

Master Drainage Plan Improvements

The City of Chesapeake utilizes a 320-acre threshold for candidate Master Drainage Facility (MDF) improvements. If a project services less than 320 acres, it will generally not be constructed as part of the City's Master Drainage Plan. Five specific projects were conceived and incorporated into the modeling during the course of this study, three of which will reduce the effects of flooding within the subject watershed (two bridge replacement projects are not required to accomplish the goals of this Master Drainage Plan update, but are currently under design by the Department of Public Works). These projects are by no means exhaustive, but seem to provide a reasonable amount of flooding relief at reasonable costs. All of the projects appear to be feasible from a preliminary planning standpoint, but issues such as future wetlands delineations and the ability to successfully acquire rights-of-way or parcels of land may necessitate some modifications as these projects move forward. The five projects are shown in Figure 8, and are included in the future (and environmental restoration) modeling scenarios. Use Figures 6 and 8 of this report to find node and link numbers and view the locations of improvements that are referenced in the following project summaries.

1. Cedar Road / Willis Creek Crossing Improvement

This project is estimated to cost approximately **\$ 505,428** in 2006 dollars.

This project is not required in order to accomplish the goals of this Master Drainage plan update, however it is a project that is currently under design by the Department of Public Works.

Replace the Willis Creek Bridge on Cedar Road (link 13621) with 48 linear feet of double 10' x 6' concrete box culverts. The culverts shall be countersunk 6 inches into the bed of the existing channel. This countersinking will create an effective opening of 10' x 5.5' for each culvert.

2. Cedar Road / Lindsey Canal Crossing Improvement

This project is estimated to cost approximately **\$ 519,334** in 2006 dollars.

This project is not required in order to accomplish the goals of this Master Drainage plan update, however it is a project that is currently under design by the Department of Public Works.

Replace the Lindsey Canal Bridge on Cedar Road (link 15921) with 40 linear feet of double 10' x 6' concrete box culverts. The culverts shall be countersunk 6 inches into the soil of the existing channel bed inverts. This countersinking will create an effective opening of 10' x 5.5' for each culvert.

3. West Road Farm Ditch Culvert Improvement

This project is estimated to cost approximately **\$ 98,255** in 2006 dollars, if constructed after surrounding land improvements are in place. If constructed as part of adjacent development projects, the cost to the City could be minimal or insignificant.

Replace the existing 15-inch corrugated metal pipe, crossing the construction entrance (link 16221), with 24 linear feet of a 4' x 3' concrete box culvert. The culvert inverts

shall be placed at the existing channel bed inverts. This improvement will provide increased conveyance capacity in West Road farm ditch. Even though the contributing area is less than 320-acres, the City of Chesapeake expressed interest in eliminating the 10- and 50-year flooding at this crossing.

4. West New Mill Reach Channel and Culvert Improvements

This project is estimated to cost approximately **\$ 1,935,050** in 2006 dollars, if constructed after surrounding land improvements are in place. If constructed as part of adjacent development projects, the cost to the City could be minimal or insignificant.

Upstream improvements to the Willis Creek natural drainage channel include widening and deepening the ravine and replacing culvert crossings. This reach is located in the western portion of the New Mill Creek Watershed (node 232 to 316) and includes over 4,500 linear feet of ditch improvements. The ditch improvements shall include widening the bottom from 8 feet at node 232 to 30-feet at node 316. This section of reach shall also receive deeper channels by “smoothing” the bottom inverts so as to create consistent positive drainage from the existing invert of 6.94 (NAVD88) at node 232 to an existing invert of 2.93 (NAVD88) at node 316. Side slopes along this reach shall be maintained at a minimum of 3 horizontal to 1 vertical. The channel shall be maintained so as to create a Manning roughness factor of 0.035.

