CITY OF MISSION PLANNING COMMISSION

AGENDA

September 23rd, 2019

7:00 PM

Mission City Hall - 6090 Woodson

Council Chambers

1. Call to Order

2. Approval of Minutes from the June 24, 2019 Meeting

3. New Business

    A. Public Hearing - Case #19-05: Land Use Application for Zoning of Property at the Northeast Corner of Johnson Drive and Roe Avenue; and a Preliminary and Final Development Plan for Parking on Said Property. SMG Investments, LLC., Applicant.
    The Commission will be asked to consider an application to zone said property "CP-O" Planned Office Building District to allow for the use of the property as associated parking for a medical office building. In addition to the requested zoning, consideration of a preliminary development plan for the medical office building will be considered.

        1. Staff Report
        2. Preliminary and Final Development Plan
        3. Traffic Study
        4. Storm Water Study

4. Old Business

5. PC Comments/CIP Committee Update

6. Staff Updates

Questions concerning this meeting may be addressed to staff contact,
Brian Scott, Assistant City Administrator at (913) 676-8353 or bscott@missionks.org.

MINUTES OF THE PLANNING COMMISSION MEETING

June 24, 2019

DRAFT

The regular meeting of the Mission Planning Commission was called to order by Chairman Mike Lee at 7:00 PM Monday, June 24, 2019. Members also present: Pete Christiansen, Jami Casper, Robin Dukelow, Stuart Braden, Brad Davidson, Charlie Troppito and Frank Bruce. Burton Taylor was absent. Also, in attendance: Brian Scott, Assistant City Administrator and Audrey McClanahan, Secretary to the Planning Commission.

Approval of Minutes from the May 20, 2019 Meeting

Comm. Dukelow moved and Comm. Troppito seconded a motion to approve the minutes of the May 20, 2019 Planning Commission meeting.

The vote was taken (8-0-1). The **motion carried**. Comm. Christiansen abstained from the vote.

New Business

Public Hearing - Application # 19-03: Amendment of Preliminary and Final Site Development Plan Review – Tidal Wave Auto Wash (Case # 17 -11)

Mr. Scott: This is preliminary and final site development plan review for Tidal Wave Auto Wash. This was originally Case #17-11, presented to you about a year ago. The property is located at 6501 Johnson Drive, which is the former site of Valero gas and convenience station. The property is within the Form Based Code. Currently, the property is zoned CP-2B, which is Planned Retail and Service District, and the proposed carwash is allowable in the zoning district. The property is also located within the Form Based Code district, specially Block 1 of the FBC. When first presented last year, in March of 2017, there was rather extensive discussion with staff and the Commission regarding the application of the Form Based Code. Staff has been working with Mr. Hardin, the applicant, for the better part of a year and a half to try to apply as much of the Form Based Code [coughing] project. Of course, we went through all of that. The Form Based Code is not so much about the use, but more about the design of the building, and how that design plays in with the corridor. Trying to bring buildings up to the sidewalk with a zero-setback line, try to create a more divergent feel along the Johnson Drive corridor from Lamar, west to Metcalf.

Doing the Form Based Code requires a two-story building in that particular block. I will compliment Mr. Hardin, who has attempted to make a two-story building into a car wash. He proposed having the car wash bays themselves be a tunnel at the back of the property. The front of the property would be the building, and the lower level of the building would be the final detailing of the cars, vacuuming, etc. The second level would be the regional offices for his company. There would be staff there, provide training, so forth.

So, that's what was agreed upon. He decided because he did not score the necessary score for a pass/review of the Planning Commission, that we treat it as preliminary and final development plan, a more traditional two-step property. So, we approved the

preliminary development plan. That was recommended to the City Council and they approved it on April of last year. The applicant came back the following day with a final development plan. We reviewed that, and we presented it to you all, and it was approved by you.

The conditions that were asked for in the preliminary development plan were met in terms of materials, landscaping, site layout, etc. Mr. Hardin can speak more to this in a second, but he's had difficulty making the numbers on this project work, building a two-story building. So, he is requesting this amendment to essentially remove the two-story building and replace it with a one-story building, which would be the bays where vehicles are vacuumed and detailed. Other than two-story versus one-story, everything else is the same. The same material, landscaping, same street scape would be called for. Johnson Drive design guidelines as well as the Form Based Code. The building essentially looks the same other than it's one story. I'm going to stop there, and I will give the floor to Mr. Hardin, and he can present the case.

Petty Hardin, Applicant, appeared before the Planning Commission and made the following comments:

Mr. Hardin: Thank you all for hearing me again. I know it's been about a year since we saw each other last. I know it looks like nothing has been happening with the property, but we have been working diligently behind the scenes to make it work. I know you know we've been working on it at least, I've owned it at least two and a half years, and dealing with the City and staff for at least a year and a half, like Mr. Scott mentioned. I don't want to go back the whole two and a half years and rehash it all, but about nine months ago, I guess, when we got approval for the project, at that point, we released contractor to remove the underground storage tanks from the gas station. So, that contractor did that. There were some concerns, and I heard grumblings about contamination. So, I waited and didn't do anything until we got the final results from that. We do have a "No Further Action" letter from the State of Kansas with no contaminations. That's the first thing. That could have killed the project at that point. So, once we got that clearance, then we went ahead and turned the architects and engineers and everybody loose to compile the full set of drawings that we would do two things with. Number one, submit to the City for a building permit, and at the same time, let out for bids for contractors to bid on the main parts of the project.

When we did get our bids back, we were absolutely shocked at the construction cost. Not the land cost, not the building of the car wash facility itself. It is a little more expensive with a retaining wall in the back, a large retaining wall we have to incorporate into our new car wash building, but it was really the building up front that caused us a lot of difficulty. If you'll remember about a year ago, I've always said in order to be in Mission, I realize it's going to cost a lot of money, and from the beginning I allowed an extra million dollars in the budget to hopefully compensate and offset some of the expenses that the Form Based Code would informed. I was shocked to find that my million didn't go very far, and we exceeded that million by another $700,000 to $800,000.

So, with that, I started scratching my head, started talking to our contractors, my partners, looking at other projects, talking with other car wash operators. One of my first calls was actually to Brian at the City. We're very transparent on what our costs are, and what's all involved in the project. So, he and I sat down, and I asked his opinion of what can we do to cut some cost, or find a way to make this work? And he had some good ideas. There's a lot of stacked stone on the building, and that's very expensive. The windows, the insulation, the sprinkler system, stairwells for the second story, HVAC systems. We looked at actually building from the outside that same building but leaving it unfinished up top and have the shell, have the complete look of it. But the more we stripped it out, the more we sacrificed functionality of not being able to use the upstairs, as well as the aesthetics were starting to suffer, too, when you start pulling out features that, the things that cost money look the best. Especially the stacked stone and the things we just mentioned.

So, we've never been over budget on a project to this magnitude. We've always been able to make the numbers for the actual construction work. There's been plenty of situations where we couldn't afford land cost, things of that nature, that killed deals. But we do have six other locations that are under various stages of development in the metro area. This is just a different animal. We've got over 40 projects in other parts of the country that we made work. In the last six months we've really spent a lot of time trying to do everything we can. I can't emphasize that enough. But we've run into these problems, and it's definitely a direct result of the Form Based Code. I'm not here to bash it or anything like that. It is what it is. But it's caused us a lot of problems. And I look in the mirror and say I don't want to be part of the problem; I want to be part of the solution. I know ways that we can make this work if we can redesign this building. That's what we've done in the last three months, is really focused on a complete overhaul of that building, and that's what we've come up with to be the only option that would make this project stay alive. Because it's kind of been derailed, so to speak. And I'm glad Mr. Scott called me a couple months ago and asked me about the status of it. That's when we were able to sit down and start talking about it.

So, that leads us to where we are tonight. One thing I'd like you all to please keep in mind is that this building, like Mr. Scott said, is not an income-producing building. The car wash in the back is the tunnel that generates the revenue. So, as the customers exit the car wash, included in their price, they can vacuum if they choose in the middle of a parking lot in an uncovered area, or up under this structure in the shade, if there's inclement weather, or if it's too hot, or whatever. The upstairs wasn't going to generate any money for us. The downstairs sure doesn't. We're used to spending, on a regular car wash, there are 11 vacuum stalls in this current design. We're used to spending maybe $150,000 on a canopy, like a gas station, rectangular canopy. And plugging in $1.7 to $1.8 million for this building, the only option we had was to redesign it, and that's what I'm here for tonight, is to propose that to you. I think you may have seen some electronic versions. We've taken the original building, like Mr. Scott said, and left all the key features in it. Made it as nice as we could possibly make it. And that's the final product that we came up with. We can make that work and go fast on new drawings. In the big picture, with this redesigned

building, it's my belief that we can achieve everything that the building needs to achieve. There are three things in particularly. Functionality – It will serve its purpose; the customers will still be able to vacuum like they need to. Aesthetically, it's going to look as good, in my opinion, as the other one, if not better. It's going to fit in just fine, and most importantly for me, it's the difference between a deal or not a deal – the economics we can make work with this. I think everybody involved with this project, if this is approved and we go forward, I think everyone wins. And what I mean by that is, I think that Tidal Wave builds another parking spot, we win. I believe the City will be very pleased with the final product of what we build. We've got several other locations that are going now. We've got one in Raytown you can look at, but that really wouldn't do a lot of good because this is such a different animal. But I've always tried to stress how we operate, in a Chik-fil-a type manner, customer service, aesthetics, curb appeal – all those things. So, I think the community will appreciate it, I think the customers will rave about it, and our employees will have a great place to work. So, I think it accomplishes all those goals. With that, it's pretty simple. I'm asking for your recommendation for approval to move forward with this redesigned building. That's really all I have tonight. Again, I appreciate your time, and I respect that. I'll be glad to answer any questions.

Chair Lee: Any questions? [None.] Thank you.

The Chairman opened the public hearing. There being no one to be heard, he closed the public hearing.

Comm. Bruce: Mr. Chairman, I am not a great proponent of Form Based Code. I'll put that right at the top. I have reviewed the Form Based Code. I don't see where there's any mechanism to address a business like this in the Form Based Code. That being said, if I lived across the street, I wouldn't want even a two, let alone a five-story building, across Johnson Drive from my residence. So, I don't really have a lot heartburn with a one-story building that replaces a blanket building that has been there for an extremely long time, not generating revenue to the City of Mission.

Also, if you go back to the minutes from the March 26, 2018 meeting, on pages 36 and 37, Mr. Heaven stated that the Form Based Code is a guideline, and he charged the Planning Commission with responsibility to make decisions for the best interests of the City/businesses in the City. And it's obvious to me that the people have gone way above and beyond a normal car wash motif to get something that would come close to the Form Based Code. And moving it up to Johnson Drive, having a ghost building face there, to start the car wash operation. Which otherwise I'm assuming wouldn't be visible to the public. Anyway, I really don't see a problem moving forward with the adjusted plan.

Comm. Troppito: As the other Ward 3 Planning Commissioner, we're pretty much in the same idea. I view this as an improvement over the previous plan that we reviewed. I also want to note that among those improvements, the key one of those isn't what you see, it's what occurred in terms of below ground, with the environmental remediation, and the expense of that. And it benefits the rest of the city, besides the revenues that were just mentioned. I believe, the way I interpret the Form Based Code, this is a fit, and an improvement.

Comm. Davidson: Brian, do you happen to have a drawing of the elevation of the original building? If not, that's okay. I agree with Charlie and Frank. I think that is a type of rendering, of taking off the top floor. I have no problem with it, as well. I have a question of the applicant. On most facilities that you have, the vacuum area, which is, in the case of this building, on Johnson Drive, it's basically just an open canopy in most cases?

Mr. Hardin: This is the first out of 46 locations that we've ever enclosed like this on three sides.

Comm. Davidson: Okay. So, there's a lot of added expense. I can see that with this structure, trying to meet the best you can with the Form Based Code. I have no issues with it either. I like the jut-out of the building material, the turret in the middle, the dormers that breaks up the rooflines. And is that a standing seam roof on that building?

Mr. Hardin: Yes.

Comm. Davidson: I think it looks absolutely great for what you had to work with, to bring it down to one level. The plate lines on the first, are they the exact same elevation height-wise?

Mr. Hardin: [inaudible-off microphone]

Comm. Davidson: But you're not raising the plate line of the first floor, like it was, let's just say on…

Mr. Hardin: I don't know offhand what that is. I can tell you that the height of the proposed… The highest point on top of this cupola here, that would be 28 feet, 7 ½ inches, all the way from the ground to the very top. Showing from the ground to the top, the main roof line shows to be 20 feet 10 ½ inches to the main roofline up here. Then from the ground to the gutter line or the eve would be 12 feet 8 ½ inches.

Comm. Davidson: Okay. So, I'm just looking at the original drawing of the first floor, you know, the elevation of the first-floor wall height is probably around [inaudible]. I think it looks great and I have no problem, Mr. Chairman.

Comm. Braden: Personally, I don't have an issue with a one-story car wash. I do wonder how, in future cases where we have a Form Based Code, for two stories, how that affects that. If that diminishes the regulations that we set forth. I'm struggling with the question. [inaudible] struggling with the question also of how that affects regulating the Form Based Code.

Comm. Troppito: Mr. Chairman, again, Mr. Heaven answered that question. I believe it was Robin asked that, if we would be setting a precedent. And the answer was no. We're professionals in our discipline here. And while I have the floor, I might also mention that having been a member of the sustainability committee, I was very pleased with the report that they gave, and with what Tidal Wave does in trying to protect the environment. It seems like that was very strong suit on their part and they seem to be a regular corporate citizen to boot.

Comm. Dukelow: I struggle with it because of the two-story requirement. I mean as it stated we came to the conclusion last time that while it didn't meet the Form Based Code,

it met the intent because the building fronting Johnson Drive was two stories. And I might add at this point, I don't see a building. It's a carport. A building would imply enclosed conditions. In my personal opinion, it's not a building, it's a carport. That I struggle with. There is also a provision in the Form Based Code for low-rise building types and that would be in the case where the site was no larger than half an acre. And honestly, I can't support the idea of it extending more anyway, so, like I said, I'm have a hard time… I'm having a hard time recommending or not recommending this because I feel it's not really the intent of what we want to see along the Johnson Drive corridor. And I'm at one story, although yes, it's a lovely car wash. I know it's an ugly site now and it's been an ugly site for several years. I mean, I don't mean an ugly site. It's not an ugly project. Don't get me wrong. My only concern is that we've got a lot of examples of developments that have occurred in the Gateway where we have required two stories or at least 60 or 40 percent. I mean, what is the square footage of the building, because the building is just [inaudible]. Technically. I struggle with that. How do you even say what the square footage of the building is when three-fourths of your construction is not technically a building? [inaudible]. Maybe the cupola would make up the 40 or 60 percent. I'll have to come up with something more intelligible by the time we call the roll, because, like I said, I'm struggling with it. Thank you.

Comm. Bruce: Mr. Chairman, Form Based Code is like telling everybody to wear an 8 ½ shoe. Some people are very happy with that; some aren't. I happen to know of people that have intended to create a business in Mission, in the West Gateway, that would have been very beneficial to Mission because it was on empty property that is currently over there. Revenue generate for the city. But, because of the Form Based Code, they choose to go to [inaudible] ridge to building their restaurant because restaurants don't lend themselves to Form Based Code, as well as this car wash. And it's nice to say that the Form Based Code is a wonderful thing, but it's also to say that the City of Mission is looking for corporate partners that are willing to come in here and invest in our cities, upgrade existing property, or vacant property that will revenue-generate for the city going forward.

Now, I'm personally not in favor of approving anything that is even marginal, but something that's certainly attractive to our business community is not a high-risk thing where I'm concerned.

Comm. Dukelow: That is an interesting perspective that Frank just shared. And I'm going to go off of what I said previously, and then what he said, because what he made me realize – and which I alluded to previously – is that our success with the Form Based Code has been more applicable to larger development parcels. The case being over there where we've got the chicken place, Mission Commons, and where we've got the Natural Grocers. Because those sites were big enough to give the developer more flexibility and the ability to go ahead and provide the restaurant, the nail salon, and those other places, along with their square footage, in a building type where they can generate revenue with that additional square footage above the first floor.

Comm. Casper: I'd like to say that I appreciate the effort that's been put forth so far, and also the effort in coming up with a solution that will work for you, and possibly the city. I

don't have a problem with a one-story building. I think the location and placement of it on the project is what we're looking for and it will be one of the nicest-looking carwashes around, hopefully. I don't have an issue with the one-story. Thank you.

Comm. Christiansen: I want to thank you for having faith in our city and coming back and being willing to put in hours of effort to build in our city. I too don't have an issue with the single story, if we're calling it that, being a carport that's not occupiable. I don't know if I would consider it a building. I was in a couple areas where Form Based Code had been applied. I haven't seen much success in it either. Robin, you mentioned the Five Guys. I don't know if the space has ever been occupied above them.

Mr. Scott: Just within the last six months.

Comm. Christiansen: So, just recently. So, I see no issue with this. I think it is important to, even though the Form Based Code is a guideline, I do think we should set the correct precedent for other developers or business owners that come before us, to show them what we're envisioning and what the City is envisioning. [inaudible] line of work with this code. The Form Based Code might not have been thought about for a car wash, obviously, or having a two-story building on the front side of it, though.

Chair Lee: Well, I also have mixed feelings. I understand both parts of it. I will say that when I mentioned to others that we were going to have a two-story car wash, everybody seemed quite shocked and surprised. And if that's what you have, I think everybody in Kansas City would recognize it as that – a two-story car wash. I agree with Robin that the larger the projects, the easier the Form Based Code is to work with. We have one other bank that's going to go in on Johnson Drive [inaudible] down the street from the park. I have mixed feelings. I mean, I believe the Form Based Code could work. Certainly, it's easier to work with for a bigger project. So, I have mixed feelings. [inaudible].

Comm. Troppito: Well, if there's no further discussion, Mr. Chairman, I move that the Planning Commission recommend to City Council approval of Case #19-03: Amendment of the Preliminary and Final Site Development Plan for Tidal Wave Auto Spa at 6501 Johnson Drive, which entails removing the second floor of the building at the front of the property, with all conditions from the original preliminary and final development plan still required.

Comm. Bruce: I'll second that.

Unidentified: Do we need to address the fact that it is a canopy [inaudible]?

Mr. Scott: How do you define a building?

Comm. Dukelow: Condition of occupiable space.

Mr. Scott: It's an occupiable space.

Comm. Dukelow: Not my definition of it [inaudible].

Comm. Troppito: [inaudible] motion…

[crosstalk]

Mr. Scott: Occupiable space?

Unidentified: Yeah. A structure, not so much.

Comm. Dukelow: [inaudible]

Comm. Troppito: I agree with substituting the word "structure."

The vote was taken (8-0). The **motion carried**.

Case #19-04 Non-Conforming Situation Permit, 5966 Barkley

Mr. Scott: This particular item is a non-conforming situation permit at 5966 Barkley. The applicant is Richard Jacobsen, president of Valvoline Instant Oil Change. The property is and has been since it was constructed back in the 1990's, an oil change/lube operation. I believe at one time it was a Valvoline then it was sold. Most recently it operated as a JC Speedy oil change. That particular business closed this winter. Mr. Jacobsen was interested in purchasing the property and reestablishing a Valvoline. He wants to make some changes to the building, minor changes. Replace the wood parapet around the roof line with an EFIS. One portion of that roof line would actually pop over just a bit to allow room for the Valvoline sign. That is within the amount of EFIS in the code. They want to paint the brick; I said no, we like the color of that brick, so they agreed to that. I asked for more landscaping on the site which they agreed to.

The parking lot needs a little help, so they're going to go in and patch it, seal coat it and stripe it. They are providing some parking spaces on site. There is also a drainage issue. I'm not sure where the water is coming from but it's going to drain across the front lawn on the south side and across the sidewalk. There's some moss on the sidewalk. They are aware of that and they'll make efforts to address that previous to the building. That is the case. The applicant is here tonight if you have any questions.

Chair Lee: [inaudible]

Mark Abeln, Architect, appeared before the Planning Commission and made the following comments:

Mr. Abeln: I'm an architect, working on this project. I'm really just here to answer any questions. I think you mentioned that even a half acre is not regulated by the Form Based Code…

Comm. Dukelow: I think there's [inaudible] to provide…

Mr. Abeln: We're even under that, so I guess we're non-conforming, but we're still conforming to the code. If you have any questions, I'd be happy to answer.

Unidentified: [inaudible]

Mr. Abeln: I don't know what the percentage is exactly. I can figure it up pretty easy. Can't hold me to it, but it's probably 20 percent, somewhere in that area.

Unidentified: So that's below the threshold.

Mr. Scott: Ballpark, right about 25 percent.

Unidentified: Really, this is the same situation we just had last month.

Comm. Dukelow: In this case, this light area, that's half an acre?

Mr. Abeln: Yes, 20,900. One hundred and ninety by 110.

Comm. Dukelow: I guess my biggest question is, what are the improvements you're going to make to the building?

Mr. Abeln: We're going to put EFIS on the top band where there's certainly a wood band. That will help that quite a bit, I think. We're going to add new overhead doors, all glass. We're going to take down the wood deck. And new signage, obviously. We're going to have new landscaping. We worked it out with the City, you know, some groupings of plants and what-not. There's a pretty serious drainage issue at the front of the drive, south side, on the east side of the south side. The east two bays have a pretty serious water problem and the water problem is from a sump. That's going to be taken care of. We're going to have all new pavement, which is pretty expensive. Basically, what's there, but it's going to have to be taken apart and patched and coated. That's it.

Richard Jacobsen, Applicant, appeared before the Planning Commission and made the following comments:

Mr. Jacobsen: I own Westco Lube, which is a [inaudible] franchisee. One of the improvements that's important to us, and I believe would be important to everyone sitting here, is we'll replace all the oil storage tanks in the facility, both new and used. Some other things on the main level which doesn't quite meet code because you're supposed to have secondary containment, which they did not, so, all of ours will be in the basement. There's going to be no floor drains, so the basement acts as secondary containment. But we go a second step past that, in that all oil tanks that we purchase either for the storage of fresh oil or used oil, they are all double-wall tanks. In essence, we've got three layers of protection, and we've got two layers of double wall on the tank, and the containment of the basement with no floor drains. We do that because we want to be safe, too.

Comm. Braden: Do you have sensors for the tank to check for leaks?

Mr. Jacobsen: No, we do not. I'm not aware of any manufacturers in this field that have that. They do on gas, I know that, but on the oil, I don't. That's what we're doing that, and that's a substantial cost, but we do that in all of our facilities.

Comm. Bruce: Are there any floor drains in the basement?

Mr. Jacobsen: I don't believe there's any there now. I mean, I've been in that basement twice and I don't think there's any, but if we find any down there, you know, which we've had in previous circumstances, we go in and cement them over. They will definitely be contained because we don't want that either.

Mr. Abeln: There's probably not in that there's water in the basement now.

Comm. Bruce: So, the water is being pumped out through the…

Mr. Abeln: [inaudible].

Comm. Bruce: And it's surface water?

Mr. Abeln: Yeah. From the foundation drain, I believe. [inaudible].

Comm. Dukelow: And this is a continued use?

Mr. Jacobsen: Correct.

Unidentified: On the green space on the north side, I guess, of the entrance, the north entrance, that green space right there, is that your property? Because the drive-through on the back side, that belongs to the barbecue, correct?

[inaudible, shuffling papers, crosstalk.]

Mr. Abeln: Yeah, the green space on the north side would be ours.

Unidentified: Okay.

[inaudible]

Mr. Abeln: Right. Since I don't have a site plan. But that green space to the north is ours.

Mr. Jacobsen: One of the things that we do on all our properties, we'll go in and put in an irrigation system in all the landscaped areas. We definitely will.

Comm. Davidson: And then, basically, the footprint of the parked surface, you were going to add some parking spaces some place in the project. That's mainly going to be fixing old curbs, and new curbing area to create a few more parking spaces, and then a mill and overlay, or something like that, or asphalt?

Mr. Abeln: It depends on what we find. If it's too far, we're going to put in a new surface all the way across, if it comes to that. We've got another project going right now and that's what we're doing there, too.

Comm. Davidson: My other question on that is, as far as drainage, like, not talking about the gravel and water that was coming over the sidewalk [inaudible]. As far as any of the sheeting of rainwater, is it all flowing in the right direction as far as stormwater, you know, and all that. Because I'm not sure when this structure was originally built, but there could have been some mistakes as far as rainwater direction…

[inaudible] [crosstalk]

Comm. Davidson: Well, I've just driven by that property for many, many years, so I'd like to bring it up.

Mr. Abeln: Yeah, and the reality is, there are mistakes, and it does kind of go into the building, which is why they have that foundation drain. That is, you know, you're observing it enough to have seen it, and it is a problem, and we intend to address that. [inaudible] So, I mean, we need to assess it, and we don't have our topo survey back yet, but we hope to address that in the redoing of the pavement. Anything we can do at that time to get any water away. We don't want to have any water in the building, obviously, or going towards the building. And we're going to pick up that sump pump in the interim also, and pump that straight into the sewer system.

Comm. Davidson: What do you mean…?

Mr. Abeln: If the sump pump is dumping all that water out on the sidewalk…

Comm. Davidson: Oh, that's what it's from. It's from the basement….

[crosstalk]

Mr. Abeln: Well, it's an outside sump pump. An exterior sump pump going to the foundation drain. It must have had water infiltrating into…

[crosstalk]

Comm. Davidson: … later point in time.

Mr. Abeln: I don't know. But I believe [inaudible] problems, clearly, so they're pumping water [inaudible] outside on the foundation.

Comm. Davidson: That's all my questions.

Comm. Troppito: Do your facilities also have oil spill kits at the ready?

Mr. Jacobsen: Yes, we do. We have them under all of our storage. And not to get into the details, but under each of the pit openings there is a catwalk, you know, the individual is servicing the vehicle from underneath, and below that is a catch pan. But if any of the oil, if the catch pan doesn't catch it and they make a mistake, instead of it going down and going all over the floor, it hits the catch pan underneath this and runs to a containment bucket, if you will. It just makes a safer environment for our people working, too.

Comm. Braden: First of all, I'm understanding or just confirming that you're not adding any more pavement, just repairing.

Mr. Abeln: Correct.

Comm. Braden: Okay. And then, for staff, I saw multiple signs. I don't look [inaudible] calculations but I assume we're in conformance with the code as far as area.

Mr. Scott: They actually submitted a sign package. I think they may be a little over in the front, so let's talk about shrinking that down a little bit.

Comm. Braden: Okay.

Mr. Scott: I was kind of kind of looking [inaudible].

Comm. Dukelow: One comment or question. So, you mentioned irrigation. Will those be smart controllers so they're not running when it's raining?

Mr. Jacobsen: I believe they're the smartest they've got. But yes, that's what we do. But I will say that we've had trouble with those in the past. Sometimes they're not performing like they should, but we do. That's part of our package.

Comm. Dukelow: A combination of planting appropriate plant material and smart controllers can make a big difference. My next question, I hate to ask this but, why is this non-conforming?

Mr. Scott: It's within the Form Based Code district, and because of value of improvements greater than 10 percent. I think a $1,000 is [inaudible]. Obviously, the improvements have been greater than $1,000…

Comm. Dukelow: [inaudible] Thank you. That's all I have.

Chair Lee: Anything else? I'll entertain a motion.

Comm. Braden: Mr. Chair, I would move that the Planning Commission adopt the findings of fact contained in the staff report and grant a non-conforming situation permit for Case #19-04, 5966 Barkley; Permit for Non-Conforming Situation, with the following conditions: The surface of the lot will need to be patched, seal coated and re-striped. Draining issues on the south side of the building where water runs across the existing sidewalk will need to be addressed.

Comm. Dukelow: Second.

The vote was taken (8-0). The **motion carried**.

Old Business

Follow-up on Case #19-02, Non-Conforming Situation Permit – 6591 Johnson Drive

Mr. Scott: This is from the application that we had last month for the former Taco Bell, which is going to be a Slim Chickens. Commissioner Dukelow suggested redoing the parking on the far west of the lot. The original suggestion was to have angled parking. The applicant did submit some drawings for angled parking. We discussed those. Their concern was that, that parking is not only for the proposed Slim Chickens, but also for some other uses in the shopping center, and folks might have difficulty coming into the shopping center from the north, and then swinging around to that angled parking. They might be forced to either drive through the shopping center to get to the angled parking or just skip it altogether. Try to reduce the amount of traffic going through the shopping center; it may be best to have straight perpendicular parking where somebody can pull right into that. They did provide a four-foot grass area or strip between the two parking rows. So, we agreed with that and thought that was a nice comprise to the project.

Comm. Braden: I guess I have one question, Mr. Chair. Is there a gap in there or some way for a person to walk across and back? Is there a sidewalk? I was wondering how to get from one part of that strip to the other without walking on the grass. [inaudible]

[No audible response]

Comm. Dukelow: I was going to ask about landscaping.

Mr. Scott: There's no landscaping proposed in the four-foot strip. We could certainly suggest that to the applicant with the final approval of the building permit. They may be putting in a crosswalk or something, avoiding walking in the grass.

Comm. Braden: [inaudible].

Comm. Troppito: Mr. Chairman, if you look at that layout, the traffic coming in front of the gym, there's an island that extends quite a ways to the west from that flow of traffic. So, as far as backing into traffic flow, they have to come and then move over that way to get there. I don't know if you can see it on that; I have it here.

Comm. Dukelow: You need to say it's 3 or wide through there. The driveway? The northwest drive is about three cars wide.

Mr. Scott: Probably about three cars wide.

Comm. Troppito: Down in that area, right where the gym is.

Mr. Scott: Yeah, the gym would be a little further south.

Comm. Troppito: Yeah and then most people continue straight unless they're going to turn right, so I don't think there's a lot of conflict there.

Mr. Scott: Yeah, they should be able to move in easily to one of these stalls. As opposed to swinging around and coming in at an angle. I just wanted to give you an update on that.

PC Comments/CIP Committee Update

Mr. Scott provided the Commission with an update on the KC Climate Action Coalition. There is summit on September 14, 2019 at Johnson County Community College. There will be a number of keynote speakers. If anyone is interested in attending, please let him know. Comm. Troppito commented that he plans to attend. He urges the Sustainability Commission to look at bringing two technology companies to the Kansas City area that deal with sequestration and CO-2. That is one of his interests in attending this meeting.

Mr. Scott then mentioned the First Suburbs Coalition Regional Housing Summit to be held on Friday, July 19th, 2019. The City of Mission is a co-sponsor of this summit, along with the city of Gladstone. He can register anyone who is interested in attending.

Staff Updates

Mr. Scott then presented a proposal for update of the City of Mission's Comprehensive Land Use Plan. He has researched what other cities are doing and looked at the American Planning Association and looked through their examples, etc. Updates proposed include land use, scope of services, analysis of demographics and emerging trends, and other items. He also mentioned trends in housing development, analysis of commercial development and emerging trends, transportation network and natural environment.

Mr. Scott then brought up the Community Satisfaction Survey set for this summer or fall. Comm. Troppito asked about ways of accessing a cross-section, not just online, but also through mail [inaudible]…. He asked if it is broad based. Mr. Scott responded that the survey will be done by ETC out of Olathe. They do telephone and mail surveys, as well as social media. He said ETC is very cautious about getting the appropriate number of applicants to establish validity of results.

Mr. Scott then provided an update on the East Gateway. He says the developer has turned all their attention to Synergy, a new tenant. Their goal is to open by May or June of next year. Plans have been reviewed and the developer has been preparing the pad

site. They are waiting for approval from Johnson County Wastewater because the sewer line on the site has to be moved. Mr. Scott expects a building permit to be issued in the next week or so. The developer has been interviewing architects. Mr. Scott anticipates reviewing plans for the food hall next winter. Neighbors Construction pulled a building permit last summer on the apartments but they have pulled out of the project. Fogel-Anderson is now going to build the apartments. Developers are working on financing. Comm. Davidson asked if it's normal to begin working on a project before construction financing is in place. Mr. Scott responded that it is not out of the ordinary.

Comm. Dukelow asked about the progress in the brewery that was planned. Mr. Scott responded that the developer is still moving forward.

ADJOURNMENT

With no other agenda items, **Comm. Casper moved and Comm. Dukelow seconded a motion to adjourn.** (Vote was unanimous). The **motion carried**. The meeting adjourned at 8:15 P.M.

_____
Mike Lee, Chair

ATTEST:

_____
Audrey McClanahan, Secretary

STAFF REPORT
Planning Commission Meeting September 23, 2019

AGENDA ITEM NO.:	2
PROJECT NUMBER / TITLE:	Application # 19-05
REQUEST:	Zoning and Preliminary and Final Development Plan for Medical Office Building Parking Lot
LOCATION:	Portion of A Parcel of Property at the Northeast Corner of Johnson Drive and Roe Avenue Parcel ID: KF251209-3004
APPLICANT:	SMG Investments, LLC 5555 W. 58th St. Mission, KS 66202
PROPERTY OWNER:	City of Roeland Park 4600 W. 51st Street Roeland Park, KS 66205
STAFF CONTACT:	Brian Scott, Assistant City Administrator
ADVERTISEMENT:	8/27/2019 - The Legal Record Newspaper
PUBLIC HEARING:	9/23/19 - Planning Commission

Property Information:

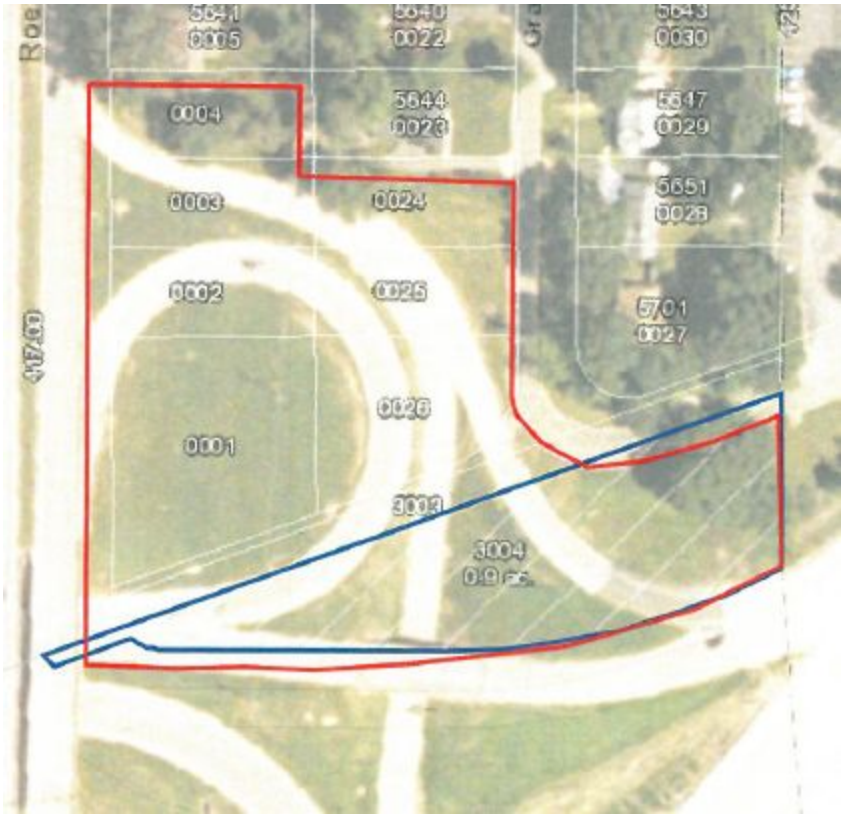
The subject property is located at the northeast corner of Johnson Drive and Roe Avenue. It is a portion of a larger parcel of property that is partly in the city of Roeland Park and partly in the city of Mission. The entire parcel is outlined in red in the aerial photograph on the previous page. The portion that is in Mission is outlined in blue with white, diagonal hatch lines. The entire parcel is approximately 2.7 acres. The portion that is in Mission is approximately .74 acres.

The portion that is in Mission is currently not zoned. The Comprehensive Plan identifies this portion of property as right-of-way and thus does not have a land use classification or zoning assigned to it.

Surrounding properties are zoned and developed as follows:
North: "SFR" Single-Family Residential District, currently undeveloped (Roeland Park)
East: "R-1" Single-family Residential District, detached single-family homes (Fairway)
"B-2" Business Office District, office park (Fairway)
West: "MXD" Mixed-Use District, bank and micro-hospital (Roeland Park)
South: No Zoning, right-of-way for US Routes 56 and 169 (Mission)

Background:

The subject property for this application is a portion of a larger parcel of property that is partly located in the city of Roeland Park and partly in the city of Mission. The larger parcel of property was owned by the Kansas Department of Transportation and served as the right-of-way for a clover-leaf interchange between Johnson Drive, Roe Avenue and Shawnee Mission Parkway - primarily to serve the former Mission Mall and Johnson Drive shopping district. The clover-leaf interchange was removed in 2003. The larger parcel of property was subsequently sold to the City of Roeland Park sometime around 2014.



The City of Roeland Park has recently entered into a contract to

sell the larger parcel of property to SMG Investors, LLC. SMG Investors would like to develop the property into a medical office building. The proposed building would be two stories in height and approximately 31,500 square feet. The building would be located entirely on that portion of the property that is within the city of Roeland Park. The remainder of the property, including that portion located in the city of Mission, would be surface parking associated with the medical building.

The applicant is requesting a rezoning of the property and consideration of a preliminary and final development plan with both the City of Roeland Park and the City of Mission. Though this report will provide information about the project as a whole, Staff's review is just for that portion that is within the city of Mission.

Proposed Land Use and Zoning

The portion of the property that is in the city of Roeland Park is currently zoned "SFR" Single-Family Residential District. Though the property itself is vacant, a single-family subdivision does exist to the north and east. The City of Roeland Park is proposing to rezone the property to "CP-O" Planned Office Building. A medical office building would be a permitted use within this zoning district.

The portion of the property that is in the city of Mission does not currently have a zoning designation. Instead, it is designated on the City's Zoning District Map as right-of-way, as is all of the land area within the city that is east of Roe Avenue. This land area comprises US Routes 59 and 169 and the ramps to and from Johnson Drive. The Rock Creek goes through this land area, and there is also a wastewater lift station located in this area. All of the land area east of Roe Avenue, with the exception of the subject property, is owned by the Kansas Department of Transportation.

City Staff proposes a designation of "CP-O" Planned Office Building District for that portion of the property that is located within the city of Mission. Medical office buildings are a permitted use in this zoning designation.

Code Review For Zoning:

Municipal Code Section 405.050 stipulates that, "All rezoning applications submitted after the effective date of this Title (January 24, 2001) will be deemed to be a submittal to a planned zoning district."

Municipal Code Section 405.080 provides a Statement of Objectives for planned zoning districts. These include:

1. Proposal to rezone land to a planned district shall be subject to the same criteria relative to compliance with master plans, land use policies, neighborhood compatibility, adequacy of streets and utilities and other elements as is normal in rezoning deliberations.

2. The submission by the developer and the approval by the City of development plans represents a firm commitment by the developer that development will

indeed follow the approved plan in all aspects.

3. Residential areas will be planned and developed in a manner that will produce more useable open space, better recreational opportunities, safer and more attractive neighborhoods than under standard zoning and development techniques.

4. Commercial areas will be planned and developed so as to result in attractive, viable and safe centers and clusters, as opposed to strip patterns along thoroughfares. Control of vehicular access, architectural quality, landscaping and signs will be exercised to soften the impact on nearby residential neighborhoods and to assure minimum adverse effects on the street system and other services of the community.

5. The applicant will be given latitude in using innovative techniques in the development of land not feasible under application of standard zoning requirements.

6. Planned zoning shall not be used as a refuge from the requirements of the equivalent district as to intensity of land use, amount of open space or other established development criteria.

7. Any building or portion thereof may be owned in condominium under K.S.A. 58-3101.

8. For purposes of this Title, the term "shopping center," "office park," "industrial park" or other grouping of buildings shall mean developments that were planned as an integral unit or cluster on property under unified control or ownership at the time the zoning was approved by the City. The sale, subdivision or other partition of the site after zoning approval does not exempt the project or portions thereof from complying with development standards, architectural quality, sign concepts and other conditions that were committed at the time of rezoning.

Municipal Code Section 410.070 provides requirements for the “CP-0” Planned Office Building District. Section 410.070(A)(3) - Permitted Uses - states, “Other offices limited to the following: (i) Physicians, osteopaths, chiropractors, optometrists, psychologists.” *The proposed use of medical office building is permitted*.

Municipal Code Section 410.070(C) - Height - states, “Buildings, or structures located within District “CP-O” shall have no minimum or maximum height requirements except as governed by yard requirements and provided approval is given by the City during rezoning and final development plan approval.” Section 410.070(D) - Front Yard - requires that minimum front yard shall not be less than thirty (30) feet. Section 410.070(E) - Side Yard - states, “Not less than fifteen (15) feet shall be provided on the street side of a corner lot up to two and one-half (2-½) story buildings.” *The front of the proposed building is situated along Roe Avenue with a front yard depth of approximately 25 feet from the back of curb. The existing sidewalk along Roe Avenue in front of the building will remain. This will provide the sense that the building is close to the*

sidewalk, and the front of the lot, which is in keeping with the Johnson Drive Design Guidelines. Due to utility easements that run through the property at the corner, it is not practical to bring the building to the corner of Roe and Johnson Drive. The proposed side-yard setback is well within the requirements of the zoning provisions. The City of Roeland Park is requesting an easement in this side-yard area for a City entrance monument. The applicant is also intending to place a piece of public art in this location, near the building. This is in keeping with Roeland Parks' requirement of 1% of construction costs to be dedicated for public art. Both the City entrance monument and the public art will provide a nice aesthetic presence to the corner that will be an enhancement for both communities.

Municipal Code Section 410.070(H) - Parking - stipulates, "The parking lot shall not be closer to the street right-of-way than one-half (½) of the front yard or street side yard requirements, nor closer than six (6) feet to the interior or rear lot lines." *The surface parking lot area within that portion of the property that is in the city of Mission (essentially that area along Johnson Drive) is setback 6 feet from the property line and 35 feet from the back of curb of Johnson Drive. This is greater than ½ of the street side yard or 7.5 feet (one-half of the 15 foot side yard requirement). Staff has requested, and the applicant has agreed, that an eight (8) foot wide sidewalk be placed on the Johnson Drive frontage from Roe Avenue to Granada Street. There will also be sidewalks to the interior of the site that provide connectivity for those walking to and from the street area.*

Municipal Code Section 410.070(J) stipulates, "All exterior alterations or improvements to buildings (excluding exact replacements or color), new building permits, site plan reviews and rezoning/special use permit applications shall be in accordance with the interim Community Wide Design Guidelines (Johnson Drive Design Guidelines). The intent of the Design Guidelines is to promote site-specific, contextual buildings that incorporate mixed uses and pedestrian friendly commercial activity. For this reason, whenever a conflict exists between the zoning ordinance and design guidelines requirements for setbacks, height, landscaping or signage, the design guidelines shall be adhered to." *As stated previously, the proposed building is situated entirely within the city of Roeland Park. As such, Staff has decided to defer to the City of Roeland Park and their design criteria. However, Staff does believe that the proposed building is in keeping with the intent of the Johnson Drive Design Guidelines in the application of materials and architectural elements.*

Code Review for Landscaping and Parking:

Municipal Code Section 415.090 provides minimum tree requirements per zoning district. In particular subsection (A) states: "In all zones one (1) tree is required for each fifty (50) feet of street frontage or portion thereof. Said trees shall be planted within the landscape setback abutting said street frontage. Trees may be clustered or arranged within the setback and need not be placed evenly at fifty (50) foot intervals. In addition, provide one (1) tree for each dwelling unit or every three thousand (3,000) square feet of landscaped open space. In addition, provide one (1) tree for each twenty (20) cars of parking area located dispersed in the parking area not at the perimeter." *The landscape plan provided as part of the final development plan indicates that there is approximately*

400 feet of frontage along Johnson Drive. This would equate to 8 trees being needed. The plans indicate that 3 Swamp White Oak (2.5" calbr.), 4 Black Gum (2.5 calbr.), and 6 Autumn Brilliance Serviceberry (1.5" calbr.) trees are proposed for the frontage. These will be planted both individually and in a cluster pattern. In addition, Sea Green Junipers and Maiden Grass will be planted along the edge of the parking lots to help in concealing the lot and parked vehicles.

The plans indicate that there will be 155 parking spaces throughout the property (both in Roeland Park and Mission). This equates to 7.75 trees being required within the parking lot area. The landscape plans indicate 8 Maidenhair trees (2.5" calbr.) will be planted in the parking lot islands. Additional plantings in the parking lot islands will include Buffalo Junipers and Iroquois Beauty Black Chokeberry bushes.

All plantings are in accordance with Municipal Code Section 415.100 Planting requirements. Staff has stipulated to the applicant, as provided in the code, that sod must be planted in the right-of-way.

The total amount of parking surface within the city of Mission will equate to approximately 14,500 square feet or 45% of the land area.

Municipal Code Section 425.020 - Minimum Space Requirements - stipulates that for general office buildings a minimum of 2.84 parking spaces is required for each 1,000 square feet of building space. *The proposed building is 31,500 square feet. This would equate to 89.46 parking spaces being required (31,500/1,000 X 2.84=89.45). Plans indicate 155 parking spaces being provided (approximately 47 parking spaces will be in the Mission portion of the property). Size of parking stalls and arrangement are within code.*

Approval of Zoning Request:

Section 440.140 (E) -Criteria for Considering Applications - lists the criteria to be used by the Planning Commission and City Council in the consideration of this application. An evaluation of these criteria is as follows:

1. **The character of the neighborhood.**
   The subject property is located at the northeast corner of Johnson Drive and Roe Avenue. Both are arterial roads connecting the area to the larger northeast Johnson County region. Commercial property (primarily non retail) already exists with the office park in the city of Fairway to the east, and the bank and micro-hospital in the city of Roeland Park to the west. The Gateway development project is to the southwest. *There is a residential subdivision to the northeast, but the proposed use should have little impact as the hours of operation will be during the weekday and not evening or weekend. The proposed use will provide a good buffer for this neighborhood to the traffic and surrounding uses. The proposed development of a medical office building is in keeping with the overall character of the neighborhood.*

2. **The zoning and uses of nearby properties, and the extent to which the proposed use would be in harmony with such zoning and uses.**
   Properties to the west (Roeland Park) and southwest (Mission) are zoned mixed-use and comprise commercial, mostly non-retail, properties. Zoning to the east (Fairway) is a business office park. Property to the south (Mission) is not zoned. Property to the north (Roeland Park) is zoned single-family residential. The proposed use is a medical office building. Hours of operation will be primarily weekdays. There will be limited evening and weekend hours of operation. There will be little to no noise generated from the proposed use outside what is associated with a parking lot. *The proposed zoning and use is in harmony with the surrounding zoning districts and uses.*

3. **The suitability of the property for the uses to which it has been restricted under the applicable zoning district regulations.**
   The subject property is 2.8 acres in size and relatively flat. It is located at the corner of two arterial roads. The property is suitable for the proposed zoning of "CP-O" and will work well for the proposed medical office use. The building will be situated near the road with parking near the residential area. The parking lots will be well screened with landscaped. *The CP-O zoning limits uses to office buildings, which should be compatible with the residential area to the north and the other commercial uses east and west.*

4. **The extent to which approval of the application would detrimentally affect nearby properties.**
   As stated previously, the proposed use is compatible with the surrounding properties. *Approval of the application will not have a detrimental effect on the surrounding properties.*

5. **The length of time the property has remained vacant as zoned.**
   The property has never been developed. Rather it has been utilized as right-of-way for the interchange of Johnson Drive, Roe Avenue, and Shawnee-Mission Parkway. This interchange was removed in 2005 and the property has remained in its current state sense. *It has never been zoned by the City of Mission for any particular land use.*

6. **The relative benefit to the public health, safety and welfare by retaining applicable restrictions on the property as compared to the destruction of the value of the property or hardship to the owner association with denying its request.** Currently, the property is not zoned. The proposed zoning of "CP-O" will limit the use of the property to office buildings, which is a use that is more compatible with the surrounding properties and will better protect the surrounding properties. If not approved, the property could remain vacant and a future use proposed that is not necessarily as appropriate as what is currently being proposed. In addition, the owner would not realize the full and best use of the property. *Staff believes that the proposed zoning of "CP-O" is appropriate and protects the surrounding properties while allowing the owner to realize the full value of the land.*

7. **The master plan or comprehensive plan.**
   The City's comprehensive plan is silent as to the future use of this property. It is currently identified on the Zoning District Map as right-of-way. *The proposed zoning of "CP-O" is appropriate and in keeping with surrounding zoning uses in other cities, and the mixed-use zoning to the southwest, in the city of Mission.*

8. **The extent to which the proposed use would adversely affect the capacity or safety of that portion of the road network influenced by the use, or present parking problems in the vicinity of the property.**
   The applicant has provided a traffic study, which was reviewed by the City's on-call traffic engineer. The on-call traffic engineer suggested that traffic counts for the proposed Gateway development be utilized for the study, to which a revised study (please see attached) was submitted by the applicant.

   The on-call traffic engineer believes that the applicant's updated traffic study still slightly under-estimates the associated total peak hour traffic from the adjacent Mission Gateway development in their analysis of the existing traffic plus the Mission Gateway plus the proposed medical office building. The overall Synchro result with the completed analysis for the Johnson/Roe intersection is LOS "C" (26.6" of delay/vehicle). With the additional traffic from the Gateway development the result should generally be the same. At worst, it may exceed the 35" average delay/vehicle threshold which moves it into a LOS "D" condition, which is still acceptable for the projected critical peak hour condition.

   The one individual movement at the intersection that may need further evaluation is the eastbound dual left-turn lanes, which are LOS "E." With the additional traffic, that movement may possibly degrade a bit more. The proposed medical office building will not have much impact on this particular movement and there is not really anything that can be done geometrically at the intersection to change the performance. *Traffic conditions at the intersection of Johnson and Roe are being impacted by a number of factors and will need to be monitored over time to evaluate the effect of these factors.*

   In addition, Staff has requested, and the applicant has agreed, that an 8 foot wide sidewalk be constructed along the Johnson Drive frontage of the property. The sidewalk will connect with an existing sidewalk along Roe and end at Granada where a sidewalk is being proposed to be constructed by Roeland Park.

9. **The recommendation of the professional staff.**
   The site plan has been reviewed by staff and the City's on-call engineer for compliance with zoning, design, and engineering standards and all recommend approval of the proposed zoning and preliminary and final development plan.

