Ashe Croft Drive Drainage Study - Draft

Prepared for:

Town of Indian Trail



Prepared by:

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1. Introduction

The Town of Indian Trail requested USInfrastructure of Carolina, Inc. (USI) to perform a drainage analysis for the area located in the Ashe Croft Drive Drainage Study. The project is located in the backyards of the properties west of Brookforest Lane and was identified by citizen concerns of flooding due to the upstream development currently under construction. The Union Grove Subdivision development is located north of Unionville Indian Trail Road adjacent to the Ashe Croft Subdivision. The initial planning phase of the project consists of an analysis of the existing storm drain system to identify any deficiencies and to develop proposed improvement alternatives for the drainage system.

2. Existing Conditions

2.1. Hydrology

Two hydrologic flow scenarios were considered for the analysis of the existing storm drainage An existing landuse (existing) and future landuse (future) flow scenario was systems. developed utilizing the Rational Method to derive the 2-year, 10-year, 25-year, 50-year, and 100-year storm event flows for evaluation of the existing pipe and channel systems. The future flow scenario utilized the Rational Method for the majority of the flow calculations with the exception of drainage area Basin E04C draining to the Union Grove Subdivision detention pond (Pond #3). See Appendix A - Future Landuse Drainage Area Map for basin and pond location. In review of the development plans, provided by the Town, USI recreated the pond model utilizing Hydraflow for a 24-hour duration storm for each storm event. The model was validated by comparing it to the development plan model results. The Rational Method uses a 6hour storm event intensity to perform flow calculations; therefore, the pond model was also ran utilizing a 6-hour storm event for an "apples to apples" flow comparison. The Rational Method flow calculations were modified for Basin E04C by lowering the runoff coefficient to mimic the detention pond outlet flows for the future landuse existing system analysis. See Appendix A -Existing Conditions Analysis for hydrologic calculations.

2.2. Pipe System Description and Analysis

The existing pipe system begins at structure E06 as an 18" RCP on the northwest side of the Unionville Indian Trail Road and Ashe Croft Drive intersection. **See Appendix A – Existing and Future Landuse Drainage Area Maps** for the existing pipe system configuration. Once the pipe system crosses Unionville Indian Trail Road; it increases in size to a 36" RCP from structure E05 to structure E02 located on Ashe Croft Drive approximately 105' southwest of the intersection of Ashe Croft Drive and Brookforest Lane. The 36" RCP continues from structure E02 to the outfall at structure E01, but the 36" RCP changes to a 36" CMP between the structures. From the pipe outfall, a channel conveys runoff approximately 650' along the southwest (rear) property lines of the Brookforest Lane properties to the common area (owned by the Ashe Croft Homeowner's Association) connecting to the South Fork Crooked Creek FEMA floodplain.



The existing pipe system has the capacity to provide a 100-year level of service (LOS) for the existing flow conditions with the exception of the existing 18" RCP from structure E06 to structure E05 which provides a 50-year LOS. As part of the future flow conditions, the new development has recently replaced the 18" RCP between structures E06 and E05 with a 24" RCP. The new development has also added a new pipe system from Pond #3 to structure E04 as shown on the Future Conditions Drainage Area Map as structures E04A through E04C. These system modifications were incorporated into the future landuse existing system analysis. Under the future landuse flow scenario, the existing "modified" pipe systems provide a 100-year LOS.

2.3. Channel Description and Analysis

The existing 650' channel is a low lying swale along the rear property lines west of Brookforest Lane with little or no defined channel characteristics. The channel conveys the flow to the common area which drains to South Fork Crooked Creek. South Fork Crooked Creek is a FEMA stream with a designated 100-year floodplain and extends throughout the common area. The existing channel was analyzed by HecRas (accounting for FEMA tailwater impacts). The average depth of flow in the existing channel under the existing landuse flow scenario was found to be between 1'+/- and 1.5'+/-. The future landuse flow scenario produced an average depth between 1.2'+/- and 1.8'+/-. The FEMA 100-year floodplain impacts water surface elevations (WSE) up to the 4001 Croftwood Lane property and does not impact the majority of the existing channel. In regards to home or structure flooding, the channel exhibits a 100-year LOS and provides 2'+/- or more of freeboard to the lowest adjacent ground of any structure. Finished floor elevations are at minimal 2' higher than the lowest adjacent ground; therefore, <u>no</u> finished floor flooding is anticipated for the structures near the channel in the existing or future landuse flow scenarios.

The existing channel has a confined flow path as well. Private property amenities impact the functionality of the channel. Retaining walls (timber, modular block, etc.), privacy fences, decks, and swimming pools have been constructed by private property owners well into the main flow path of the channel. Many private utilities such as power, telephone, and cable also have service features located along the channel that may be impacted by any future improvements.

