

VILLAGE OF CLEMMONS
STORMWATER ADVISORY BOARD

AGENDA

September 10, 2020

6:00 pm

- I. CALL TO ORDER**
- II. APPROVAL OF MINUTES – January 15, 2020 & March 5, 2020 Special Meeting**
- III. CHANGES TO THE AGENDA**
- IV. ANNOUNCEMENTS**
- V. PUBLIC COMMENTS**
- VI. BUSINESS – ACTION ITEMS**
 - a. Discussion and acceptance/rejection of five CIP Project additions**
 - i. Glen Oaks**
 - ii. Lasater Rd.**
 - iii. Moravian Heights**
 - iv. Rolling Oak Court**
 - v. Springfield Farm**
 - b. Quarterly Stormwater Review**
 - c. Election of officers**
 - d. Determine regular meeting schedule for upcoming fiscal year**
- VII. STAFF COMMENTS**
 - a. Emily Harrison**
 - b. Wesley Kimbrell**
 - c. Mike Gunnell**
- VIII. ADJOURNMENT**

**REGULAR MEETING OF
THE VILLAGE OF CLEMMONS STORMWATER ADVISORY BOARD
January 15, 2020 MINUTES**

The Village of Clemmons Stormwater Advisory Board met on Wednesday, October 16th, 2019 at Village Hall. All members were present except, Planning Board Liaison Bobby Patterson. Staff members Emily Harrison, Mike Gunnell, Wes Kimbrell and Marketing/Communications Director Shannon Ford were also present.

CALL TO ORDER

The meeting was called to order by Chair, Laurie Fitzgerald at 6:04 p.m.

APPROVAL OF MINUTES

Daniel Butner made a motion to approve the minutes of the October 16, 2019 meeting as presented. Kevin Farmer seconded the motion, which was unanimously approved.

CHANGES TO THE AGENDA

No changes to the agenda

ANNOUNCEMENTS

Emily Harrison made an announcement informing the board that Forsyth Creek Week, in its eighth year, will be running from Saturday March 21st through Sunday March 29th.

PUBLIC COMMENTS

1 person in attendance

BUSINESS

- A. New SWAB member was introduced.
Councilwoman Michelle Barson introduced herself as the newest appointed council liaison to the Stormwater Advisory Board. Ms. Barson is currently 2 years into her 4 year term and is very excited to be joining the stormwater advisory board.

- B. Shannon Ford informed the advisory board of a marketing plan to reach more individuals for Stormwater Outreach. In order to reach more people, it was decided to focus on one issue/topic that many people can grasp and then build upon that audience. The topic chosen for 2020 will be pet waste, as it is a topic that many people can relate to. Ms. Ford

then discussed different marketing outlets that Clemmons can use for the campaign: such as local media, school blasts, posters, social media, surveys and giveaways to name a few. The board was in agreement of using free/lost cost options available for the marketing campaign. The board was in favor of having Ms. Ford to continue working on the Stormwater Marketing Campaign with Staff for the Pet Waste Marketing Program, and allocating \$500 out of the Education account for this process.

- C. Mike Gunnell discussed with the board a possible consideration for Yard Waste Collection to the residents in Clemmons in an effort help lower the amount of yard waste being left in the roadways, and how much this options would cost Clemmons residents. One option Mr. Gunnell informed the board about is Waste Management could possibly provide the service of yard waste removal via a cart for grass waste. Mr. Gunnell informed the board that Waste Management does not currently provide this service anywhere else. The service would be every other week. Every house hold in would have three (3) containers (trash, recycle and yard waste). The fixed cost for this service for the Village would be \$567,486 which includes a new truck specifically for yard waste, and new personnel. Mr. Gunnell informed the board that with approximately 6,000 residential homes in Clemmons, the cost for each home owner would be around \$7.75 if everyone participated. The board asked if this could be an optional service, and Mr. Gunnell informed the board that it can be, but since it is a fixed cost for service, depending on how much participation there is from the residents, it will affect the final cost for each resident who does participate for this service. The board asked if this service would take away any personnel on the public works side and Mr. Gunnell stated he did not believe it would not eliminate any staff personnel.
- Another option the board discussed is if the grass pickup service were to be completely taken away, it would force the residents to mulch the grass back into their yards. Then if residents still places it in the street, then fines would have to be enforced.
- Another option discussed was increasing grass pickups throughout the Village, which would result in pickups on both sides of Clemmons every week, compared to the current schedule which is every other week for both sides. However Mr. Gunnell noted the problem with this option is, it is harder to take away this option once it has been implemented, and there will be an increase cost in equipment. SWAB members agreed to table this discussion until more numbers related to cost for different options could be viewed in more detail.
- D. Wesley Kimbrell presented a Stormwater Fee Increase Option to the Board for their consideration. Mr. Kimbrell informed the board that all tax parcels in the Village of Clemmons are subject to a Stormwater Utility Bill. The Village of Clemmons utilizes an Equivalent Residential Unit (ERU) billing system, and in 2007 when the Village of

Clemmons began its NPDES Phase 2 Stormwater program, it was determined through site visits and aerial imagery that the ERU value would be set at 3,952 square feet (sq. ft.) per lot. As of the 2019-2020 fiscal year the ERU rate is set at \$5.00 per month, or \$60 per year. Currently the Stormwater Utility Billing is broken into two separate realms, Single Family Residential (SFR), and everything else that is not SFR. Currently, all single family (detached dwelling) units are billed only 1 ERU per year, regardless of its current impervious coverage. Currently, all parcels not listed as a single family residential units (Commercial, Industrial, Institutional) are billed based upon their current impervious coverage.

A proposal for changes to the Stormwater Utility Billing on the Single Family Residential side is to integrate a tiered billing system similar to what Winston-Salem, Raleigh, and Charlotte have in place.

The ERU will remain the same (3,952 square feet), however there will now be a four (4) tiered system for residential, so everyone will pay their part, and a buffer will be created for residents, as other municipalities do, for the total impervious area on the parcel.

Tier 1: 0 - 4,250 square feet of impervious - Tier 1: \$5/month or \$60/year

Tier 2: 4,251 - 8,500 square feet of impervious - Tier 2: \$10/month or \$120/year

Tier 3: 8,501 - 12,750 square feet of impervious - Tier 3: \$15/month or \$180/year

Tier 4: 12,751 - Infinite square feet of impervious - Tier 4: \$5/ERU/month or \$60/ERU/year

Mr. Kimbrell explained in more detail why Staff is considering this option. With single family residential units being billed at 1 ERU, it allows some homeowners to take advantage of the set billing rate. Homeowners with 3,500 square feet of impervious area on their site are being billed 1 ERU or \$60 a year, while several homeowners currently have over $\frac{1}{4}$ of an acre (~11,000 square feet) of impervious area on site are also only paying 1 ERU or \$60 a year. Those with more impervious coverage are generating far more stormwater runoff than those with less, and this is a fair option for all residential homeowners to pay for their part of stormwater runoff. Currently Staff has completed mapping of 60% of the SFR units within Clemmons and have determined a net gain so far of over \$100,000 at this time assuming the same ERU rate (no rate increase) and have the tiered ranges as previously mentioned.

Staff is providing QA/QC on all lots by cross referencing between different software's and multiple aerials (as most recent as possibly available).

After a lengthy discussion, the board did agree that changes need to be made to the current ERU billing system that is fair for both realms for billing. The board made a direction for staff to continue to analyze the SFR residential data within Clemmons and

get the finalized numbers to show where the numbers will fall for each tier before the next meeting.

- E. Wesley Kimbrell and Emily Harrison presented the quarterly review of Stormwater related events and projects to the board (October – December 2019). The following items were reviewed: Good Housekeeping (Minor CIP Projects) for Municipal Operations (ditch work, culvert/inlet cleaning and street sweeping), Illicit Discharge (sewer/water discharges, dog waste collection numbers) Post-Construction (BMP inspections and permits issued), Public Education (school presentations, radio PSA numbers) and Public Participation (Community Events).

STAFF COMMENTS

- Emily Harrison updated the board on the Village of Clemmons NPDES Phase II Permit, as Staff is currently waiting for feedback from the State.
- Wesley Kimbrell updated the board on the Springside North CIP Project.
- Mike Gunnell had no additional comments to add.

ADJOURNMENT:

Kevin Farmer made a motion to adjourn. Jeffrey Dean seconded the motion which was unanimously approved. The meeting was adjourned at 8:11pm. The next regular meeting is scheduled to be held Wednesday, April 15, 2020 at 6pm.

Respectfully submitted,

Jeffrey Dean, Secretary

**SPECIAL MEETING OF
THE VILLAGE OF CLEMMONS STORMWATER ADVISORY BOARD
March 5, 2020 MINUTES**

The Village of Clemmons Stormwater Advisory Board met on Wednesday, March 5th, 2020 at Village Hall. All members were present except, Planning Board Liaison Bobby Patterson. Staff members Emily Harrison, Mike Gunnell, Wes Kimbrell and Council Woman Liaison Michelle Barson were also present.

CALL TO ORDER

The meeting was called to order by Chair, Laurie Fitzgerald at 6:05 p.m.

PUBLIC COMMENTS

0 people in attendance

BUSINESS

- A. Mr. Kimbrell presented to the Stormwater Advisory Board a comparison of different fee models, which are from other cities in the triad, and one created by Clemmons Staff for consideration to Clemmons Council. Mr. Kimbrell informed the board that currently, the Village of Clemmons has a flat fee of \$60 annually for all single family residential (SFR) units, regardless of impervious area. The current revenue for 2019 gathered \$357,900 for SFR, and if nothing changes, the revenue is expected to be \$406,380 for 2020. All non-residential units are billed \$60 per equivalent residential billing unit (ERU) annually. The ERU for the Village of Clemmons was determined at the beginning of the program by a hired 3rd party consultant, and it was determined through random sampling off one hundred (100) houses throughout Clemmons to be 3,952 square feet (sq. ft.). The revenue collected in 2019 for all non-residential properties equaled \$430,410, and if nothing changes the revenue collected is expected to be \$408,900. The reasoning for the drop, some single family residential (condominiums) billings were being billed as multi family, but should have been SFR. Mr. Kimbrell then went on to present a comparison of residential stormwater fees as asked for by the Stormwater Advisory Board.

Item 1A – Staff will present a comparison from high to low of the annual residential storm water fees from the following cities in the triad that include Clemmons, Winston Salem, High Point, Greensboro and Kernersville. Mr. Kimbrell informed the board that

this is a little difficult to rank because there are two different type of systems. There are flat rate systems and tiered systems for different municipalities. Mr. Kimbrell's basis for ranking Clemmons second, is Winston Salem has tier 3 and 4 components that are higher than Clemmons current flat rate fee, High Point has a flat rate fee of \$48 dollars (\$12 less than Clemmons), Greensboro has a tiered system, and Kernersville has a flat fee of \$39.51.

Item 1B – Staff will present a comparison from high to low of annual nonresidential stormwater fees, and fee per acre of the following cities in the triad that include Clemmons, Winston Salem, High Point, Greensboro and Kernersville. Mr. Kimbrell stated that Clemmons ranks in the middle of these municipalities with Winston Salem at \$831 an acre, High Point at \$807.91 an acre, Clemmons is \$661.34 an acre, Kernersville is \$587.75 an acre and Greensboro is \$554.99 an acre.

Item 1C – Staff will present a comparison of the nonresidential and residential funding percentage of total stormwater utility revenue from the following cities in the Triad that include that include Clemmons, Winston Salem, High Point, Greensboro and Kernersville. Clemmons staff talked with staff from Winston Salem and Greensboro, however, Clemmons staff was unable to receive this particular data from High Point, and Kernersville. Clemmons currently bills 45% residential and 55% non-residential, Winston bills 40% residential and 60% nonresidential and Greensboro bills 30 % residential and 70% nonresidential. Mr. Kimbrell addressed the board that in some of the emails, the discussion was Winston has a 40/60 split, and the split was that way from after talking with staff at Winston Salem the Master Zoning Plan falls at 60% is projected to be nonresidential, and 40% residential. Clemmons Master Zoning Plan, at full bill out is showing over 80% residential and under 20% as nonresidential. The current impervious area is showing 7,341 ERU's for residential, which is 52% of the total impervious area of Clemmons, and 6,815 ERU's for nonresidential, which is 48%. Currently Clemmons has more impervious area of residential over nonresidential, but nonresidential areas are being billed more than residential.

Item 1D – Staff will demonstrate using an example of how reducing the ERU square footage amount will increase stormwater revenue. This calculation is for nonresidential billing only. The current ERU for Clemmons is 3,952 sq. ft., and the proposed ERU mentioned is 3,000 sq. ft. When creating the scale factor, this results in a 31.73% increase to the nonresidential customers. Mr. Kimbrell informed the board that this type of action may not be legal or ethical.

1E – Staff will calculate the total square footage of all impervious surfaces owned by the Village of Clemmons and illustrate the additional revenue generated if the Village were

assessed a stormwater fee based on this number. There was not enough time for staff to obtain accurate values so an approximation has been provided on the street and sidewalk areas. Clemmons currently pays for both facilities that staff work at. However, to pay for the roads and sidewalks as well will result in a property tax increase to offset those costs.

2A - Establish a Residential Tier structure based on impervious square footage similar to the tier structure used by Winston-Salem, using an incremental fee increase between tiers and a maximum cap on the top tier fee (See Table 2A in Appendix) with 4 tiers. The residential top tier should be between 6,000 and 7,000 sq. ft. Keeping the same tiered system, and scaling factor as what Winston Salem currently does, 11% of the Clemmons community would see a decrease of \$3 a year in their annual stormwater revenue fee. 39% in tier 2 would see no change and stay at \$60 annually, 36% of the population would move up to a tier 3 and have to pay \$90 annually, and 14% would become a tier 4, with a cap at 6,001 sq. ft and up, would pay \$120 annually. Assuming no change to the \$60 ERU billing for both residential and non-residential (ERU=3,952 SF), this would increase the residential portion of the SW fund by \$129,153.

2B Option 1 – Calculate the Non-residential revenue increase if the ERU is reduced to 3000 sq. ft, assuming 1 ERU is still \$60. The current nonresidential ERU total in Clemmons is 6,815, but if we multiply by the 31.73% increase, this will now create 8,978 ERU's, which would generate \$538,658 in nonresidential, and this would be an increase \$129,758 increase on the nonresidential side if no other changes were made. Mr. Kimbrell again stressed to the board the ethics and legality and rate shock of this option. Mr Kimbrell then discussed the impact this will have on the nonresidential community for, which a lot of these businesses are tax exempt programs (ex: churches and schools). If Clemmons were to lower the ERU threshold, this would increase the amount of ERU's each business has, and would increase what their new stormwater fee will be. (See Table 2B-Option1 in Appendix)

2B Option 2 - Calculate the Non-residential revenue increase if the ERU is reduced to 2750 sq. ft. assuming 1 ERU is still \$60. This calculation scale factor would show a 43.71% increase to nonresidential. This would generate \$587,626 in nonresidential revenue, an increase of \$178,726 of what Clemmons is currently collecting now. Mr. Kimbrell then discussed the impact this option would have on the nonresidential community (See Table 2B-Option2 in Appendix).

2C - Calculate the residential and non-residential funding percentage of total stormwater revenue using the new revenue stream from the stormwater fee model in 2a. Show percentages for both 1 ERU = 3000 sq. ft. and 1 ERU = 2750 sq. ft. These figures are assuming no change (flat-rate) to residential billing. Option 1 of 3,000 sq. ft. would have

a breakdown of \$406,380 for residential (43%), and \$538,658 for nonresidential (57%). Mr. Kimbrell reminded the board that over 50% of current impervious area in Clemmons is in the residential community. Option 2 of 2,750 sq. ft. has a breakdown of \$406,380 for residential (41%), and \$587,626 for nonresidential (59%). Mr. Kimbrell also reminded the board again that the Master Plan for Clemmons shows over 80% of Clemmons will be classified as residential and less than 20% will be nonresidential.

Mr. Kimbrell presented the Stormwater Staff Recommendation with a minor alteration from the January SWAB meeting. Residential billing goes to a tiered system with a cap at the 4th tier. 56% of residents remain a Tier 1 or \$60 annually, 40% of residents increase to Tier 2 at \$120 annually, 3% of residents increase to Tier 3 at \$180 annually and 1% of residents increase to Tier 4 at \$240 annually, which being capped, the Village would lose about \$4,000 annually. This option for residential will generate an extra \$197,760 in revenue generated from the residential community. This option would create more of a 60/40 split of residential vs nonresidential, (60% being residential), assuming SFR and nonresidential stays the same at \$60 per ERU and the impervious area stays at 3,952 sq. ft.

After a lengthy discussion of all the options presented, Ms Fitzgerald made a motion for Staff to present to Council at the March retreat for their consideration of Option 2A, and make the changes suggested by the board to the residential structure scaling factor with an incremental fee increase for a 4 tier system, and to raise the ERU billing fee from \$60 to \$72 annually for both residential and nonresidential parcels, with the nonresidential being a flat fee increase. (See Table 3a and 3b below) After some more discussion from the board, Ms Douglass seconded the motion. The motion was passed 6-1, with Mr. Farmer voting against.

After some more discussion from the board on wanting council to view all the options presented, Mr. Dean made a motion that when staff presents the Stormwater Advisory Boards recommendation to Council at the retreat, to make sure that council views all of the information and options presented at this special meeting as well. Ms Fitzgerald seconded the motion, which was unanimously approved.

STAFF COMMENTS

- No Staff Comments

ADJOURNMENT:

Kevin Farmer made a motion to adjourn. Laurie Fitzgerald seconded the motion which was unanimously approved. The meeting adjourned at 7:15pm.

Respectfully submitted,

Jeffrey Dean, Secretary

(Table 2A – Residential Tier Structure Option)

Residential Tiers	Lower Range	Upper Range	Scaling Factor	ERU Fee	Units	Revenue
1	0	2000	0.95	\$ 57.00	729	\$ 41,553.00
2	2001	4000	1	\$ 60.00	2621	\$ 157,260.00
3	4001	6000	1.5	\$ 90.00	2468	\$ 222,120.00
4 (Per ERU)	6001	infinite	2	\$ 120.00	955	\$ 114,600.00
					Total	\$ 535,533.00
					RES-Increase	\$ 129,153.00

(Table 2B-Option 1 – reduce ERU’s impact on Non-residential from 3,952 sq. ft. to 3,000 sq. ft)

Example Non-Residential	Ex. ERU	New ERU	Ex. Annual Fee	New Fee
River Oaks Community Church	68	90	\$ 4,080.00	\$ 5,374.72
Agape Church	61	80	\$ 3,660.00	\$ 4,821.44
Clemmons Elementary	56	74	\$ 3,360.00	\$ 4,426.24
Hayward	307	404	\$ 18,420.00	\$ 24,265.28
West Forsyth High School	204	269	\$ 12,240.00	\$ 16,124.16
Southwest Elementary	110	145	\$ 6,592.99	\$ 8,685.16
Morgan Elementary	68	89	\$ 4,072.32	\$ 5,364.60

(Table 2B-Option2 – reduce ERU’s impact on Non-residential from 3,952 sq. ft. to 2,750 sq. ft)

Example Non-Residential	Ex. ERU	New ERU	Ex. Annual Fee	New Fee
River Oaks Community Church	68	98	\$ 4,080.00	\$ 5,863.33
Agape Church	61	88	\$ 3,660.00	\$ 5,259.75
Clemmons Elementary	56	80	\$ 3,360.00	\$ 4,828.63
Hayward	307	441	\$ 18,420.00	\$ 26,471.21
West Forsyth High School	204	293	\$ 12,240.00	\$ 17,589.99
Southwest Elementary	110	158	\$ 6,592.99	\$ 9,474.72
Morgan Elementary	68	98	\$ 4,072.32	\$ 5,852.29

(Table 3a Elected SWAB decision - residential structure scaling factor with an incremental fee increase for a 4 tier system and raise the ERU billing fee from \$60 to \$72 annually for single family residential)

Residential Tiers	Lower Range	Upper Range	Scaling Factor	ERU Fee	Units	Revenue
1	0	2000	0.95	\$ 68.40	729	\$ 49,863.60
2	2001	4000	1	\$ 72.00	2621	\$ 188,712.00
3	4001	6000	1.5	\$ 108.00	2468	\$ 266,544.00
4	6001	infinite	2	\$ 144.00	955	\$ 137,520.00
					Total	\$ 642,639.60

(Table 3b Elected SWAB decision – Example of Non-residential raised ERU billing fee impact from \$60 to \$72 annually for nonresidential parcels)

Example Non-Residential	Ex. ERU	Ex. Annual Fee	New Fee	Increase
River Oaks Community Church	68	\$ 4,080.00	\$ 4,896.00	\$ 816.00
Agape Church	61	\$ 3,660.00	\$ 4,392.00	\$ 732.00
Clemmons Elementary	56	\$ 3,360.00	\$ 4,032.00	\$ 672.00
Hayward	307	\$ 18,420.00	\$ 22,104.00	\$ 3,684.00
West Forsyth High School	204	\$ 12,240.00	\$ 14,688.00	\$ 2,448.00
Southwest Elementary	110	\$ 6,592.99	\$ 7,911.58	\$ 1,318.60
Morgan Elementary	68	\$ 4,072.32	\$ 4,886.78	\$ 814.46

Glen Oaks Road Stormwater System



Glen Oaks Road looking at location where water overtops the road

Glen Oaks Road looking at approximate alignment of 24-inch culvert near upstream inlet



INLET TO 24-INCH CULVERT



Existing downstream 24-inch outlet draining to Blanket Bottom Creek floodplain



Preliminary Report and Recommendations February, 2009

Glen Oaks Road Culvert System

Introduction

This report is in response to a request from the Village of Clemmons that JEWELL Engineering Consultants (JEC) analyze the storm drainage system at 1330 Glen Oaks Road to determine if the existing stormwater drainage system meets Village design standards and to identify improvements where needed. The residence at 1330 Glen Oaks Road experiences occasional flooding, the residence at 1329 Glen Oaks Road reports increased moisture its crawl space, and runoff frequently overtops the road.