10. **The extent to which utilities and services, including but not limited to, sewers, water service, police and fire protection, and parks and recreation facilities, are available and adequate to serve the proposed use.**
    All utilities and services are in place and are adequate to serve the proposed use. Public improvements to sidewalks, crosswalks and street trees will be made by the

applicant as a condition of approval.

11. **The extent to which the proposed use would create excessive stormwater runoff, air pollution, water pollution, noise pollution or other environmental harm.**
    The applicant provided a storm water study, which was reviewed by the City's on-call stormwater engineer. A revised study was provided to reflect an analysis of the amount of impervious surface area at the time that it served as right-of-way for the interchange and the amount of impervious surface area that will exist when it is a medical office building with associated parking. In addition, onsite, underground stormwater detention has been added at the recommendation of the City's on-call stormwater engineer.

    The revised stormwater study indicates that stormwater from most of the site will drain to a rain garden that is situated on the property. Stormwater from the portion of the parking lot that is in the city of Mission will drain to one of two storm inlets that will drain to the underground stormwater detention before draining to storm water sewer lateral.

    In accordance with Section 15-515 of Ordinance No. 809 of Roeland Park, the owner will complete an annual certification inspection of the stormwater management systems and is subject to City inspection at least once every three years.

12. **The extent to which there is a need for the use in the community.**
    The applicant is the Sunflower Medical Group, which is currently located within the City or Mission at 5555 W. 58th Street. They will be moving to a bigger facility, but still within the community and available to serve their clients here.

13. **The economic impact of the proposed use on the community.**
    The proposed use will not generate any economic activity taxes for the City of Mission. The City will receive property tax for the parking lot portion that is within the City. The City will also receive a stormwater utility fee for the impervious surface area that is the parking lot.

14. **The ability of the applicant to satisfy any requirements applicable to the specific use imposed pursuant to the zoning district regulations.**
    The applicant should be able to satisfy any requirements applicable to the specific use that will be allowed within the zoning regulations.

Staff Recommendation

Staff recommends the Planning Commission recommend approval of Case #19-05 to the City Council for:

(a) That portion of a parcel of property located at the northeast corner of Johnson Drive and Roe Avenue that is within the corporate limits of the City of Mission (Parcel ID: KF251209-3004) be zoned as "CP-O" Planned Office Building District; and

(b) That a preliminary development plan for a parking lot associated with a medical

office building to be built on the property be approved with the following conditions:

1. Landscaping be provided in accordance with the submitted landscape plans, and such landscaping (including the rain garden) will be maintained and adequately watered in accordance with a contract between the owner of the property and a landscaping company, such contract to be submitted to the City for review.

2. Sod to be laid in grass areas along the Johnson Drive right-of-way and maintained in contract as stipulated in the first condition.

3. Underground detention system be constructed as indicated in the submitted plans.

4. An eight (8) foot sidewalk be constructed along Johnson Drive from Roe Avenue to a terminus at Granada Drive in accordance with the site plans submitted.

5. A plat of the entire property be filed with both the City of Roeland Park and the City of Mission for approval by both cities, said plat indicating boundaries of the property, location of the building, dedicated easements and the dedication of right-of-way. be completed prior to the issuance of any permits for improvements.

Staff further recommends that the Planning Commission approve a final development plan for parking lot associated with a medical office building to be built on the subject property in accordance with the plans that have been submitted:

Planning Commission Action

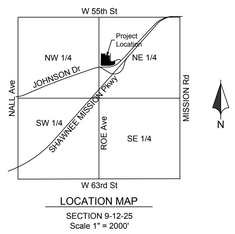
The Planning Commission will hold a public hearing at their regular meeting on Monday, September 23, 2018 at which time they will take testimony from any and all interested parties. At the conclusion of the public hearing, they will take the application under consideration and render a recommendation to the City Council if so deemed appropriate.

City Council Action

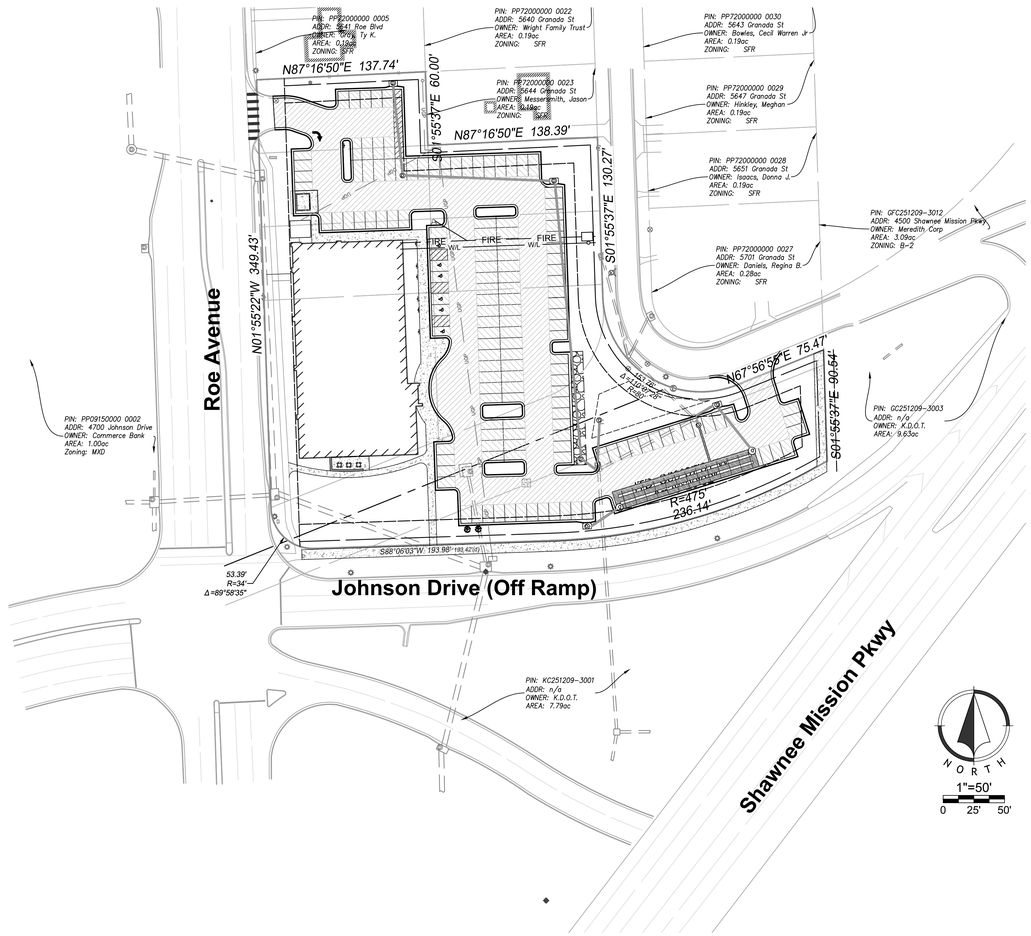
The City Council will consider this application at their regular meeting on October 16, 2019 m

Sep 18 , 2019-8:52am

FINAL DEVELOPMENT PLANS for
Sunflower Medical
City of Mission, Johnson County, Kansas



LOCATION MAP
SECTION 9-12-25
Scale 1" = 2000'



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A5.2.....EXTERIOR PERSPECTIVE

LEGEND

Existing Section Line	Proposed Right-of-Way
Existing Right-of-Way Line	Proposed Property Line
Existing Lot Line	Proposed Lot Line
Existing Easement Line	Proposed Easement
Existing Curb & Gutter	Proposed Curb & Gutter
Existing Sidewalk	Proposed Sidewalk
Existing Storm Sewer	Proposed Storm Sewer
Existing Storm Structure	Proposed Storm Structure
Existing Waterline	Proposed Fire Hydrant
Existing Gas Main	Proposed Waterline
Existing Sanitary Sewer	Proposed Sanitary Sewer
Existing Sanitary Manhole	Proposed Sanitary Manhole
Existing Contour Major	Proposed Contour Major
Existing Contour Minor	Proposed Contour Minor
Existing Underground Power Line	Future Curb and Gutter

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APPLICANT/DEVELOPER

SMG Investments, LLC
5555 W 58th St, Mission, KS 66202
(913) 432-2080

CONSULTANT

Renaissance Infrastructure Consulting
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PRELIMINARY, NOT FOR CONSTRUCTION, RECORDING PURPOSES, OR IMPLEMENTATION
8/6/2019 8:04:22 AM

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ACI/Boland, Inc.
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Phone Number: 816-531-4144

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Sunflower Medical
Roe & Johnson Drive | Mission, KS

Date	Sep 18 , 2019
Job Number	19-0143
Drawn By	CR
Checked By	DJB

Revision

Number	Date	Description
01	08/06/19	Original Submittal
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03	09/13/19	Architectural Update

C01

TITLE SHEET

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Description:

All of Lots 1 thru 4 and Lots 24 thru 26, ROSELAND COURT, and all that part of the NE 1/4 of Section 9, Township 12, Range 25, all in the City of Roeland Park, Johnson County, Kansas, more particularly described as follows:

Commencing at the Northwest corner of the NE 1/4 of said Section 09; thence S 1° 55' 22" E, along the West line of said NE 1/4, a distance of 1222.46 feet, to a point on the Westerly extension of the North line of said Lot 4; thence N 87° 16' 50" E, along the North line of the Westerly extension of said Lot 4, a distance of 40.00 feet, to the Point of Beginning; thence continuing N 87° 16' 50" E, along the North line of said Lot 4, a distance of 137.74 feet, to the Northeast corner of said Lot 4; thence S 1° 55' 37" E, along the East line of said Lot 4, a distance of 60.00 feet, to the Southeast corner of said Lot 4; thence N 87° 16' 50" E, along the North line of said Lot 24, a distance of 138.39 feet, to the Northeast corner of said Lot 24; thence S 1° 55' 37" E, along said West right of way line of Granada Lane (Platted as Walnut Street), as now established a distance of 130.27 feet, to a point of curvature; thence Southeasterly along a curve to the left having a radius of 80.00 feet, a central angle of 110° 07' 28", an arc distance of 153.76 feet; thence N 67° 56' 55" E, along said South right of way line, a distance of 75.47 feet, to a point on the East line of ROSELAND COURT; thence S 1° 55' 37" E, along the Southerly extension of the East line of said ROSELAND COURT, a distance of 90.54 feet; thence Southwesterly along a curve to the right having an initial tangent bearing of S 59° 37' 01" W, a radius of 475.00 feet, a central angle of 28° 29' 02", an arc distance of 236.14 feet, to a point of tangency; thence S 88° 06' 03" W, a distance of 193.98 feet (193.42 feet Deed), to a point of curvature; thence Northwesterly along a curve to the right having a radius of 34.00 feet, a central angle of 89° 58' 35", an arc distance of 53.39 feet, to a point on the East line Roe Boulevard, as established on said plat of ROSELAND COURT; thence N 1° 55' 22" W, along the West line of said NE 1/4, a distance of 349.43 feet, to the Point of Beginning, as described in Survey by McClure Engineering Co. dated April 12, 2019 as Project No. 190349.

UNPLATTED

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C02

EXISTING CONDITIONS

Sep 18, 2019-8:52am
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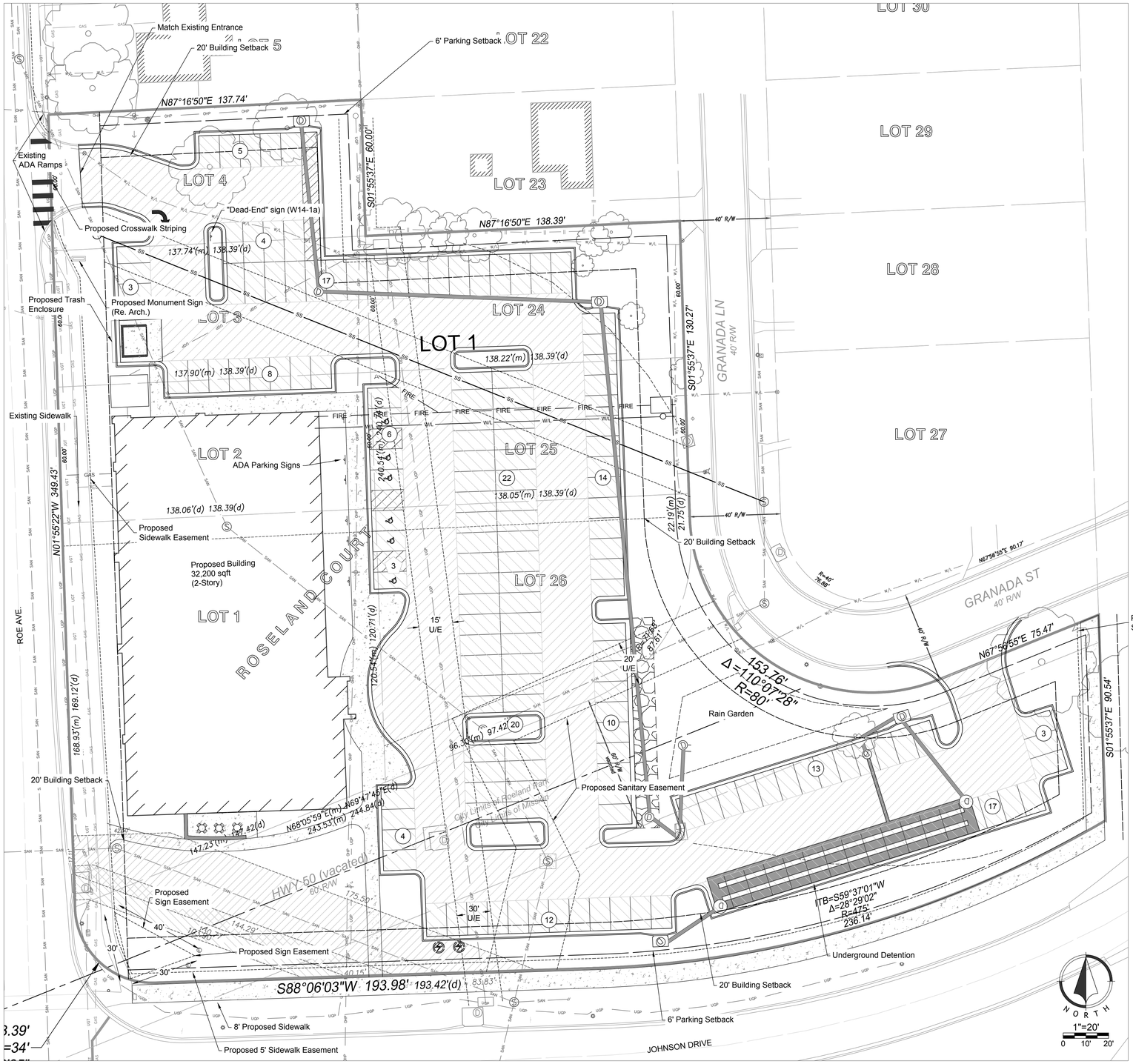

Parking Count Legend:

(X) Parking Stall Count

⬠X⬠ ADA Parking Stall Count

Parking Required

120 Stalls

3.8 Stalls per 1,000sqft

Parking Provided

153 Typical Stalls

6 ADA Stalls

159 Total Stalls Provided

SITE DATA TABLE

Existing Zone: R-1
Proposed Zone: CP-O

FAR : (32,200 / 117,217) =	27.5%
Lot Area (sf):	117,217 sf
Total Area (ac):	2.69 ac
Lot 1 Area (Roeland Park):	1.95ac
Lot 1 Area (Mission):	0.74ac
Building Gross Area:	32,200 sf
Paved Area:	54,487 sf
Impervious Area:	70,701 sf (60%)
Pervious Area:	46,415 sf (40%)

Front Building Setback: 30'

Proposed Front Setback: 22.5' (25% reduction)

Front Parking Setback: 22.5' (25% Reduction)

Interior Parking Setback: 6' (Variance Requested)

Interior Building Setback: 20'

CURB LEGEND

- Dry Curb
- Ribbon Curb
- Wet Curb

Pavement Section Details

- PC Concrete Pavement
- Heavy Duty Asphalt Pavement
- Light Duty Asphalt Pavement

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C03

GENERAL LAYOUT PLAN

Sep 18, 2019 8:53pm
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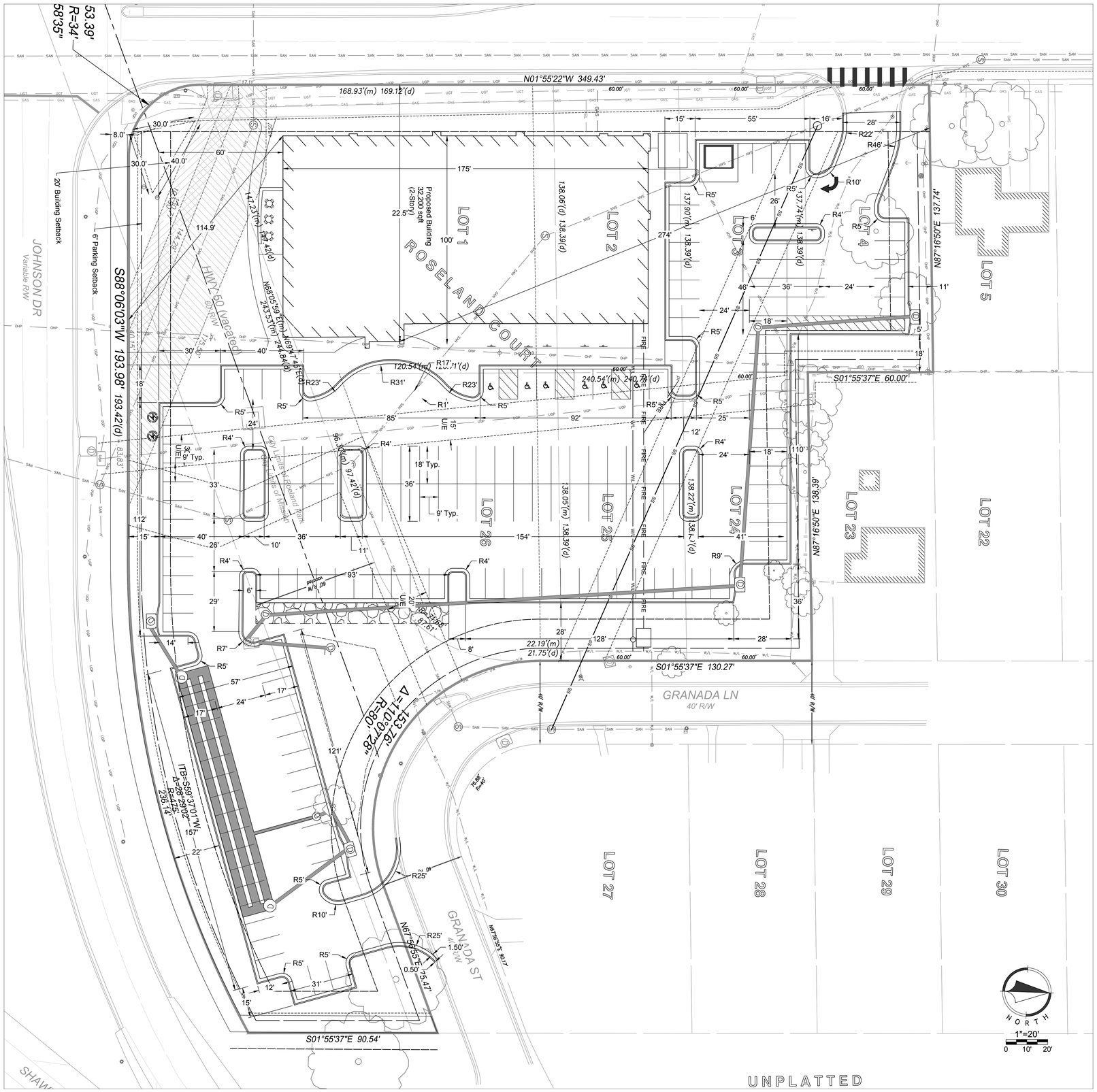

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C04

SITE DIMENSION PLAN

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C05

UTILITY PLAN

Sep 18 , 2019-8:53am

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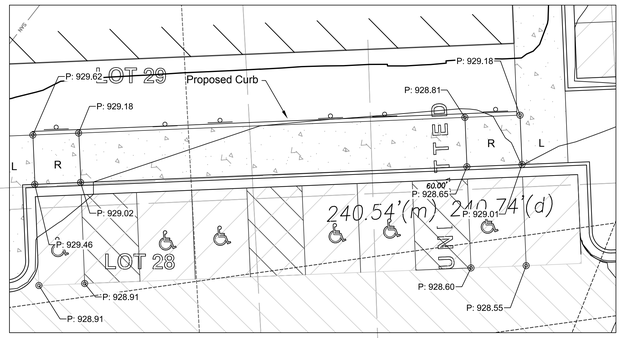
Legend

Existing Grade

Proposed Grade

Detail



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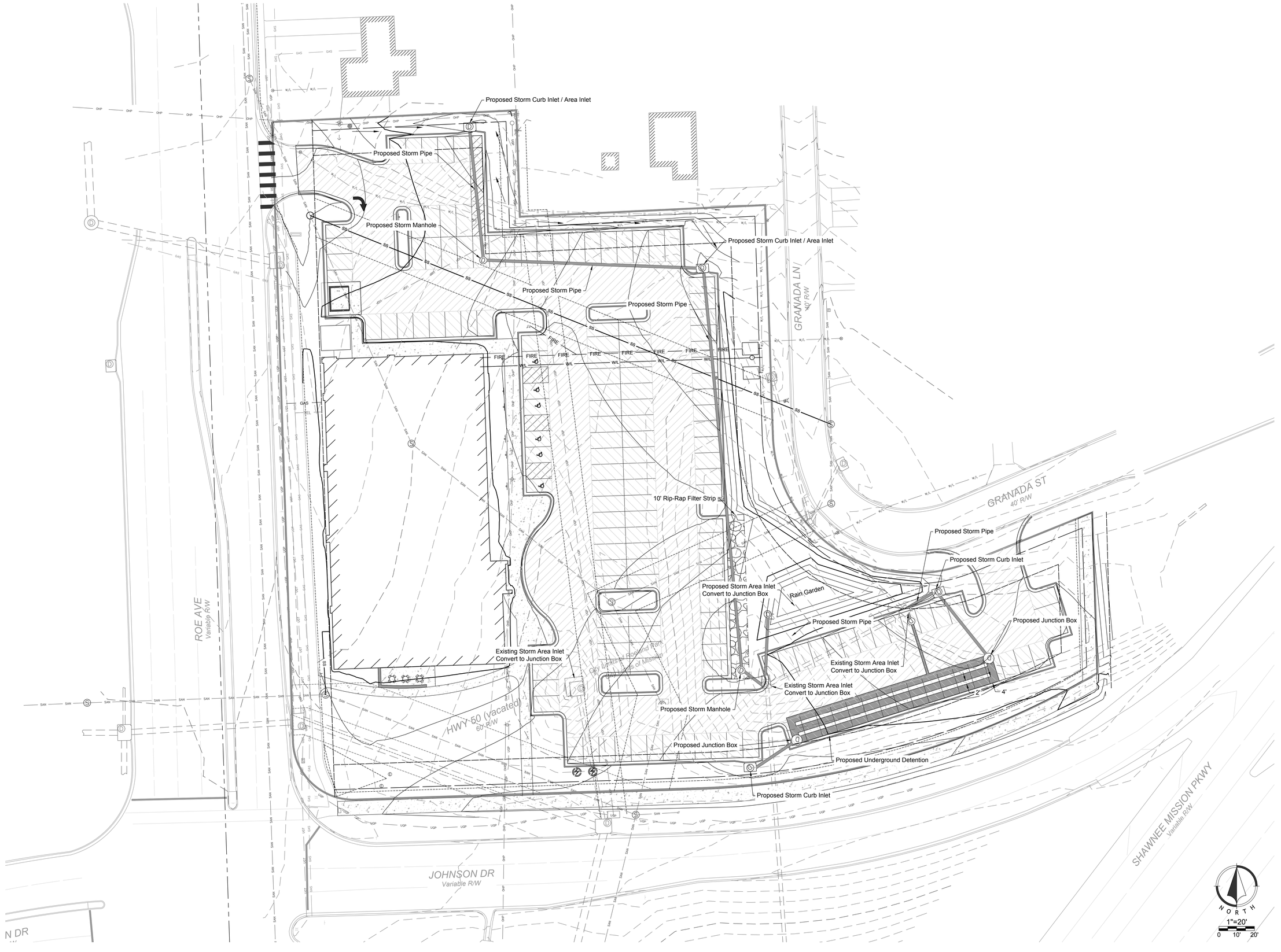
C06

GRADING PLAN



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C07

STORM PLAN

Sep 18 , 2019-8:53am

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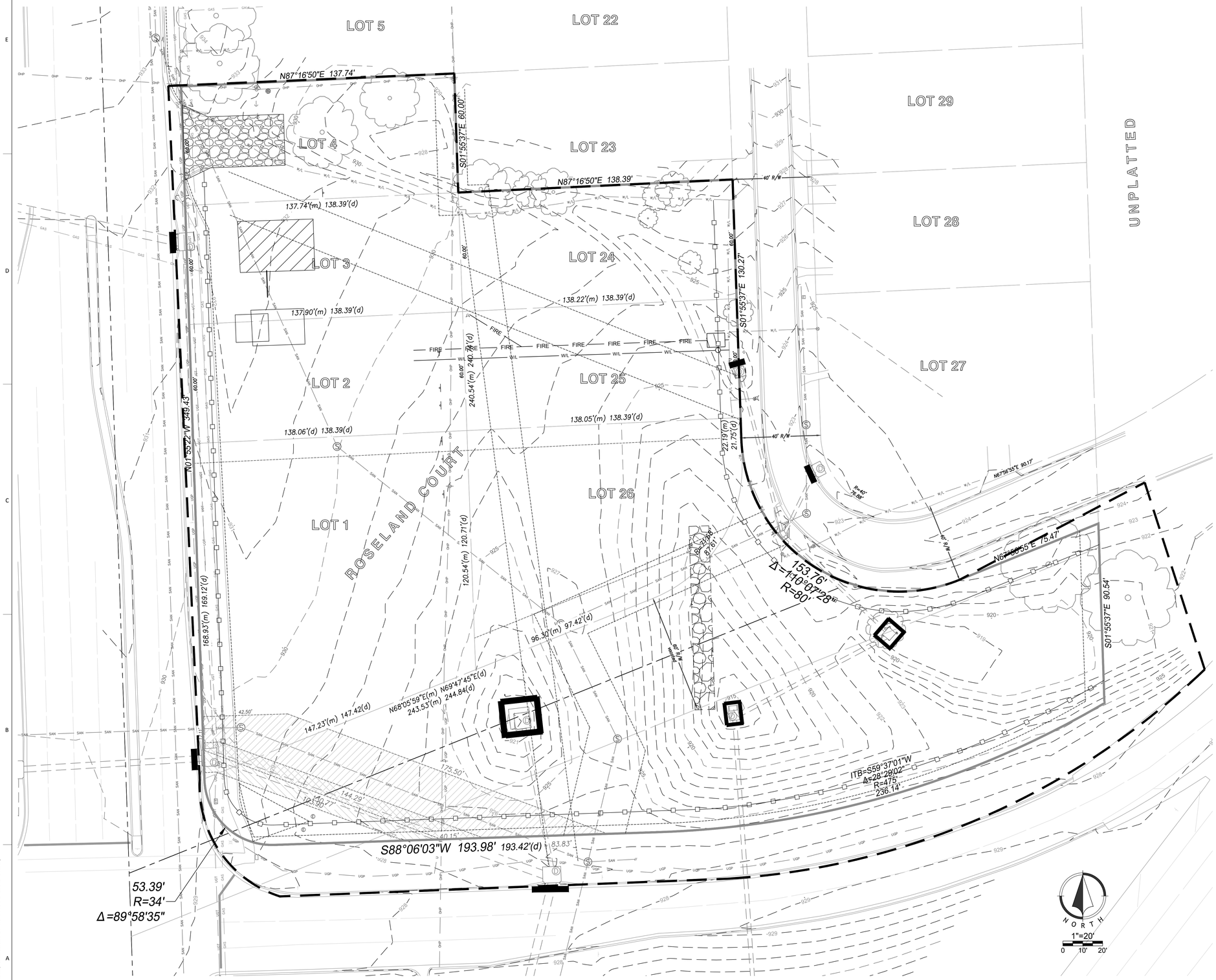

DISTURBED AREA : 2.69 ACRES

ESTIMATED EARTHWORK

Cut: CY
Fill: CY

Earthwork calculations are informational only. Contractor shall be responsible for their own earthwork calculations and perform all necessary earthwork shown herein without additional cost to the owner if quantities differ than above. Earthwork numbers are unadjusted.

WRITTEN SEQUENCING

1. Implement Pre-Clearing Plan:
   All temporary structural BMP's shown on the pre-clearing plan must be in place before the general clearing operations. Clearing necessary to place temporary structural BMP's is the minimum required for installation. Coordinate clearing necessary to place temporary structural BMP's with local weather forecast so that clearing and placement may be completed within a forecast dry period. Temporary Barrier Fence shall be in Place, around areas not to be disturbed, prior to any construction activities.
2. Clear and Stabilize Work Areas:
   Grade contractor areas and place all-weather surface on contractor areas.
3. Clearing and Grubbing:
   After Phase I BMP's are installed, contractor may clear, grub, and demo required areas as necessary.

EROSION CONTROL LEGEND

- Stabilized Construction Entrance
- Staging Area
- Stockpile Area
- Concrete Washout
- Area Not to be Disturbed
- Limits of Disturbance
- Silt Fence
- Inlet Protection
- Visible Temporary Barrier Fence

EROSION CONTROL NOTES

1. Erosion control plan modifications shall be required if the plan fails to substantially control erosion and offsite sedimentation.
2. The retention of access controls and sediment controls shall be required for areas where seed has not established 70% cover.
3. The contractor shall temporarily seed and mulch all disturbed areas if there has been no construction activity on them for a period of fourteen (14) calendar days.
4. Install "J' Hooks on silt fence every 100 LF

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EROSION CONTROL PHASE 1

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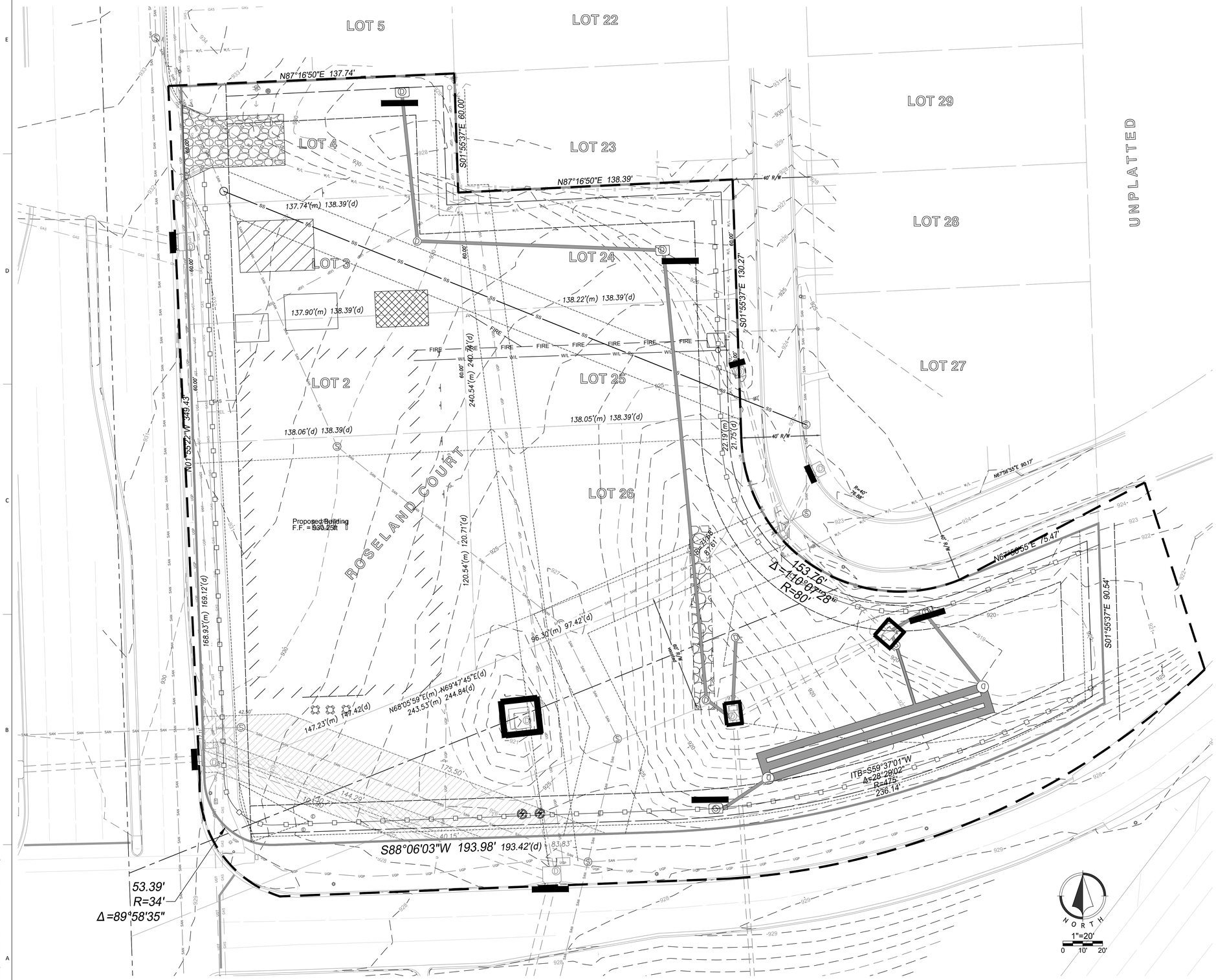

DISTURBED AREA : 2.69 ACRES

ESTIMATED EARTHWORK

Cut: CY
Fill: CY

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EROSION CONTROL LEGEND

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4. Install "J' Hooks on silt fence every 100 LF

NORTH
1"=20'
0 10' 20'

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EROSION CONTROL PHASE 2

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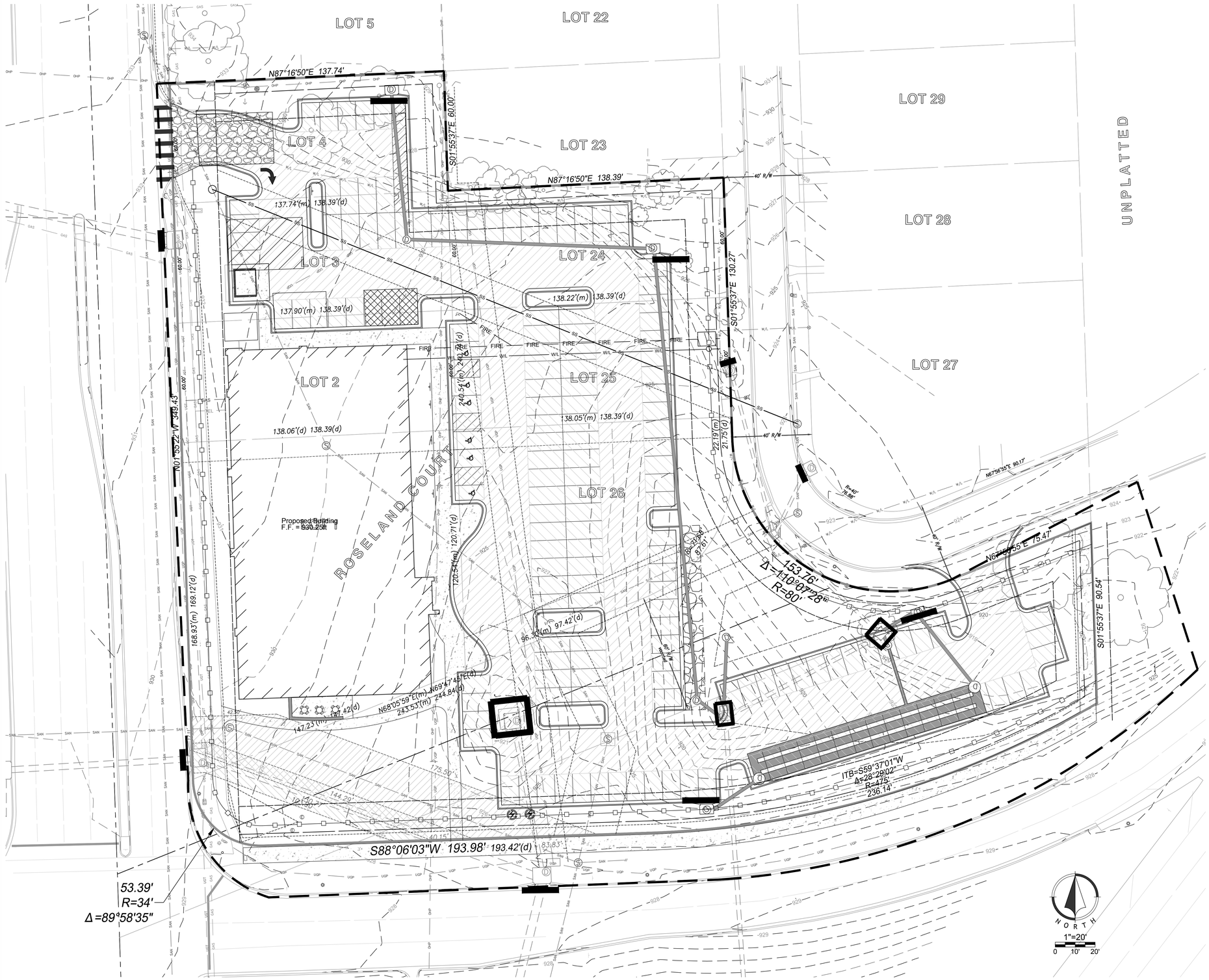

DISTURBED AREA : 2.69 ACRES

ESTIMATED EARTHWORK

Cut: CY
Fill: CY

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EROSION CONTROL PHASE 3

Sep 18 , 2019-8:54am

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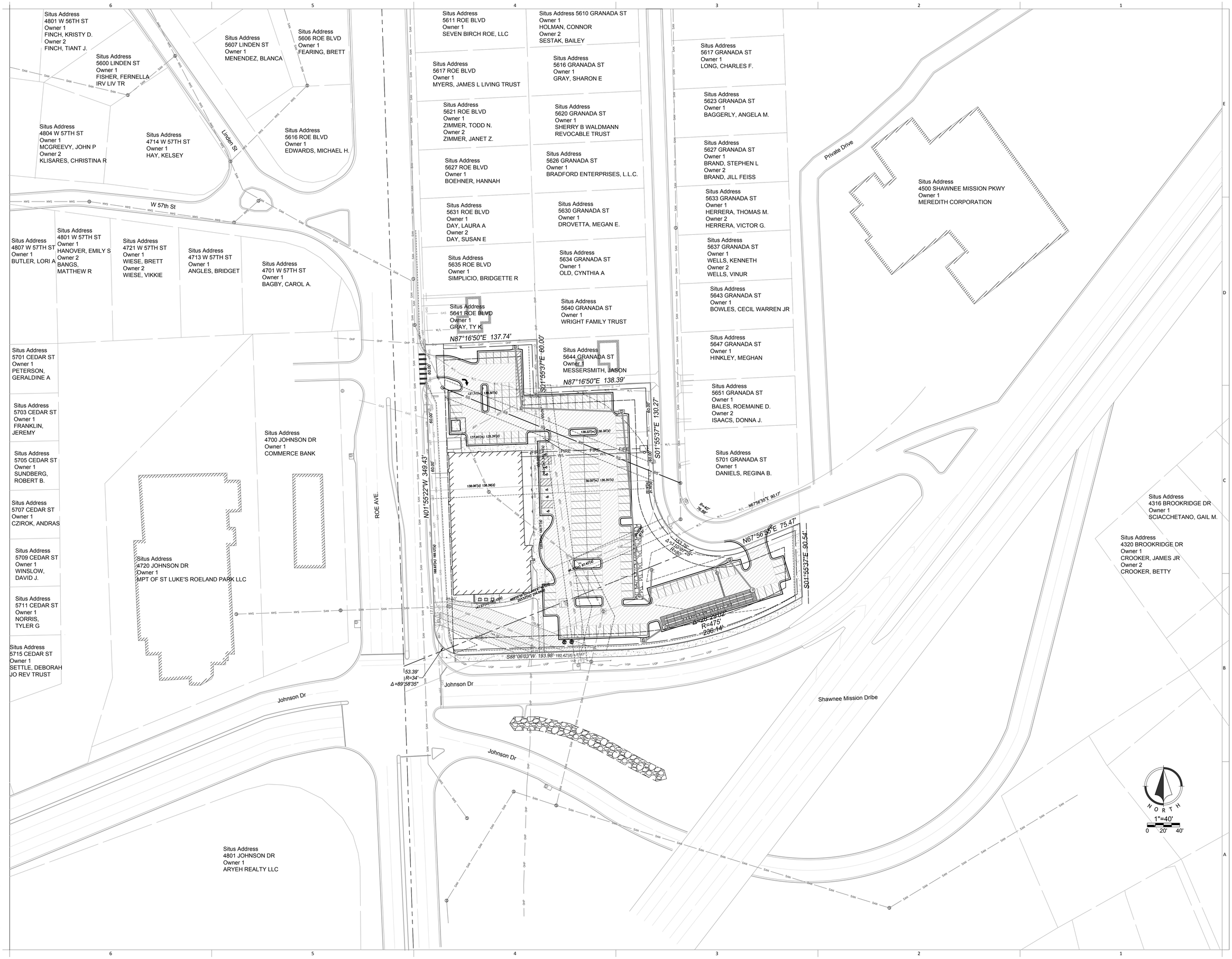

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Licensee's Certificate of Authority Number:

Phone Number: 913-317-9500

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LANDSCAPE CONSULTANT
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Sunflower Medical
Roe & Johnson Drive | Mission, KS

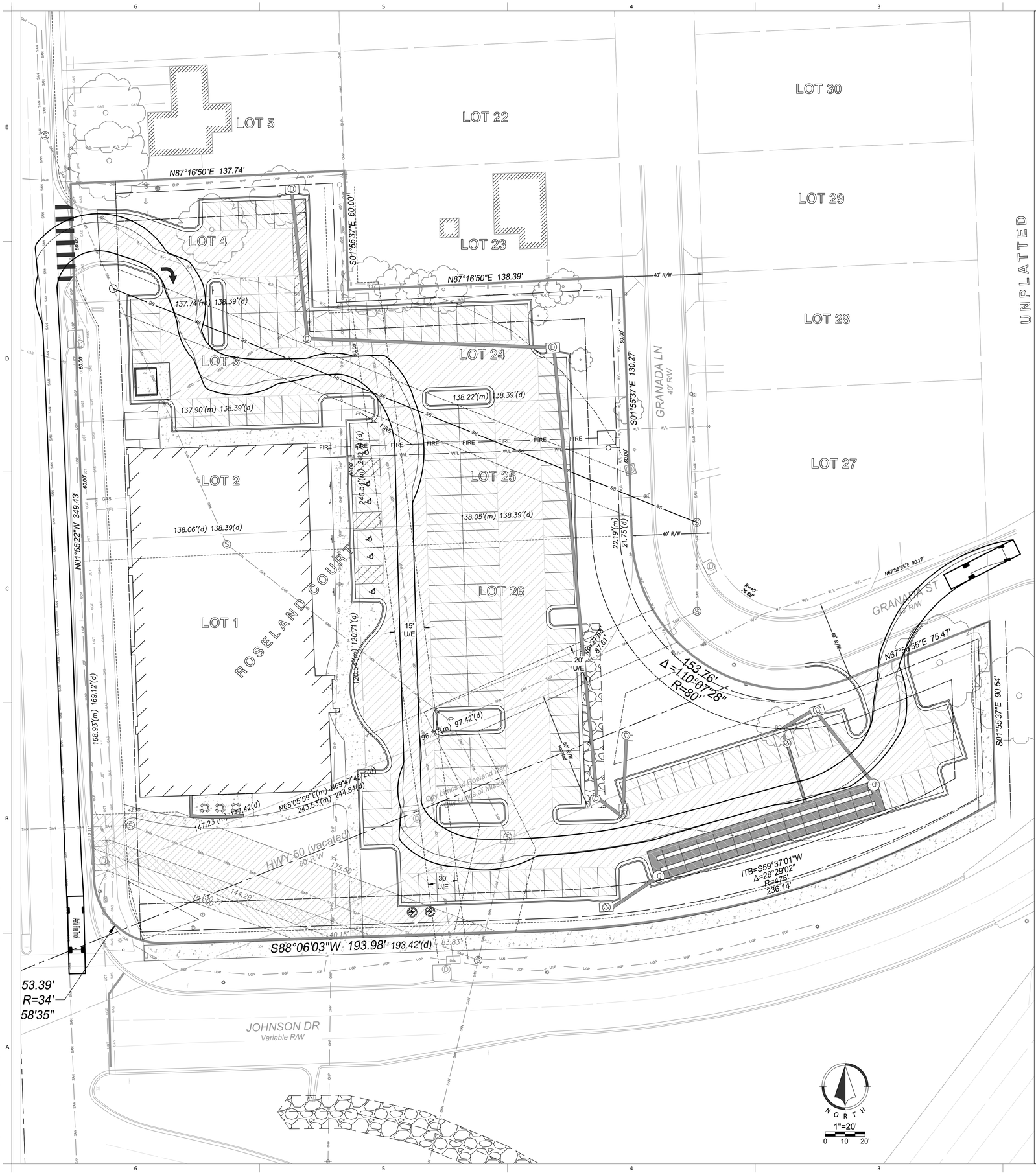
Date	Sep 18 , 2019
Job Number	19-0143
Drawn By	CR
Checked By	DJB

Revision

Number	Date	Description
01	08/06/19	Original Submittal
02	09/03/19	Revided Per City Submittal
03	09/13/19	Architectural Update

C11

OVERALL AREA PLAN



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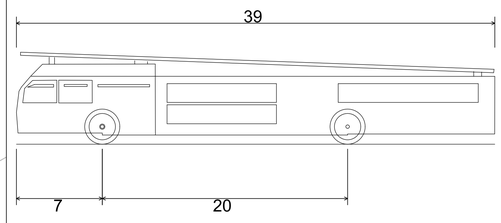

Aerial Fire Truck

Overall Length	39.000ft
Overall Width	8.167ft
Overall Body Height	7.500ft
Min Body Ground Clearance	0.750ft
Track Width	8.167ft
Lock-to-lock time	5.00s
Max Wheel Angle	45.00°

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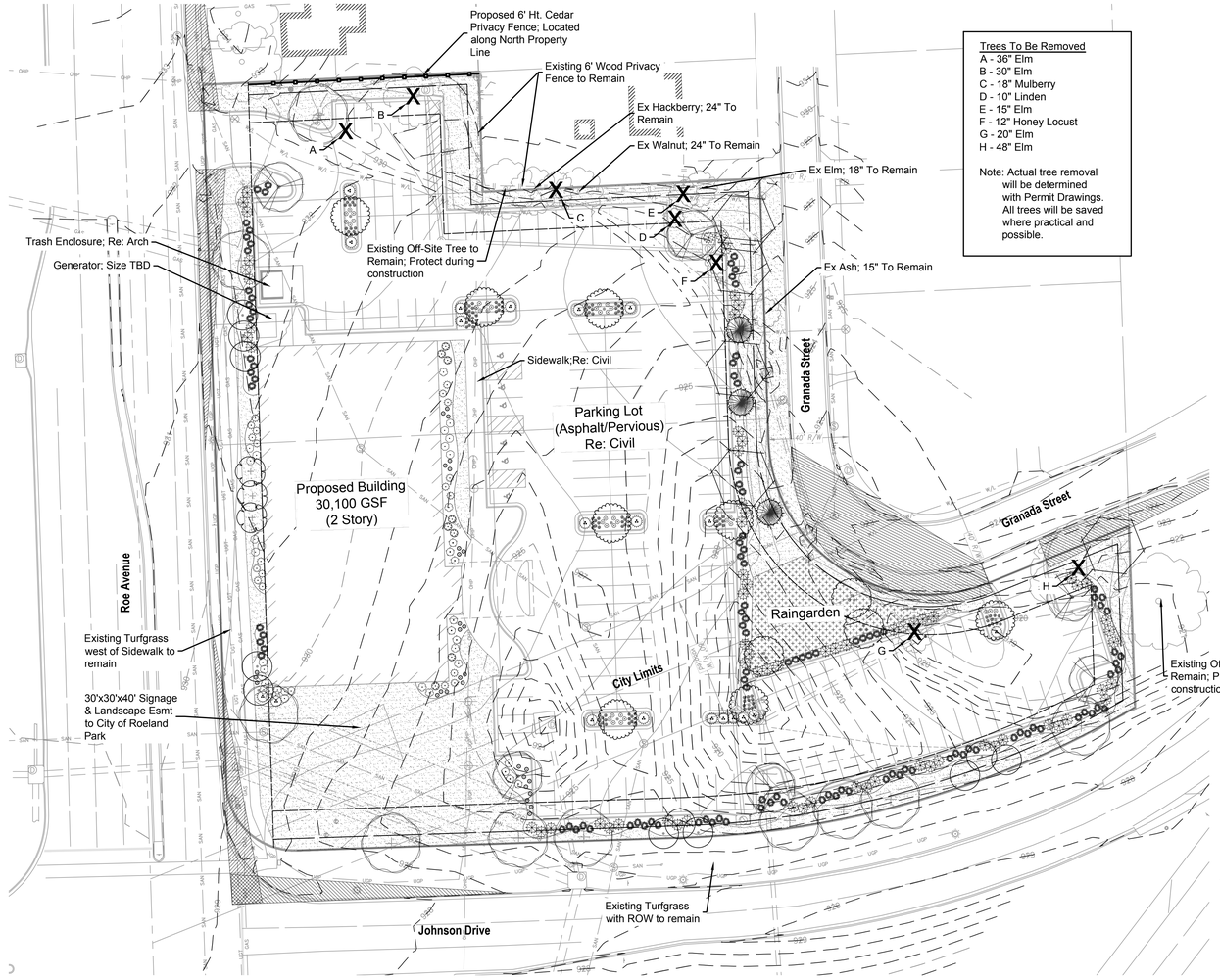
C12

FIRE DEPARTMENT ACCESSIBILITY

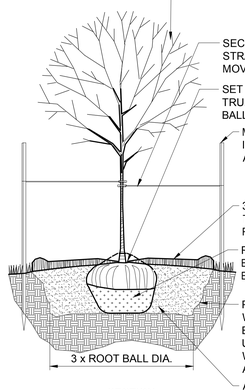


Trees To Be Removed
- A - 36" Elm
- B - 30" Elm
- C - 18" Mulberry
- D - 10" Linden
- E - 15" Elm
- F - 12" Honey Locust
- G - 20" Elm
- H - 48" Elm

Note: Actual tree removal will be determined with Permit Drawings. All trees will be saved where practical and possible.