Property owners, adjacent to the channel, also reported the channel and surrounding area stays saturated at all times. Reports indicate, prior to the Union Grove Subdivision erosion control pond construction, the channel stayed dry except during rain events. A field investigation was performed to validate the property owner's concerns and it is evident that water flows continually in the channel. The continuous flow in the channel is considered to be a result of the erosion control sediment/detention pond construction upstream of the existing system. The North Carolina Department of Natural Resources (NCDNR) water quality standards for sediment/detention facilities require a slow release rate (2 to 5 day drawdown) of detained water, usually through a 2" to 6" orifice attached to the pond outlet structure. Due the frequency of storm events, the pond is constantly releasing flow which causes the area surrounding the existing channel to remain saturated.



3. Proposed Alternatives

3.1. Alternative 1

3.1.1. Improvement Description

Proposed Alternative 1 consists of upgrading the existing channel only from the existing outfall E01 to the common area approximately 575' downstream utilizing the future flow scenario. See Appendix B – Proposed Conditions Alternative 1 Drainage Map for location of the proposed improvements. A three foot wide, two foot deep trapezoidal channel with 3:1 side slopes and a 1%+/- longitudinal grade was determined to be the appropriate size and shape of the proposed channel. The channel dimensions were selected based on the width of the outfall pipe (36"), depth of flow in the existing channel, and to provide a non-erosive velocity along the channel. The proposed channel was then modeled in HecRas and compared to the existing channel model resulting in an overall reduction in WSE in the proposed channel section. See **Appendix B – Alternative 1 Hecras Model Output** for comparison results. As shown in the geometry comparison, the proposed channel invert was balanced between cutting and filling the surrounding area to provide better channel definition. This method was selected to provide a more central flow path for the continuous flow (released by upstream erosion control/detention ponds), reduce soil saturation, and limit impacts to the underground utilities servicing the properties near the channel. The proposed channel improvements lower the WSE for all storm events; therefore, no finished floor flooding is anticipated for the structures near the channel.

3.1.2. Construction

The construction of Alternative 1 would consist mainly of channel excavation and fill along the rear property lines of the affected properties. The top width of the channel would be approximately 15' wide. See **Appendix B – Proposed Conditions Alternative 1 Conceptual Plan** for the proposed channel improvements. The footprint of the proposed channel could be reduced to 11' with the use of 2:1 side slopes, but this would slightly increase WSEs and make the channel more difficult for property owner maintenance. The potential footprint reduction would not reduce the amount of permanent storm drainage easement required for the proposed channel alignment was selected to remain within the existing 20'+/- wide storm drain easement designated on the Ashe Croft Neighborhood development plat.

As simple as the construction of the proposed channel appears, there are many obstacles to avoid and/or require relocation within the project limits. The survey provided information on existing utilities within the project area. It appears the majority of the privately owned utilities, servicing the properties, run underground along and/or crossing the rear property lines within the proposed improvements corridor. The survey does not provided horizontal or vertical locations of the existing underground utilities, but above ground features such as power boxes, cable pedestals, and telephone pedestals skirt the entire construction area and are shown in the conceptual plan. It is assumed the underground utilities are located vertically one to three feet beneath the existing ground. Further utility survey and coordination would be required to know if improvements in the area are feasible at a reasonable cost.



In addition to the potential utility conflicts, there are many privately constructed amenities that impact the improvements corridor. Retaining walls (timber, modular block, etc.), large privacy fences, decks, and swimming pools have been constructed by private property owners and encroach into the construction corridor. Private amenities requiring relocation, resetting, or replacements are listed below and shown in **Appendix G – Project Photographs**:

- 4000 Croftwood Lane 3' Picket Fence replacement
- 4001 Brookforest Lane Tree removals and/or replacements
- 4002 Croftwood Lane Block wall, private underdrains, pool, and deck relocations and/or replacements
- 4007 Brookforest Lane 12' privacy fence relocation and/or replacement
- 4009 Brookforest Lane modular block wall and planter relocation and/or replacements
- 4001 Beaverbrook Drive Timber retaining wall relocation and/or replacement
- 4013 Brookforest Lane 12' privacy fence relocation and/or replacement
- 4017 Brookforest Lane Outdoor overhanging covered deck/storage building/ relocation and/or replacement
- 4002 and 404 Beaverbrook Lane Tree removals and/or replacements and 6' privacy fence relocation and/or replacements
- 4023 Brookforest Lane 6' vinyl privacy fence and deck relocation and/or replacement (construction entrance)

Construction of the improvements is not feasible without amenity relocations and/or replacements as described above. The private amenity replacements also increase construction costs.

3.1.3. Estimate

The cost estimate was prepared for Alternative 1 and is shown in **Appendix F – Alternative 1 Cost Estimate**. The estimate was divided into two separate cost breakouts, construction cost and easement acquisition cost. The construction cost for Alternative 1 was approximately \$177,000 which was larger than anticipated due to the private amenity conflicts described in the previous section. Private utility relocation was not included in the cost estimate but would increase the construction cost.