Design Standards

Design guidelines include ensuring that a culvert system will pass stormwater runoff from the 25-yr precipitation event without overtopping the street and without causing water surface elevations (WSEs) to reach critical elevations of nearby, permanent structures. Where appropriate, culvert design also includes compliance with NCDOT culvert design guidelines. Analyses and designs are performed based on fully developed watershed conditions.

Existing Systems

The existing drainage system under Glen Oaks Road consists of a single 24-inch reinforced concrete pipe (RCP) culvert with a pipe entrance approximately 160 feet upstream of the road and a grated inlet approximately 105 feet upstream of the road with both inlets on the 1330 Glen Oaks property. The existing system extends under Glen Oaks Road where it connects to a 24-inch high density polyethylene (HDPE) pipe that was installed by private property owners. Downstream of Glen Oaks Road, the 24-inch HDPE pipe extends approximately 200 feet before discharging to the Blanket Bottom Creek floodplain west of the 1339 Glen Oaks Road property line. A drainage area of approximately 19.1 acres flows to the Glen Oaks culvert. The grated inlet is prone to clogging with yard debris and an inlet grate typically cannot manage a significant amount of runoff.

Analyses

Hydrologic Analysis

Precipitation data was obtained from the National Oceanic and Atmospheric Administration (NOAA) website for this location. Aerial photography, topographic, and zoning data were obtained from the Forsyth County GIS system. The watersheds draining to the structure were delineated and a time of concentration for the watershed was calculated using the Kirpich equation. Using precipitation data for the 25-yr event, the Rational Runoff method was applied to calculate the peak discharge flow at the structure under fully developed land use conditions (as determined from existing zoning for the watershed).

Hydraulic Analysis

The hydraulic analysis included analyzing two different flow conditions: 1) the inlet capacity of the culvert (inlet control) and 2) the capacity of the culvert system when subject to hydraulic influences from downstream and/or culvert barrel friction (outlet control). Either of these two flow conditions can govern the capacity of the culvert system and both must be checked, with the one that results in the higher hydraulic (driving) head being the one that governs. Using the Federal Highway Administration's HY-8 culvert analysis computer program, culvert hydraulic analysis was applied to determine the capacity of the existing culvert system as well as to

Glen Oaks Road Culvert System

determine the improvements needed to provide adequate capacity to meet Village design standards.

Existing Conditions Analysis

The lowest finished floor elevation of 1330 Glen Oaks Road is lower than the low point in the street (see table below), thus the finished floor elevation is most critical in analyzing the performance of the existing system. It was determined that under inlet control, the Glen Oaks Road culvert does not meet Village design standards. For the results of this existing conditions analysis, see the tables below. An open inlet to the existing 24-inch culvert has been covered with soil and the pipe has been extended upstream on the 1330 property. Water from the watershed either flows to the grated inlet located approximately 105 feet east of the Glen Oaks Road right-of-way on private property or downstream directly over the road.

Moisture problems in the crawl space at 1329 Glen Oaks Road are deemed to be from a source other than stormwater at the right-of-way. This problem may be resulting from springs in the area or inadequate management of ground and surface waters on the property. Based on limited investigation, at this time JEC deems crawl space moisture to be a private property issue and not the responsibility of the Village of Clemmons.

Proposed Conditions Analysis

Using the Federal Highway Administration's HY-8 culvert analysis computer program, a variety of options was analyzed to determine the improvements needed to provide adequate capacity to meet Village design standards. An effective and efficient option was determined to be: add two additional 24-inch culverts to the existing 24-inch culvert under Glen Oaks Road. Add yard inlets at both the upstream and downstream ends of the culvert system. This approach is described in more detail below.

Analysis Results for Glen Oaks Road Culvert:

Rainfall Event	25-Year
Flow (Fully Developed Watershed)	66.9 CFS
WSEL Upstream of Existing Culvert w/Fully Developed Watershed	732.1 ^{1,2}
WSEL Upstream of Modified Culvert w/Fully Developed Watershed	726.3

¹ Exceeds 1330 Glen Oaks first floor elevation of 730.11

² Overtops Glen Oaks Road, low point elevation 731.26

Recommendations

Two additional 24-inch RCP culverts should be added to the existing 24-inch RCP under Glen Oaks Road. On either side of Glen Oaks Road, a yard inlet (YI) should be installed to connect the existing private 24-inch upstream system and the private 24-inch downstream system to the proposed 3 x 24-inch system under Glen Oaks Road. Excess runoff from a heavy precipitation event that is unable to get into the existing upstream system will flow over the ground surface to the proposed yard inlet in the Glen Oaks Road right-of-way. Grading to provide positive drainage from the existing grated inlet and surrounding area to the proposed yard inlet will be needed to manage excess runoff.

Glen Oaks Road Culvert System

The proposed downstream concrete yard inlet junction box connecting the 3 x 24-inch culvert to the existing private downstream 24-inch culvert on 1339 Glen Oaks Road may overflow at times during heavy precipitation events when the capacity of the 24-inch HDPE culvert is exceeded. Excess runoff can safely flow out of the yard inlet over the ground downstream to the Blanket Bottom Creek floodplain.

Work in the right-of-way will require traffic control and construction work will impact the driveway at 1330 Glen Oaks Road. Temporary construction easements and permanent drainage easements will be required to accomplish portions of the work. Other underground utilities such as sanitary sewers, water lines, power lines, gas lines, and telephone/TV/internet cables will likely be encountered in the work area.

Enclosed in this report are exhibits of the analysis area and preliminary cost estimates for the stormwater system improvements at Glenn Oaks Road.



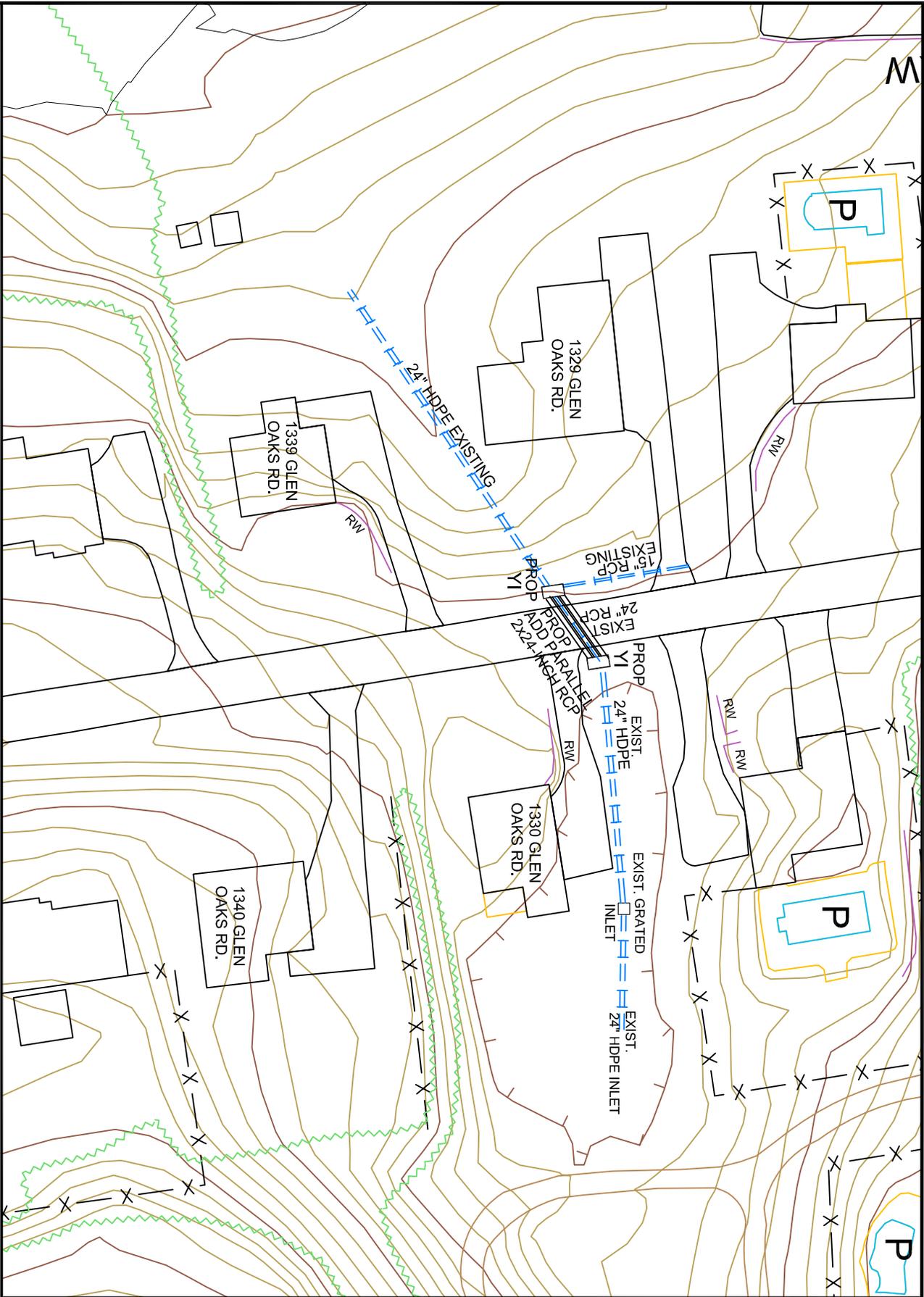
Forsyth County, NC

Map Scale
1 inch = 66 feet

Legend

-  Parcel Lots
-  Addresses
-  Major Thoroughfares
-  Expressway
-  Stream Names
-  City Limits
-  BETHANIA
-  CLEMMONS
-  HIGH POINT
-  KERNERSVILLE
-  KING
-  LEWISVILLE
-  RURAL HALL
-  TOBACCOVILLE
-  WALKERTOWN
-  WINSTON-SALEM

Disclaimer: Forsyth County cannot guarantee the accuracy of this information, and the County hereby disclaims all warranties, including warranties as to the accuracy of this information.



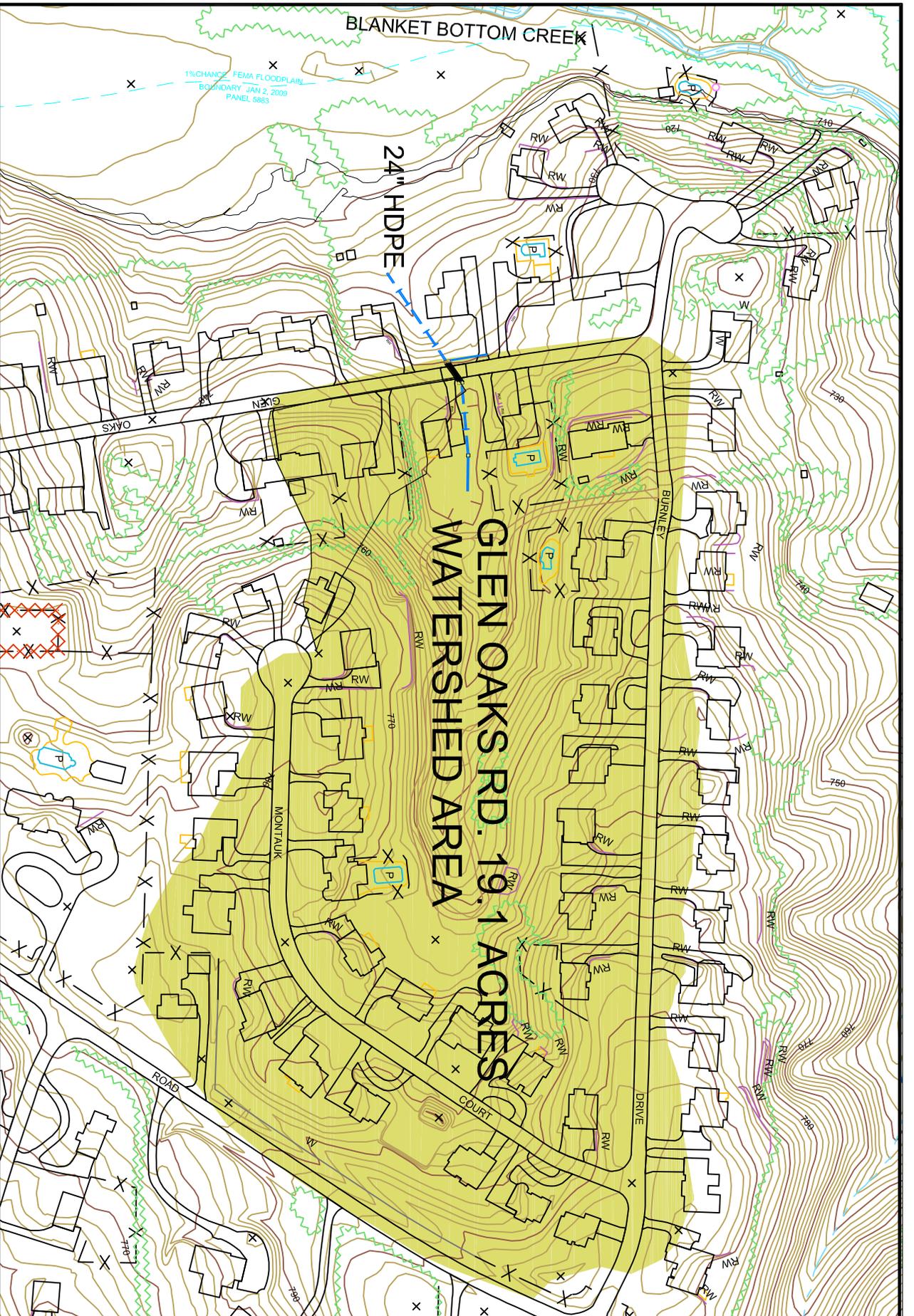
GLEN OAKS ROAD DRAINAGE SYSTEM IMPROVEMENT

NOTES:

- 24" CULVERT REMAINS WITH 2 ADDITIONAL PARALLEL 24-INCH CULVERTS
- ADD NCDOT CONCRETE YARD INLETS UPSTREAM AND
- AND DOWNSTREAM OF GLEN OAKS ROAD R/W

SCALE: 1" = 60'





**GLEN OAKS RD. 19.1 ACRES
WATERSHED AREA**

GLEN OAKS ROAD WATERSHED AREA

SCALE: 1" = 200'



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BLANKET BOTTOM CREEK

1% CHANCE FEMA FLOODPLAIN
BOUNDARY JAN 2, 2009
PANEL 5883

24" HDPE

OAKS

GLEN

MONTAUK

COURT

DRIVE

BURNLEY

ROAD

750

760

770

780

790

740

760

720

730

740

750

760

770

780

790

740

750

760

770

780

790

740

750

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770

780



PRELIMINARY COST ESTIMATE

	JOB NO.	JEC	02-087-009-016		
	LOCATION:	GLEN OAKS ROAD, CLEMMONS			
	JOB NAME:	CAPITAL IMPROVEMENT PROJECT			
	COMPILED BY:	BETTY A. FARR, PE			
	DATE:	4/13/2010			

ITEM	QUANTITY	UNIT	DESCRIPTION	UNIT COST	COST
------	----------	------	-------------	-----------	------

CULVERT MODIFICATION AND ASSOCIATED SITE WORK

ITEM	QUANTITY	UNIT	DESCRIPTION	UNIT COST	COST
Site work/culvert replacement at Glen Oaks Road					
1	1	EA	Mobilization	\$ 2,500.00	\$ 2,500
2	6	DAY	Traffic control (1/2 road closure-road cannot be completely closed off for work)	\$ 300.00	\$ 1,800
3	1,500	SF	Machine grading/excavation at inlets and drainage swale to YI	\$ 1.75	\$ 2,625
4	90	LF	Install 2x24-inch RCP, trench and backfill (45 lf each)	\$ 105.00	\$ 9,450
5	11	TON	Misc gravel associated with storm structures	\$ 67.00	\$ 737
6	2	EA	Concrete yard inlet doghouse style on each side of Glen Oaks Rd (8' x 5')	\$ 4,500.00	\$ 9,000
7	120	TON	Riprap for drainage to YI, CLASS B	\$ 53.00	\$ 6,360
8	1,200	SF	Soil stabilization fabric under RipRap	\$ 3.50	\$ 4,200
9	5	EA	Inlet protection when construction crew not on site (5-days)	\$ 1,200.00	\$ 6,000
10	1	LS	Existing sanitary sewer crossing increase construction Costs	\$ 5,000.00	\$ 5,000
11	5	CY	concrete (6") driveway and apron replace/repair	\$ 300.00	\$ 1,500
12	1,500	SF	Fine finish grading may include hand raking	\$ 0.50	\$ 750
13	40	LF	Waterline Utility relocation-potential valve box, waterline, etc	\$ 25.00	\$ 1,000
14	2,500	SF	Seeding and stabilization	\$ 0.35	\$ 875
15	25	TON	ABC stone base under asphalt	\$ 50.00	\$ 1,250
16	80	SY	Asphalt repair-Remove	\$ 6.00	\$ 480
17	10	TON	Ashpalt Surface (2-inch) I-19	\$ 110.00	\$ 1,100
18	5	TON	Ashpalt Surface (1-inch) SF-9	\$ 105.00	\$ 525
19	15	TON	Asphalt placement	\$ 105.00	\$ 1,575
20	3	TON	Asphalt for plant mix pgPG64-22	\$ 500.00	\$ 1,500
21	1	EA	Pavement Striping	\$ 350.00	\$ 350
					\$ -
					\$ -
					\$ -
Work in Right-of-way if utility encountered					
					\$ -
1	1	EA	Existing sewer if leader impacted	\$ 1,500.00	\$ 1,500
2	1	EA	Existing water line if impacted	\$ 1,500.00	\$ 1,500
3	1	EA	Existing Fiber Optic in r/w if impacted	\$ 3,000.00	\$ 3,000
4	100	LF	Cable-phone in ground coordination/relocation	\$ 10.00	\$ 1,000
					\$ -
Erosion Control and finish work					
					\$ -
5	100	LF	Silt Fence	\$ 3.50	\$ 350
6	200	SY	Matting for Erosion Control swale outlet side and drainage ditch	\$ 1.47	\$ 294
7	2	EA	temporary Stone outlet	\$ 1,500.00	\$ 3,000
8	10	TON	Erosion Contro #57 misc stone	\$ 50.00	\$ 500
9	2	EA	Wire and stone Inlet control	\$ 500.00	\$ 1,000
10	1		Permitting fees, USACE, NC DENR	\$ 5,000.00	\$ 5,000
					\$ -
					\$ -
					\$ -
			Subtotal		\$ 69,721
					\$ -
			SUBCONTRACTOR TOTAL		\$ 69,721
			CONTINGENCY	30%	20,916
			SUBCONTRACTOR TOTAL FOR SITE		\$ 90,637
			GENERAL CONTRACTOR OVERHEAD & PROFIT	15%	13,596
			GENERAL CONTRACTOR TOTAL		\$ 125,149
					\$ -
			Engineering Plans, specifications, as-built drawings	25%	\$ 31,287
			Glen Oaks Road Total Cost		\$ 156,436

EXCLUSIONS:					
1)	ASSUME ALL SURVEYING BY OTHERS				
2)	ASSUME NO SIGNIFICANT UTILITY RELOCATION REQUIRED				
3)	ASSUME VILLAGE WILL OBTAIN ALL NECESSARY TEMPORARY AND PERMANENT EASEMENTS				
NOTES:					
1)	THIS IS A PRELIMINARY COST ESTIMATE				

**7510 LASATER ROAD
EXISTING CONDITIONS ANALYSIS AND
PROPOSED IMPROVEMENTS**

Revised and Updated
August 2020



PREPARED FOR:

**Village of Clemmons
Stormwater Department**

PREPARED BY:

JEWELL-LJB

311 S. Main St.
Kernersville, NC 27284
(336) 996-9974

LJB Inc. NC Firm # C-4123

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APPENDIX C - INFORMATION AND PHOTOS COMPILED BY VILLAGE STAFF

INTRODUCTION

This report is in response to a request from the Village of Clemmons that JEWELL Engineering Consultants/LJB Inc. (JEWELL-LJB) analyze the culvert under Lasater Mill Road to determine if the existing culvert meets Village design standards and to size an adequately sized replacement if needed. Although overtopping of Lasater Road has not been reported, the upstream home at 7510 has reported frequent flooding in recent years. A vicinity map for the culvert crossing is provided as Figure A-1. All figures for this report are included in Appendix A.

