APPENDIX G: STRUCTURAL REVIEW REPORT

REHABILITATION OF OXON COVE TRAIL AND OXON RUN TRAIL

PEDESTRIAN BRIDGE CONCEPT REPORT

This report covers four proposed shared use pedestrian bridge crossings identified in the concept plan study. These are located at:

- Stream Crossing @ Oxon Run/Oxen Cove Trail Interface
- Audrey Lane Stream crossing
- Barnaby Run crossing
- Oxon Run crossing @ South Capitol Street

Structural Design Criteria:

It is assumed that the latest applicable AASHTO Design Criteria will be used for the design of this project. It is also assumed that the pedestrian bridges for this project will be designed for and are primarily intended to carry pedestrians, bicyclists and light maintenance vehicles. These bridges are not to be designed for or intended to carry typical highway traffic. Applicable AASHTO Design Criteria includes the following:

- AASHTO LRFD Bridge Design Specifications, 5th Edition
- AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaries, and Traffic Signals, 5th Edition (for wind load criteria)
- AASHTO LRFD Guide Specifications for the Design of Pedestrian Bridges
- AASHTO Guide for Development of Bicycle Facilities

For new pedestrian bridges, AASHTO criteria mandates that if vehicular access is not prevented by permanent physical methods, pedestrian bridges shall be design for a maintenance vehicle. An H5 Design Live Load vehicle is considered appropriate for this project.

Since this project spans multiple jurisdictions, it is also anticipated that the following Design Criteria may also be applicable to either all of or portions of the project:

- D. C. Department of Transportation Standard Specifications for Highways and Structures
- D. C. Department of Transportation Design and Engineering Manual
- Federal Lands Highway Project Development and Design Manual
- Maryland State Highway Administration Standard Specifications for Construction and Materials
- Maryland State Highway Administration, Office of Bridge Development, Policy and Procedures Manual and Structural Standards Manual
- Maryland State Highway Administration Bicycle and Pedestrian Design Guidelines.

It is suggested that as the project progresses and funding and maintenance responsibilities are further clarified that a comprehensive list of Design Criteria be developed for the project as a whole.

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Existing Conditions: Oxon Run Watershed:

There are a total of 15.3 miles of natural channel amongst Oxon Run and its tributaries within the Oxon Run watershed. This amount represents only about 60% of the natural channel found in the watershed prior to development. The remaining 40% has been relegated to either pipe or concretelined channel. As a result of this reduction in natural channel and the high percentage of impervious surface in the watershed, the stream tends to witness flashy, intense flows. The Oxon Run's Bankfull estimates range between 375 and 450 cfs for lower District reach.

The existing Oxon Run channel is sloped at approximately 0.5% in the vicinity of the four pedestrian bridge crossings considered in this report. The channel gradually flattens out near the south of DC Village (at the Oxon Cover Trail interface). This area is subjected to Tidal flooding from Potomac River.

The over bank area is covered with trees, shrubs and grass and there is a concrete flow control structure at South Capitol. Channel and over banks scour is visible at all crossings.

For the footprinting of these pedestrian bridge crossings, it is recommended that adequate capacity be provided to safely discharge flood flows without causing backwater effects upstream or increased flow velocity downstream. It is further recommended that the footprint avoiding disturbance of the stream banks. Ideally the crossing should take place on a well-defined stream channel, at the point of minimal channel width, and a flat stream gradient.

Scour countermeasures design using appropriate and widely accepted technical engineering methods to protect the channel banks is recommended for each crossing area.

The Federal Emergency Management Agency (FEMA) has published Flood Insurance Rate Maps (FIRM) for Washington, D. C., and Prince Gorges County, Maryland that covers Oxon Run. Prince Gorges County FIRM Panel 0070C, dated June 18, 1987, and Washington, D. C., FIRM Panel 0025C dated November 15, 1985, covers the 100-year floodplain limits and elevations along Oxon Run. Below are the 10-, 25-, 50-, 100-, and 500 year approximately water surface elevations for Oxon Run at the four bridges. These water surface elevations are taken from FEMA published Flood Insurance study report and are the basis of footprinting assumptions described for each crossing location, below.

At South Capitol Street near 1st Street

Approximate Water surface elevations (feet)*
32.0
33.0
34.0
35.0



North of Oxon Run Drive

Frequency	Approximate Water surface elevations (feet)*
10-year	19.5
50-year	21.0
100-year	22.0
500-year	23.0

Audrey Lane

Frequency	Approximate Water surface elevations (feet)*
10-year	12.5
50-year	13.5
100-year	14.0
500-year	15.0

South of DC Village (Tidal flooding from the Potomac River)

Frequency	Approximate Water surface elevations (feet)*
10-year	9.0
50-year	10.0
100-year	11.0
500-year	14.0

* National Geodetic Vertical Datum (NGVD) of 1929

Stream Crossing @ Oxon Run/Oxen Cove Trail Interface:

The proposed structural feature at this location consists of a new pedestrian bridge crossing the unnamed tributary to Oxon Run adjacent to the existing Oxon Cove Connector Trail pedestrian bridge. The proposed structure replaces a previous trail bridge over this tributary that has been washed out by high water. This previous structure was a single span bridge set on timber and concrete spread footing foundations. The unnamed tributary enters Oxon Run to the east and upstream of the existing Pedestrian Bridge over Oxon Run.

