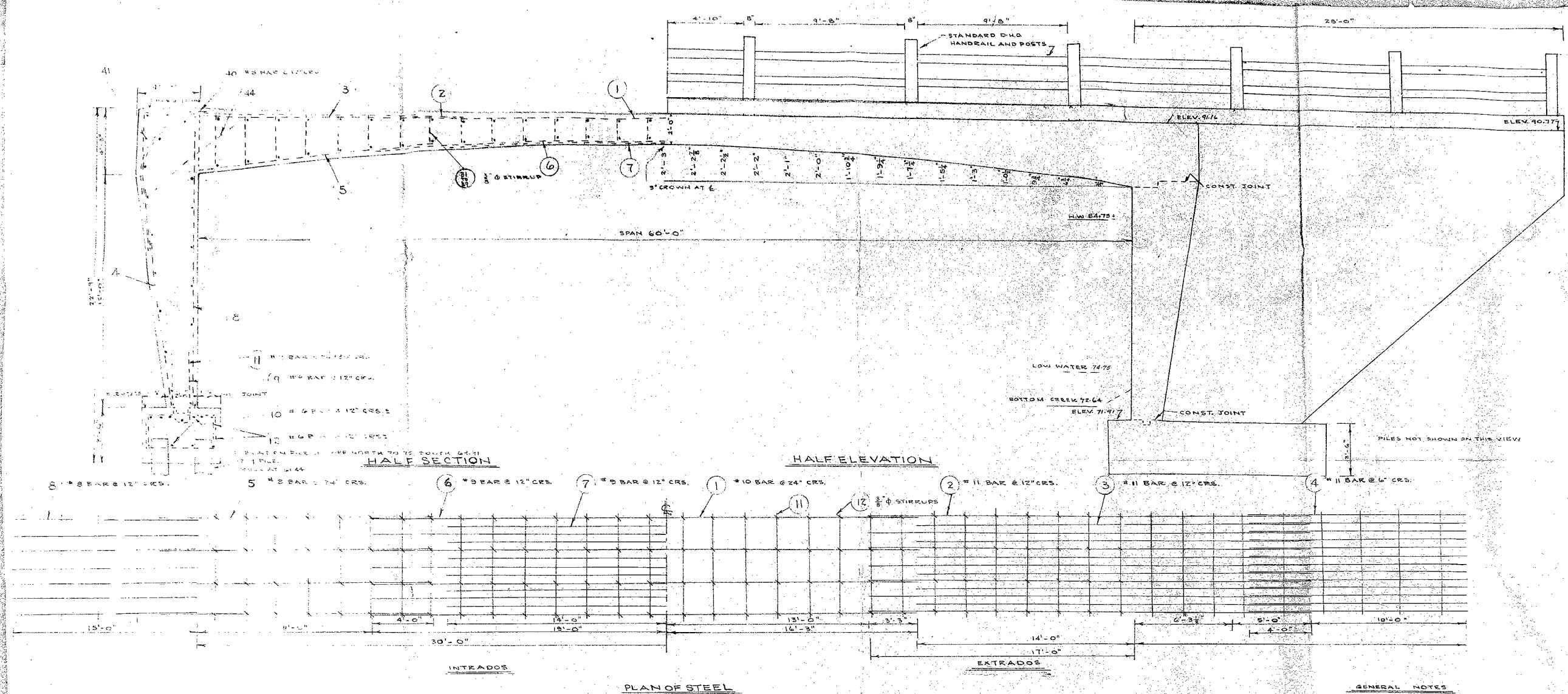
Diagram of a hook for a bar, showing a 180-degree turn with a 1/2 inch hook length and a 1/2 inch bend radius.

MCDOWELL / ZENITT
Engineering and Surveying
92 KENT ST S SIMCOE

PROPOSED BRIDGE OVER BLACK CREEK
OWNER TOWNSHIP OF WOODHOUSE
COUNTY OF NORFOLK

TOWNSHIP OF WOODHOUSE COM^{IV} 10T18f:
JAN. 16 1963
SCALE 3/8" = 1'
LOADING H20 S16

Dr. C. M. Arnold
DESIGN ENGINEER
Dwg. No. E 3643



- GENERAL NOTES

1. STRUCTURE TO BE DESIGNED FOR 425-PSI LOADING
2. WORK IN THE STRUCTURE MUST NOT BE COMMENCED UNTIL MONUMENTS TO FIX CONTROL POINTS HAVE BEEN ERECTED AND CHECKED BY THE ENGINEER
3. STRUCTURE TO BE BUILT IN ACCORDANCE WITH D.W. FORMING REINFORCED AND PRECAST CONCRETE SPECIFICATIONS FOR THE BLACK CREEK BRIDGE
4. THE SOIL INVESTIGATION REPORT AVAILABLE AT OFFICE OF MCDONNELL & JEWITT
5. (a) MINIMUM STRENGTH OF CONCRETE IN SUB-STRUCTURE AND FOOTINGS 3500 PSI. IN 28 DAYS
6. (b) MINIMUM STRENGTH OF CONCRETE IN FLOOR SLABS 3500 PSI. IN 28 DAYS
7. (c) MAXIMUM SIZE OF AGGREGATE TO BE $\frac{3}{4}$ INCH
8. ALL FLOOR BOARDS TO BE CHAMFERED IF UNLESS OTHERWISE NOTED
9. THE FALSEWORK TO BE STRUCK AFTER BACKFILL HAS BEEN PLACED
10. ALL PILES AND ABUTMENTS SIMULTANEOUSLY
11. CONSTRUCTION JOINTS NOT SHOWN ON PLANS MUST BE APPROVED BY THE ENGINEER
12. REINFORCING STEEL TO BE H-60 EXCEPT BARS 31-34 CLEAR COVER 3" IN FOOTINGS AND ALL SURFACES IN CONTACT WITH EARTH OR WATER, DECK 2" BOTTOM
13. TOP

12" Φ TOPS ON
WHITE OR BLACK
OAK PILES
NATIONAL BUI
CODE SPECIAT
3.7-10.1 FOR
LOAD CAPAC
3.7-13.3 (3.2
AREA PILE MI
CAPACITY 6

McDOWELL F JEWITT
Engineering and Surveying
92 KENT ST. S. SIMCOE

TOWNSHIP OF WOODHOUSE CON IV LOT 15 #19
JAN. 16 1953
SCALE 3/8" = 1'
LOADING H2O 516

W. J. H. H. H. H. H.
CDS-EN ENGINEER
TUNING NO E364.