PLANN VIEW

VANE ARM SECTION A - A'

THIS FIGURE IS ONLY MEANT TO DEFINE THE MINIMUM INFORMATION REQUIRED BY THE CITY OF CHARLOTTE TO BE INCLUDED IN A DETAIL FOR THIS TYPE OF TECHNIQUE.
THIS FIGURE IS NOT MEANT TO REPRESENT A STANDARD DESIGN METHOD FOR THIS TYPE OF TECHNIQUE AND SHALL NOT BE USED AS SUCH.

PHOTO: CROSS VANE PLAN VIEW

NOT TO SCALE

BOULDER CROSS VANE

DRAFT - NOT TO BE USED FOR CONSTRUCTION
COARSE BACKFILL

FLOW

FILTER FABRIC

X1 - CROSS VANE INVERT CONTROL POINT ELEVATION (SEE NOTE 2)

BANKFULL (SEE NOTE 3)

X2 OR X3 - LEFT OR RIGHT VANE ARM INTERCEPT CONTROL POINT ELEVATION

VARIABLES (SEE NOTE 10E)

X4 - POOL CONTROL POINT ELEVATION (SEE NOTE 2)

X12 (SEE NOTE 10E)

X8

X13

X15

X16

X5

FLOODPLAIN SILL, TYPICAL

FILTER FABRIC

HEADER BOULDER, TYPICAL

FOOTER BOULDER, TYPICAL

PHOTO: CROSS VANE PROFILE VIEW

PROFILE VIEW

CROSS SECTION B-B'

THIS FIGURE IS ONLY MEANT TO DEFINE THE MINIMUM INFORMATION REQUIRED BY THE CITY OF CHARLOTTE TO BE INCLUDED IN A DETAIL FOR THIS TYPE OF TECHNIQUE. THIS FIGURE IS NOT MEANT TO REPRESENT A STANDARD DESIGN METHOD FOR THIS TYPE OF TECHNIQUE AND SHALL NOT BE USED AS SUCH.
NOT TO SCALE

BOULDER CROSS VANE

NOTES:
1. A BOULDER CROSS VANE IS A GRADE CONTROL IN-STREAM STRUCTURE THAT DIRECTS STREAM FLOW AWAY FROM THE STREAM BANKS AND IN TOWARD THE CENTER OF THE CHANNEL.
2. ELEVATION CONTROL POINTS SHALL BE DESIGNATED AT THE UPSTREAM INVERT (CENTER) OF THE CROSS VANE TO ESTABLISH PART OF THE PROFILE. POOL ELEVATION CONTROL POINTS OR EXCAVATION TO A SPECIFIED MAXIMUM POOL DEPTH SHALL BE DESIGNATED TO ESTABLISH THE REMAINING PROFILE. SURVEY OF CONTROL POINTS SHALL BE REQUIRED TO ESTABLISH ACCURATE CROSS VANE INSTALLATION WITHIN THE TOLERANCE SPECIFIED BY THE DESIGNER.
3. THE VANE ARM SHALL INTERCEPT THE STREAM BANK AT A HEIGHT EQUAL TO BETWEEN ½ BANKFULL STAGE AND BANKFULL STAGE. ELEVATION CONTROL POINTS MAY BE ESTABLISHED AT THE LEFT AND RIGHT STREAM BANK/VANE ARM INTERCEPT POINTS. THE VANE ARM INTERCEPT LOCATION MAY BE OTHERWISE DESCRIBED BY ITS RELATIONSHIP TO BANKFULL STAGE OR BY THE LENGTH AND SLOPE OF THE VANE ARM. BANKFULL IS NOT NECESSARILY THE TOP OF THE STREAM BANK SLOPE.
4. IF PLANS DESIGNATE THE USE OF MULTIPLE BOULDER CROSS VANES, A TABLE OF ALL STATION LOCATIONS AND CONTROL POINT ELEVATIONS SHALL BE PROVIDED IN THIS DETAIL OR REFERENCED ELSEWHERE IN THE PLANS AND REFERENCED HERIN.
5. TYPICAL RIFFLE AND POOL CROSS SECTIONS SHALL BE PROVIDED ELSEWHERE IN THE PLANS TO ESTABLISH THE DIMENSIONS OF THE CHANNEL GRADING INTO WHICH THE BOULDER CROSS VANES ARE TO BE INSTALLED.
6. THE CROSS VANE SHALL BE CONSTRUCTED WITH FLAT-SIDED BOULDERS OF A SIZE (LENGTH, WIDTH, AND DEPTH) AS SPECIFIED BY THE DESIGNER.
7. FILTER FABRIC OF A TYPE AND SIZE SPECIFIED BY THE DESIGNER SHALL BE USED TO SEAL THE GAPS BETWEEN THE BOULDERS AND UNDER THE COARSE BACKFILL MATERIAL. THERE SHALL BE NO FILTER FABRIC VISIBLE IN THE FINISHED WORK; EDGES SHALL BE FOLDED, TUCKED, OR TRIMMED AS NEEDED.
8. COARSE BACKFILL OF THE BOULDER CROSS VANE SHALL BE OF A TYPE, SIZE, AND GRADATION AS SPECIFIED BY THE DESIGNER. COARSE BACKFILL SHALL BE PLACED TO A THICKNESS EQUAL TO THE DEPTH OF THE HEADER AND FOOTER BOULDERS AND SHALL EXTEND OUT FROM THE VANE ARMS TO THE STREAM BANK AND UPSTREAM A DISTANCE SPECIFIED BY THE DESIGNER.
9. THE INVERT (CENTER) OF THE BOULDER CROSS VANE SHALL BE CONSTRUCTED FIRST, FOLLOWED BY ONE VANE ARM AND THEN THE OTHER VANE ARM. THE FLOODPLAIN SILLS SHALL BE CONSTRUCTED LAST.
10. BOULDER CROSS VANE SHALL BE BUILT TYPICALLY AS FOLLOWS:
   A. OVER-EXCAVATE STREAM BED TO A DEPTH EQUAL TO THE TOTAL THICKNESS OF THE HEADER AND FOOTER BOULDERS.
   B. PLACE FOOTER BOULDERS. THERE SHALL BE NO GAPS BETWEEN BOULDERS.
   C. INSTALL FILTER FABRIC.
   D. PLACE COURSE BACKFILL BEHIND THE FOOTER BOULDERS.
   F. PLACE COURSE BACKFILL BEHIND HEADER BOULDERS ENSURING THAT ANY VOIDS BETWEEN THE BOULDERS ARE FILLED.
11. IF ANY EROSION CONTROL MATTING IS SPECIFIED FOR USE IN THE VICINITY OF THE VANE ARM INTERCEPT POINTS AND FLOODPLAIN SILLS ALL MATTING EDGES SHALL BE NEATLY SECURED AROUND THE BOULDERS.