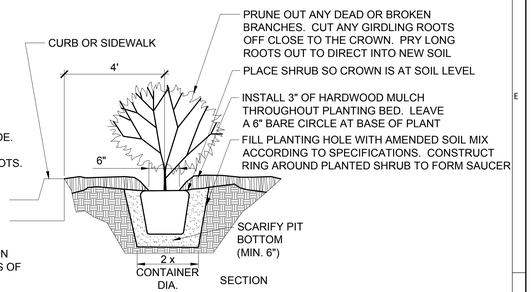
NORTH
1"=30'
0 15' 30'

NOTES:
1. TREES THAT DO NOT MEET THE SIZE REQUIREMENT WILL BE REJECTED
2. TREES SHALL BE INSPECTED BY OWNERS REPRESENTATIVE PRIOR TO INSTALLATION.



SECTION

DECIDUOUS TREE PLANTING DETAIL - NTS



SECTION

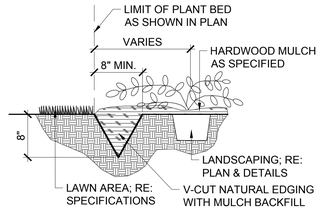
NOTES:
1. REFER TO SPECIFICATIONS FOR TOPSOIL BACKFILL MIX.
2. CONTRACTOR TO WATER THOROUGHLY AFTER PLANTING
3. INSTALLATION TO BE IN ACCORDANCE WITH PLANTING SPECIFICATIONS

SHRUB PLANTING DETAIL - NTS

NOTES:
1. CONTRACTOR SHALL LOCATE AND MARK ALL PLANTBED LOCATIONS PRIOR TO EXCAVATING FOR FINAL APPROVAL BY OWNER OR LANDSCAPE ARCHITECT.
2. TRANSITION TO MULCH CONTAINMENT DETAIL AT ALL LOCATIONS ADJACENT TO CURBS & SIDEWALKS. RE: DETAIL, THIS SHEET.
3. CONTRACTOR TO VERIFY ALL UTILITY LOCATIONS PRIOR TO TRENCHING OR LANDSCAPE INSTALLATION.

UTILITY BOXES SHALL BE CLUSTERED AS MUCH AS POSSIBLE

TYPICAL UTILITY BOX SCREENING DETAILS - NTS



V-CUT NATURAL EDGE DETAIL - NTS

PLANT SCHEDULE

TREES	BOTANICAL / COMMON NAME	CONT	CAL	SIZE	QTY
	Amelanchier x grandiflora `Autumn Brilliance` / `Autumn Brilliance` Serviceberry	B&B	1.5" Cal.		11
	Betula nigra `Heritage` / Heritage River Birch	B&B	2.5" Cal.		3
	Cercis canadensis `Forest Pansy` TM / Forest Pansy Redbud	B&B	1.5" Cal.		3
	Ginkgo biloba `Autumn Gold` TM / Maidenhair Tree	B&B	2.5" Cal.		8
	Picea pungens `Hoopsii` / Hoopsi Blue Spruce	B&B		6' Ht. Min.	3
	Quercus bicolor / Swamp White Oak	B&B	2.5" Cal.		10
	Ulmus americana `Valley Forge` / American Elm	B&B	2.5" Cal.		5
	Zelkova serrata `Green Vase` / Sawleaf Zelkova	B&B	2.5" Cal.		6

SHRUBS	BOTANICAL / COMMON NAME	CONT	±	±	QTY
	Aronia melanocarpa `Morton` TM / Iroquis Beauty Black Chokeberry	3 Gal.			17
	Calamagrostis x acutiflora `Karl Foerster` / Feather Reed Grass	3 Gal.			30
	Cornus stolonifera `Arctic Fire` / Arctic Fire Dogwood	3 Gal.			12
	Hemerocallis x `Stella de Oro` / Stella de Oro Daylily	1 Gal.			123
	Hydrangea paniculata `Little Lime` / Little Lime Hydrangea	3 Gal.			8
	Hypericum frondosum `Sunburst` / Sunburst Hypericum	3 Gal.			10
	Juniperus chinensis `Sea Green` / Sea Green Juniper	5 Gal.			60
	Juniperus sabina `Buffalo` / Buffalo Juniper	3 Gal.			20
	Juniperus virginiana `Skyrocket` / Skyrocket Juniper	5 Gal.			19
	Miscanthus sinensis `Gracillimus` / Maiden Grass	5 Gal.			104
	Sedum x `Autumn Joy` / Autumn Joy Sedum	1 Gal.			36

GROUND COVERS	BOTANICAL / COMMON NAME	CONT	SPACING	QTY
	Bouteloua Dactyloides Cody / Cody Buffalo Sod	SOD		26,768 sf
	Rain Garden See Species List / Rain Garden RE: Notes	D.C.P.	15" o.c.	1,687

Upper Fringe Zone:
- Prairie Drop Seed - 20%
- Black Eyed Susan - 10%
- Blazing Star - 20%
- Switchgrass - 50%

Lower Flood Zone:
- Blue Flag Iris - 25%
- Soft Rush - 25%
- Switchgrass - 50%

LANDSCAPE NOTES

1. LOCATE UTILITIES PRIOR TO COMMENCING LANDSCAPE OPERATIONS. ALL TREES SHALL BE FIELD POSITIONED AS TO AVOID CONFLICTS WITH EXISTING AND PROPOSED UTILITIES. NOTIFY LANDSCAPE ARCHITECT OF ANY CONFLICTS OR OBSTRUCTIONS.
2. CONTRACTOR SHALL STAKE ALL PLANTING AREAS IN THE FIELD PRIOR TO PLANTING FOR APPROVAL OF THE OWNER OR THEIR REPRESENTATIVE.
3. CONTRACTOR SHALL VERIFY ALL PLANT QUANTITIES PRIOR TO PLANTING. ANY DISCREPANCIES WITH THE PLAN SHALL BE BROUGHT TO THE ATTENTION OF THE LANDSCAPE ARCHITECT. THE PLAN QUANTITIES SHALL SUPERCEDE SCHEDULED QUANTITIES.
4. ALL PLANT MATERIAL SHALL BE SPECIMEN QUALITY AND SHALL COMPLY WITH RECOMMENDATIONS AND REQUIREMENTS OF ANSI Z60.1 THE 'AMERICAN STANDARD FOR NURSERY STOCK'.
5. ALL PLANTING BEDS & NATIVE GRASS STANDS SHALL BE EDGED AS SHOWN IN PLAN.
6. PREPARE PLANTING BEDS AND INCORPORATE AMENDMENTS ACCORDING TO PLANS.
7. SHREDDED HARDWOOD MULCH, PER SPECIFICATIONS SHALL BE USED AS A THREE INCH (3") TOP DRESSING IN ALL PLANTING BEDS AND AROUND ALL TREES. SINGLE TREES AND SHRUBS SHALL BE MULCHED TO THE OUTSIDE EDGE OF THE SAUCER OR LANDSCAPE ISLAND.
8. ALL TREES SHALL BE STAKED PER DETAIL.
9. ALL PLANT MATERIAL SHALL BE INSTALLED TO ALLOW A ONE FOOT (1') CLEARANCE BETWEEN PLANT AND ADJACENT PAVEMENT.
10. THE LANDSCAPE CONTRACTOR SHALL NOT COMMENCE WORK UNTIL THE SITE IS FREE OF DEBRIS CAUSED BY ON-GOING CONSTRUCTION OPERATIONS. REMOVAL OF DEBRIS SHALL BE THE RESPONSIBILITY OF THE GENERAL CONTRACTOR. LANDSCAPE WORK SHALL NOT BEGIN UNTIL THE LANDSCAPE ARCHITECT AND OWNER HAVE GIVEN WRITTEN APPROVAL FOR SUCH. THERE SHALL BE NO DELAYS DUE TO LACK OF COORDINATION FOR THIS ACTIVITY.
11. THE LANDSCAPE ARCHITECT AND OWNER SHALL APPROVE GRADES AND CONDITION OF SITE PRIOR TO SODDING/SEEDING OPERATIONS.
12. ALL AREAS DISTURBED DURING CONSTRUCTION AND NOT DESIGNATED FOR OTHER PLANTINGS OR HARDSCAPE SHALL BE SODDED WITH BUFFALO GRASS. ALL AREAS OUTSIDE OF THE BUFFALO PLANTING ZONE SHALL BE SODDED WITH TURF TYPE TALL FESCUE.
15. ALL SHRUB BED AREAS SHALL BE IRRIGATED BY DRIP IRRIGATION. BUFFALO SOD AREAS SHALL BE IRRIGATED BY QUICK COUPLE ACCESS AT 100 FT O.C OR WITHIN 50' OF A BUILDING HOSE BIB. IRRIGATION SYSTEM SHALL INCLUDE AUTOMATIC RAIN-SENSOR DEVICE. IRRIGATION SHOP DRAWINGS SHALL BE PROVIDED BY THE CONTRACTOR FOR APPROVAL PRIOR TO CONSTRUCTION.
16. RAINGARDEN PLANTINGS SHALL BE GROUPED IN NO LESS THAN 10 PLANTS PER GROUP. FINAL DESIGN OF RAINGARDEN SHALL BE PROVIDED WITH PERMIT DRAWINGS.

LANDSCAPE REQUIREMENTS

Proposed Zoning: CP-O

Minimum Tree Requirements (Sec 16-1005)
- Street Frontage: 1 Tree / 40 lf
- Open Space: 1 Tree / 3,000 sf Open Space

Vehicular Use Areas Requirements (Sec 16-1007)
- Min. 6% Interior Of Parking Lot (Spaces x 280)

Screening Requirements (Sec 16-1010)
- Trash Enclosures shall be screened and appropriately landscaped
- Exterior ground/building mounted equipment shall be screened from public view
- Adjacent to Residential (SFR) shall provide a solid screen or wall not less than 6' in height along the rear and side property lines which are common to subject property to the building line. The screening shall not be required where similar screening exists on the abutting residential property.

Provided Street Trees
- Street Frontage: Roe Blvd: 377 LF / 40 = 9.42 Trees
  Provided: 10 Trees
- Street Frontage: Johnson Dr.: 430 LF / 40 = 10.75 Trees
  Provided: 13 Trees
- Street Frontage: Grenada: 359 LF / 40 = 8.98 Trees
  Provided: 9 Trees

Provided Open Space
- Total Open Space: 36,363.47 sf / 3,000 sf = 12 Trees
- Open Space Trees (including parking lot trees): 17 Trees

Provided Vehicular Use Areas
- Total Parking Spaces = 161 x 280 = 45,080 x 6% = 2,704.8 sf
- Total Area Provided = 3,724 sf

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Johnson & Roe Medical Office Building
Roe & Johnson Drive | Roeland Park, KS

Date	8/7/19
Job Number	3-19133
Drawn By	AG
Checked By	AG

Revision

Number	Date	Description
1	08-07-19	FDP/PDP

L01

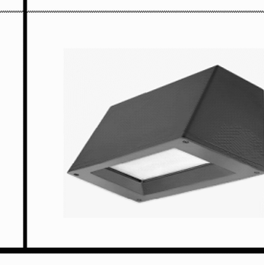
LANDSCAPE PLAN

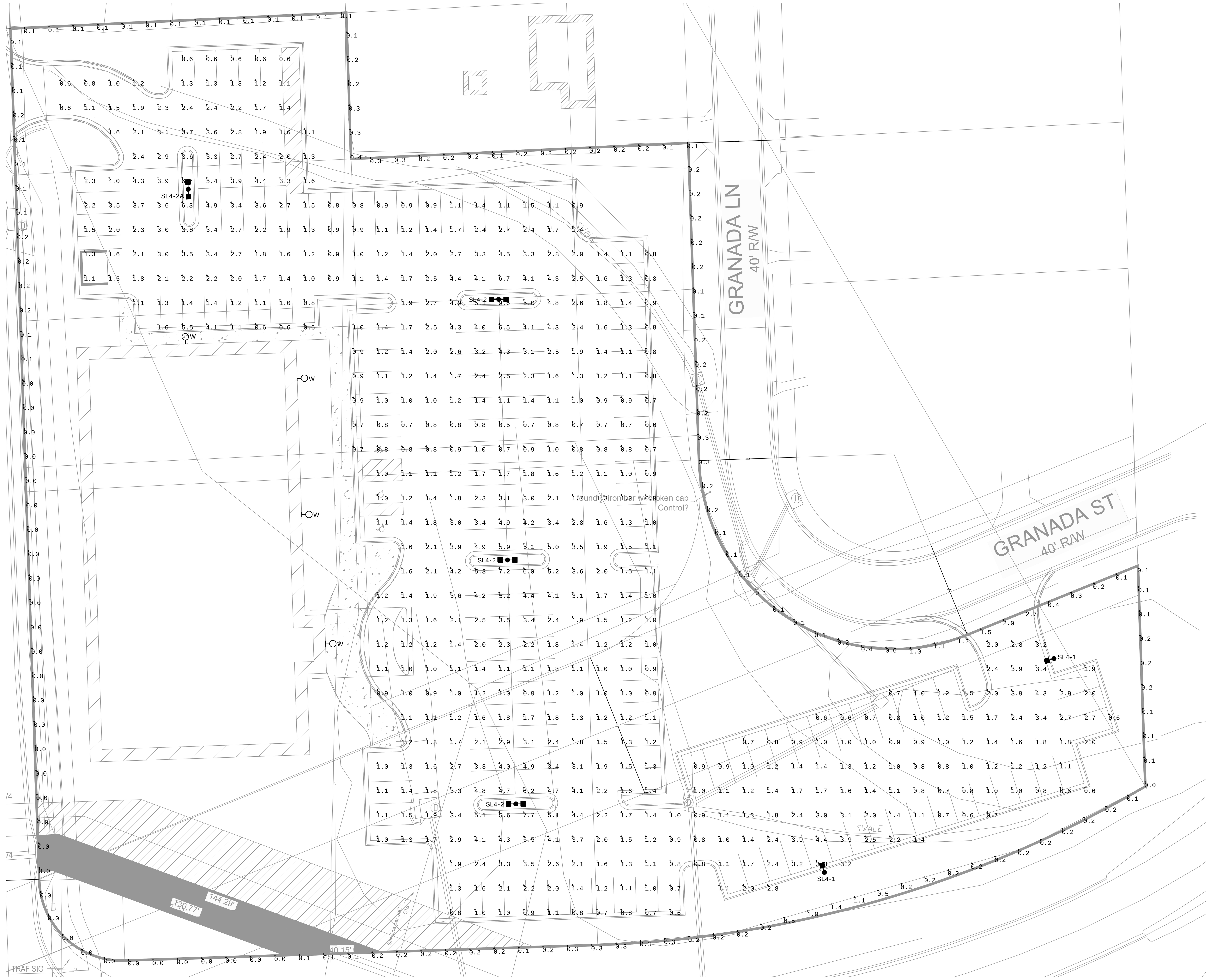
8/6/2019 8:04:22 AM

C:\Users\apeisen\Documents\3-19133_Sunflower MOB SD_apeisen-burow@acboland.com.rvt

CALCULATION SUMMARY					
AREA NAME	AVE	MAX	MIN	AVG/MIN	MAX/MIN
PROPERTY LINE	0.21	2.7	0.0	N/A	N/A
PARKING LOT	1.96	9.6	0.6	3.3	16.0

NOTES:
1. ILLUMINANCE VALUES ARE IN FOOTCANDLES.

FIXTURE SCHEDULE							
TYPE	IMAGE	DESCRIPTION	MOUNTING	LAMP	VOLTS	MANUFACTURER	V-A
SL4-1		1-HEAD PARKING LOT EXTERIOR POLE FIXTURE, TYPE T4FT DISTRIBUTION, 0-10V DIMMING, UL LISTED FOR WET LOCATIONS, ARCHITECT TO SELECT FINISH, 800mA DRIVEN, SPILL CONTROL.	POLE 20'-0"	LED 20,515 LUMENS 4000K 80+ CRI	120/277	McGRAW-EDISON SERIES GLEON	191
SL4-2		2-HEADS @ 180 DEGREES APART PARKING LOT EXTERIOR POLE FIXTURE, TYPE T4FT DISTRIBUTION, 0-10V DIMMING, UL LISTED FOR WET LOCATIONS, ARCHITECT TO SELECT FINISH, 800mA DRIVEN.	POLE 20'-0"	LED 20,515 LUMENS (PER HEAD) 4000K 80+ CRI	120/277	McGRAW-EDISON SERIES GLEON	382
SL4-2A		2-HEADS @ 180 DEGREES APART PARKING LOT EXTERIOR POLE FIXTURE, TYPE T4W DISTRIBUTION, 0-10V DIMMING, UL LISTED FOR WET LOCATIONS, ARCHITECT TO SELECT FINISH, 800mA DRIVEN.	POLE 20'-0"	LED 20,249 LUMENS (PER HEAD) 4000K 80+ CRI	120/277	McGRAW-EDISON SERIES GLEON	382
W		17"W X 8.5"H X 10.5"D EXTERIOR LED WALL PACK, UL LISTED FOR WET LOCATIONS, INTEGRAL 0-10V / 100-10% DIMMABLE DRIVER, VISUAL COMFORT WIDE DISTRIBUTION, ARCHITECT TO SELECT FINISH.	SURFACE WALL	LED 3000 LUMENS 4000K 80+ CRI	120/277	LITHONIA SERIES WST	30



PHOTOMETRIC SITE PLAN LIGHTING

SCALE: 1" = 20'-0"

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Checked By	Checker

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LP101

PHOTOMETRICS SITE PLAN - LIGHTING

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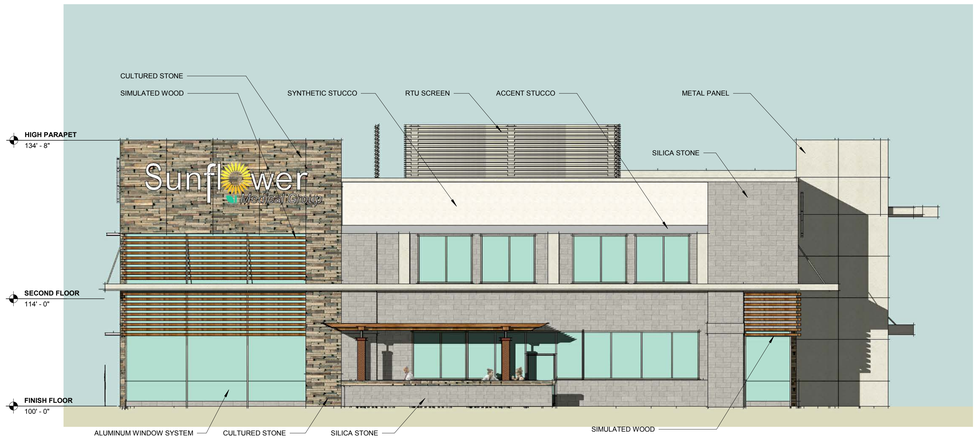
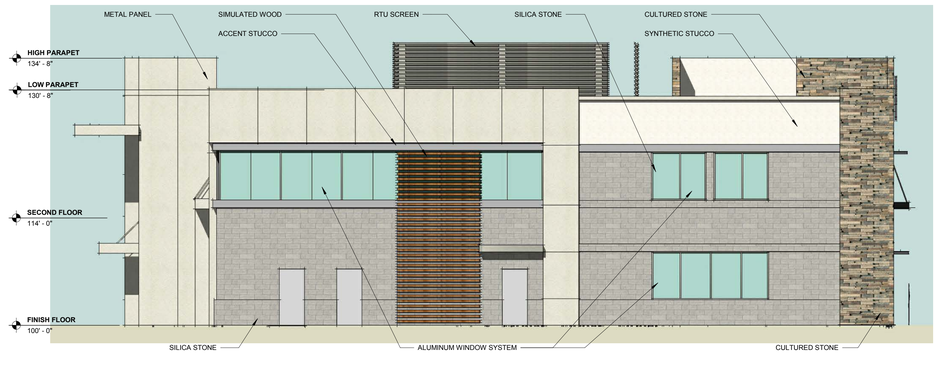
AUTOCAD FILE LOCATION \ NAME: X:\19\19223\1922300\Design\Photometrics\06-1922300_LP101.dwg
LAST CORRECTION BY • DATE • TIME: Lkelsey Wednesday, August 7, 2019 8:20:30 AM
PLOTTED BY • DATE • TIME: Lucinda Kelsey Wednesday, August 7, 2019 8:22:18 AM

D6 WEST ELEVATION
1/8" = 1'-0"



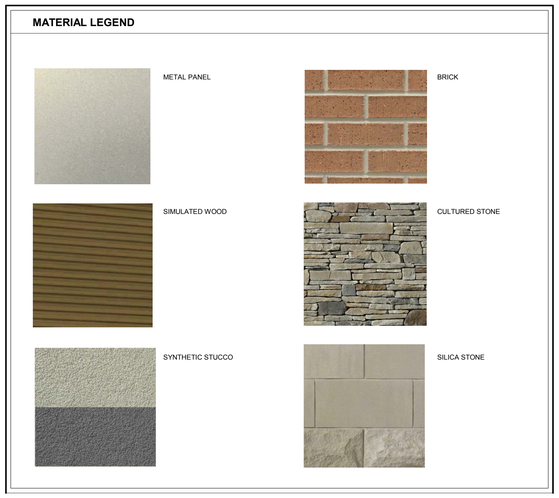
B6 SOUTH ELEVATION
1/8" = 1'-0"



B3 NORTH ELEVATION
1/8" = 1'-0"

A6 EAST ELEVATION
1/8" = 1'-0"

MATERIAL LEGEND



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Drawn By	BM
Checked By	JS

Revision

Number	Date	Description

A5.1

EXTERIOR ELEVATIONS

C6 ROE BLVD PERSPECTIVE
1/4" = 1'-0"

A6 EAST SIDE PERSPECTIVE
1/8" = 1'-0"

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A5.2

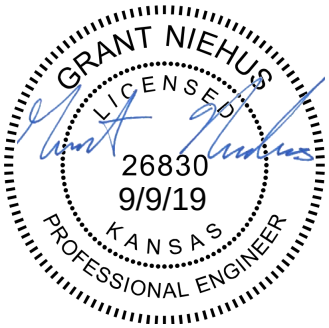
EXTERIOR PERSPECTIVES

Traffic Impact Study

Medical Office Building

Johnson Dr & Roe Ave

Mission, KS



Prepared For:

CBC Real Estate Group
4706 Broadway, Suite 240
Kansas City, Missouri 64112

Prepared By:

Renaissance Infrastructure Consulting
September 2019

September 9, 2019

Mr. Mike Belew
CBC Real Estate Group
4706 Broadway, Suite 240
Kansas City, Missouri 64112

RE: Medical Office Building Traffic Impact Study
Johnson Dr & Roe Ave
City of Mission, KS

Dear Mike Belew,

In response to your request, RIC has completed a traffic impact study for the proposed development to be located northeast of Johnson Dr and Roe Ave. The purpose of this study was to assess the impact of the proposed development on the surrounding transportation system. The following report documents our analysis and recommendations.

Please do not hesitate to contact us should you have any questions.

Sincerely,

Renaissance Infrastructure Consulting

Grant Niehus, PE, PTOE
Traffic Engineer

Contents

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PROPOSED DEVELOPMENT 5

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BASELINE TRAFFIC CONDITIONS 6

FUTURE CONDITIONS 6

AUXILIARY TURN LANES 7

OPERATIONAL ANALYSIS 7

INTERSECTION SIGHT DISTANCE 9

SUMMARY 10

INTRODUCTION

Renaissance Infrastructure Consulting (RIC) has completed trip generation calculations and traffic analysis for a proposed Medical Office Building on the northeast corner of Johnson Drive and Roe Avenue. The purpose of this analysis is to assess the impact of the proposed development on the surrounding transportation system. The proposed development will include two stories with a total leasable area of 31,500 square feet and supporting parking. To evaluate the increase of traffic on adjacent streets, the number of trips were estimated for the morning and afternoon peak time periods.

Figure 1-Proposed project location

PROPOSED DEVELOPMENT

The proposed development is located on the northeast corner of Johnson Dr and Roe Ave in Mission, KS. Access to the development will be provided through two driveways, one from Roe Ave. and one from Granada St. On-site parking is included for the development and currently spans across Roeland Park, KS and Mission, KS jurisdictions as shown in **Figure 2**.

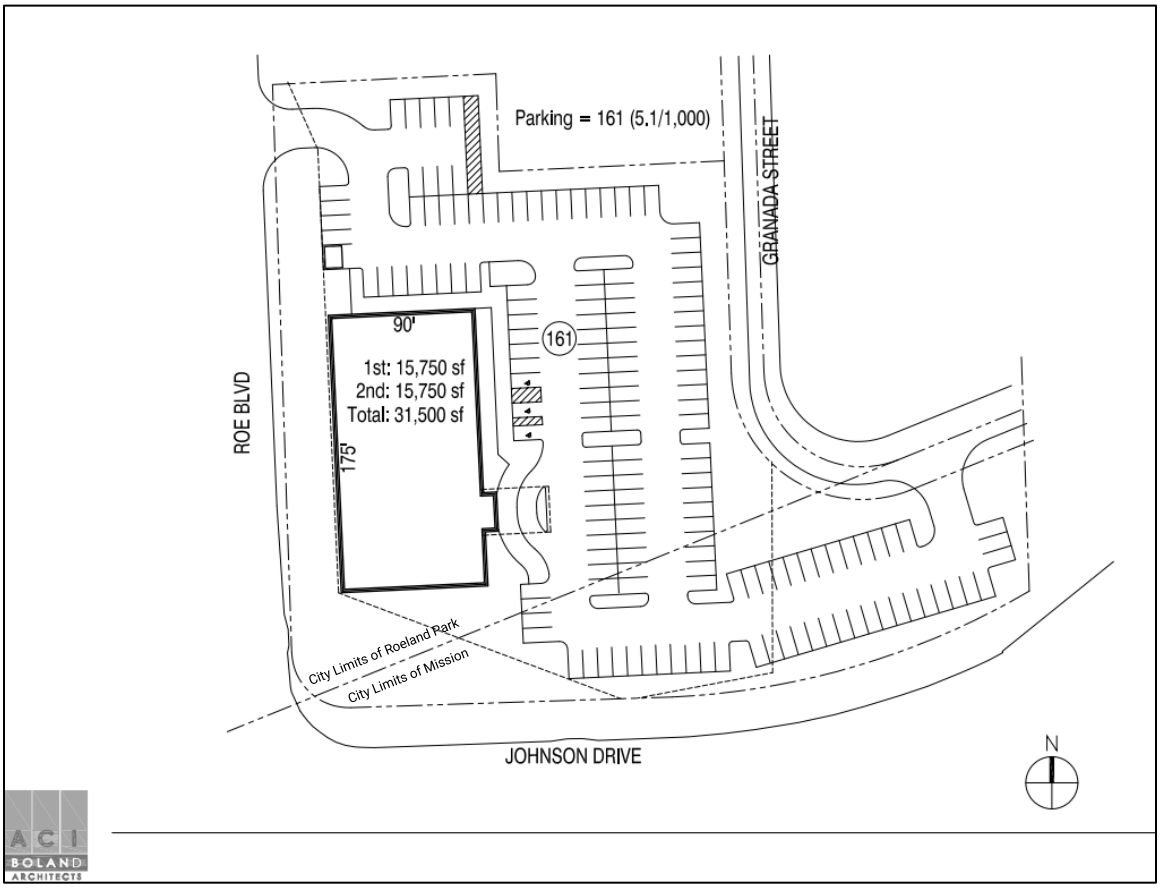


Figure 2- Proposed Development

EXISTING CONDITIONS

Roe Avenue is adjacent to the proposed development to the west and is a 4-lane roadway with a posted speed limit of 35 mph. It is classified as a minor arterial by Mid-America Regional Council's (MARC) Roadway Functional Classification System. Johnson Drive is a 4-lane facility adjacent to the proposed development to the south with a posted speed limit of 30 mph. It is classified as a minor arterial by MARC. Granada Street is adjacent to the development to the northeast and acts as a residential street to the north and connects to Johnson Drive to the east.

Shawnee Mission Parkway is located to the southeast of the development but does not directly run adjacent to the lot. However, the westbound exit off Shawnee Mission Parkway turns into Johnson Drive which runs directly adjacent to the south of the development. Shawnee Mission Parkway is 4-lane divided principal arterial which carries an ADT of approximately 32,600 vehicles. There is an existing traffic signal at the intersection of Roe Ave & Johnson Drive while Granada St & Shawnee Mission Pkwy is controlled by a stop sign on Granada St.

The site location is currently vacant surrounded by residential and offices to the northeast and commercial/retail to the west. There is a television station office located to the northeast of the proposed development, a Commerce Bank to the west, and a community hospital further west. There is also construction currently going on to the southwest of Johnson Drive and Roe that will become the Mission Gateway project. This multi-use project will include over 500,000 square feet of leasable space.

BASELINE TRAFFIC CONDITIONS

To assess the impacts of the proposed development, the intersections listed below were identified for study during the A.M and P.M peak hours of a typical weekday.

- Roe Ave & Johnson Dr
- Commerce Bank Driveway & Roe Ave

Traffic counts for the above-mentioned locations were collected on July 16th, 2019 between the hours of 7:00AM to 9:00AM and 4:00PM to 6:00PM. This data revealed that the weekday peak hours of the adjacent roadway to be from 7:30AM to 8:30AM and 5:00PM to 6:00PM. The existing peak hour traffic volumes are summarized in **Appendix A.**

FUTURE CONDITIONS

Trip generation estimates developed for this study are based on the 10th Edition of the Trip Generation Manual published by the Institute of Transportation Engineers (ITE). The Manual is the most widely used industry resource for this type of data. The trip generation data are organized by land use types, with more than 170 different categories of land uses. For each category the manual provides a data set for use in estimating the number of vehicle and person trips generated by a site based on its characteristics such as physical size or intensity. Trips may be estimated by direction (entering or exiting the site) and for time periods typically pertaining to a full day (weekday or weekend), peak hours of the adjacent roadway, and peak hours of the particular land use. Used properly, the Trip Generation Manual provides an objective basis for estimating trips generated by a proposed development.

The ITE category "Medical-Dental Office Building" was used to project traffic volumes for the proposed development and the total gross leasable area in square feet was used as the parameter for projecting traffic. The total expected trips by land use is shown in **Table 1**.

Table 1 - Trip Generation

Land Use	Intensity	ITE Code	Weekday	AM Peak Hour			PM Peak Hour		
				Total	In	Out	Total	In	Out
Medical-Dental Office Building	31,500 sq ft	720	1123	80	62	18	109	30	79

The traffic generated by the proposed development was assigned to the adjacent roadway system based on existing traffic patterns and engineering judgement. It is anticipated that 50 percent of traffic arrives from the north and 50 percent arrives from the south. It is expected that a very small amount of traffic uses the driveway on Granada Street and thus has not been included in this analysis. The distributed traffic volumes are included in **Appendix A-3.**

AUXILIARY TURN LANES

The AM peak period is expected to generate the highest amount of northbound right turning traffic into the development on Roe Ave and was analyzed to determine if an auxiliary right turn lane was warranted. Following procedures outlined in KDOT's Access Management Policy, it was determined that the northbound right turning volume of 31 vehicles per hour did not exceed the required amount of 115 veh/hr with a directional design hourly volume of 700 veh/hr. The southbound left movement on Roe Ave already provides a dedicated left turn lane and thus was not analyzed.

OPERATIONAL ANALYSIS

In order to analyze the traffic impacts, operating conditions were analyzed using SYNCHRO 10, a macroscopic analysis and optimization software. Synchro is based on study procedures outlined in the Highway Capacity Manual, 6th edition. The analysis determines the "Level of Service" of the intersections and is based on factors such as the number and types of lanes, signal timing, traffic volumes, pedestrian activity, etc. This manual, which is used universally by traffic engineers to measure roadway capacity, establishes six levels of traffic service: Level A ("Free Flow") to Level F ("Fully Saturated").

Table 2 – Level of Service Criteria		
Level of Service	**Signalized Intersection (sec/veh)**	**Unsignalized Intersection (sec/veh)**
A	< 10 seconds	< 10 seconds
B	< 20 seconds	< 15 seconds
C	< 35 seconds	< 25 seconds
D	< 55 seconds	< 35 seconds
E	< 80 seconds	< 50 seconds
F	≥ 80 seconds	≥ 50 seconds

Level of Service "D" is considered the minimum acceptable LOS in most areas. However, LOS E is sometimes accepted during peak periods. The above table shows the thresholds for Levels of Service A through F for unsignalized intersections. The analysis focused on the signalized intersection of Johnson Dr & Roe Dr and the unsignalized intersection of Roe Ave and Commerce Bank. Two scenarios were modeled for each time period:

1. Existing conditions
2. Existing conditions plus development

The first scenario modeled existing traffic conditions, while the second scenario modeled traffic conditions with the expected trips generated from the proposed development added to the existing traffic conditions. The results of each scenario are included in **Appendix B.** The signalized Level of Service and control delay of Johnson Dr & Roe Ave is included in **Table 3**. The performance of a two-way, stop-controlled intersection is more closely reflected in terms of its individual movements, rather than its performance overall. For this reason, LOS for a two-way, stop-controlled intersection is defined in terms of its individual movements.
The Level of Service and 95th percentile queue lengths of each approach for Roe Ave & Commerce Bank Driveway are included in **Table 4**.

Table 3 – Operating Conditions Summary Johnson Dr & Roe Ave		
Scenario	**AM Peak Hour**	**PM Peak Hour**
Existing	B (18.4)	C (22.8)
Existing + Development	B (18.7)	C (23.3)

Table 4 – Operating Conditions Summary
Roe Ave & Commerce Bank Driveway

Scenario	AM Peak Hour				PM Peak Hour			
	NBL	SBL	EB	WB	NBL	SBL	EB	WB
Existing	A (25')		C (25')		B (25')		D (25')	
Existing + Development	A (25')	A (25')	D (25')	D (25')	B (25')	A (25')	E (25')	E (50')

[1] Queue lengths rounded up to nearest 25' interval
[2] Unsignalized, free-flow movements not included

The Existing + Development scenario showed a minor increase in delay at Johnson Dr & Roe Ave while remaining at an acceptable level of service. The eastbound and westbound exits from Commerce Bank Driveway increased to a level of service "D" and "E" in the AM and PM peak hours, respectively. However, the 95th percentile queue lengths of both exits do not exceed two vehicles. A third scenario which added the PM peak hour volumes for the proposed Gateway development was analyzed but did not significantly impact the results. Data for that scenario was obtained from the City of Mission and is included in **Appendix C.**

INTERSECTION SIGHT DISTANCE

The intersection sight distance design guidelines used for this is based on *AASHTO - A Policy on Geometric Design of Highways and Streets, 7th Edition* (AASHTO Green Book) which was developed to establish a uniform method to determine the necessary sight distance for an entrance constructed by permit.

Using AASHTO's guidelines and a design speed of 35 mph, the minimum recommended sight distances and field measured sight distances for the proposed driveway on Roe Ave are shown in **Table 5**.

Table 5 – Intersection Sight Distance

	AASHTO Intersection Sight Distance	Measured Intersection Sight Distance
Turning Left	440 ft	>525 ft
Turning Right	335 ft	>600 ft

Intersection sight distance was measured from the perspective of a passenger vehicle exiting the driveway 14.5 ft back from the end of the curb. The available intersection sight distance on

a driveway should provide drivers a sufficient view of the intersecting roadway to allow vehicles to exit the driveway without excessively slowing vehicles traveling at or near the operating speed on the intersecting mainline.

The driveway on Granada Street exceeds the required intersection sight distances of 280 ft and 240 ft for left turning and right turning traffic, respectively.

SUMMARY

RIC completed the preceding study to analyze the traffic impacts associated with the proposed medical office building on the northeast corner of Johnson Drive and Roe Avenue. Based on traffic analysis completed, no improvements outside of those in the site layout are needed. The following summary is provided:

- Access to the site is provided via two unsignalized full-access driveways with one on Roe Avenue and the other on Granada Street.
- The proposed development was estimated to generate a total of 80 new trips in the AM peak hour and 109 new trips in the PM peak hour.
- The signalized intersection of Johnson Drive and Roe Avenue is expected to operate at an acceptable level under the Existing + Development condition.
- Both proposed driveways have acceptable sight triangles for intersection sight distance.
- The proposed westbound driveway approach on Roe Avenue is expected to operate with a Level of Service “E”. However, the 95th % queue length is not expected to exceed two car lengths.

Please do not hesitate to contact us should you have any questions.

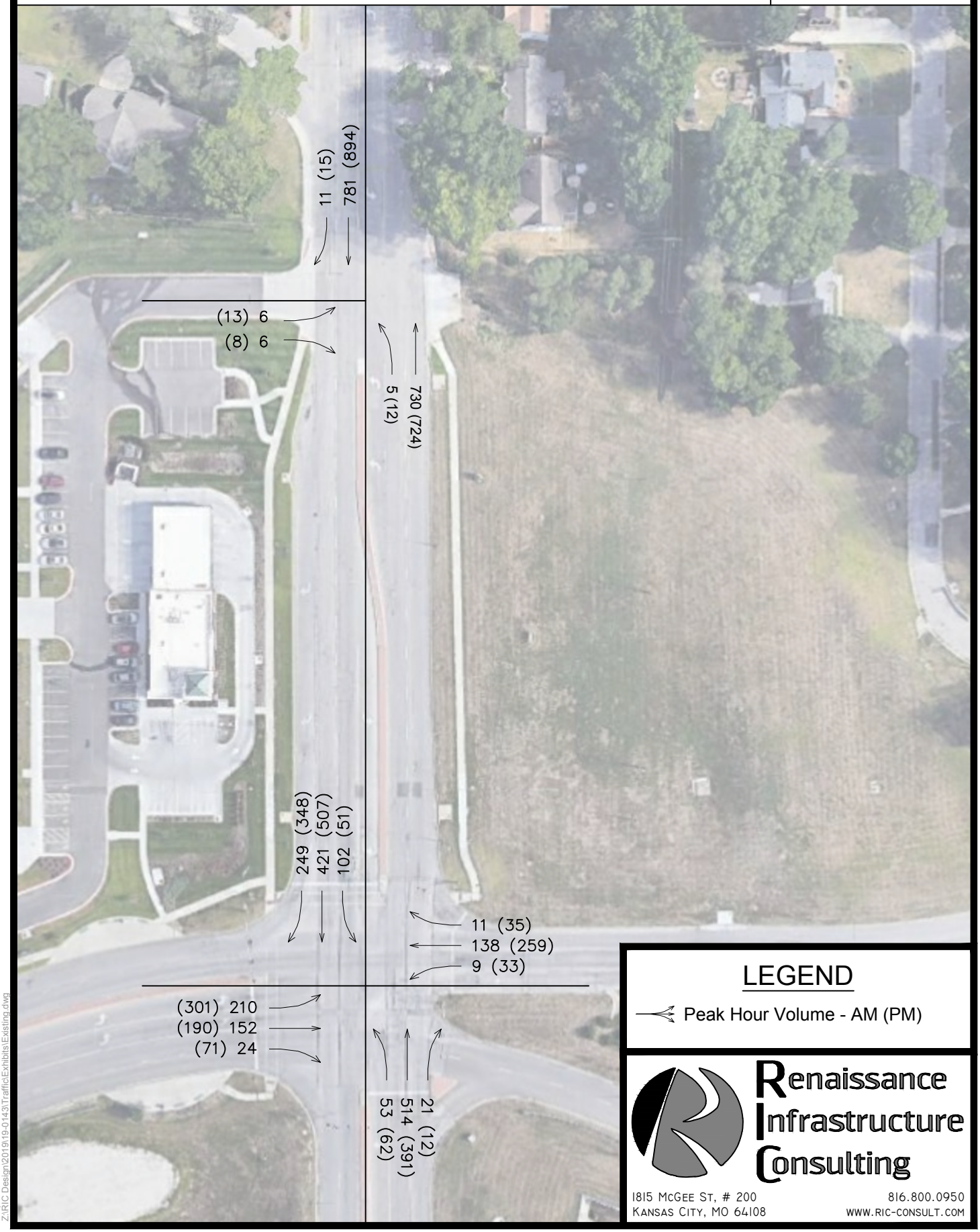
Sincerely,
Renaissance Infrastructure Consulting

Grant Niehus, PE, PTOE
Traffic Engineer

Appendix A – Turning Movement Counts

Existing Traffic Counts

Figure A–1



LEGEND

Peak Hour Volume - AM (PM)

Renaissance Infrastructure Consulting

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Kansas City, MO 64108

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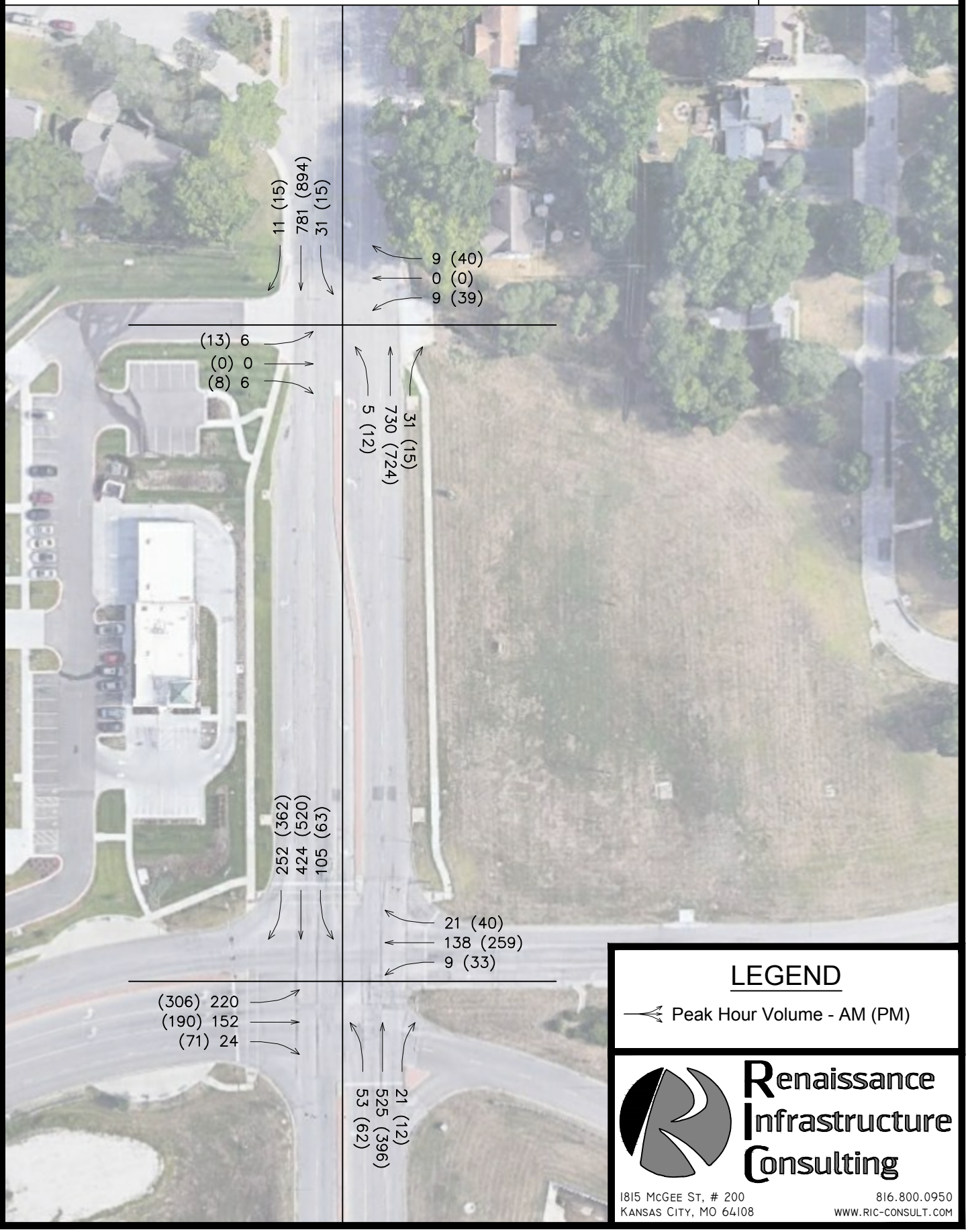
Existing + Development Traffic Projections

Figure A–2



LEGEND

Peak Hour Volume - AM (PM)

Renaissance Infrastructure Consulting

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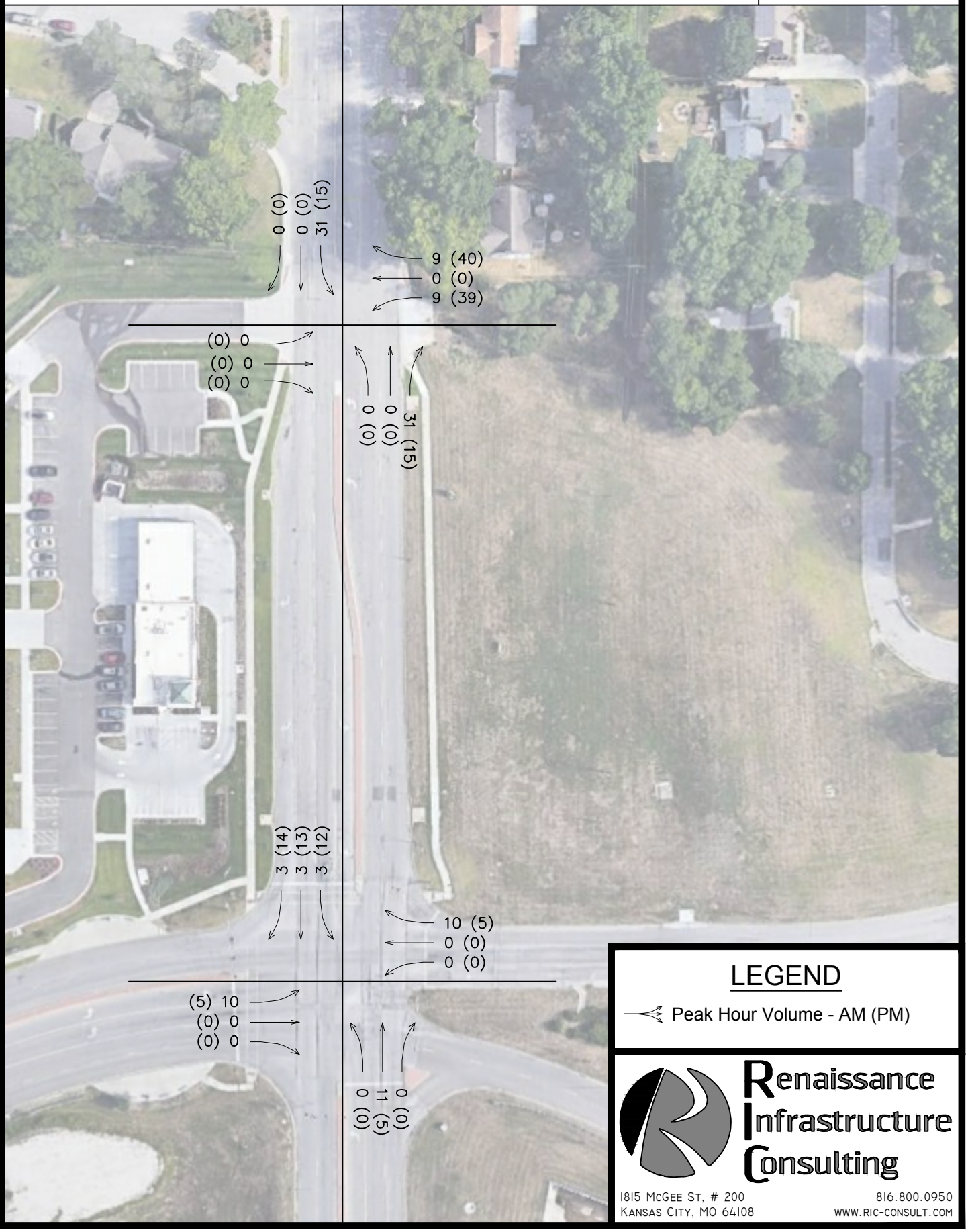
Development Volume

Figure A–3



LEGEND

Peak Hour Volume - AM (PM)

Renaissance Infrastructure Consulting

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Gewalt Hamilton Associates Inc

625 Forest Edge Drive
Vernon Hills, IL, 60061

4900.976 Johnson & Roe

File Name : Johnson Dr & Roe Ave AM
Site Code : 00000000
Start Date : 7/16/2019
Page No : 1

Groups Printed- Lights - Mediums - Articulated - Peds

	From North					From East					From South					From West							
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Exclu. Total	Inclu. Total	Int. Total
07:00 AM	28	49	20	0	97	2	31	4	0	37	1	64	7	0	72	2	13	25	0	40	0	246	246
07:15 AM	55	74	21	0	150	1	18	6	0	25	4	97	15	0	116	6	24	30	0	60	0	351	351
07:30 AM	63	100	21	0	184	4	26	5	0	35	4	130	12	0	146	4	36	48	0	88	0	453	453
07:45 AM	69	123	41	0	233	2	36	2	0	40	4	136	15	0	155	8	35	55	0	98	0	526	526
Total	215	346	103	0	664	9	111	17	0	137	13	427	49	0	489	20	108	158	0	286	0	1576	1576
08:00 AM	59	99	22	0	180	3	34	1	0	38	8	136	8	0	152	8	36	49	0	93	0	463	463
08:15 AM	58	99	18	0	175	2	42	1	0	45	5	112	18	0	135	4	45	58	0	107	0	462	462
08:30 AM	37	90	24	0	151	3	36	2	0	41	6	121	3	0	130	4	27	59	0	90	0	412	412
08:45 AM	41	85	13	0	139	5	30	3	0	38	7	81	10	0	98	5	27	37	0	69	0	344	344
Total	195	373	77	0	645	13	142	7	0	162	26	450	39	0	515	21	135	203	0	359	0	1681	1681
Grand Total	410	719	180	0	1309	22	253	24	0	299	39	877	88	0	1004	41	243	361	0	645	0	3257	3257
Apprch %	31.3	54.9	13.8			7.4	84.6	8			3.9	87.4	8.8			6.4	37.7	56					
Total %	12.6	22.1	5.5		40.2	0.7	7.8	0.7		9.2	1.2	26.9	2.7		30.8	1.3	7.5	11.1		19.8	0	100	
Lights	391	698	156		1245	21	242	24		287	38	868	86		992	41	233	351		625	0	0	3149
% Lights	95.4	97.1	86.7	0	95.1	95.5	95.7	100	0	96	97.4	99	97.7	0	98.8	100	95.9	97.2	0	96.9	0	0	96.7
Mediums	19	19	24		62	1	11	0		12	1	9	2		12	0	7	10		17	0	0	103
% Mediums	4.6	2.6	13.3	0	4.7	4.5	4.3	0	0	4	2.6	1	2.3	0	1.2	0	2.9	2.8	0	2.6	0	0	3.2
Articulated	0	1	0		1	0	0	0		0	0	0	0		0	0	0	0		0	0	0	1
% Articulated	0	0.1	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Peds	0	1	0		1	0	0	0		0	0	0	0		0	0	3	0		3	0	0	4
% Peds	0	0.1	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	1.2	0	0	0.5	0	0	0.1

