Item 5D.
BCWMC 5-17-18
Full Report &
Appendices Online

DeCola Ponds B and C Improvement Project
Feasibility Study

Golden Valley, Minnesota

May 2018

Prepared for
Bassett Creek Watershed Management Commission

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DeCola Ponds B and C Improvement Project Feasibility Study

May 2018

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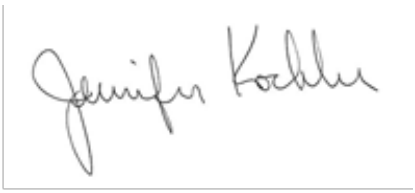
Certifications

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the state of Minnesota.



5/9/2018

Jennifer Koehler, PE
PE #: 47500

Date

1.0 Executive summary

1.1 Background

The Bassett Creek Watershed Management Commission's (BCWMC) current Capital Improvement Program (CIP) (Table 5-3 in the 2015-2025 Bassett Creek Watershed Management Plan) includes BC-2, 3, 8, 10: Medicine Lake Road and Winnetka Avenue Area Long-Term Flood Mitigation Plan (MLRWA Plan) Implementation. The first phase of this CIP is the DeCola Ponds B & C Improvement Project (BC-2, 3, 8), the subject of this feasibility study. At their meetings in September and October 2017, the Commission approved a proposal and an addition to the proposal (respectively) to conduct a feasibility study for this project.

The DeCola Ponds B & C Improvement Project builds on the City of Golden Valley's Liberty Crossing flood mitigation and conveyance project that was completed in 2017. The Liberty Crossing project was the first flood mitigation project implemented from the Medicine Lake Road and Winnetka Avenue Area Long-Term Flood Mitigation Plan Report (Barr, 2016). The City of Golden Valley city council is supportive of this specific project (and the larger long-term flood mitigation plan) with the flood mitigation projects identified in the plan being included in the City of Golden Valley's CIP. In 2015, the City of Golden Valley adopted their Natural Resources Management Plan, which specifically listed the proposed flood mitigation goals for the Pennsylvania Woods Nature Area and DeCola Ponds B and C. This project is also the City's top legislative priority for 2018 and is included in the Minnesota state bonding bill within Minnesota Department of Natural Resources (MnDNR) flood damage reduction projects, due to continued efforts by City staff.

As is required for BCWMC CIP Projects, a feasibility study must be completed prior to BCWMC holding a hearing and ordering the project. This study examines the feasibility of developing flood storage volumes in the Pennsylvania Woods area around DeCola Ponds B & C, developing additional water quality treatment volume, modifying the DeCola Pond C outlet structure, and removing accumulated sediment that has collected at the storm sewer outfall on the north end of DeCola Pond B. The goal of the project is to alleviate flooding around the low point on Medicine Lake Road, reduce downstream flooding at DeCola Ponds A through D, and to improve water quality downstream of the DeCola Ponds by trapping additional sediment and pollutants in the ponds and expanded storage areas, thus minimizing sediment passing downstream to Bassett Creek. The proposed project will also improve ecology and wildlife habitat, enhance active and passive recreation opportunities, and provide educational opportunities.

Three conceptual flood mitigation designs were investigated during this feasibility study. The first conceptual design examined a scenario maximizing flood storage, the second represented a scenario maximizing tree preservation (while still developing flood storage), and the third scenario was a hybrid of the previous two scenarios, trying to balance flood mitigation and tree preservation. Furthermore permitting requirements for each conceptual design were reviewed and cost estimates are provided.

The proposed DeCola Ponds B & C Improvement Project was identified as a priority in the MLRWA Plan and is proposed as "Phase I" of this CIP project to mitigate flooding and improve water quality in the Medicine Lake Road and DeCola Ponds B & C area. Based on the CIP (and if ordered), the project will be

implemented in 2019 and 2020. The BCWMC CIP funding (ad valorem tax levied by Hennepin County on behalf of the BCWMC), is not the sole source of funding for this project. The remainder of the funding will come from a variety of sources, including the City of Golden Valley, Hennepin County, Minnesota Department of Natural Resources (MnDNR) Flood Damage Reduction Grant program, and other sources (e.g. other grants, as appropriate).

