## ESTIMATE OF QUANTITIES AND ENVIRONMENTAL COMMITMENTS

### 18" Culvert Liners – Alternate A

<table>
<thead>
<tr>
<th>BID ITEM NUMBER</th>
<th>ITEM DESCRIPTION</th>
<th>QUANTITY</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>009E0010</td>
<td>Mobilization</td>
<td></td>
<td>LS</td>
</tr>
<tr>
<td>110E0500</td>
<td>Remove Pipe Culvert</td>
<td>57</td>
<td>Ft</td>
</tr>
<tr>
<td>110E0510</td>
<td>Remove Pipe End Section</td>
<td>Each</td>
<td></td>
</tr>
<tr>
<td>110E1690</td>
<td>Remove Sediment</td>
<td>1.0</td>
<td>CuYd</td>
</tr>
<tr>
<td>230E0200</td>
<td>Contractor Furnished Topsoil</td>
<td>50</td>
<td>CuYd</td>
</tr>
<tr>
<td>450E4799</td>
<td>18&quot; CMP 16 Gauge, Furnish</td>
<td>6</td>
<td>Ft</td>
</tr>
<tr>
<td>450E4800</td>
<td>18&quot; CMP, Install</td>
<td>6</td>
<td>Ft</td>
</tr>
<tr>
<td>450E5211</td>
<td>18&quot; CMP Flared End, Furnish</td>
<td>6</td>
<td>Each</td>
</tr>
<tr>
<td>450E5212</td>
<td>18&quot; CMP Flared End, Install</td>
<td>6</td>
<td>Each</td>
</tr>
<tr>
<td>450E5227</td>
<td>42&quot; CMP Flared End, Furnish</td>
<td>1</td>
<td>Each</td>
</tr>
<tr>
<td>450E5228</td>
<td>42&quot; CMP Flared End, Install</td>
<td>1</td>
<td>Each</td>
</tr>
<tr>
<td>450E5235</td>
<td>54&quot; CMP Flared End, Furnish</td>
<td>2</td>
<td>Each</td>
</tr>
<tr>
<td>450E5236</td>
<td>54&quot; CMP Flared End, Install</td>
<td>2</td>
<td>Each</td>
</tr>
<tr>
<td>450E5310</td>
<td>24&quot; CMP Sloped End, Furnish</td>
<td>4</td>
<td>Each</td>
</tr>
<tr>
<td>450E5311</td>
<td>24&quot; CMP Sloped End, Install</td>
<td>4</td>
<td>Each</td>
</tr>
<tr>
<td>450E5314</td>
<td>30&quot; CMP Sloped End, Furnish</td>
<td>4</td>
<td>Each</td>
</tr>
<tr>
<td>450E5315</td>
<td>30&quot; CMP Sloped End, Install</td>
<td>4</td>
<td>Each</td>
</tr>
<tr>
<td>450E9900</td>
<td>Cleanout Pipe Culvert</td>
<td>5</td>
<td>Each</td>
</tr>
<tr>
<td>450E9910</td>
<td>Cleanout for Culvert Treatment</td>
<td>9</td>
<td>Each</td>
</tr>
<tr>
<td>450E9934</td>
<td>54&quot; Cured in Place Pipe</td>
<td>122</td>
<td>Ft</td>
</tr>
<tr>
<td>634E0110</td>
<td>Flaging</td>
<td>75.0</td>
<td>Hour</td>
</tr>
<tr>
<td>634E0120</td>
<td>Traffic Control Signs</td>
<td>356.0</td>
<td>SqFt</td>
</tr>
<tr>
<td>734E0010</td>
<td>Erosion Control</td>
<td></td>
<td>LS</td>
</tr>
<tr>
<td>734E0154</td>
<td>12&quot; Diameter Erosion Control Wattle</td>
<td>200</td>
<td>Ft</td>
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<tr>
<td>734E0600</td>
<td>Low Flow Silt Fence</td>
<td>150</td>
<td>Ft</td>
</tr>
<tr>
<td>734E0610</td>
<td>Mucking Silt Fence</td>
<td>10</td>
<td>CuYd</td>
</tr>
<tr>
<td>734E0620</td>
<td>Repair Silt Fence</td>
<td>40</td>
<td>Ft</td>
</tr>
</tbody>
</table>

### 30" Culvert Liners – Alternate A

<table>
<thead>
<tr>
<th>BID ITEM NUMBER</th>
<th>ITEM DESCRIPTION</th>
<th>QUANTITY</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>450E9526</td>
<td>30&quot; Cured in Place Pipe</td>
<td>161</td>
<td>Ft</td>
</tr>
<tr>
<td>450E9524</td>
<td>24&quot; Cured in Place Pipe</td>
<td>150</td>
<td>Ft</td>
</tr>
<tr>
<td>450E9726</td>
<td>30&quot; Fold and Form PVC Liner Pipe</td>
<td>161</td>
<td>Ft</td>
</tr>
<tr>
<td>450E9724</td>
<td>24&quot; Fold and Form PVC Liner Pipe</td>
<td>150</td>
<td>Ft</td>
</tr>
</tbody>
</table>

### 18" Culvert Liners – Alternate B

<table>
<thead>
<tr>
<th>BID ITEM NUMBER</th>
<th>ITEM DESCRIPTION</th>
<th>QUANTITY</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>450E9718</td>
<td>16&quot; Fold and Form PVC Liner Pipe</td>
<td>216</td>
<td>Ft</td>
</tr>
<tr>
<td>450E9724</td>
<td>24&quot; Fold and Form PVC Liner Pipe</td>
<td>150</td>
<td>Ft</td>
</tr>
</tbody>
</table>

### 30" Culvert Liners – Alternate B

<table>
<thead>
<tr>
<th>BID ITEM NUMBER</th>
<th>ITEM DESCRIPTION</th>
<th>QUANTITY</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>450E9726</td>
<td>30&quot; Fold and Form PVC Liner Pipe</td>
<td>161</td>
<td>Ft</td>
</tr>
<tr>
<td>450E9724</td>
<td>24&quot; Fold and Form PVC Liner Pipe</td>
<td>150</td>
<td>Ft</td>
</tr>
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### 24" Culvert Liners – Alternate A

<table>
<thead>
<tr>
<th>BID ITEM NUMBER</th>
<th>ITEM DESCRIPTION</th>
<th>QUANTITY</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>450E9524</td>
<td>24&quot; Cured in Place Pipe</td>
<td>150</td>
<td>Ft</td>
</tr>
<tr>
<td>450E9526</td>
<td>30&quot; Cured in Place Pipe</td>
<td>161</td>
<td>Ft</td>
</tr>
</tbody>
</table>

### 24" Culvert Liners – Alternate B

<table>
<thead>
<tr>
<th>BID ITEM NUMBER</th>
<th>ITEM DESCRIPTION</th>
<th>QUANTITY</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>450E9724</td>
<td>24&quot; Fold and Form PVC Liner Pipe</td>
<td>150</td>
<td>Ft</td>
</tr>
</tbody>
</table>

### SPECIFICATIONS

ENVIRONMENTAL COMMITMENTS

The SDDOT is committed to protecting the environment and uses Environmental Commitments as a communication tool for the Engineer and Contractor to ensure that attention is given to avoid, minimize, and/or mitigate an environmental impact. Environmental commitments to various agencies and the public have been made to secure approval of this project. An agency with permitting authority can delay a project if identified environmental impacts have not been adequately addressed. Unless otherwise designated, the Contractor’s primary contact regarding matters associated with these commitments will be the Project Engineer. These environmental commitments are not subject to change without prior written approval from the SDDOT Environmental Office.