Gewalt Hamilton Associates Inc

625 Forest Edge Drive
Vernon Hills, IL, 60061

4900.976 Roe & Commerce Bank Driveway

File Name : Roe & Commerce Bank Driveway
Site Code : 00000000
Start Date : 7/16/2019
Page No : 1

Groups Printed- Lights - Mediums - Articulated - Peds

	From North					From East					From South					From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	1	98	0	0	99	0	0	0	0	0	0	95	2	0	97	1	0	1	0	2	198
07:15 AM	1	149	0	0	150	0	0	0	0	0	0	125	2	0	127	0	0	2	0	2	279
07:30 AM	2	181	0	0	183	0	0	0	0	0	0	178	1	0	179	2	0	3	0	5	367
07:45 AM	3	236	0	0	239	0	0	0	0	0	0	195	0	0	195	0	0	0	0	0	434
Total	7	664	0	0	671	0	0	0	0	0	0	593	5	0	598	3	0	6	0	9	1278
08:00 AM	5	172	0	0	177	0	0	0	0	0	0	184	2	0	186	4	0	2	0	6	369
08:15 AM	1	192	0	0	193	0	0	0	0	0	0	173	2	0	175	0	0	1	0	1	369
08:30 AM	3	153	0	0	156	0	0	0	0	0	0	180	3	0	183	2	0	2	0	4	343
08:45 AM	1	141	0	0	142	0	0	0	0	0	0	123	0	0	123	2	0	0	0	2	267
Total	10	658	0	0	668	0	0	0	0	0	0	660	7	0	667	8	0	5	0	13	1348
Grand Total	17	1322	0	0	1339	0	0	0	0	0	0	1253	12	0	1265	11	0	11	0	22	2626
Apprch %	1.3	98.7	0	0		0	0	0	0		0	99.1	0.9	0		50	0	50	0		
Total %	0.6	50.3	0	0	51	0	0	0	0	0	0	47.7	0.5	0	48.2	0.4	0	0.4	0	0.8	
Lights	17	1239	0	0	1256	0	0	0	0	0	0	1227	12	0	1239	11	0	11	0	22	2517
% Lights	100	93.7	0	0	93.8	0	0	0	0	0	0	97.9	100	0	97.9	100	0	100	0	100	95.8
Mediums	0	76	0	0	76	0	0	0	0	0	0	26	0	0	26	0	0	0	0	0	102
% Mediums	0	5.7	0	0	5.7	0	0	0	0	0	0	2.1	0	0	2.1	0	0	0	0	0	3.9
Articulated	0	7	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
% Articulated	0	0.5	0	0	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.3
Peds	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Peds	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Gewalt Hamilton Associates Inc

625 Forest Edge Drive
Vernon Hills, IL, 60061

4900.976 Johnson Dr & Roe Ave

File Name : Johnson Dr & Roe Ave PM
Site Code : 00000000
Start Date : 7/16/2019
Page No : 1

Groups Printed- Lights - Mediums - Articulated - Peds

	From North					From East					From South					From West							
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Exclu. Total	Inclu. Total	Int. Total
04:00 PM	93	96	13	0	202	7	45	4	0	56	1	65	9	0	75	15	45	65	0	125	0	458	458
04:15 PM	71	71	19	0	161	5	51	9	0	65	3	80	14	0	97	18	40	71	0	129	0	452	452
04:30 PM	76	108	8	0	192	5	62	11	0	78	1	65	14	0	80	11	48	58	0	117	0	467	467
04:45 PM	87	107	11	0	205	10	62	3	0	75	4	84	17	0	105	17	57	60	0	134	0	519	519
Total	327	382	51	0	760	27	220	27	0	274	9	294	54	0	357	61	190	254	0	505	0	1896	1896
05:00 PM	83	128	14	0	225	11	71	12	0	94	2	111	11	0	124	22	45	95	0	162	0	605	605
05:15 PM	92	127	10	0	229	8	67	5	0	80	4	92	18	0	114	22	44	71	0	137	0	560	560
05:30 PM	81	132	13	0	226	8	54	11	0	73	1	103	14	0	118	13	50	64	0	127	0	544	544
05:45 PM	92	120	14	0	226	8	67	5	0	80	5	85	19	0	109	14	51	71	0	136	0	551	551
Total	348	507	51	0	906	35	259	33	0	327	12	391	62	0	465	71	190	301	0	562	0	2260	2260
Grand Total	675	889	102	0	1666	62	479	60	0	601	21	685	116	0	822	132	380	555	0	1067	0	4156	4156
Apprch %	40.5	53.4	6.1			10.3	79.7	10			2.6	83.3	14.1			12.4	35.6	52					
Total %	16.2	21.4	2.5		40.1	1.5	11.5	1.4		14.5	0.5	16.5	2.8		19.8	3.2	9.1	13.4		25.7	0	100	
Lights	661	882	91		1634	60	468	59		587	21	676	116		813	131	370	542		1043	0	0	4077
% Lights	97.9	99.2	89.2	0	98.1	96.8	97.7	98.3	0	97.7	100	98.7	100	0	98.9	99.2	97.4	97.7	0	97.8	0	0	98.1
Mediums	14	5	11		30	1	10	1		12	0	8	0		8	1	8	13		22	0	0	72
% Mediums	2.1	0.6	10.8	0	1.8	1.6	2.1	1.7	0	2	0	1.2	0	0	1	0.8	2.1	2.3	0	2.1	0	0	1.7
Articulated	0	0	0		0	1	0	0		1	0	0	0		0	0	0	0		0	0	0	1
% Articulated	0	0	0	0	0	1.6	0	0	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0
Peds	0	2	0		2	0	1	0		1	0	1	0		1	0	2	0		2	0	0	6
% Peds	0	0.2	0	0	0.1	0	0.2	0	0	0.2	0	0.1	0	0	0.1	0	0.5	0	0	0.2	0	0	0.1

Gewalt Hamilton Associates Inc

625 Forest Edge Drive
Vernon Hills, IL, 60061

4900.976 Roe & Commerce Bank Driveway

File Name : Roe & Commerce Bank Driveway PM
Site Code : 00000000
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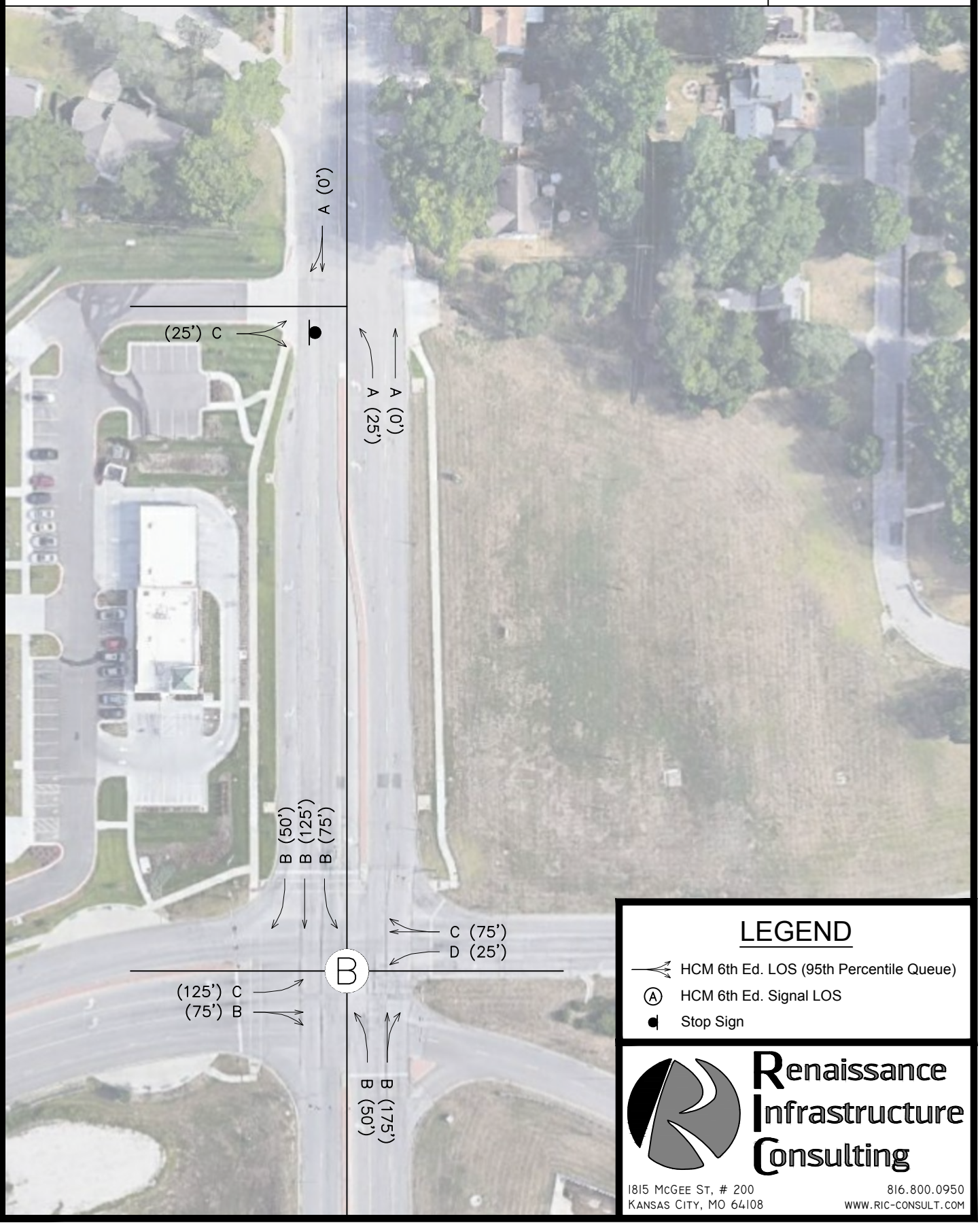
Groups Printed- Lights - Mediums - Articulated - Peds

	From North					From East					From South					From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
04:00 PM	0	183	7	0	190	0	0	0	0	0	0	132	6	0	138	4	0	2	0	6	334
04:15 PM	0	163	4	0	167	0	0	0	0	0	0	152	6	0	158	3	0	1	0	4	329
04:30 PM	0	187	2	0	189	0	0	0	0	0	0	119	5	0	124	3	0	2	0	5	318
04:45 PM	0	204	4	0	208	0	0	0	0	0	0	156	4	0	160	3	0	0	0	3	371
Total	0	737	17	0	754	0	0	0	0	0	0	559	21	0	580	13	0	5	0	18	1352
05:00 PM	0	224	8	0	232	0	0	0	0	0	0	200	6	0	206	1	0	5	0	6	444
05:15 PM	0	228	4	0	232	0	0	0	0	0	0	181	3	0	184	3	0	3	0	6	422
05:30 PM	0	223	3	0	226	0	0	0	0	0	0	176	2	0	178	2	0	4	0	6	410
05:45 PM	0	219	0	0	219	0	0	0	0	0	0	167	1	0	168	2	0	1	0	3	390
Total	0	894	15	0	909	0	0	0	0	0	0	724	12	0	736	8	0	13	0	21	1666
Grand Total	0	1631	32	0	1663	0	0	0	0	0	0	1283	33	0	1316	21	0	18	0	39	3018
Apprch %	0	98.1	1.9	0		0	0	0	0		0	97.5	2.5	0		53.8	0	46.2	0		
Total %	0	54	1.1	0	55.1	0	0	0	0	0	0	42.5	1.1	0	43.6	0.7	0	0.6	0	1.3	
Lights	0	1605	32	0	1637	0	0	0	0	0	0	1252	33	0	1285	21	0	18	0	39	2961
% Lights	0	98.4	100	0	98.4	0	0	0	0	0	0	97.6	100	0	97.6	100	0	100	0	100	98.1
Mediums	0	26	0	0	26	0	0	0	0	0	0	28	0	0	28	0	0	0	0	0	54
% Mediums	0	1.6	0	0	1.6	0	0	0	0	0	0	2.2	0	0	2.1	0	0	0	0	0	1.8
Articulated	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	3
% Articulated	0	0	0	0	0	0	0	0	0	0	0	0.2	0	0	0.2	0	0	0	0	0	0.1
Peds	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Peds	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix B – Operational Analysis

Existing AM Peak Hour Levels of Service

Figure B–1



LEGEND

- HCM 6th Ed. LOS (95th Percentile Queue)
- (A) HCM 6th Ed. Signal LOS
- Stop Sign

Renaissance Infrastructure Consulting

1815 McGee St, # 200
Kansas City, MO 64108

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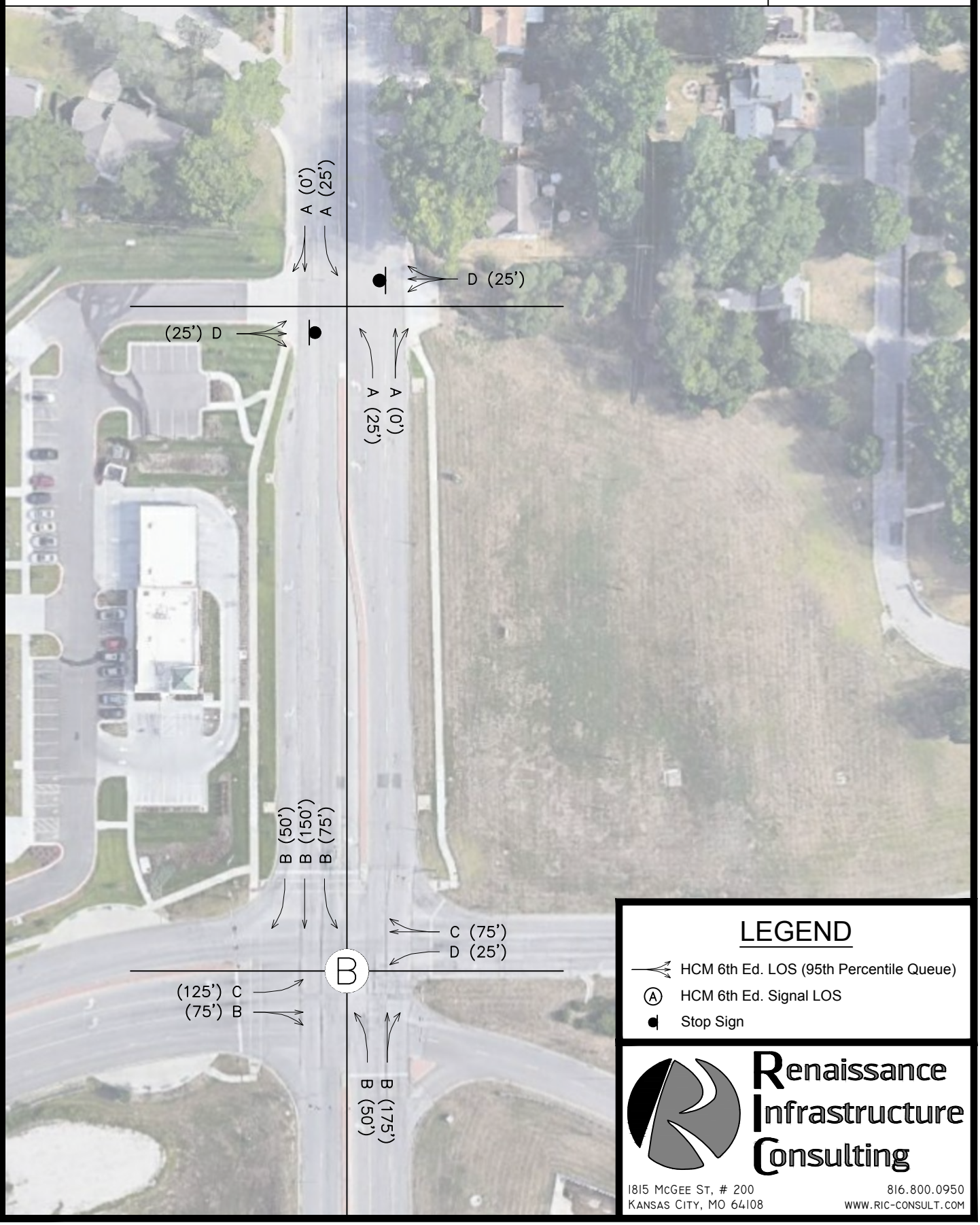
Existing + Development AM Peak Hour Levels of Service

Figure B–2



LEGEND

- HCM 6th Ed. LOS (95th Percentile Queue)
- (A) HCM 6th Ed. Signal LOS
- Stop Sign

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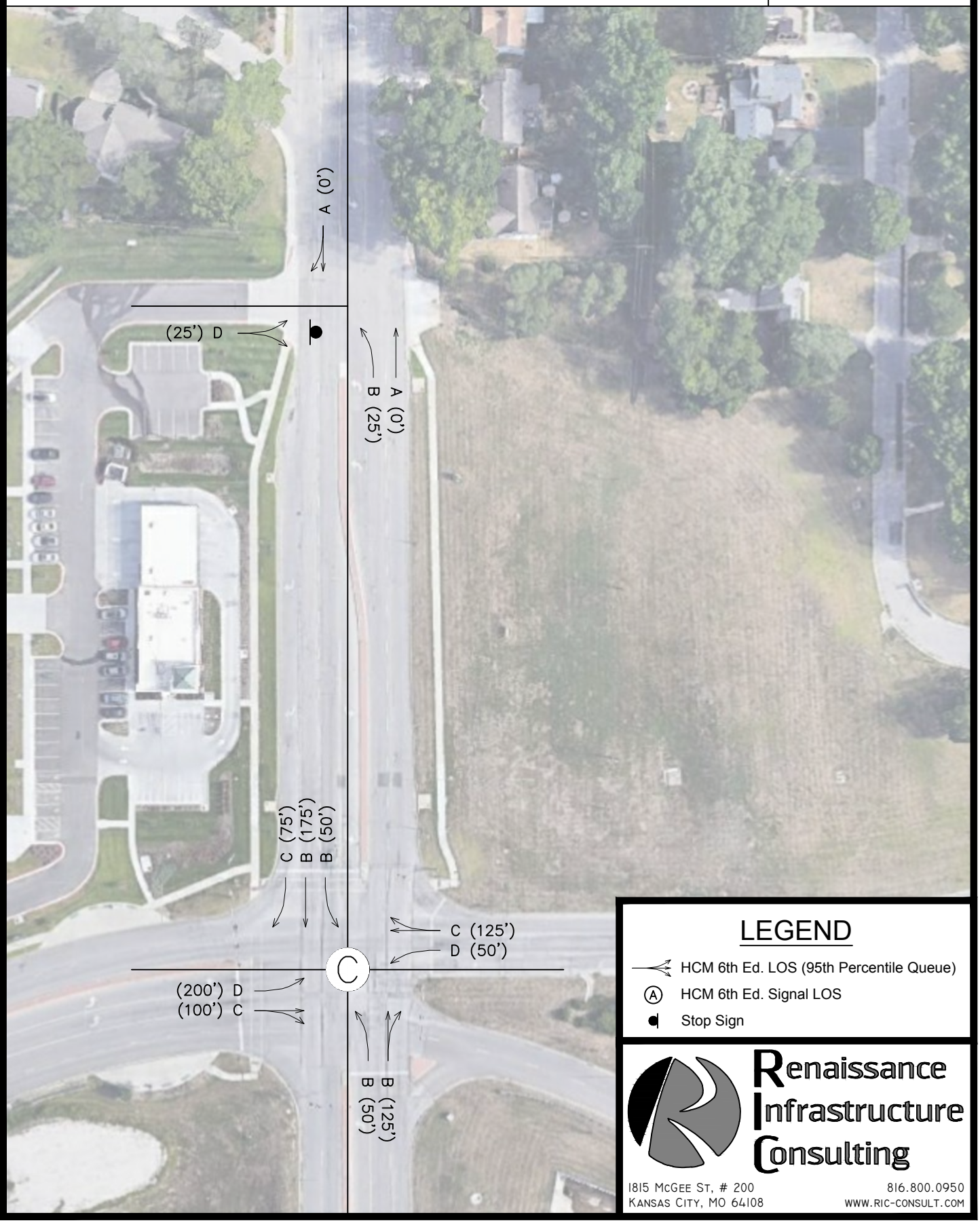
Existing PM Peak Hour Levels of Service

Figure B–3



LEGEND

- HCM 6th Ed. LOS (95th Percentile Queue)
- (A) HCM 6th Ed. Signal LOS
- Stop Sign

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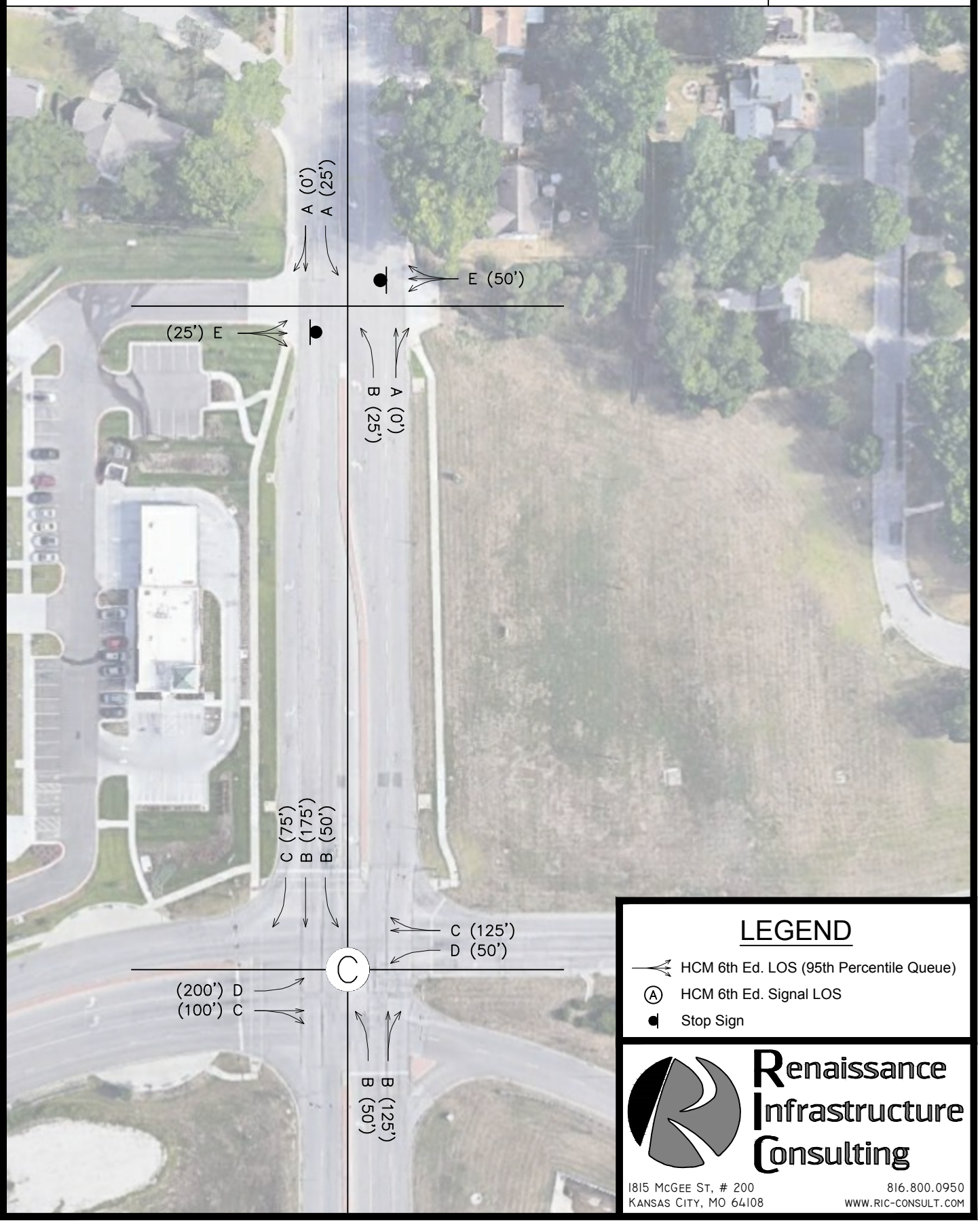
Existing + Development PM Peak Hour Levels of Service

Figure B–4



LEGEND

- HCM 6th Ed. LOS (95th Percentile Queue)
- (A) HCM 6th Ed. Signal LOS
- Stop Sign

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	210	152	24	9	138	11	53	514	21	102	421	249
Future Volume (veh/h)	210	152	24	9	138	11	53	514	21	102	421	249
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Adj Flow Rate, veh/h	231	167	26	10	152	12	58	565	23	112	463	274
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	0	0	0	0	0	0	0	0	0	0	0	0
Cap, veh/h	359	592	91	23	337	26	363	888	36	373	990	442
Arrive On Green	0.10	0.19	0.19	0.01	0.10	0.10	0.05	0.25	0.25	0.08	0.27	0.27
Sat Flow, veh/h	3510	3138	480	1810	3392	265	1810	3535	144	1810	3610	1610
Grp Volume(v), veh/h	231	95	98	10	80	84	58	288	300	112	463	274
Grp Sat Flow(s),veh/h/ln	1755	1805	1814	1810	1805	1852	1810	1805	1874	1810	1805	1610
Q Serve(g_s), s	3.2	2.3	2.4	0.3	2.1	2.2	1.2	7.3	7.3	2.3	5.5	7.6
Cycle Q Clear(g_c), s	3.2	2.3	2.4	0.3	2.1	2.2	1.2	7.3	7.3	2.3	5.5	7.6
Prop In Lane	1.00		0.26	1.00		0.14	1.00		0.08	1.00		1.00
Lane Grp Cap(c), veh/h	359	341	342	23	179	184	363	454	471	373	990	442
V/C Ratio(X)	0.64	0.28	0.29	0.43	0.45	0.46	0.16	0.64	0.64	0.30	0.47	0.62
Avail Cap(c_a), veh/h	549	1411	1418	177	1306	1340	440	1235	1282	444	2540	1133
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	22.1	17.8	17.8	25.1	21.7	21.7	12.9	17.1	17.1	12.9	15.5	16.2
Incr Delay (d2), s/veh	1.9	0.4	0.5	11.8	1.7	1.8	0.2	1.5	1.4	0.4	0.3	1.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.3	0.9	0.9	0.2	0.9	1.0	0.4	2.8	2.9	0.8	2.0	2.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	24.0	18.2	18.3	36.9	23.5	23.5	13.1	18.5	18.5	13.3	15.8	17.7
LnGrp LOS	C	B	B	D	C	C	B	B	B	B	B	B
Approach Vol, veh/h		424			174			646			849	
Approach Delay, s/veh		21.4			24.2			18.0			16.1	
Approach LOS		C			C			B			B	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	10.0	18.9	6.7	15.7	8.8	20.0	11.2	11.1
Change Period (Y+Rc), s	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Max Green Setting (Gmax), s	6.0	35.0	5.0	40.0	5.0	36.0	8.0	37.0
Max Q Clear Time (g_c+I1), s	4.3	9.3	2.3	4.4	3.2	9.6	5.2	4.2
Green Ext Time (p_c), s	0.0	3.6	0.0	1.1	0.0	4.1	0.2	0.9

Intersection Summary	
HCM 6th Ctrl Delay	18.4
HCM 6th LOS	B

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	6	6	5	730	781	11
Future Vol, veh/h	6	6	5	730	781	11
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	0	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	7	7	6	820	878	12

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1306	445	890	0	-	0
Stage 1	884	-	-	-	-	-
Stage 2	422	-	-	-	-	-
Critical Hdwy	6.8	6.9	4.1	-	-	-
Critical Hdwy Stg 1	5.8	-	-	-	-	-
Critical Hdwy Stg 2	5.8	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	154	566	770	-	-	-
Stage 1	369	-	-	-	-	-
Stage 2	635	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	153	566	770	-	-	-
Mov Cap-2 Maneuver	153	-	-	-	-	-
Stage 1	366	-	-	-	-	-
Stage 2	635	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	20.8	0.1	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	770	-	241	-	-
HCM Lane V/C Ratio	0.007	-	0.056	-	-
HCM Control Delay (s)	9.7	-	20.8	-	-
HCM Lane LOS	A	-	C	-	-
HCM 95th %tile Q(veh)	0	-	0.2	-	-

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	231	193	10	164	58	588	112	463	274
v/c Ratio	0.50	0.16	0.07	0.32	0.15	0.57	0.33	0.38	0.38
Control Delay	34.3	17.8	34.9	27.6	11.2	21.9	13.1	17.8	4.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	34.3	17.8	34.9	27.6	11.2	21.9	13.1	17.8	4.1
Queue Length 50th (ft)	42	23	4	28	12	102	23	76	0
Queue Length 95th (ft)	#115	73	21	68	32	164	55	125	45
Internal Link Dist (ft)		931		442		500		359	
Turn Bay Length (ft)	250		160		190		175		290
Base Capacity (vph)	460	2334	148	2175	391	2067	340	2137	1067
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.50	0.08	0.07	0.08	0.15	0.28	0.33	0.22	0.26

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	220	152	24	9	138	21	53	525	21	105	424	252
Future Volume (veh/h)	220	152	24	9	138	21	53	525	21	105	424	252
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Adj Flow Rate, veh/h	242	167	26	10	152	23	58	577	23	115	466	277
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	0	0	0	0	0	0	0	0	0	0	0	0
Cap, veh/h	370	615	94	23	326	49	360	894	36	368	996	444
Arrive On Green	0.11	0.20	0.20	0.01	0.10	0.10	0.05	0.25	0.25	0.08	0.28	0.28
Sat Flow, veh/h	3510	3138	480	1810	3152	469	1810	3539	141	1810	3610	1610
Grp Volume(v), veh/h	242	95	98	10	86	89	58	294	306	115	466	277
Grp Sat Flow(s),veh/h/ln	1755	1805	1814	1810	1805	1816	1810	1805	1875	1810	1805	1610
Q Serve(g_s), s	3.5	2.3	2.4	0.3	2.3	2.4	1.2	7.6	7.6	2.4	5.6	7.8
Cycle Q Clear(g_c), s	3.5	2.3	2.4	0.3	2.3	2.4	1.2	7.6	7.6	2.4	5.6	7.8
Prop In Lane	1.00		0.26	1.00		0.26	1.00		0.08	1.00		1.00
Lane Grp Cap(c), veh/h	370	354	355	23	187	188	360	456	474	368	996	444
V/C Ratio(X)	0.65	0.27	0.28	0.43	0.46	0.47	0.16	0.64	0.65	0.31	0.47	0.62
Avail Cap(c_a), veh/h	539	1386	1393	174	1282	1290	435	1143	1188	505	2495	1113
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	22.4	17.8	17.8	25.5	22.0	22.0	13.1	17.4	17.4	13.1	15.7	16.5
Incr Delay (d2), s/veh	2.0	0.4	0.4	11.9	1.8	1.9	0.2	1.5	1.5	0.5	0.3	1.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.4	0.9	0.9	0.2	1.0	1.0	0.4	2.9	3.0	0.9	2.0	2.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	24.4	18.2	18.2	37.4	23.7	23.9	13.3	18.9	18.9	13.6	16.0	17.9
LnGrp LOS	C	B	B	D	C	C	B	B	B	B	B	B
Approach Vol, veh/h		435			185			658			858	
Approach Delay, s/veh		21.6			24.5			18.4			16.3	
Approach LOS		C			C			B			B	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	10.1	19.2	6.7	16.2	8.8	20.4	11.5	11.4
Change Period (Y+Rc), s	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Max Green Setting (Gmax), s	8.0	33.0	5.0	40.0	5.0	36.0	8.0	37.0
Max Q Clear Time (g_c+I1), s	4.4	9.6	2.3	4.4	3.2	9.8	5.5	4.4
Green Ext Time (p_c), s	0.1	3.6	0.0	1.1	0.0	4.1	0.2	1.0

Intersection Summary	
HCM 6th Ctrl Delay	18.7
HCM 6th LOS	B

Intersection	
Int Delay, s/veh	0.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	6	0	6	9	0	9	5	730	31	31	781	11
Future Vol, veh/h	6	0	6	9	0	9	5	730	31	31	781	11
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	0	-	-	0	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	89	89	89	89	89	89	89	89	89	89	89	89
Heavy Vehicles, %	0	2	0	2	2	2	0	0	2	2	0	0
Mvmt Flow	7	0	7	10	0	10	6	820	35	35	878	12

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1376	1821	445	1359	1810	428	890	0	0	855	0	0
Stage 1	954	954	-	850	850	-	-	-	-	-	-	-
Stage 2	422	867	-	509	960	-	-	-	-	-	-	-
Critical Hdwy	7.5	6.54	6.9	7.54	6.54	6.94	4.1	-	-	4.14	-	-
Critical Hdwy Stg 1	6.5	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.5	5.54	-	6.54	5.54	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4.02	3.3	3.52	4.02	3.32	2.2	-	-	2.22	-	-
Pot Cap-1 Maneuver	106	77	566	107	78	575	770	-	-	781	-	-
Stage 1	282	335	-	322	375	-	-	-	-	-	-	-
Stage 2	585	368	-	515	333	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	100	73	566	102	74	575	770	-	-	781	-	-
Mov Cap-2 Maneuver	100	73	-	102	74	-	-	-	-	-	-	-
Stage 1	280	320	-	319	372	-	-	-	-	-	-	-
Stage 2	570	365	-	486	318	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	28	28.5	0.1	0.4
HCM LOS	D	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	770	-	-	170	173	781	-	-
HCM Lane V/C Ratio	0.007	-	-	0.079	0.117	0.045	-	-
HCM Control Delay (s)	9.7	-	-	28	28.5	9.8	-	-
HCM Lane LOS	A	-	-	D	D	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.3	0.4	0.1	-	-

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	242	193	10	175	58	600	115	466	277
v/c Ratio	0.54	0.16	0.07	0.34	0.15	0.59	0.32	0.37	0.37
Control Delay	36.1	18.4	35.7	27.3	11.2	23.1	12.6	17.4	4.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	36.1	18.4	35.7	27.3	11.2	23.1	12.6	17.4	4.0
Queue Length 50th (ft)	47	24	4	30	12	110	24	77	0
Queue Length 95th (ft)	#123	73	21	70	32	175	56	126	45
Internal Link Dist (ft)		931		442		500		359	
Turn Bay Length (ft)	250		160		190		175		290
Base Capacity (vph)	449	2276	144	2106	384	1901	379	2084	1049
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.54	0.08	0.07	0.08	0.15	0.32	0.30	0.22	0.26

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	301	190	71	33	259	35	62	391	12	51	507	348
Future Volume (veh/h)	301	190	71	33	259	35	62	391	12	51	507	348
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Adj Flow Rate, veh/h	324	204	76	35	278	38	67	420	13	55	545	374
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	0	0	0	0	0	0	0	0	0	0	0	0
Cap, veh/h	422	590	213	65	456	62	327	1142	35	420	1133	505
Arrive On Green	0.12	0.23	0.23	0.04	0.14	0.14	0.05	0.32	0.32	0.05	0.31	0.31
Sat Flow, veh/h	3510	2598	938	1810	3195	432	1810	3575	110	1810	3610	1610
Grp Volume(v), veh/h	324	140	140	35	156	160	67	212	221	55	545	374
Grp Sat Flow(s),veh/h/ln	1755	1805	1731	1810	1805	1822	1810	1805	1880	1810	1805	1610
Q Serve(g_s), s	5.8	4.2	4.4	1.2	5.3	5.4	1.6	5.9	5.9	1.3	7.9	13.5
Cycle Q Clear(g_c), s	5.8	4.2	4.4	1.2	5.3	5.4	1.6	5.9	5.9	1.3	7.9	13.5
Prop In Lane	1.00		0.54	1.00		0.24	1.00		0.06	1.00		1.00
Lane Grp Cap(c), veh/h	422	410	393	65	258	260	327	576	600	420	1133	505
V/C Ratio(X)	0.77	0.34	0.36	0.54	0.60	0.62	0.20	0.37	0.37	0.13	0.48	0.74
Avail Cap(c_a), veh/h	432	1083	1038	167	1027	1037	368	999	1041	472	1999	892
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	27.7	21.1	21.1	30.8	26.1	26.2	14.0	17.1	17.1	13.9	18.0	19.9
Incr Delay (d2), s/veh	8.0	0.5	0.5	6.7	2.3	2.4	0.3	0.4	0.4	0.1	0.3	2.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.8	1.7	1.8	0.6	2.3	2.4	0.6	2.3	2.4	0.5	3.0	4.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	35.7	21.5	21.7	37.5	28.4	28.6	14.3	17.5	17.4	14.0	18.3	22.1
LnGrp LOS	D	C	C	D	C	C	B	B	B	B	B	C
Approach Vol, veh/h		604			351			500			974	
Approach Delay, s/veh		29.2			29.4			17.0			19.5	
Approach LOS		C			C			B			B	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	9.1	26.8	8.3	20.8	9.5	26.4	13.8	15.3
Change Period (Y+Rc), s	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Max Green Setting (Gmax), s	5.0	36.0	6.0	39.0	5.0	36.0	8.0	37.0
Max Q Clear Time (g_c+I1), s	3.3	7.9	3.2	6.4	3.6	15.5	7.8	7.4
Green Ext Time (p_c), s	0.0	2.5	0.0	1.7	0.0	4.9	0.0	1.9

Intersection Summary	
HCM 6th Ctrl Delay	22.8
HCM 6th LOS	C

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	13	8	12	724	894	15
Future Vol, veh/h	13	8	12	724	894	15
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	0	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	14	9	13	770	951	16

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1370	484	967	0	-	0
Stage 1	959	-	-	-	-	-
Stage 2	411	-	-	-	-	-
Critical Hdwy	6.8	6.9	4.1	-	-	-
Critical Hdwy Stg 1	5.8	-	-	-	-	-
Critical Hdwy Stg 2	5.8	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	140	534	720	-	-	-
Stage 1	337	-	-	-	-	-
Stage 2	643	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	137	534	720	-	-	-
Mov Cap-2 Maneuver	137	-	-	-	-	-
Stage 1	331	-	-	-	-	-
Stage 2	643	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	26.3	0.2	0
HCM LOS	D		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	720	-	191	-	-
HCM Lane V/C Ratio	0.018	-	0.117	-	-
HCM Control Delay (s)	10.1	-	26.3	-	-
HCM Lane LOS	B	-	D	-	-
HCM 95th %tile Q(veh)	0.1	-	0.4	-	-

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	324	280	35	316	67	433	55	545	374
v/c Ratio	0.73	0.24	0.21	0.51	0.20	0.37	0.14	0.52	0.51
Control Delay	43.3	18.1	36.9	28.8	12.5	18.6	11.8	21.7	4.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	43.3	18.1	36.9	28.8	12.5	18.6	11.8	21.7	4.9
Queue Length 50th (ft)	66	30	13	58	15	75	12	98	0
Queue Length 95th (ft)	#185	94	49	122	37	119	32	152	52
Internal Link Dist (ft)		931		442		500		359	
Turn Bay Length (ft)	250		160		190		175		290
Base Capacity (vph)	444	2161	171	2085	331	2051	394	2060	1082
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.73	0.13	0.20	0.15	0.20	0.21	0.14	0.26	0.35

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	306	190	71	33	259	40	62	396	12	63	520	362
Future Volume (veh/h)	306	190	71	33	259	40	62	396	12	63	520	362
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Adj Flow Rate, veh/h	329	204	76	35	278	43	67	426	13	68	559	389
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	0	0	0	0	0	0	0	0	0	0	0	0
Cap, veh/h	422	593	214	65	451	69	323	1149	35	427	1161	518
Arrive On Green	0.12	0.23	0.23	0.04	0.14	0.14	0.05	0.32	0.32	0.05	0.32	0.32
Sat Flow, veh/h	3510	2598	938	1810	3139	480	1810	3576	109	1810	3610	1610
Grp Volume(v), veh/h	329	140	140	35	158	163	67	215	224	68	559	389
Grp Sat Flow(s),veh/h/ln	1755	1805	1731	1810	1805	1814	1810	1805	1880	1810	1805	1610
Q Serve(g_s), s	6.0	4.3	4.5	1.3	5.5	5.6	1.6	6.1	6.1	1.6	8.3	14.4
Cycle Q Clear(g_c), s	6.0	4.3	4.5	1.3	5.5	5.6	1.6	6.1	6.1	1.6	8.3	14.4
Prop In Lane	1.00		0.54	1.00		0.26	1.00		0.06	1.00		1.00
Lane Grp Cap(c), veh/h	422	412	395	65	259	261	323	580	604	427	1161	518
V/C Ratio(X)	0.78	0.34	0.36	0.54	0.61	0.62	0.21	0.37	0.37	0.16	0.48	0.75
Avail Cap(c_a), veh/h	422	1059	1016	163	1005	1009	363	978	1018	466	1955	872
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	28.4	21.5	21.5	31.5	26.7	26.8	14.1	17.4	17.4	13.8	18.1	20.2
Incr Delay (d2), s/veh	9.0	0.5	0.5	6.8	2.3	2.4	0.3	0.4	0.4	0.2	0.3	2.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.9	1.8	1.8	0.7	2.4	2.5	0.6	2.4	2.5	0.6	3.2	5.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	37.4	21.9	22.1	38.3	29.0	29.2	14.4	17.8	17.8	14.0	18.4	22.4
LnGrp LOS	D	C	C	D	C	C	B	B	B	B	B	C
Approach Vol, veh/h		609			356			506			1016	
Approach Delay, s/veh		30.3			30.0			17.3			19.6	
Approach LOS		C			C			B			B	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	9.6	27.3	8.4	21.2	9.5	27.4	14.0	15.6
Change Period (Y+Rc), s	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Max Green Setting (Gmax), s	5.0	36.0	6.0	39.0	5.0	36.0	8.0	37.0
Max Q Clear Time (g_c+I1), s	3.6	8.1	3.3	6.5	3.6	16.4	8.0	7.6
Green Ext Time (p_c), s	0.0	2.6	0.0	1.7	0.0	5.0	0.0	1.9

Intersection Summary	
HCM 6th Ctrl Delay	23.3
HCM 6th LOS	C

Intersection	
Int Delay, s/veh	2.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	13	0	8	39	0	40	12	724	15	15	894	15
Future Vol, veh/h	13	0	8	39	0	40	12	724	15	15	894	15
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	0	-	-	0	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	94	94	94	94	94	94	92	94	94
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	14	0	9	41	0	43	13	770	16	16	951	16

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1402	1803	484	1312	1803	393	967	0	0	786	0	0
Stage 1	991	991	-	804	804	-	-	-	-	-	-	-
Stage 2	411	812	-	508	999	-	-	-	-	-	-	-
Critical Hdwy	7.5	6.5	6.9	7.5	6.5	6.9	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.5	5.5	-	6.5	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.5	5.5	-	6.5	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	102	80	534	118	80	612	720	-	-	842	-	-
Stage 1	268	327	-	347	398	-	-	-	-	-	-	-
Stage 2	594	395	-	521	324	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	92	77	534	113	77	612	720	-	-	842	-	-
Mov Cap-2 Maneuver	92	77	-	113	77	-	-	-	-	-	-	-
Stage 1	263	321	-	341	391	-	-	-	-	-	-	-
Stage 2	543	388	-	503	318	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	37.2	37.6	0.3	0.2
HCM LOS	E	E		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	720	-	-	134	192	842	-	-
HCM Lane V/C Ratio	0.018	-	-	0.167	0.438	0.019	-	-
HCM Control Delay (s)	10.1	0.1	-	37.2	37.6	9.4	-	-
HCM Lane LOS	B	A	-	E	E	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	0.6	2	0.1	-	-

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	329	280	35	321	67	439	68	559	389
v/c Ratio	0.75	0.24	0.21	0.51	0.21	0.42	0.18	0.53	0.52
Control Delay	44.3	18.1	37.1	28.8	12.7	20.2	12.2	21.8	4.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	44.3	18.1	37.1	28.8	12.7	20.2	12.2	21.8	4.9
Queue Length 50th (ft)	68	31	13	59	15	76	15	102	0
Queue Length 95th (ft)	#188	94	49	123	37	121	38	156	53
Internal Link Dist (ft)		931		442		500		359	
Turn Bay Length (ft)	250		160		190		175		290
Base Capacity (vph)	441	2150	170	2071	320	2043	375	2049	1085
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.75	0.13	0.21	0.15	0.21	0.21	0.18	0.27	0.36

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

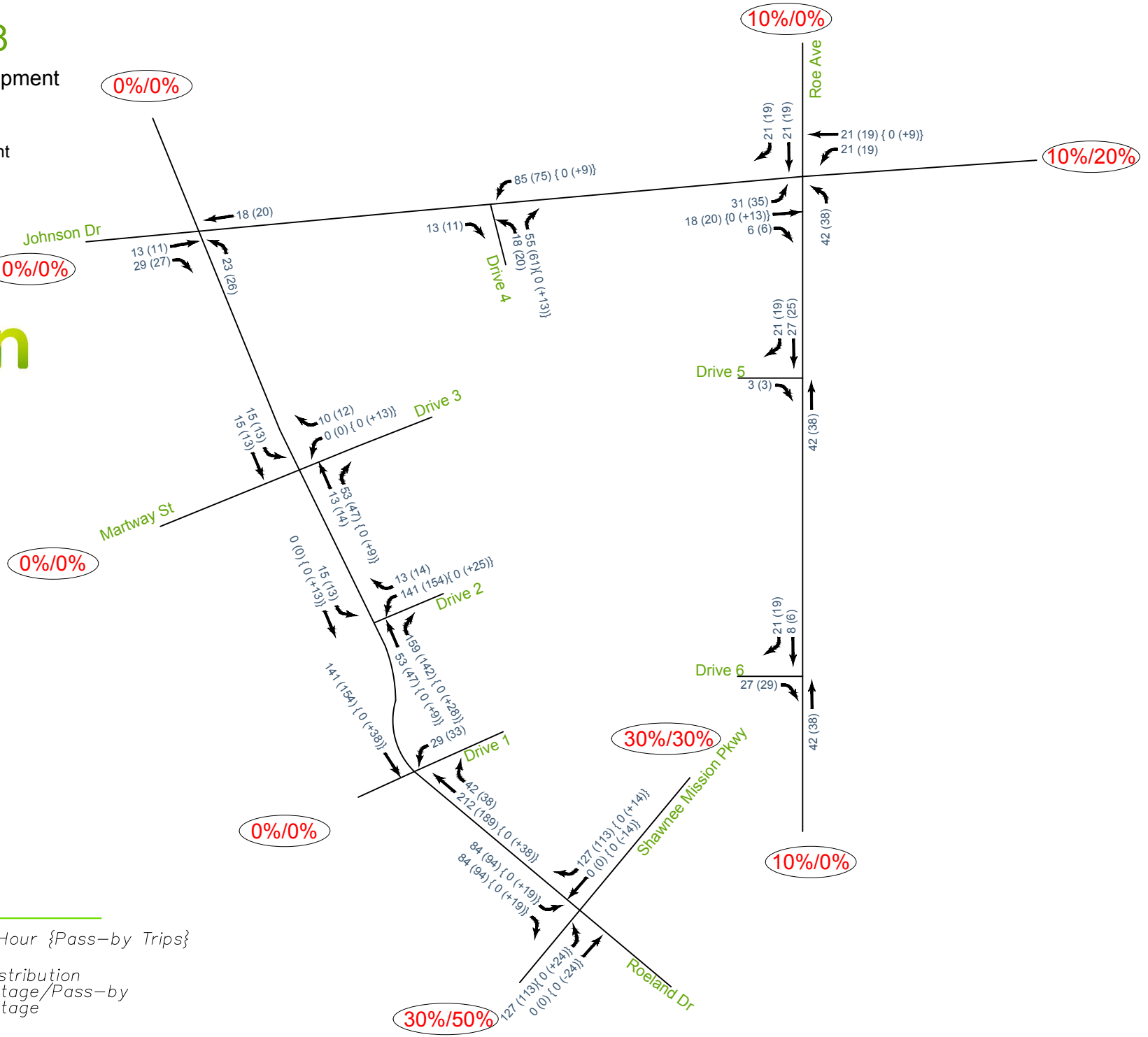
Appendix C – Gateway Development PM Volumes

FIGURE 8

Proposed Development
Trip Distribution

Gateway Development
Mission, KS

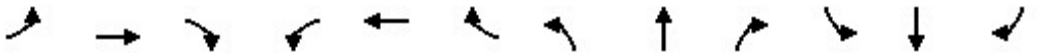
olsson



LEGEND

AM (PM) {AM (PM)} *Peak Hour {Pass-by Trips}*

X%/X% *Trip Distribution Percentage/Pass-by Percentage*



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	341	210	77	52	278	40	100	396	12	63	539	381
Future Volume (veh/h)	341	210	77	52	278	40	100	396	12	63	539	381
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Adj Flow Rate, veh/h	367	226	83	56	299	43	108	426	13	68	580	410
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	0	0	0	0	0	0	0	0	0	0	0	0
Cap, veh/h	402	561	200	86	470	67	334	1219	37	441	1193	532
Arrive On Green	0.11	0.22	0.22	0.05	0.15	0.15	0.06	0.34	0.34	0.05	0.33	0.33
Sat Flow, veh/h	3510	2607	930	1810	3172	452	1810	3576	109	1810	3610	1610
Grp Volume(v), veh/h	367	154	155	56	169	173	108	215	224	68	580	410
Grp Sat Flow(s),veh/h/ln	1755	1805	1733	1810	1805	1819	1810	1805	1880	1810	1805	1610
Q Serve(g_s), s	7.2	5.1	5.4	2.1	6.1	6.3	2.7	6.2	6.2	1.7	8.9	16.0
Cycle Q Clear(g_c), s	7.2	5.1	5.4	2.1	6.1	6.3	2.7	6.2	6.2	1.7	8.9	16.0
Prop In Lane	1.00		0.54	1.00		0.25	1.00		0.06	1.00		1.00
Lane Grp Cap(c), veh/h	402	389	373	86	267	269	334	615	641	441	1193	532
V/C Ratio(X)	0.91	0.40	0.41	0.65	0.63	0.64	0.32	0.35	0.35	0.15	0.49	0.77
Avail Cap(c_a), veh/h	402	957	919	207	957	964	350	931	970	476	1862	831
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	30.5	23.5	23.6	32.7	27.9	28.0	14.4	17.2	17.2	14.0	18.6	21.0
Incr Delay (d2), s/veh	24.6	0.7	0.7	8.1	2.5	2.6	0.6	0.3	0.3	0.2	0.3	2.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.3	2.2	2.2	1.1	2.7	2.8	1.0	2.4	2.5	0.6	3.5	5.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	55.2	24.2	24.3	40.7	30.4	30.5	14.9	17.5	17.5	14.2	18.9	23.4
LnGrp LOS	E	C	C	D	C	C	B	B	B	B	B	C
Approach Vol, veh/h		676			398			547			1058	
Approach Delay, s/veh		41.0			31.9			17.0			20.4	
Approach LOS		D			C			B			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	9.7	29.8	9.3	21.0	10.4	29.1	14.0	16.3
Change Period (Y+Rc), s	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Max Green Setting (Gmax), s	5.0	36.0	8.0	37.0	5.0	36.0	8.0	37.0
Max Q Clear Time (g_c+I1), s	3.7	8.2	4.1	7.4	4.7	18.0	9.2	8.3
Green Ext Time (p_c), s	0.0	2.6	0.0	1.9	0.0	5.1	0.0	2.1

Intersection Summary	
HCM 6th Ctrl Delay	26.6
HCM 6th LOS	C

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	367	309	56	342	108	439	68	580	410
v/c Ratio	0.86	0.30	0.29	0.52	0.34	0.40	0.18	0.53	0.53
Control Delay	55.5	21.7	37.4	29.3	14.8	20.3	12.5	22.1	4.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	55.5	21.7	37.4	29.3	14.8	20.3	12.5	22.1	4.9
Queue Length 50th (ft)	79	51	22	66	26	77	16	108	0
Queue Length 95th (ft)	#221	108	69	131	57	125	40	168	55
Internal Link Dist (ft)		931		442		500		359	
Turn Bay Length (ft)	250		160		190		175		290
Base Capacity (vph)	425	1972	219	1998	318	1969	383	1976	1069
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.86	0.16	0.26	0.17	0.34	0.22	0.18	0.29	0.38

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Intersection	
Int Delay, s/veh	2.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	13	0	8	39	0	40	12	759	15	15	932	0
Future Vol, veh/h	13	0	8	39	0	40	12	759	15	15	932	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	0	-	-	0	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	94	94	94	94	94	94	92	94	94
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	14	0	9	41	0	43	13	807	16	16	991	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1453	1872	496	1369	1864	412	991	0	0	823	0	0
Stage 1	1023	1023	-	841	841	-	-	-	-	-	-	-
Stage 2	430	849	-	528	1023	-	-	-	-	-	-	-
Critical Hdwy	7.5	6.5	6.9	7.5	6.5	6.9	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.5	5.5	-	6.5	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.5	5.5	-	6.5	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	93	73	525	107	74	595	706	-	-	816	-	-
Stage 1	256	316	-	330	383	-	-	-	-	-	-	-
Stage 2	579	380	-	507	316	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	84	70	525	102	71	595	706	-	-	816	-	-
Mov Cap-2 Maneuver	84	70	-	102	71	-	-	-	-	-	-	-
Stage 1	251	310	-	324	376	-	-	-	-	-	-	-
Stage 2	528	373	-	489	310	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	40.3	42.9	0.3	0.2
HCM LOS	E	E		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	706	-	-	124	176	816	-	-
HCM Lane V/C Ratio	0.018	-	-	0.18	0.478	0.02	-	-
HCM Control Delay (s)	10.2	0.1	-	40.3	42.9	9.5	-	-
HCM Lane LOS	B	A	-	E	E	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	0.6	2.3	0.1	-	-

Storm Water Drainage Study

Sunflower Medical Offices

Roe Boulevard & Johnson Drive, Roeland Park Kansas

Prepared:
July 2019
Revised:
September 2019

Prepared by:

Renaissance Infrastructure Consulting

5015 NW Canal St. Suite 100 | Riverside, MO 64150
dburton@ric-consult.com
816.800.0950

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Proposed Condition Analysis ..... Exhibit G

BMP Analysis ..... Exhibit H

General Information

A. Project Description

Sunflower Medical Offices are located at Northwest corner of Roe Boulevard and Johnson Drive in Roeland Park, Johnson county, Kansas. The property is approximately 2.7acre, located in the northeast corner of section 09, Township 12 south, Range 25 east. The proposed development includes the construction of a Medical Office Building with a combined total floor area of approximately 31 thousand square feet along with supporting parking and drive areas. According to the Flood Insurance Rate Map (FIRM) panel number 2009C0024G, revised August 3, 2009, the property lies within OTHER FLOOD AREAS, ZONE X, defined as areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths led than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood. No base flood elevations have been determined. See Exhibit A for a site location map. See Exhibit B for FEMA FIRM Map.