DESIGN STANDARDS

Village stormwater infrastructure design guidelines include ensuring that a culvert system will pass the estimated peak discharge rate from stormwater runoff in a 4% annual chance (25-yr) design storm event without overtopping the street and without causing water surface elevations (WSELs) to reach critical elevations of nearby permanent structures. Where appropriate, culvert design also includes compliance with NCDOT hydraulic design guidelines for highway culverts, which recommend limiting headwater depth to pipe diameter ratios to 1.2 or less. Analyses and designs are performed based on fully developed watershed conditions. Although peak discharges at some culvert crossings may be attenuated by upstream flood storage, the Village design guidelines are based on the watershed peak discharge rate without attenuation that, under existing conditions, causes inundation on upstream properties.

The Regional General Conditions for 2017 Nationwide Permits for the Wilmington District of the US Army Corps of Engineers (Corps), and correlated water quality certifications from the North Carolina Department of Environmental Quality (NCDEQ), require that culverts greater than 48" in diameter be buried at least one foot below the bed of the stream. In addition, the main culvert is to be designed to approximate the bank-full cross-sectional area. Additional culverts or culvert barrels at the crossing are to be installed at a higher elevation, or with inlet sills, such that normal flows and runoff from frequent storm events is routed only to the main culvert.

EXISTING DRAINAGE INFRASTRUCTURE

The existing culvert under Lasater Road is a 48" reinforced concrete pipe (RCP). Village staff report that the pipe is in fair condition. Figure A-2 shows the topography of the area in the vicinity of the culvert, based on 2018 QL2 LIDAR downloaded from the North Carolina Floodplain Mapping Program (NCFMP) spatial data information website. Based on the LIDAR, the existing pipe inverts are estimated at 704.8 feet upstream and 704.0 downstream. The pipe length, based on Village of Clemmons GIS database information, is approximately 124 feet.

The LIDAR elevation of the sag point in Lasater Road, approximately 125 feet north of the culvert crossing, is estimated at 722.8 feet. The lowest adjacent grade to the house at 7510 Lasater Road is 712.2 feet, based on the LIDAR. Estimated construction date for the house is 2008. Owners have reported flooding multiple times in recent years.

Hydrologic Analysis

The contributing drainage area at the culvert crossing is 267 acres. The predominant land use is single-family residential, with the majority of lot sizes averaging ½ acre. Figures A-3 and A-4 show the existing and expected future land use conditions in the contributing watershed, categorized based on NCRS Curve Number urban land use tables. Most of the watershed is fully developed, with only a few parcels judged to have potential for commercial or multi-family residential development.

The peak discharges for the 50%, 20%, 10% and 4% annual chance storm events were estimated using HEC-HMS with NCRS methodology for rainfall/runoff estimates, watershed travel time, and unit hydrographs. The storm events are 6-hour duration, without an assumption of any initial

abstraction. The peak flow estimates for the watershed draining to the Lasater Road crossing, for existing and future watershed conditions, are listed in Table 1.

The sag elevation of Lasater Road is about 18 feet above the stream bed. A very large area, extending up to homes on Donegal Court, has potential to be inundated before Lasater Road would be overtopped. The flood storage volume upstream of Lasater Road reduces the actual existing peak flow at the culvert crossing such that it would not be expected to overtop in the 25-year design storm event.

We also ran a hydrologic model for an estimate of the recorded rainfall over the watershed on August 6th based on NexRAD data. The rainfall intensities for that storm had roughly a 500-year return period. The estimated watershed peak flow in the model we created was 656 cfs but the attenuated flow was estimated as 241 cfs. The maximum flood elevation at Lasater Road was about 722 feet, not quite a foot below the sag point.

TABLE 1. PEAK FLOW DISCHARGES BASED ON HEC-HMS ANALYSIS
(Discharges in cubic feet per second (cfs))

	50%	20%	10%	4%
Existing Conditions – Watershed Peak Flows	178	278	347	442
Existing Conditions – Peak Flows Attenuated by Flood Storage	135	167	181	198
Future Conditions – Watershed Peak Flows	206	292	362	459

Hydraulic Analysis

Analysis using the Federal Highway Administration’s (FHWA’s) HY-8 software program indicates that the 25-year storm peak discharge from the contributing watershed would overtop Lasater Road if not attenuated by the flood storage and that relatively frequent storm events have potential to cause backwater above the basement elevation of the home at 7510. When the analysis includes the available upstream flood storage, the 25-year design storm event is estimated to flood the upstream areas to an elevation of 717.3 feet, flooding the home at 7510 Lasater Road with about a 5-foot depth, but not overtopping the road.

PROPOSED IMPROVEMENT OPTIONS

In order to reduce the flood risk for the home at 7510 Lasater Road, the Village proposes to replace the existing culvert with one that meets Village design standards. Using the HY-8 culvert analysis computer program, several options were analyzed to determine the improvements needed to provide adequate capacity to meet Village design standards. For budgeting purposes, we propose replacing the 48” RCP with a 84” RCP buried 1 foot below the streambed, with a 60” RCP floodplain culvert, per Corps/NCDEQ requirements, installed approximately one foot above the stream bed.

The estimated flood elevation in the 4% annual chance storm event at the culvert is 711.8 feet with this culvert configuration, slightly below the estimated basement finished floor elevation at 7510 Lasater Road of 712.2 feet.

An opinion of probable costs for the culvert replacement project is provided as Appendix B. This project is expected to require 401/404 permit approval from the Corps and NCDEQ. In addition, a sanitary sewer force main crosses over the culvert crossing, and it is assumed that construction of a bypass will be required in order to facilitate continuous service during the culvert installation project.

ASSOCIATED POLICY IMPLICATIONS FOR CONSIDERATION

The house at 7510 Lasater Road was built in 2007-2008, based on historical aerial photography. The basement level is at elevation which is susceptible to flooding and has a door opening to the stream side of the house. Even after a culvert replacement based on Village design standards, the home will remain susceptible to flooding in storms more extreme than the 4% annual chance flood. If this stream reach were included in FEMA mapping and regulation, the homeowners would be required to purchase flood insurance.

For new subdivisions, construction of homes at significant risk of flooding can be avoided by requiring developers to analyze and project flood elevations for a 1% annual chance flood event, even in relatively small watersheds, and then permitting the subdivision plan with a requirement for minimum finished floor elevations (FFE) on flood-prone parcels to be at or above the level of the 1% annual chance elevations. This is done in some municipalities.

For existing parcels, the Village may want to consider instituting a policy which would require a review by stormwater staff before building permits are granted on parcels where there is a stream on the property. That would allow the Village to at least offer feedback to the builder in regard to possible flood risks associated with a relatively low FFE.

APPENDIX A

Figure A-1. Vicinity Map

Legend

 7510 Lasater Rd



Google Earth

© 2018 Google

2000 ft

Legend

- Water Mains - WS GIS
- Sewer Mains - WS GIS
- Drainage Culverts - VOC GIS
- Property Lines - Forsyth Co GIS
- Contours from 2017 LIDAR



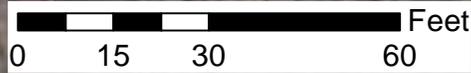
7510

15in HDPE

48in RCP

15in RCPe

Aerial photography from
NC Center for Geographic
Information Analysis



**Figure A-2. 7510 Lasater Road
Existing Culvert and Area Topography**

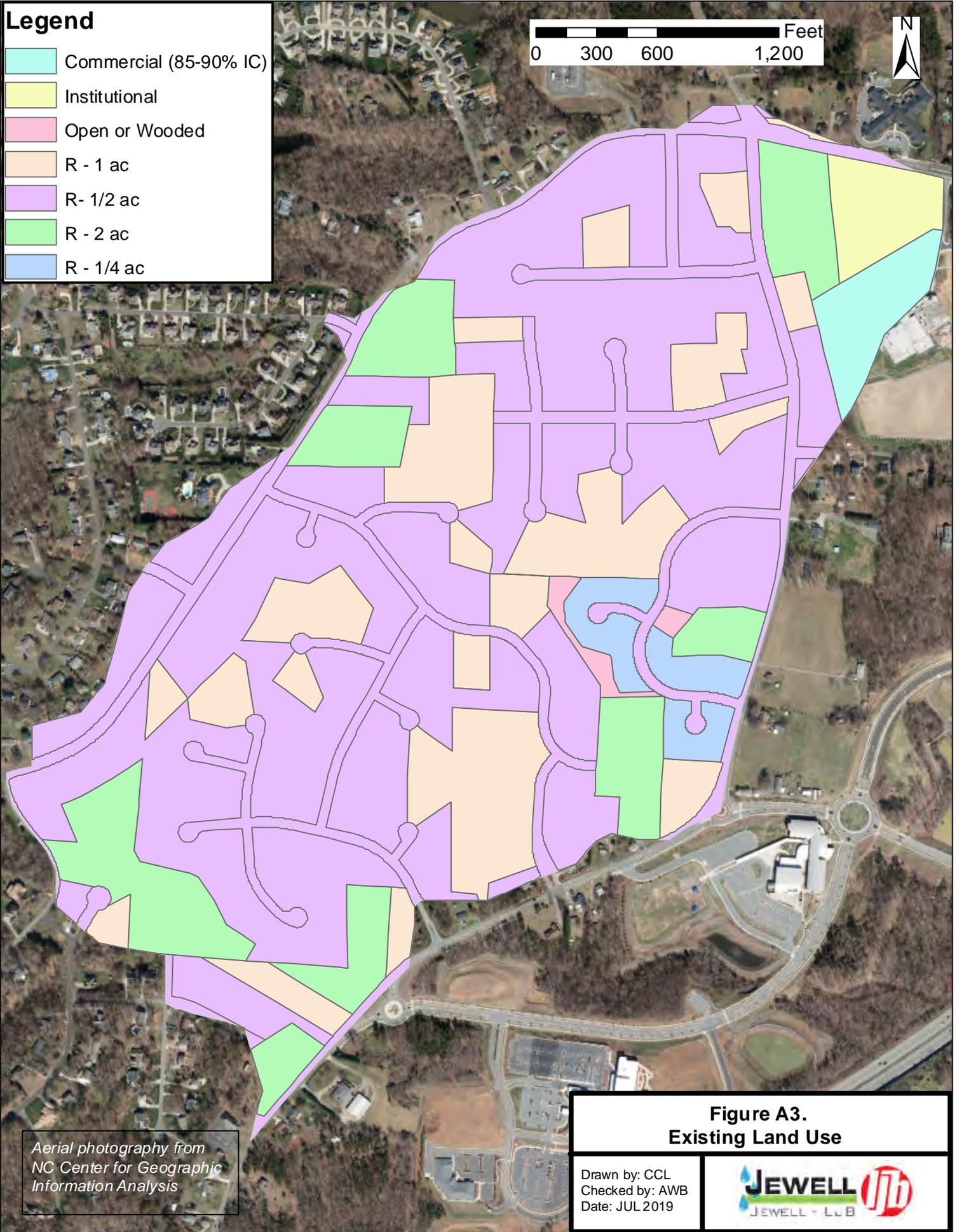
Drawn by: CCL
Checked by: AWB
Date: JUL 2019



Legend

- Commercial (85-90% IC)
- Institutional
- Open or Wooded
- R - 1 ac
- R - 1/2 ac
- R - 2 ac
- R - 1/4 ac

0 300 600 1,200 Feet



*Aerial photography from
NC Center for Geographic
Information Analysis*

**Figure A3.
Existing Land Use**

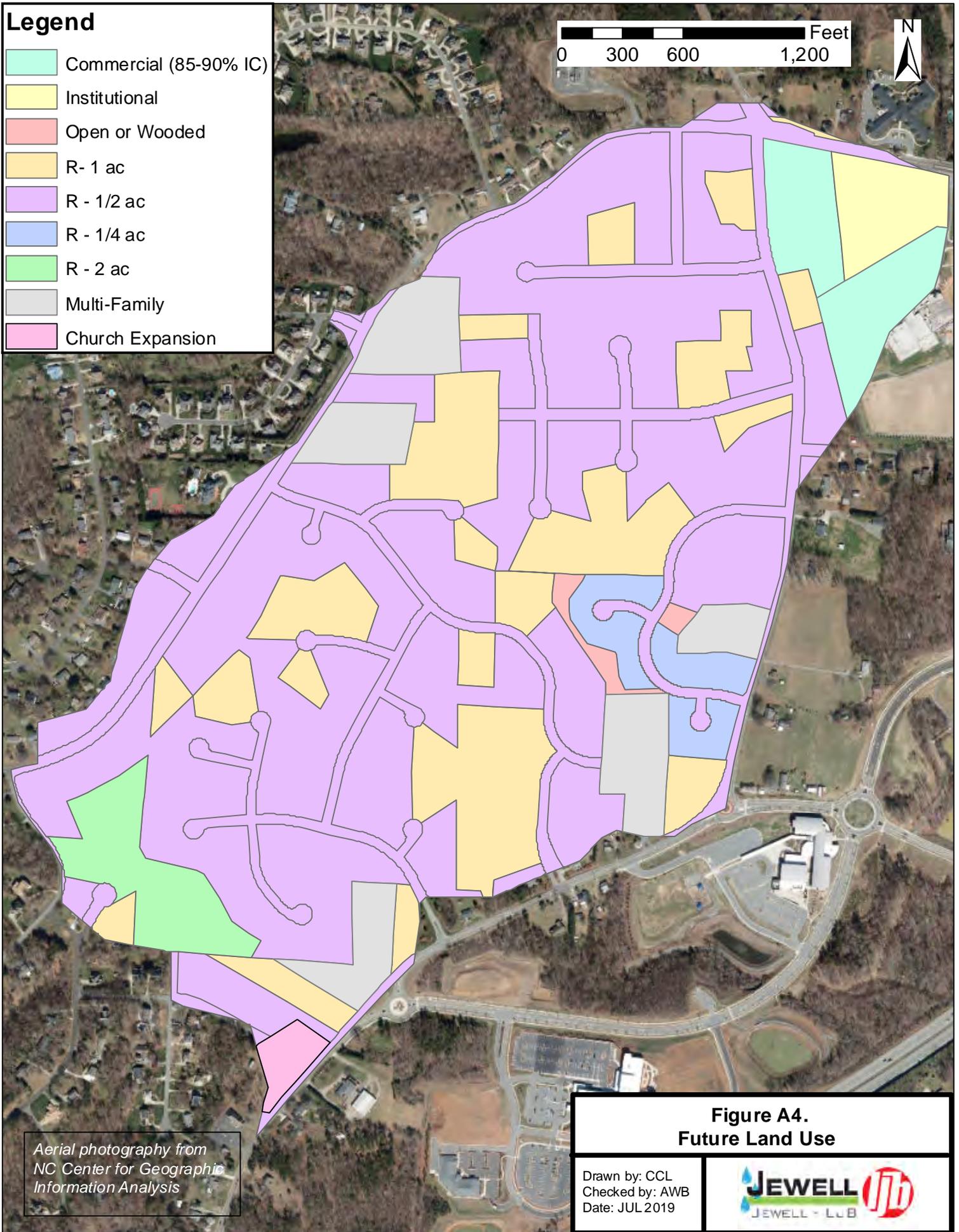
Drawn by: CCL
Checked by: AWB
Date: JUL 2019



Legend

- Commercial (85-90% IC)
- Institutional
- Open or Wooded
- R- 1 ac
- R - 1/2 ac
- R - 1/4 ac
- R - 2 ac
- Multi-Family
- Church Expansion

0 300 600 1,200 Feet



**Figure A4.
Future Land Use**

*Aerial photography from
NC Center for Geographic
Information Analysis*

Drawn by: CCL
Checked by: AWB
Date: JUL 2019



Legend

-  Proposed Culvert Replacement
-  Ex. Drainage Culverts - VOC GIS
-  Sewer Mains - WS GIS
-  Water Mains - WS GIS
-  Property Lines - Forsyth Co GIS
-  Contours from 2017 LIDAR

Existing 48" RCP to be replaced with 1-78" RCP with two 48" RCPs at floodplain bench elevation, one on either side. Concrete headwall with wingwalls to be added on each end. It is expected that the water main and the sanitary sewer force main will remain at elevations above the new culvert installation.



7510



Aerial photography from
NC Center for Geographic
Information Analysis



**Figure A-5. 7510 Lasater Road
Proposed Culvert Replacement**

Drawn by: CCL
Checked by: AWB
Date: JUL 2019



APPENDIX B

APPENDIX C

Village of Clemmons - Watershed Drainage (preliminary analysis)
 Property Street Address - 7510 Lasater RD



Legend

- Streams
- Clipped_tax_Polygon_2018
- Inlet
- Culvert_Line
- Topo_West
- STREETS
- Culvert

clemmons_watershed

Id

- LASATER

258 Acres
Drainage Area

48 inch RCP
CULVERT

LASATER



CREATED BY: Emily Harrison & Wesley Kimbrell

TAXPIN: 5883-43-0545.00
 ADDRESS: 7510 Lasater Rd
 OWNER LISTED ON TAX RECORD:
 French, James Kenneth;
 French, Carey Leigh
 AERIAL PHOTO DATE: SPRING 2014



NOTES:
 Watershed drainage area
 Approximate watershed analysis
 258 acre drainage to property
 48 inch culvert pipe under Lasater Rd
 Property not located in FEMA floodplain/flood zone
 Property flood during steady rainfall events





(1 of 3) ▶ □

Parcels

Detailed Property Info - [Click Here](#)

Parcel Number: 5883-43-0545.00
 REID: 5883430545000

Current Owner 1: French James Kenneth
 Current Owner 2: French Carey Leigh

[Zoom to](#) ⋮

Village of Clemmons - Watershed Drainage (preliminary analysis)
 Property Street Address - 7510 Lasater RD



0 500 1,000 2,000 3,000 4,000 Feet

CREATED BY: Emily Harrison & Wesley Kimbrell

TAXPIN: 5883-45-0545.00
 ADDRESS: 7510 Lasater Rd
 OWNER LISTED ON TAX RECORD:
 French, James Kenneth; French, Carey Leigh
 AERIAL PHOTO DATE: SPRING 2014



NOTES:
 Watershed drainage area
 Approximate watershed analysis
 258 acre drainage to property
 48 inch culvert pipe under Lasater Rd
 Property not located in FEMA floodplain/flood zone
 Property flood during steady rainfall events







INTERSECTION OF MORAVIAN HEIGHTS LANE
AND MESSIAH PARK TRAIL
EXISTING CONDITIONS ANALYSIS AND
PROPOSED IMPROVEMENTS

February 2020



PREPARED
FOR:
Village of Clemmons
Stormwater Department

PREPARED
BY:
JEWELL-LJB
311 S. Main St.
Kernersville, NC 27284
(336) 996-9974

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APPENDIX C - INFORMATION AND PHOTOS COMPILED BY VILLAGE STAFF

INTRODUCTION

This report is in response to a request from the Village of Clemmons that JEWELL Engineering Consultants/LJB Inc. (JEWELL-LJB) analyze the existing drainage system and propose appropriate improvements to address failing infrastructure of the intersection at Moravian Heights Lane and Messiah Park Trail. The existing yard inlet/junction box where ditches converge at the street corner at 5495 Messiah Park Trail has sinkholes around it and evidence of voids and infiltration at the bottom. Some of these problems have possibly been aggravated by drainage system modifications implemented by private property owners. It is likely that the junction box itself was installed by a resident or by a contractor hired by the property owner. A vicinity map for the area is provided as Figure A-1. All figures for this report are included in Appendix A.