1.2 Site conditions

DeCola Ponds B and C and the Pennsylvania Woods area are located in the City of Golden Valley east of Rhode Island Avenue and south of Medicine Lake Road. DeCola Ponds B and C are listed as Public Water Inventory Basins and are Minnesota Department of Natural Resources (MnDNR) public waters (#27-0647P). Although all proposed concepts described in this report propose normal water level (NWL) changes to DeCola Ponds A, B, and C due to outlet modifications, no other impacts are expected for DeCola Pond A, which is also a MnDNR public water (#27-0630P). DeCola Ponds B and C are located within Pennsylvania Woods Nature Area, a public, urban, walking park consisting of deciduous forest, wooded knolls, and various wetland communities. The walking trails are used heavily by the single family and multi-family residential communities surrounding the nature area. DeCola Ponds A, B, and C discharge downstream to DeCola Ponds D, E and F, which continues to Honeywell Pond and ultimately discharges to Bassett Creek. Any improvements to runoff water quality within DeCola Ponds A, B, and C will result in improvements to the Main Stem of Bassett Creek which is currently listed as impaired. The affected use is aquatic life based on fish bioassessments, and although a stressor identification study has not been completed to determine the exact cause of this impairment, reductions in sediment and pollutant loads to the creek can likely help address this impairment.

The area directly north of DeCola Pond B is located on property owned by Dover Hill Apartments, LLC (from here forward, referred to as the Dover Hills area). This area consists of deciduous forest and a delineated wetland area of approximately 0.12 acres. As part of the City of Golden Valley's flood mitigation project on the Liberty Crossing Development site, city staff engaged the owners of the apartments. The property owners supported the improvement project and a drainage and utility easement was secured in 2015 at no cost to the City of Golden Valley. No additional easement acquisition is anticipated for the area north of DeCola Pond B. A temporary construction easement on residential land may be needed for the implementation of the outlet modification and raising of the overflow between DeCola Ponds B and C. Adequate permanent easements already exist on the residential parcels on the north end of DeCola Pond D for the outlet and overflow modifications.

As part of the Liberty Crossing project, the City of Golden Valley performed wetland delineations on the Dover Hill property and around DeCola Pond B (2015), completed Phase 1 and Phase 2 environmental site assessments, developed a Response Action Plan (2015), and completed bathymetric surveys of DeCola Ponds A, B, and C and sediment sampling and testing (2015). For the DeCola Ponds B & C Improvement Project Feasibility Study, topographic and tree surveys were completed (2017), a Phase 2 site investigation was completed with soil test trenches (2018), and desktop reviews of cultural resource and threatened and endangered species databases (2017) were finalized. The results of these studies were utilized as much as applicable to define the conceptual designs and quantify impacts for this feasibility study.

1.3 Project alternatives

Three conceptual designs were evaluated for developing flood storage volume within the DeCola Ponds B and C and the Dover Hills areas. The first conceptual design focused on developing maximum flood storage volume, the second focused on tree preservation (while still providing flood storage), and the third concept concentrated on developing flood storage volume between the first and second alternatives while also trying to preserve trees and develop new habitat.

In addition of expanding flood storage within varying footprints within the project area, measures considered for potential implementation in all scenarios included the following:

- Lowering the normal water level (NWL) of DeCola Ponds A, B, and C from 893.8 ft MSL to 893.5 ft MSL to provide additional flood mitigation volume without needing to excavate that volume.
- Installing a 14′ x 4′ box culvert that will connect the Liberty Crossing flood storage features to the expanded storage in theDover Hills and DeCola Ponds B and C areas.
- Developing a sediment forebay in the permanent easement on the Dover Hills area to develop water quality treatment volume, improve ease of maintenance, enhance water quality in downstream locations, and to allow lowering the normal water level of DeCola Ponds A, B, and C in order to increase flood storage capacity, while preserving or increasing the water quality treatment provided by the DeCola Ponds system.
- Increasing the DeCola Ponds B and C open water area, and increasing associated water quality treatment volume through expanding contours below the NWL and dredging accumulated sediment in DeCola Pond B. The proposed expansion does not change the overall depth of the existing ponds, but will provide additional water quality treatment volume and provide additional aquatic habitat for fish, macroinvertebrates, and macrophytes.
- In addition to increasing the open water areas, expanding the storage around DeCola Ponds B and C allows for the opportunity to create and restore wetlands. For all conceptual designs, a 25-foot wetland buffer will be placed around the proposed open water areas within the projected disturbed limits, based on the City of Golden Valley's wetland management classification for these ponds (Manage 2/3). Additionally, all areas outside of the buffer areas that fall below elevation 896.0 feet MSL will be restored as wetland habitats.
- Modifying the DeCola Pond C outlet structure and overflow to lower the NWL (and provide additional flood storage volume) while increasing the overflow on the south end of DeCola Pond C (to increase the flood storage in DeCola Ponds A, B, and C). The modified outlet will also prevent the accumulation of debris on the inlet pipe which is currently a major maintenance issue for the City.
- Preserving trees on the large knolls between DeCola Ponds A, B, and C, and preserving screening trees along the east and south side of DeCola Pond B and along east side of DeCola Pond C. Tree removal is expected within project disturbance limits. However, upland areas will be restored with native vegetation and replanted with trees at a density potentially ranging from savanna (~35 trees/acre) to forest (~110 trees/acre) – to be determined during final design.