For questions regarding change orders in the field that may have an effect on an Environmental Commitment, the Project Engineer will contact the Environmental Office at 605-773-3098 or 605-773-4336 to determine whether an environmental analysis and/or resource agency coordination is necessary.

COMMITMENT B: FEDERALLY THREATENED, ENDANGERED, AND PROTECTED SPECIES

COMMITMENT B2: WHOOPING CRANE

The Whooping Crane is a spring and fall migratory bird in South Dakota that is about 5 feet tall and typically stops on wetlands, rivers, and agricultural lands along their migration route. An adult Whooping Crane is white with a red crown and a long, dark, pointed bill. Immature Whooping Cranes are cinnamon brown. While in flight, their long legs are kept straight and their long dark legs trail behind. Adult Whooping Cranes' black wing tips are visible during flight.

Action Taken/Required:

Harassment or other measures to cause the Whooping Crane to leave the site is a violation of the Endangered Species Act. If a Whooping Crane is sighted roosting in the vicinity of the project, borrow pits, or staging areas associated with the project, cease construction activities in the affected area until the Whooping Crane departs and immediately contact the Project Engineer. The Project Engineer will contact the Environmental Office so that the sighting can be reported to USFWS.

COMMITMENT C: WATER SOURCE

The Contractor will not withdraw water with equipment previously used outside the State of South Dakota or previously used in aquatic invasive species waters within South Dakota without prior approval from the SDDOT Environmental Office. Thoroughly wash all construction equipment to prevent and control the introduction and spread of invasive species into the project vicinity.

The Contractor will not withdraw water directly from streams of the James, Big Sioux, and Vermillion watersheds without prior approval from the SDDOT Environmental Office.

Action Taken/Required:

The Contractor will provide a copy of the approved permit to the Project Engineer prior to proceeding with any dewatering activities. The approved permit must be kept on-site and as part of the project records.

Effluent monitoring, as a result of dewatering activities, will be summarized for each month and recorded on a separate Discharge Monitoring Report (DMR) and submitted to DENR monthly. Additional information can be found at http://denr.sd.gov/des/sw/WhatsaDMR.aspx.

COMMITMENT D: WATER QUALITY STANDARDS

COMMITMENT D2: SURFACE WATER DISCHARGE

The DENR General Permit for Temporary Discharge is required for temporary dewatering and discharges to waters of the state. The effluent limit for total suspended solids will be 90 mg/L 30-day average. The effluent limit applies to discharges to all waters of the state except discharges to waters classified as cold water permanent fish life propagation waters according to the ARSD 74:51:01:45. For discharges to waters of the state classified as cold water permanent fish life propagation waters, the effluent limit for total suspended solids will be 53 mg/L daily maximum.

The permittee has the option of completing effluent testing or implementing a pollution prevention plan for compliance with this permit. If the permittee develops a pollution prevention plan instead of total suspended solids sampling, the plan must be developed and implemented prior to discontinuing total suspended solids sampling. Refer to section 3.0 of the permit. If any pollutants are suspected of being discharged, a sample must be taken for those parameters listed in section 2.2 of the permit.

Refer to Commitment D1: Surface Water Quality for stream classification.

Action Taken/Required:

If construction dewatering is required, the Contractor will obtain the General Permit for Temporary Discharge Activities from the DENR Surface Water Program, 605-773-3351. http://denr.sd.gov/des/sw/swformsandpermits.aspx

The Contractor will provide a copy of the approved permit to the Project Engineer prior to proceeding with any dewatering activities. The approved permit must be kept on-site and as part of the project records.

Effluent monitoring, as a result of dewatering activities, will be summarized for each month and recorded on a separate Discharge Monitoring Report (DMR) and submitted to DENR monthly. Additional information can be found at http://denr.sd.gov/des/sw/WhatsaDMR.aspx.

COMMITMENT E: STORM WATER

Construction activities constitute less than 1 acre of disturbance.

Action Taken/Required:

At a minimum and regardless of project size, appropriate erosion and sediment control measures must be installed to control the discharge of pollutants from the construction site.

COMMITMENT G: DEWATERING AND SEDIMENT COLLECTION

The purpose of a dewatering and sediment collection system is to collect turbid storm water on the project, treat it with flocculants as needed, and capture the sediment that falls out of suspension before the water is discharged into “Waters of the US” or “Waters of the State”. Refer to Commitment D1: Surface Water Quality for stream classification.

Action Taken/Required:

The Contractor will meet the terms of the Temporary Discharge Permit and the Storm Water Permit for Construction Activities.

The Contractor will create a Pollution Prevention Plan (PPP) for dewatering and sediment collection if the Contractor chooses to discharge the water into “Waters of the US” or “Waters of the State”. Refer to the detail sheet OPTIONS FOR DEWATERING AND SEDIMENT COLLECTION in the plans. The PPP must be kept on-site and updated as site conditions change.
COMMITMENT I: HISTORICAL PRESERVATION OFFICE CLEARANCES

The SDDOT has obtained concurrence with the State Historical Preservation Office (SHPO or THPO) for all work included within the project limits and all department designated sources and designated option material sources, stockpile sites, storage areas, and waste sites provided within the plans.

Action Taken/Required:

All earth disturbing activities not designated within the plans require a cultural resource review prior to scheduling the pre-construction meeting. This work includes, but is not limited to: Contractor furnished material sources, material processing sites, stockpile sites, storage areas, plant sites, and waste areas. The Contractor will arrange and pay for a record search and when necessary, a cultural resource survey. The Contractor has the option to contact the state Archaeological Research Center (ARC) at 605-394-1936 or another qualified archaeologist, to obtain either a records search or a cultural resources survey. A record search might be sufficient for review if the site was previously surveyed; however, a cultural resources survey may need to be conducted by a qualified archaeologist.

The Contractor will provide ARC with the following: a topographical map or aerial view of which the site is clearly outlined, site dimensions, project number, and PCN. If applicable, provide evidence that the site has been previously disturbed by farming, mining, or construction activities with a landowner statement that artifacts have not been found on the site. The Contractor will submit the cultural resources survey report to SDDOT Environmental Office, 700 East Broadway Avenue, Pierre, SD 57501-2586. SDDOT will submit the information to the appropriate SHPO/THPO. Allow 30 Days from the date this information is submitted to the Environmental Engineer for SHPO/THPO review.

In the event of an inadvertent discovery of human remains, funerary objects, or suspected of having contaminated soil or water. The Contractor will provide the required permits and clearances to the Project Engineer at the preconstruction meeting.

COMMITMENT J: CONSTRUCTION PRACTICES FOR TEMPORARY WORKS IN WATERWAYS OF THE U.S.

The Contractor is advised that special construction measures must be taken to ensure that the waterways of the U.S. are not impacted.

Action Taken/Required:

Excavation will not occur below the ordinary high water elevation in waterways outside of caissons, crib, cofferdams, steel piling, or sheeting. The natural streambed will not be disturbed unless specified by the plans and under the observation of the Project Engineer. Refer to the Table of U.S. Waterways to Protect for ordinary high water elevations. Any structure work over or within the waterway shall be constructed according to Section 7.21 C of the Specifications.