DESIGN STANDARDS

Village stormwater infrastructure design guidelines include ensuring that a culvert under a public road will pass stormwater runoff from a 4% annual chance (25-year) storm event without overtopping the street and without causing water surface elevations (WSELs) to reach critical elevations of nearby permanent structures. Where feasible, culvert design also includes compliance with NCDOT hydraulic design guidelines for highway culverts, which limit headwater to pipe depth ratios to 1.2 or less. Analyses and designs are performed based on fully developed watershed conditions.

EXISTING DRAINAGE INFRASTRUCTURE

The drainage infrastructure and the area topography are shown in Figure A-2. There are two culverts and two ditches leading to the junction box and a 42" RCP exiting the box and running under Moravian Heights Lane and discharging to the open channel on the south side. Flow from the ditch on the north side of Moravian Heights Lane draining from the west towards Messiah Park Trail is routed through an 18" RCP under Messiah Park Trail to the junction box. A ditch draining from the east along Messiah Park Lane discharges directly to the junction box. From the north, both an open ditch and an underlying 18" RCP drain to the junction box. The upstream end of the 18" RCP has been buried and bricked off, but video inspection indicates there is still flow entering the pipe at or near that end.

Both of the roadside ditches on the property and along the rights-of-way at 5495 Moravian Heights Lane appear to have been modified by the property owner with riprap added and herbicide applied to keep them clear of vegetation. The practices are likely to be contributing to ongoing erosion in the ditches. The history of the change from pipe to ditch is unknown. Notes and photos compiled by Village stormwater staff are included as Appendix C.

HYDROLOGIC AND HYDRAULIC ANALYSIS OF EXISTING SYSTEM

We estimated the area draining to the junction box as totaling 39.3 acres, including 8.6 acres from US 421 and areas upstream. Approximately 5.7 acres drains to the 18" RCP under Messiah Park Trail. From the east, 3.1 acres drains to the ditch entering the yard inlet/junction box. The largest portion of the drainage area, about 30 acres, drains into the corner inlet/junction box from the north side. The 4% annual chance peak flow to the junction box and through the 42" RCP is estimated as 118 cfs.

We reviewed the NCDOT plans for the proposed Northern Beltway interchange with US 421, and concluded that the drainage area north of US 421 will be re-routed through the project area towards Muddy Creek instead of under the highway and to the south of US 421. The projected future watershed draining to the intersection at Moravian Heights Lane and Messiah Park Trail is expected to be reduced to 30.9-acre area. We calculated a peak runoff rate in a 4% annual chance storm event of 108 cfs.

Analysis of the existing 42" RCP indicates that it can convey the peak discharge for the 4% annual chance flow without coming out of the box and flooding the intersection, but the water level in the box will be about 7 feet, equating to an HW/D ratio of about two. The 18" RCP under Messiah Park Trail adequately conveys the 25-year design storm peak, and the contributing watershed can be considered built-out.

The conveyance capacity in the ditch between the driveway for 5495 Moravian Heights Lane and the junction box is inadequate, and the opening into the yard inlet is also too small. One practical indicator is that the upstream pipe culvert under Marty Lane and along Messiah Park Trail is a 30" RCP and the downstream open channel is significantly deeper and more well-defined than the ditch along 5495 Moravian Heights Lane. To the right is a photo of the outlet of the 30" RCP and the channel leading to the 15" RCP driveway pipe at 5495 Moravian Heights Lane.



PROPOSED IMPROVEMENT OPTIONS

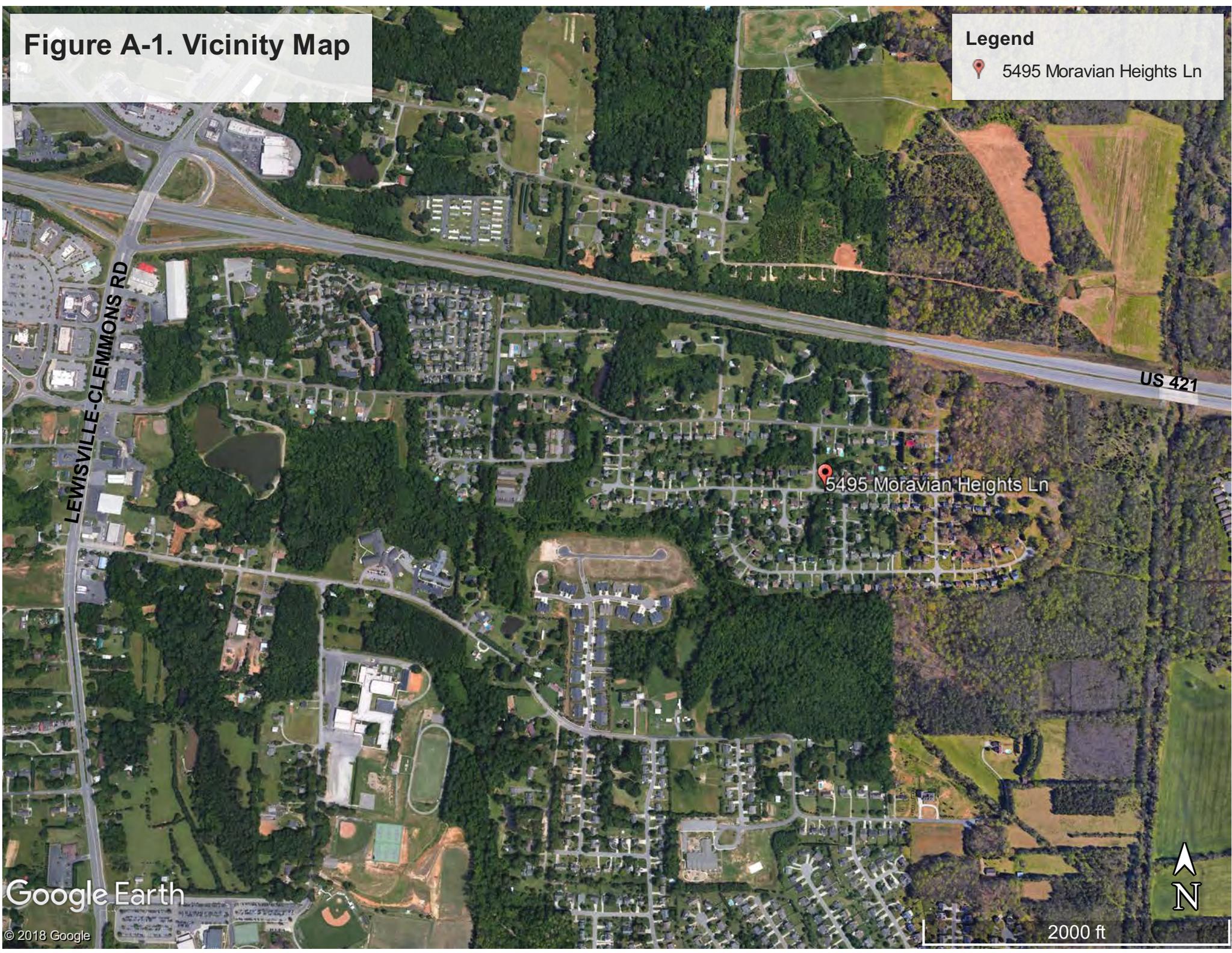
In order to provide adequate conveyance capacity along Messiah Trail from the property owner's driveway into a repaired or replaced junction box, the ditch and the opening at the yard inlet both need to be appropriately sized. We also recommend removal of the 18" RCP and installation of a French drain beneath the ditch to capture underground flows, as opposed to trying to excavate and compact all of the potential areas from which the existing infiltration into the blocked pipe and the bottom of the junction box may be originating. For grading of the channel, the peak flow would result in a depth of just under 2 feet in a channel with 3-foot bottom width and 3:1 side slopes on approximately a 1% grade. Keeping the channel slope mild enough to be stable as a grassed channel will require having boulder drops or concrete steps at the downstream end to accommodate inflow to the structure with sufficient hydraulic head.

The yard inlet/junction box needs to be replaced with one that is designed and constructed with openings large enough to convey peak design flows into the box without water backing up over the roadway. This will likely require a concrete structure designed with openings on three sides for the ditch flows from the north and east, and possibly also a grate opening on the top to facilitate additional intake. There are various box configurations that could work as a pre-cast or poured-in-place structure. We estimated that 3-24"Wx18"H openings at an elevation roughly 18" below the existing ditch inflow elevation of the structure, plus a 36" x 24" grated opening on the top, would be sufficient for getting the design storm peak flow into the box without inundating the street intersection. Openings that large would require some type of cross-bars as a child safety measure. Figure A-5 notes proposed improvements and a cost estimate for budgeting purposes is provided as Appendix B. Notes and photos compiled by Village stormwater staff are included as Appendix C.