The proposed pedestrian bridge spans the tributary upstream from the previous pedestrian bridge location approximately 100' from the confluence with Oxon Run. The bridge is oriented on a tangent alignment parallel to the Oxon Run and roughly on line with the proposed shared use path to the east. This alignment lessens the severity of the bridge skew relative to the tributary flow which helps minimize the required length. The alignment is also set to clear the heavily wooded region further upstream. A three-span structure with span arrangement of 30' - 60' - 30' is proposed with an approximate structure soffit elevation of 10.0'. This elevation matches the existing Oxon Cove Trail grade and would roughly clear 25 and 50 year flood events per data gathered from FEMA published Flood Insurance study reports. This soffit elevation also matches that of the existing pedestrian

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bridge crossing Oxon Run. In final design, H&H and scour analyses will have to be conducted to verify adequacy of the proposed structure footprint and foundation design parameters.

The existing trail bridge over Oxon Run consists of a three-span weathering steel stringer structure on steel framed pile bents. The bridge features a galvanized open three-post pedestrian railing with concrete deck. Due to the close proximity of the existing and proposed structures, consideration should be given to matching the existing structure type and barrier/rail treatment. Alternately, a proprietary prefabricated tubular through truss structure is also feasible. The detailing and deck surface treatment for this type of structure could be made consistent with the multiple water crossings upstream should continuity of the bridge appearance and deck surface treatment be a desired aesthetic outcome for the project.

The existing trail bridge over Oxon Run is situated downstream of the unnamed tributary and its south abutment is prone to the confluent flows of the unnamed tributary and Oxon Run. This abutment is currently heavily rip-rapped to provide for stability of the placed embankment. For the proposed new trail bridge, similar embankment stabilizing measures are anticipated. The design and detailing of these measures should be addressed in H&H and scour studies as part of final design.

The pedestrian bridge crossing at the Oxon Run/Oxon Cover Trail Interface is anticipated to cost approximately \$470,000.

Audrey Lane Stream crossing:

The proposed structural feature at this location consists of a new pedestrian bridge crossing over the unnamed stream at Audrey Lane and upstream from an existing reinforced concrete weir structure. The proposed structure alignment is anticipated to approximate that of the existing gravel trail crossing at the site. The proposed structure crosses approximately 60' upstream from an existing reinforced concrete weir structure in terrain that sits above flood elevations for Oxon Run. The existing terrain at the site is relatively level and the stream appears to have been successfully stabilized by the downstream weir.

It is proposed that the new pedestrian bridge consist of a short single span on the order of 30' in length. The orientation of the bridge should be approximately normal to stream flow direction in order to minimize the required length. A proprietary prefabricated tubular through truss structure is recommended for this location. This type of structure, with minimally obstructing railings, is anticipated to create negligible obstruction to flood flows. The approach grade should be kept low so as to result in no further obstruction of overflow bank. In final design, H&H and scour analyses will have to be conducted to verify adequacy of the proposed structure footprint and foundation design parameters.

The structure will be located near the Barnaby Run crossing and consideration should be given to matching or blending the chosen structure type and barrier/rail treatment at that location. For the tubular through truss structure, corrosion protection of the steel members can be achieved using either galvanized finish or weathering steel finish. Railing and decking options for the structure will vary depending on the need to accommodate a lightweight maintenance vehicle. Decking options could range from concrete to wood (or composite with wood appearance).

The pedestrian bridge crossing near Audrey Lane is anticipated to cost approximately \$118,000.

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Barnaby Run crossing:

The proposed structural feature at this location consists of a new pedestrian bridge crossing over Barnaby Run. Several locations were considered for this structure, with crossing locations ranging from a point 100' from the confluence of Oxen Run and Barnaby Run to a point some 700' upstream. For the proposed crossing closest to the waterway confluence (western alignment), the southern approach would traverse the existing open terrain west of Oxon Run Drive, cross the stream on a perpendicular alignment and proceed directly to higher ground along a defined and stable ridgeline centered between the two waterways (NPS owned land). The upstream crossing (eastern alignment) would require the southern approach to run adjacent to Oxon Run Drive, then turn perpendicular to cross Barnaby Run and turn again once the ridgeline is reached.