All dredged or excavated materials will be placed at a site above the ordinary high water elevation in a confined area (not classified as a wetland) that is a minimum of 50 feet away from concentrated flows of storm water, drainage courses, and inlets to prevent return of such material to the waterway.

The construction of temporary work platforms, crossings, or berms below the ordinary high water elevation will be allowed if all material placed below the ordinary high water elevation consists of Class B or larger riprap. All temporary caissons, crib, cofferdams, steel piling, sheeting, work platforms, crossings, and berms will be removed with minimal disturbance to the streambed. Provocative construction practices will be used to minimize increases in suspended solids and turbidity in the waterway.

Bridge berms, wing dams, traffic diversions, channel reconstruction, stream diversions, grading, etc. will be constructed in close conformity with the plans to ensure that the hydraulic capacity of the waterway is not changed.

Temporary waterway crossings required for the Contractor's construction operations will be constructed with an adequate drainage structure size and minimum fill height to reduce the potential for upstream flooding. The Contractor will be responsible for sizing the temporary drainage structure for these crossings.

COMMITMENT N: SECTION 404 PERMIT

The SDDOT has obtained a Section 404 Permit from the USACE for the permanent actions associated with this project.

Action Taken/Required:

The Contractor will comply with all requirements contained in the Section 404 Permit.

The Contractor will also be responsible for obtaining a Section 404 Permit for any dredge, excavation, or fill activities associated with material sources, storage areas, waste sites, and Contractor work sites outside the plan work limits that affect wetlands, floodplains, or waters of the United States.
<table>
<thead>
<tr>
<th>Culvert Inventory</th>
<th>MMB + Dip</th>
<th>Status</th>
<th>Side</th>
<th>Culvert Length (ft)</th>
<th>Culvert Type</th>
<th>Culvert End Type</th>
<th>Directed Flow</th>
<th>Remove Pipe</th>
<th>Culvert and Install</th>
<th>Cleanout Culvert &amp; Treatment</th>
<th>Approximate Water Level in Culvert Comments</th>
<th>Approximate Debits Level in Culvert Comments</th>
<th>Repair Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>19518</td>
<td>298.70</td>
<td>0.22</td>
<td>788+29</td>
<td>18&quot; CMP</td>
<td>None</td>
<td>None</td>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>16' over top on 10-22-19. Undeterminable</td>
<td>Clean, replace end treatment and install liner.</td>
<td></td>
</tr>
<tr>
<td>19519</td>
<td>298.08</td>
<td>0.69</td>
<td>829+00</td>
<td>24&quot; CMP</td>
<td>None</td>
<td>None</td>
<td></td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>9&quot; on 10-22-19. Clean and determine if liner is warranted. Install liner if warranted. Clean, install end treatment and liner. (On Left side, culvert has possibly cut about 10' from the far left end.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19521</td>
<td>300.00</td>
<td>0.94</td>
<td>895+00</td>
<td>18&quot; CMP</td>
<td>None</td>
<td>None</td>
<td></td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>1.5' over top on 10-22-19. Undeterminable</td>
<td>Clean, install end treatment and liner.</td>
<td></td>
</tr>
<tr>
<td>19522</td>
<td>300.00</td>
<td>0.97</td>
<td>896+60</td>
<td>30&quot; CMP</td>
<td>None</td>
<td>None</td>
<td></td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>0.5' on 10-22-19. Clean, install end treatments and Liner.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19524</td>
<td>302.00</td>
<td>0.19</td>
<td>960+21</td>
<td>24&quot; CMP</td>
<td>None</td>
<td>None</td>
<td></td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>0.5' on 10-22-19. Cut of 6' Lt, 3' Rt, clean, install end treatments and Liner.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19525</td>
<td>302.00</td>
<td>0.43</td>
<td>973+22</td>
<td>18&quot; CMP</td>
<td>None</td>
<td>None</td>
<td></td>
<td>20</td>
<td>1</td>
<td>1</td>
<td>culvert full on 10-22-19. Undeterminable</td>
<td>Clean and determine is liner is warranted. Install liner if warranted. Flared End is riveted to 1' of barrel section. Flared Ends may require replacement.</td>
<td></td>
</tr>
<tr>
<td>19534</td>
<td>306.00</td>
<td>0.73</td>
<td>1199+50</td>
<td>42&quot; CMP</td>
<td>Flared</td>
<td>None</td>
<td></td>
<td>100</td>
<td>1</td>
<td>1</td>
<td>over 2' on 10-22-19. None on 10-22-19. Clean, replace end treatment and install liner.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19535</td>
<td>307.00</td>
<td>0.43</td>
<td>1236+55</td>
<td>30&quot; CMP</td>
<td>Flared</td>
<td>None</td>
<td></td>
<td>80</td>
<td>1</td>
<td>1</td>
<td>0.5' on 10-22-19. None on 10-22-19. Clean, replace end treatment and install liner.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19536</td>
<td>307.00</td>
<td>0.63</td>
<td>1247+20</td>
<td>54&quot; CMP</td>
<td>1327</td>
<td>None</td>
<td></td>
<td>10</td>
<td>5</td>
<td>1</td>
<td>2' on 10-22-19. None on 10-22-19, other than large rocks. Clean and determine is liner is warranted. Install liner if warranted, cut off 5' on each end, install end treatment and liner.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Left and Right based upon project station, thus Left is North side and Right is South side.

Culvert type and size obtained from a combination of visual inspection and original construction plans. Additional repair may be required at time of construction.

In place Culvert Markers shall be removed and reset when performing Culvert Work. Cost to remove and reset Culvert Markers shall be incidental to the various culvert contract items.
**SCOPE OF WORK**

Work on this project involves removing pipe culvert sections and ends, resetting pipe culvert sections and ends, and cleaning and inspection of pipe culverts. Subsequent to the cleaning and inspection additional repairs are anticipated which include lining of the pipe culverts.

**UTILITIES**

Utilities are not planned to be affected on this project. If utilities are identified near the improvement area through the SD One Call Process as required by South Dakota Codified Law 49-7A and Administrative Rule Article 20:25, the Contractor will contact the Project Engineer to determine modifications that will be necessary to avoid utility impacts.

**SEQUENCE OF OPERATIONS**

The Contractor will submit to the Area Engineer a minimum of 1 week prior to the Preconstruction Meeting, a detailed plan of how the pipe culvert cleaning and inspection will be staged. The plan will show how the Contractor is going to maintain traffic at each pipe culvert site, where equipment is going to be stored, the total length of the work space if a lane of traffic needs to be closed to traffic, and the methods used to prevent material removed from the pipe culverts from entering the waterway. These plans will be approved by the Area Engineer prior to starting work on the pipe culvert cleaning and inspection.

**TRAFFIC CONTROL**

The roadways will remain open to traffic at all times. One lane of traffic may be closed during work hours, with traffic control being handled with the use of Flaggers as per Standard Plate 634.23. The length of a work zone will be limited to 1 culvert site and there will be a minimum of 1000 ft between work zones. If 2 culverts are within 200 ft of each other it can be considered one work site.

Flaggers or FLAGGER symbol signs will be in place when work activities or equipment present a hazard to workers, traffic, or encroaches into driving lanes open to traffic.