- Replacing disturbed trails with ADA-compliant trails to preserve park use and improved walking trail opportunities.

The alternatives are discussed in more detail in Sections 5.0 and 6.0.

1.4 Relationship to Watershed Management Plan

The BCWMC included the DeCola Ponds B and C Improvement Project in its CIP, based on the following "gatekeeper" policy from the BCWMC Plan. Those items in bold italics represent those that directly apply to the DeCola Ponds B and C Improvement Project.

110. The BCWMC will consider including projects in the CIP that meet one or more of the following "gatekeeper" criteria.

- Project is part of the BCWMC trunk system (see Section 2.8.1, Figure 2-14 and Figure 2-15 of the report)
- ***Project improves or protects water quality in a priority waterbody***
- Project addresses an approved TMDL or watershed restoration and protection strategy (WRAPS)
- ***Project addresses flooding concern***

The BCWMC will use the following criteria, in addition to those listed above, to aid in the prioritization of projects:

- Project protects or restores previous Commission investments in infrastructure
- ***Project addresses intercommunity drainage issues***
- Project addresses erosion and sedimentation issues
- ***Project will address multiple Commission goals (e.g., water quality, runoff volume, aesthetics, wildlife habitat, recreation, etc.)***
- ***Subwatershed draining to project includes more than one community***
- ***Addresses significant infrastructure or property damage concerns***

The BCWMC will place a higher priority on projects that incorporate multiple benefits, and will seek opportunities to incorporate multiple benefits into BCWMC projects, as opportunities allow.

The DeCola Ponds B and C Improvement Project meets multiple of the gatekeeper criteria— the project addresses flooding concerns (main objective) and the project will improve water quality by reducing the amount of sediment and pollutants that reach Bassett Creek. Additionally, this project will address intercommunity drainage concerns, multiple communities (the Cities of Golden Valley, Crystal, and New Hope) are within the project's subwatershed, and the project will address multiple Commission goals by capturing increased runoff volume, enhancing water quality, providing recreation opportunities, and improving wildlife habitat.

1.5 Project impacts and estimated costs

Potential impacts of the proposed project (increasing the flood storage and water quality treatment volumes of DeCola Ponds B and C and developing a forebay area in the existing Dover Hills area north of DeCola Pond B) are summarized in Table 6-1 and discussed in Section 6.0. This section also summarizes permit requirements (e.g., Minnesota Department of Natural Resources public waters work permit), temporary impacts to wetlands, the disposal of contaminated sediment, tree loss, and closure of the pedestrian trails.

Of the project impacts, the most significant consideration is the development of the flood storage volume and the impact on flood elevations, passage of emergency vehicles and public safety, and reducing the number of structures at-risk of flooding. One of the main purposes of the proposed DeCola Ponds B & C Improvement Project is to lower the flood depths on Medicine Lake Road to allow passage of emergency vehicles during larger storm events, maintain access to Rosalyn Court, and protect structures around this area. The DeCola Ponds B and C improvement project builds on the Liberty Crossing Flood Mitigation Project implemented by the City of Golden Valley, which lowered the 100-year flood elevation on the Medicine Lake Road low point from 4.8 to 3.1 feet and reducing the number of structures at-risk of flooding by five. Of these five structures, two were commercial buildings along Medicine Lake Road and three were 12-unit condominiums at Rosalyn Court.

The proposed feasibility concept designs for the DeCola Pond B and C Improvement Project aimed to improve upon the flood reductions resulting from the Liberty Crossing Flood Mitigation Project. The XP-SWMM results for this project indicate that for all three concepts the 10-year recurrence interval flood depth on Medicine Lake Road is reduced from 1.5 feet to 1.0 feet at the low point. For the 100-year flood event, the flood depth on Medicine Lake Road is reduced from 3.1 feet to 1.7 – 1.8 feet, depending on the concept. Reductions in flood elevations can translate to structures no longer being at-risk of flooding. For all three concepts, one structure is expected to be removed from the at-risk properties list for the 100-year event, which includes 2740 Rosalyn Court, a twelve unit condominium, in New Hope. While reductions in the 10-year and 100-year flood elevations on DeCola Ponds A, B, C, and D are anticipated (0.3 to 1.0 feet), the reductions in flood elevations do not result in reducing the number of at-risk structures surrounding these ponds.