The easement acquisition costs were based on a cost per square foot of permanent drainage and temporary construction easements, easement plats, and easement acquisition. The cost per square foot was derived from the total parcel land value divided by the square footage of the parcel to derive a cost of approximately \$3.60 per square foot. The permanent storm drainage easements provided are designated for the properties on the development plat. For a conservative planning approach, it is assumed the easements will need to be acquired. The permanent drainage easement costs were taken as 75% (\$2.70 per square foot) of the estimated land value and the temporary construction easement costs were taken as 25% (\$1.00 per square foot) of the estimated land value. An estimate of \$1,500 per plat and acquisition was applied to the 22 properties that would require easement acquisition. The total easement acquisition cost was approximately \$92,000. The total cost of Alternative 1 was derived by



adding the construction and easement acquisition costs to obtain a total cost of approximately <u>\$269,000</u>.

3.1.4. Permitting

404/401 permitting is not anticipated for the construction of this alternative. The recently introduced continuous flow (from upstream detention facilities) complicates the validation of the stream assessment being jurisdictional or non-jurisdictional. If selected for continued design, a jurisdictional stream assessment would be recommended to verify if the existing channel is non-jurisdictional waters. A Floodplain Development Permit may be required for the improvements due to entering the FEMA floodplain.

3.2. Alternative 2

3.2.1. Improvement Description

Proposed Alternative 2 consists of piping in the existing channel with a 45"x29" horizontal elliptical reinforced concrete pipe (HERCP) from the outfall E01 to the common area approximately 575' downstream utilizing the future landuse flow scenario. See Appendix C -Proposed Conditions Alternative 2 Drainage Map for location of the proposed improvements. In addition to the proposed pipe improvements, ending near the existing sanitary sewer crossing, the proposed channel invert was lowered and would require tail ditching approximately 175' downstream. Elliptical pipe was used to help minimize the horizontal construction limits. An additional one foot rise to the proposed swale on top of the pipe system would expand the construction limits approximately 15' to 20' and would require additional construction easements. The proposed pipe system could not be lowered due to invert constraints associated with the downstream channel slope. Piping in the existing channel would alleviate the continuous flows keeping the backyards saturated. The proposed 45"x29" HERCP has the capacity equivalent to a 36" RCP and provides a 25-year LOS for the pipe system. The proposed system's capacity is limited due to the FEMA tail water conditions encountered at the outlet of the proposed system. Any overflow experienced in the larger storm events will be conveyed by a proposed swale on top of the pipe system from Structure P36 to the proposed outfall location.

3.2.2. Construction

The construction of Alternative 2 would consist mainly of drainage pipe installation, channel excavation, and fill along the rear property lines of the affected properties. See **Appendix C** – **Proposed Conditions Alternative 1 Conceptual Plan** for the proposed pipe and channel improvements. A swale was proposed on top of the pipe to collect and direct any above ground flows into the proposed pipe system. Similar to Alternative 1, the area surrounding the system will be filled with borrow to supply cover for the proposed pipe and in turn will provide a more usable yard for the property owners. The proposed pipe alignment was selected to remain within the existing 20'+/- wide storm drain easement designated on the Ashe Croft Neighborhood development plat.



The footprint of the proposed pipe system would remain constant at approximately an 8.5' trench width, but the grading area required for the pipe cover and swale would range from 20' to 45' wide. The majority of the grading improvements can be performed within a 25' width with the exception being near the proposed outfall. The existing ground near the outfall is much lower than at other locations along the system; therefore, the fill limits would have to expand to an approximate 45' width to obtain minimal pipe cover and positive grade to the proposed swale on top of the proposed pipe system.

The installation of the proposed pipe system has the same obstacles as discussed in Alternative 1. Private utilities and private property amenities fill the construction corridor. In addition to these obstacles, the sewer line near the proposed outfall will need to be raised approximately 0.5' to allow a 10-year flow to pass beneath the sewer and the proposed channel invert.

Construction of the improvements is not feasible without amenity relocations and/or replacements as described in the previous section. There is potential to eliminate conflict to some amenities by realigning the proposed pipe system. System realignment may impact some property owners, in regards to easements, more than others. For this exercise, the proposed pipe system alignment will remain similar to the existing channel alignment. The private amenity replacements also increase construction costs.

3.2.3. Estimate

The cost estimate was prepared for Alternative 2 and is shown in **Appendix F – Alternative 2 Cost Estimate**. The estimate was divided into two separate cost breakouts, construction cost and easement acquisition cost. The construction cost for Alternative 2 was approximately \$281,000 which was larger than anticipated due to the private amenity conflicts and the use of an elliptical pipe. Private utility relocation was not included in the cost estimate but would increase the cost of the project. The permanent storm drainage easements provided are designated for the properties on the development plat. For a conservative planning approach, it is assumed the easements will need to be acquired. The easement acquisition costs were based on a cost per square foot of permanent drainage and temporary construction easements, easement plats, and easement acquisition. An estimate of \$1,500 per plat and acquisition was applied to the 22 properties that would require easement acquisition. The total easement acquisition cost was approximately \$92,000. The total cost of the Alternative 2 was derived by adding the construction and easement acquisition costs to obtain a total of approximately <u>\$373,000</u>.