Traffic control devices will be placed beyond the surfaced edge of the roadway when not in use.

Removing, relocating, covering, salvaging and resetting of existing traffic control devices, including delineation, will be the responsibility of the Contractor. Cost of this work will be incidental to the various contract items unless otherwise specified in the plans. Delineators and signs damaged or lost will be replaced by the Contractor at no cost to the State.

Work activities during non-daylight hours are subject to prior approval.

The bottom of signs on portable or temporary supports will not be less than seven feet above the pavement in urban areas and on one foot above the pavement in rural areas. Portable sign supports may be used as long as the duration is less than 3 days. If the duration is more than 3 days the signs will be on fixed location, ground mounted, breakaway supports.

Traffic Control Signs, as shown in the Estimate of Quantities, are estimates. Contractor’s operation may require adjustments in quantities, either more or less. Payment will be for those signs actually ordered by the Engineer and used.

Fixed location signing placed more than 4 calendar days prior to the start of construction will be covered or laid down until the time of construction. The covers must be approved by the Engineer prior to installation. The cost of materials, labor, and equipment necessary to complete this work will be incidental to other contract items. No separate payment will be made.

All fixed location signs, sign posts, and breakaway bases will be removed within 7 calendar days following pavement marking.

Traffic will be maintained on the driving lanes. Use of the shoulders as a driving lane will not be permitted. Any damage to the shoulder due to rerouted traffic or Contractor’s equipment will be repaired at no expense to the Department.

The Contractor will be responsible for maintaining all existing traffic control signing for the safety of the traveling public.

The Contractor will accommodate vehicles up to 16 feet wide through the work area at all times.

**TRAFFIC CONTROL SIGNS**

Sufficient traffic control devices have been included in these plans to sign two workspaces as per Standard Plate 634.03 and two workspaces as per Standard Plate 634.23. If the Contractor elects to work on additional locations simultaneously, the cost for additional traffic control devices will be incidental to the contract unit price per square foot for TRAFFIC CONTROL SIGNS.

**CLOSED-CIRCUIT TELEVISION (CCTV) CAMERA**

The CCTV camera will be mounted on a crawler. The crawler will be capable of traveling the entire length of the pipe culvert. If unable to travel through the culvert due to an obstacle or large void, then the CCTV camera will be run from both ends of the culvert as far as possible.

The CCTV camera will travel through the culvert at a speed not exceeding 30 feet per minute.

The CCTV camera will be equipped with an accurate working footage counter that shows accurate distances on the video recordings.

The CCTV camera will have the ability to pan and tilt. Lighting for the CCTV camera will be suitable to allow a clear picture of the entire periphery of the pipe. The CCTV monitor and other components of the CCTV system will be capable of producing a clear color picture/CCTV image.

A DVD recording of each CCTV camera inspection of each pipe culvert will be provided to the Engineer. Other methods of transferring video recordings may be considered and approved by the Engineer.

All defects such as holes, cracks, open joints will be fully documented when doing the CCTV inspections.

**CLEANOUT PIPE CULVERTS**

The contract item CLEANOUT PIPE CULVERT is included in this contract for use at those locations where water and sediment levels did not allow for any type of visual inspection inside of the culvert. The Table of Pipe Culvert Repairs indicate locations where this contract item will be utilized.

Cleannout of pipe culverts will be done in advance of pipe culvert repair operations, as indicated in the Table of Mainline Pipe Culvert Repairs. Following cleaning, pipe inspection will be completed with a CCTV camera. The inspection will determine any deviations in the vertical and horizontal alignments, location and size of any gaps in joints, and location of any damage.

The pipe culvert cleaning and inspection will be scheduled such that there is adequate time to evaluate what repairs are required and allow for ordering and delivery of pipe culvert repair materials.

Material in all existing pipe culverts will be cleaned out by water flushing or other approved methods.

Material removed from the pipe culverts will become the property of the Contractor for disposal.

The Contractor will implement appropriate sediment control measures prior to water flushing in order to prevent discharges from the project boundaries.

Pipe culverts may need to be dewatered to allow for CCTV inspection.

The pipe culvert will be cleaned to the satisfaction of the Engineer and the cleaning will be adequate to determine pipe condition and potential repair techniques.

All costs to dewater, clean pipes, dispose of removed materials and CCTV camera inspection pipe culverts will be incidental to the contract unit price per each for CLEANOUT PIPE CULVERT.

The contract item CLEANOUT PIPE CULVERT will be paid for a maximum of one time for each pipe culvert.

When the contract item CLEANOUT PIPE CULVERT is indicated at a culvert site, the SDDOT will not be responsible for any materials that were ordered prior to the culvert being cleaned and CCTV inspected.
CLEANOUT FOR CULVERT TREATMENT

Cleanout of pipe culverts will be done in advance of pipe culvert repair operations. Following cleaning, pipe inspection will be completed with a CCTV camera. The inspection will determine any deviations in the vertical and horizontal alignments, location and size of any gaps in joints, and location of any damage.

Material in all existing pipe culverts will be cleaned out by water flushing or other approved methods.

Material removed from the pipe culverts will become the property of the Contractor for disposal.

The Contractor will implement appropriate sediment control measures prior to water flushing in order to prevent discharges from the project boundaries.

Pipe culverts may need to be dewatered to allow for CCTV inspection.

The pipe culvert will be cleaned to the satisfaction of the Engineer and the cleaning will be adequate to determine pipe condition and potential repair techniques.

All costs to dewater, clean pipes, dispose of removed materials and CCTV camera inspect pipe culverts will be incidental to the contract unit price per each for CLEANOUT FOR CULVERT TREATMENT.

The contract item CLEANOUT FOR CULVERT TREATMENT will be paid for a maximum of one time for each pipe culvert. The contract item CLEANOUT FOR CULVERT TREATMENT will not be paid for if during the contract work item CLEANOUT PIPE CULVERTS, it is determined that culvert lining is not possible. In addition, the contract item CLEANOUT FOR CULVERT TREATMENT will not be paid if after the initial cleanout (paid as CLEANOUT PIPE CULVERTS) a 2nd cleanout effort is not necessary to line the pipe.

RCP AND CMP CULVERT REPAIRS FOR MAINLINE PIPE CULVERTS

Resetting and replacement of CMP will be completed prior to culvert lining.

All pipe and end treatments designated for removal will become the property of the Contractor for his disposal.

When necessary to remove end sections of CMP culverts, they may be cut with a torch. If the pipe culvert is cut the damaged area will be painted with a galvanizing paint approved by the Engineer. All costs associated with cutting and painting will be incidental to the various contract items.

The Contractor is advised of the risk of lead exposure when cutting galvanized paint. The Contractor should plan his/her operations accordingly, and inform employees of hazards of lead exposure.

CORRUGATED METAL PIPE

Corrugated metal pipes will have 2 ¾-inch x ¾-inch corrugations for 42-inch and smaller round pipe and 48-inch and smaller arch pipe unless otherwise stated in the plans. Corrugated metal pipes will have 3-inch x 1-inch or 5-inch x 1-inch corrugations for 48-inch and larger round pipe and 54-inch and larger arch pipe unless otherwise stated in the plans.

For pipe segments of 10' or less, helical spun pipe with rolled ends will not be required. Riveted pipe will be allowed.

