

TABLE OF CONTENTS

	Page
TABLE OF CONTENTS.....	I
EXECUTIVE SUMMARY	III
1.0 REASON FOR VARIANCE REQUEST	1
1.1 Type of Variance Request	1
1.2 Project Description	2
1.3 Affected Stream Resources.....	3
1.4 Proposed SCPZ Impacts.....	4
1.5 Statement of Hardship.....	5
1.5.1 Channel Relocation Impacts	5
1.5.2 Culvert Outfall Impacts	7
2.0 PROJECT ALTERNATIVES	8
2.1 Preferred Alternative	8
2.2 Minimal Impact Alternatives	8
2.3 No Impact Alternative.....	9
2.4 Alternatives Summary.....	10
3.0 MITIGATION	12
3.1 Mitigation Requirements	12
3.2 Proposed Mitigation For Channel Impacts	12
3.3 Proposed Mitigation for Riparian SCPZ Impacts.....	13
3.3.1 On-Site Riparian Mitigation	13
3.3.2 Off-Site Riparian Mitigation	14
3.4 Summary of Proposed SCPZ Mitigation Measures	14

TABLES

<u>Table No.</u>	<u>Title</u>	<u>Page</u>
1	Existing SCPZ Values in Project Area	4
2	Proposed SCPZ Impacts – Preferred Alternative	4
3	Comparison of Alternatives	11
4	Summary of Proposed SCPZ Mitigation Measures	15

APPENDICES

APPENDIX	Title
A	Project Location Map
B	Project Overview Map
C	Baseline Stream Information
D	Meeting Minutes from December 5, 2016 Design Workshop
E	Culvert Headwater Exhibits
F	Alternatives Exhibits
G	Proposed Stream Mitigation Exhibits

EXECUTIVE SUMMARY

The City of Columbus, Department of Public Service, Division of Design & Construction (DDC) is proposing to undertake certain improvements to the existing highway interchange at State Route (SR) 315, North Broadway, and Olentangy River Road, near Riverside Hospital. The purpose of the proposed improvements is to accommodate future projected traffic service needs, including projected local traffic service needs associated with new development occurring on North Broadway at the interchange. The proposed interchange improvements will also provide direct southbound access to North Broadway from SR 315, which is currently not available under the present interchange configuration.

To accomplish the proposed improvements, an estimated 425 linear feet (lf) of an unnamed tributary to the Olentangy River and its associated Stream Corridor Protection Zone (SCPZ) will be unavoidably impacted. Specifically, Columbus DDC is requesting a Type III Variance (Stream Protection) in order to:

- 1) Relocate an estimated 412 linear feet (lf) of the unnamed tributary in the southbound State Route (SR) 315 right-of way (ROW) in order to accommodate a westerly shift in the alignment of the existing southbound SR 315 exit ramp to Olentangy River Road. This westerly shift is necessary to accommodate the geometry of the new direct exit ramp to North Broadway safely, and in compliance with Ohio Department of Transportation (ODOT) standards.
- 2) Place rock channel protection (RCP) in an estimated 13 lf of the same tributary in the northbound SR 315 ROW to provide flow energy dissipation and erosion protection at the outlets of twin 60-inch culverts carrying the tributary flow beneath SR 315; and
- 3) Associated riparian zone impacts in the Stream Corridor Protection Zone (SCPZ) of the tributary totaling an estimated 0.55 acre.

All proposed channel impacts, and the majority of riparian SCPZ impacts will be mitigated on-site. Proposed off-site riparian SCPZ mitigation consists of invasive species removal and revegetation activities in the Olentangy River riparian corridor along the Olentangy Trail between West 2nd and West 1st Avenues in Columbus. Proposed off-site riparian SCPZ mitigation will occur at an approximate acreage ratio of 1:9, significantly exceeding the required minimum ratio of 1:2.