APPENDIX A

Figure A-1. Vicinity Map

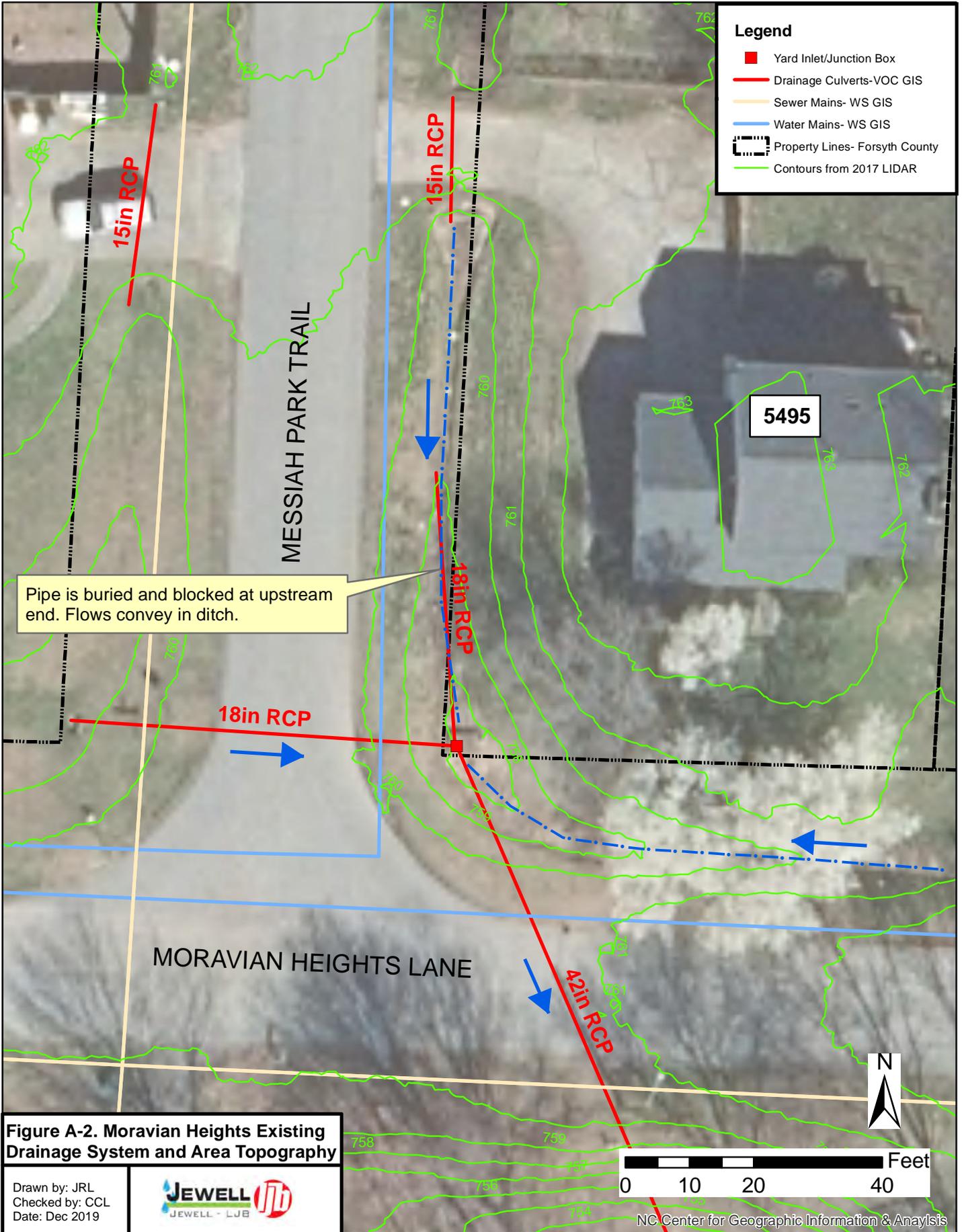
Legend
📍 5495 Moravian Heights Ln



Google Earth

© 2018 Google

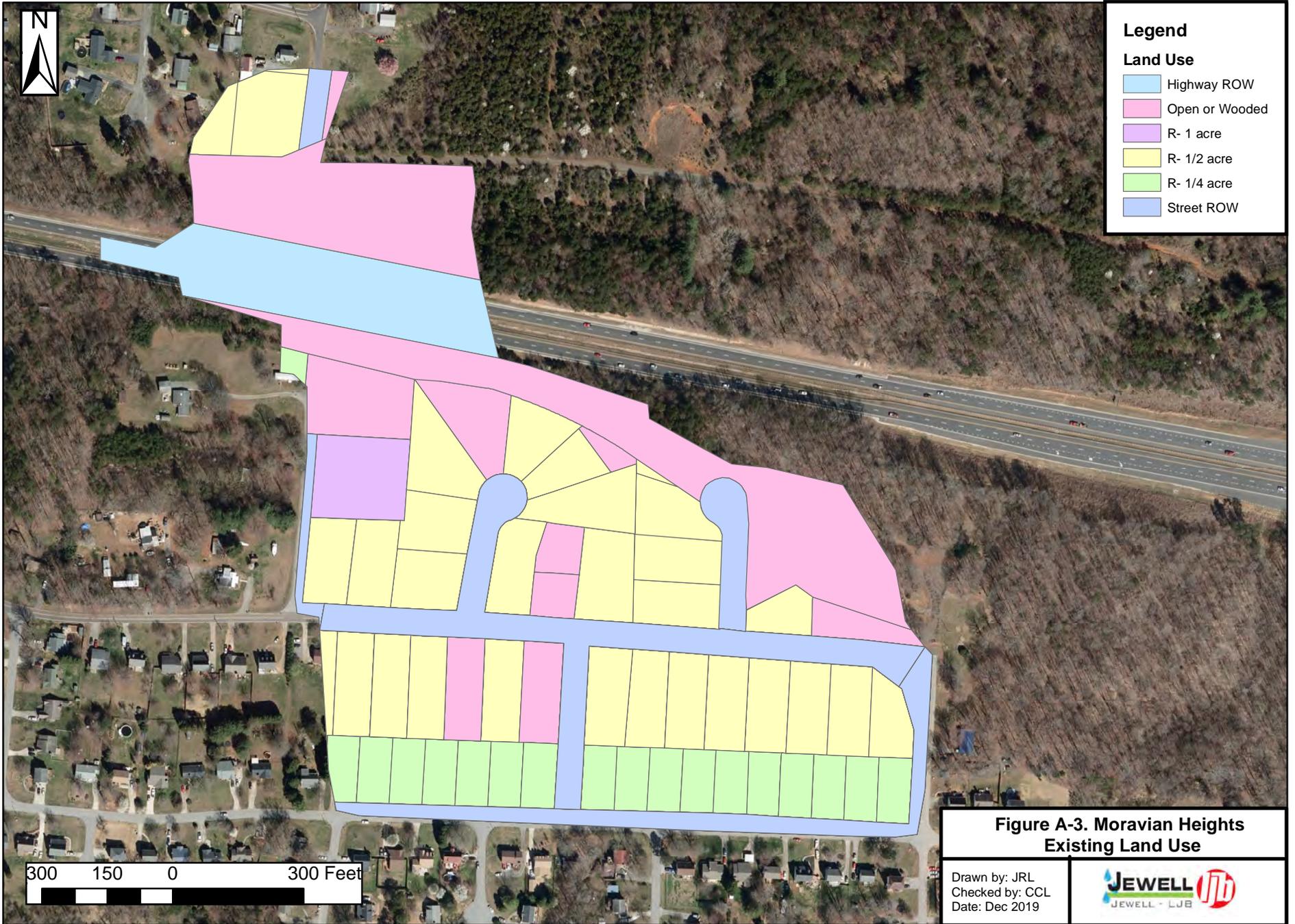
2000 ft

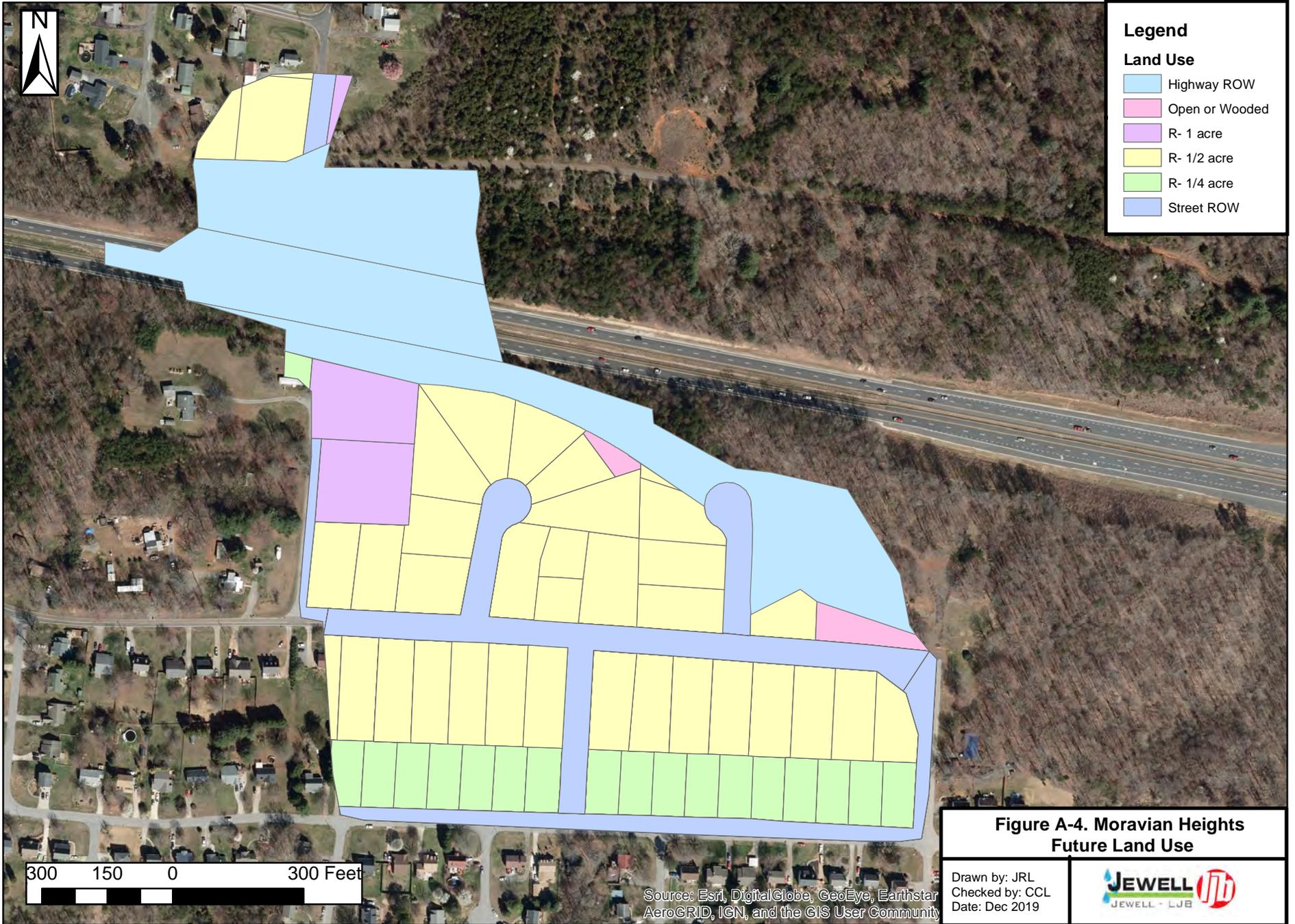


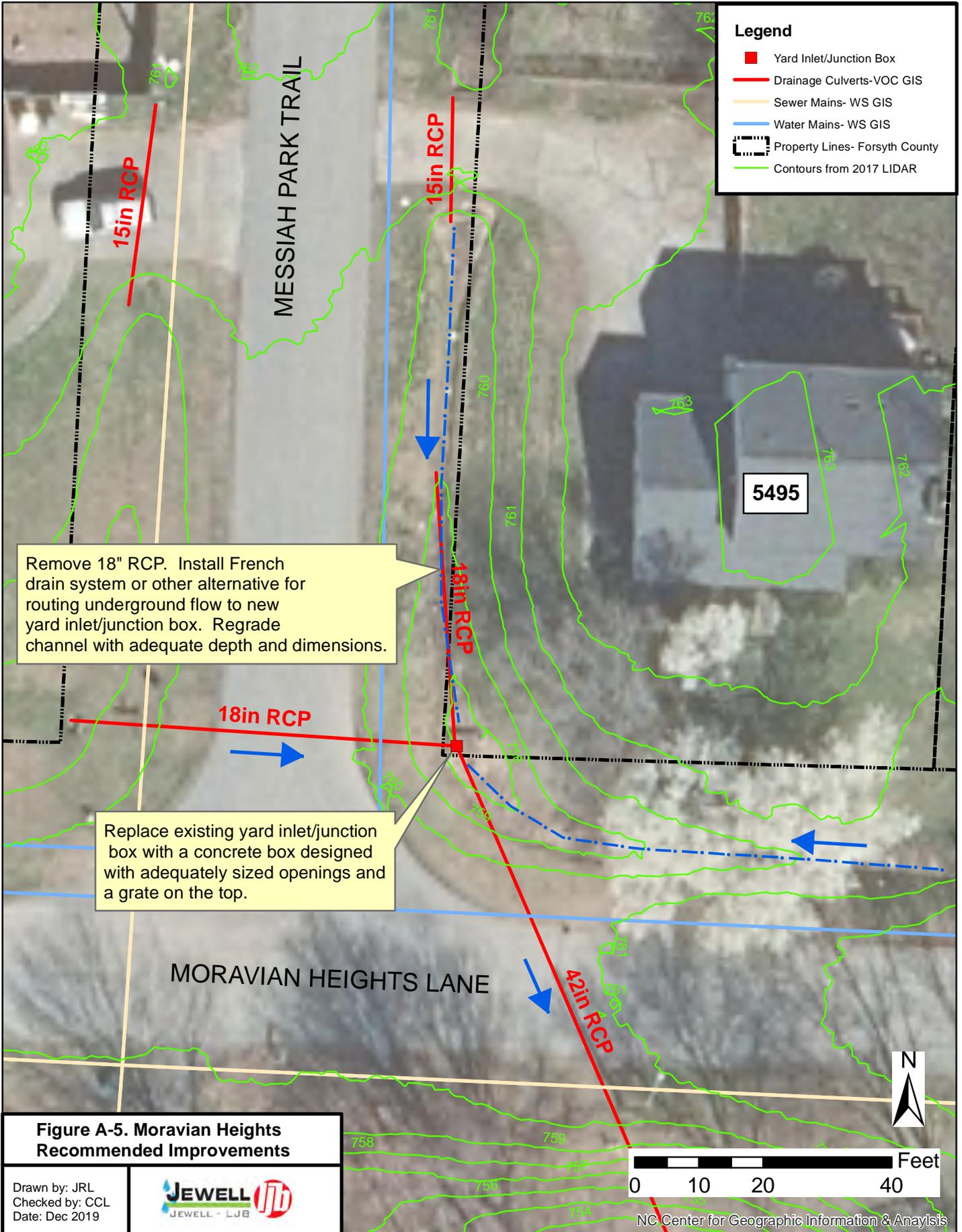
Pipe is buried and blocked at upstream end. Flows convey in ditch.

5495









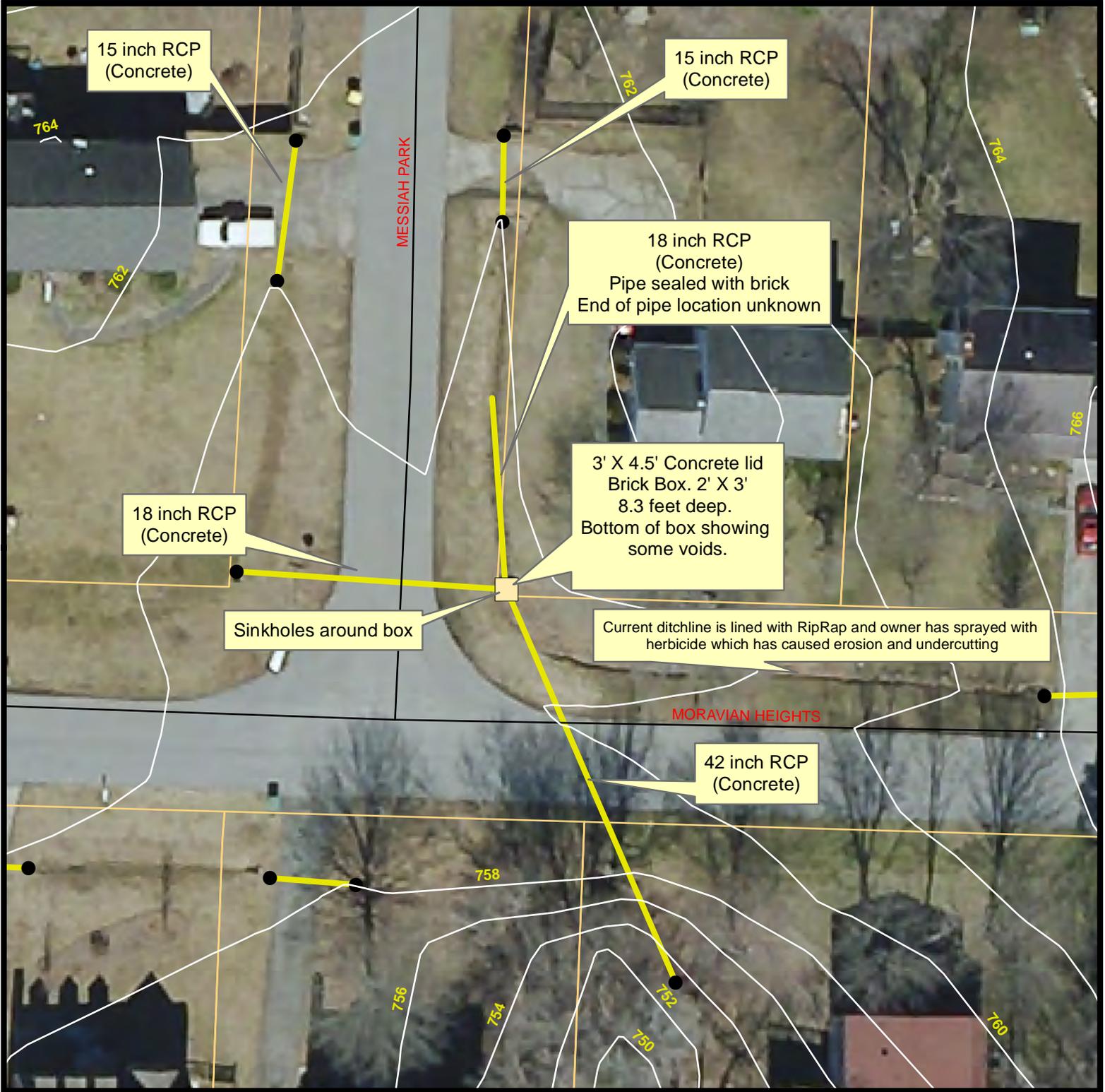
APPENDIX B

PRELIMINARY COST ESTIMATE

LOCATION:	5495 MORAVIAN HEIGHTS LANE				
JOB NAME:	MORAVIAN HEIGHTS DRAINAGE IMPROVEMENTS				
LJB #:	0117329A.00 (1)				
COMPILED BY:	CYNTHIA C. LANCASTER, P.E.				
DATE:	February 2020				
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	COST
1	Mobilization & Demobilization	1	LS	5,000	\$ 5,000
2	Construction Staking / Surveying	1	LS	1,200	\$ 1,200
3	Traffic Control	1	LS	2,000	\$ 2,000
4	General Erosion & Sediment Control Practices	1	LS	3,000	\$ 3,000
5	Control of Water	1	LS	1,000	\$ 1,000
6	Clearing & Grubbing	1	LS	500	\$ 500
7	Comprehensive Grading-excavate and backfill around box; channel	1	LS	8,000	\$ 8,000
8	Undercut excavation & disposal	15	CY	20	\$ 300
9	Select material from off-site	15	CY	50	\$ 750
10	Remove and dispose of 18" RCP	20	LF	35	\$ 700
11	Remove and dispose of existing junction box	1	LS	3,000	\$ 3,000
12	French drain with geotextile, filter stone and backfill	20	LF	150	\$ 3,000
13	New junction box/yard inlet w/ openings and bars	1	EA	15,000	\$ 15,000
14	Class B riprap	20	TN	120	\$ 2,400
15	Boulder or concrete steps around inlet	1	LS	2,000	\$ 2,000
16	Geotextile fabric	1	LS	1,500	\$ 1,500
17	Temporary construction zone fencing	150	LF	3.00	\$ 450
18	Erosion Control #57 misc stone	5	TON	70	\$ 350
19	Temporary seeding and mulching-erosion control as needed	200	SY	4.00	\$ 800
20	Permanent Seeding	1	LS	1,000	\$ 1,000
					\$ -
					\$ -
					\$ -
					\$ -
	Subtotal				\$ 52,000
					\$ -
	CONTRACTOR TOTAL				\$ 52,000
	CONTINGENCY			20%	10,400
	CONTRACTOR TOTAL FOR SITE				\$ 62,400
	Engineering design, construction plans, permitting, specifications, construction phase assistance			20%	\$ 12,500
	Morvian Heights Drainage Improvements Total Cost				\$ 74,900
	EXCLUSIONS:				
	1) ASSUME VILLAGE WILL OBTAIN ALL NECESSARY TEMPORARY AND PERMANENT EASEMENTS				
	2) ASSUME NO UTILITY RELOCATIONS REQUIRED				

APPENDIX C

Village of Clemmons - Stormwater Sinkhole Call-In
 Property Street Address - 5945 Moravian Heights Ln



CREATED BY: Emily Harrison

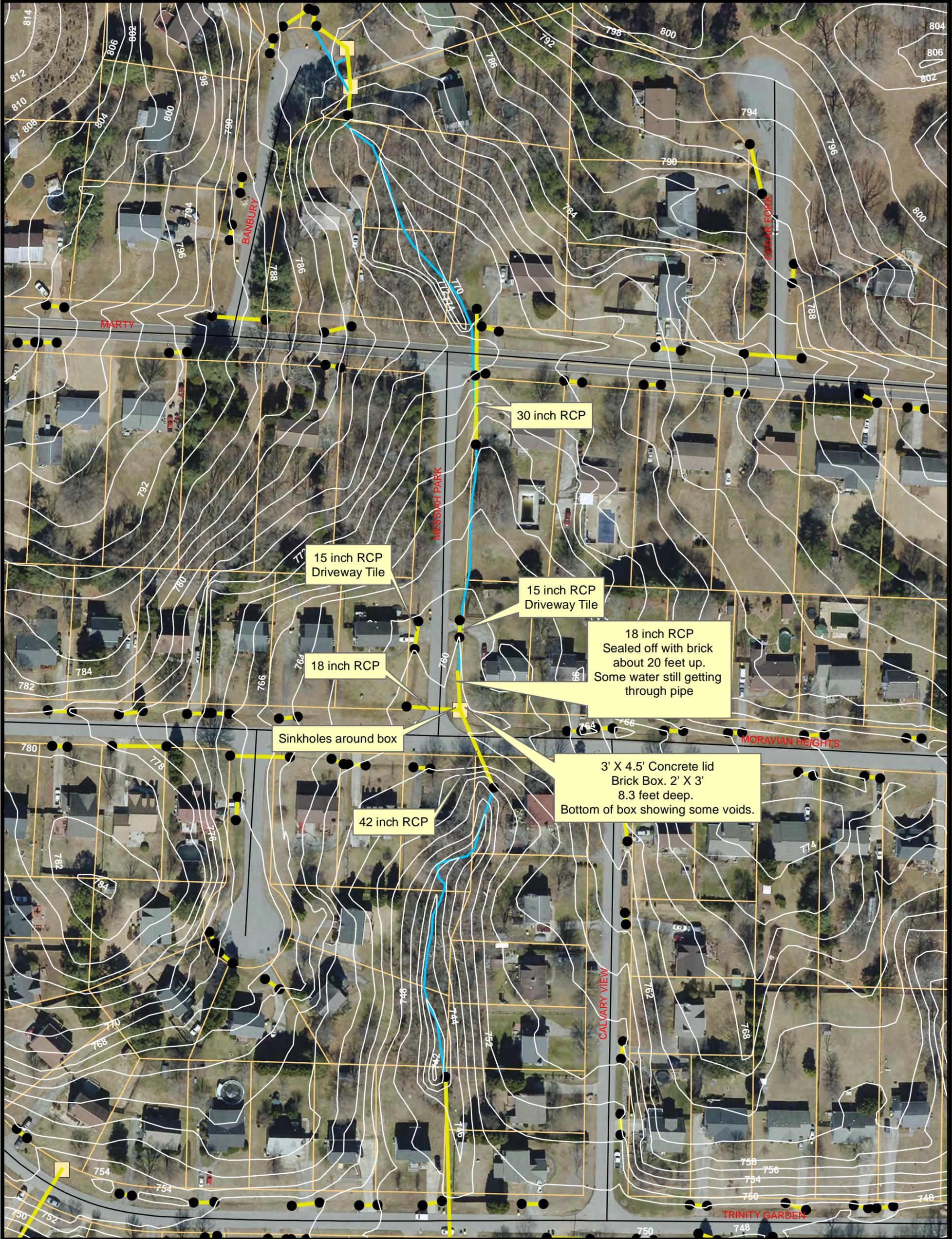
TAXPIN: 5894-47-1906.00
 ADDRESS: 5495 Moravian Heights LN
 OWNER LISTED ON TAX RECORD:
 Sandbank Steven S
 AERIAL PHOTO DATE: SPRING 2014



NOTES:
 Multiple call in about sinkholes in front of inlet located at 5495 Moravian Heights Ln. (corner of Moravian Heights Ln and Messiah Park Ln)
 VOC has been out to fill in holes on numerous occasions, but holes kept returning. Inspection in June 2017 found holes in bottom of box.
 2 - 18 inch RCP pipes enter box. One pipe parallel to Messiah Park is sealed off and no longer functioning.
 42 inch RCP exits box, flows under Moravian Heights and discharges onto private property at 1700 Calvary View LN



Village of Clemmons - Stormwater Sinkhole Call-In
 Property Street Address - 5945 Moravian Heights Ln



0 50 100 200 300 400 Feet

CREATED BY: Emily Harrison

TAXPIN: 5894-47-1906.00
 ADDRESS: 5495 Moravian Heights LN
 OWNER LISTED ON TAX RECORD:
 Sandbank Steven S
 AERIAL PHOTO DATE: SPRING 2014



NOTES:
 Multiple call in about sinkholes in front of inlet located at 5495 Moravian Heights Ln. (corner of Moravian Heights Ln and Messiah Park Ln)
 VOC has been out to fill in holes on numerous occasions, but holes kept returning.
 Inspection in June 2017 found holes in bottom of box.
 2 - 18 inch RCP pipes enter box. One pipe parallel to Messiah Park is sealed off and no longer functioning.
 42 inch RCP exits box, flows under Moravian Heights and discharges onto private property at 1700 Calvary View LN

VILLAGE OF CLEMMONS
 NORTH CAROLINA
 Date: 7/25/2018

















PUBLIC WORKS

⚠ DANGER

⚠ DANGER
STAND CLEAR



PUBLIC WORKS



A DANGER
STAND CLEAR

ROLLING OAK COURT
EXISTING CONDITIONS ANALYSIS AND
PROPOSED IMPROVEMENTS

December 2019



PREPARED FOR:

Village of Clemmons
Stormwater Department

PREPARED BY:

JEWELL-LJB
311 S. Main St.
Kernersville, NC 27284
(336) 996-9974

NC Firm # C-4123

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ASSOCIATED POLICY IMPLICATIONS FOR CONSIDERATION 2

APPENDIX A - FIGURES

APPENDIX B - OPINION OF PROBABLE COSTS

APPENDIX C - INFORMATION AND PHOTOS COMPILED BY VILLAGE STAFF

INTRODUCTION

This report is in response to a request from the Village of Clemmons that JEWELL Engineering Consultants/LJB Inc. (JEWELL-LJB) propose appropriate improvements to address the evident concerns and problems for an existing 36" corrugated metal pipe (CMP) at 7634 Rolling Oak Court where the bottom of the pipe has eroded away along several sections. There are also problems with sinkholes and voids in and around the junction box at the downstream end of the pipe. The junction box was constructed from bricks and concrete blocks, in somewhat of an odd shape. JEWELL-LJB's assessment of existing conditions also included a review of conveyance capacity of the existing system relative to the Village drainage design standards. A vicinity map for the culvert crossing is provided as Figure A-1. All figures for this report are included in Appendix A.

DESIGN STANDARDS

Village stormwater infrastructure design guidelines include ensuring that a culvert under a public road will pass stormwater runoff from a 4% annual chance design storm (also referred to as a 25-year storm) without overtopping the street and without causing water surface elevations (WSELs) to reach critical elevations of nearby permanent structures. Where appropriate, culvert design also includes compliance with NCDOT hydraulic design guidelines for highway culverts, which limit headwater depth to pipe diameter ratios to 1.2 or less. Analyses and designs are performed based on fully developed watershed conditions.

EXISTING DRAINAGE INFRASTRUCTURE

The drainage infrastructure in the area of 7634 Rolling Oak Court is shown in Figure A-2. The failing 36" CMP crosses through the front yard of that property, partially within the street right-of-way and partially on private property. The pipe is partially blocked with rip-rap at the upstream end and there are sinkholes where the pipe connects to the downstream yard inlet/junction box. Village staff have TV'd the pipe and noted that there are three sections of the pipe where the bottom has eroded out. Some photos are included in Appendix C.

The existing culvert under Rolling Oak Court is a 30" reinforced concrete pipe RCP, with the upstream invert in the yard inlet/junction box at 7634 Rolling Oak. The downstream end of the 30" RCP terminates at a junction box topped by a grate inlet, with a 24" CMP exiting that junction box. The concrete yard inlet east of the road with the associate 36" CMP and the grated inlet west of the road with the 24" CMP both appear to have been installed sometime after the road construction, either by a home builder or a private property owner, in order to pipe drainage through the yards and eliminate open drainage conveyances. The 24" CMP on the property at 7637 Rolling Oak flows to another junction box and into another 24" CMP that outlets at the back of their property, where the drainage discharges to the upper end of Lasater Lake. Both of the 24" CMPs appear to be on relatively steep slopes, estimating from measurements at the grated inlet and LIDAR topography at the other junction and the outlet.