The gauge of the corrugated metal ends will match the thickest gauge of corrugated metal pipe it is connected to. When connecting to an existing culvert, the gauge of the corrugated metal ends will be 14 gauge.

TABLE OF MAINLINE PIPE CULVERT REPAIR

Pipe culvert lengths shown in the Table of Mainline Pipe Culvert Repairs were obtained from the original grading plans and were not verified in the field.

It is the Contractors responsibility to investigate each pipe culvert pipe repair site to determine the pipe culvert size and length, along with other information needed to prepare a bid.

SEDIMENT CONTROL

Sediment control may be required if water is flowing through the pipe culvert at the time of cleaning. Otherwise sediment control is not anticipated.

The Contractor will implement appropriate sediment control measures prior to water flushing in order to prevent discharges beyond the project boundaries.

Wattles and Silt Fence have been provided in the Estimate of Quantities and will be used to capture pipe cleanout material. Placement of the wattles and Silt Fence will be as directed by the Engineer.

EROSION CONTROL WATTLE

Erosion control wattles for restraining the flow of runoff and sediment will be installed at locations determined by the Engineer during construction. Refer to Standard Plate 734.06 for details.

The Contractor will provide certification that the erosion control wattles do not contain noxious weed seeds.

Erosion control wattles will remain on the project to decompose.

An additional quantity of 12" Diameter Erosion Control Wattles has been added to the Estimate of Quantities for temporary erosion and sediment control in highway ditch channels and as an alternative to low flow or high flow silt fence at wetland areas adjacent to the highway.

The erosion control wattle provided will be from the approved product list. The approved product list for erosion control wattle may be viewed at the following internet site:

http://apps.sd.gov/HC60ApprovedProducts/main.aspx

LOW FLOW SILT FENCE

The low flow silt fence fabric provided will be from the approved product list. The approved product list for low flow silt fence may be viewed at the following internet site:

http://apps.sd.gov/HC60ApprovedProducts/main.aspx

Low flow silt fence will be placed at locations determined by the Engineer and at locations that will minimize siltation of adjacent streams, lakes, dams, or drainage areas as determined by the Engineer during construction. Refer to Standard Plate 734.04 for details.

CONTRACTOR FURNISHED TOPSOIL

Contractor furnished topsoil will be free from clay lumps, stones, coarse gravel, or similar objects larger than 1/2 inch in diameter. Brush, stumps, roots, wood, objectionable weeds, litter, or any other material which may be harmful to plant growth will not be allowed. Organic material will be decomposed.

All costs to furnish and place the Contractor furnished topsoil will be incidental to the contract unit price per cubic yard for “Contractor Furnished Topsoil”.

EROSION CONTROL

The areas to be seeded consist of areas at pipe culvert locations where resetting or replacement of pipe culvert sections or end treatments are required. In addition, any location where vegetation was destroyed, such that quick revegetation is not expected will be reseeded.

The estimated area requiring erosion control is 1/4 acres at locations where pipe culvert section and ends were reset or replaced. All costs for the erosion control work for furnishing, placing, and maintaining erosion control including equipment, labor, and seeding will be incidental to the contract lump sum price for EROSION CONTROL.

The limits of erosion control work will be determined by the Engineer during construction.

Type C Permanent Seed Mixture will be used on this project.

Application of fertilizer will not be required on this project.

Type C Permanent Seed Mixture will consist of the following:

<table>
<thead>
<tr>
<th>Grass Species</th>
<th>Variety</th>
<th>Pure Live Seed (PLS) (Pounds/Acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Western Wheatgrass</td>
<td>Arib, Flintlock, Rodan, Rosana, Walsh</td>
<td>16</td>
</tr>
<tr>
<td>Canada Wildrye</td>
<td>Mandan</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td></td>
<td><strong>18</strong></td>
</tr>
</tbody>
</table>

http://apps.sd.gov/HC60ApprovedProducts/main.aspx
A. CIPP LINER MATERIAL
The CIPP liner will be manufactured in accordance to ASTM F2019. In addition, the liner will meet the following requirements:
1. fit the host pipe tightly
2. have a maximum thickness of 1/2 inch
3. provide a continuous lining of the host pipe
4. use a nontoxic lining process
5. is nontoxic when cured
6. have a minimum of 50-year design life.
CIPP liner will be shipped, stored, and handled in a manner consistent with written recommendations of the manufacturer.

B. CIPP LINER SUBMITTALS
For each host pipe to be lined the Contractor will submit the following to the Area Engineer a minimum of 2 weeks before the preconstruction meeting for their approval. Information will be provided into the category breakdown as shown below:

1. Liner Data
   a. pipe liner material type and trade name
   b. nominal inside and outside pipe liner diameters
   c. manufacturer’s recommended maximum and minimum fill heights for the identified liner
   d. certification that liner meets specifications
   e. include calculations showing that the liner is designed for AASHTO HL-93 live loading when the pipe is considered to be fully deteriorated

As an alternate to designing to AASHTO HL-93, design for ASTM F2019 based upon a fully deteriorated pipe. ASTM F1216 will be the basis of furnished calculations and engineering drawing.

2. Work Area Plan
   a. the work area required for the liner installation
   b. method of preventing water from interfering with the installation
   c. a site restoration plan

3. Pipe Cleaning
   Provide a plan that includes the cleaning of the host pipe and disposal of the debris

4. Liner Installation
   Provide a liner installation plan which will include the following:
   a. method of liner installation
   b. curing method identifying required cure times, temperatures, and pressures
   c. containment plan for collection of contaminated water
   d. management and disposal plan for contaminated materials resulting from the liner installation

5. Training Certification and Experience
   Provide written proof that at least one member of the installation team has attended training and been certified by the manufacturer on the liner material being installed.

   The installer must supply the Engineer with 5 prior job references of projects where they have successfully installed CIPP liners.

C. HOST PIPE PREPARATION AND INSPECTION
The host pipe will be thoroughly cleaned using a high-pressure water jet or similar methods. The cleaning method will produce a clean, sound surface that demonstrates no evidence of loose material, debris or contaminates. The host pipe will be cleaned just prior to insertion of the CIPP liner. The Contractor will implement appropriate sediment control measures prior to cleaning in order to prevent discharges from the project boundaries to comply with the Storm Water Permit.

Host pipe inspection will be completed with a CCTV camera. A DVD recording of the inspection will be provided to the Engineer. The inspection will determine the suitability of the liner for the host pipe including such items as the horizontal and vertical alignments, location of gaps in the joints and pipe damage. The Engineer will be notified if any pipe sections are impassable or the pipe cannot be lined.

Any intrusions into the pipe will be cut or ground off flush with the host pipe interior wall before installing the liner. Cut off existing pipe tie bolts flush with the nut or as per the manufacturer’s recommendations, if manufacturer’s recommendations are more stringent.

Control groundwater infiltration that will interfere with installation of the CIPP liner. Dewatering may be necessary. Host pipe will be in a dry condition as prescribed by the CIPP liner manufacturer.

The Engineer shall inspect host pipes prior to lining to determine the pipes acceptance for lining including if additional cleaning is required. The host pipe will be clean and in a dry condition prior to commencing the lining process.