B. Soil Classification

Soil classifications published by the United States Department of Agriculture/Natural Resources Conservation Service (USDA/NRCS) website for Johnson County, KS on September 12, 2018 indicate the existing site is made up of the following soil type:

Table 1: Storm Analysis Table

Map Unit Symbol	Map Unit Name	HSG
7545	Sharpsburg-Urban land complex, 4 to 8 percent slopes	c

See Exhibit C for a detailed soil report.

Methodology

This study was prepared in accordance with the provisions of "Section 5600 – Storm Drainage Systems and Facilities" (February 16, 2011) of the Kansas City Metropolitan Chapter of the American Public Works Association (APWA) and the "Manual of Best Management Practices for Stormwater Quality" (October 2012) of the Mid-America Regional Council (MARC). Pre and post development runoff were determined using the curve number method described in SCS (now NRCS) Technical Release No. 55 "Urban Hydrology for Small Watersheds" (2nd Edition, June 1986) as provided for in Sub-section 5602.2. The analyses were performed using the Type II 24-hour storm distribution for 1% (100 year), 10% (10 year) and 100% (1 year) annual probability storm events. The rainfall depths used in the analyses corresponding to those events are shown in the following table 2.

Portions of this study also utilizes information and methodology from the "Preliminary Stormwater Study for Commerce Bank & Embree Hospital" prepared by Olsson Associates and approved in July of 2016. This study analyzes the site directly west of this proposed development and contains relevant analysis due to the adjacency of the two developments.

Table 2: Storm Analysis Table

Storm	Percent	Rainfall Depth (in)
1 Year	100%	3.0
10 Year	10%	5.4
100 Year	1%	7.9

Existing Conditions Analysis

The existing 2.7acre site consists of urban undeveloped area that was previously a portion of the Johnson Drive and Roe Avenue interchange. The north boundary consists of single-family houses. To the East, West and South, the property is surrounded by paved roads as follow: Granada Lane, Roe Avenue and Johnson Drive. At the time of analysis, the site contained public interchange ramps. Due to the earthwork and construction that had taken place on-site, the Hydrologic soil group was assumed to be D for existing conditions.

The existing site is composed by one sub-basin which drain to discharge point located at the south perimeter of the property. Exhibit D shows the location of the sub basin and discharge point on the property. The site generally drains to the

southwest to an area inlet with a 36” discharge. This pipe flows to the south off site and is marked as Discharge Point A.

Curve numbers (CN) used in the TR55 existing conditions analysis were taken from Subsection 2602.2 of the APWA. A CN 84 of was utilized for the undeveloped areas as the site was previously a compacted urban interchange. A CN of 98 was used for the impervious area. Time of concentration calculations were performed using TR55 methodology. Table 3 gives a summary of the results of the existing conditions analysis for all sub-basins. Detailed calculations can be found within Exhibit E.

Table 3: Existing Conditions – Sub-basins

Sub-Basin	Area (Ac.)	CN	Time of Concentration (min)	Downstream Discharge	Q 1-year (cfs)	Q 10-year (cfs)	Q 100-year (cfs)
A1	2.7	88	13.96	Point A	5.33	11.53	20.62

Table 4 gives a summary of the Discharge Points for the 100%, 10%, and 1% annual probability storm events.

Table 4: Existing Conditions – Discharge Points

Name	Q 1-year (cfs)	Q 10-year (cfs)	Q 100-year (cfs)
Point A	5.33	11.53	20.62

Proposed Conditions Analysis

The proposed development will consist of a 2-story medical office building and associated parking features. The developed site will split the site into 3-sub basins with a final discharge point, Point A, remaining unchanged from existing conditions. Sub basin A1 Undet. will drain straight to the discharge point while A1 Det. And A-48in will be captured by a Rain garden and an Underground Detention basin respectively before draining to the discharge point.

CNs used in the TR55 proposed conditions analysis were taken from Subsection 2602.2 of the APWA. A CN of 74 was utilized for the undisturbed and landscaped areas of the site. A CN of 98 was used for the impervious areas, buildings, and remaining farm pond. Time of concentration calculations were performed using TR55 methodology. Table 5 gives a summary of the proposed sub-basins, detailed calculations can be found in Exhibit G.

Table 5: Proposed Conditions – Sub-basins

Sub-Basin	Area (Ac.)	CN	Time of Concentration (min)	Downstream Discharge	Q 1-year (cfs)	Q 10-year (cfs)	Q 100-year (cfs)
A1 Undet.	1.10	85.8	6.08	Point A	2.79	6.33	10.04
A1 Det.	0.62	91.0	5.00	Rain-Garden	2.01	4.07	6.19
A-48in	0.93	92.58	5.00	48in-Pipe	2.21	6.23	9.37

Detention

A Rain Garden (Pond 1) and a 350ft long 48in pipe (Pond 2) will be used as detention basin for the proposed development. Pond 1 consists of an open area to the east of the property. Pond 1 will be utilized as a combination raingarden and detention system. Water quality storm events will be retained in the bottom of this pond to allow for infiltration. Larger storms will be detained and slowly released through a control structure. Table 7 shows the Pond 1 routing results for each design storm. Pond 1 will be constructed with a base at 921 and top at 926. Pond 1 has the following outfall structure:

12” Riser
4” Orifice – 922
4” Orifice – 922
6” Riser Opening– 924.5
100’ 6” Weir – 925.5

Pond 2 consists of 350 linear feet of 48” HDPE piping that will be installed at the southeast of the site. Pond 2 will have a invert elevation of 916 with a top elevation of 923. Pond 2 will discharge to a new manhole with restrictor plates installed to control

the peak flow out. Table 6 shows Pond 2 routing results for each design storm. The outfall structure will have the following properties

48" Dia. Manhole
15" Orifice – 919.7
8" Orifice – 916
Overflow – 922.5

Table 6: Pond 2 – Routing Summary

Storm Event	Q_{in} (cfs)	Ponding Elevation	Max Depth Attained (ft)	Q_{out} (cfs)	Q Overflow (cfs)
1% Storm	9.37	921.41	5.41	9.35	0.00
10% Storm	6.22	920.40	4.40	4.70	0.00
100 % Storm	3.16	918.23	2.23	1.59	0.00

Table 7: Pond 1 – Routing Summary

Storm Event	Q_{in} (cfs)	Ponding Elevation	Max Depth Attained (ft)	Q_{out} (cfs)	Q Overflow (cfs)
1% Storm	6.19	925.42	4.42	2.31	0.00
10% Storm	4.07	924.60	3.60	1.36	0.00
100 % Storm	2.00	923.38	2.38	0.94	0.00

Flow from the two ponds and undetained area discharges to the existing stormwater system and is routed to Point A at the south of the site. The table below summarized the peak flow for the 1%, 10% and 100% annual probability storm events at the Discharge point A for the proposed conditions.

Table 8: Existing Conditions – Discharge Points

Name	Q 100%	Q 10%	Q 1%
Point A	4.89	10.96	20.71

BMP Analysis

Improvements to the property will increase impervious surface area compared to existing conditions, thus proposed improvements qualify the project to meet water quality requirements with stormwater treatment facilities (STFs). STFs on the site are proposed to mitigate post-construction runoff pollutant levels. The MARC BMP Manual was utilized to measure the Level of Service (LS) and Value Rating (VR) required for an undeveloped site. The required LS for this site is 5.0. Water quality treatment calculations are available in the Exhibit H.

The STF systems detailed below satisfy water quality treatment requirements for the project as determined by MARC BMP Manual calculations. Site construction documents will fully detail the construction and landscape specifications for all BMPs. The property owner shall be responsible for long term maintenance and upkeep of storm water treatment facilities. As required by Section 15-515 of Ordinance No. 809 of Roeland Park, the owner must complete an annual certification inspection of the stormwater management systems and is subject to City inspection at least once every three years.

A combination of STFs is proposed for the development and will include the following STFs with corresponding VRs:

- Native Vegetation (9.25)
- Rain Garden (9.0)
- Inlet Inserts (4.0).

Calculations, STF drainage maps and other information are available in the Exhibit H.

The proposed rain garden will be constructed with an invert elevation at 921 with a max water quality elevation of 922. The raingarden will have a total treatment volume of 4692.84 Cu.Ft. and is sized to handle a water quality design storm of 4379.84 Cu.Ft. The water quality storm will be infiltrated into an approximately 12” deep amended soil bed within the raingarden itself.

Summary

The outfall summary table below compares the peak flows for the existing and proposed conditions at the discharge points on the site.

Table 9: Outfall Summary

Outfall Desc.	Q 1-year (cfs)	Q 10-year (cfs)	Q 100-year (cfs)
Point A Existing	5.33	11.53	20.62
Point A Proposed	4.89	11.11	20.71
Point A Comparison	- 0.44	-0.42	+ 0.09
% Change	-8.26%	-3.64%	0.44%

All analysis points will see a decrease in total peak flow for the 1 and 10 year design storms at Point A. The 100 year event will see a small increase of flow of approximately 0.40% which is statistically insignificant and meets the intent of matching the precondition peak flow.

The stormwater management proposed for this development meets the MARC BMP level of service calculations while also not increasing the peak flow during the 1, 10, and 100year storm events. Therefore, we recommend approval of this stormwater study.

Regards,

Dustin Burton, P.E.
Renaissance Infrastructure Consulting

EXHIBIT A

SITE LOCATION MAP

Site Location Map

Scale: 1":1000'

NORTH

19-0143

Renaissance Infrastructure Consulting
132 Abbie Avenue
Kansas City, Kansas 66103
913.317.9500
www.ric-consult.com

EXHIBIT B

FEMA FIRM REPORT

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures.** Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures in this jurisdiction.

The **projection** used in the preparation of this map was Kansas State Plane North Zone (FIPS zone 1501). The **horizontal datum** was NAD 83, GRS 80 spheroid. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum.** For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

Spatial Reference System Division
National Geodetic Survey, NOAA
Silver Spring Metro Center
1315 East-West Highway
Silver Spring, Maryland 20910
(301) 713-3191

To obtain current elevation, description, and/or location information about the **bench marks** shown on this map, please contact the Automated Information Mapping System (AIMS) at **(913) 715 -1600**, or visit their website at http://aims.jocogov.org/.

Base map information shown on this FIRM was provided for Johnson County by Analytical Surveys, Inc. The vector data was derived from Aerial Photography, dated 1998-2000 and captured at a resolution of .5 feet.

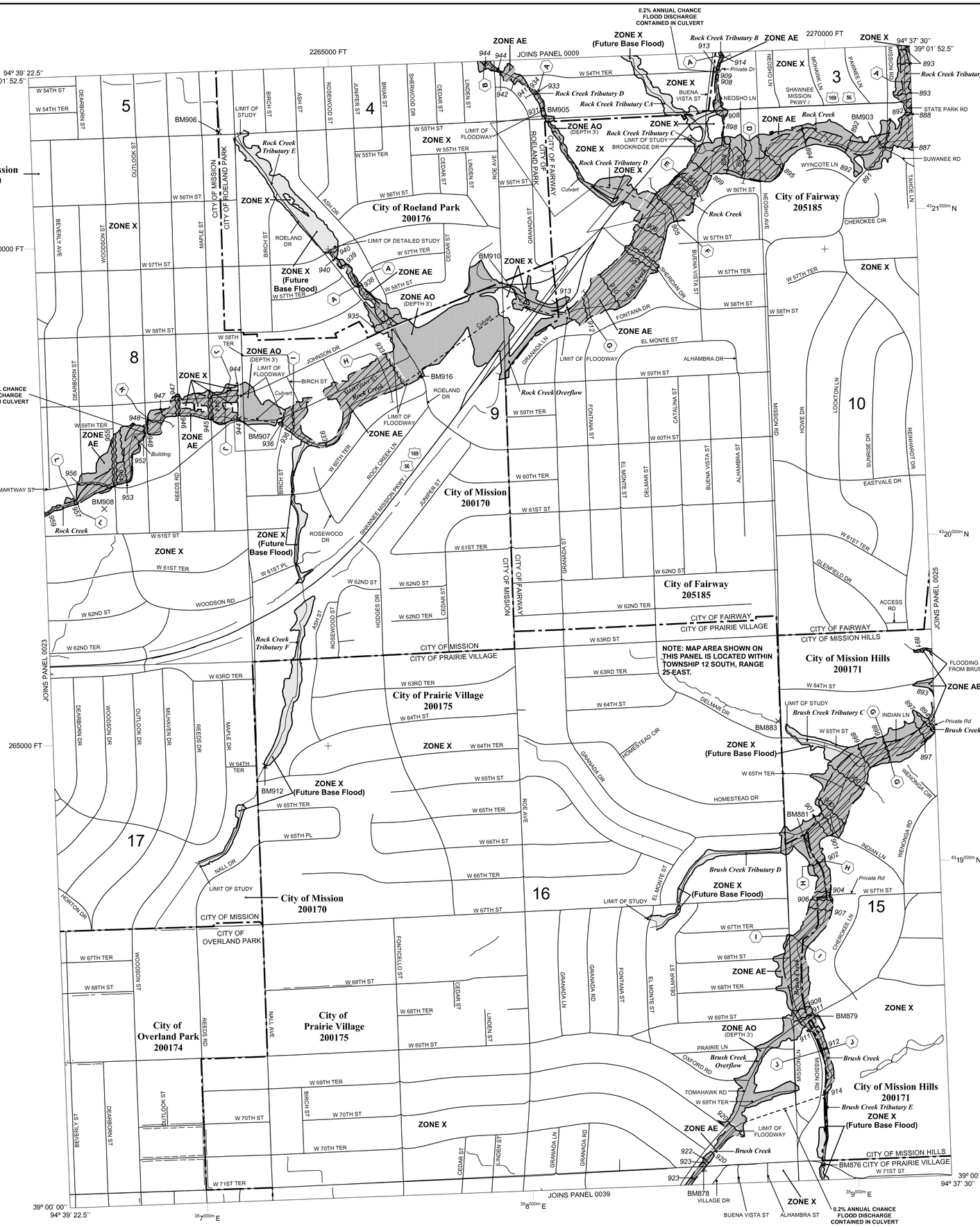
This map reflects more detailed up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and their website at http:// www.msc.fema.gov .

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1- 877- FEMA MAP** (1-877-336-2627) or visit the FEMA website at http:// www.fema.gov.



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
ZONE X (Future Base Flood)	Areas of 1% annual chance flood based on future conditions hydrology. No Base Flood Elevations determined.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- Floodplain Boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
- 513 (EL 987) — Base Flood Elevation line and value; elevation in feet* / Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

- A–A — Cross section line
- 23 – – – 23 — Transect line
- 45° 02' 08", 93° 02' 12" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) Western Hemisphere
- 4989000FT — 5000-foot grid ticks: Kansas State Plane coordinate system, north zone (FIPS Zone 1501), Transverse Mercator
- 4389000mN — 1000-meter Universal Transverse Mercator grid values, zone 15
- DX5510 × — Bench mark (see explanation in Notes to Users section of this FIRM panel)
- •M1.5 — River Mile

MAP REPOSITORY
REFER TO LISTING OF MAP REPOSITORIES ON MAP INDEX

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP

SEPTEMBER 27, 1991

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
OCTOBER 18, 1995
JULY 17, 1997
JUNE 17, 2002

August 3, 2009 - to change the Base Flood Elevations, Special Flood Hazard Areas, floodway and zone designations; to add Base Flood Elevations, Special Flood Hazard Areas, floodway, roads and road names; to reflect updated topographic information; to incorporate previously issued Letters of Map Revision and to update corporate limits.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET
150 0 150 300 METERS

NFIP NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0024G

FIRM

FLOOD INSURANCE RATE MAP

JOHNSON COUNTY, KANSAS
AND INCORPORATED AREAS

PANEL 24 OF 161

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
FAIRWAY, CITY OF	205185	0024	G
MISSION HILLS, CITY OF	200171	0024	G
MISSION, CITY OF	200170	0024	G
OVERLAND PARK, CITY OF	200174	0024	G
PRAIRIE VILLAGE, CITY OF	200175	0024	G
ROELAND PARK, CITY OF	200176	0024	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
20091C0024G

MAP REVISED
AUGUST 3, 2009

Federal Emergency Management Agency

EXHIBIT C

NRCS WEB SOIL SURVEY

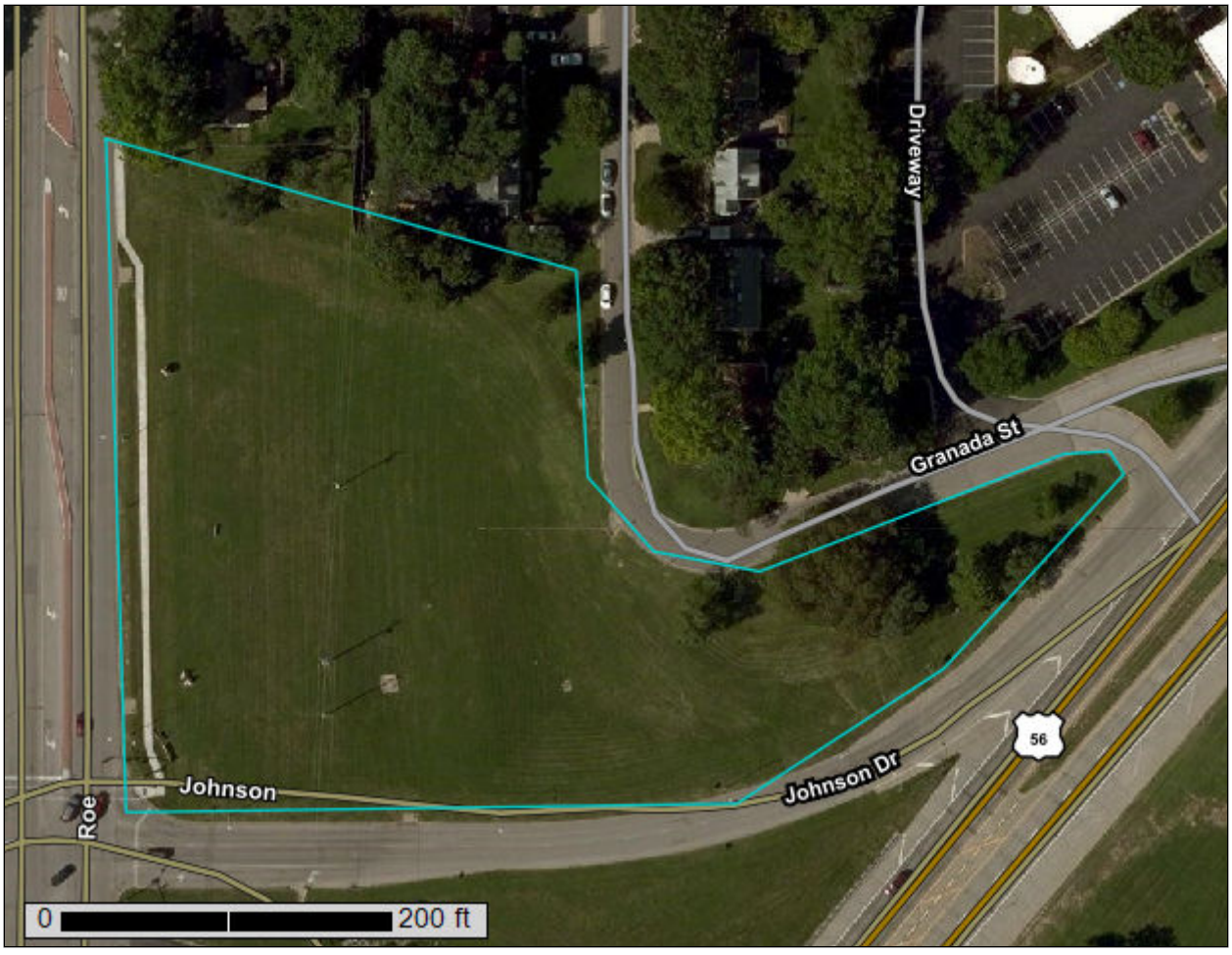
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Johnson County, Kansas



July 26, 2019

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:1,050 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 15 30 60 90

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Johnson County, Kansas
Survey Area Data: Version 17, Sep 12, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 23, 2014—Sep 7, 2014

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
7545	Sharpsburg-Urban land complex, 4 to 8 percent slopes	3.2	100.0%
Totals for Area of Interest		**3.2**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however,

onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Johnson County, Kansas

7545—Sharpsburg-Urban land complex, 4 to 8 percent slopes

Map Unit Setting

National map unit symbol: tq4z
Elevation: 1,000 to 1,300 feet
Mean annual precipitation: 31 to 47 inches
Mean annual air temperature: 45 to 64 degrees F
Frost-free period: 185 to 255 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Sharpsburg and similar soils: 55 percent
Urban land: 45 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sharpsburg

Setting

Landform: Hillslopes
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Silty and clayey loess

Typical profile

A - 0 to 9 inches: silt loam
AB - 9 to 13 inches: silty clay loam
Bt - 13 to 35 inches: silty clay loam
BC - 35 to 60 inches: silty clay loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 36 to 40 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 11.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: Loamy Upland (PE 30-37) (R106XY015KS)
Hydric soil rating: No

Description of Urban Land

Setting

Landform: Hillslopes
Down-slope shape: Convex
Across-slope shape: Convex

Soil Information for All Uses

Soil Reports

The Soil Reports section includes various formatted tabular and narrative reports (tables) containing data for each selected soil map unit and each component of each unit. No aggregation of data has occurred as is done in reports in the Soil Properties and Qualities and Suitabilities and Limitations sections.

The reports contain soil interpretive information as well as basic soil properties and qualities. A description of each report (table) is included.

Soil Physical Properties

This folder contains a collection of tabular reports that present soil physical properties. The reports (tables) include all selected map units and components for each map unit. Soil physical properties are measured or inferred from direct observations in the field or laboratory. Examples of soil physical properties include percent clay, organic matter, saturated hydraulic conductivity, available water capacity, and bulk density.

Engineering Properties

This table gives the engineering classifications and the range of engineering properties for the layers of each soil in the survey area.

Hydrologic soil group is a group of soils having similar runoff potential under similar storm and cover conditions. The criteria for determining Hydrologic soil group is found in the National Engineering Handbook, Chapter 7 issued May 2007(http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba). Listing HSGs by soil map unit component and not by soil series is a new concept for the engineers. Past engineering references contained lists of HSGs by soil series. Soil series are continually being defined and redefined, and the list of soil series names changes so frequently as to make the task of maintaining a single national list virtually impossible. Therefore, the criteria is now used to calculate the HSG using the component soil properties and no such national series lists will be maintained. All such references are obsolete and their use should be discontinued. Soil properties that influence runoff potential are those that influence the minimum rate of infiltration for a bare soil after prolonged wetting and when not frozen. These properties are depth to a seasonal high water table, saturated hydraulic conductivity after prolonged wetting, and depth to a layer with a very slow water transmission

rate. Changes in soil properties caused by land management or climate changes also cause the hydrologic soil group to change. The influence of ground cover is treated independently. There are four hydrologic soil groups, A, B, C, and D, and three dual groups, A/D, B/D, and C/D. In the dual groups, the first letter is for drained areas and the second letter is for undrained areas.

The four hydrologic soil groups are described in the following paragraphs:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Depth to the upper and lower boundaries of each layer is indicated.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, an appropriate modifier is added, for example, "gravelly."

Classification of the soils is determined according to the Unified soil classification system (ASTM, 2005) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 2004).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to particle-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of particle-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group

index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Percentage of rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

References:

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Absence of an entry indicates that the data were not estimated. The asterisk '*' denotes the representative texture; other possible textures follow the dash. The criteria for determining the hydrologic soil group for individual soil components is found in the National Engineering Handbook, Chapter 7 issued May 2007(http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba). Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Engineering Properties–Johnson County, Kansas														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*
7545—Sharpsburg-Urban land complex, 4 to 8 percent slopes														
Sharpsburg	55	C	0-9	Silt loam	CL	A-7, A-6	0- 0- 0	0- 0- 0	100-100-100	100-100-100	100-100-100	95-98-100	33-43-46	12-18-19
			9-13	Silty clay loam, silt loam	CH, CL	A-7-6, A-6	0- 0- 0	0- 0- 0	100-100-100	100-100-100	100-100-100	95-98-100	39-45-52	17-21-25
			13-35	Silty clay loam, silty clay	CH, CL	A-7-6	0- 0- 0	0- 0- 0	100-100-100	100-100-100	100-100-100	95-98-100	49-53-57	26-28-30
			35-60	Silty clay loam, silt loam	CL	A-6, A-7-6	0- 0- 0	0- 0- 0	100-100-100	100-100-100	100-100-100	95-98-100	36-41-45	17-20-23

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

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Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

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United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

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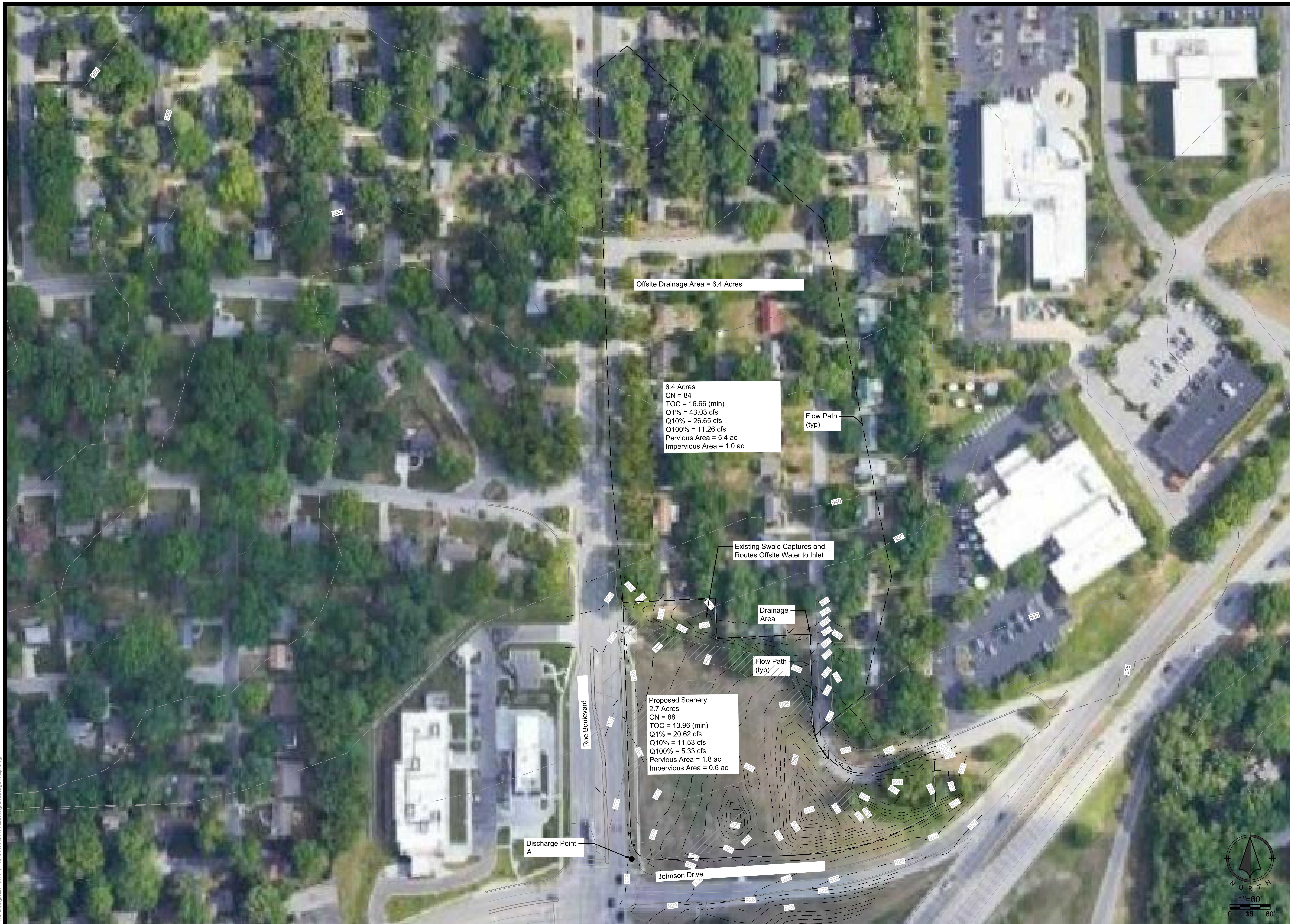
EXHIBIT D

EXISTING DRAINAGE MAP



Sheet
1 of 1

Sunflower Medical Office Building

19-0143
Sunflower Medical Office Building

Existing and Offsite Drainage Area

NO	BY	DATE	REVISION
XXX	XXX	XXXX/XX	ORIGINAL SUBMITTAL

Renaissance Infrastructure Consulting
1815 McGee Street, Suite 200
Kansas City, Missouri 64108
816.800.0950
www.ric-consult.com
KS Certificate of Authority: E-1814

Sep 03, 2019-2:55pm
Z:\RIC Design\2019\19-0143\Office\SWR\Existing Drainage Map.dwg

EXHIBIT E

EXISTING CONDITIONS ANALYSIS

Project Description

File Name	Storm Analysis Existing.SPF

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	SCS TR-55
Time of Concentration (TOC) Method	SCS TR-55
Link Routing Method	Kinematic Wave
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	NO

Analysis Options

Start Analysis On	Jul 25, 2019	00:00:00
End Analysis On	Jul 26, 2019	00:00:00
Start Reporting On	Jul 25, 2019	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	3
Subbasins	1
Nodes	1
Junctions	0
Outfalls	1
Flow Diversions	0
Inlets	0
Storage Nodes	0
Links	0
Channels	0
Pipes	0
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	100yr	Time Series	100 yr	Intensity	inches	Kansas	Johnson	100	7.90	SCS Type II 24-hr
2	10yr	Time Series	10 yr	Intensity	inches	Kansas	Johnson	10	5.40	SCS Type II 24-hr
3	1yr	Time Series	1 yr	Intensity	inches	Kansas	Johnson	1	3.00	SCS Type II 24-hr

Subbasin Summary

SN	Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	Existing	2.69	88.37	7.90	6.51	17.52	20.96	0 00:13:57

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft²)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Out-01	Outfall	0.00					0.00	0.00					

Subbasin Hydrology

Subbasin : Existing

Input Data

Area (ac) 2.69
Weighted Curve Number 88.37
Rain Gage ID 100yr

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Pasture, grassland, or range, Fair	1.85	D	84.00
Paved parking & roofs	0.84	D	98.00
Composite Area & Weighted CN	2.69		88.37

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.15	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.60	0.00	0.00
Velocity (ft/sec) :	0.18	0.00	0.00
Computed Flow Time (min) :	9.24	0.00	0.00

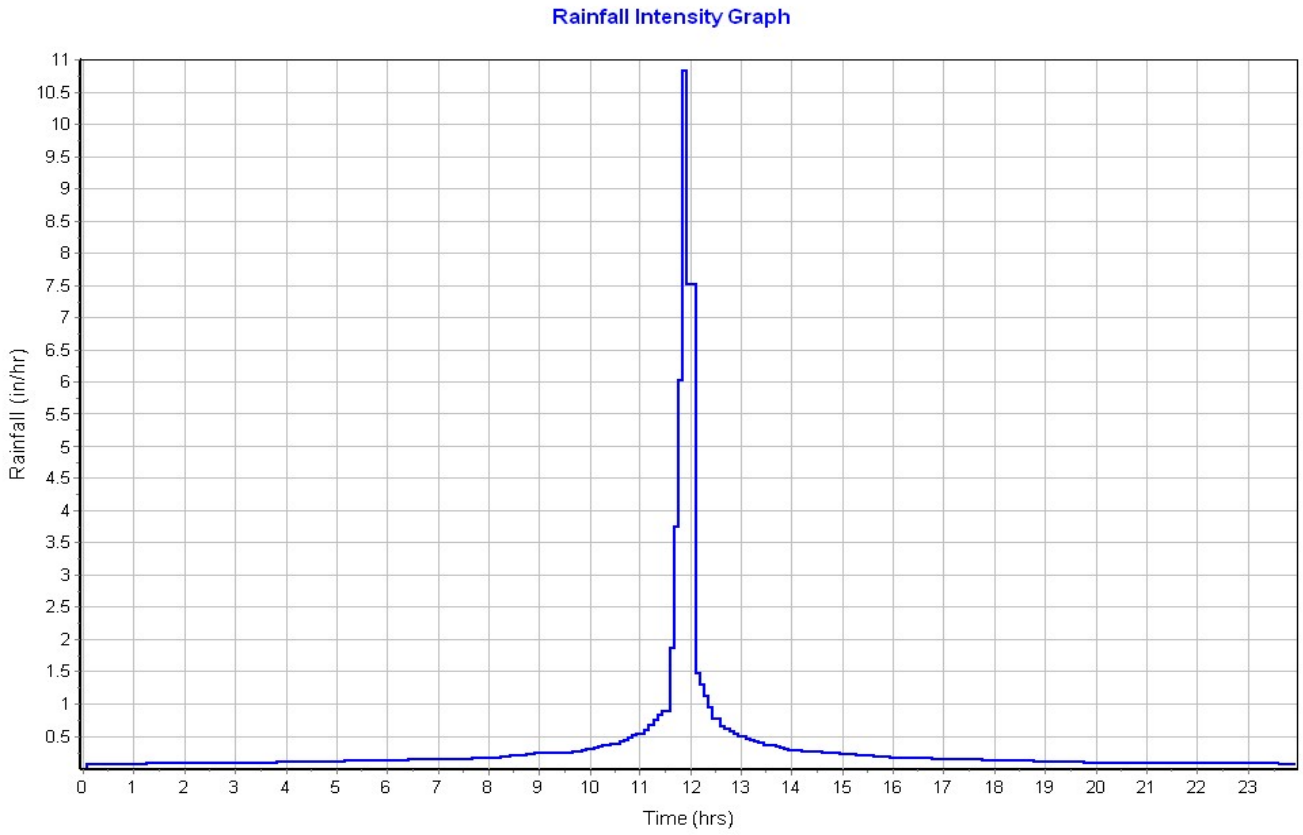
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	334	267	0.00
Slope (%) :	4.5	.5	0.00
Surface Type :	Unpaved	Paved	Unpaved
Velocity (ft/sec) :	3.42	1.44	0.00
Computed Flow Time (min) :	1.63	3.09	0.00

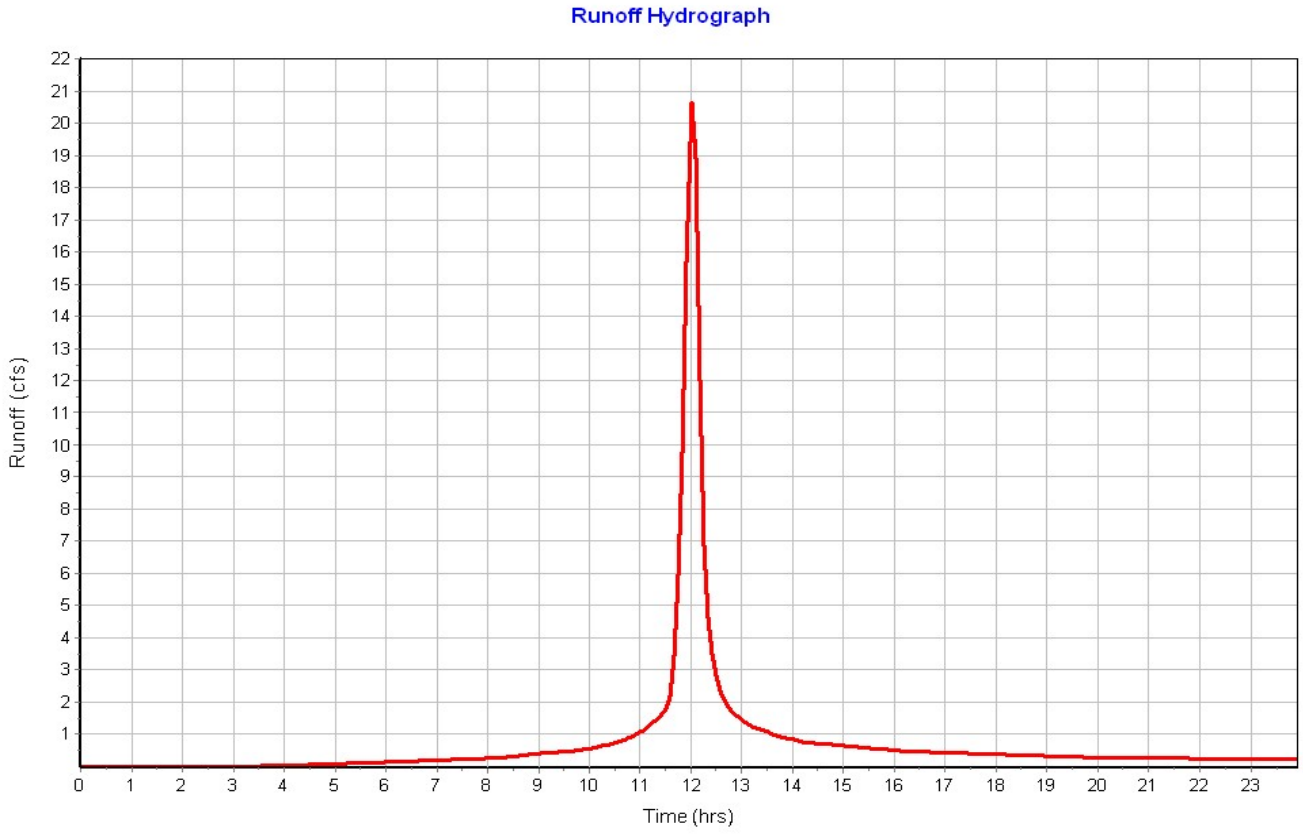
Total TOC (min) 13.96

Subbasin Runoff Results

Total Rainfall (in)	7.90
Total Runoff (in)	6.51
Peak Runoff (cfs)	20.96
Weighted Curve Number	88.37
Time of Concentration (days hh:mm:ss)	0 00:13:58

Subbasin : Existing





Project Description

File Name	Storm Analysis Existing.SPF

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	SCS TR-55
Time of Concentration (TOC) Method	SCS TR-55
Link Routing Method	Kinematic Wave
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	NO

Analysis Options

Start Analysis On	Jul 25, 2019	00:00:00
End Analysis On	Jul 26, 2019	00:00:00
Start Reporting On	Jul 25, 2019	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	3
Subbasins	1
Nodes	1
Junctions	0
Outfalls	1
Flow Diversions	0
Inlets	0
Storage Nodes	0
Links	0
Channels	0
Pipes	0
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	100yr	Time Series	100 yr	Intensity	inches	Kansas	Johnson	100	7.90	SCS Type II 24-hr
2	10yr	Time Series	10 yr	Intensity	inches	Kansas	Johnson	10	5.40	SCS Type II 24-hr
3	1yr	Time Series	1 yr	Intensity	inches	Kansas	Johnson	1	3.00	SCS Type II 24-hr

Subbasin Summary

SN	Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	Existing	2.69	88.37	5.40	4.09	11.00	13.48	0 00:13:57

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft²)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Out-01	Outfall	0.00					0.00	0.00					

Subbasin Hydrology

Subbasin : Existing

Input Data

Area (ac) 2.69
Weighted Curve Number 88.37
Rain Gage ID 10yr

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Pasture, grassland, or range, Fair	1.85	D	84.00
Paved parking & roofs	0.84	D	98.00
Composite Area & Weighted CN	2.69		88.37

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.15	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.60	0.00	0.00
Velocity (ft/sec) :	0.18	0.00	0.00
Computed Flow Time (min) :	9.24	0.00	0.00

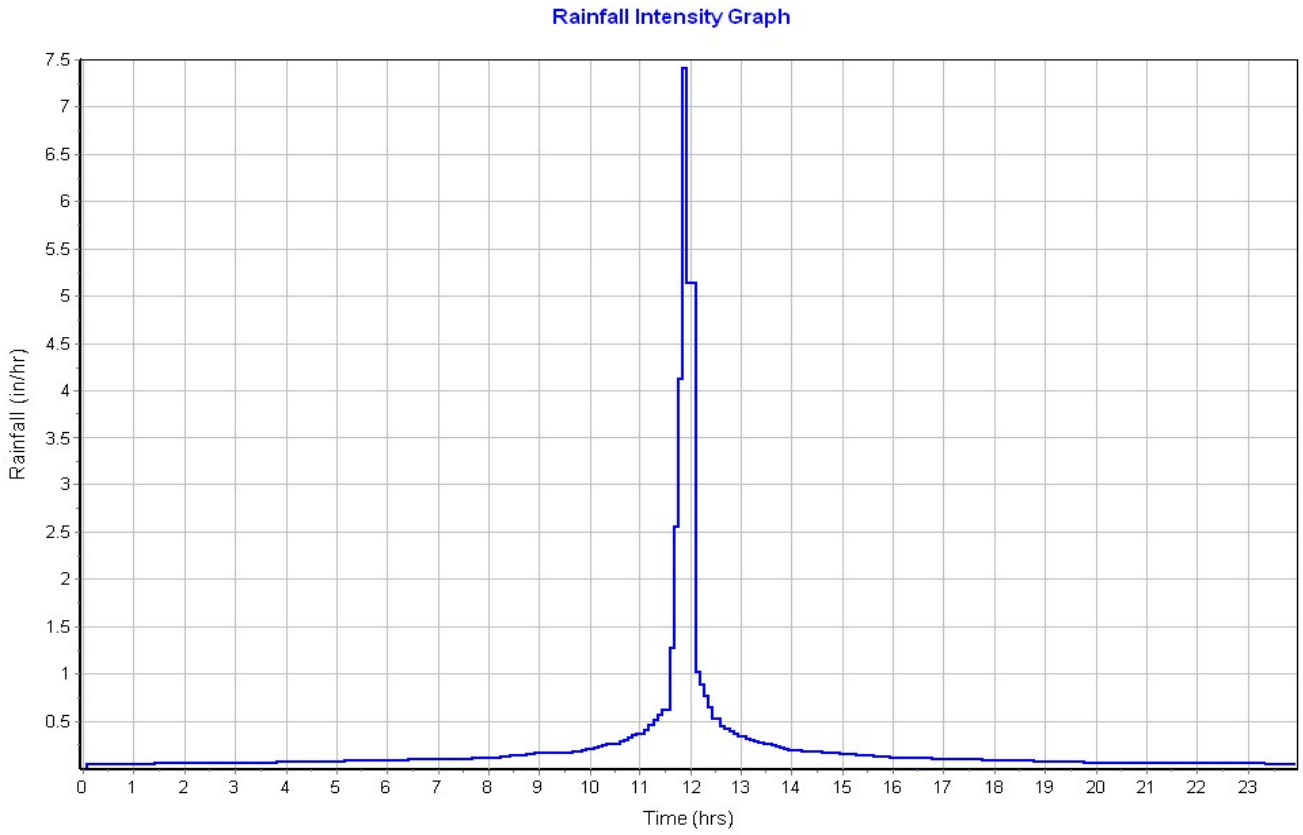
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	334	267	0.00
Slope (%) :	4.5	.5	0.00
Surface Type :	Unpaved	Paved	Unpaved
Velocity (ft/sec) :	3.42	1.44	0.00
Computed Flow Time (min) :	1.63	3.09	0.00