1.0 REASON FOR VARIANCE REQUEST

1.1 Type of Variance Requested

The City of Columbus, Department of Public Service, Division of Design & Construction (DDC) is requesting a Type III Variance (Stream Protection) from certain provisions in Sections 1.3.2 and Section 1.33 of the Columbus Stormwater Drainage Manual (CSWDM).¹ Type III Variance approval is required in order to:

- 1) Relocate an estimated 412 linear feet (lf) of an unnamed tributary to the Olentangy River located in the southbound State Route (SR) 315 right-of way (ROW) at the North Broadway/Olentangy River Road interchange near Riverside Hospital;
- 2) Place rock channel protection (RCP) in an estimated 13 lf of the same tributary in the northbound SR 315 ROW to provide flow energy dissipation and erosion protection at the joint outlets of several new and existing storm culverts; and
- 3) Associated riparian zone impacts in the Stream Corridor Protection Zone (SCPZ) of the tributary totaling an estimated 0.55 acre.

The above impacts are unavoidable and necessary in order to construct proposed improvements to the State Route (SR) 315/North Broadway/Olentangy River Road interchange that will accommodate future traffic service needs; in particular, projected local traffic needs associated with new development occurring on North Broadway at the interchange. The proposed improvements will also provide direct southbound access to North Broadway from SR 315.

All proposed channel impacts, and the majority of riparian SCPZ impacts will be mitigated on-site. Proposed off-site SCPZ mitigation consists of invasive species removal and revegetation activities in the Olentangy River riparian corridor along the Olentangy Trail between West 2nd and West 1st Avenues in Columbus. Proposed off-site riparian SCPZ mitigation will occur at an approximate acreage ratio of 1:9, significantly exceeding the required minimum ratio of 1:2.

¹ *City of Columbus Stormwater Drainage Manual*, Department of Public Utilities, Division of Sewerage and Drainage, Columbus, Ohio, August 2012.

1.2 Project Description

The City of Columbus is proposing to construct certain improvements to the SR 315/North Broadway/Olentangy River Road interchange in northwest Columbus, near Riverside Hospital. The purpose of the proposed improvements is to accommodate future projected traffic service needs, including projected local traffic service needs associated with new development occurring on North Broadway at the interchange. The proposed interchange improvements will also provide direct southbound access to North Broadway from SR 315, which is not currently available. Currently, North Broadway can only be accessed southbound by first traveling through the intersection at Olentangy River Road and Thomas Lane, a major entrance to Riverside Hospital, and then along Olentangy River road to its intersection with North Broadway.

The project will be constructed in two phases, identified as Project 1 and Project 2. Project 1 will consist of construction of temporary SR 315 traffic lanes to maintain traffic. Project 2 will consist of construction of the proposed permanent improvements. Principal proposed project elements include:

- Construction of temporary SR 315 traffic lanes to maintain traffic while a new bridge is constructed to carry SR 315 over a proposed new southbound exit ramp that will provide direct access to North Broadway (Project 1).
- Construction of the new southbound exit ramp referenced above that will provide direct southbound access to North Broadway from SR 315. Currently, North Broadway can only be accessed southbound by first traveling along Olentangy River Road to its intersection with North Broadway. The new exit ramp will cross beneath a new bridge on SR 315, and will terminate at a new intersection on East North Broadway.
- A slight westerly shift of the existing southbound SR 315 exit ramp to Olentangy River Road and Thomas Lane to accommodate geometry of the new exit ramp to North Broadway. ***This will necessitate relocation of the unnamed tributary slightly to the west of its current alignment.***
- Demolition of the existing elevated off-ramp providing eastbound access to North Broadway from northbound SR 315. (This work was completed by the City of Columbus in fall of 2017).
- Alignment shifts to the SR 315 northbound on-ramp from North Broadway and the SR 315 northbound off-ramp to Olentangy River Road.

- Improvements to existing city street intersections at Olentangy River Road/North Broadway, Olentangy River Road/Thomas Lane, North Broadway/White Cross Drive (main riverside Hospital entrance), and North Broadway and a proposed new entrance road providing access to new development occurring on North Broadway.

A site location map is included in **Appendix A**. A project overview map is included in **Appendix B**.

1.3 Affected Stream Resources

As described above, the need to shift the existing alignment of the SR 315 southbound exit ramp to Olentangy River Road to the west will require relocation of an estimated 412 linear feet (lf) of an unnamed tributary to the Olentangy River that currently runs in the southbound SR 315 right-of-way (ROW). An estimated 13 lf of the same tributary will also be impacted by placement of rock channel protection (RCP) at new culvert outlets on the east side of SR 315 (northbound ROW).