D. PIPE LINER INSTALLATION
The manufacturer’s representative will be on site to provide training to Contractor’s staff. A manufacturer’s representative will be present for at least one complete liner installation and until the Engineer is satisfied that the Contractor’s staff is competent in performing this work. A manufacturer’s representative will also provide education to the Engineer on the liner installation and curing process.

Prior to inserting the CIPP liner, a sliding foil protector will be pulled into the host pipe to protect the CIPP liner from damage.

Installation of the liner into the host pipe will be in accordance with ASTM F2019.

CCTV camera inspection will be completed after inflation and prior to curing.

The cured CIPP liner will be continuous over the entire length of an installation run and be free of material defects. The lining will be impervious and free of any leakage from the pipe to the surrounding ground or from the ground to the inside of the pipe.

Trim the liner to length according to the manufacturer’s recommendations. The liner will provide a smooth transition taper at each end of the pipe. There will not be any gaps between the liner and the host pipe. The ends will be sealed with an epoxy or resin mixture compatible with the liner and resin system, providing a watertight seal between the host pipe and the CIPP liner.

E. FINAL ACCEPTANCE AND PAYMENT
Host pipe inspection will be completed with a CCTV crawler after the liner has been cured. A DVD recording of the inspection will be provided to the Engineer.

Defects which will or could affect the structural integrity, strength, capacity, or future maintenance of the installed CIPP liner will be repaired at the Contractor’s expense, in a manner approved by the Engineer.

Any disrupted areas will be restored and stabilized to the satisfaction of the Engineer.

All costs for equipment, material and labor for the CIPP liner work will be incidental to the contract unit price per foot for the various sizes of CURED IN PLACE PIPE.
C. HOST PIPE PREPARATION AND INSPECTION

The host pipe will be thoroughly cleaned using a high-pressure water jet or hydro-mechanical methods. The cleaning method will produce a clean, sound surface that demonstrates no evidence of loose material, debris or contaminates. The host pipe will be cleaned just prior to insertion of the FFPP liner. The Contractor will implement appropriate sediment control measures prior to cleaning in order to prevent discharges from the project boundaries to the horizontal and vertical alignments, location of gaps in the joints and pipe damage. The Engineer will be notified if any pipe sections are impassible or the pipe cannot be lined.

For each host pipe to be lined the Contractor will submit the following to the Area Engineer a minimum of 2 weeks before the preconstruction meeting for their approval. Information will be provided in the category breakdown as shown below:

1. Liner Data
   a. pipe liner material type and trade name
   b. nominal inside and outside pipe liner diameters
   c. material class classification
   d. manufacturer’s recommended maximum and minimum fill heights for the identified liner
   e. certification that liner meets specifications
   f. include calculations showing that the liner is designed for AASHTO HL-93 live loading when the pipe is considered to be fully deteriorated by a Professional Engineer registered in the state of South Dakota.

2. Work Area Plan
   Provide work area plans that includes the following:
   a. the work area required for the liner installation
   b. method of preventing water from interfering with the installation
   c. a site restoration plan

3. Pipe Cleaning
   Provide a plan that includes the cleaning of the host pipe and disposal of the debris

4. Liner Installation
   Provide a liner installation plan which will include the following:
   a. method of liner installation
   b. curing method identifying required cure/cool down times, temperatures, and pressures
   c. containment plan for collection of contaminated water
   d. management and disposal plan for contaminated materials resulting from the liner installation

5. Training Certification and Experience
   Provide written proof that at least 1 member of the installation team has attended training and been certified by the manufacturer on the liner material being installed.
   The installer must supply the Engineer with 5 prior job references of projects where they have successfully installed FFPP liners.

B. FFPP LINER SUBMITTALS

The manufacturer’s representative will be on site to provide training to Contractor’s staff. A manufacturer’s representative will be present for at least one complete liner installation and until the Engineer is satisfied that the Contractor’s staff is competent in performing this work. A manufacturer’s representative will also provide education to the Engineer on the liner installation and curing process.

Installation of the liner into the host pipe will be in accordance with ASTM F1947.

The cured FFPP liner will be continuous over the entire length of an installation run and be free of material defects. The lining will be impervious and free of any leakage from the pipe to the surrounding ground or from the ground inside the lined pipe.

Trim the liner to length according to the manufacturer’s recommendations, allowing for possible shrinkage during further cooling. The liner will provide a smooth transition taper at each end of the pipe. There will not be any gaps between the liner and the host pipe. The ends will be sealed with an epoxy or resin mixture compatible with the liner system, providing a watertight seal between the host pipe and the FFPP liner.

A. FFPP LINER MATERIAL

The FFPP liner will be manufactured in accordance to ASTM F1504.

The pipe will be made from PVC compound meeting all the requirements for cell classification 12334 as defined in specification D1784 and with minimum physical properties:

<table>
<thead>
<tr>
<th>Test Method</th>
<th>Tensile Strength</th>
<th>Tensile Modulus</th>
<th>Flexural Strength</th>
<th>Flexural Modulus</th>
<th>Heat Deflection Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>D638</td>
<td>6,000psi</td>
<td>320,000psi</td>
<td>6,000psi</td>
<td>320,000psi</td>
<td>115°F</td>
</tr>
</tbody>
</table>

The cured FFPP liner will be continuous over the entire length of an installation

Table 1: Minimum Impact Strength at 73°F (23°C)

<table>
<thead>
<tr>
<th>Pipe size, in.</th>
<th>Impact strength, ft-lb f</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>220</td>
</tr>
<tr>
<td>24</td>
<td>220</td>
</tr>
<tr>
<td>30</td>
<td>220</td>
</tr>
</tbody>
</table>

Table 2: Minimum Pipe Stiffness at 5% Deflection

<table>
<thead>
<tr>
<th>Pipe Size, in.</th>
<th>Pipe Stiffness, psi</th>
<th>Dimension Ratio, (DR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>6</td>
<td>66</td>
</tr>
<tr>
<td>24</td>
<td>6</td>
<td>66</td>
</tr>
<tr>
<td>30</td>
<td>6</td>
<td>66</td>
</tr>
</tbody>
</table>

In addition, the liner will meet the following requirements:

1. fit the host pipe tightly
2. have a maximum thickness of ½ inch
3. provide a continuous lining of the host pipe
4. use a nonrotating curing process
5. is nonrotic when cured
6. have a minimum 50-year design life.

The FFPP liner will be shipped, stored, and handled in a manner consistent with written recommendations of the manufacturer.

The FFPP liner will be clearly marked as follows at intervals of 5ft or less:

- Manufacturer’s name or trademark and code
- Nominal outside diameter
- The PVC cell classification, for example “12334”
- The legend “DR XX FOLDED PVC PIPE”
- The designation “Specification ASTM F1504”

D. PIPE LINER INSTALLATION

The manufacturer’s representative will be on site to provide training to Contractor’s staff. A manufacturer’s representative will be present for at least one complete liner installation and until the Engineer is satisfied that the Contractor’s staff is competent in performing this work. A manufacturer’s representative will also provide education to the Engineer on the liner installation and curing process.

Installation of the liner into the host pipe will be in accordance with ASTM F1947.

The cured FFPP liner will be continuous over the entire length of an installation run and be free of material defects. The lining will be impervious and free of any leakage from the pipe to the surrounding ground or from the ground inside the lined pipe.