An alternative pipe material could be utilized to reduce the cost of the project. A 40"x31" aluminized steel pipe arch may be used in lieu of the 45"x29" HERCP. This was not proposed because the aluminized pipe arch requires two feet of cover and the design allows only one foot of cover. Further coordination with a manufacturer may provide a resolution to the lack of cover by creating the pipe arch with heavier gauged steel. The cost of the 45"x29" HERCP was estimated at \$120 per linear foot installed. The cost of the 40"x31" aluminized steel pipe arch was estimated at approximately \$40 per linear foot installed. This could produce a cost savings of approximately \$50,000 for Alternative 2.



3.2.4. Permitting

404/401 permitting is not anticipated for the construction of this alternative. The recently introduced continuous flow (from upstream detention facilities) complicates the validation of the stream assessment being jurisdictional or non-jurisdictional. If selected for continued design, a jurisdictional stream assessment would be recommended to verify if the existing channel is non-jurisdictional waters. A Floodplain Development Permit may be required for the improvements due to entering the FEMA floodplain.

3.3. Alternative 3

3.3.1. Improvement Description

Proposed Alternative 3 was requested by the Town for USI to review the Union Grove Subdivision site plans and determine if any improvements can be made to the development site to alleviate downstream flooding during construction. This alternative was requested prior to the completion of the existing system analysis. Currently, the existing pipe and channel system provides a 100-year LOS for the entire area.

In review of the development plans, the only possibility of limiting downstream "flooding" would be to adjust the outlet structure of the future detention pond, currently the erosion control sediment basin. The future landuse flow scenario provided in Appendix D - Proposed Conditions Alternative 3 Final Detention Pond #3 Routing (24-hour storm duration) was used as the starting point to create a model of the erosion control sediment basin and outlet structure. The Final Detention Pond #3 model was modified by replacing the detention pond outlet structure with the erosion control sediment basin outlet structure as shown in Appendix D - Proposed Conditions Alternative 3 Erosion Control Pond #3 Routing. The results of the two models were then compared. Because both modeled outlet structures are controlled by the same size orifice (24" RCP), the pond outflows were similar for all storm events. The 100-year storm outflow of the erosion control sediment basin was approximately 10 cfs larger than the detention pond. To eliminate this increase in outflow, the emergency spillway elevation could be increased by 0.5' to an elevation of 638.5 as shown in Appendix D - Proposed Conditions Alternative 3 Modified Erosion Control Pond #3 Routing. After completing the existing condition analysis, it was determined the existing downstream pipe and channel system has the capacity to convey the increased flows with no anticipated increase in potential flooding of structures. The result of the erosion control pond modification provided minimal benefit and does not resolve the continuous flow and saturated soils near the existing channel.

3.3.2. Construction

The construction of Alternative 3 should be an inexpensive solution to offset the subtle increase in outflows of the erosion control sediment basin. The existing emergency spillway could be removed and replaced in the same location approximately six inches higher to eliminate the flow increase. It is assumed the Town will coordinate the construction of the proposed emergency spillway modification with the development contractor.



3.3.3. Estimate

The cost estimate was prepared for Alternative 3 and is shown in **Appendix F – Alternative 3 Cost Estimate**. The construction cost for this alternative was approximately \$5,900. No easement acquisition costs are anticipated for the alternative.

3.3.4. Permitting

No 404/401 or floodplain development permitting would be required for this alternative.

3.4. Alternative 4

3.4.1. Improvement Description

Proposed Alternative 4 consists of rerouting the existing pipe system down Brookforest Lane to the outfall located southeast of the existing cul-de-sac. See **Appendix E – Proposed Conditions Alternative 4 Drainage Map** for location of proposed improvements. The improvements would utilize the future landuse flow scenario and include a "flow splitter" junction box at the intersection of Ashe Croft Drive and Brookforest Lane. The purpose of the "flow splitter" junction box is to divert the continuous flow from the newly constructed development erosion/detention pond away from the existing channel. The "flow splitter" will completely divert flows up to the 25-year storm event to the common area south of the Brookforest Lane cul-de-sac. The flow diversion will not completely remove flow from the existing channel. The existing channel. The existing channel of the Brookforest Lane cul-de-sac. The flow diversion will not completely remove flow from the existing channel. The existing channel of the Brookforest Lane cul-de-sac. The flow diversion will not completely remove flow from the existing channel. The existing channel of the Brookforest Lane cul-de-sac. The flow diversion will not completely remove flow from the existing channel. The existing channel of the Brookforest Lane cul-de-sac. The flow diversion will not completely remove flow from the existing channel. The existing channel of the Brookforest Lane cul-de-sac. The flow diversion will not completely remove flow from the existing channel. The existing channel of the Brookforest Lane cul-de-sac. The flow diversion will not completely remove flow from the existing channel. The existing catch basins on Ashe Croft Drive at the sag near 4023 Brookforest Lane will continue to deliver runoff flows during all storm events. During the 25-year and larger storm events, the "flow-splitter" will continue to allow flows to enter the existing channel via the existing 36" RCP overflow outlet of the "flow splitter" structure.