The proposed projects will result in increased permanent pool volume and sediment storage volume in the forebay and both ponds and, therefore, reduce sediment and phosphorus loading to the main stem of Bassett Creek and all downstream water bodies, including the Mississippi River. Estimates of existing pollutant loadings are presented in Section 6.0. The estimated increase in annual total phosphorus removal ranges from approximately 8.0 pounds per year (Concept 2) to 10.5 pounds per year (Concept 1).

In order to develop the flood storage volume, tree removals within the project disturbance/grading limits will be required. Since a portion of the project area is within a public nature area and is a popular walking area, community resistance to tree removal is a concern. Wetland and upland restoration, including planting of new trees and shrubs, will occur in all areas disturbed by construction, and many existing trees

will be preserved in key areas, such as the knoll with hardwoods between DeCola Ponds B and C and trees that provide screening along the edges of DeCola Ponds A and B.

The feasibility-level opinion of costs for implementing the various concepts for the 2019-2020 DeCola Ponds B & C Improvement Project is presented in Table 1-1. This table also lists the 30-year annualized total phosphorus reduction costs (based on the estimated cost of the water quality improvement work only) and the project costs per acre foot of flood mitigation volume developed. For a complete summary of the estimated impacts and costs of the concepts, including the methodology and assumptions used for the cost estimate, refer to Section 6.0, Section 7.0, and Table 6-1.

Table 1-1 Feasibility-level Cost Estimates Summary

Concept	Total Project Cost (-20%/30%)	30-Year Annualized Cost per Pound of Total Phosphorus Removed[1]	Cost per Acre-Foot of Flood Mitigation Volume Developed
1	$5.7 million ($4.5 – 7.4 million)	$8,900	$173,900
2	$3.5 million ($2.8 - $4.6 million)	$11,100	$203,400
3	$3.8 million ($3.0 – $4.9 million)	$9,600	$173,400

[1] The costs presented represent the portion of the total project cost allocated to water quality improvements

The cost per pound of phosphorus removed for this project using the current P8 model analysis is high when compared to other BCWMC CIP projects—for example, the previous high costs per pound of phosphorus removed for a BCWMC CIP project was $5,900 for the Northwood Lake Improvement Project. The high cost per pound of phosphorus removed for this project is due to do the fact that the DeCola Ponds B and C Improvement Project's primary goal is to mitigate flooding. A major portion of the construction costs are for the development of flood storage volume and for the restoration of the graded areas rather than for water quality improvement.

1.6 Recommendations

Based on review of the project impacts for each of the three concepts, the recommended concept is Concept 3, which balances the development of flood mitigation volume with tree preservation. However, we also recommend that during the design process, the city pursue opportunities to increase the flood mitigation volume within the general concept disturbance footprint, with the goal to maximize the reduction of flood elevations around the low point on Medicine Lake Road and the downstream DeCola Ponds.

Concept 3 develops approximately 22 acre-feet of additional flood storage for the 100-year flood frequency event, which brings the 100-year flood elevation on the Medicine Lake Road low point from 3.1 feet of depth to approximately 1.8 feet of depth. This flood depth reduction on Medicine Lake Road is close to achieving the goal outlined in the *Medicine Lake Road Winnetka Avenue Long Term Flood*

Mitigation Plan (Barr, 2016) and will allow passage of emergency vehicles during large, intense rain events. Additionally, lowering the 100-year flood elevation eliminates one structure (12-unit condominium on Rosalyn Court) from being at-risk of flooding and improves access to Rosalyn Court during the 100-year design storm event). There are also reductions in the flood elevations on DeCola Ponds A, B, C, and D. With the combination of the Liberty Crossing Flood Mitigation Project and the recommended DeCola Ponds B and C Improvement Project, a total of six structures (two commercial properties and four 12-unit condominiums) would no longer be at-risk of flooding during the 100-year event.

Additionally, the concept increases the phosphorus load reduction by 9.0 pounds per year. The estimated tree disturbance area for Concept 3 only slightly greater than for Concept 2 and also results in the restoration of 1.7 acres of wetland and 1.0 acres of upland habitat.