Trim the liner to length according to the manufacturer’s recommendations, allowing for possible shrinkage during further cooling. The liner will provide a smooth transition taper at each end of the pipe. There will not be any gaps between the liner and the host pipe. The ends will be sealed with an epoxy or resin mixture compatible with the liner system, providing a watertight seal between the host pipe and the FFPP liner.

STATE OF SOUTH DAKOTA  
FOLD AND FORM PVC PIPE (FFPP)  
STATE OF SOUTH DAKOTA  
P 0013(54)  
9 17  
117 9
E. FINAL ACCEPTANCE AND PAYMENT

Host pipe inspection will be completed with a CCTV crawler after the liner has been cured and cooled below 90°F. A DVD recording of the inspection will be provided to the Engineer.

FFPP will be inspected for visible cracks, holes, foreign inclusions or other injurious defects. Defects which will or could affect the structural integrity, strength, capacity, or future maintenance of the installed FFPP liner will be repaired at the Contractor’s expense, in a manner approved by the Engineer.

Any disrupted areas will be restored and stabilized to the satisfaction of the Engineer.

All costs for equipment, material and labor for the FFPP liner work will be incidental to the contract unit price per foot for the various sizes of FOLD AND FORM PVC LINER PIPE.
### Posted Speed Prior to Work (M.P.H.)

<table>
<thead>
<tr>
<th>Speed Range</th>
<th>Advance Warning Signs (Feet)</th>
<th>Advance Warning Devices (Feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 30</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>35 - 40</td>
<td>350</td>
<td>350</td>
</tr>
<tr>
<td>45</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>50</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>55</td>
<td>750</td>
<td>750</td>
</tr>
<tr>
<td>60 - 65</td>
<td>1000</td>
<td>1000</td>
</tr>
</tbody>
</table>

**Channelizing Device**

The channelizing devices shall be drums or 42" cones if traffic control must remain overnight.

For short duration operations (1 hour or less), all channelizing devices may be eliminated if a vehicle with an activated flashing or revolving yellow light is used.

**A Shoulder Work sign** should be placed on the left side of a divided or one-way roadway only if the left shoulder is affected.

The channelizing devices shall be drums or 42" cones.

**Channelizing Devices**

Channelizing devices are not required along the centerline adjacent to work area when pilot cars are utilized for escorting traffic through the work area.

Channelizing devices and flaggers shall be used at intersecting roads to control intersecting road traffic as required.

The buffer space should be extended so that the two-way traffic taper is placed before a horizontal or vertical curve to provide adequate sight distance for the flagger and queue of stopped vehicles.

The length of A may be adjusted to fit field conditions.
**GENERAL NOTES:**

The top of anchor posts and slip bases SHALL NOT extend above a 60° chord line within a 120° diameter circle around the post with ends 4" above the ground. At locations where there is curb and gutter adjacent to the breakaway sign support, the stub height shall be a maximum of 4" above the ground line at the localized area adjacent to the breakaway support stub. The 4" stub height clearance is not necessary for U-channel lap splices where the support is designed to yield (bend) at the base.
<table>
<thead>
<tr>
<th>SIGN CODE</th>
<th>SIGN DESCRIPTION</th>
<th>NUMBER</th>
<th>SIGN SIZE</th>
<th>SQFT PER SIGN</th>
<th>SQFT</th>
</tr>
</thead>
<tbody>
<tr>
<td>W20-1</td>
<td>ROAD WORK AHEAD</td>
<td>8</td>
<td>48'' x 48''</td>
<td>16.0</td>
<td>128.0</td>
</tr>
<tr>
<td>W20-4</td>
<td>ONE LANE ROAD AHEAD</td>
<td>4</td>
<td>48'' x 48''</td>
<td>16.0</td>
<td>64.0</td>
</tr>
<tr>
<td>W20-7</td>
<td>FLAGGER (symbol)</td>
<td>4</td>
<td>48'' x 48''</td>
<td>16.0</td>
<td>64.0</td>
</tr>
<tr>
<td>W21-5</td>
<td>SHOULDER WORK</td>
<td>4</td>
<td>48'' x 48''</td>
<td>16.0</td>
<td>64.0</td>
</tr>
<tr>
<td>G20-2</td>
<td>END ROAD WORK</td>
<td>8</td>
<td>36'' x 18''</td>
<td>4.5</td>
<td>36.0</td>
</tr>
</tbody>
</table>

**TOTAL**

- CONVENTIONAL ROAD
- TRAFFIC CONTROL SIGNS SQFT: 356.0
Alternate Type Connector
Sections may be used with approval of the Engineer.

1. Dimple Bond Reinforced Collar
Galvanized Metal

APRON PLAN ELEVATION

NOTE:
STATE OF SOUTH DAKOTA
PROJECT P 0013(54)
Plotted Date: 04/27/2020

DIMENSIONS (in.): APPROX. GA. B H L W SLOPE BODY

<table>
<thead>
<tr>
<th>Size (in)</th>
<th>A</th>
<th>B</th>
<th>H</th>
<th>L</th>
<th>W</th>
<th>Slope Body</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>16</td>
<td>6</td>
<td>6</td>
<td>21</td>
<td>24</td>
<td>2½:1 Pc.</td>
</tr>
<tr>
<td>15</td>
<td>16</td>
<td>7</td>
<td>8</td>
<td>26</td>
<td>30</td>
<td>2½:1 Pc.</td>
</tr>
<tr>
<td>18</td>
<td>16</td>
<td>9</td>
<td>10 2</td>
<td>37</td>
<td>50 2½:1 Pc.</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>16</td>
<td>9</td>
<td>12 6</td>
<td>36</td>
<td>42 2½:1 Pc.</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>16</td>
<td>10</td>
<td>13 6</td>
<td>41</td>
<td>48 2½:1 Pc.</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>16</td>
<td>10</td>
<td>13 6</td>
<td>41</td>
<td>48 2½:1 Pc.</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>16</td>
<td>10</td>
<td>13 6</td>
<td>41</td>
<td>48 2½:1 Pc.</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>16</td>
<td>10</td>
<td>13 6</td>
<td>41</td>
<td>48 2½:1 Pc.</td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>16</td>
<td>10</td>
<td>13 6</td>
<td>41</td>
<td>48 2½:1 Pc.</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>16</td>
<td>10</td>
<td>13 6</td>
<td>41</td>
<td>48 2½:1 Pc.</td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>16</td>
<td>10</td>
<td>13 6</td>
<td>41</td>
<td>48 2½:1 Pc.</td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>16</td>
<td>10</td>
<td>13 6</td>
<td>41</td>
<td>48 2½:1 Pc.</td>
<td></td>
</tr>
<tr>
<td>51</td>
<td>16</td>
<td>10</td>
<td>13 6</td>
<td>41</td>
<td>48 2½:1 Pc.</td>
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<td>13 6</td>
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<td>13 6</td>
<td>41</td>
<td>48 2½:1 Pc.</td>
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</table>

STANDARD CONNECTIONS
- Dimple Bond Collar Bolted to end section with 1/4" bolts

TUBING ATTACHMENT DETAILS

SECTION A-A

Pipe
- Finish Earth Slope as Required
- Approx. 2½:1 Slope
- Standard Coupling Band

TYPICAL CROSS-SECTION

GENERAL NOTES
- All 5 pc. bodies shall have 12 Ga. slopes and 10 Ga. center panels. Width of center panels shall be greater than 25% of the pipe periphery. Multiple panel bodies to have top seams tightly joined by 1/4" dia. galvanized rivets or bolts.
- For 60" through 84" sizes, reinforced edges shall be supplemented with galvanized stiffener angles. The angles will be 3" x 3" x 1/4" for 60" through 72" diameters and 3½" x 3½" x 1/2" for 78" and 84" diameters. The angles shall be attached by 1/4" dia. galvanized nuts and bolts.