The proposed pipe system runs along the east side of Brookforest Lane for approximately 550' as a 24" RCP to the cul-de-sac. The system continues as a 30" RCP for approximately 90' to the proposed outfall located between the 4004 and 4006 Brookforest Lane properties. The proposed system will require tail ditching of the existing channel approximately 200' downstream to accommodate the grades required to construct the proposed pipe system.

3.4.2. Construction

The construction of Alternative 4 would consist mainly of drainage pipe installation, channel excavation, and associated roadway improvements along Brookforest Lane. See **Appendix C** – **Proposed Conditions Alternative 1 Conceptual Plan** for the proposed pipe and channel improvements. The proposed 24" RCP pipe system will be installed directly beneath the eastern curb line of Brookforest Lane. There is a 6" waterline that changes to a 2" waterline and an unknown size gas line along the same side of the street which appears to be offset near the existing right-of-way line. The gas line is not anticipated to be disturbed during installation of the proposed improvements. This will be validated with the completion of the survey in the area. Currently, the 811 utility locating service is unresponsive to the surveyor's location request and the utilities have not been located. The utilities will be surveyed upon completion of the location and applied to the proposed improvements.



The installation of the proposed pipe system may potentially conflict with the majority of the water and gas service lines feeding the west side of the Brookforest Lane. The improvements will include vertically relocating the water services and utility coordination for the necessary gas service relocations. There is potential for all sanitary sewer service laterals to be vertically relocated as well. The design does provide vertical clearance below the proposed pipe system to reconnect the sewer laterals with the exception of the laterals from the 4006 and 4008 Brookforest Lane properties. A specialized design to reroute the existing laterals in front of these properties may include a shared lateral to remedy the conflict with the proposed pipe system. Further coordination may also be required with Union County Public Works to resolve the sewer lateral issues.

Tail ditching will also be required at the outfall of the proposed 30" RCP. The proposed tail ditching will extend approximately 200' downstream across two properties and continue into the common area. The proposed alignment was selected to remain within the existing 10'+/- (pipe) and 25'+/- (channel) wide storm drain easements designated on the Ashe Croft Neighborhood development plat. The proposed channel will be a trapezoidal channel with a 3' bottom width and 3:1 side slopes.

3.4.3. Estimate

The cost estimate was prepared for Alternative 4 and is shown in **Appendix F – Alternative 4 Cost Estimate**. The estimate was divided into two separate cost breakouts, construction cost and easement acquisition cost. The construction cost for Alternative 4 was approximately \$261,000. Private utility relocation was not included in the cost estimate but may increase the cost of the project. The permanent storm drainage easements are designated for the properties on the development plat. For a conservative planning approach, it is assumed the easements will need to be acquired. The easement acquisition costs were based on cost per square foot of permanent drainage and temporary construction easements, easement plats, and easement acquisition. An estimate of \$1,500 per plat and acquisition was applied to the 3 properties that would require easement acquisition. The total easement acquisition cost was approximately \$31,000. The total cost of the Alternative 4 was derived by adding the construction and easement acquisition costs to obtain a total of approximately \$292,000.

3.4.4. Permitting

404/401 permitting is not anticipated for the construction of this alternative. The recently introduced continuous flow (from upstream detention facilities) complicates the validation of the stream assessment being jurisdictional or non-jurisdictional. If selected for continued design, a jurisdictional stream assessment would be recommended to verify if the existing channel is non-jurisdictional waters. A Floodplain Development Permit may be required for the improvements due to entering the FEMA floodplain.



4. Conclusion and Recommendations

As a result of the Alternative Analysis performed for the report, there are three viable solutions to remedy the problems associated with the existing channel. Alternative 1 and Alternative 2 were derived in the same alignment as the existing channel and convey the runoff in the same drainage pattern. The cons to the two alternatives are the substantial costs associated with easements and acquisition, private property amenity relocations/replacements, and private underground utility relocation. Alternative 3 provides a more cost effective solution, but does not resolve the continuous flows exiting the upstream pond. Alternative 4 provides a standard roadway drainage system running along the eastern side of Brookforest Lane. The "flow splitter" structure would alleviate the existing channel from the continuous release of flow from the upstream development pond. The system alignment would remain in the street right-of-way with the exception of the outfall and would divert approximately the 25-year flows from the existing channel as well. Alternative 4 is recommended to resolve the soil saturation issues on the properties along the existing channel.



Project #:060202 - 02Project Name:Ashe Croft Drive Drainage Study - Planning Estimate Alternative 1 (Channel Work Only)Estimate Dy:USIEstimate Date:5/20/2016