The planning level estimated cost for the recommended Concept 3 is $3.8 million (-20%/+30%). The BCWMC CIP budget for this project is $1.6 million. The BCWMC CIP funding (ad valorem tax levied by Hennepin County on behalf of the BCWMC), is not the sole source of funding for this project. The remainder of the funding will come from a variety of sources, including the City of Golden Valley, Hennepin County, Minnesota Department of Natural Resources (MnDNR) Flood Damage Reduction Grant program, and other sources (e.g. other grants, as appropriate). The current request for the MnDNR Flood Damage Reduction Grant is $2.3 million. This request is currently included in the state bonding bill, which is still under discussion at the state legislature as of the date of this feasibility report. The legislative session should be complete by May 21, 2018, when it will be known if the complete flood damage grant amount requested by the Cities of Golden Valley, Crystal, and New Hope will be secured for implementation of this project. Approximately $700,000 in funds from Hennepin County and the City of Golden Valley will also be available for use on this project.

Because this feasibility report was completed before the State of Minnesota legislative session closes and the status of the project funding is unknown, we anticipate the following potential outcomes:

- ***Project is fully-funded***: If the Cities of Golden Valley, Crystal, and New Hope MnDNR Flood Damage Reduction grant request is fully funded is obtained ($2.3 million), the recommended DeCola Ponds B & C Improvement project (Concept 3) can proceed as anticipated with the other funding sources in place. For project construction to occur in 2019, project design would be scheduled to begin in fall 2018, after an agreement is reached between the City of Golden Valley and the BCWMC.
- ***Project is partially-funded:*** If the Cities of Golden Valley, Crystal, and New Hope MnDNR Flood Damage Reduction grant request is partially funded, the recommended DeCola Ponds B & C Improvement project (Concept 3) could proceed as recommended, depending on the level of state funding that is obtained. For example, if half of the original MnDNR flood damage reduction request is secured (e.g. $1.15 million), there may be sufficient funding (e.g. $3.45 million) to implement the major components of the recommended concept, with minor modifications to help bring the anticipated design and proposed project into alignment with the available budget and/or look at potential opportunities to phase the project. For project

construction to occur in 2019, project design would be scheduled to begin in fall 2018, after an agreement is reached between the City of Golden Valley and the BCWMC.

- ***Project is not funded:*** If the Cities of Golden Valley, Crystal, and New Hope MnDNR Flood Damage Reduction grant is not funded during this legislative session, the recommended DeCola Ponds B & C Improvement project (Concept 3) will need to be delayed until the Cities can re-request MnDNR Flood Damage Reduction grant funds during the next legislative session. This could potentially delay the implementation of the DeCola Ponds B & C Improvement project construction. Although not preferred, BCWMC CIP funds do not have to be expended in the same year they are levied and can be held until all of the funding comes together, even if the project is delayed a year or two.

Connect Existing Storm Sewer Box Culvert

Installation of 14'x4' Box Culvert with Inlet Weir at 896.0

Forebay for Water Quality Treatment

Proposed Trail

Proposed ADA Boardwalk/ Floating Trail

Expansion of Open Water Area

DeCola Pond B

DeCola Pond C

Wetland Habitat Restoration

Remove Accumulated Sediment in DeCola Pond B

Expansion of Open Water Area

Native Upland Habitat Restoration

Preservation of Existing Trees Outside Project Grading Extents

Provide Signage, Fencing or Landscaping as Barrier

Modify Outlet Structure (Lower NWL to 893.5 and Raise Overflow to 901.5) and Add Maintenance Access