In addition to the ditch improvement, there are four culvert crossings along this reach that will need to be replaced. All four crossings are existing 27-inch circular pipes. The most upstream crossing (link 12361) shall be replaced with triple 5’ x 3’ concrete box culverts. The next crossing downstream (link 12401) shall be replaced with triple 6’ x 3’ concrete box culverts. The next crossing downstream (link 12461) shall be replaced with triple 6’ x 4’ concrete box culverts. The next crossing downstream (link 12681) shall be replaced with triple 10’ x 5’ concrete box culverts, counter-sunk one foot into the new channel bottom. This portion of the watershed is currently open farmland that will eventually be developed. When the development occurs, the locations of these culverts will no doubt be shifted to conform to future site development plans. The locations used in the future conditions models here are based on existing culvert locations, but can be moved to accommodate future plans.

The combined channel and culvert crossing improvements will provide increased conveyance capacity and flood storage in the ravine.

Although the most upstream portion of this reach does not strictly have 320 or more acres of contributing land, the entire reach will need to convey flows from the runoff of future “regional mixed use” land use, which bears an imperviousness of 65%.

5. Borrow Pit Lake Outfall Channel and Culvert Improvements

This project is estimated to cost approximately **\$ 1,214,339** in 2006 dollars, if constructed after surrounding land improvements are in place. If constructed as part of adjacent development projects, the cost to the City could be minimal or insignificant.

The borrow pit lake is located in the western portion of the subject watershed between Dominion Boulevard and the Dismal Swamp Canal. Downstream improvements to the borrow pit lake outfall include widening and deepening the existing ditches and replacing

culvert crossings. This outfall reach includes over 3,500 linear feet of channels and culvert crossings, starting at the outfall of the 40-acre lake (node 520) and continue northeast to node 812. At this point (node 812) the flow splits to the east and north with the majority of the flow directed to the north where it travels to a junction (node 266) of the channel described in Improvement Number 4. In order to provide adequate drainage without causing flooding, the entire outfall ditch (nodes 520 to 266) will need to be widened and deepened.

The grading of the ditch shall be conducted in a manner such that the bottom profile from the lake outfall (node 520) invert to the junction (node 266) invert will have a consistent slope that will promote positive drainage. The ditch improvements shall also include widening the bottom from 5 feet at node 522 to 6 feet at node 266 while maintaining minimum side slopes of 2 horizontal to 1 vertical. The channel shall be maintained so as to create a Manning roughness factor of 0.035.

In addition to the ditch improvements, there are three culvert crossings between nodes 812 and 266 and a lake outlet structure that will need to be replaced. The new lake outlet structure (link 15201) shall be a single 36-inch circular concrete pipe, with an outlet invert of 8.0 (NAVD88), thus making the permanent pool elevation in the lake 8.0 (NAVD88) as well. The three culvert crossings between nodes 812 and 266 and are identified as links 12521, 12561, and 12601 will each need to be replaced with 40-linear feet of double 36-inch pipes. Several alternative configurations were modeled, however a permanent pool elevation of 8.0 feet provides a near optimum design condition (i.e. adequate positive drainage downstream with ample flood storage capacity in the lake).

The combined channel and culvert crossing improvements will provide increased conveyance capacity and flood storage in the ravine.

Although the most upstream portion of this reach does not strictly have 320 or more acres of contributing land, the entire reach will need to convey flows from the runoff of future “regional mixed use” land use, which bears an imperviousness of 65%. It is important to note that the three crossings recommended for replacement may not be constructed in their current locations. Their exact locations depend upon site and traffic plan configurations that have yet to be developed.

This conversion of the borrow pit lake to a large retention basin will promote better flushing through the lake than is currently available, and will make good use of existing floodplain storage that has resulted from previous excavation activities.

The goal of this type of study is not to relieve *all* flooding, but rather to identify Master Drainage Facility improvements that can be feasibly constructed. It is also important to consider that neighborhood and commercial parcel drainage and storm water systems are neither required nor designed to accommodate flooding from extreme events such as the 50-year storm.