The unnamed tributary emerges from a culvert on private property west of the southbound SR 315 ROW, flows east into the ROW, and then flows north in the southbound ROW for an estimated 412 lf, where it enters an existing 60-inch culvert that conveys it east beneath SR 315, and ultimately to the Olentangy River. The tributary has been historically channelized to accommodate construction of SR 315, and essentially functions as a roadside ditch. Flow regime in the affected segment appears to be ephemeral and supplied principally by stormwater flows from the upstream culvert at its head. Estimated upstream drainage area (derived from StreamStats) is 0.05 square miles (mi²). The riparian corridor adjacent to the tributary is currently wooded, with a dense understory dominated virtually exclusively by invasive bush honeysuckle (*Lonicera sp.*).

A Headwater Habitat Evaluation Index (HHEI) assessment of the unnamed tributary was conducted in May 2017. The HHEI assessment resulted in a score of 61, and a classification of **Modified Class II PHWH**, due to the historical channel modifications. The relatively high HHEI score of 61 was attributable primarily to the number and diversity of substrate types observed, presumably from upstream sources. Results of a Stream Eligibility Determination for Clean Water Act (CWA) Section 404/401 purposes indicate the unnamed tributary is not a “high quality” stream resource warranting Individual Section 401 WQC review. Water quality in the affected segment is likely adversely impacted by common pollutants present in urban stormwater runoff, such as total suspended solids (TSS), oil and grease (O&G), metals, and chlorides. The calculated total SCPZ width for the unnamed tributary is 50 ft (25 ft. each side),

which represents the minimum SCPZ width assignable under CSWDM provisions. **Table 1** below summarizes existing channel and riparian SCPZ values for the unnamed tributary.

Table 1: Unnamed Tributary to Olentangy River - Existing SCPZ Values in Project Area

Location	Channel (lf)	Riparian (ac)	Total SCPZ Width (ft)
SR 315 Southbound ROW	504	0.60	50 ft
SR 315 Northbound ROW	13	0.02	50 ft.
TOTALS	517	0.62	50 ft.

An exhibit showing the tributary and its associated SCPZ, limits, photographs depicting existing conditions, resource mapping, and HHEI scoring forms are provided in **Appendix C**.

1.4 Proposed SCPZ Impacts

The need to shift the existing alignment of the SR 315 southbound exit ramp to Olentangy River Road to the west will require relocation of an estimated 412 linear feet (lf) of the unnamed tributary in order to avoid elimination or enclosure of the channel. An estimated 13 lf of the same tributary will be impacted by placement of rock channel protection (RCP) at new culvert outlets on the east side of SR 315 (northbound ROW). In order to accomplish relocation, an estimated 0.53 acre of riparian zone within the SCPZ will need to be cleared of vegetation and regraded to form the new channel valley.

The City is proposing to mitigate the majority of these impacts on-site by reestablishing a slightly larger and longer channel, and revegetating the riparian zone. A small portion of the existing riparian zone will be permanently displaced by the new ramp alignment. This impact, and the impact area associated with RCP placement at the new culvert outlets will necessarily be mitigated off-site. **Table 2** below summarizes anticipated SCPZ impacts associated with the Preferred Alternative.

Table 2: Proposed SCPZ Impacts – Preferred Alternative

Location	Channel (lf)	Riparian (ac)
SR 315 Southbound ROW (west side)	412	0.53
SR 315 Northbound ROW (east side)	13	0.02
TOTALS	425	0.55

1.5 Statement of Hardship

1.5.1 Channel Relocation Impacts

A key element of the proposed SR 315 and North Broadway interchange improvements is construction of a new exit ramp from SR 315 southbound that will provide direct access to North Broadway while still maintaining the existing SR 315 southbound exit to Olentangy River Road and Thomas Lane, which is a major entrance to Riverside Hospital.