Hydrologic Analysis

The contributing drainage area to the pipes and the yard inlet at the upstream end of the 30" RCP under Rolling Oak is estimated as 7.5 acres. The predominant land use is ½ acre single-family residential, with a commercial/office property on Harper Road partly draining to Rolling Oak. The entire drainage area is zoned R15, with only a church site on Harper Road having a likelihood of further expansion and development. The peak discharge for a 4% annual chance storm event is estimated as 15 cfs under existing watershed conditions and 17 cfs for full build-out conditions.

The area draining to the existing 36" CMP is estimated as 5.4 acres, with a 4% annual chance storm peak discharge of 11 cfs for existing watershed conditions and 13 cfs for full build-out conditions.

Hydraulic Analysis

Analysis based on Manning's "n" full-flow equations and a check with FHWA's HY-8 culvert analysis program, both confirm that the 30" RCP under the road is projected to adequately convey the 4% annual chance design storm peak discharge, even when the effects of the smaller downstream pipes are accounted for.

PROPOSED IMPROVEMENT OPTIONS

For replacement of the failing 36" CMP, hydraulic analysis indicates that an 18" RCP (or some other type of smooth-walled pipe) would adequately convey the 4% annual chance peak discharge if the pipe slope is 1.5% or steeper. Flatter slopes would require installation of 24" RCP. It is recommended that a new yard inlet be installed, at the edge of the right-of-way near the property line between 7630 and 7634 Rolling Oak Court, to collect drainage currently routed to the existing 36" CMP. The existing yard inlet/junction box at 7634 should be replaced. Costs for re-installing the driveway pipe at 7638 Rolling Oak Court, south of the existing yard inlet/junction box, are also included in the project construction cost estimate. The original 12" RCP is connected in some manner to the HDPE pipe which discharges into the junction box. This connection could become a source of future problems and could be addressed as part of this project.

Proposed improvements are shown in Figure A-3. An opinion of probable costs for replacement of two pipes and construction of two new yard inlet/junction box is provided as Appendix B.

ASSOCIATED POLICY IMPLICATIONS FOR CONSIDERATION

It appears that of the failing components in this stormwater system were installed by private property owners subsequent to the initial construction of the road and the 30" RCP. Although the 36" CMP to be replaced is partially within the street right-of-way and therefore is listed in the Village GIS drainage infrastructure database as a pipe maintained by the Village, it may be appropriate for the Village to consider establishing a policy which requires owners to at least participate in repair or replacement costs for pipe that was not installed as part of a public drainage system. If the property at 7634 Rolling Oak was originally platted and sold with a driveway pipe and a ditch across the front yard, and that system had been allowed to continue to function, the Village may not be needing to replace a 100+ foot length of pipe.

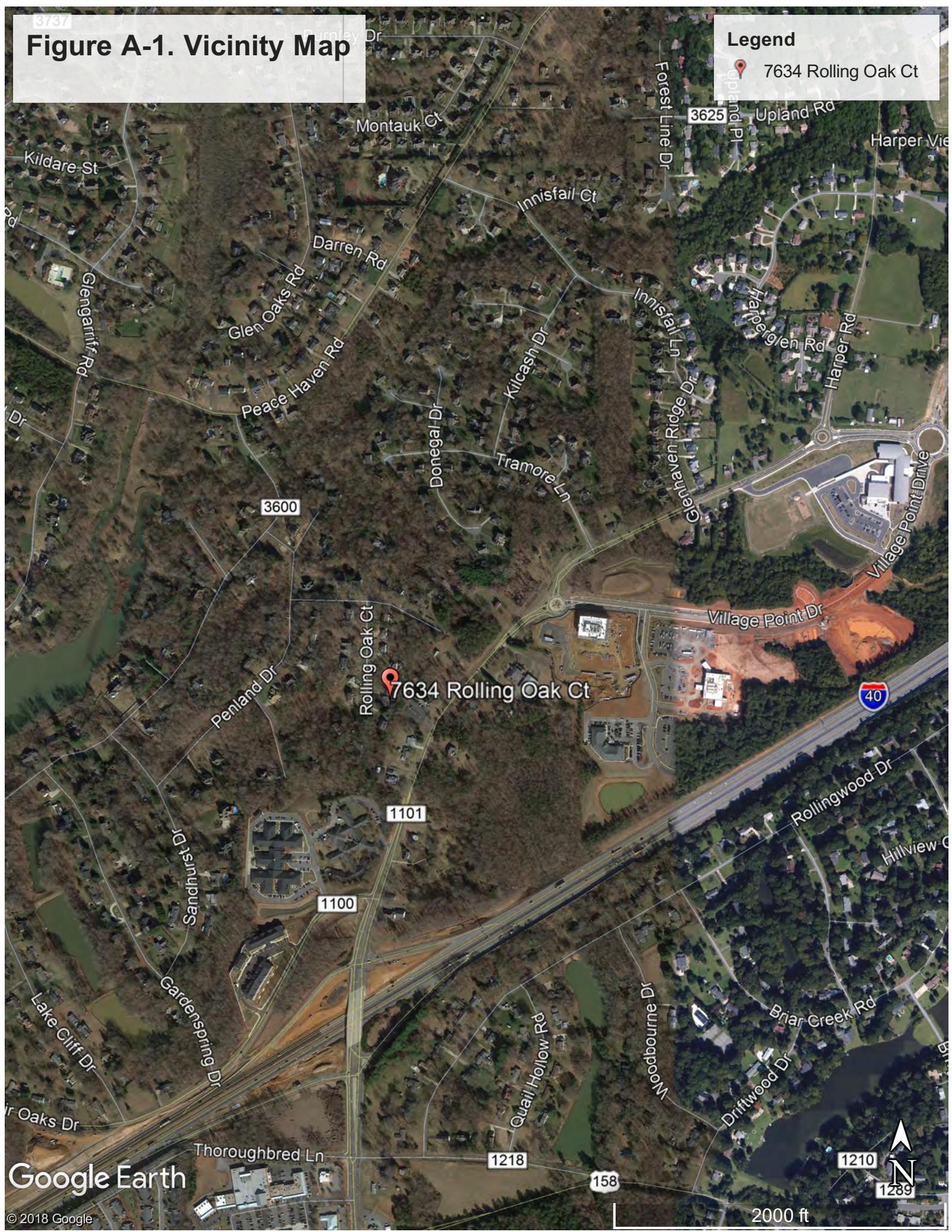
Another policy option for consideration by the Village would to only fund replacement of privately-installed failing pipes with a return to an open drainage conveyance (1) unless it is clearly in the public interest to replace the pipe or (2) if the property owner pays the estimated cost difference for replacement over the cost of pipe removal and re-establishing open conveyance.

APPENDIX A

Figure A-1. Vicinity Map

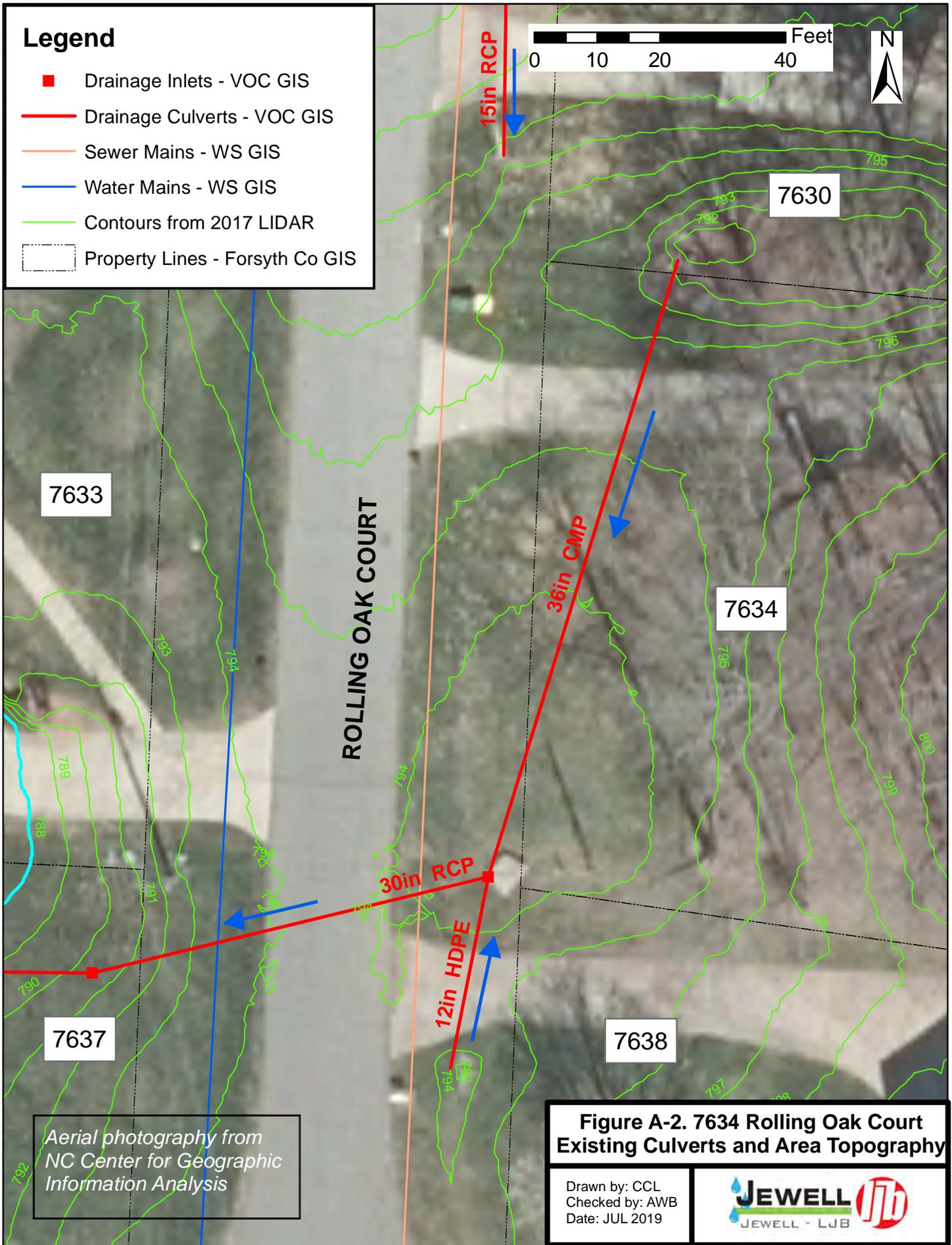
Legend

 7634 Rolling Oak Ct



Legend

- Drainage Inlets - VOC GIS
- Drainage Culverts - VOC GIS
- Sewer Mains - WS GIS
- Water Mains - WS GIS
- Contours from 2017 LIDAR
- Property Lines - Forsyth Co GIS



7633

7630

7634

7637

7638

ROLLING OAK COURT

15in RCP

36in CMP

30in RCP

12in HDPE

Aerial photography from
NC Center for Geographic
Information Analysis

Figure A-2. 7634 Rolling Oak Court
Existing Culverts and Area Topography

Drawn by: CCL
Checked by: AWB
Date: JUL 2019



Legend

- Drainage Culverts - VOC GIS
- Sewer Mains - WS GIS
- Water Mains - WS GIS
- Contours from 2017 LIDAR
- Property Lines - Forsyth Co GIS

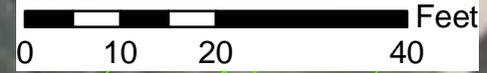
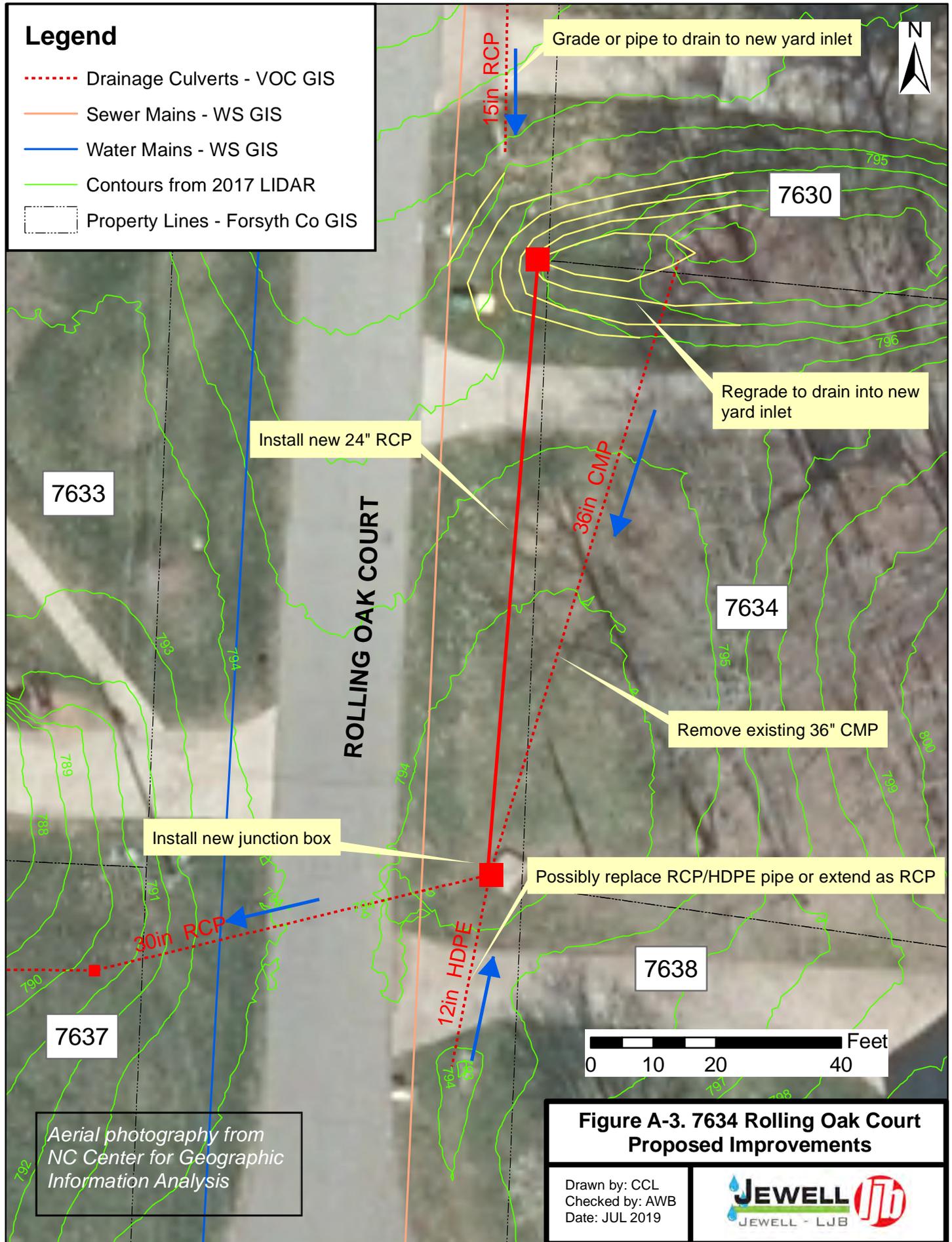


Figure A-3. 7634 Rolling Oak Court Proposed Improvements

Drawn by: CCL
Checked by: AWB
Date: JUL 2019



Aerial photography from
NC Center for Geographic
Information Analysis

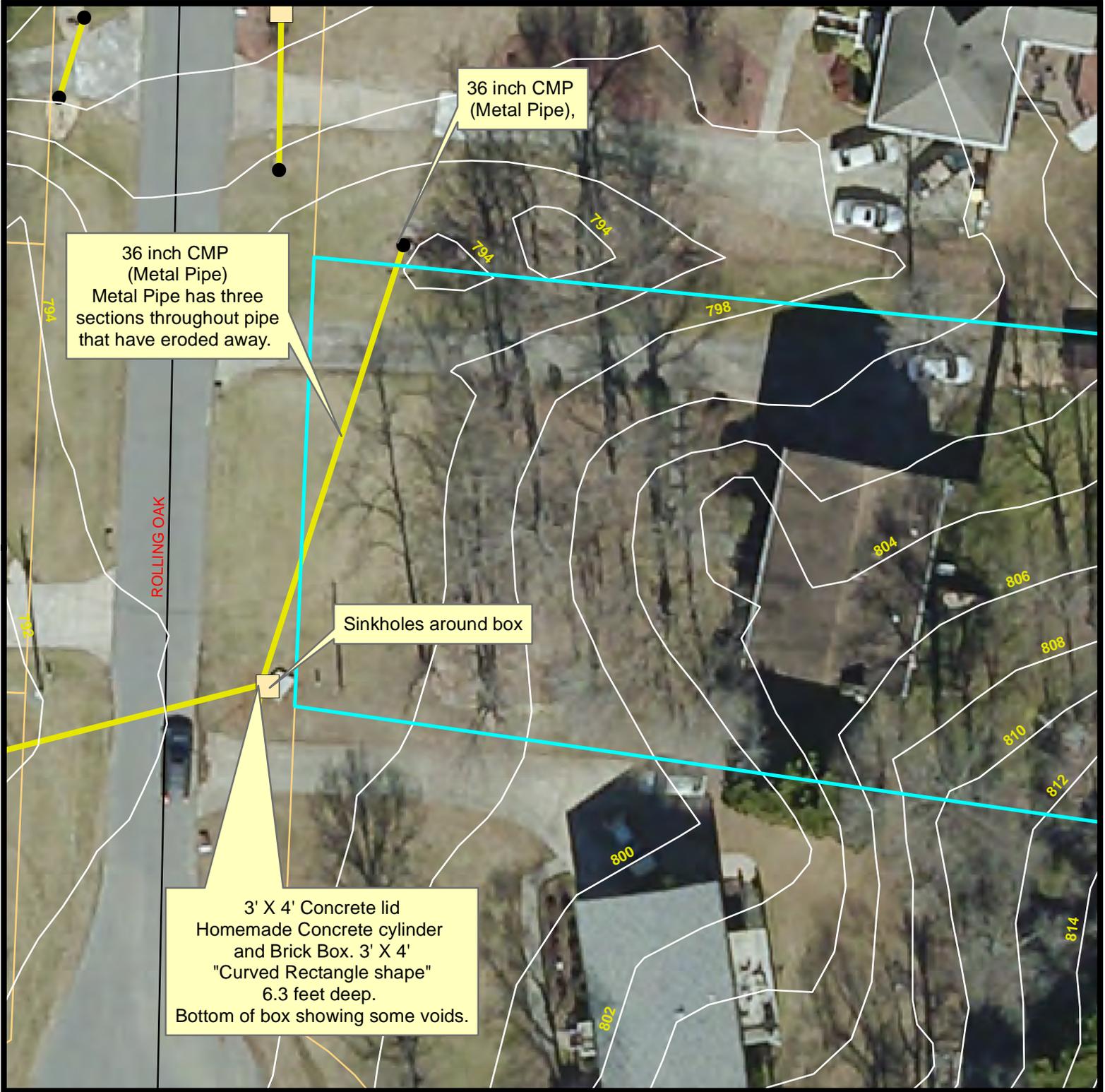
APPENDIX B

PRELIMINARY COST ESTIMATE

LOCATION:	7634 ROLLING OAK COURT				
JOB NAME:	ROLLING OAK DRAINAGE IMPROVEMENTS				
LJB #:	0117329A.00 (4)				
COMPILED BY:	CYNTHIA C. LANCASTER, P.E.				
DATE:	July 2019				
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	COST
1	Mobilization & Demobilization	1	LS	5,000	\$ 5,000
2	Construction Staking / Surveying	1	LS	2,000	\$ 2,000
3	Traffic Control	1	LS	500	\$ 500
4	General Erosion & Sediment Control Practices	1	LS	2,000	\$ 2,000
5	Control of Water	1	LS	1,000	\$ 1,000
6	Clearing & Grubbing	1	LS	2,000	\$ 2,000
7	Comprehensive Grading	1	LS	3,500	\$ 3,500
8	Undercut excavation & disposal	10	CY	20	\$ 200
9	Select material from off-site	10	CY	50	\$ 500
10	Remove and dispose of 36" CMP & backfill area	104	LF	80	\$ 5,200
11	Sanitary Sewer service lateral adjustment	1	EA	500	\$ 500
12	Water service lateral adjustment	1	EA	500	\$ 500
13	Remove and dispose of existing junction box	1	LS	3,000	\$ 3,000
14	15" RCP Driveway pipe extension	16	LF	85	\$ 1,360
15	Remove 12" driveway pipe and replace with 15" RCP	32	LF	125	\$ 2,720
15	Cut and replace driveway	12	SY	100	\$ 2,720
16	Yard inlets	2	EA	8,000	\$ 16,000
17	Install 24" RCP	98	LF	120	\$ 11,760
18	Class B riprap	15	TN	100	\$ 1,500
19	Geotextile fabric	1	LS	1,500	\$ 1,500
20	Silt Fence	200	LF	3.50	\$ 700
21	Temporary stone outlet	2	EA	1,500	\$ 3,000
22	Erosion Control #57 misc stone	15	TON	70	\$ 1,050
23	Temporary seeding and mulching-erosion control as needed	300	SY	4.00	\$ 1,200
24	Permanent Seeding	1	LS	1,200	\$ 1,200
					\$ -
					\$ -
					\$ -
					\$ -
	Subtotal				\$ 70,600
					\$ -
	CONTRACTOR TOTAL				\$ 70,600
	CONTINGENCY			20%	14,100
	CONTRACTOR TOTAL FOR SITE				\$ 84,700
	Engineering design, construction plans, permitting, specifications, construction phase assistance			20%	\$ 16,900
	Rolling Oak Drainage Improvements Total Cost				\$ 101,600
	EXCLUSIONS:				
	1) ASSUME VILLAGE WILL OBTAIN ALL NECESSARY TEMPORARY AND PERMANENT EASEMENTS				
	2) ASSUME NO UTILITY RELOCATIONS REQUIRED				

APPENDIX C

Village of Clemmons - Stormwater Sinkhole Call-In
 Property Street Address - 7634 Rolling Oak CT



36 inch CMP (Metal Pipe)
 Metal Pipe has three sections throughout pipe that have eroded away.