DeCola Pond A

900
895
890
885
895
895
895
900
905
910
915
920

Rhode Island Ave N

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Key

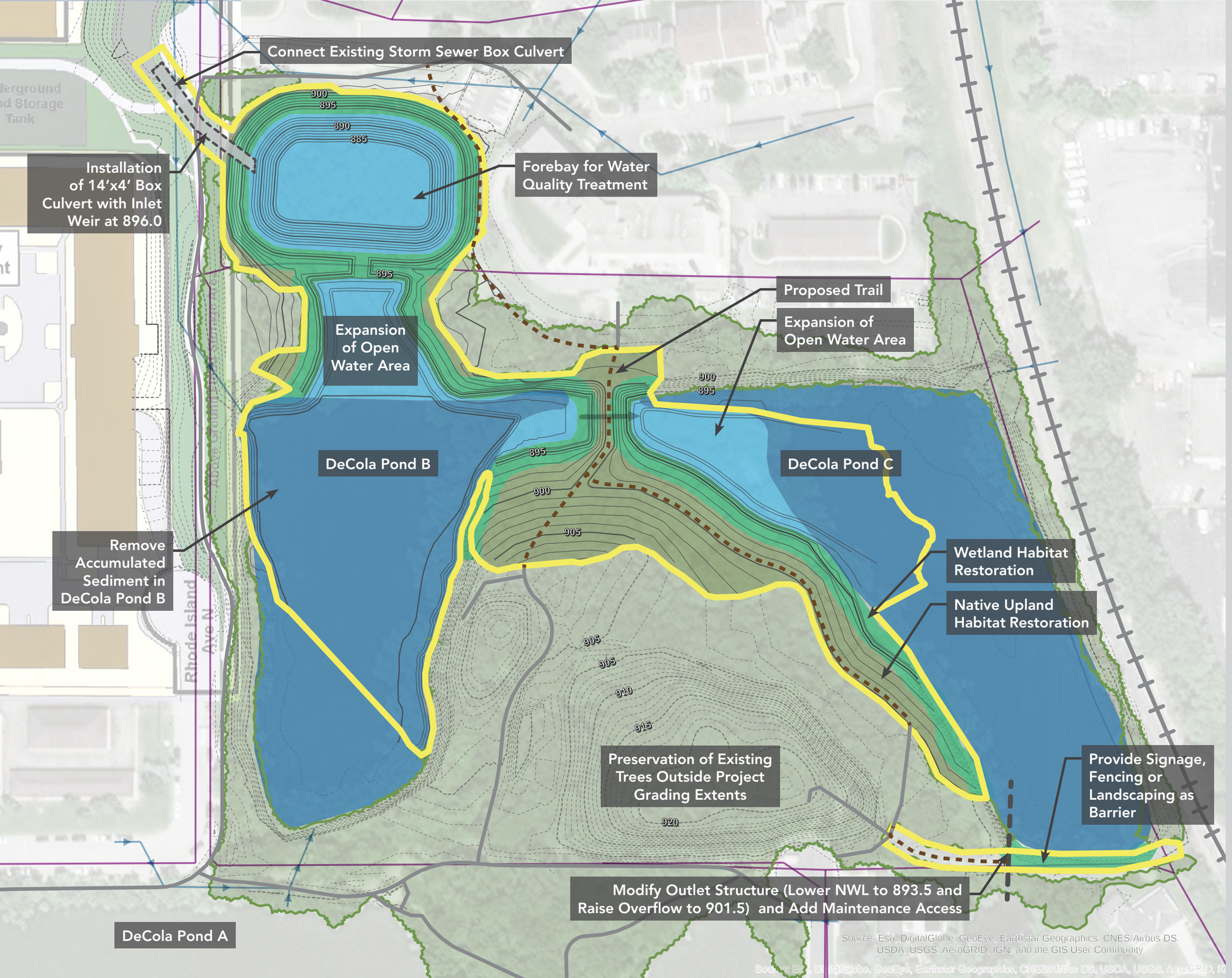
- Project Grading Extents
- Expanded Open Water
- Wetland Habitat
- Upland Habitat
- Tree Preservation Area
- Existing Pond Footprint
- 14'x4' Box Culvert
- Proposed Paved Trail
- Proposed Boardwalk/ Floating Trail
- Modified Outlet Structure
- Proposed Contour
- Existing Contour
- Existing Storm Sewer
- Existing Sanitary Sewer
- Existing City Trail
- Existing Rail

N

0 60 120
Feet

Figure 5-1
Concept 1
Maximize Flood Storage

DeCola Ponds B&C Improvement Project
Feasibility Study



Key

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- Expanded Open Water
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- Existing Contour
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- Existing Sanitary Sewer
- Existing City Trail
- Existing Rail