| Item | Item Description | Qty | Unit | Unit Price | Amount |
|------|--|-------|-------------|----------------|---------------------|
| 1 | Mobilization | 1 | LS | \$10,000.00 | \$10,000.00 |
| 2 | Comprehensive Grading | 1 | LS | \$18,000.00 | \$18,000.00 |
| 3 | Borrow Excavation | 1500 | CY | \$25.00 | \$37,500.00 |
| 4 | Traffic Control | 1 | LS | \$3,000.00 | \$3,000.00 |
| 5 | Wall, Precast Modular Block Retaining, 4009 Brookforest Lane | 80 | SF | \$32.00 | \$2,560.00 |
| 6 | Reset Wall, Timber , 4001 Beaverbrook Lane | 150 | SF | \$12.00 | \$1,800.00 |
| 7 | Brick Gravity Wall, 4002 Croftwood Lane | 70 | SF | \$75.00 | \$5,250.00 |
| 80 | 6" Concrete Driveways | 133 | SY | \$50.00 | \$6,666.67 |
| 8 | Fence, 3' Picket Fence | 110 | LF | \$23.00 | \$2,530.00 |
| 11 | Fence, 6' Vinyl Privacy | 80 | LF | \$35.00 | \$2,800.00 |
| 9 | Fence, 7' Wood Privacy | 40 | LF | \$40.00 | \$1,600.00 |
| 10 | Fence, 12' Wood Privacy, 4007 Brookforest Lane | 60 | LF | \$80.00 | \$4,800.00 |
| 11 | Fence, 12' Wood Privacy, 4013 Brookforest Lane | 105 | LF | \$80.00 | \$8,400.00 |
| 16 | Riprap, Class 1 | 35 | TN | \$60.00 | \$2,100.00 |
| 17 | Geotextile for Drainage | 50 | SY | \$3.50 | \$175.00 |
| 12 | Pool Deck, 4002 Croftwood Lane | 340 | SF | \$20.00 | \$6,800.00 |
| 13 | Overhanging Deck, 4017 Brookforest Lane | 675 | SF | \$20.00 | \$13,500.00 |
| 14 | Overhanging Deck Cover, 4017 Brookforest Lane | 144 | SF | \$30.00 | \$4,320.00 |
| 15 | Overhanging Deck Building, 4017 Brookforest Lane | 72 | SF | \$35.00 | \$2,520.00 |
| 16 | Erosion Control Matting | 1000 | SY | \$4.00 | \$4,000.00 |
| 17 | Erosion Control | 1 | LS | \$6,000.00 | \$6,000.00 |
| 18 | Seeding and Mulching | 3200 | SY | \$0.50 | \$1,600.00 |
| 19 | Sanitary Sewer Installation/Relocation 8" DIP, class 350 | 18 | LF | \$90.00 | \$1,620.00 |
| | | | | SUBTOTAL | \$147,541.67 |
| | | | 20.0% | Contingency | \$29,508.33 |
| | <u>CONSTRUCTION</u> | | | TOTAL BASE BID | <u>\$177,050.00</u> |
| | | | | | |
| 1 | Permanent Drainage Easement (Assume 20' width, Development Plat) | 16200 | SF | \$2.70 | \$43,740.00 |
| 2 | Temporary Construction Easement | 19400 | SF | \$1.00 | \$19,400.00 |
| 3 | Easement Plats and Acquisition | 22 | ΕA | \$1,500.00 | \$33,000.00 |
| | | | 00.00 | SUBIOTAL | \$76,740.00 |
| | 20.0% Contingent | | Contingency | \$15,348.00 | |
| | EASEMENT TOTAL BASE | | | | <u>\$92,088.00</u> |
| | | | | | |
| | | | | | ~_0,_200.00 |

Project #: 060202 - 02

Project Name: Ashe Croft Drive Drainage Study - Planning Estimate Alternative 2 (Pipe in Exisitng Channel)