36 inch CMP (Metal Pipe),

Sinkholes around box

3' X 4' Concrete lid
 Homemade Concrete cylinder and Brick Box. 3' X 4' "Curved Rectangle shape" 6.3 feet deep.
 Bottom of box showing some voids.



CREATED BY: Emily Harrison

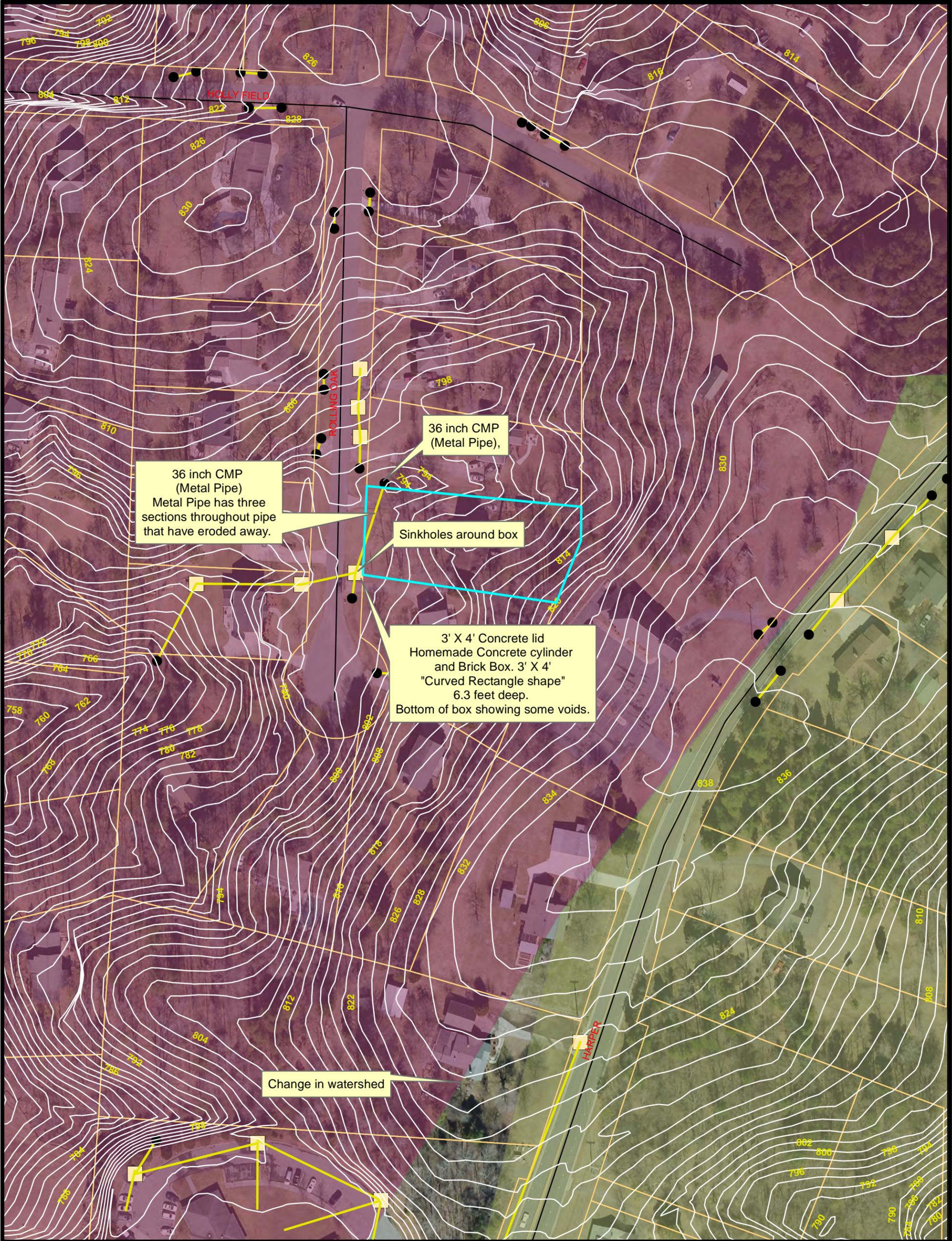
TAXPIN: 5883-42-7146.00
 ADDRESS: 7634 Rolling Oak CT
 OWNER LISTED ON TAX RECORD:
 Hege Tammy E
 AERIAL PHOTO DATE: SPRING 2014



NOTES:
 Call in about sinkholes in front of inlet located at 7634 Rolling Oak Ct. (close to property line of 7638 Rolling Oak Ct)
 36 inch CMP pipe, measured 101 foot in length from private property to drop inlet box.
 CMP Pipe was found to be eroded in three separate sections of pipe on 4/26/18



Village of Clemmons - Stormwater Sinkhole Call-In
 Property Street Address - 7634 Rolling Oak CT



CREATED BY: Emily Harrison

TAXPIN: 5883-42-7146.00
 ADDRESS: 7634 Rolling Oak CT
 OWNER LISTED ON TAX RECORD:
 Hege Tammy E
 AERIAL PHOTO DATE: SPRING 2014



NOTES:
 Call in about sinkholes in front of inlet located at 7634 Rolling Oak Ct. (close to property line of 7638 Rolling Oak Ct)
 36 inch CMP pipe, measured 101 foot in length from private property to drop inlet box.
 CMP Pipe was found to be eroded in three separate sections of pipe on 4/26/18

VILLAGE OF CLEMMONS
 NORTH CAROLINA
 Date: 6/28/2018

























INTERSECTION OF SPRINGFIELD FARM ROAD
AND KNOB HILL DRIVE
EXISTING CONDITIONS ANALYSIS AND
PROPOSED IMPROVEMENTS

December 2019



PREPARED FOR:

Village of Clemmons
Stormwater Department

PREPARED BY:

JEWELL-LJB
311 S. Main St.
Kernersville, NC 27284
(336) 996-9974

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APPENDIX A - FIGURES

APPENDIX B - OPINION OF PROBABLE COSTS

APPENDIX C - INFORMATION AND PHOTOS COMPILED BY VILLAGE STAFF

INTRODUCTION

This report is in response to a request from the Village of Clemmons that JEWELL Engineering Consultants/LJB Inc. (JEWELL-LJB) analyze the existing drainage system and propose appropriate improvements to address frequent flooding of the intersection at Springfield Farm Road and Knob Hill Drive. The basic problem appears to be clogging of the downstream drainage pipes, but recent modifications to the drainage system by a private property owner may have contributed to, or directly caused, the compromise of the hydraulic conveyance of the system. A vicinity map for the culvert crossing is provided as Figure A-1. All figures for this report are included in Appendix A.

Springfield Farm Road and Knob Hill Drive, in the area around the intersection, were platted in 2000 and the intersection can be seen as fully constructed in 2002 aerial photos on Google Earth. The plat for the lots along Ridge Run Court is dated July 2006. Eight of the homes between Ridge Run Court and Springfield Farm Road are evident in 2008 aerial photos as being at least partially constructed.

DESIGN STANDARDS

Village stormwater infrastructure design guidelines include ensuring that a culvert under a public road will pass stormwater runoff from a 4% annual chance (25-year) storm event without overtopping the street and without causing water surface elevations (WSELs) to reach critical elevations of nearby permanent structures. Where appropriate, culvert design also includes compliance with NCDOT hydraulic design guidelines for highway culverts, which limit headwater to pipe depth ratios to 1.2 or less. Analyses and designs are performed based on fully developed watershed conditions.

EXISTING DRAINAGE INFRASTRUCTURE

The drainage infrastructure and the area topography are shown in Figure A-2. The existing culvert under Knob Hill Road is a 15" RCP connecting curb inlets on either side of the intersection. Another 15" RCP connects the roadway pipe to a downstream junction box at the rear of 6685 Ridge Run Court. The drainage is then piped under Springfield Farm Road in a 24" reinforced concrete pipe (RCP).

Historical aerial photography and older topography indicates that when Springfield Farm Road was initially constructed, drainage from a sump area at the rear of 6685 Ridge Run Court was piped in a 24" RCP under the new road towards what was at that time a natural stream on the north side of the road. The low spot at the rear of what is now the 6685 Ridge Run Court parcel was at an elevation of about 763 feet. The discharge point of the 24" RCP is not clear from old aerial photos. The natural stream on the north side of Springfield Farm Road has since been piped, but it is not certain to which junction box along the 60" pipe the 24" RCP is connected.

In later neighborhood development, the inlets at the intersection of Knob Hill Drive and Springfield Farm Road were connected to the 24" RCP with a reach of 15" RCP installed in a private drainage easement along the back of the lots at 6693 and 6685 Ridge Run Court. A junction box with a grated inlet was installed at the rear of 6685 to connect the 15" RCP to the 24" RCP. Village staff measured the depth of the junction box as approximately 11 feet, which would equate to a top elevation of about 774 feet. Changes to the system were made by the property owners at 6685 Ridge Run Court subsequent to their purchase of the property in late 2015. A 2015 aerial photo shows the backyard with a fence about 50 feet from the house and 80 feet from the road. The back part of the property was left in a natural state. The owners covered the junction box with a concrete lid and regraded the yard such that the junction box is no longer visible. (See photos in Appendix C.)

HYDROLOGIC AND HYDRAULIC ANALYSIS OF EXISTING SYSTEM

The area draining to the Springfield Farm/Knob Hill intersection only totals about 0.84 acres, which would be projected to generate a peak runoff rate in a 4% annual chance storm event of only about 3

cfs. The 15” RCP under the road should be adequate to convey at least 12 cfs. The 15” RCP between the intersection and the junction box at 6685 Ridge Run Court is on a steeper slope and should be more than adequate to convey even extreme storm events. The hydraulic analysis concludes that there is no inadequacy in the design of the existing system and that it must have been comprised by some type of blockage or failure. There are no indications of sinkholes along any of the known pipe alignments. All of the pipes between the intersection and the large 60” pipe conveying the former stream north of Springside Farm are on slopes which would be associated with high flow velocities and low potential for sedimentation in the pipes. Some of the pipes are relatively deep and it is possible some concrete sections have separated at the joints and soils have migrated into the pipes, without yet having created a sinkhole evident from the ground surface, and created a blockage. Nevertheless, it seems odd that this could have occurred to an extent that causes blockages which so significantly inhibit pipe conveyance as to cause the frequency of flooding that has occurred at the intersection of Knob Hill Drive and Springfield Farm Road. (See photos in Appendix C.)

The Village staff have attempted to inspect the 15” RCP connecting the intersection pipes to the junction box at the rear of 6685 Ridge Run Court, but there has been too much water backed up in the pipe for the camera to access the whole reach.

PROPOSED IMPROVEMENT OPTIONS

The issues with the 15” RCP need to be addressed by repair or replacement. The required repair could be as straightforward as excavating to uncover and demolish the concrete lid over the junction box on the property at 6685 Ridge Run Court and excavating or vacuuming sediment out of the box and reachable areas of the adjacent pipes, at least to the point where a camera can be deployed in the pipe for inspection. If there is no evidence of damaged or failing pipes, remaining sediment could hopefully be flushed out of the pipes.

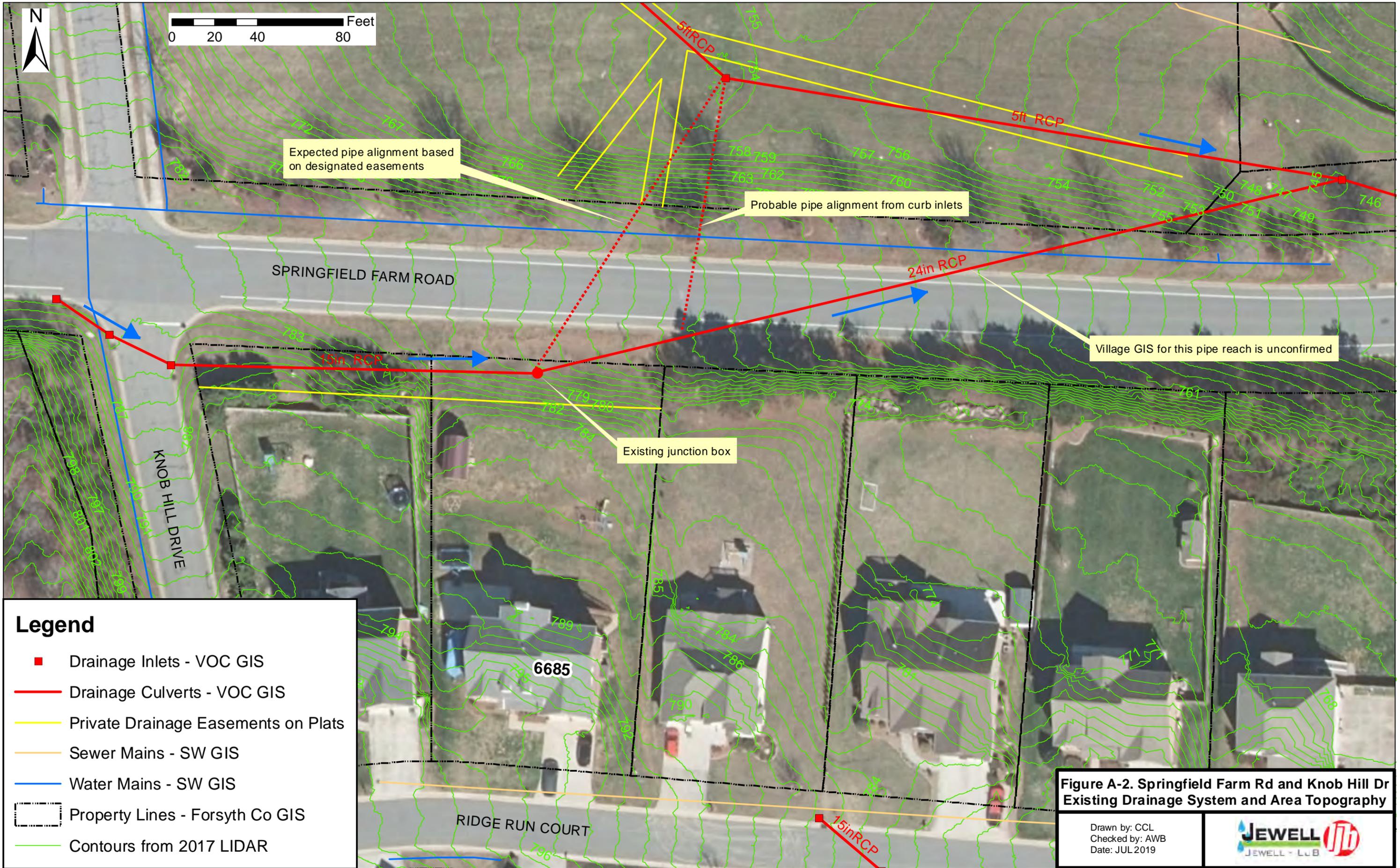
If the 15” RCP is damaged and/or the Village prefers to move the pipe within the Springfield Farm Road right-of-way and construct a new junction box, Figure A-3 shows the proposed replacements and Appendix B includes a cost estimate for these repairs.

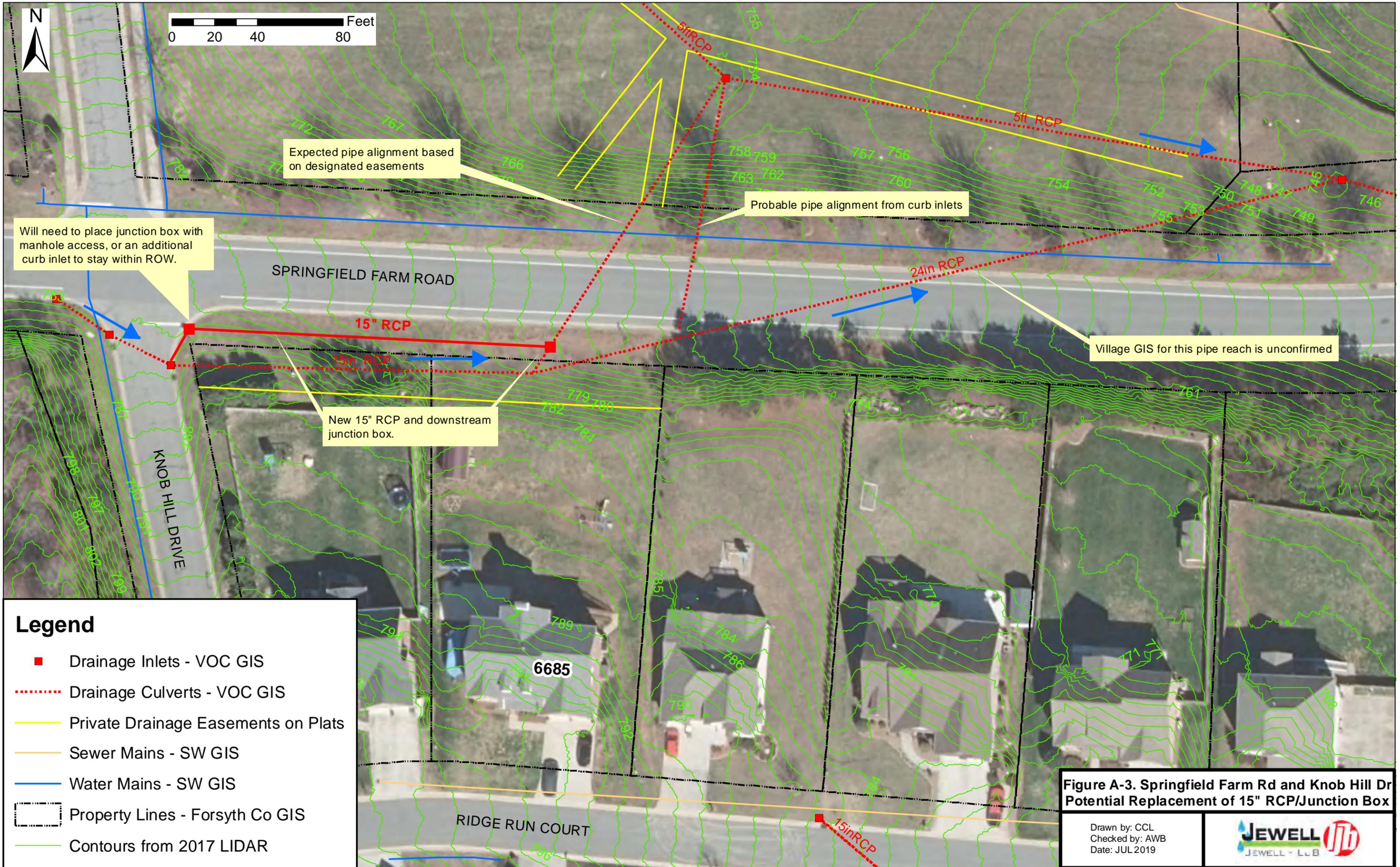
APPENDIX A

Figure A-1. Vicinity Map



Intersection of Springfield Farm Road and Knob Hill Drive





Expected pipe alignment based on designated easements

Probable pipe alignment from curb inlets

Will need to place junction box with manhole access, or an additional curb inlet to stay within ROW.