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Number of bars required will vary depending on the length of the end section. When bars are specified in the plans, the cross drainage bar is required when span is over 30". Cross bar to be welded to parallel bars to make piece unit.

**DETAIL OF SAFETY BARS**

- ½" Dia. Galvanized Steel Rod or No. 4 Galvanized Reinforcing Bar

**SECTION A-A**

- Corrugation sized to fit pipe.

**SECTION B-B**

- Reinforced Edge Full Length of End Section (See Section A-A)
- Nails Spaced at 12" (Max.)

**FRONT VIEW**

- Side Lug
- ½" x 6" Culvert bolt with flanged nut

**CIRCULAR C.M.P. SLOPED ENDS**

<table>
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<tr>
<th>Pipe Dia. (Inch)</th>
<th>Min. Thick.</th>
<th>Dimensions (Inches)</th>
<th>Overall Width</th>
<th>Slope</th>
<th>Length (Inch)</th>
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**GENERAL NOTES:**

- Safety bars shall be attached to sloped ends over 30" in diameter only when specified in the plans.
- Sloped ends shall be fabricated from galvanized steel and shall conform to the requirements of the Specifications.
- Safety bars shall be fabricated from steel schedule 40 pipe in conformance with ASTM A53, grade B or MSS SP-66, grade B.
- Slotted holes for safety bar attachment shall be provided for all end sections.
- Attachment to circular pipes 15" through 24" diameter shall be made with Type "I" straps. All other sizes shall be attached with Type "2" rods and lugs.
- When stated in the plans, optional toe plate extension shall be punched and bolted to end section apron lip with 3/8" diameter galvanized bolts. Steel for toe plate extension shall be same gauge as end section. Dimensions shall be overall width less 6" by 8" high.
- Installation shall be performed in accordance with the Specifications.

Cost of all work and materials required for fabrication and installation of sloped ends shall be incidental to the bid items for the various sizes of sloped ends.
MANUAL LOW FLOW SILT FENCE INSTALLATION

1. EXCAVATE TRENCH
2. DRIVE STEEL T FENCE POSTS
3. ATTACH 26" WOVEN WIRE FENCE TO POSTS

Fabric for silt fence will be 26" (Min.) width. Fabric will overlap the top of fence will be placed between the posts and the woven wire fence. See Detail B.

4. ATTACH SILT FENCE FABRIC
5. BACKFILL TRENCH AND WHEEL COMPACT SOIL

8" staples will be placed at each post to secure the silt fence fabric to the bottom of the trench.

The silt fence length and width may be adjusted due to a larger pipe, multiple pipe, or other circumstances during construction as determined by the Engineer.

The elevation at these locations will be, at a minimum, higher than the top of the silt fence fabric at its lowest elevation.

Fabric for silt fence will be 36" (Min.) width. Fabric that overlaps the top of fence will be placed between the posts and the woven wire fence. Detail B.

Backfill trench and wheel compact soil.

6. (Min.) Fabric Overlap

Post spacing will be 3' for these types of applications of silt fence. All other components of the silt fence will be the same as shown above.

Fabric that overlaps the top of fence will be placed between the posts and the woven wire fence. Detail B.

The elevation at these locations will be, at a minimum, higher than the top of the silt fence fabric at its lowest elevation.

MACHINE SLICED LOW FLOW SILT FENCE INSTALLATION

1. INSTALL SILT FENCE FABRIC BY MACHINE SLICING METHOD.
   Silt fence fabric will be overlapped a minimum of 2" at top of woven wire fence. Silt Fence Fabric.
   26" Woven Wire Fence Bend at base as necessary to provide for a minimum of 2" of silt fence fabric overlap.
   26" Woven Wire Fence

2. WHEEL COMPACT SOIL ABOVE SLICED IN PORTION OF FABRIC AND THEN DRIVE STEEL T FENCE POSTS.
   Attach the silt fence fabric with plastic ties, wire ties, or hog rings at 12" (Max.) horizontal spacing on the top and bottom wires of the woven wire fence and with plastic or wire ties at 12" (Max.) vertical spacing on the posts.
   Wheel Compact Soil

3. ATTACH 26" WOVEN WIRE FENCE TO POSTS AND ATTACH SILT FENCE FABRIC.
   The elevation at these locations will be, at a minimum, higher than the top of the silt fence fabric at its lowest elevation.

   The silt fence length and width may be adjusted due to a larger pipe, multiple pipe, or other circumstances during construction as determined by the Engineer.

   The radius of the silt fence will be the minimum capable by the slicing machine. The post spacing will be 3' for these types of applications of silt fence. All the other components of the silt fence will be the same as shown above.

   A silt trap will be provided when specified by a plan note. All costs for constructing the silt trap will be incidental to the contract unit price per cubic yard for "Silt Trap".

   If a trench can not be dug or the silt fence fabric can not be sliced in due to the type of earthen material (such as rock), then a row of 30 to 40 pound sandbags butted end to end will be provided on top of the extra length of silt fence fabric to prevent underflow.

February 14, 2020

Published Date: 2nd Qtr. 2020
Sheet 1 of 2

LOW FLOW SILT FENCE AND SILT TRAP
PLATE NUMBER 7.34.04

SDDOT

February 14, 2020

Published Date: 2nd Qtr. 2020
Sheet 2 of 2

LOW FLOW SILT FENCE AND SILT TRAP
PLATE NUMBER 7.34.04

SDDOT
GENERAL NOTES:

At cut or fill slope installations, wattles will be installed along the contour and perpendicular to the water flow. At ditch installations, point A must be higher than point B to ensure that water flows over the wattle and not around the ends.

The Contractor will dig a 3" to 5" trench, install the wattle tightly in the trench so that daylight cannot be seen under the wattle, and then compact the soil excavated from the trench against the wattle on the uphill side. See Detail B.

The stakes will be 1"x2" or 2"x2" wood stakes, however, other types of stakes such as rebar may be used only if approved by the Engineer. The stakes will be placed 6" from the ends of the wattles and the spacing of the stakes along the wattles will be 3' to 4'.

Where installing running lengths of wattles, the Contractor will butt the second wattle tightly against the first and will not overlap the ends. See Detail C.

The Contractor and Engineer will inspect the erosion control wattles in accordance with the storm water permit. The Contractor will remove, dispose, or reshape the accumulated sediment when necessary as determined by the Engineer.

Sediment removal, disposal, or necessary shaping will be as directed by the Engineer. All costs for removing accumulated sediment, disposal of sediment, and necessary shaping will be incidental to the contract unit price per cubic yard for "Remove Sediment".

All costs for furnishing and installing the erosion control wattles including labor, equipment, and materials will be incidental to the contract unit price per foot for the corresponding erosion control wattle contract item.

All costs for removing the erosion control wattle from the project including labor, equipment, and materials will be incidental to the contract unit price per foot for "Remove Erosion Control Wattle".