Estimated by: USI

Estimate Date: 1/0/1900

| Item | Item Description | Qty | Unit | Unit Price | Amount |
|------|---|-------|-------|----------------|---------------------|
| 1 | Mobilization | 1 | LS | \$12,000.00 | \$12,000.00 |
| 2 | Comprehensive Grading | 1 | LS | \$28,000.00 | \$28,000.00 |
| 3 | Borrow Excavation | 800 | СҮ | \$25.00 | \$20,000.00 |
| 4 | Undercut Excavation | 25 | СҮ | \$40.00 | \$1,000.00 |
| 4 | Traffic Control | 1 | LS | \$3,000.00 | \$3,000.00 |
| 5 | Trench Rock Removal | 25 | СҮ | \$180.00 | \$4,500.00 |
| 7 | Foundation Conditioning Material, Minor Structures | 35 | ΤN | \$41.00 | \$1,435.00 |
| 8 | Foundation Conditioning Geotextile | 100 | SY | \$3.00 | \$300.00 |
| 26 | 45"x29" R.C. Elliptial Pipe Culverts, Class III | 570 | LF | \$120.00 | \$68,400.00 |
| 5 | Wall, Precast Modular Block Retaining, 4009 Brookforest Lane | 80 | SF | \$32.00 | \$2,560.00 |
| 6 | Reset Wall, Timber, 4001 Beaverbrook Lane | 150 | SF | \$12.00 | \$1,800.00 |
| 7 | Brick Gravity Wall, 4002 Croftwood Lane | 70 | SF | \$75.00 | \$5,250.00 |
| 20 | Endwalls, Reinforced | 6 | СҮ | \$700.00 | \$4,200.00 |
| 61 | Masonry Drainage Structures | 20 | СҮ | \$600.00 | \$12,000.00 |
| 66 | Frame and Cover, CLDS 20.05B | 5 | EA | \$360.00 | \$1,800.00 |
| 80 | 6" Concrete Driveways | 133 | SY | \$50.00 | \$6,650.00 |
| 8 | Fence, 3' Picket Fence | 110 | LF | \$23.00 | \$2,530.00 |
| 11 | Fence, 6' Vinyl Privacy | 80 | LF | \$35.00 | \$2,800.00 |
| 9 | Fence, 7' Wood Privacy | 40 | LF | \$40.00 | \$1,600.00 |
| 10 | Fence, 12' Wood Privacy, 4007 Brookforest Lane | 60 | LF | \$80.00 | \$4,800.00 |
| 11 | Fence, 12' Wood Privacy, 4013 Brookforest Lane | 105 | LF | \$80.00 | \$8,400.00 |
| 16 | Riprap, Class 1 | 35 | ΤN | \$60.00 | \$2,100.00 |
| 17 | Geotextile for Drainage | 50 | SY | \$3.50 | \$175.00 |
| 12 | Pool Deck, 4002 Croftwood Lane | 340 | SF | \$20.00 | \$6,800.00 |
| 13 | Overhanging Deck, 4017 Brookforest Lane | 675 | SF | \$20.00 | \$13,500.00 |
| 14 | Overhanging Deck Cover, 4017 Brookforest Lane | 144 | SF | \$30.00 | \$4,320.00 |
| 15 | Overhanging Deck Building, 4017 Brookforest Lane | 72 | SF | \$35.00 | \$2,520.00 |
| 16 | Erosion Control Matting | 600 | SY | \$4.00 | \$2,400.00 |
| 17 | Erosion Control | 1 | LS | \$6,000.00 | \$6,000.00 |
| 18 | Seeding and Mulching | 4000 | SY | \$0.50 | \$2,000.00 |
| 19 | Sanitary Sewer Installation/Relocation 8" DIP, class 350 | 18 | LF | \$90.00 | \$1,620.00 |
| 23 | Precast Concrete Sanitary Sewer Manhole (4-foot Diameter) | 2 | EA | \$3,000.00 | \$6,000.00 |
| | | | | SUBTOTAL | \$234,460.00 |
| | | | 20.0% | Contingency | \$46,892.00 |
| | <u>CONSTRUCTION</u> | | | TOTAL BASE BID | <u>\$281,352.00</u> |
| 1 | Permanent Drainage Fasement (Assume 20' width Development Plat) | 16200 | SF | \$2.70 | \$43 740 00 |
| 2 | Temporary Construction Fasement | 19400 | SF | \$1.00 | \$19 400 00 |
| 3 | Easement Plats and Acquisition | 22 | EA | \$1,500.00 | \$33,000,00 |
| | | | | SUBTOTAL | \$76,740.00 |
| | | | 20.0% | Contingency | \$15,348.00 |
| | FASEMENT TOTAL BAS | | | | \$92,088.00 |
| | | | | | |
| | CONSTRUCTION AND FASEMENT TOTAL COST \$373 500 00 | | | | |
| | | | | | |

Project #:060202 - 02Project Name:Ashe Croft Drive Drainage Study - Planning Estimate Alternative 3 (Development EC Pond emergency Spillway Adjustment)Estimated by:USIEstimate Date:5/20/2016

| Item | Item Description | Qty | Unit | Unit Price | Amount |
|------|--|-----|------|------------|-------------------|
| 1 | Mobilization | 1 | LS | \$500.00 | \$500.00 |
| 3 | Borrow Excavation | 15 | СҮ | \$25.00 | \$375.00 |
| 16 | Riprap, Class 1 | 65 | TN | \$60.00 | \$3,900.00 |
| 18 | Seeding and Mulching | 200 | SY | \$0.50 | \$100.00 |
| | | | | SUBTOTAL | \$4,875.00 |
| | 20.0% CONSTRUCTION | | | | \$975.00 |
| | | | | | <u>\$5,850.00</u> |
| | | | | | |
| 1 | Permanent Drainage Easement (Assume 20' width, Development Plat) | 0 | SF | \$2.70 | \$0.00 |
| 2 | Temporary Construction Easement | 0 | SF | \$1.00 | \$0.00 |
| 3 | Easement Plats and Acquisition | 0 | EA | \$1,500.00 | \$0.00 |
| | SUBTOTAL | | | | |
| | 20.0%ContingencyEASEMENTTOTAL BASE | | | | \$0.00 |
| | | | | | <u>\$0.00</u> |
| | | | | | |
| | CONSTRUCTION AND EASEMENT TOTAL COST | | | | |

| Project #: | 060202 - 02 |
|----------------|---|
| Project Name: | Ashe Croft Drive Drainage Study - Planning Estimate Alternative 4 (Prop. Pipe System along Brookforest Ln.) |
| Estimated by: | USI |
| Estimate Date: | 5/20/2016 |