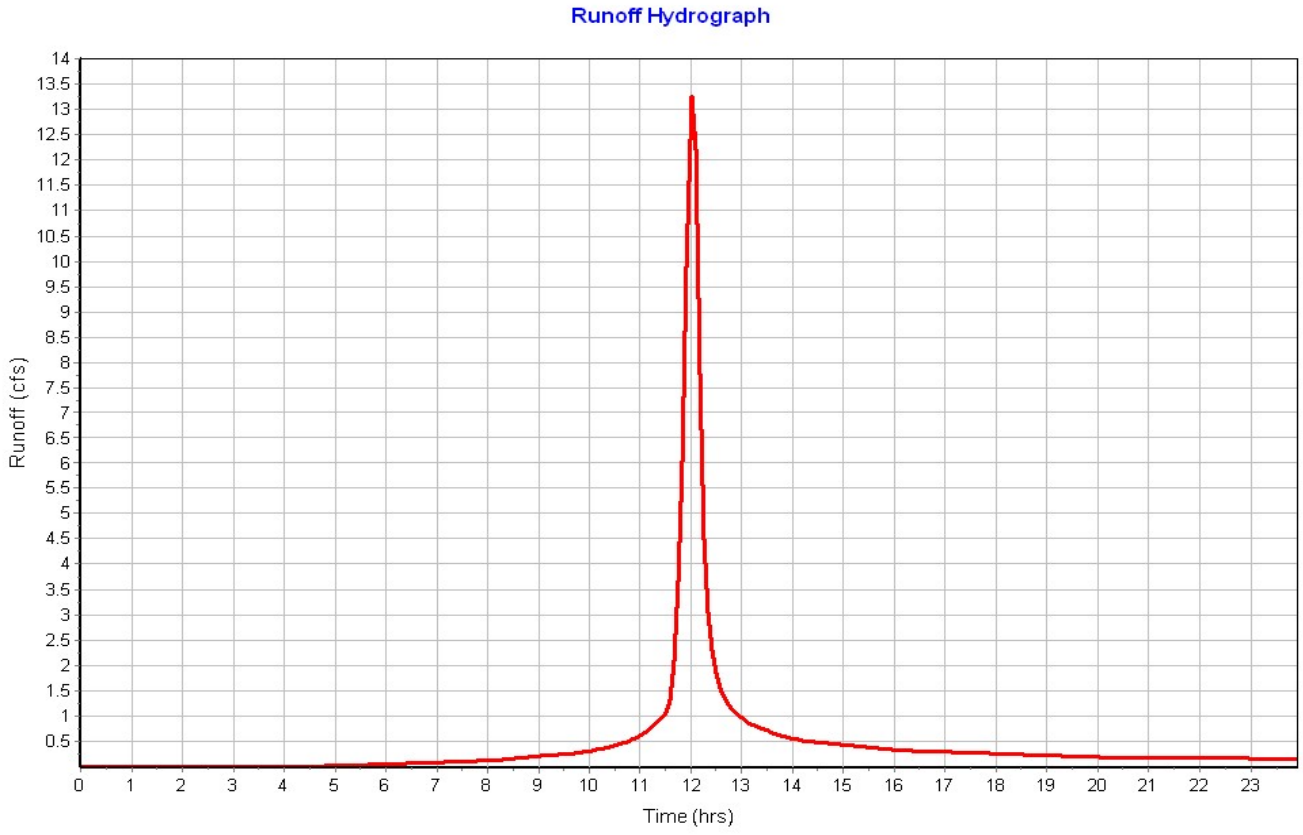
Total TOC (min) 13.96

Subbasin Runoff Results

Total Rainfall (in)	5.40
Total Runoff (in)	4.09
Peak Runoff (cfs)	13.48
Weighted Curve Number	88.37
Time of Concentration (days hh:mm:ss)	0 00:13:58

Subbasin : Existing





Subbasin Summary

SN	Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	Existing	2.69	88.37	5.40	4.09	11.00	13.48	0 00:13:57

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft²)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Out-01	Outfall	0.00					0.00	0.00					

Subbasin Hydrology

Subbasin : Existing

Input Data

Area (ac) 2.69
Weighted Curve Number 88.37
Rain Gage ID 10yr

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Pasture, grassland, or range, Fair	1.85	D	84.00
Paved parking & roofs	0.84	D	98.00
Composite Area & Weighted CN	2.69		88.37

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.15	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.60	0.00	0.00
Velocity (ft/sec) :	0.18	0.00	0.00
Computed Flow Time (min) :	9.24	0.00	0.00

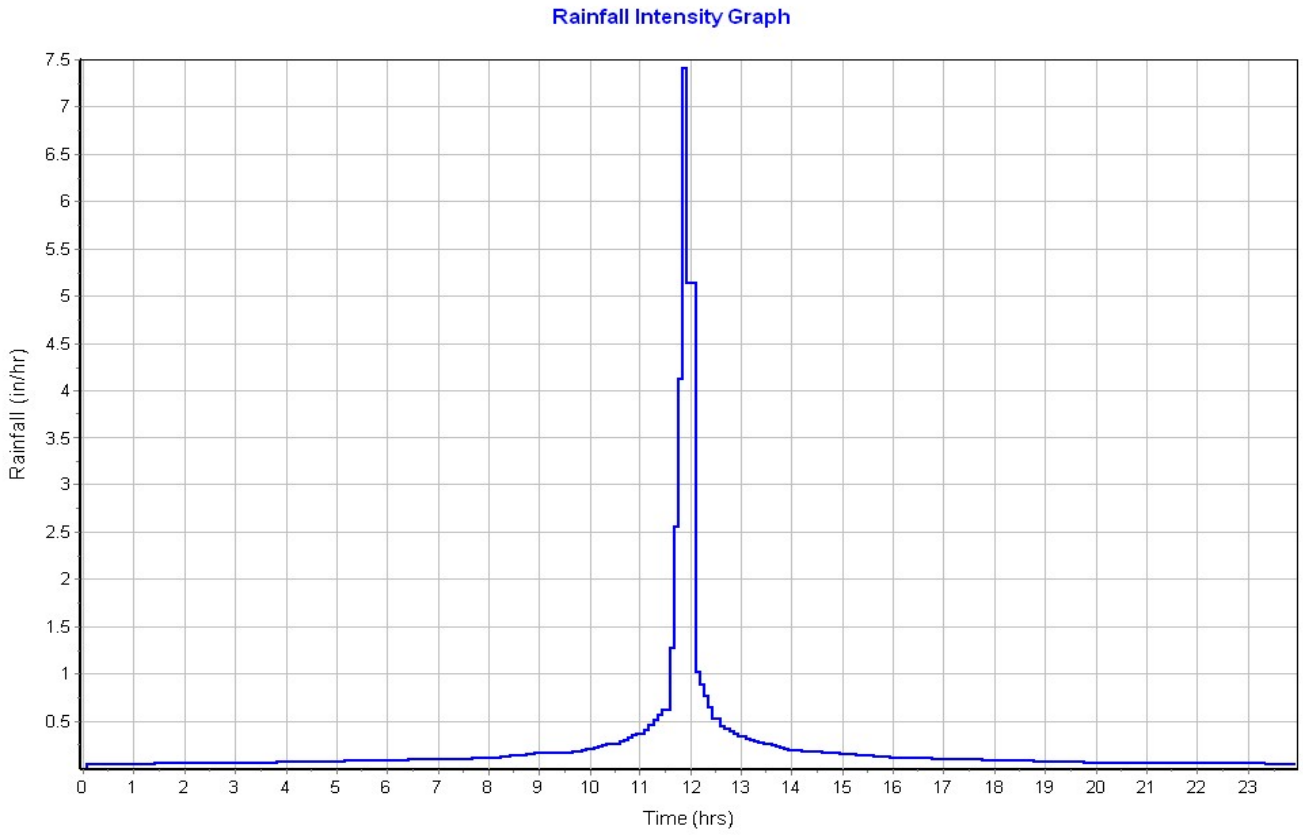
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	334	267	0.00
Slope (%) :	4.5	.5	0.00
Surface Type :	Unpaved	Paved	Unpaved
Velocity (ft/sec) :	3.42	1.44	0.00
Computed Flow Time (min) :	1.63	3.09	0.00

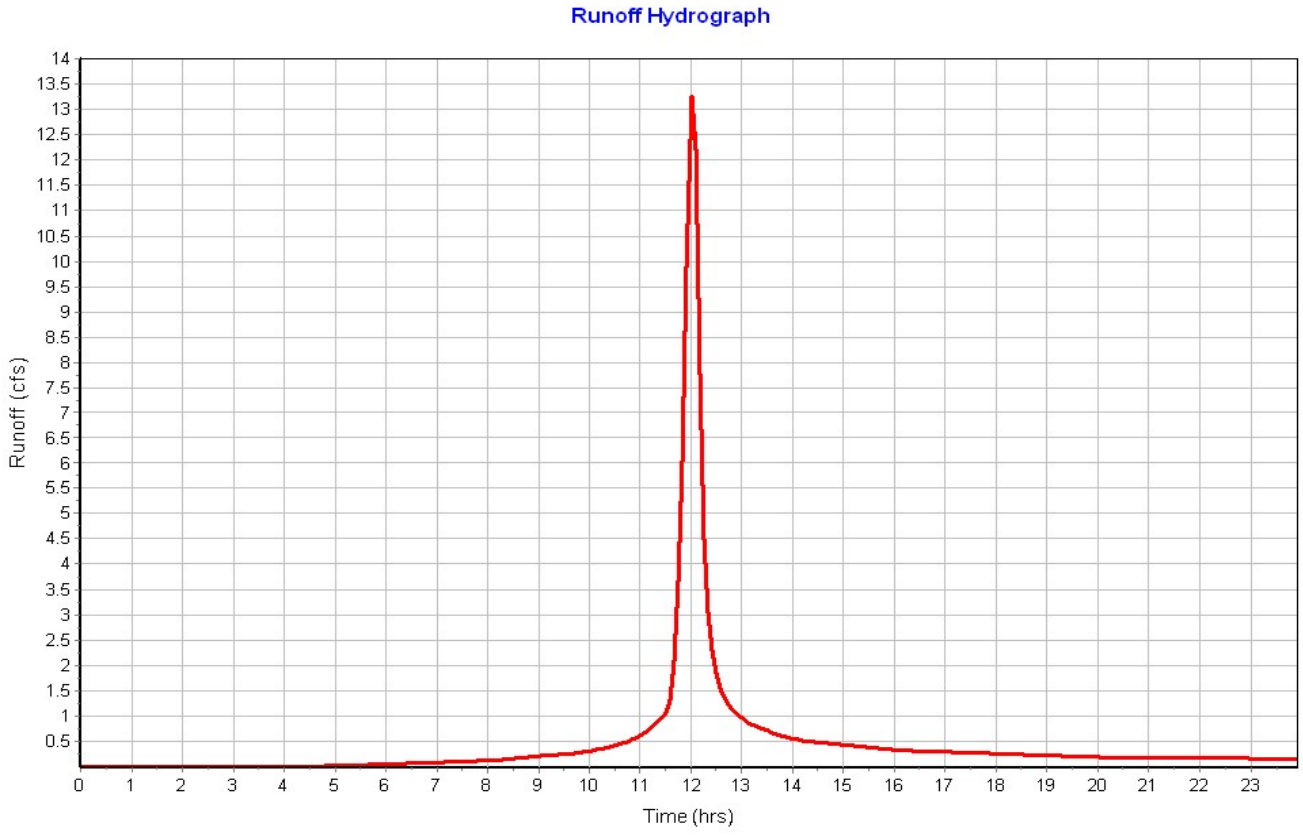
Total TOC (min) 13.96

Subbasin Runoff Results

Total Rainfall (in)	5.40
Total Runoff (in)	4.09
Peak Runoff (cfs)	13.48
Weighted Curve Number	88.37
Time of Concentration (days hh:mm:ss)	0 00:13:58

Subbasin : Existing





Project Description

File Name	Storm Analysis Existing.SPF

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	SCS TR-55
Time of Concentration (TOC) Method	SCS TR-55
Link Routing Method	Kinematic Wave
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	NO

Analysis Options

Start Analysis On	Jul 25, 2019	00:00:00
End Analysis On	Jul 26, 2019	00:00:00
Start Reporting On	Jul 25, 2019	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	3
Subbasins	1
Nodes	1
Junctions	0
Outfalls	1
Flow Diversions	0
Inlets	0
Storage Nodes	0
Links	0
Channels	0
Pipes	0
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	100yr	Time Series	100 yr	Intensity	inches	Kansas	Johnson	100	7.90	SCS Type II 24-hr
2	10yr	Time Series	10 yr	Intensity	inches	Kansas	Johnson	10	5.40	SCS Type II 24-hr
3	1yr	Time Series	1 yr	Intensity	inches	Kansas	Johnson	1	3.00	SCS Type II 24-hr

Subbasin Summary

SN	Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	Existing	2.69	88.37	7.90	6.51	17.52	20.96	0 00:13:57

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft²)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Out-01	Outfall	0.00					0.00	0.00					

Subbasin Hydrology

Subbasin : Existing

Input Data

Area (ac) 2.69
Weighted Curve Number 88.37
Rain Gage ID 1yr

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Pasture, grassland, or range, Fair	1.85	D	84.00
Paved parking & roofs	0.84	D	98.00
Composite Area & Weighted CN	2.69		88.37

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.15	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.60	0.00	0.00
Velocity (ft/sec) :	0.18	0.00	0.00
Computed Flow Time (min) :	9.24	0.00	0.00

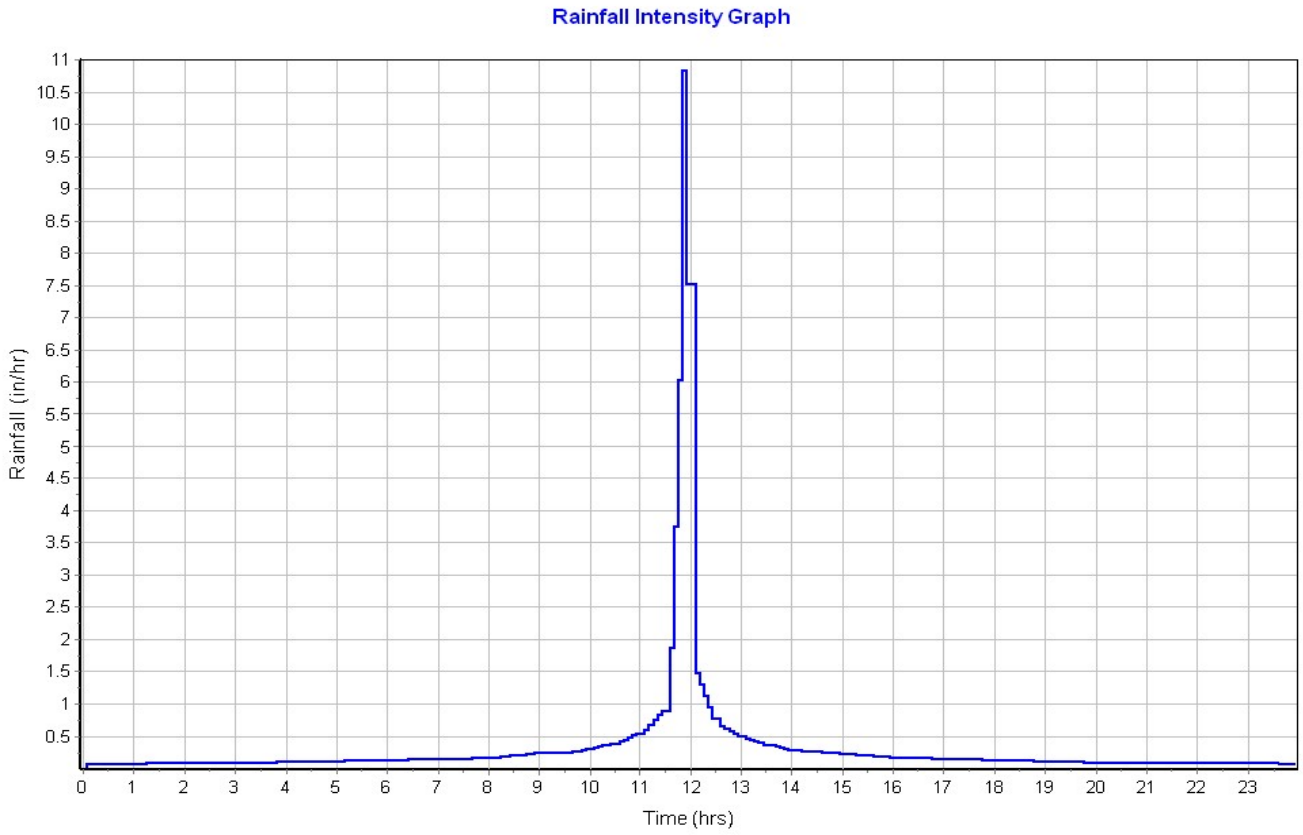
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	334	267	0.00
Slope (%) :	4.5	.5	0.00
Surface Type :	Unpaved	Paved	Unpaved
Velocity (ft/sec) :	3.42	1.44	0.00
Computed Flow Time (min) :	1.63	3.09	0.00

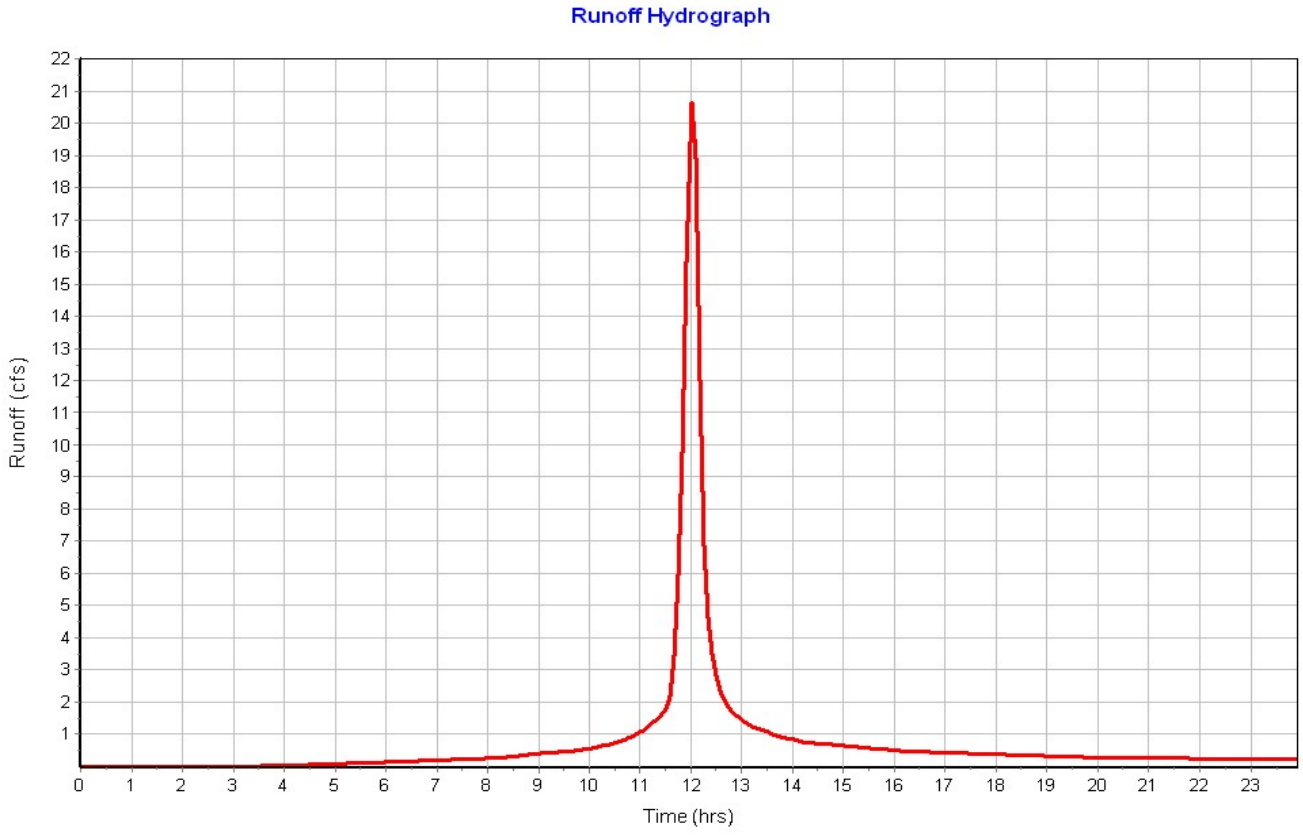
Total TOC (min) 13.96

Subbasin Runoff Results

Total Rainfall (in)	7.90
Total Runoff (in)	6.51
Peak Runoff (cfs)	20.96
Weighted Curve Number	88.37
Time of Concentration (days hh:mm:ss)	0 00:13:58

Subbasin : Existing





Subbasin Summary

SN	Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	Existing	2.69	88.37	7.90	6.51	17.52	20.96	0 00:13:57

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft²)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Out-01	Outfall	0.00					0.00	0.00					

Subbasin Hydrology

Subbasin : Existing

Input Data

Area (ac) 2.69
Weighted Curve Number 88.37
Rain Gage ID 1yr

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Pasture, grassland, or range, Fair	1.85	D	84.00
Paved parking & roofs	0.84	D	98.00
Composite Area & Weighted CN	2.69		88.37

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.15	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.60	0.00	0.00
Velocity (ft/sec) :	0.18	0.00	0.00
Computed Flow Time (min) :	9.24	0.00	0.00

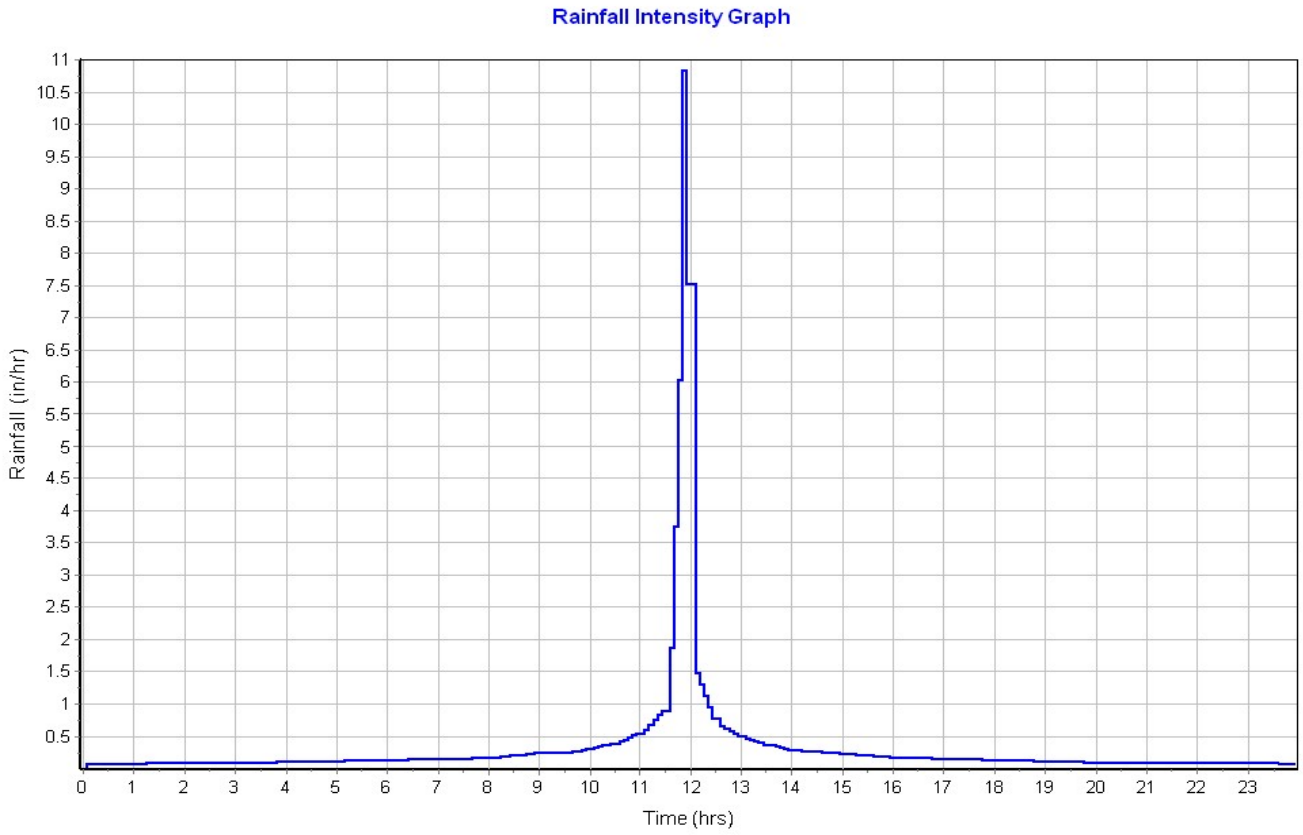
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	334	267	0.00
Slope (%) :	4.5	.5	0.00
Surface Type :	Unpaved	Paved	Unpaved
Velocity (ft/sec) :	3.42	1.44	0.00
Computed Flow Time (min) :	1.63	3.09	0.00

Total TOC (min) 13.96

Subbasin Runoff Results

Total Rainfall (in)	7.90
Total Runoff (in)	6.51
Peak Runoff (cfs)	20.96
Weighted Curve Number	88.37
Time of Concentration (days hh:mm:ss)	0 00:13:58

Subbasin : Existing



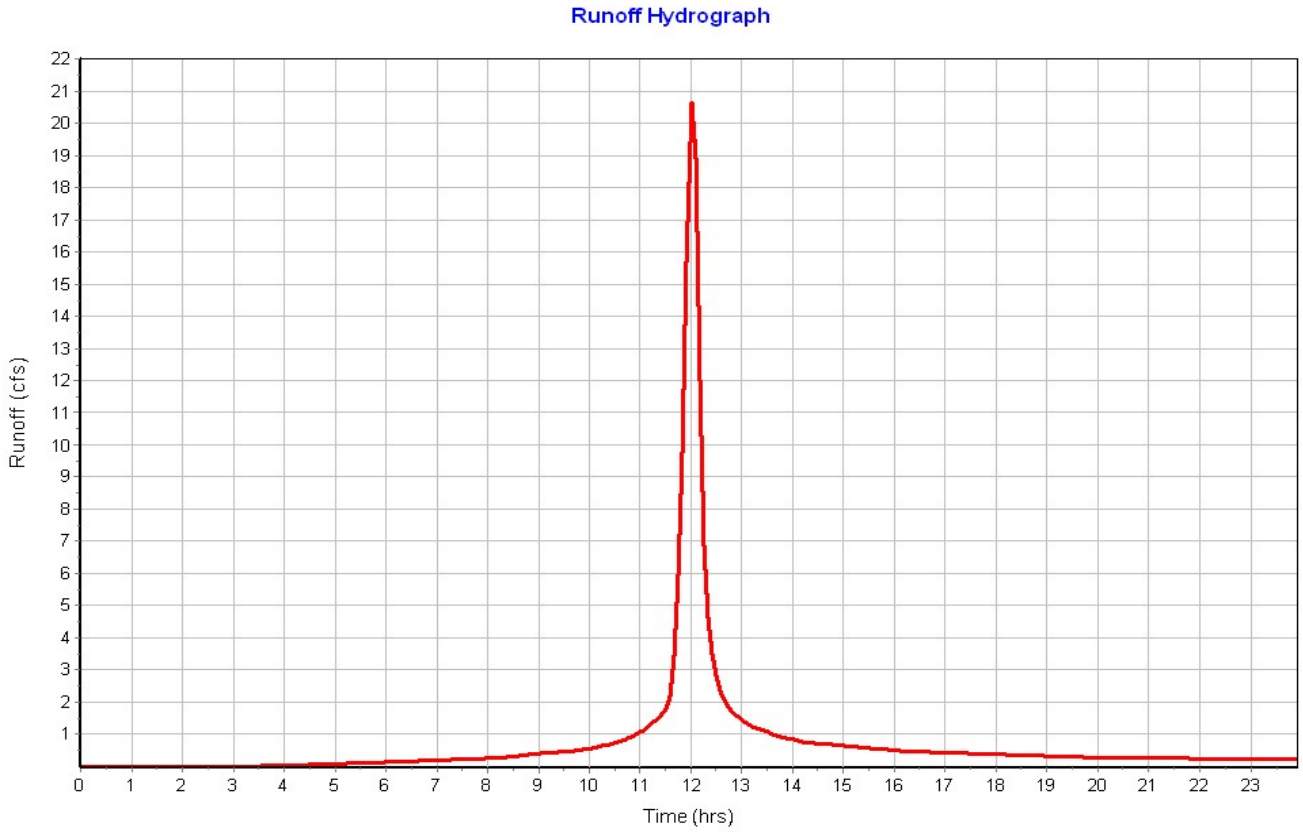


EXHIBIT F

PROPOSED DRAINAGE MAP

Offsite Drainage Area = 6.4 Acres

5.2 Acres
CN = 81
TOC = 23.63 (min)
Q1% = 28.77 cfs
Q10% = 17.14 cfs
Q100% = 6.66 cfs
Pervious Area = 5.2 ac

Flow Path (typ)

Drainage Area

Proposed swales to direct offsite water to new storm & Existing inlets

Property Line

Roe Boulevard

See Site Drainage Area

Johnson Drive

NORTH
1"=60'
0 30' 60'

Sheet
1 of 1

Sunflower Medical

19-0143
Sunflower Medical Office Building

Proposed and Offsite Drainage Area

NO.	BY	CD	DATE	REVISION
XXX	XXX	XXXXXX		ORIGINAL SUBMITTAL

Renaissance Infrastructure Consulting
1815 McGee Street, Suite. 200
Kansas City, Missouri 64108
816.800.0950
www.ric-consult.com

KS Certificate of Authority: E-1814

Sep 17, 2019 4:37pm
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Proposed swales to direct offsite water to new storm & Existing inlets

Offsite Drainage Area

5.2 Acres
CN = 81
TOC = 23.63 (min)
Q1% = 28.77 cfs
Q10% = 17.14 cfs
Q100% = 6.66 cfs
Pervious Area = 5.2 ac

Property Line

Drainage Area

A1 Undetained:
Area = 1.10 Acres
CN = 86
TOC = 6.08 min
Q1% = 10.04cfs
Q10% = 6.33cfs
Q100% = 2.79cfs

Granada Ln

926.00
6" Riser - 924.5
921
Emergency Overflow 925.5
12" Amendment soil
(2) 4" Orifice - 922.0

Pond 1 - Rain Garden Detention
N.T.S.

FIRE

GAS
TEL

Roe Boulevard

A1 Det.
Area = 0.62 Acres
CN = 93
TOC = 5.00 min
Q1% = 6.19cfs
Q10% = 4.07cfs
Q100% = 2.01cfs

A-48in:
Area = 0.93 Acres
CN = 93
TOC = 5.00 min
Q1% = 9.37cfs
Q10% = 6.23cfs
Q100% = 2.21cfs

Pond 1 - Detention/Raingarden
Top - 926
Top - 921
1.5'
923
924
925
Pond Bottom
31.5'

Ø4.0' Manhole Control Structure

Ø6.0' Junction Box

4.0'

2.0'

Pond 2 / 3 Rows 116.7ft 48" Pipe

Ø6.0' Junction Box

42.50'
175.50'
144.29'
101.30'
40.15'
83.83'

Johnson Drive

Discharge Point A

N O R T H
1"=20'
0 10' 20'

Sheet
1 of 1

Sunflower Medical
19-0143
Sunflower Medical Office Building

Proposed Site Drainage Exhibit

NO	BY	XXX	XXXXXX
		XXX	QD
			DATE
		ORIGINAL SUBMITTAL	
		REVISION	

Renaissance Infrastructure Consulting
815 McGee Street, Suite. 200
Kansas City, Missouri 64108
816.800.0950
www.ric-consult.com

KS Certificate of Authority: E-1814

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EXHIBIT G

PROPOSED CONDITIONS ANALYSIS

Project Description

File Name	Storm Analysis 091619.SPF

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	SCS TR-55
Time of Concentration (TOC) Method	SCS TR-55
Link Routing Method	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	YES

Analysis Options

Start Analysis On	Sep 16, 2019	00:00:00
End Analysis On	Sep 17, 2019	00:00:00
Start Reporting On	Sep 16, 2019	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	3
Subbasins	3
Nodes	6
Junctions	1
Outfalls	3
Flow Diversions	0
Inlets	0
Storage Nodes	2
Links	8
Channels	0
Pipes	1
Pumps	0
Orifices	5
Weirs	2
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1		Time Series	1yr	Cumulative	inches	Kansas	Johnson	1	3.00	SCS Type II 24-hr

Subbasin Summary

SN	Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	A1Det.	0.62	91.03	3.00	2.07	1.29	2.01	0 00:05:00
2	A1Undet.	1.10	85.78	3.00	1.65	1.81	2.79	0 00:06:04
3	A-48in	0.93	92.58	3.00	2.22	2.06	3.16	0 00:05:00

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft²)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Jun-01	Junction	916.00	924.00	916.00	924.00	0.00	2.52	917.47	0.00	6.53	0 00:00	0.00	0.00
2	Out48	Outfall	0.00					0.00	0.00					
3	OutA	Outfall	0.00					4.88	0.00					
4	OutRG	Outfall	0.00					0.00	0.00					
5	Pond1	Storage Node	921.00	926.00	921.00		0.00	2.00	923.38				0.00	0.00
6	Pond2	Storage Node	916.00	923.00	916.00		0.00	3.16	918.23				0.00	0.00

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Reported Condition
					(ft)	(ft)	(ft)	(%)	(ft)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)	
1	Link-01	Pipe	Jun-01	OutA	47.30	917.00	914.50	5.2900	1.500	0.0150	3.19	20.93	0.15	50.00	0.37	0.25	0.00	Calculated
2	48in-12	Orifice	Pond2	Jun-01		916.00	916.00		1.250		0.00							
3	48in-6in	Orifice	Pond2	Jun-01		916.00	916.00		0.670		1.59							
4	RG-4in	Orifice	Pond1	Jun-01		921.00	916.00		0.330		0.47							
5	RG4in(01)	Orifice	Pond1	Jun-01		921.00	916.00		0.330		0.47							
6	RG-8in	Orifice	Pond1	Jun-01		921.00	916.00		0.500		0.00							
7	Weir-01	Weir	Pond1	OutRG		921.00	0.00				0.00							
8	Weir-02	Weir	Pond2	Out48		916.00	0.00				0.00							

Subbasin Hydrology

Subbasin : A1Det.

Input Data

Area (ac) 0.62
Weighted Curve Number 91.03
Rain Gage ID ..... *

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.44	-	98.00
-	0.18	-	74.00
Composite Area & Weighted CN	0.62		91.03

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

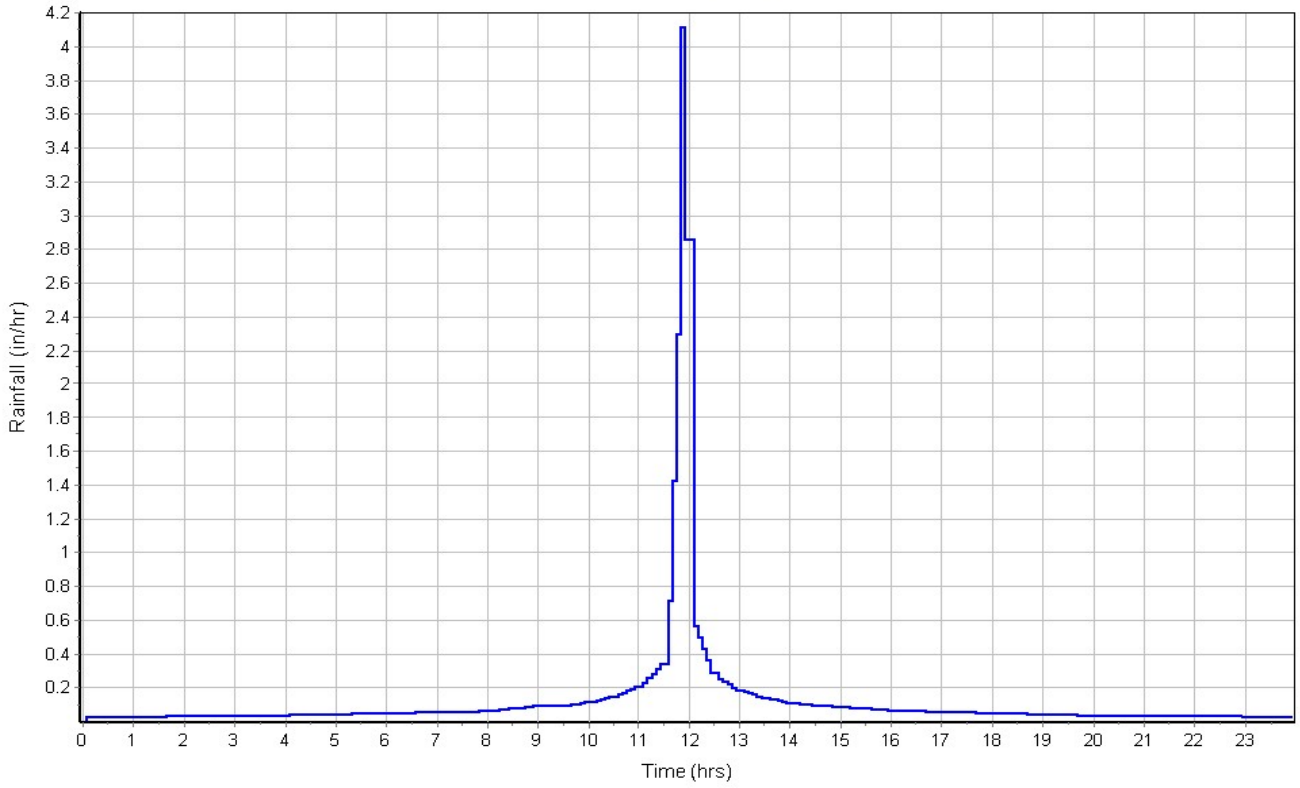
User-Defined TOC override (minutes): 5.00

Subbasin Runoff Results

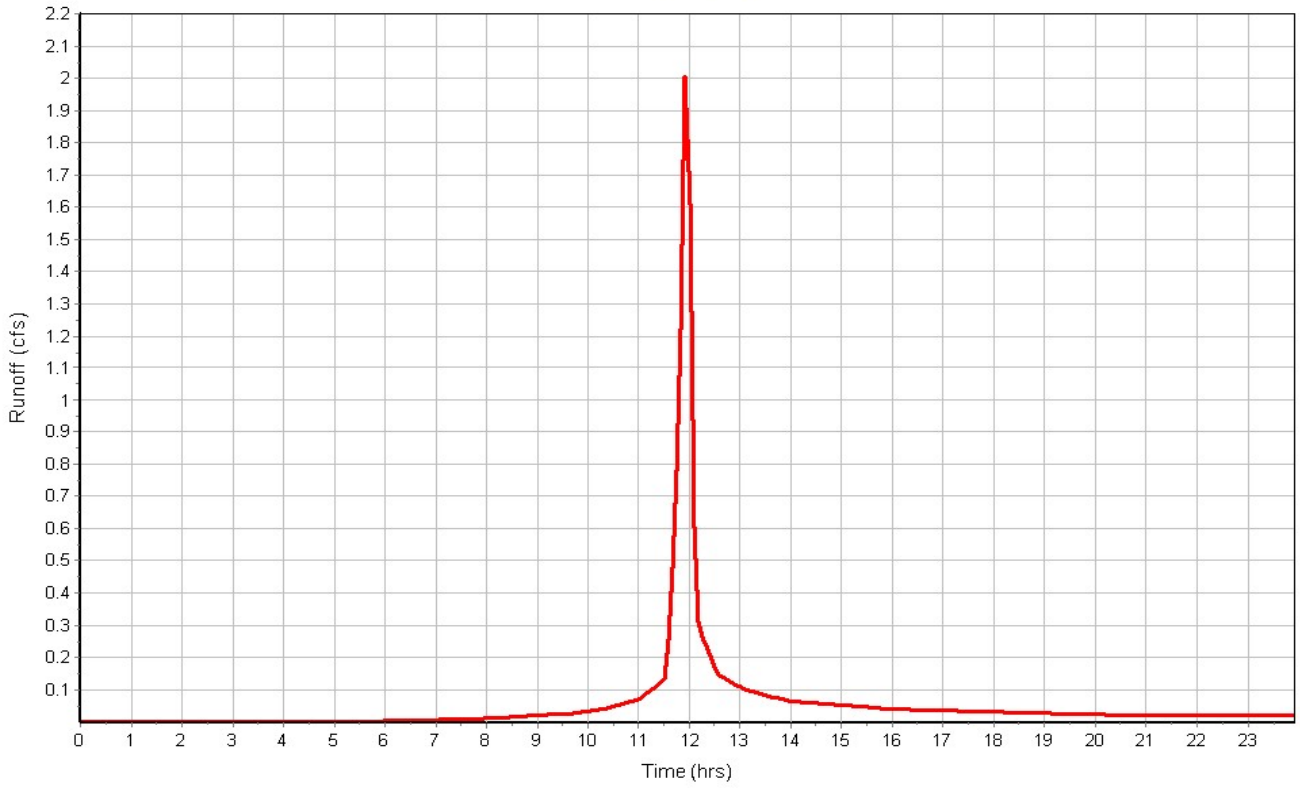
Total Rainfall (in) 3.00
Total Runoff (in) 2.07
Peak Runoff (cfs) 2.01
Weighted Curve Number 91.03
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : A1Det.

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : A1Undet.

Input Data

Area (ac) 1.10
Weighted Curve Number 85.78
Rain Gage ID 1yr

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.54	-	98.00
-	0.56	-	74.00
Composite Area & Weighted CN	1.10		85.78

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.013	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.6	0.00	0.00
Velocity (ft/sec) :	1.28	0.00	0.00
Computed Flow Time (min) :	1.31	0.00	0.00

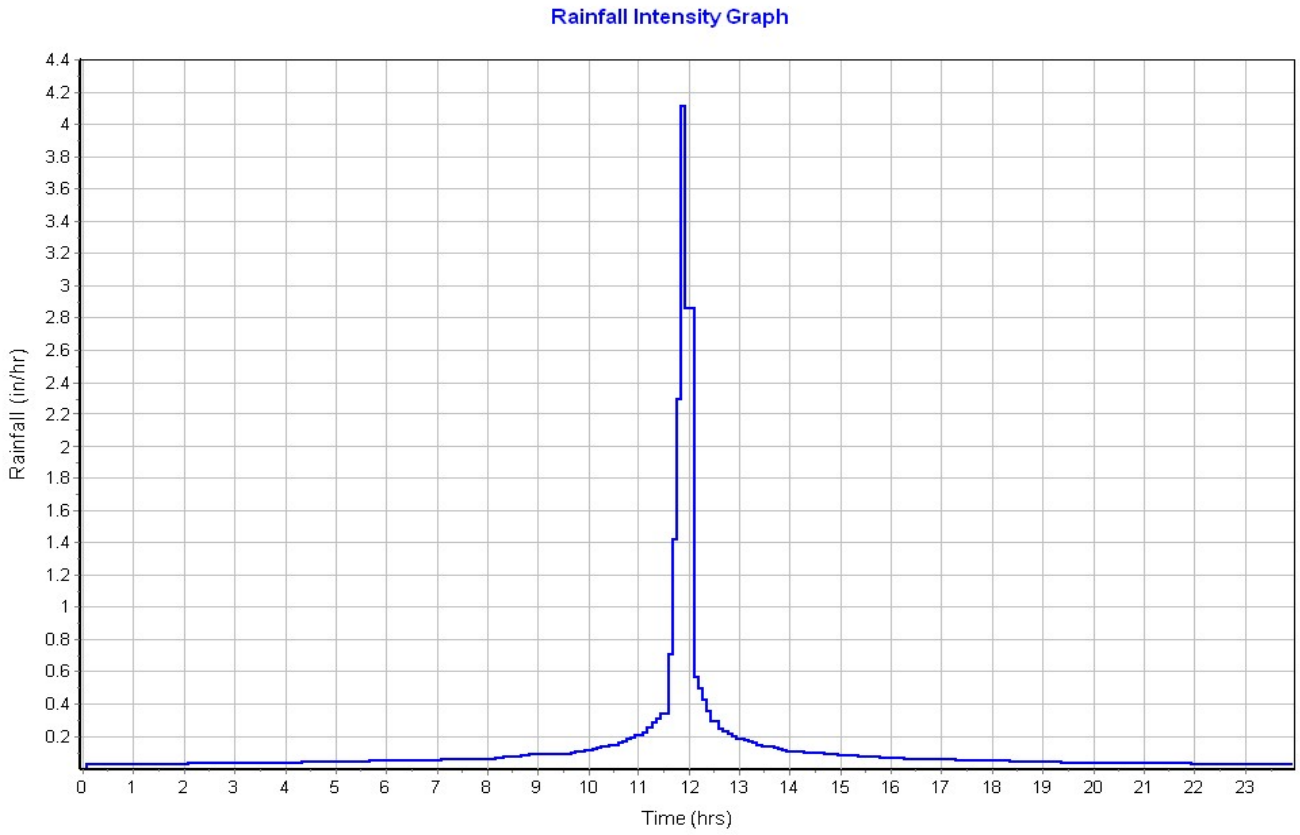
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	145	340	0.00
Slope (%) :	2	.5	0.00
Surface Type :	Paved	Paved	Unpaved
Velocity (ft/sec) :	2.87	1.44	0.00
Computed Flow Time (min) :	0.84	3.94	0.00

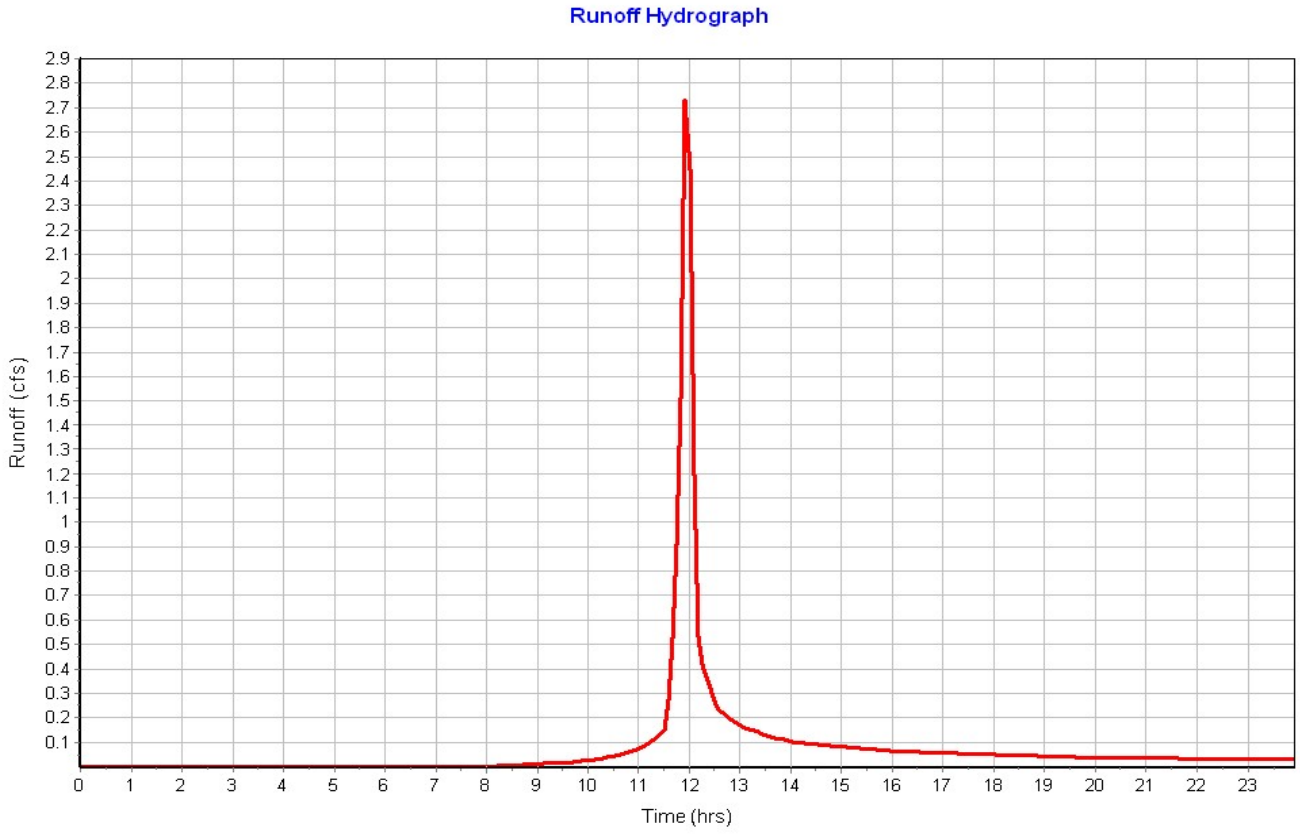
Total TOC (min) 6.08

Subbasin Runoff Results

Total Rainfall (in) 3.00
Total Runoff (in) 1.65
Peak Runoff (cfs) 2.79
Weighted Curve Number 85.78
Time of Concentration (days hh:mm:ss) 0 00:06:05

Subbasin : A1Undet.