Numerous design alternatives for this new direct exit ramp were considered in the preliminary engineering phases of the project. Alternatives included looking at ramp alignments that crossed over SR 315 as well as alignments that crossed under SR 315. It quickly became evident that there were no feasible alternatives involving an elevated crossing over SR 315 because there was no feasible way to design a structure that could cross over SR 315 and travel down again in time to connect to North Broadway at the desired Ohio Health intersection location while still meeting mandatory minimum traffic safety parameters. Multiple configurations involving a ramp alignment traveling under SR 315 were further evaluated. These alternative configurations varied primarily in the location of the divergence point from SR 315, and the location of the split (gore) between the new direct exit ramp to North Broadway and the Olentangy River Road/Thomas lane exit ramp. Each ramp configuration was evaluated against design criteria established in the Ohio Department of Transportation's (ODOT) Location and Design (L&D) Manual, Volume 1. This is ODOT's design criteria for interstates and interchange ramps. Having the project meet these criteria is an expectation of ODOT and the Federal Highway administration (FHWA). Although maintained by the City, SR 315 and its Limited Access Right-of-Way (LA/ROW) are owned and controlled by ODOT.

As potential ramp alternatives for crossing beneath SR 315 were further considered, several consistent safety deficiencies became evident. Multiple configurations involving varying distances between the initial divergence from SR 315 and the split between the two exit ramps were considered, but most violated one or more ODOT standards regulating the distance between successive ramp divergences (gore-to-gore spacing). By not providing the required spacing between ramp divergences, overhead guide signs directing drivers are spaced too closely, creating a potential safety hazard as drivers may not be provided adequate time to read and comprehend the successive signs. If drivers are not provided enough time to read, comprehend, and react to a guide sign, it can lead to erratic driving behavior, such as late or sudden lane changes, which creates a potential crash hazard.

Another deficiency that consistently appeared when investigating “under SR 315” ramp alternatives was horizontal stopping sight distance (HSSD). HSSD is a distance measured along a roadway alignment that allows a driver to safely perceive a hazard, react, apply the brakes, and successfully get the vehicle stopped before striking the hazard. Ramps and roadway segments that do not provide the minimum required HSSD create a crash hazard as drivers may not be able to perceive other cars or potentially hazardous objects with enough time to fully stop their vehicle or otherwise avoid the hazard. Providing adequate HSSD on the two new southbound exit ramps to North Broadway and Olentangy River Road is especially critical due to the fact that they terminate at traffic signals, and, in the case of Olentangy River Road, at a busy major hospital entrance. Vehicles exiting on these ramps will need adequate HSSD to be able to perceive and avoid cars ahead of them in the queue that may be formed at the traffic signal when it is a red light.

The final deficiency that became consistently apparent with the various “under SR 315” ramp alternatives was the challenge of providing adequate drainage to keep water from ponding on the new ramp. In order to travel under SR 315, the new North Broadway exit ramp will have to be constructed significantly below the existing ground surface elevation. The existing water table is close to the existing ground surface in this location. Several of the alternatives involved lowering the new ramp below the existing water table and did not allow for adequate drainage of the pavement. This creates a safety hazard as ponded water on the pavement can cause hydroplaning.

A Design Workshop was held on December 5, 2016 with ODOT and the City of Columbus to summarize evaluation results for the various design alternatives, and select a Preferred Alternative. Although numerous alternatives were evaluated during the above preliminary deliberations, a total of six alternatives were carried through to the workshop. Three of the six alternatives were eliminated immediately due to one or more of the above discussed safety concerns. During the workshop, the remaining three alternatives were deliberated. The Preferred Alternative presented in this variance request is the solution that best met ODOT standards and was mutually approved by all parties. This alternative was the only one to meet gore-to-gore spacing requirements, maximize HSSD, and allow for an adequate drainage solution that keeps water from ponding on the new ramp. Deviations from the Preferred Alternative will reintroduce one or more of the safety deficiencies discussed above, and preclude ODOT acceptance of the proposed improvements. Meeting minutes from the December 5, 2016 Design Workshop are included as **Appendix D**.