| Item | Item Description | Qty | Unit | Unit Price | Amount | | |
|------|---|------|-------|-----------------------|---------------------|--|--|
| 1 | Mobilization | 1 | LS | \$11,000.00 | \$11,000.00 | | |
| 2 | Comprehensive Grading | 1 | LS | \$26,000.00 | \$26,000.00 | | |
| 3 | Select Material | 600 | TN | \$28.00 | \$16,800.00 | | |
| 3 | Borrow Excavation | 65 | СҮ | \$25.00 | \$1,625.00 | | |
| 4 | Undercut Excavation | 15 | CY | \$40.00 | \$600.00 | | |
| 4 | Traffic Control | 1 | LS | \$3,000.00 | \$3,000.00 | | |
| 5 | Trench Rock Removal | 10 | CY | \$180.00 | \$1,800.00 | | |
| 7 | Foundation Conditioning Material, Minor Structures | 25 | TN | \$41.00 | \$1,025.00 | | |
| 8 | Foundation Conditioning Geotextile | 140 | SY | \$3.00 | \$420.00 | | |
| 11 | 24" R.C. Pipe Culverts, Class III | 200 | LF | \$63.00 | \$12,600.00 | | |
| 12 | 30" R.C. Pipe Culverts, Class III | 84 | LF | \$68.00 | \$5,712.00 | | |
| 24 | 24" R.C. Pipe Culverts, Class IV | 334 | LF | \$65.00 | \$21,710.00 | | |
| 40 | Channel Excavation | 85 | СҮ | \$25.00 | \$2,125.00 | | |
| 11 | Milling Asphalt Pavement, 0.0" to 3.0" | 400 | SY | \$5.50 | \$2,200.00 | | |
| 14 | Asphalt Concrete Base Course, Type B 25.0B | 50 | TN | \$72.00 | \$3,600.00 | | |
| 15 | Asphalt Concrete Intermediate Course, Type I 19.0B | 70 | TN | \$72.00 | \$5,040.00 | | |
| 16 | Asphalt Concrete Surface Course, Type S 9.5B | 80 | TN | \$76.00 | \$6,080.00 | | |
| 17 | Asphalt Binder for Plant Mix | 10 | TN | \$438.00 | \$4,380.00 | | |
| 59 | Masonry Drainage Structures | 4 | EA | \$2,100.00 | \$8,400.00 | | |
| 64 | Non-Standard Drainage Structures | 7 | СҮ | \$1,000.00 | \$7,000.00 | | |
| 65 | Frame with Grate (all types) | 4 | EA | \$340.00 | \$1,360.00 | | |
| 69 | Manhole Frame and Cover, NCDOT Std 840.54 | 1 | EA | \$400.00 | \$400.00 | | |
| 76 | 2'-0" Valley Gutter | 625 | LF | \$25.00 | \$15,625.00 | | |
| 77 | 4 " Concrete Sidewalk | 10 | SY | \$36.00 | \$360.00 | | |
| 80 | 6" Concrete Driveways | 180 | SY | \$50.00 | \$9,000.00 | | |
| 81 | 6" Concrete Wheelchair/Accessible Ramps | 5 | EA | \$700.00 | \$3,500.00 | | |
| 16 | Riprap, Class 1 | 35 | TN | \$60.00 | \$2,100.00 | | |
| 17 | Geotextile for Drainage | 40 | SY | \$3.50 | \$140.00 | | |
| 17 | Erosion Control | 1 | LS | \$4,000.00 | \$4,000.00 | | |
| 18 | Seeding and Mulching | 1500 | SY | \$0.50 | \$750.00 | | |
| 22 | Erosion Control - Matting (100% Biodegradable Coconut Fiber (Coir)) | 200 | SY | \$6.00 | \$1,200.00 | | |
| | 6" DIP Water Main, PC 350 | 100 | LF | \$45.00 | \$4,500.00 | | |
| 41 | Installation of ¾" Copper Water Service, Long Side | 10 | EA | \$2,000.00 | \$20,000.00 | | |
| 42 | Installation of ¾" Copper Water Service, Short Side | 1 | EA | \$1,025.00 | \$1,025.00 | | |
| 55 | 4" DIP Sewer Laterals | 200 | LF | \$60.00 | \$12,000.00 | | |
| | | _ | | SUBTOTAL | \$217,077.00 | | |
| | | | 20.0% | Contingency | \$43,415.40 | | |
| | CONSTRUCTION | | | <u>TOTAL BASE BID</u> | <u>\$260,492.40</u> | | |
| 1 | Permanent Drainage Easement (Assume 20' width, Development Plat) | 7900 | SF | \$2,70 | \$21.330.00 | | |
| 2 | Temporary Construction Easement | 3600 | SF | \$1,00 | \$3.600.00 | | |
| 3 | Easement Plats and Acquisition | 3 | EA | \$1.500.00 | \$4,500.00 | | |
| | | | | SUBTOTAL | \$25.830.00 | | |
| | | | | | | | |
| | FASEMENT T | | | TOTAL BASE | \$30.996.00 | | |
| | | | | | | | |
| | CONSTRUCTION AND FASEMENT TOTAL COST | | | | \$291 500.00 | | |
| | | | | | | | |