Subbasin : A-48in

Input Data

Area (ac) 0.93
Weighted Curve Number 92.58
Rain Gage ID ..... *

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.72	-	98.00
-	0.21	-	74.00
Composite Area & Weighted CN	0.93		92.58

Time of Concentration

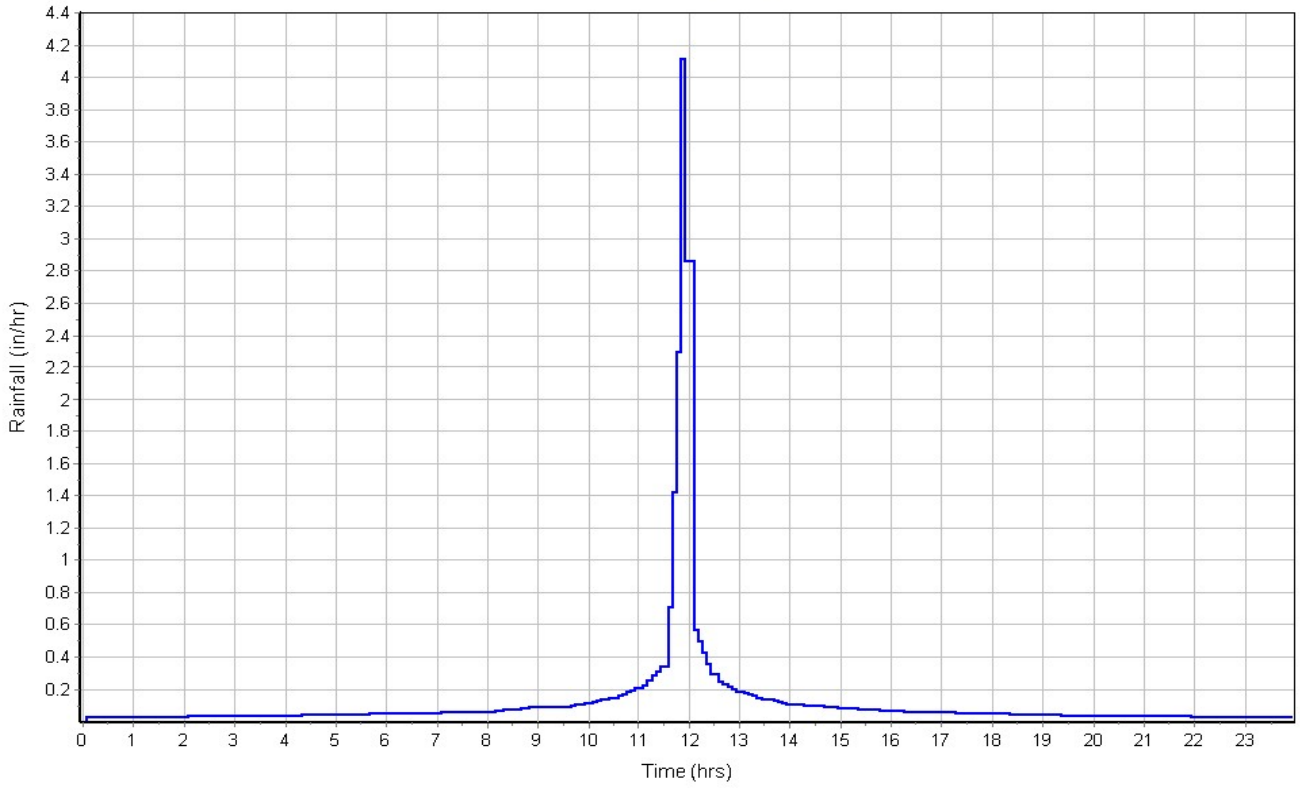
User-Defined TOC override (minutes): 5

Subbasin Runoff Results

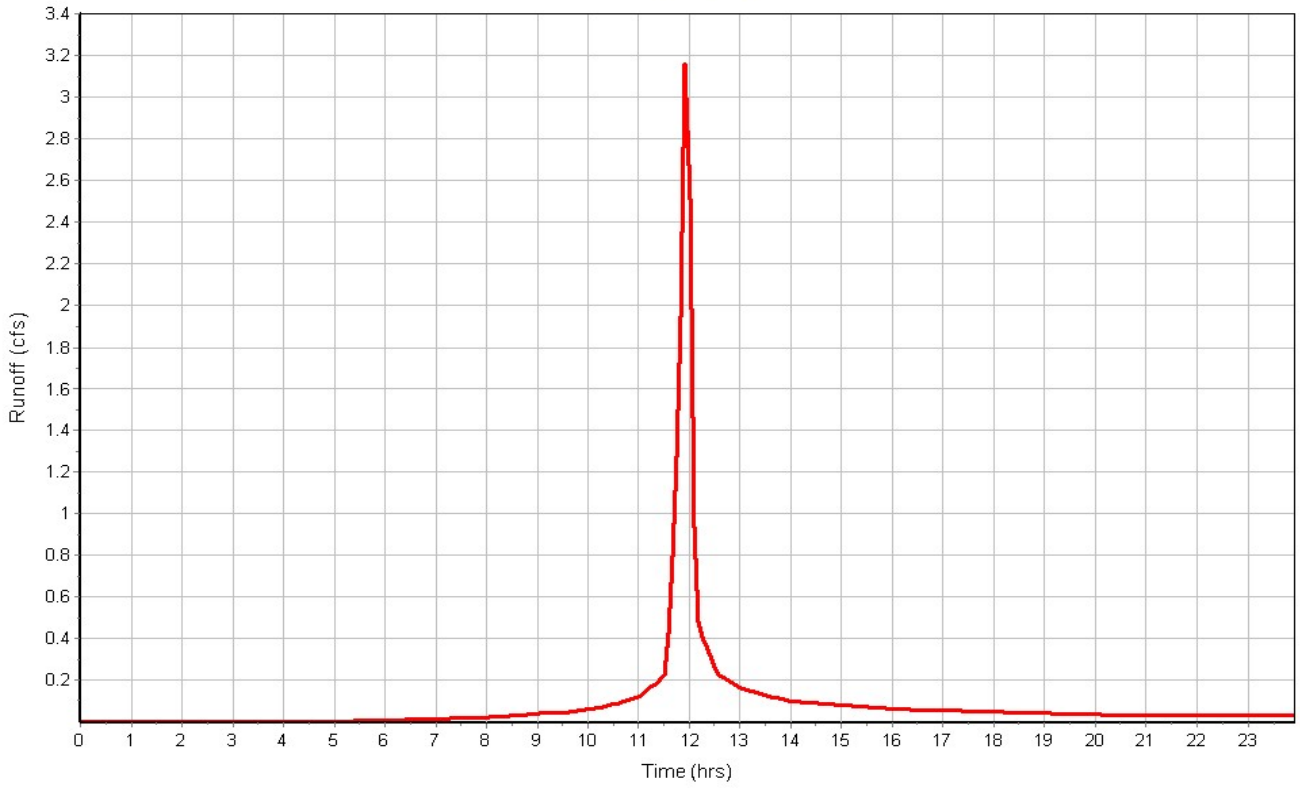
Total Rainfall (in) 3.00
Total Runoff (in) 2.22
Peak Runoff (cfs) 3.16
Weighted Curve Number 92.58
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : A-48in

Rainfall Intensity Graph



Runoff Hydrograph



Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft^2)	Minimum Pipe Cover (ft)
1	Jun-01	916.00	924.00	8.00	916.00	0.00	924.00	0.00	0.00	0.00

Junction Results

SN	Element ID	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Max HGL Elevation Attained (ft)	Max HGL Depth Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)	Time of Max HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Jun-01	2.52	0.00	917.47	1.47	0.00	6.53	916.77	0.77	0 11:42	0 00:00	0.00	0.00

Pipe Input

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (ft)	Pipe Width (ft)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate	No. of Barrels
1	Link-01	47.30	917.00	1.00	914.50	914.50	2.50	5.2900	CIRCULAR	1.500	1.500	0.0150	0.5000	0.5000	0.0000	0.00	No	1

Pipe Results

SN	Element ID	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Froude Number	Reported Condition
1	Link-01	3.19	0 11:31	20.93	0.15	50.00	0.02	0.37	0.25	0.00		Calculated

Storage Nodes

Storage Node : Pond1

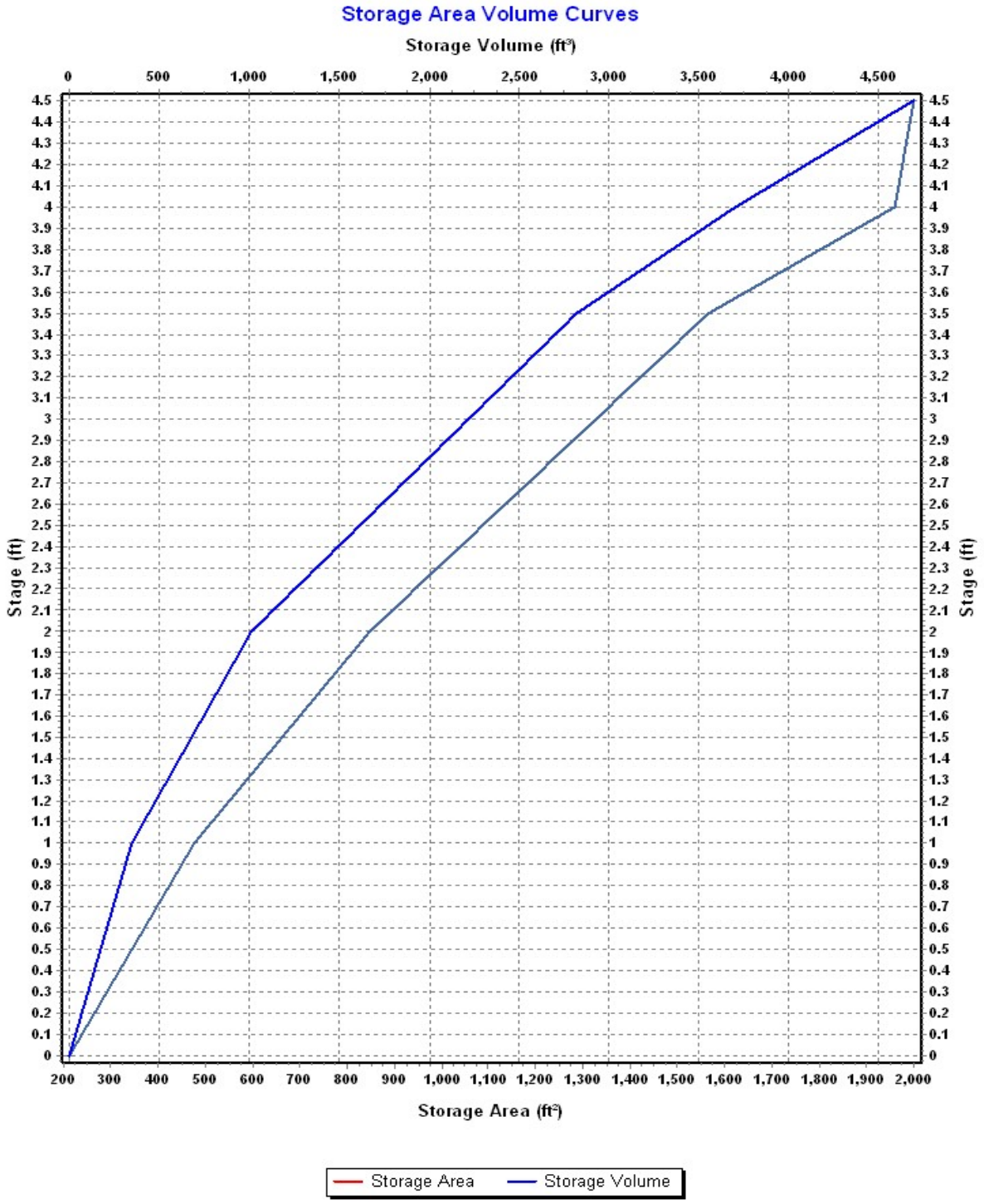
Input Data

Invert Elevation (ft)	921.00
Max (Rim) Elevation (ft)	926.00
Max (Rim) Offset (ft)	5.00
Initial Water Elevation (ft)	921.00
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	0.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : Rain Garden

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	212.88	0.000
1	478.86	345.87
2	848.71	1009.66
3.5	1566.50	2821.07
4	1960.28	3702.77
4.5	2000	4692.84


Storage Area Volume Curves
Storage Volume (ft³)
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
4,500
Stage (ft)
Stage (ft)
Storage Area (ft²)
200
300
400
500
600
700
800
900
1,000
1,100
1,200
1,300
1,400
1,500
1,600
1,700
1,800
1,900
2,000
Storage Area
Storage Volume

Storage Node : Pond1 (continued)

Outflow Weirs

SN	Element ID	Weir Type	Flap Gate	Crest Elevation (ft)	Crest Offset (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
1	Weir-01	Trapezoidal	No	925.50	4.50	100.00	0.50	3.33

Outflow Orifices

SN	Element ID	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (ft)	Rectangular Orifice Height (ft)	Rectangular Orifice Width (ft)	Orifice Invert Elevation (ft)	Orifice Coefficient
1	RG-4in	Side	CIRCULAR	No	0.33			922.00	0.61
2	RG4in(01)	Side	CIRCULAR	No	0.33			922.00	0.61
3	RG-8in	Side	CIRCULAR	No	0.50			924.50	0.61

Output Summary Results

Peak Inflow (cfs)	2.00
Peak Lateral Inflow (cfs)	2.00
Peak Outflow (cfs)	0.93
Peak Exfiltration Flow Rate (cfm)	0.00
Max HGL Elevation Attained (ft)	923.38
Max HGL Depth Attained (ft)	2.38
Average HGL Elevation Attained (ft)	921.93
Average HGL Depth Attained (ft)	0.93
Time of Max HGL Occurrence (days hh:mm)	0 12:08
Total Exfiltration Volume (1000-ft³)	0.000
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : Pond2

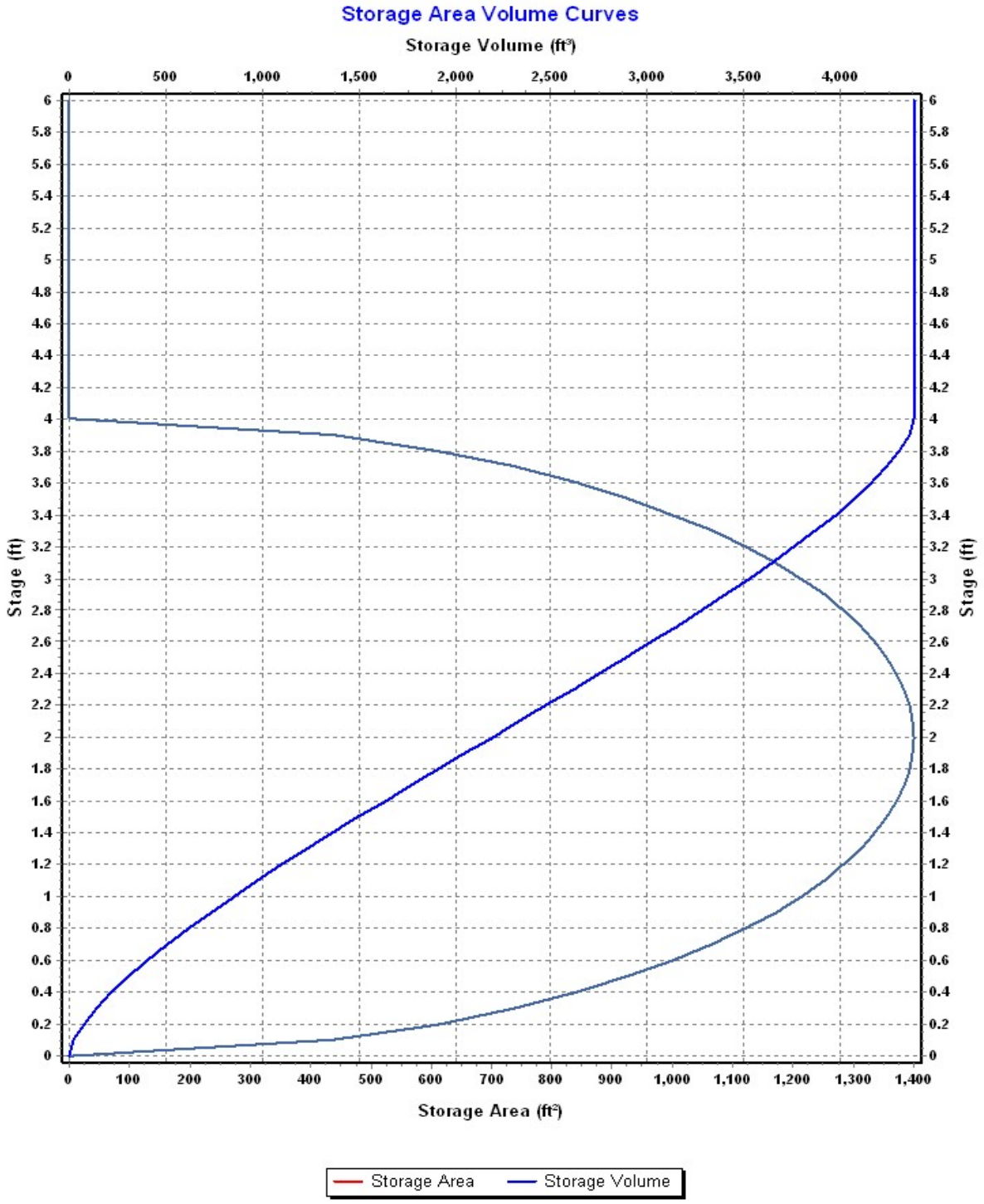
Input Data

Invert Elevation (ft)	916.00
Max (Rim) Elevation (ft)	923.00
Max (Rim) Offset (ft)	7.00
Initial Water Elevation (ft)	916.00
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	0.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : 48in

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	0.0000	0.000
0.1	437.1499	21.86
0.2	610.2459	74.23
0.3	737.4958	141.62
0.4	840.0000	220.49
0.5	926.0130	308.79
0.6	999.8000	405.08
0.7	1063.9079	508.27
0.8	1120.0000	617.47
0.9	1169.2305	731.93
1	1212.4356	851.01
1.1	1250.2400	974.14
1.2	1283.1212	1100.81
1.3	1311.4496	1230.54
1.4	1335.5149	1362.89
1.5	1355.5442	1497.44
1.6	1371.7143	1633.80
1.7	1384.1604	1771.59
1.8	1392.9824	1910.45
1.9	1398.2489	2050.01
2	1400.0000	2189.92
2.1	1398.2489	2329.83
2.2	1392.9824	2469.39
2.3	1384.1604	2608.25
2.4	1371.7143	2746.04
2.5	1355.5442	2882.40
2.6	1335.5149	3016.95
2.7	1311.4496	3149.30
2.8	1283.1212	3279.03
2.9	1250.2400	3405.70
3	1212.4356	3528.83
3.1	1169.2305	3647.91
3.2	1120.0000	3762.37
3.3	1063.9079	3871.57
3.4	999.8000	3974.76
3.5	926.0130	4071.05
3.6	840.0000	4159.35
3.7	737.4958	4238.22
3.8	610.2459	4305.61
3.9	437.1499	4357.98
4	0.0000	4379.84
5	0	4379.84
6	0	4379.84


Storage Area Volume Curves
Storage Volume (ft³)
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
Stage (ft)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
3
3.2
3.4
3.6
3.8
4
4.2
4.4
4.6
4.8
5
5.2
5.4
5.6
5.8
6
Storage Area (ft²)
0
100
200
300
400
500
600
700
800
900
1,000
1,100
1,200
1,300
1,400
Storage Area
Storage Volume

Storage Node : Pond2 (continued)

Outflow Weirs

SN	Element ID	Weir Type	Flap Gate	Crest Elevation (ft)	Crest Offset (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
1	Weir-02	Trapezoidal	No	922.50	6.50	50.00	1.00	3.33

Outflow Orifices

SN	Element ID	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (ft)	Rectangular Orifice Height (ft)	Rectangular Orifice Width (ft)	Orifice Invert Elevation (ft)	Orifice Coefficient
1	48in-12	Side	CIRCULAR	No	1.25			919.75	0.61
2	48in-6in	Side	CIRCULAR	No	0.67			916.00	0.61

Output Summary Results

Peak Inflow (cfs)	3.16
Peak Lateral Inflow (cfs)	3.16
Peak Outflow (cfs)	1.59
Peak Exfiltration Flow Rate (cfm)	0.00
Max HGL Elevation Attained (ft)	918.23
Max HGL Depth Attained (ft)	2.23
Average HGL Elevation Attained (ft)	916.87
Average HGL Depth Attained (ft)	0.87
Time of Max HGL Occurrence (days hh:mm)	0 12:07
Total Exfiltration Volume (1000-ft³)	0.000
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Project Description

File Name	Storm Analysis 091619.SPF

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	SCS TR-55
Time of Concentration (TOC) Method	SCS TR-55
Link Routing Method	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	YES

Analysis Options

Start Analysis On	Sep 16, 2019	00:00:00
End Analysis On	Sep 17, 2019	00:00:00
Start Reporting On	Sep 16, 2019	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	3
Subbasins	3
Nodes	6
Junctions	1
Outfalls	3
Flow Diversions	0
Inlets	0
Storage Nodes	2
Links	8
Channels	0
Pipes	1
Pumps	0
Orifices	5
Weirs	2
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1		Time Series	10yr	Cumulative	inches	Kansas	Johnson	10	5.40	SCS Type II 24-hr

Subbasin Summary

SN	Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	A1Det.	0.62	91.03	5.40	4.37	2.71	4.07	0 00:05:00
2	A1Undet.	1.10	85.78	5.40	3.82	4.20	6.33	0 00:06:04
3	A-48in	0.93	92.58	5.40	4.54	4.23	6.23	0 00:05:00

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft²)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Jun-01	Junction	916.00	924.00	916.00	924.00	0.00	5.95	917.66	0.00	6.34	0 00:00	0.00	0.00
2	Out48	Outfall	0.00					0.00	0.00					
3	OutA	Outfall	0.00					11.11	0.00					
4	OutRG	Outfall	0.00					0.00	0.00					
5	Pond1	Storage Node	921.00	926.00	921.00		0.00	4.06	924.60				0.00	0.00
6	Pond2	Storage Node	916.00	923.00	916.00		0.00	6.22	920.40				0.00	0.00

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Reported Condition
					(ft)	(ft)	(ft)	(%)	(ft)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)	
1	Link-01	Pipe	Jun-01	OutA	47.30	917.00	914.50	5.2900	1.500	0.0150	6.02	20.93	0.29	50.00	0.48	0.40	0.00	Calculated
2	48in-12	Orifice	Pond2	Jun-01		916.00	916.00		1.250		1.79							
3	48in-6in	Orifice	Pond2	Jun-01		916.00	916.00		0.670		2.91							
4	RG-4in	Orifice	Pond1	Jun-01		921.00	916.00		0.330		0.66							
5	RG4in(01)	Orifice	Pond1	Jun-01		921.00	916.00		0.330		0.66							
6	RG-8in	Orifice	Pond1	Jun-01		921.00	916.00		0.500		0.04							
7	Weir-01	Weir	Pond1	OutRG		921.00	0.00				0.00							
8	Weir-02	Weir	Pond2	Out48		916.00	0.00				0.00							

Subbasin Hydrology

Subbasin : A1Det.

Input Data

Area (ac) 0.62
Weighted Curve Number 91.03
Rain Gage ID ..... *

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.44	-	98.00
-	0.18	-	74.00
Composite Area & Weighted CN	0.62		91.03

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

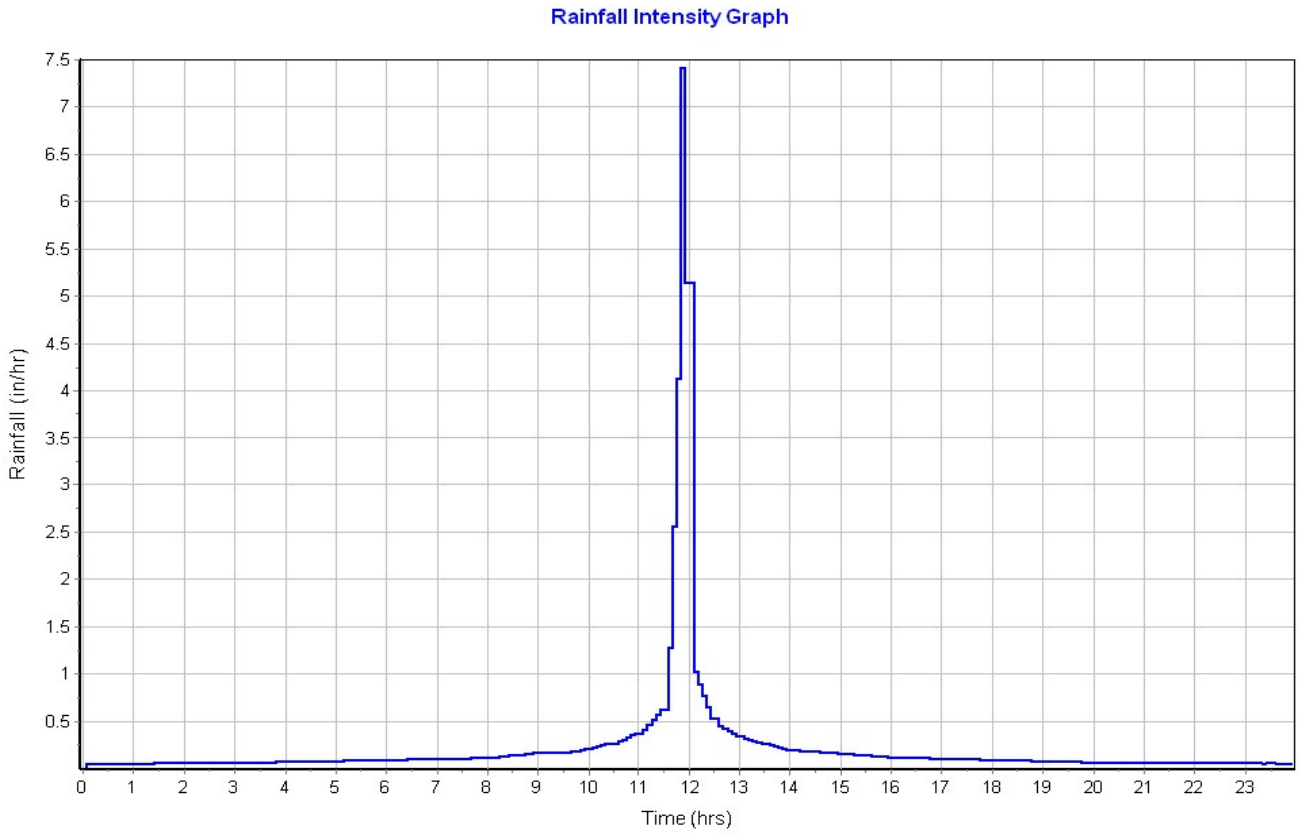
Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

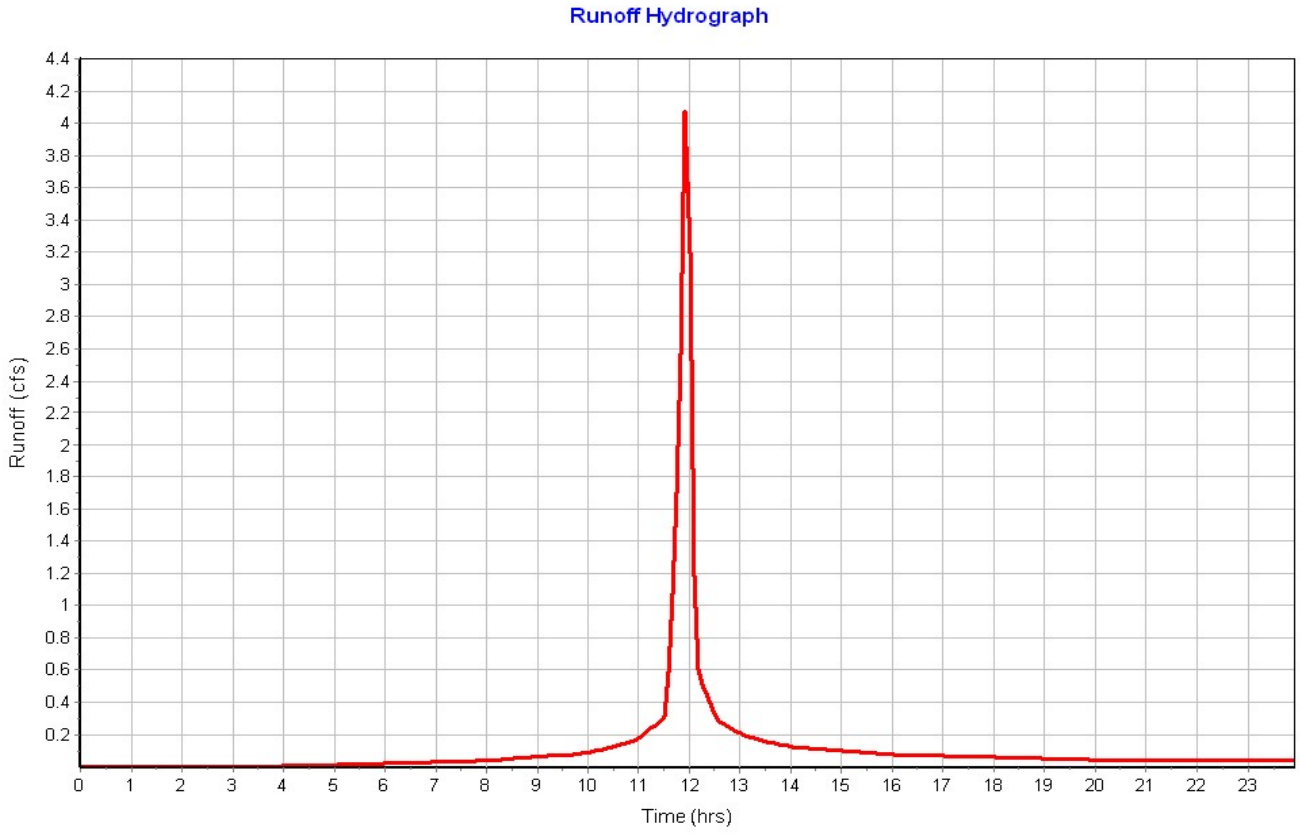
User-Defined TOC override (minutes): 5.00

Subbasin Runoff Results

Total Rainfall (in) 5.40
Total Runoff (in) 4.37
Peak Runoff (cfs) 4.07
Weighted Curve Number 91.03
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : A1Det.





Subbasin : A1Undet.

Input Data

Area (ac) 1.10
Weighted Curve Number 85.78
Rain Gage ID 1yr

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.54	-	98.00
-	0.56	-	74.00
Composite Area & Weighted CN	1.10		85.78

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.013	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.6	0.00	0.00
Velocity (ft/sec) :	1.28	0.00	0.00
Computed Flow Time (min) :	1.31	0.00	0.00

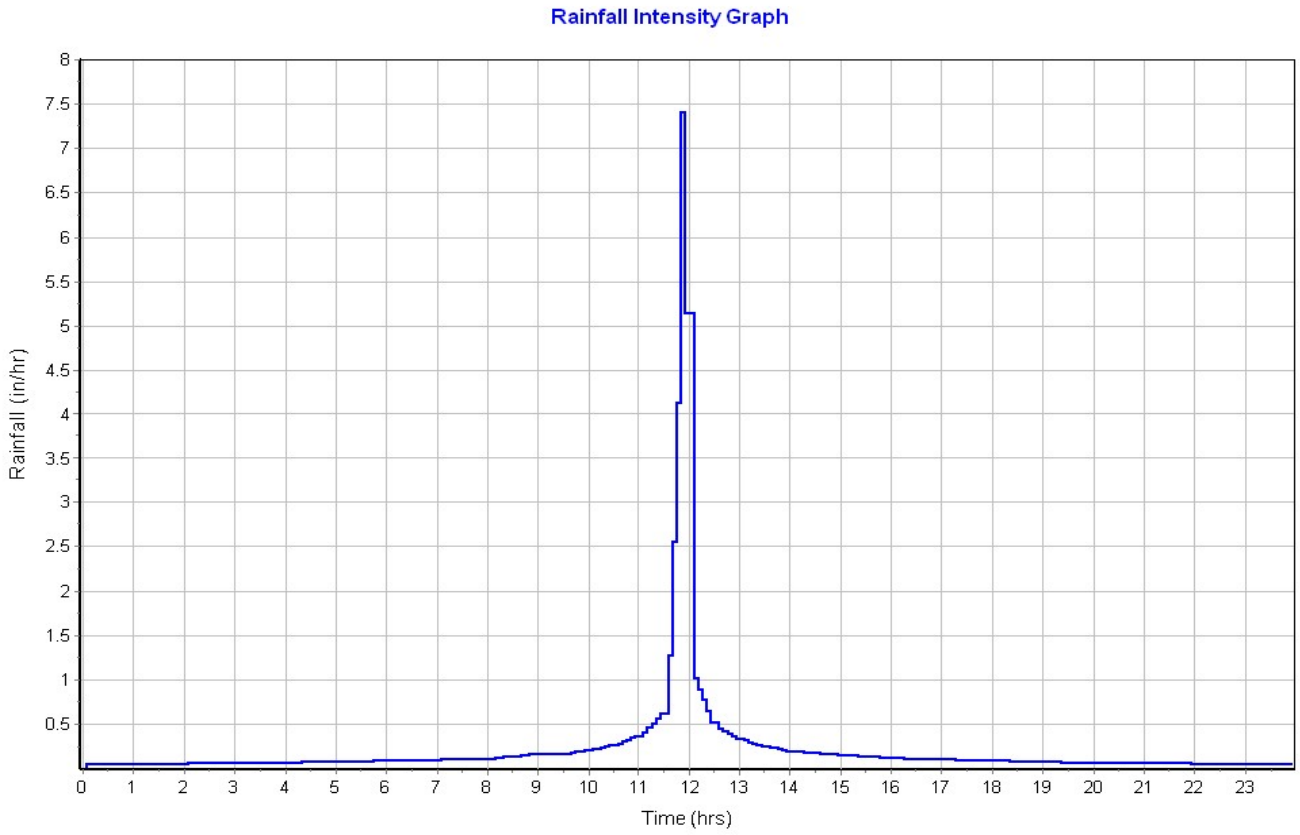
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	145	340	0.00
Slope (%) :	2	.5	0.00
Surface Type :	Paved	Paved	Unpaved
Velocity (ft/sec) :	2.87	1.44	0.00
Computed Flow Time (min) :	0.84	3.94	0.00

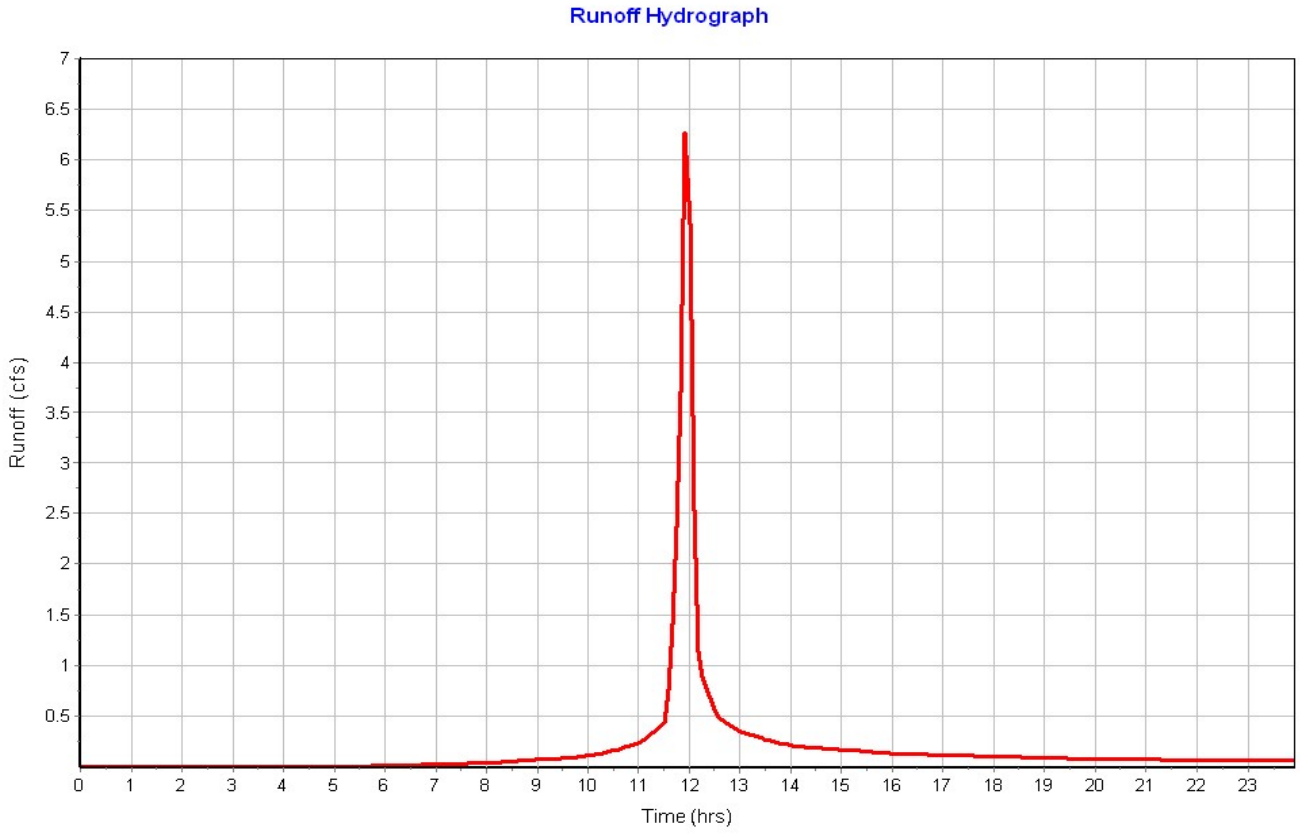
Total TOC (min) 6.08

Subbasin Runoff Results

Total Rainfall (in) 5.40
Total Runoff (in) 3.82
Peak Runoff (cfs) 6.33
Weighted Curve Number 85.78
Time of Concentration (days hh:mm:ss) 0 00:06:05

Subbasin : A1Undet.





Subbasin : A-48in

Input Data

Area (ac) 0.93
Weighted Curve Number 92.58
Rain Gage ID ..... *

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.72	-	98.00
-	0.21	-	74.00
Composite Area & Weighted CN	0.93		92.58

Time of Concentration

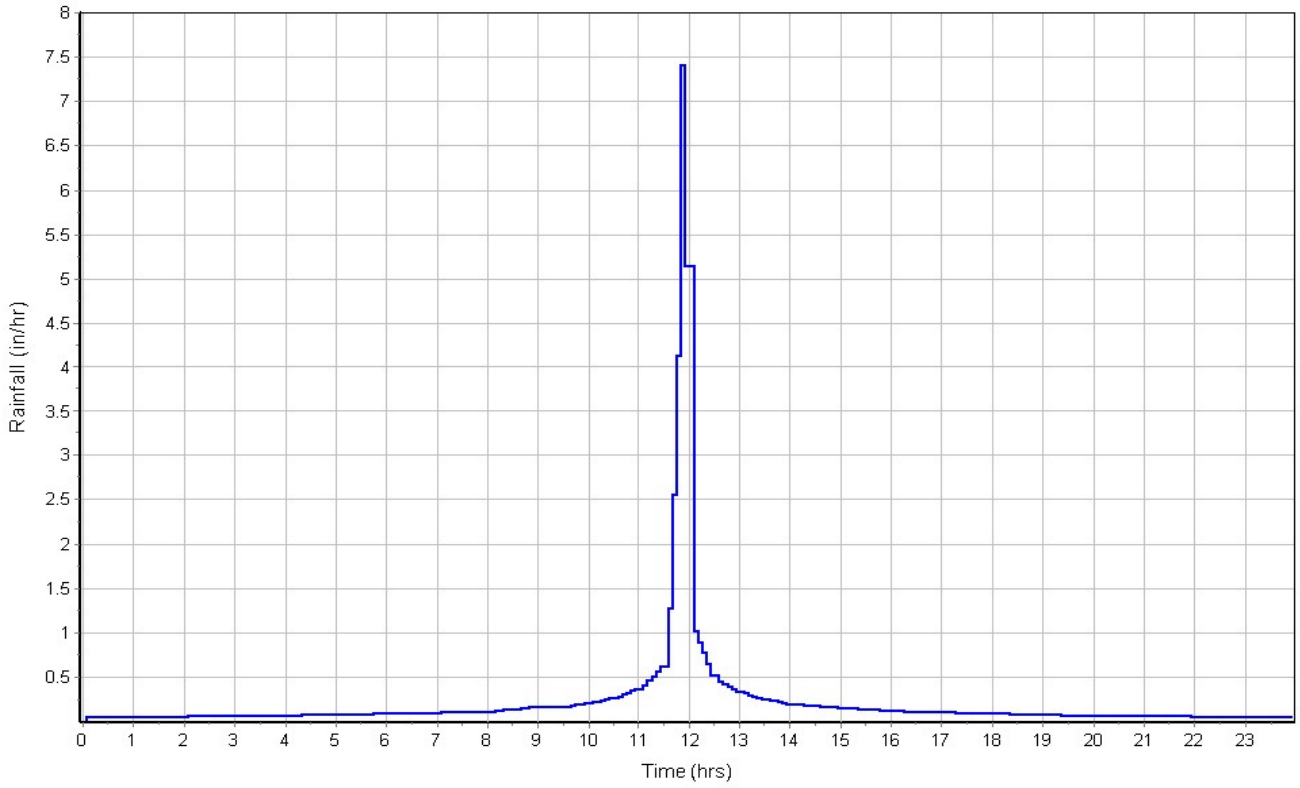
User-Defined TOC override (minutes): 5

Subbasin Runoff Results

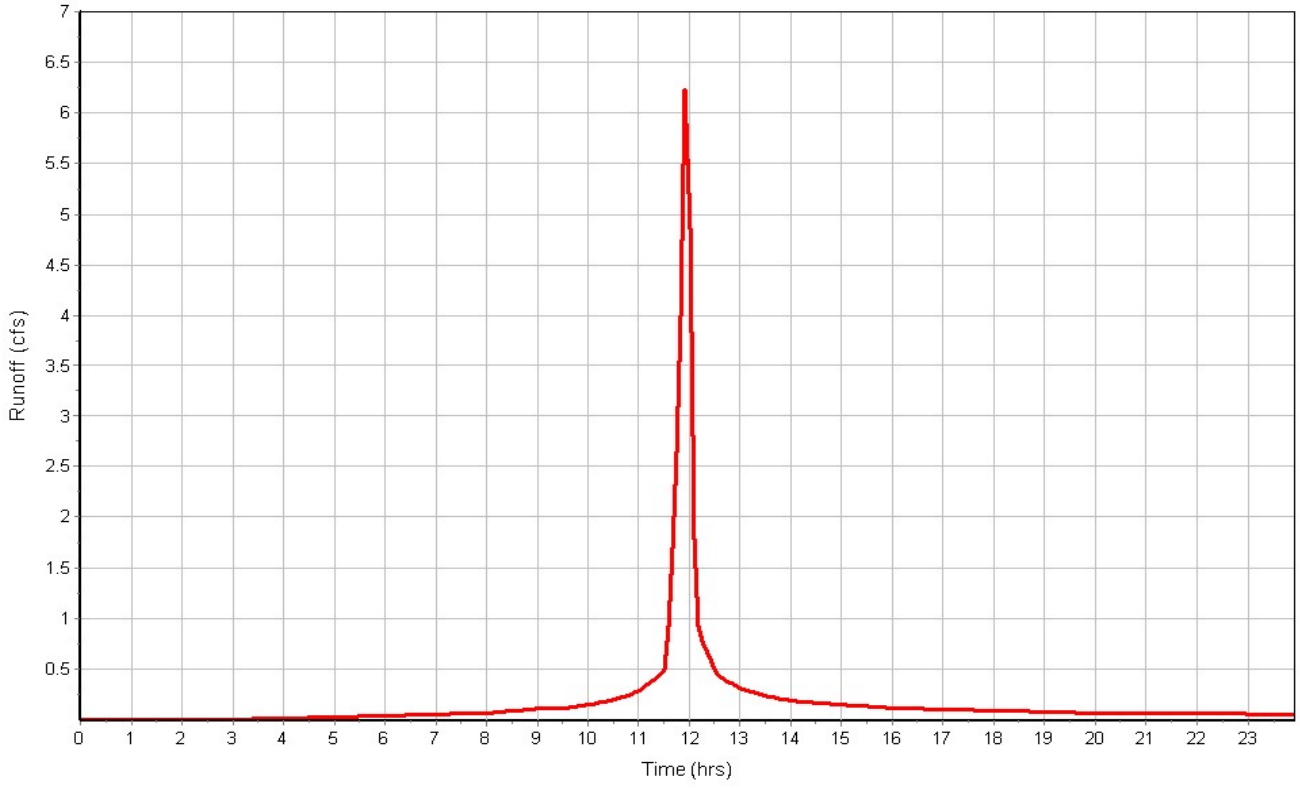
Total Rainfall (in) 5.40
Total Runoff (in) 4.54
Peak Runoff (cfs) 6.23
Weighted Curve Number 92.58
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : A-48in

Rainfall Intensity Graph



Runoff Hydrograph



Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft^2)	Minimum Pipe Cover (ft)
1	Jun-01	916.00	924.00	8.00	916.00	0.00	924.00	0.00	0.00	0.00

Junction Results

SN	Element ID	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Max HGL Elevation Attained (ft)	Max HGL Depth Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)	Time of Max HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Jun-01	5.95	0.00	917.66	1.66	0.00	6.34	916.99	0.99	0 12:05	0 00:00	0.00	0.00

Pipe Input

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (ft)	Pipe Width (ft)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate	No. of Barrels
1	Link-01	47.30	917.00	1.00	914.50	914.50	2.50	5.2900	CIRCULAR	1.500	1.500	0.0150	0.5000	0.5000	0.0000	0.00	No	1

Pipe Results

SN	Element ID	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Froude Number	Reported Condition
1	Link-01	6.02	0 12:05	20.93	0.29	50.00	0.02	0.48	0.40	0.00		Calculated

Storage Nodes

Storage Node : Pond1

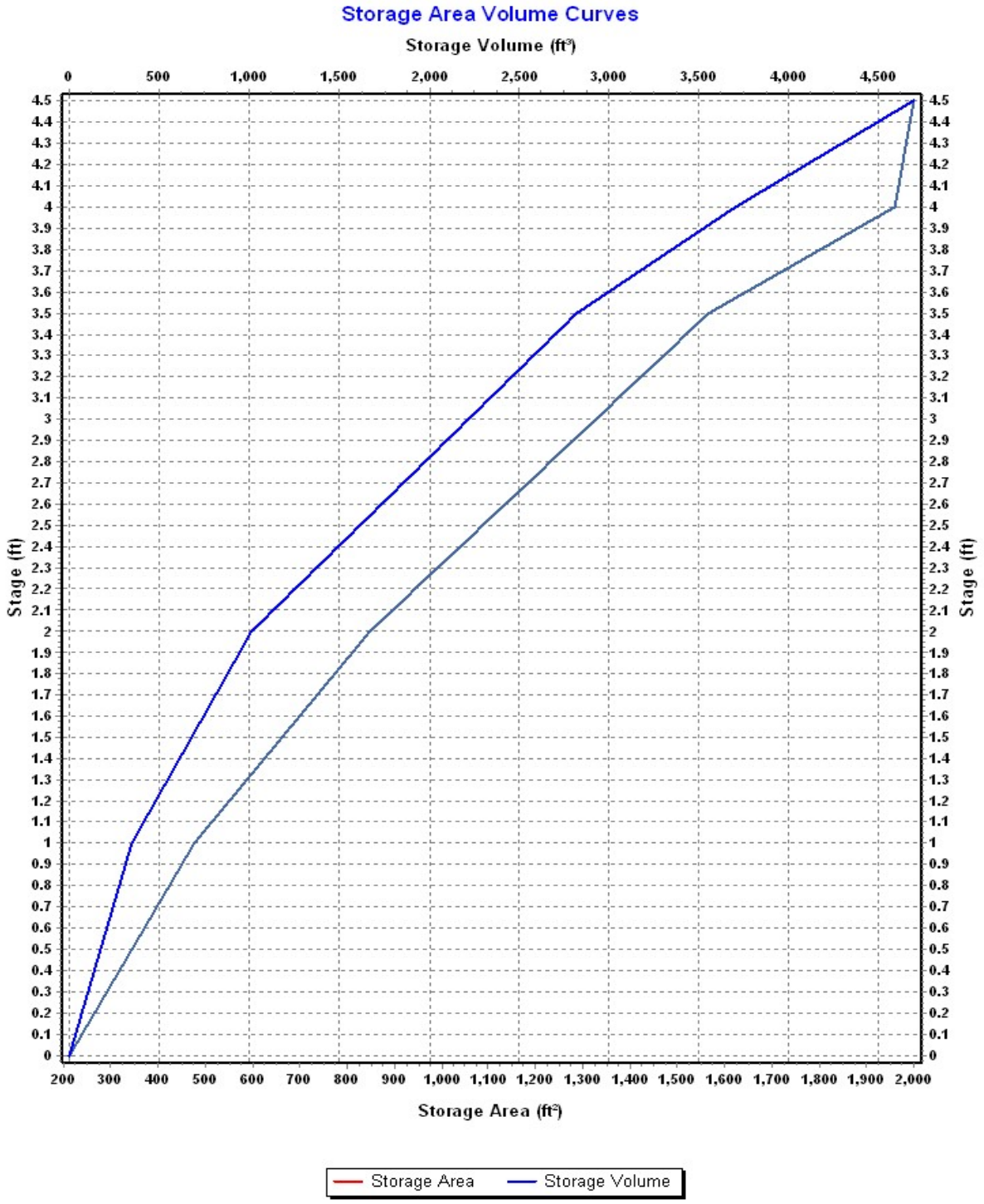
Input Data

Invert Elevation (ft)	921.00
Max (Rim) Elevation (ft)	926.00
Max (Rim) Offset (ft)	5.00
Initial Water Elevation (ft)	921.00
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	0.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : Rain Garden

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	212.88	0.000
1	478.86	345.87
2	848.71	1009.66
3.5	1566.50	2821.07
4	1960.28	3702.77
4.5	2000	4692.84


Storage Area Volume Curves
Storage Volume (ft³)
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
4,500
Stage (ft)
Stage (ft)
Storage Area (ft²)
200
300
400
500
600
700
800
900
1,000
1,100
1,200
1,300
1,400
1,500
1,600
1,700
1,800
1,900
2,000
Storage Area
Storage Volume

Storage Node : Pond1 (continued)

Outflow Weirs

SN	Element ID	Weir Type	Flap Gate	Crest Elevation (ft)	Crest Offset (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
1	Weir-01	Trapezoidal	No	925.50	4.50	100.00	0.50	3.33

Outflow Orifices

SN	Element ID	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (ft)	Rectangular Orifice Height (ft)	Rectangular Orifice Width (ft)	Orifice Invert Elevation (ft)	Orifice Coefficient
1	RG-4in	Side	CIRCULAR	No	0.33			922.00	0.61
2	RG4in(01)	Side	CIRCULAR	No	0.33			922.00	0.61
3	RG-8in	Side	CIRCULAR	No	0.50			924.50	0.61

Output Summary Results

Peak Inflow (cfs)	4.06
Peak Lateral Inflow (cfs)	4.06
Peak Outflow (cfs)	1.36
Peak Exfiltration Flow Rate (cfm)	0.00
Max HGL Elevation Attained (ft)	924.60
Max HGL Depth Attained (ft)	3.6
Average HGL Elevation Attained (ft)	922.47
Average HGL Depth Attained (ft)	1.47
Time of Max HGL Occurrence (days hh:mm)	0 12:09
Total Exfiltration Volume (1000-ft³)	0.000
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : Pond2