1.5.2 Culvert Outfall Impacts

In order to maintain an open stream channel and existing stream flows in the unnamed tributary, a new 60-inch concrete culvert will need to be installed parallel to the existing 60-inch culvert that currently carries the tributary beneath SR 315 and east in to the Olentangy River. The existing 60-inch culvert is undersized, and the additional 60-inch culvert is needed to meet ODOT culvert design criteria and minimize flooding of the parking lot adjacent to First Merchants Bank at high flow events. The ODOT culvert design year frequency is the 50-year storm event. According to ODOT criteria, the 50-year storm headwater elevation must be 1 foot below the near edge of pavement, and a maximum of 2 feet above the inlet crown elevation of the culvert. The low edge of the roadway elevation is 735.58, setting the maximum 50-year headwater at elevation 734.58 to meet the 1 foot below the low edge of roadway criteria. The 2 feet above the crown criteria is at elevation 734.47. Another limiting design headwater consideration is the parking lot adjacent to the First Merchants Bank which is at elevation 733.0.

A 50-year headwater analysis was completed for the existing 60-inch culvert alone. The 50-year headwater is at elevation 734.66, which is above the elevation of 734.58 required to meet ODOT's 1 foot below the low edge of roadway criteria. The 50-year headwater is also 1.66 feet higher than the parking lot adjacent to First Merchants Bank, meaning the parking lot would be flooded at the 50-year event under existing conditions. A 50-year headwater analysis with an additional 60-inch culvert placed adjacent to the existing 60-inch culvert results in a 50-year headwater elevation 731.72. This elevation meets the ODOT 1 foot below the edge of roadway requirement, and also avoids flooding of the First Merchants Parking lot, which is at elevation 733.0. For these reasons, an additional 60-inch culvert must be installed parallel to the existing 60-inch culvert to adequately carry flow from the unnamed tributary beneath SR 315 and into the Olentangy River. To meet ODOT flow dissipation requirements, and minimize channel and bank erosion impacts, RCP will need to be placed in the stream channel at the outlet of this new culvert and the existing 60-inch culvert on the east side of SR 315.

Exhibits depicting ODOT headwater analysis results for the existing 60-inch culvert alone and with the additional 60-inch culvert are provided in **Appendix E**.

2.0 PROJECT ALTERNATIVES

2.1 Preferred Alternative

The Preferred Alternative consists of a single lane exit ramp diverging from SR 315 southbound that both maintains the existing exit to Olentangy River Road and accommodates the proposed new exit ramp to North Broadway. Under the Preferred Alternative, the latter two ramps split apart at a diverge located greater than 800 feet south of the initial diverge from SR 315, meeting the gore-to-gore spacing requirement that ODOT specifies. The proposed new exit ramp to Olentangy River Road follows the existing ramp alignment closely, but is shifted slightly to the west to accommodate the new direct exit ramp to North Broadway in a configuration that meets minimum ODOT curvature, design speed, and HSSD standards. The low point of the profile of the new North Broadway exit ramp is also situated above the existing water table, allowing for positive drainage and avoiding ponding on the ramp pavement.

As discussed above, the Preferred Alternative was the only compliant alternative to emerge from intensive alternative formulation and design deliberations focused on meeting ODOT minimum safety standards. The configuration presented in the Preferred Alternative provides acceptable ramp curvature, design speeds, and HSSD lengths for both ramps. ODOT minimum gore-to-gore spacing requirements are achieved, allowing for adequate signing and wayfinding to be provided. The diverging curvature for the split between the two ramps also meets minimum ODOT standards, providing a configuration where excessive cross slope breaks are not present within the split. The tangent lengths between the horizontal curves are adequate for rotating the super elevation between the curves consistent with the design speeds of the curves. An acceptable drainage solution is also able to be achieved with this alternative that avoids ponding on the pavement at the low point in the new North Broadway profile. The Preferred Alternative was the only alternative presented that was accepted by ODOT.

2.2 Minimal Impact Alternatives

In an attempt to further minimize impacts to the unnamed tributary and its associated SCPZ, the feasibility of constructing a retaining wall positioned tight against the right edge of the shoulder of the proposed new ramp alignment to Olentangy River Road was considered. Feasibility of constructing a bridge structure to carry the ramp where it would encroach on the unnamed tributary was also considered.