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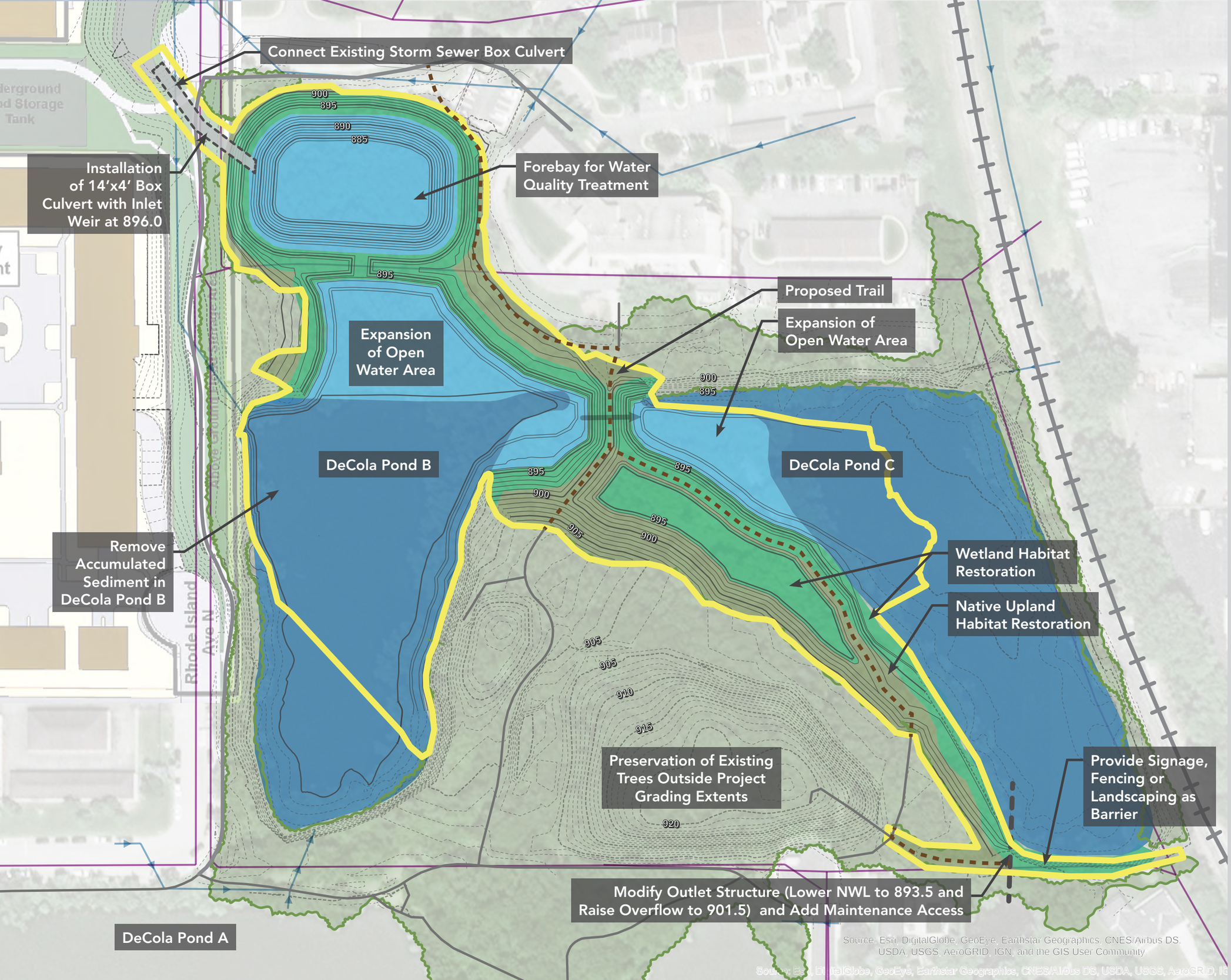
Feet

Figure 5-3
Concept 2
Maximize Tree Preservation

DeCola Ponds B&C Improvement Project
Feasibility Study



Key

- Project Grading Extents
- Expanded Open Water
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- Existing Contour
- Existing Storm Sewer
- Existing Sanitary Sewer
- Existing City Trail
- Existing Rail