Village GIS for this pipe reach is unconfirmed

New 15" RCP and downstream junction box.

Legend

- Drainage Inlets - VOC GIS
- ⋯ Drainage Culverts - VOC GIS
- Private Drainage Easements on Plats
- Sewer Mains - SW GIS
- Water Mains - SW GIS
- Property Lines - Forsyth Co GIS
- Contours from 2017 LIDAR

Figure A-3. Springfield Farm Rd and Knob Hill Dr Potential Replacement of 15" RCP/Junction Box

Drawn by: CCL
 Checked by: AWB
 Date: JUL 2019



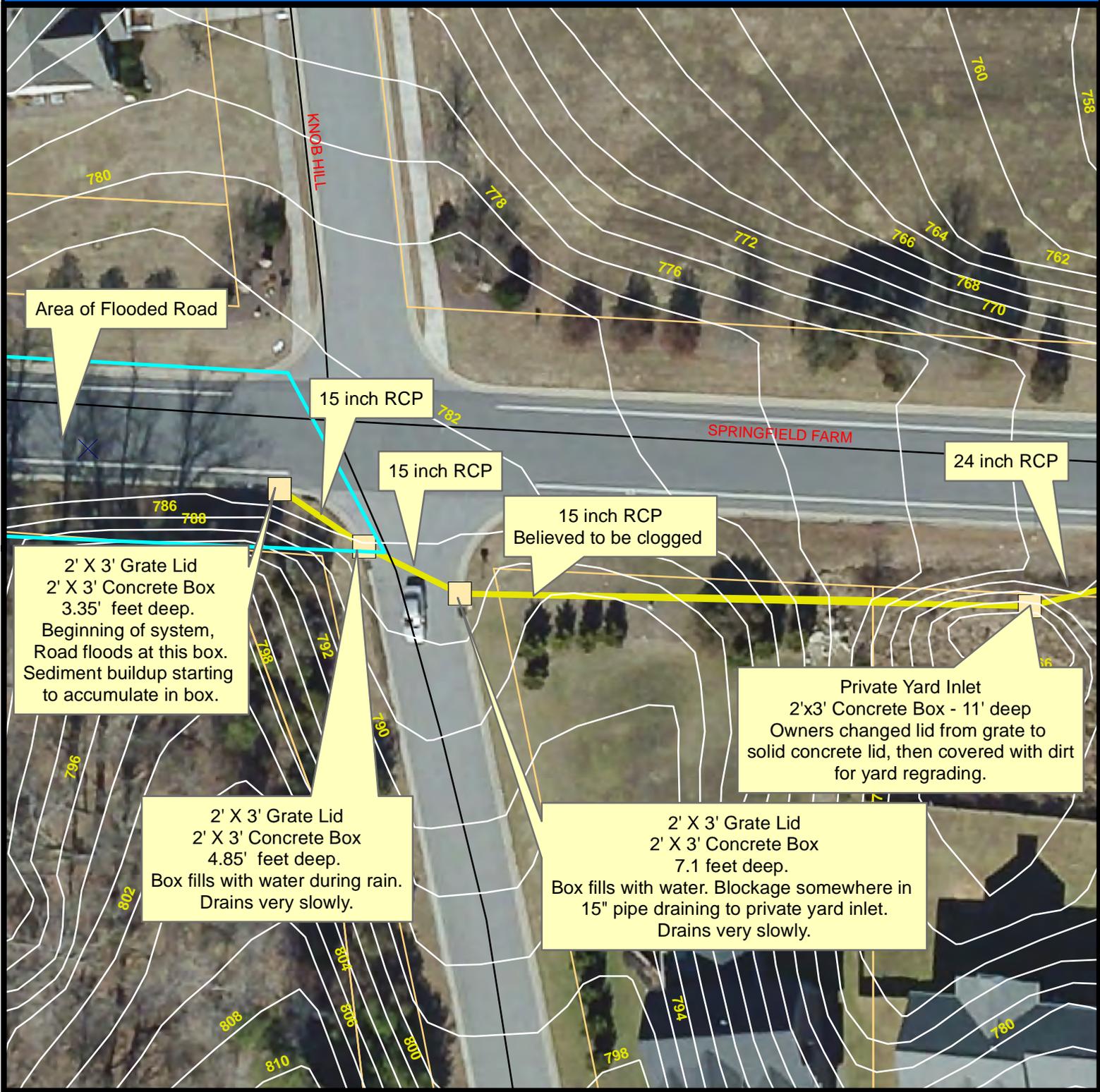
APPENDIX B

PRELIMINARY COST ESTIMATE

LOCATION:	INTERSECTION OF SPRINGFIELD FARM ROAD & KNOB HILL DRIVE				
JOB NAME:	SPRINGFIELD FARM DRAINAGE IMPROVEMENTS				
LJB #:	0117329A.00 (2)				
COMPILED BY:	CYNTHIA C. LANCASTER, P.E.				
DATE:	July 2019				
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	COST
1	Mobilization & Demobilization	1	LS	5,000	\$ 5,000
2	Construction Staking / Surveying	1	LS	2,000	\$ 2,000
3	Traffic Control	1	LS	2,000	\$ 2,000
4	General Erosion & Sediment Control Practices	1	LS	1,500	\$ 1,500
5	Control of Water	1	LS	1,000	\$ 1,000
6	Clearing & Grubbing	1	LS	1,500	\$ 1,500
8	Undercut excavation & disposal	50	CY	20	\$ 1,000
9	Select material from off-site	50	CY	50	\$ 2,500
10	Modify existing curb inlet for new pipe, removal of existing pipe connection, and plugging of 15" RCP	1	EA	5,000	\$ 5,000
11	Install curb inlet or junction box ~ 7-ft depth	1	LS	6,000	\$ 6,000
12	Install 15" RCP	186	LF	85	\$ 15,810
13	Plug outlet of existing junction box and remove 24" RCP up to new box	1	EA	5,000	\$ 5,000
14	Install new junction box ~11-ft depth to connect existing 24" RCP	1	EA	10,000	\$ 10,000
15	Geotextile fabric	1	LS	1,500	\$ 1,500
16	Silt Fence	150	LF	3.50	\$ 525
17	Curb inlet protection	3	EA	800	\$ 2,400
18	Erosion Control #57 misc stone	15	TON	70	\$ 1,050
19	Temporary seeding and mulching-erosion control as needed	400	SY	4.00	\$ 1,600
20	Permanent Seeding	1	LS	1,500	\$ 1,500
					\$ -
					\$ -
					\$ -
					\$ -
	Subtotal				\$ 66,900
					\$ -
	CONTRACTOR TOTAL				\$ 66,900
				20%	13,400
	CONTRACTOR TOTAL FOR SITE				\$ 80,300
	Engineering design, construction plans, permitting, specifications, construction phase assistance			20%	\$ 16,100
	Springfield Farm Drainage Improvements Total Cost				\$ 96,400
	EXCLUSIONS:				
	1) ASSUME VILLAGE WILL OBTAIN ALL NECESSARY TEMPORARY AND PERMANENT EASEMENTS				
	2) ASSUME NO UTILITY IMPACTS AND NO ESC PERMIT REQUIRED				

APPENDIX C

Village of Clemmons - Stormwater Sinkhole Call-In
 Property Street Address - Intersction of Knob Hill Dr. and Springfield Farm Rd



CREATED BY: Emily Harrison

TAXPIN: 5894-01-9788.00
 ADDRESS: Linwood DR (backside of property)
 at intersection of Knob Hill and Springfield Farm
 OWNER LISTED ON TAX RECORD:
 Springfield Farm Rd - Village of Clemmons Rd
 AERIAL PHOTO DATE: SPRING 2014



NOTES:
 October 26, 2016 homeowners at 6685 Ridge Run CT regraded their back yard, which included covering the stormwater lid (grate) on their property with a concrete lid. (private yard inlet)
 5/23/17 - first reported flooding of springfield farm/knob hill intersecion. Since then any hard extended rain causes flooding to intersecion which flows across Springfield Farm Rd.
 VOC tried to check line by video cable multiple times but pipe has been full of water which made us determine there is a clog in the 15' RCP pipe heading to private yard inlet.



Village of Clemmons - Stormwater Sinkhole Call-In
 Property Street Address - Intersction of Knob Hill Dr. and Springfield Farm Rd



Private Drop Inlet
 2'x3' Grated Lid
 4'X4' Concrete Box
 Stream/Creek has been piped through field.
 24" RCP Pipe connects to box

5 ft. RCP
 Piped Creek

15 inch RCP

Buried junction box

15 inch RCP

24 inch RCP

2' X 3' Grate Lid
 2' X 3' Concrete Box
 3.35 feet deep.
 Beginning of system. Road floods at this box.
 Sediment buildup starting to accumulate in box

2' X 3' Grate Lid
 2' X 3' Concrete Box
 4.85' feet deep.
 Box fills with water during rain.
 Drains very slowly.

2' X 3' Grate Lid
 2' X 3' Concrete Box
 7.1 feet deep.
 Box fills with water. Blockage somewhere in
 15" pipe draining to private yard inlet.
 Drains very slowly.

Private Yard Inlet
 2'x3' Concrete Box - 11' deep
 Owners changed lid from grate to
 solid concrete lid, then covered with dirt
 for yard regrading.



CREATED BY: Emily Harrison

TAXPIN: 5894-01-9788.00
 ADDRESS: Linwood DR (backside of property)
 at intersection of Knob Hill and Springfield Farm
 OWNER LISTED ON TAX RECORD:
 Springfield Farm Rd - Village of Clemmons Rd
 AERIAL PHOTO DATE: SPRING 2014



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 flows across Springfield Farm Rd.
 VOC tried to check line by video cable multiple times but pipe has been full of
 water which made us determine there is a clog in the 15' RCP pipe heading
 to private yard inlet.

VILLAGE OF
CLEMMONS
 NORTH CAROLINA
 Date: 7/19/2018

Knob Hill Dr
Springfield Farm Rd

May 23, 2017, 14:43



Feb 7, 2018, 09:43



Feb 7, 2018, 09:44



Knob Hill Dr

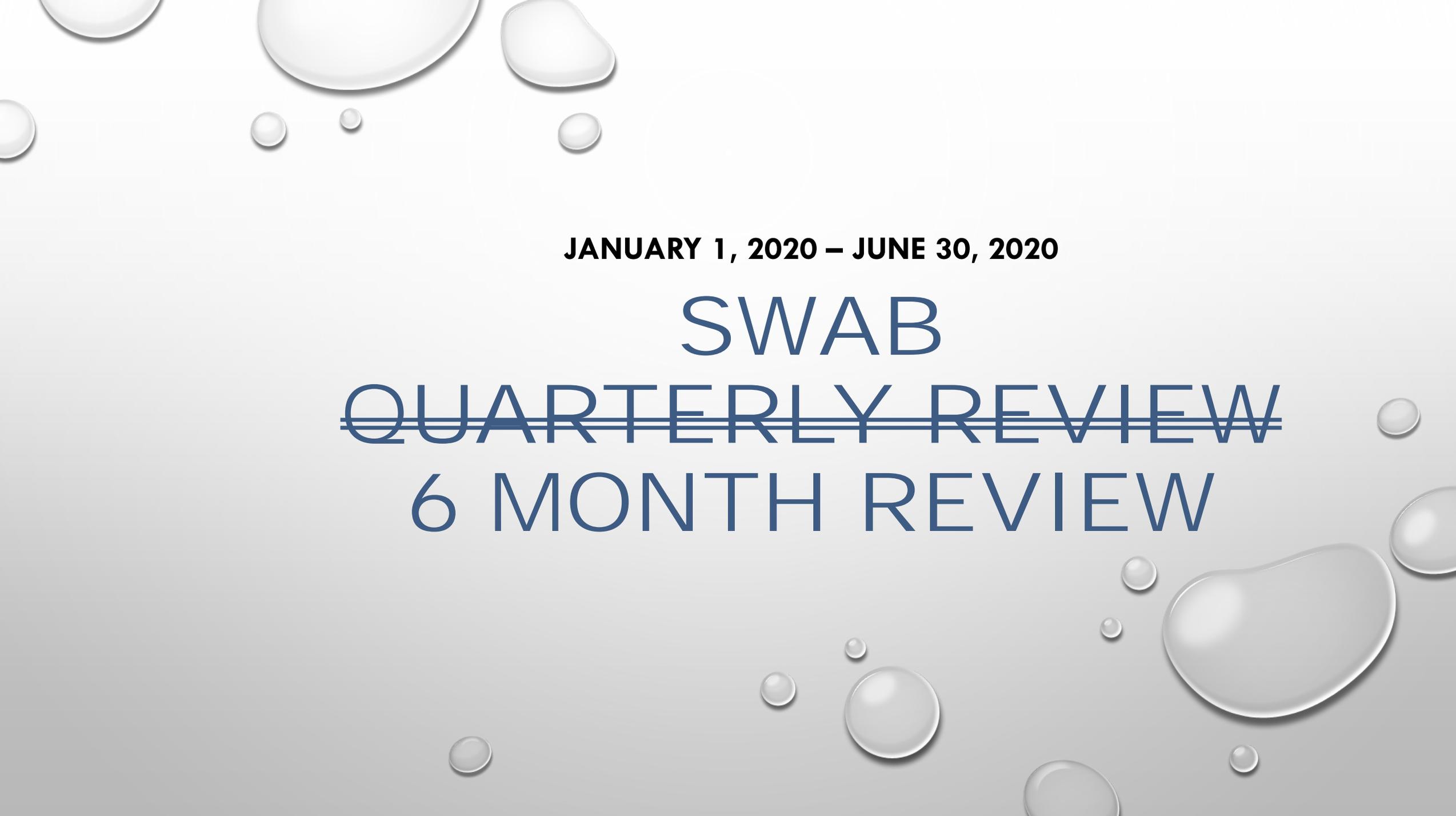
May 18, 2018, 15:17



Oct 27, 2016, 16:13



Oct 27, 2016, 16:15

The background of the slide is a light gray gradient with several realistic water droplets of various sizes scattered across it. The droplets have highlights and shadows, giving them a three-dimensional appearance.

JANUARY 1, 2020 – JUNE 30, 2020

SWAB
~~**QUARTERLY REVIEW**~~
6 MONTH REVIEW

GOOD HOUSEKEEPING PROJECTS (MINOR CIP) 1/1/20 – 3/31/20

- **GOOD HOUSEKEEPING FIX UP DROP INLET BOXES/ CULVERTS/DITCHES/SWELLS ALONG ROW**

- SEDALIA DR. (2395, 2485, 2475)
- 5529 MORAVIAN HEIGHTS LN.
- COOK PLACE
- 145, 150 MCKNIGHTS TRACE
- RIDGECREST DR./GREENFIELD WAY INTERSECTION
- 7638 ROLLING OAK CT.
- 3602 TANGLEBROOK TRL
- 4023 BEAVER BROOK RD.
- 105 MOSSYDELL CT.
- 100 DOUBLEGATE CT
- 120 MAPLE SPRING CT.
- 3728 SQUIREWOOD DR.
- 705 LAVALE DR.
- 4210, 4220 BRIAR CREEK RD
- 2772 KNOB HILL DR.
- 6731 LINWOOD DR



- **TOTAL COST = \$35,150**
- **LINEAR FEET GRADED – 1,005 FT.**
- **# OF STRUCTURES REPAIRED (EX: BOX, LID, PIPE) - 10**

GOOD HOUSEKEEPING PROJECTS (MINOR CIP) 4/1/20 – 6/30/20

- **GOOD HOUSEKEEPING FIX UP DROP INLET BOXES/ CULVERTS/DITCHES/SWELLS ALONG ROW**
 - **UPPER HARPERVALLEY LN
(6912, 6916, 6920)**
 - **LOWER HARPERVALLEY LN
(6923, 6928)**
 - **TANGLEBROOK TRL
(3584, 3590, 3596)**
 - **3555 N LAKESHORE DR**



- **TOTAL COST = \$28,500**
- **LINEAR FEET GRADED – 628 FT.**
- **# OF STRUCTURES REPAIRED (EX: BOX, LID, PIPE) - 0**

STREET SWEEPING

- COMMERCIAL CORRIDORS SWEEP WEEKLY
- RESIDENTIAL STREETS SWEEP QUARTERLY
- 24.9 CUBIC YARD OF DEBRIS SWEEP UP
 - (26.89 TONS) (JAN – MARCH 2020)
- 17.9 CUBIC YARD OF DEBRIS SWEEP UP
 - (19.33 TONS) (APRIL – JUNE 2020)



ILLICIT DISCHARGE/WATER LEAKS/NOV'S REPORTED

January – June 2020

- 1 WATER MAIN/LINE LEAK/BRAKE
- 2 REPORTED SANITARY SEWER LEAKS
- 1 GRASS NOV
- 2 ILLEGAL DUMPING NOV'S
- 1 IMPERVIOUS NOV



* No Penalizing Enforcement Actions Taken

PERMITS ISSUED

- 20-107 CLEMMONS MEDICAL OFFICE SWM PERMIT – 1-21-20
- 20-090 MONTESSORI SCHOOL NORTH CAMPUS - OCCUPANCY PERMIT – 3-2-20
- 20-108 TANGLEWOOD FOREST SWM PERMIT – 6-25-20



BMP INSPECTIONS (JAN – JUNE 2020)



• 39 INSPECTIONS PERFORMED

- 7 DRY DETENTION PONDS - **PASSED**
- 11 BIO RETENTION DEVICES - **PASSED**
- 8 WET PONDS - **PASSED**
- 1 SAND FILTER/INFILTRATION DEVICE - **PASSED**
- 5 UNDERGROUND DEVICES - **PASSED**
- 3 WET POND - **FAILED**
- 3 BIO RETENTION CELL - **FAILED**
- 1 SAND FILTER/INFILTRATION DEVICE - **FAILED**

• 7 RE-INSPECTIONS PERFORMED

- 3 WET PONDS - **PASSED**
- 3 BIO RETENTION DEVICES - **PASSED**
- 1 SAND FILTER/INFILTRATION DEVICE - **PASSED**

PET WASTE DATA

- 11 DOG WASTE STATIONS THROUGHOUT CLEMMONS
- 78 CLEAN UP AFTER YOUR DOG SIGNS THROUGHOUT CLEMMONS



MEDIA - RADIO PSA AIRTIME DATA

- JANUARY - MARCH TOTAL AIR PLAYS = 225
- APRIL – JUNE TOTAL AIR PLAYS = 0 (NO BROADCASTS)



JANUARY 1, 2020 – MARCH 31, 2020

APRIL 1 – JUNE 30, 2020

SWAB

~~QUARTERLY REVIEW~~

6 MONTH REVIEW

* EVENTS IN CLEMMONS *

EVENTS

- **MORGAN ELEMENTARY - JANUARY 7, 2020 – (K-2, 3-5 EC CLASSES)**
- **SOUTHWEST ELEMENTARY – FEBRUARY 4, 2020 – (3, 4 YR. OLD CLASSES, K-1 EC CLASS)**
- **SOUTHWEST ELEMENTARY - MARCH 10 & 11 2020 – CAREER DAYS**
- **FORSYTH CREEK WEEK – MARCH – CANCELLED**
- **VIRTUAL FORSYTH CREEK WEEK – APRIL 13 – 19, 2020**