The addition of a retaining wall against the right shoulder of the proposed new Olentangy River Road exit ramp alignment would introduce a safety hazard not present in the Preferred Alternative, and would render the ramp design non-compliant with ODOT standards. Specifically, placing this retaining wall immediately adjacent to the shoulder would require a concrete barrier along the top of the wall to keep vehicles from dropping over the edge of the wall. This concrete barrier would introduce an HSSD deficiency that would downgrade the design speed of the ramp to only 33-mph design standards, rather than the preferred design speed of 40-mph. Construction of a retaining wall would still encroach upon the SCPZ, and sedimentation associated with construction of the wall footings may unavoidably adversely impact water quality in the unnamed tributary.

In lieu of a retaining wall, a bridge structure carrying the ramp over the SCPZ and the unnamed tributary was considered. In evaluating this alternative, it was determined that the bridge construction, specifically construction of the piers and abutment footings, would still unavoidably encroach within the SCPZ, and may still impact water quality in the unnamed tributary. As with the retaining wall option, the right outside edge of the bridge would also have a concrete parapet that would unacceptably compromise HSSD along the ramp. In addition to rendering the ramp configuration unacceptable to ODOT, both the retaining wall and bridge alternatives would also significantly increase construction costs to a level exceeding available project funding. Additionally, all SCPZ impacts, although overall less than the Preferred Alternative, would have to be mitigated off-site. Based on these factors, neither of these alternatives were considered feasible, and were ultimately rejected.

2.3 No Impact Alternative

In order to avoid all impacts to the SCPZ and the unnamed tributary, the geometry of the exit ramp to Olentangy River Road would have to be shifted back to its existing alignment. A retaining wall would need to be constructed along the right side of the ramp to contain grading limits and avoid impacts to the SCPZ. In order to maintain the existing alignment for this ramp, the diverge splitting this ramp from the proposed new exit ramp to North Broadway would need to be shifted significantly further to the south. This shift would necessitate altering the curvature of the new North Broadway ramp alignment such that it would only meet 35 mph design speed standards, rather than the preferred 40 mph. It would also push the new direct exit ramp to North Broadway close enough to the existing SR 315 southbound on ramp from Olentangy River Road to necessitate construction of a retaining wall between these two ramps. By shifting the split between the two ramps to the south, the crossing under SR 315 for the new North Broadway ramp would occur in a location where adequate drainage could not be provided at the

low point in the profile, and would require construction of a pump station or other forced drainage alternative to clear the pavement of ponded water after rain events. Finally, the new exit ramp to North Broadway would unavoidably intersect with North Broadway slightly to the west of a proposed new entrance road serving new development, creating an offset intersection.

While it would result in no impacts to the unnamed tributary or SCPZ, the No Impact Alternative introduces several significant safety and geometry deficiencies. Like the Minimal Alternative, the retaining wall along the right side of the ramp to Olentangy River Road would require a concrete barrier along the top that would compromise HSSD. The design speed of the new exit ramp to North Broadway would be reduced from the preferred 40-mph to 35-mph to allow the ramp curvature and super elevation transition lengths to be compliant. The new retaining wall that would be required to protect the existing southbound on ramp from Olentangy River Road would, due to its location along the outside of a sharp horizontal left curve, create an obstruction that cars could potentially hit head-on if they left the roadway. Drainage of the new North Broadway exit ramp would require a pump station or other active means of clearing water from the roadway. The cost and maintenance of a pump station would add significantly to project costs, and is not a preferred drainage solution by ODOT. Finally, the new North Broadway ramp terminus would be shifted slightly west of the proposed new entrance road serving new development, creating an offset intersection. An offset intersection here would create a potentially unsafe situation, especially for southbound through movement into the new development complex, and for left turning traffic. This alternative would not be acceptable to ODOT given the significant traffic safety and geometric deficiencies it would introduce. Based on these factors, this alternative was determined to be infeasible, and was ultimately rejected.