NOT TO SCALE

CHARLOTTE—MECKLENBURG
STORM WATER SERVICES
GENERIC DETAIL REQUIREMENTS

BOULDER CROSS VANE

DRAFT - NOT TO BE USED FOR CONSTRUCTION

DIMENSIONS (VALUES TO BE PROVIDED BY DESIGNER)

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>VALUES</th>
<th>TYPICAL UNIT</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>X1</td>
<td></td>
<td>FT. (NAVD)</td>
<td>CROSS VANE INVERT CONTROL POINT ELEVATION</td>
</tr>
<tr>
<td>X2</td>
<td></td>
<td>FT. (NAVD)</td>
<td>LEFT VANE ARM INTERCEPT CONTROL POINT ELEVATION</td>
</tr>
<tr>
<td>X3</td>
<td></td>
<td>FT. (NAVD)</td>
<td>RIGHT VANE ARM INTERCEPT CONTROL POINT ELEVATION</td>
</tr>
<tr>
<td>X4</td>
<td></td>
<td>FT. (NAVD)</td>
<td>POOL CONTROL POINT ELEVATION</td>
</tr>
<tr>
<td>X5</td>
<td></td>
<td>FT.</td>
<td>BANKFULL WIDTH</td>
</tr>
<tr>
<td>X6</td>
<td></td>
<td>FT.</td>
<td>VANE ARM LENGTH</td>
</tr>
<tr>
<td>X7</td>
<td></td>
<td>FT.</td>
<td>FLOODPLAIN SILL LENGTH</td>
</tr>
<tr>
<td>X8</td>
<td></td>
<td>FT.</td>
<td>LENGTH OF COURSE BACKFILL</td>
</tr>
<tr>
<td>X9</td>
<td></td>
<td>IN.</td>
<td>D50 OF COURSE BACKFILL</td>
</tr>
<tr>
<td>X10</td>
<td></td>
<td>DEGREES</td>
<td>VANE ARM ANGLE WITH STREAM BANK</td>
</tr>
<tr>
<td>X11</td>
<td></td>
<td>IN. OR FT.</td>
<td>DIFFERENCE BETWEEN TOP OF BANK (BANKFULL) AND VANE ARM INTERCEPT POINT</td>
</tr>
<tr>
<td>X12</td>
<td></td>
<td>PERCENT</td>
<td>VANE ARM SLOPE</td>
</tr>
<tr>
<td>X13</td>
<td></td>
<td>IN. OR FT.</td>
<td>BOULDER LENGTH</td>
</tr>
<tr>
<td>X14</td>
<td></td>
<td>IN. OR FT.</td>
<td>BOULDER WIDTH</td>
</tr>
<tr>
<td>X15</td>
<td></td>
<td>IN. OR FT.</td>
<td>BOULDER THICKNESS</td>
</tr>
<tr>
<td>X16</td>
<td></td>
<td>FT.</td>
<td>MAXIMUM POOL DEPTH</td>
</tr>
<tr>
<td>X17</td>
<td></td>
<td>IN.</td>
<td>HEADER BOULDER SET BACK</td>
</tr>
</tbody>
</table>

NOT TO SCALE