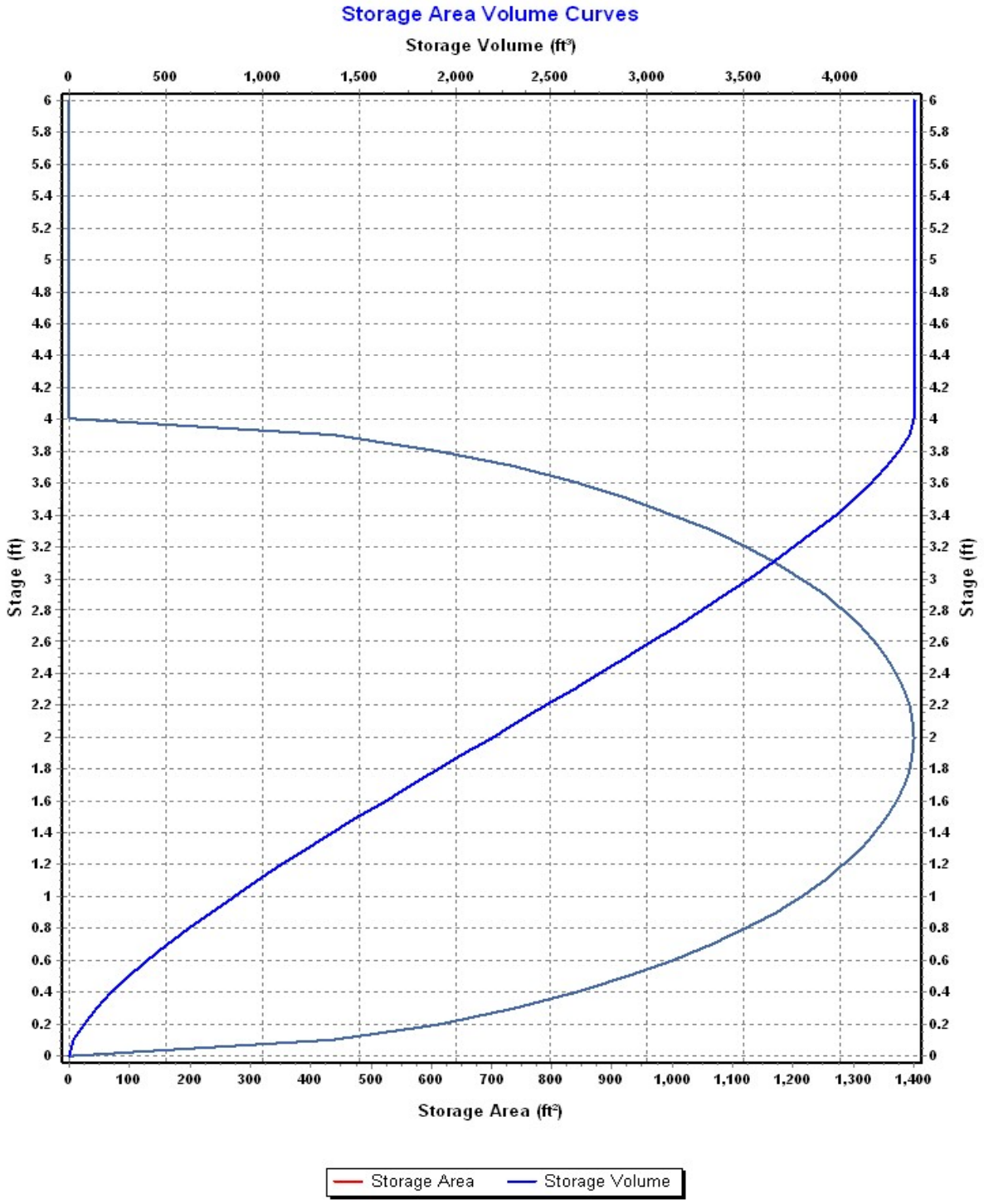
Input Data

Invert Elevation (ft)	916.00
Max (Rim) Elevation (ft)	923.00
Max (Rim) Offset (ft)	7.00
Initial Water Elevation (ft)	916.00
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	0.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : 48in

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	0.0000	0.000
0.1	437.1499	21.86
0.2	610.2459	74.23
0.3	737.4958	141.62
0.4	840.0000	220.49
0.5	926.0130	308.79
0.6	999.8000	405.08
0.7	1063.9079	508.27
0.8	1120.0000	617.47
0.9	1169.2305	731.93
1	1212.4356	851.01
1.1	1250.2400	974.14
1.2	1283.1212	1100.81
1.3	1311.4496	1230.54
1.4	1335.5149	1362.89
1.5	1355.5442	1497.44
1.6	1371.7143	1633.80
1.7	1384.1604	1771.59
1.8	1392.9824	1910.45
1.9	1398.2489	2050.01
2	1400.0000	2189.92
2.1	1398.2489	2329.83
2.2	1392.9824	2469.39
2.3	1384.1604	2608.25
2.4	1371.7143	2746.04
2.5	1355.5442	2882.40
2.6	1335.5149	3016.95
2.7	1311.4496	3149.30
2.8	1283.1212	3279.03
2.9	1250.2400	3405.70
3	1212.4356	3528.83
3.1	1169.2305	3647.91
3.2	1120.0000	3762.37
3.3	1063.9079	3871.57
3.4	999.8000	3974.76
3.5	926.0130	4071.05
3.6	840.0000	4159.35
3.7	737.4958	4238.22
3.8	610.2459	4305.61
3.9	437.1499	4357.98
4	0.0000	4379.84
5	0	4379.84
6	0	4379.84


Storage Area Volume Curves
Storage Volume (ft³)
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
Stage (ft)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
3
3.2
3.4
3.6
3.8
4
4.2
4.4
4.6
4.8
5
5.2
5.4
5.6
5.8
6
Storage Area (ft²)
0
100
200
300
400
500
600
700
800
900
1,000
1,100
1,200
1,300
1,400
Storage Area
Storage Volume

Storage Node : Pond2 (continued)

Outflow Weirs

SN	Element ID	Weir Type	Flap Gate	Crest Elevation (ft)	Crest Offset (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
1	Weir-02	Trapezoidal	No	922.50	6.50	50.00	1.00	3.33

Outflow Orifices

SN	Element ID	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (ft)	Rectangular Orifice Height (ft)	Rectangular Orifice Width (ft)	Orifice Invert Elevation (ft)	Orifice Coefficient
1	48in-12	Side	CIRCULAR	No	1.25			919.75	0.61
2	48in-6in	Side	CIRCULAR	No	0.67			916.00	0.61

Output Summary Results

Peak Inflow (cfs)	6.22
Peak Lateral Inflow (cfs)	6.22
Peak Outflow (cfs)	4.67
Peak Exfiltration Flow Rate (cfm)	0.00
Max HGL Elevation Attained (ft)	920.40
Max HGL Depth Attained (ft)	4.4
Average HGL Elevation Attained (ft)	917.34
Average HGL Depth Attained (ft)	1.34
Time of Max HGL Occurrence (days hh:mm)	0 12:05
Total Exfiltration Volume (1000-ft³)	0.000
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Project Description

File Name	Storm Analysis 091619.SPF

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	SCS TR-55
Time of Concentration (TOC) Method	SCS TR-55
Link Routing Method	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	YES

Analysis Options

Start Analysis On	Sep 16, 2019	00:00:00
End Analysis On	Sep 17, 2019	00:00:00
Start Reporting On	Sep 16, 2019	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	3
Subbasins	3
Nodes	6
Junctions	1
Outfalls	3
Flow Diversions	0
Inlets	0
Storage Nodes	2
Links	8
Channels	0
Pipes	1
Pumps	0
Orifices	5
Weirs	2
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1		Time Series	100yr	Cumulative	inches					User Defined

Subbasin Summary

SN	Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	A1Det.	0.62	91.03	7.90	6.83	4.23	6.19	0 00:05:00
2	A1Undet.	1.10	85.78	7.90	6.21	6.83	10.04	0 00:06:04
3	A-48in	0.93	92.58	7.90	7.01	6.52	9.37	0 00:05:00

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft²)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Jun-01	Junction	916.00	924.00	916.00	924.00	0.00	10.81	917.99	0.00	6.01	0 00:00	0.00	0.00
2	Out48	Outfall	0.00					0.00	0.00					
3	OutA	Outfall	0.00					20.71	0.00					
4	OutRG	Outfall	0.00					0.00	0.00					
5	Pond1	Storage Node	921.00	926.00	921.00		0.00	6.19	925.42				0.00	0.00
6	Pond2	Storage Node	916.00	923.00	916.00		0.00	9.37	921.41				0.00	0.00

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Reported Condition
					(ft)	(ft)	(ft)	(%)	(ft)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)	
1	Link-01	Pipe	Jun-01	OutA	47.30	917.00	914.50	5.2900	1.500	0.0150	10.81	20.93	0.52	50.00	0.87	0.58	0.00	Calculated
2	48in-12	Orifice	Pond2	Jun-01		916.00	916.00		1.250		6.14							
3	48in-6in	Orifice	Pond2	Jun-01		916.00	916.00		0.670		3.21							
4	RG-4in	Orifice	Pond1	Jun-01		921.00	916.00		0.330		0.76							
5	RG4in(01)	Orifice	Pond1	Jun-01		921.00	916.00		0.330		0.76							
6	RG-8in	Orifice	Pond1	Jun-01		921.00	916.00		0.500		0.79							
7	Weir-01	Weir	Pond1	OutRG		921.00	0.00				0.00							
8	Weir-02	Weir	Pond2	Out48		916.00	0.00				0.00							

Subbasin Hydrology

Subbasin : A1Det.

Input Data

Area (ac) 0.62
Weighted Curve Number 91.03
Rain Gage ID ..... *

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.44	-	98.00
-	0.18	-	74.00
Composite Area & Weighted CN	0.62		91.03

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

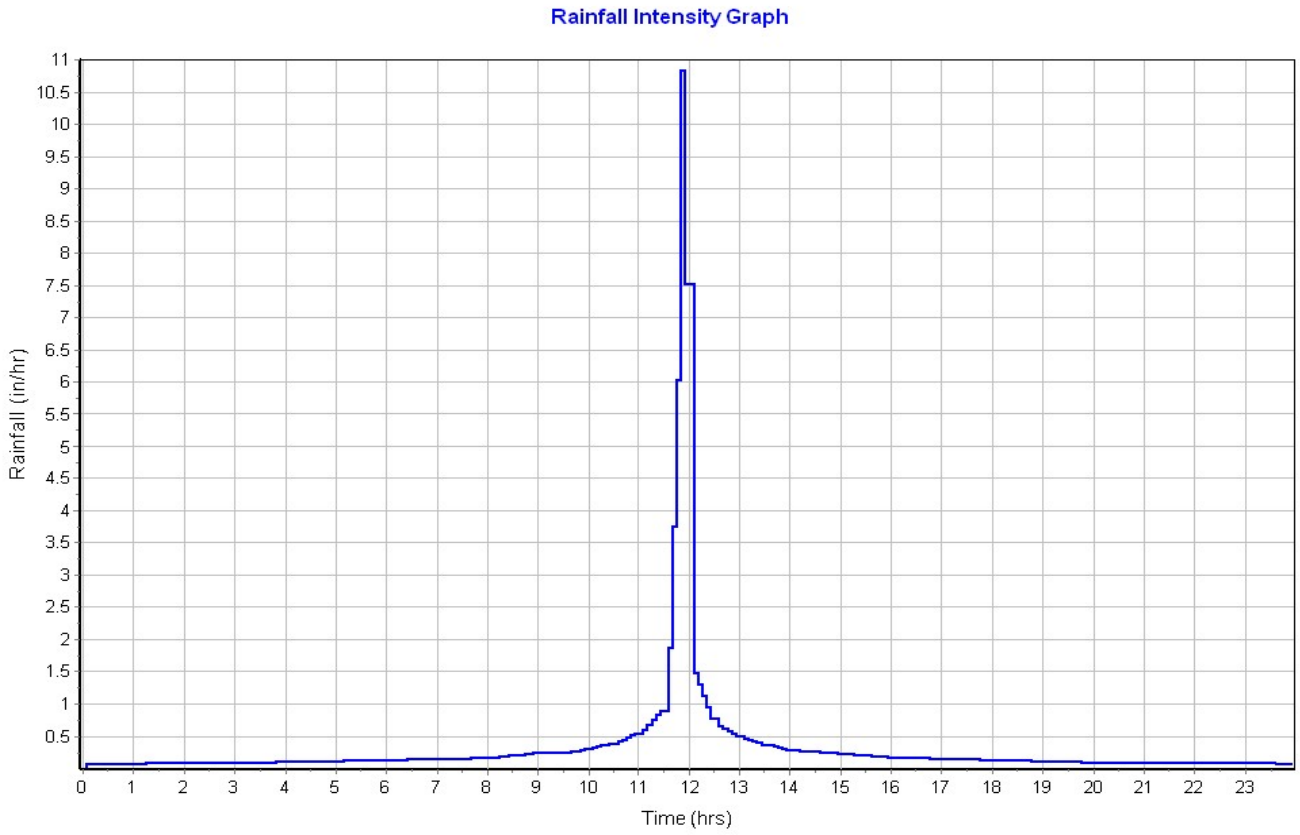
Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

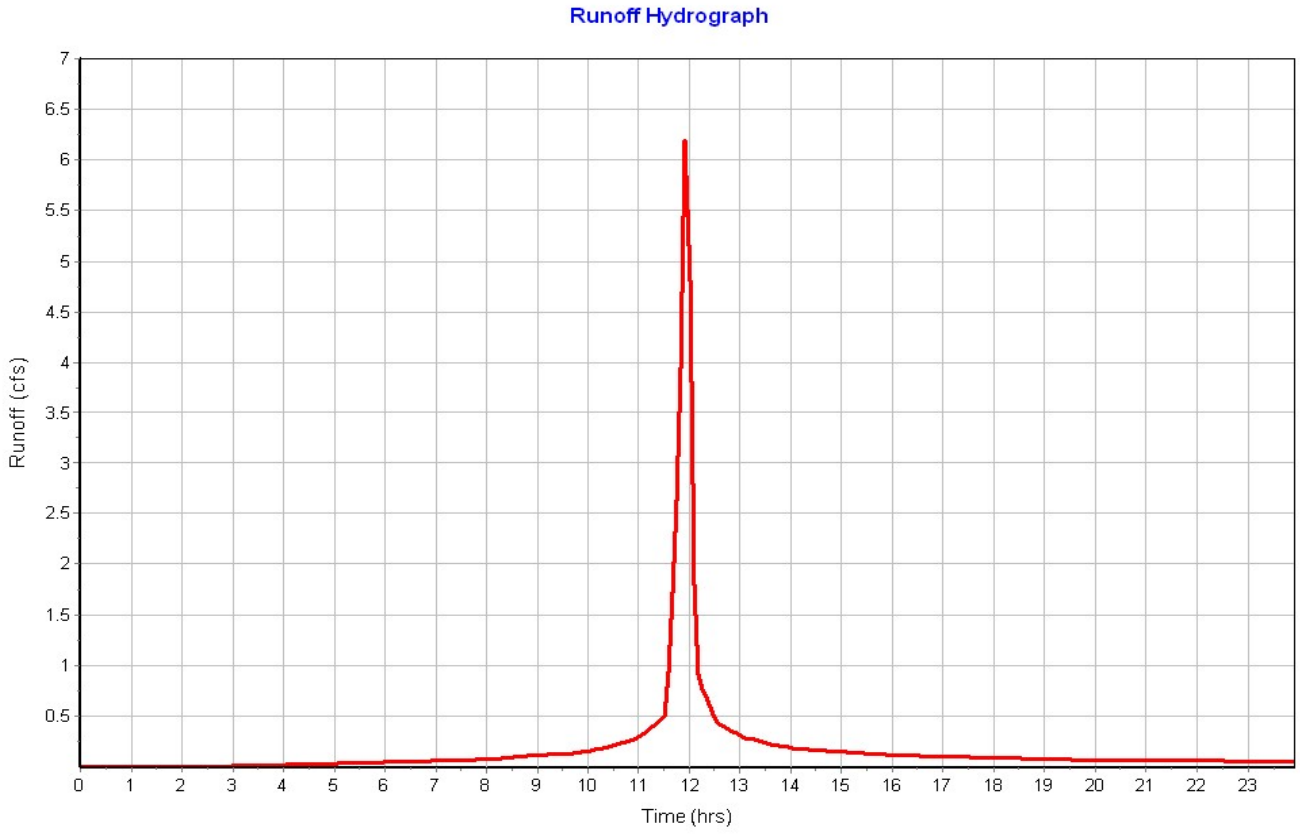
User-Defined TOC override (minutes): 5.00

Subbasin Runoff Results

Total Rainfall (in) 7.90
Total Runoff (in) 6.83
Peak Runoff (cfs) 6.19
Weighted Curve Number 91.03
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : A1Det.





Subbasin : A1Undet.

Input Data

Area (ac) 1.10
Weighted Curve Number 85.78
Rain Gage ID 1yr

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.54	-	98.00
-	0.56	-	74.00
Composite Area & Weighted CN	1.10		85.78

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.013	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	3.6	0.00	0.00
Velocity (ft/sec) :	1.28	0.00	0.00
Computed Flow Time (min) :	1.31	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	145	340	0.00
Slope (%) :	2	.5	0.00
Surface Type :	Paved	Paved	Unpaved
Velocity (ft/sec) :	2.87	1.44	0.00
Computed Flow Time (min) :	0.84	3.94	0.00

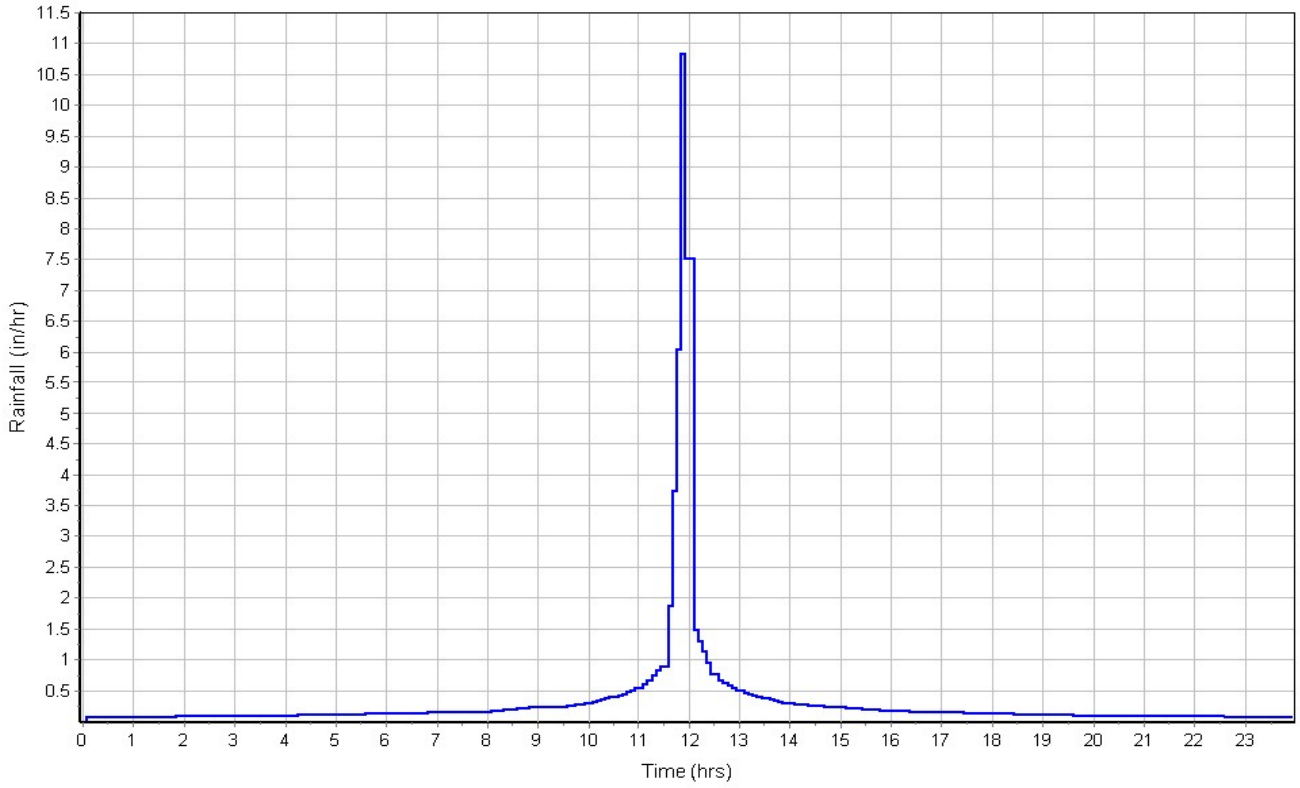
Total TOC (min) 6.08

Subbasin Runoff Results

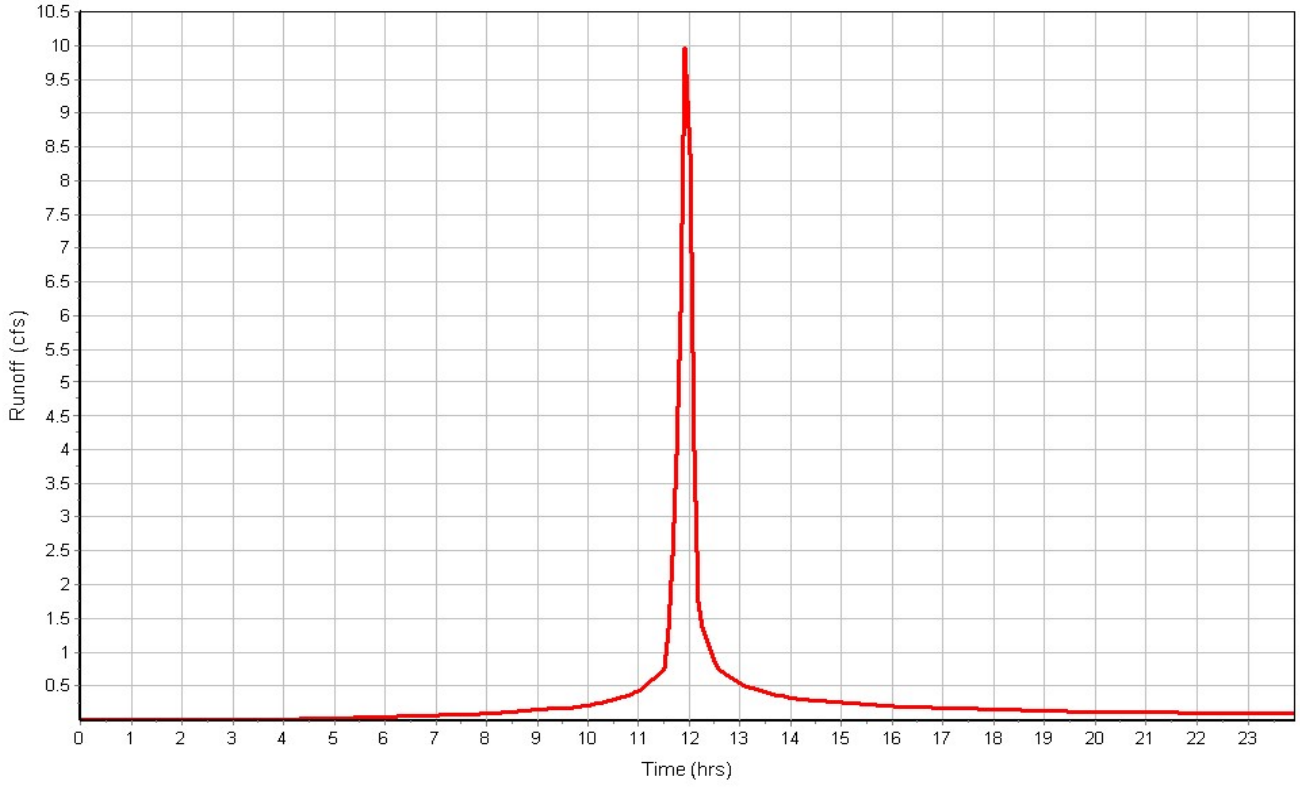
Total Rainfall (in) 7.90
Total Runoff (in) 6.21
Peak Runoff (cfs) 10.04
Weighted Curve Number 85.78
Time of Concentration (days hh:mm:ss) 0 00:06:05

Subbasin : A1Undet.

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : A-48in

Input Data

Area (ac) 0.93
Weighted Curve Number 92.58
Rain Gage ID ..... *

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.72	-	98.00
-	0.21	-	74.00
Composite Area & Weighted CN	0.93		92.58

Time of Concentration

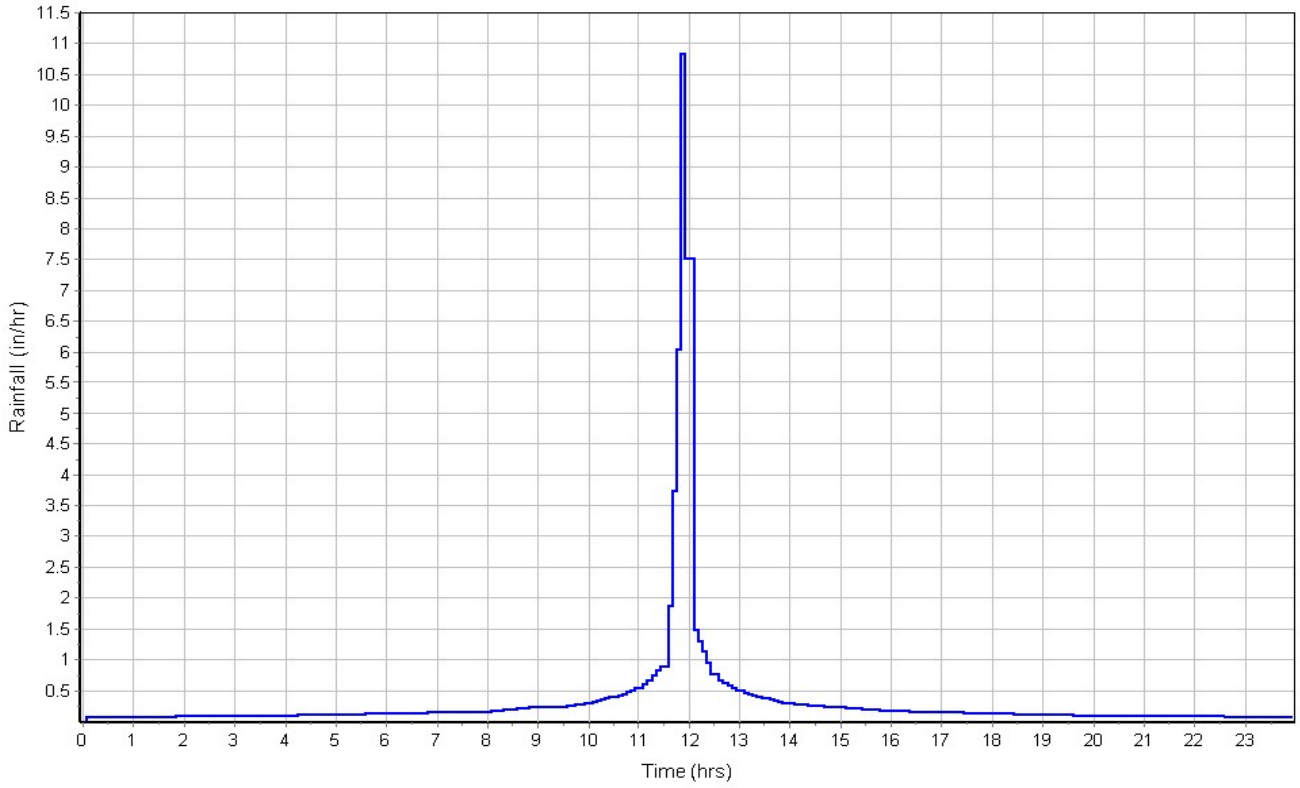
User-Defined TOC override (minutes): 5

Subbasin Runoff Results

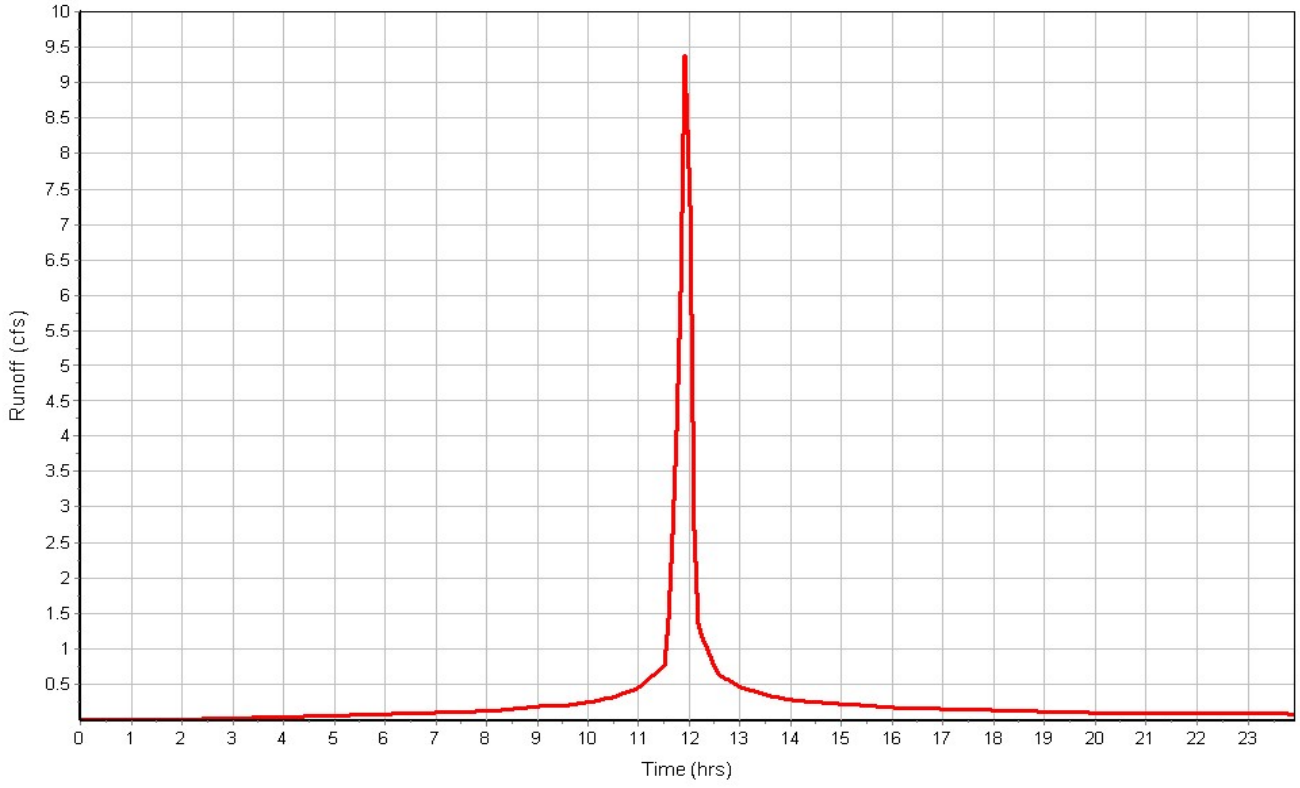
Total Rainfall (in) 7.90
Total Runoff (in) 7.01
Peak Runoff (cfs) 9.37
Weighted Curve Number 92.58
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : A-48in

Rainfall Intensity Graph



Runoff Hydrograph



Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft^2)	Minimum Pipe Cover (ft)
1	Jun-01	916.00	924.00	8.00	916.00	0.00	924.00	0.00	0.00	0.00

Junction Results

SN	Element ID	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Max HGL Elevation Attained (ft)	Max HGL Depth Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)	Time of Max HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Jun-01	10.81	0.00	917.99	1.99	0.00	6.01	917.12	1.12	0 12:00	0 00:00	0.00	0.00

Pipe Input

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (ft)	Pipe Width (ft)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate	No. of Barrels
1	Link-01	47.30	917.00	1.00	914.50	914.50	2.50	5.2900	CIRCULAR	1.500	1.500	0.0150	0.5000	0.5000	0.0000	0.00	No	1

Pipe Results

SN	Element ID	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Froude Number	Reported Condition
1	Link-01	10.81	0 12:00	20.93	0.52	50.00	0.02	0.87	0.58	0.00		Calculated

Storage Nodes

Storage Node : Pond1

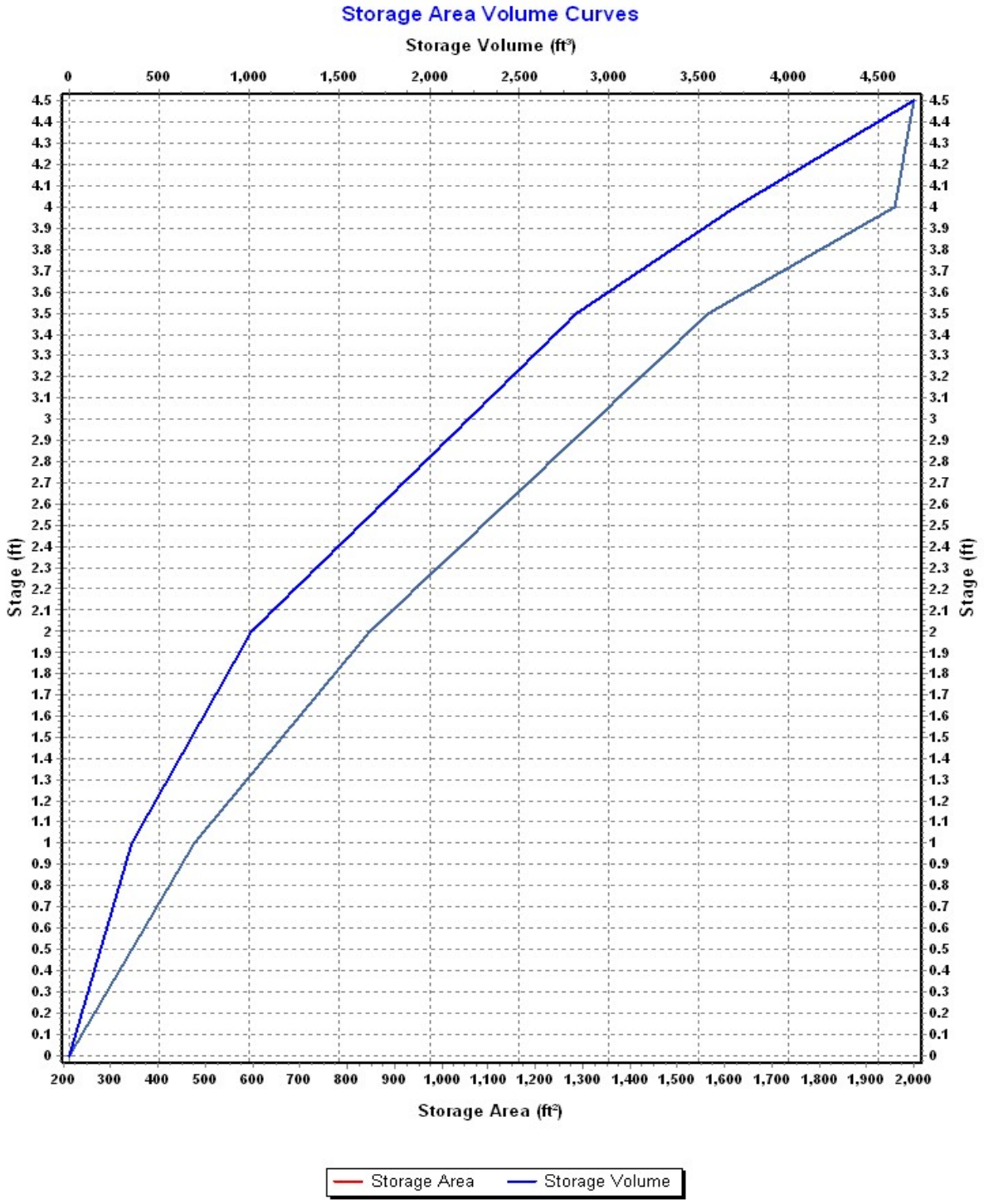
Input Data

Invert Elevation (ft)	921.00
Max (Rim) Elevation (ft)	926.00
Max (Rim) Offset (ft)	5.00
Initial Water Elevation (ft)	921.00
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	0.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : Rain Garden

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	212.88	0.000
1	478.86	345.87
2	848.71	1009.66
3.5	1566.50	2821.07
4	1960.28	3702.77
4.5	2000	4692.84


Storage Area Volume Curves
Storage Volume (ft³)
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
4,500
Stage (ft)
Stage (ft)
Storage Area (ft²)
200
300
400
500
600
700
800
900
1,000
1,100
1,200
1,300
1,400
1,500
1,600
1,700
1,800
1,900
2,000
Storage Area
Storage Volume

Storage Node : Pond1 (continued)

Outflow Weirs

SN	Element ID	Weir Type	Flap Gate	Crest Elevation (ft)	Crest Offset (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
1	Weir-01	Trapezoidal	No	925.50	4.50	100.00	0.50	3.33

Outflow Orifices

SN	Element ID	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (ft)	Rectangular Orifice Height (ft)	Rectangular Orifice Width (ft)	Orifice Invert Elevation (ft)	Orifice Coefficient
1	RG-4in	Side	CIRCULAR	No	0.33			922.00	0.61
2	RG4in(01)	Side	CIRCULAR	No	0.33			922.00	0.61
3	RG-8in	Side	CIRCULAR	No	0.50			924.50	0.61

Output Summary Results

Peak Inflow (cfs)	6.19
Peak Lateral Inflow (cfs)	6.19
Peak Outflow (cfs)	2.31
Peak Exfiltration Flow Rate (cfm)	0.00
Max HGL Elevation Attained (ft)	925.42
Max HGL Depth Attained (ft)	4.42
Average HGL Elevation Attained (ft)	922.85
Average HGL Depth Attained (ft)	1.85
Time of Max HGL Occurrence (days hh:mm)	0 12:09
Total Exfiltration Volume (1000-ft³)	0.000
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

Storage Node : Pond2

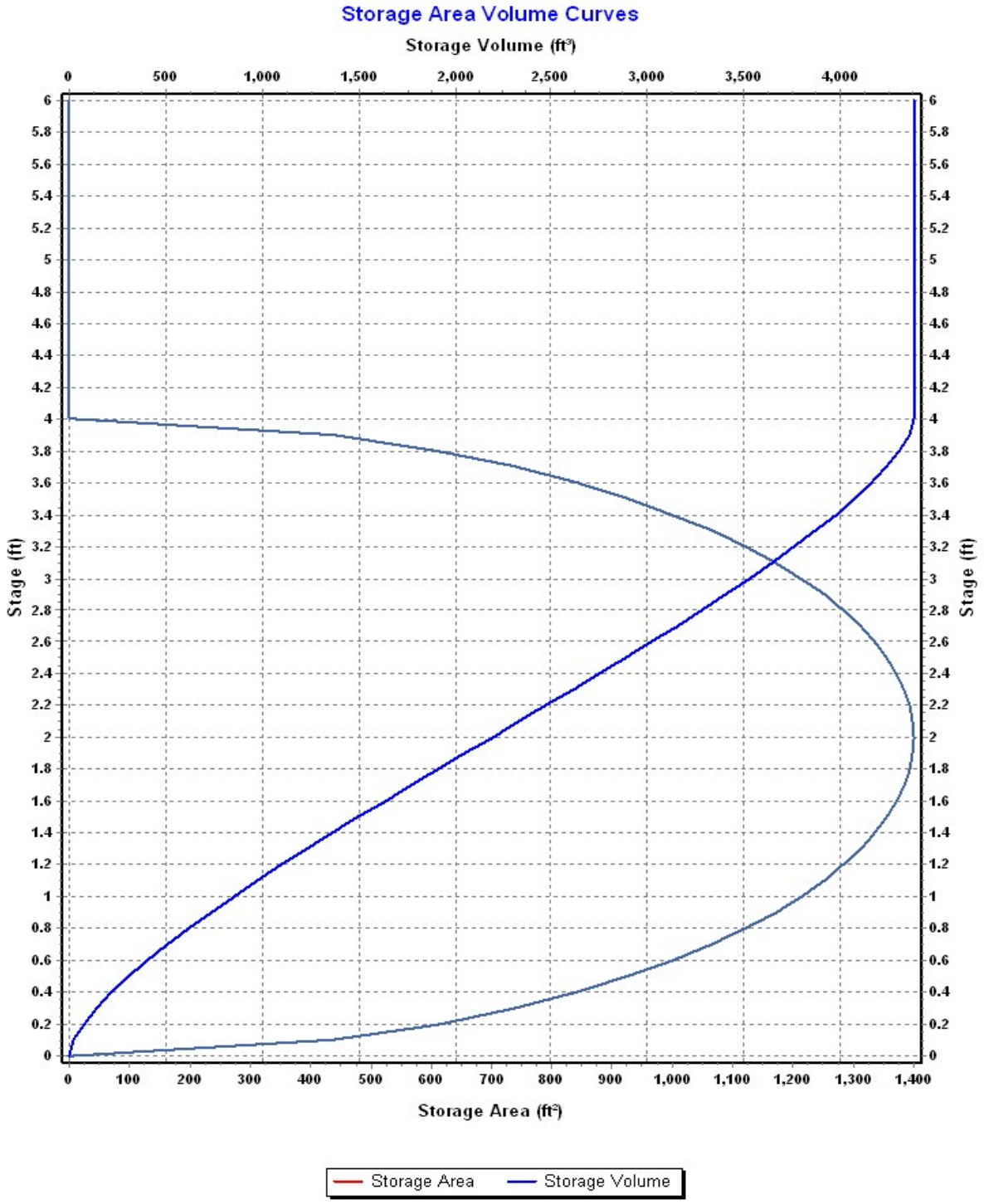
Input Data

Invert Elevation (ft)	916.00
Max (Rim) Elevation (ft)	923.00
Max (Rim) Offset (ft)	7.00
Initial Water Elevation (ft)	916.00
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	0.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : 48in

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	0.0000	0.000
0.1	437.1499	21.86
0.2	610.2459	74.23
0.3	737.4958	141.62
0.4	840.0000	220.49
0.5	926.0130	308.79
0.6	999.8000	405.08
0.7	1063.9079	508.27
0.8	1120.0000	617.47
0.9	1169.2305	731.93
1	1212.4356	851.01
1.1	1250.2400	974.14
1.2	1283.1212	1100.81
1.3	1311.4496	1230.54
1.4	1335.5149	1362.89
1.5	1355.5442	1497.44
1.6	1371.7143	1633.80
1.7	1384.1604	1771.59
1.8	1392.9824	1910.45
1.9	1398.2489	2050.01
2	1400.0000	2189.92
2.1	1398.2489	2329.83
2.2	1392.9824	2469.39
2.3	1384.1604	2608.25
2.4	1371.7143	2746.04
2.5	1355.5442	2882.40
2.6	1335.5149	3016.95
2.7	1311.4496	3149.30
2.8	1283.1212	3279.03
2.9	1250.2400	3405.70
3	1212.4356	3528.83
3.1	1169.2305	3647.91
3.2	1120.0000	3762.37
3.3	1063.9079	3871.57
3.4	999.8000	3974.76
3.5	926.0130	4071.05
3.6	840.0000	4159.35
3.7	737.4958	4238.22
3.8	610.2459	4305.61
3.9	437.1499	4357.98
4	0.0000	4379.84
5	0	4379.84
6	0	4379.84


Storage Area Volume Curves
Storage Volume (ft³)
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
Stage (ft)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
3
3.2
3.4
3.6
3.8
4
4.2
4.4
4.6
4.8
5
5.2
5.4
5.6
5.8
6
Storage Area (ft²)
0
100
200
300
400
500
600
700
800
900
1,000
1,100
1,200
1,300
1,400
Storage Area
Storage Volume

Storage Node : Pond2 (continued)

Outflow Weirs

SN	Element ID	Weir Type	Flap Gate	Crest Elevation (ft)	Crest Offset (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
1	Weir-02	Trapezoidal	No	922.50	6.50	50.00	1.00	3.33

Outflow Orifices

SN	Element ID	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (ft)	Rectangular Orifice Height (ft)	Rectangular Orifice Width (ft)	Orifice Invert Elevation (ft)	Orifice Coefficient
1	48in-12	Side	CIRCULAR	No	1.25			919.75	0.61
2	48in-6in	Side	CIRCULAR	No	0.67			916.00	0.61

Output Summary Results

Peak Inflow (cfs)	9.37
Peak Lateral Inflow (cfs)	9.37
Peak Outflow (cfs)	9.36
Peak Exfiltration Flow Rate (cfm)	0.00
Max HGL Elevation Attained (ft)	921.41
Max HGL Depth Attained (ft)	5.41
Average HGL Elevation Attained (ft)	917.61
Average HGL Depth Attained (ft)	1.61
Time of Max HGL Occurrence (days hh:mm)	0 12:00
Total Exfiltration Volume (1000-ft³)	0.000
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0.00

EXHIBIT H

BMP ANALYSIS

Renaissance Infrastructure Consulting

WORKSHEET 1: REQUIRED LEVEL OF SERVICE - UNDEVELOPED SITE

Project:	19-0143 Medical Office Building	By:	CMK	Date:	8/6/2019
Location:	Roeland Park, Kansas	Checked:		Date:	

1. Runoff Curve Number

A. Predevelopment CN

Cover Description	Soil HSG	CN	Area (ac.)	Product of CN x Area
Pasture, Fair	D	84.0	1.9	155.4
Parking lots, roofs, streets w/ sewer, water, etc	C	98.0	0.8	82.3
		Totals:	2.7	237.7

Area-Weighted CN = total product/total area = 88.0

B. Postdevelopment CN

Cover Description	Soil HSG[1]	CN	Area (ac.)	Product of CN x Area
Pasture, Fair	D	84.0	0.4	33.6
Parking lots, roofs, streets w/ sewer, water, etc	C	98.0	1.7	166.6
Native grass	D	78.0	0.6	46.8
		Totals:	2.7	247.0

[1] Postdevelopment CN is one HSG higher for all cover types except preserved vegetation, absent documentation showing how postdevelopment soil structure will be preserved.

Area-Weighted CN = total product/total area = 91.0

C. Level of Service (LS) Calculation

Predevelopment CN:	88
Postdevelopment CN:	91
Difference:	3
LS Required (see scale at right):	5

Renaissance Infrastructure Consulting

WORKSHEET 2: DEVELOP MITIGATION PACKAGE(S) THAT MEET THE REQUIRED LS

Projec 19-0143 Medical Office Building By: Date: 7/31/2019
Locati Roeland Park, Kansas Checked: Date:
Sheet 1 of 1

1. Required LS (New Development, Wksht 1) or Total VR (Redevelopment, Wksht 1A): 5.00

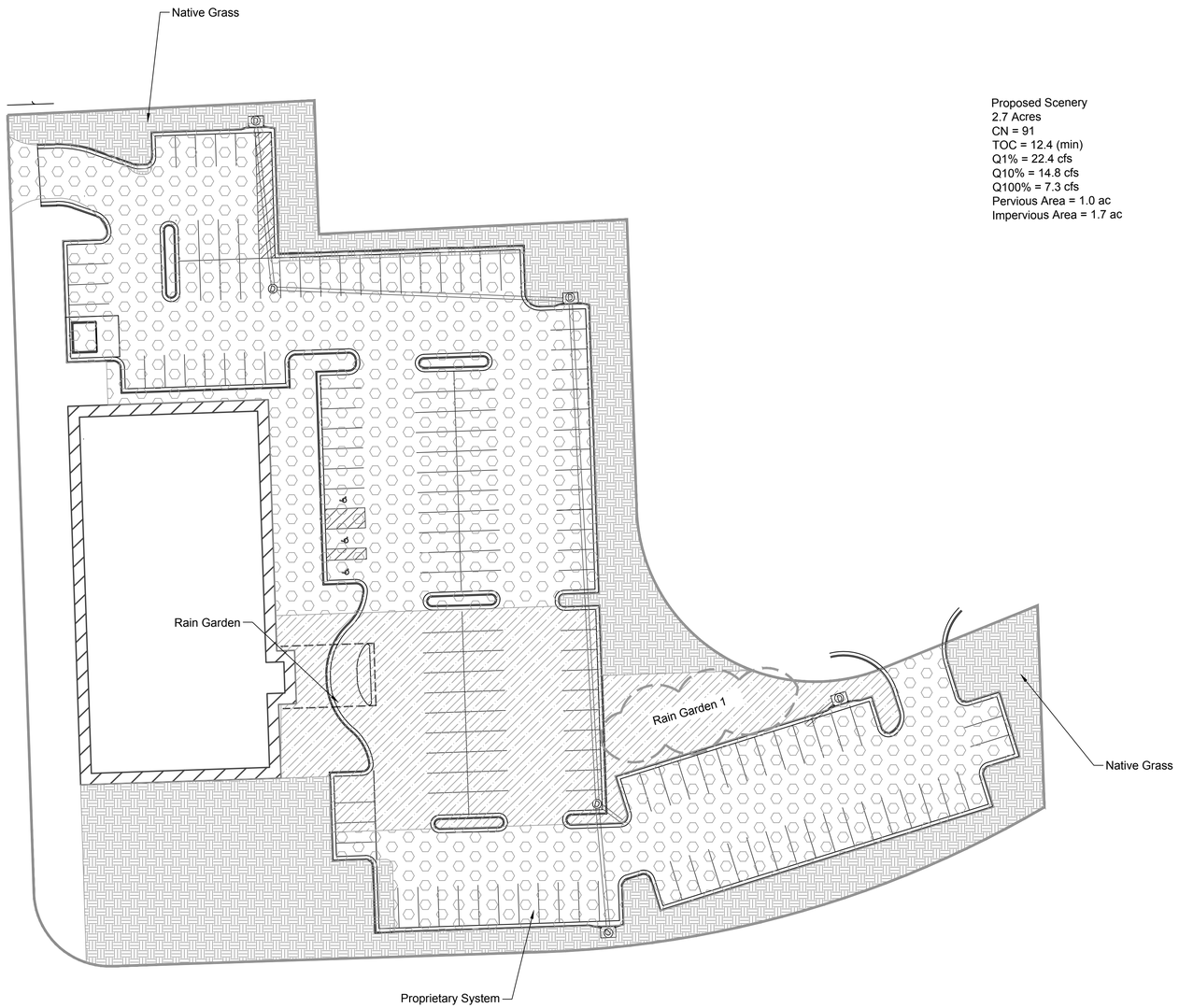
Note: Various BMPs may alter CN of proposed development, and LS; recalculate bith if applicable.

2. Proposed BMP Option Package No. 1

Cover/BMP Description	Treatment Area	VR	Product of VR x Area
Native Vegation	0.6	9.3	5.7
Rain Garden	0.4	9.0	3.6
Pavement	0.6	-	-
Proprietary System	1.1	4.0	4.4
.			
Total[2]:	2.7	**Total:**	13.7
		***Weighted VR:**	5.1 = total product/total area

[1] VR calculated for final BMP only in Treatment Train
[2] Total treatment area cannot exceed 100 percent of the actual site area
* Blank in Redevelopment

Meets required LS (Yes/No)? Yes (If No, or if additional options are being tested, proceed below)



Proposed Scenery
2.7 Acres
CN = 91
TOC = 12.4 (min)
Q1% = 22.4 cfs
Q10% = 14.8 cfs
Q100% = 7.3 cfs
Pervious Area = 1.0 ac
Impervious Area = 1.7 ac

LEGEND

Native Vegetation
Area = 0.6 ac

Rain Garden
Area = 0.4 ac

Proprietary System
Area = 1.1 ac

N O R T H

1"=20'

0 10' 20'

Sheet
1 of 1

Sunflower Medical Office Building

19-0143
Sunflower Medical Office Building

BMP Analysis

NO	BY	DATE	REVISION
XXX	XXX	XX/XX/XX	ORIGINAL SUBMITTAL

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