2.4 Alternatives Summary

The Preferred Alternative represents the only feasible and compliant alternative from a roadway design and safety perspective, and is the only alternative to emerge as acceptable to ODOT, which ultimately controls improvements and other activities within its LA/ROW. Under the Preferred Alternative, the unnamed tributary would be relocated and remain open, and the majority of riparian impacts to the SCPZ would be mitigated on site. The small area of new pavement and shoulder associated with the westerly shift of the SR 315 southbound exit ramp to Olentangy River Road, and the impacts associated with RCP placement at the new culvert outfalls would be mitigated off-site at ratios exceeding required minimums. **Table 3** below compares impacts and proposed mitigation quantities of all three alternatives.

Table 3: Comparison of Alternatives – SCPZ Impacts & Proposed Mitigation

Alternative	SCPZ Impacts		SCPZ Mitigation				
			Channel (lf)		Riparian (ac)		
	Channel (LF)	Riparian (AC)	On-Site (1:1) *	Off-Site (1:2)	On-Site (1:1)	Off-Site (@1:2 Required Minimum)	Off-Site Proposed (1:9)
Preferred							
SR 315 Southbound ROW	412	0.53	429	0	0.43	0.20	1.08
SR 315 Northbound ROW	13	0.02	0	0	0.00	0.04	
TOTALS	425	0.55	429	0	0.43	0.24	1.08
Minimal							
SR 315 Southbound ROW	0	0.16	0	0	0.00	0.32	NA
SR 315 Northbound ROW	0	0.02	0	0	0.00	0.04	
TOTALS	0	0.18	0	0	0.00	0.36	NA
No Impact							
SR 315 Southbound ROW	0	0.00	0	0	0.00	0.00	NA
SR 315 Northbound ROW	0	0.00	0	0	0.00	0.00	
TOTALS	0	0.00	0	0	0.00	0.00	NA

* Note: All channel impacts are proposed to be mitigated on -site in the channel relocation area in SR 315 southbound ROW.

Exhibits depicting principal features of the Preferred, Minimal, and No Impact Alternatives are provided in **Appendix F**.

3.0 MITIGATION

3.1 Mitigation Requirements

Guidance established by the City of Columbus Division of Sewerage & Drainage (DOSD) requires adequate mitigation to be provided for SCPZ and channel impacts as a condition of granting Type III Variance requests². Adequate mitigation for SCPZ and channel impacts generally consists of the following:

Riparian SCPZ Impacts: Restoration or replacement of disturbed SCPZ area with functionally equivalent area at minimum On-Site ratio = 1:1, and/or Off-Site ratio = 1:2

Channel Impacts: Demonstrate channel functionality will not be impaired, as measured by equivalent or greater projected post-construction QHEI/HHEI score and relevant supporting documentation.

3.2 Proposed Mitigation for Channel Impacts

As discussed in **Chapters 1.0 and 2.0** above, the need to shift the existing southbound SR 315 exit ramp to Olentangy River Road to the west in order to accommodate the geometry of the proposed new exit ramp to North Broadway will require relocating an estimated 412 lf of the unnamed tributary to the Olentangy River. An estimated 92 lf of the unnamed tributary upstream of the proposed relocation segment will remain unimpacted.

An estimated 13 lf of the same tributary will also be impacted by placement of RCP at new culvert outlets on the east side of SR 315 (northbound ROW). The nature of this impact precludes channel mitigation at this location. All proposed on-site channel mitigation will occur in the relocated channel segment. No off-site mitigation for channel impacts is warranted or proposed.

To accomplish the proposed channel relocation, the affected segment of the existing unnamed tributary will be filled, and a new stream “valley” and channel constructed slightly to the west, within the existing ROW. The new channel will be slightly wider and deeper than the existing channel to accommodate anticipated bankfull flows without cutting, and to allow for modest

² *Guidance Document for Applying for a Variance from the Stormwater Drainage Manual*, Department of Public Utilities, Division of Sewerage and Drainage, Columbus, Ohio, September 2012.

post-construction channel adjustment. Substrate material incorporating cobble, gravel, sand, and boulder classes will be placed in the new channel bed. Boulders and large cobble will be used to establish riffle heads along the new channel alignment at intervals approximating 5-7 times bankfull width. Pools will excavated at appropriate locations and intervals between the riffle heads. Proposed total length of the relocated segment is 429 lf. (see **Table 4**).