The western option was chosen as the preferred alternate due to its much more direct horizontal alignment. For this option, the east bank of Barnaby Run is fairly stable, but the west side is less defined and subject to flooding in high water situations. According to data gathered from FEMA published Flood Insurance study reports, a 10-year flood at approximate elevation 19.5 would fill a significant portion of this west side. As such, the proposed crossing at this location involves spanning both the defined steam channel and adjacent floodplain. A three-span structure on tangent alignment with span arrangement of 50' - 50' - 45' is proposed with an approximate structure soffit elevation of 21.0'. This soffit elevation would roughly allow clearance of 25 and 50 year flood events per FEMA published data. In final design, H&H and scour analyses will have to be conducted to verify adequacy of the proposed structure footprint and foundation design parameters.

Superstructure options for this proposed crossing can range from traditional steel stringers to a proprietary prefabricated through truss. Use of either galvanized or weathering steel is preferred. The through truss option would allow this structure to blend with the structure recommended at the nearby Audrey Lane stream crossing and possibly at the Oxon Cove Trail interface location. The use of the steel stringer option would allow some greater flexibility in horizontal alignment and a horizontally curved alignment is possible should this be desired aesthetically. This alignment would be noticeable from the proposed trail wayside overlook area near the east bridge abutment.

Railing and decking options for the structure will vary depending on the need to accommodate a lightweight maintenance vehicle. Decking options could range from concrete to wood (or composite with wood appearance). Since this pedestrian bridge proceeds through dense woodlands, consideration for a more rustic finish, possibly using timber railings, may be more appropriate to complement the surrounding environment.

The substructure components for this bridge will be largely hidden from view. Abutments should be nominal in size, but should be well stabilized against scour and erosion. Simple pile bents would provide cost effective pier elements.

The pedestrian bridge crossing at Barnaby Run is anticipated to cost approximately \$570,000, this assuming a tangent alignment with either structural option.

Oxon Run crossing @ South Capitol Street:

The proposed structural feature at this location consists of a new pedestrian bridge over Oxon Run on an alignment parallel to and downstream (south) of the existing single span South Capitol Street vehicular bridge. The existing Oxon Run waterway features a controlled concrete channel section that begins approximately 30' downstream from the vehicular bridge and continues upstream for an extended length. The Oxon Run channel downstream from the concrete section is briefly controlled

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by large diameter riprap, but otherwise is not controlled. This section of Oxon Run may be subject to a future stream restoration project. The stream channel beyond the riprap section features fairly extensive bank erosion and portions of the existing concrete channel protection at the terminus appear to be undermined or in an advanced state of disrepair.

Studies to date have placed the new pedestrian bridge on a parallel alignment with the existing vehicular bridge. Due to the deteriorated condition of the channel beyond the controlled section, a crossing tight in to the existing vehicular bridge appears to be beneficial in order to take advantage of the existing stabilized condition for the proposed bridge abutments. This "tight" alignment conflicts with an existing storm drain and outfall, however, and special design measures will be needed to address this interface.

Numerous utilities exist in the vicinity of the proposed pedestrian bridge crossing. These include the existing storm drain outfall into Oxon Run, a downstream 24" sewer pipe, and a 12" diameter water main, amongst others. The proposed pedestrian bridge footprint will have to be carefully coordinated with these existing utility features.

Two structural alternatives were developed based on geometrics described above and are as follows:

- Provide a stand-alone single-span pedestrian bridge set 5'-6" clear from the existing vehicular bridae.
- Widen the existing vehicular bridge by 9'-3" to allow for accommodation of the shared use trail on the existing bridge structure.

The stand-alone pedestrian bridge is complicated by the interface with the existing outfall structure. The new west pedestrian bridge abutment will have to be designed with foundations straddling the outfall in order to maintain the outfall in its current location and not compromise its structural integrity. Superstructure options for this proposed crossing can range from traditional steel stringers to a proprietary prefabricated through truss (including a bowstring truss option which has been identified as a preferred alternate). A lightweight maintenance vehicle should not be required for this pedestrian bridge location due to the adjacent vehicular crossing and, as such, a simple pedestrian railing should suffice. Decking options could range from concrete to wood (or composite with wood appearance).

The bridge widening would be accommodated by removing the entire existing sidewalk and the bridge deck to the centerline of the existing fascia girder. Two new W33x241 beams would be erected on widened abutments to accommodate a new 14'-0" wide shared use sidewalk. It is assumed that rail standards for the bridge would be in accordance with D. C. Department of Transportation Standards. Similar to the stand-alone pedestrian bridge option, the existing storm drain outfall conflicts with the proposed widening. It is proposed that the sidewalk width in the constrained zone be reduced slightly to simplify the construction in this area.

The pedestrian bridge crossing for the stand-alone alternate over Oxon Run is anticipated to cost approximately \$295,000.

The bridge widening alternate over Oxon Run is anticipated to cost approximately \$180,000. This cost covers only those pay items associated with the bridge widening itself and does not include costs that may be required to upgrade structural elements for the remainder of the bridge that are structurally deficient at the time construction takes place.

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