N

0 60 120
Feet

Figure 5-4
Concept 3
Hybrid of Concepts 1 & 2

DeCola Ponds B&C Improvement Project
Feasibility Study

Table 6-1: DeCola Ponds B & C Improvement Project Concept Matrix Summary

Category	Item	Existing Conditions	Concept 1: Maximize Flood Storage	Concept 2: Maximize Tree Preservation	Concept 3: Hybrid Alternative
Outlet Modifications	Normal Water Level (NWL)	893.8	893.5	893.5	893.5
	Overflow Elevation (DeCola Pond C)	899.5	901.5	901.5	901.5
	Ordinary High Water Level (OHWL)	895.3	895.3	895.3	895.3
Flood Mitigation	Connection to Liberty Crossing (Box Culvert)	-	14' x 4'	14' x 4'	14' x 4'
	Box Culvert Inlet Weir Elevation	-	896	896	896
	Total Flood Mitigation Volume (ac-ft) (DeCola Ponds A, B, & C)	140.3	173.1	157.5	162.2
	Increase in Flood Mitigation Volume (ac-ft)	-	32.8	17.2	21.9
	10-Year Flood Elevation (Low Point Medicine Lake Road)	902.0	901.5	901.5	901.5
	10-Year Flood Depth (Low Point Medicine Lake Road)	1.5	1.0	1.0	1.0
	10-Year Flood Elevation (DeCola Ponds A, B, & C)	899.4	898.4	898.9	898.7
	10-Year Flood Elevation (DeCola Pond D)	894.1	893.8	893.8	893.8
	10-Year Flood Elevation (DeCola Pond E)	893.3	893.3	893.3	893.3
	10-Year Flood Elevation (DeCola Pond F)	893.2	893.2	893.2	893.2
	# of Potentially At-Risk Structures (10-year)	11	11	11	11
	100-Year Flood Elevation (Low Point Medicine Lake Road)	903.6	902.2	902.3	902.3
	100-Year Flood Depth (Low Point Medicine Lake Road)	3.1	1.7	1.8	1.8
	100-Year Flood Elevation (DeCola Ponds A, B, & C)	902.3	901.7	902.0	901.8
	100-Year Flood Elevation (DeCola Pond D)	902.3	901.1	902.0	901.8
	100-Year Flood Elevation (DeCola Pond E)	896.1	896.0	896.0	896.0
	100-Year Flood Elevation (DeCola Pond F)	896.1	896.0	896.0	896.0
	# of Potentially At-Risk Structures (100-year)	35	34	34	34
Water Quality	Open Water Surface Area (ac) (DeCola Ponds B & C and Pennsylvania Woods)	4.8	7.5	6.4	6.7
	Increase in Open Water Surface Area (ac) (DeCola Ponds B & C and Pennsylvania Woods)	-	2.7	1.6	1.9
	Forebay Water Quality Treatment Volume (ac-ft)	-	5.2	5.2	5.2
	Pond Water Quality Treatment Volume (ac-ft) (DeCola Ponds A, B, & C)	50.5	55.6	51.8	52.8
	Additional Pond Water Quality Treatment Volume (ac-ft)	-	5.1	1.3	2.3
	Total Phosphorus Removal (lbs/yr)	143.0	153.5	151.0	152.0
	Increase in Total Phosphorus Removal (lbs/yr)	-	10.5	8.0	9.0
	Accumulated Sediment Removal Volume in DeCola Pond B (Cu. Yd.)	-	3480	2760	3040
Trees	Total # of Surveyed[1] Trees (> 4 inches)	1591	1591	1591	1591
	Tree Removal Estimate	-	1156	672	687
	Percentage of Total Surveyed[1] Trees Removed	-	73%	42%	43%
	Percentage of Total Surveyed[1] Trees Preserved	-	27%	58%	57%
	# of Significant Trees Removed	535	386	235	245
	# of Legacy Trees Removed	6	2	0	1
	# of Other Trees (< 6 inches diameter) Removed	915	674	373	371
	# of Dead/Dying Trees Removed	135	94	64	70
	Tree Planting Estimate	-	60 - 180	40 - 120	35 - 105
	Preservation of Hardwood Trees on Knoll	Yes	Yes	Yes	Yes
	Preservation of Screening Trees	Yes	Yes	Yes	Yes

Category	Item	Existing Conditions	Concept 1: Maximize Flood Storage	Concept 2: Maximize Tree Preservation	Concept 3: Hybrid Alternative
Other Habitat	Wetland Impact Area (ac)	-	3.09	2.53	2.53
	Restored Wetland Area (ac)	-	2.31	1.37	1.68
	Restored Native Upland Area (ac)		1.70	1.10	1.00
Trails	Legnth of Trail to be Removed (ft)	-	1426	984	946
	Length of New Paved Trail (ft)	-	1417	1421	1383
	Length of New Boardwalk/Floating Trail (ft)	-	385	-	-
	Connection to Railroad Right of Way	No	No	No	No
Project Costs	Feasibility Level Opinion of Cost	-	$ 5.7 million	$3.5 million	3.8 million
	Feasibility Level Opinion of Cost Range (-20% to +30%)	-	$4.5 - 7.4 million	$2.8 - $4.6 million	$3.0 - 4.9 million
	30-Year Annualized Cost Estimate	-	$303,500	$193,700	$208,500
	Cost per Acre-Ft of Flood Mitigation Volume	-	$173,900	$203,400	$173,400
	Annualized Cost per Pound of Total Phosphorus Removed (Total Project)	-	$28,900	$24,200	$23,200
	Annualized Cost per Pound of Total Phosphorus Removed (Water Quality Treatment)	-	$8,900	$11,100	$9,600

[1] Does not reflect a complete survey of all trees in the DeCola Ponds B and C (Pennsylvania Woods) area; Trees on large, upland knoll were not included in the original survey as the goal was not to impact those trees as part of this flood mitigation project.