The relocated channel will be temporarily stabilized during Project 2 using coir fiber rolls and ODOT-compliant temporary erosion control matting. Permanent features (substrate placement, pool/riffle construction, riparian plantings) will be installed by a qualified contractor under a separate contract following temporary stabilization.

When assessed in May 2017, the existing tributary was assigned an HHEI score of 61, and a corresponding classification of Modified Class II PHWH. The relatively high HHEI score was attributable primarily to the diversity of substrate types observed, including coarse substrates in the cobble and gravel classes. These were, and will presumably continue to be, contributed from the upstream watershed via the existing culvert at the head of the reach. The relocated channel is expected to achieve a **projected minimum HHEI score of 61** (equivalent to existing) within 1 to 5 years following completion of proposed channel mitigation measures. A **maximum projected HHEI score of 65** is forecast for the same period.

Proposed schematics, plan sheets, projected HHEI forms, and other supporting channel mitigation materials are provided in **Appendix G**.

3.3 Proposed Mitigation for Riparian SCPZ Impacts

3.3.1 On-Site Riparian Mitigation

Columbus DDC is proposing to mitigate the majority of riparian SCPZ impacts on site in the channel relocation area. Proposed on site riparian SCPZ mitigation measures generally consist of:

- Clearing of invasive bush honeysuckle (*Lonicera sp.*) in the relocation reach.
- Incorporation of “bankfull benches” adjacent to the relocated channel, where feasible, to introduce habitat for sedges (*Carex sp.*), rushes (*Juncus sp.*), willow (*Salix sp.*) and other species adapted to frequently flooded fluvial conditions.

- Proposed native tree and shrub plantings in the new riparian corridor adjacent to the relocated reach.
- Proposed seedings of riparian grass and forb species to establish appropriate native herbaceous vegetation in both upland and frequently flooded zones of the new riparian corridor.

3.3.2 Off-Site Riparian Mitigation

A small area (0.1 ac.) within the SCPZ will be permanently displaced by the new pavement and shoulder associated with the westerly shift of the SR 315 southbound exit ramp. This impact, and the impact area associated with RCP placement at the new culvert outlets (0.02 ac.) will necessarily be mitigated off-site.

Columbus DDC is proposing to mitigate these impacts off-site by undertaking invasive species removal activities in the Olentangy River riparian corridor adjacent to the Olentangy Trail between West 2nd and West 1st Avenues in Columbus. Proposed invasive species removal activities will occur on City property located within a fenced area lying between the trail and SR 315 northbound, and will add to invasive species removal efforts being undertaken in the vicinity by Friends of the Lower Olentangy (FLOW) and citizen volunteers. Invasive bush honeysuckle (*Lonicera sp.*), and tree-of-heaven (*Ailanthus altissima*) are both prevalent in this area. Existing native trees and shrubs in the area will be preserved. Disturbed zones in the treated area will be replanted with appropriate native trees and shrubs following clearing. Estimated extent of the proposed off-site mitigation area is 1.08 ac., corresponding to an approximate mitigation acreage ratio of 1:9, significantly exceeding the required minimum ratio of 1:2. An exhibit showing the location and extent of proposed off-site mitigation is included in **Appendix F**. Native tree and shrub species for replanting will be selected from the same planting lists developed for on-site riparian SCPZ mitigation.

Proposed schematics, plan sheets, planting and seeding lists, and other supporting riparian mitigation materials are provided in **Appendix G**.

3.4 Summary of Proposed SCPZ Mitigation Measures

Table 4 below summarizes proposed channel and SCPZ mitigation measures for the Preferred Alternative.

Table 4: Summary of Proposed SCPZ Mitigation Measures -Preferred Alternative

Alternative	SCPZ Impacts		Proposed SCPZ Mitigation				
			Channel (lf)		Riparian (ac)		
	Channel (LF)	Riparian (AC)	On-Site (1:1) *	Off-Site (1:2)	On-Site (1:1)	Off-Site (@1:2 Required Minimum)	Off-Site Proposed (1:9)
Preferred							
SR 315 Southbound ROW	412	0.53	429	0	0.43	0.20	1.08
SR 315 Northbound ROW	13	0.02	0	0	0.00	0.04	
TOTALS	425	0.55	429	0	0.43	0.24	1.08