CITY OF MISSION PLANNING COMMISSION

AGENDA

August 24, 2020

7:00 PM

Virtual Through Zoom

(Instructions for accessing the meeting will be
posted to the city's website the day of the meeting)

1. Call to Order

2. Approval of Minutes from the July 27, 2020 Meeting

3. New Business

   A. Case # 20-03 Preliminary Development Plan - 5399 Martway Street - Lot 3 and 4 of the Mission Martway Plat
   An application for Preliminary Development Plan for an approximately 164 unit apartment building at 5399 Martway Street.
      a. Staff Report
      b. Letter from the applicant
      c. Site Plan
      d. Elevations
      e. Review of Traffic Study (GBA - On Call Engineers for City)
      f. Traffic Study
      g. Review of Stormwater Study (GBA - On Call Engineers for City)
      h. Letters from Interested Parties Regarding the Project.

4. Old Business

5. PC Comments

6. Staff Updates

Questions concerning this meeting may be addressed to staff contact,
Kaitlyn Service, Planner, at (913) 676-8366 or kservice@missionks.org.

MINUTES OF THE PLANNING COMMISSION MEETING
JULY 27, 2020

Virtual Through Zoom

DRAFT

The regular meeting of the Mission Planning Commission was called to order by Chairman Mike Lee at 7:06 PM Monday, July 27, 2020. Members also present: Pete Christiansen, Jordon McGee, Robin Dukelow (arrived after roll call and approval of minutes), Stuart Braden, Charlie Troppito and Frank Bruce. Burton Taylor and Brad Davidson were absent. Also in attendance: Brian Scott, Assistant City Administrator, Kaitlyn Service, Planner, and Audrey McClanahan, Secretary to the Planning Commission.

Chair Lee: Our meeting tonight is being held virtually via Zoom. Commissioners, staff, and the applicant are still joining us remotely. The public is invited to participate by using the instructions included in the Planning Commission calendar item listed on the front page of missionks.org. Public participants will be allowed to make public comment through the comments feature. Please note that comments are visible by all participants. If you wish to make a public comment, please state your name and city of residence for the record. Please be conscientious of others trying to speak and speak slowly and clearly. If I need to confirm something that may have been difficult to hear, I will ask for clarification. With that, we will start the meeting.

Approval of Minutes from the April 27, 2020 Meeting

Comm. Braden moved and Comm. Bruce seconded a motion to approve the minutes of the April 27, 2020, Planning Commission meeting.

The vote was taken (6-0). The **motion carried**.

New Business

Case #20-04 Non-Conforming Situation Permit – 6350 Johnson Drive

Mr. Scott: I'm going to hand this over to our planner. She's going to present the report for you. Kaitlyn, take it away.

Ms. Service: This is an application for a non-conforming situation permit for the property located at Johnson Drive and Russell Street, formerly Qdoba, before that it was Schlotzsky's. They are seeking a non-conforming situation permit, similar to one that we've seen recently with Johnny's Barbecue. The property is currently developed with a one-story building that was built in 1993. The applicant would like to convert it to a Taco Bell. As proposed, the property will remain really similar to how it was when it was Qdoba, with some changes to the exterior that are outlined in the Planning Commission packet, including the re-installment of the drive-through window, which was there with Schlotzsky's. Qdoba removed the drive-through window for a couple years, and then, this application proposes to reinstall the drive-through window. The building is non-conforming to the Form Based Code for the West Gateway that applies to the property. This is Box X. The Form Based Code envisions a multi-story building with retail on the first floor, residential and office space on the upper floors. It also suggests some townhomes along Russell Street. So, essentially, it envisions a two to four story building with some

townhouses on that residential street, with some parking in the interior of the lot. Since the applicant is just requesting to keep the existing building and continue to use it as is, just wants that building permit to invest in the property and convert it into the Taco Bell. They are not redeveloping the entire parcel. That's the reason that they're seeing the non-conforming situation permit. Since the repairs and renovations exceed 10 percent of the structural value, this is the process for them to be able to move forward with that.

The Planning Commission packet includes site plan information, elevations showing exterior changes to the building. There are photometric lighting plans, landscaping plan. We can get into those if there are any questions on anything specifically there. Also, I believe the applicant is here with us, and she had sent us a PowerPoint, if the Planning Commission would like to hear that.

Chair Lee: Yes, go ahead.

[Accessing/loading PowerPoint]

Aaron March, Attorney with Rouse Frets White Goss Law Firm, appeared before the Planning Commission and made the following comments:

Mr. March: I'm here today on behalf of the applicant. We are seeking approval of the non-conforming situation permit, essentially because we want to invest more than 10 percent of the current value of the property. I can't see the slides on my screen.

[Adjusting screen]

Mr. March: What I have here are simply slides of the existing facility. Brian, if you wouldn't mind going through those.

Mr. Scott: Yeah, showing the front of the building right now.

Mr. March: What we are talking about doing is, if you will, re-skinning the building. We're not changing the footprint. We're keeping the patio. We're taking off all the things that made this a Qdoba and converting it into what will look like the new, modern iterations of Taco Bell. I thought it was important for you to see the building and see that the drive-through, there's plenty of stacking for cars for the drive-through, parking is existing. This is an allowed use, and if we were only spending less money, we wouldn't need to come in and get the approval of the non-conforming situation permit. But, our investment is about $350,000 on the shell improvements and the landscaping. If there are specific questions you have on the operations, we've got Chris Czyz with the developer here, Rosa Paddock and Karissa Pankratz. They're the architect and landscape architect. We'd be happy to discuss with you the specifics of the architecture and design, and that was included within your packet.

Immediately to our east is a CVS, to the west is Starbucks, so it's not that we won't fit in with the existing environment there. We'd like to make the investment and would ask for your approval. I'd be happy to answer any questions that you might have.

Chair Lee: Thank you.

Comm. Troppito: Mr. Chair, I have a question about the traffic pattern, ingress and egress on Russell Avenue. Is that going to change from what it is now?

Mr. March: No. On site plan #1, it shows the existing curb cut off of Russell Avenue, where it is today. And then, the connection to the east that goes to the CVS lot. So, the traffic situation would be exactly the same.

Comm. Troppito: Thank you.

Chair Lee: Other questions?

Comm. Dukelow: I have a question regarding the drive-through. I recall several years ago when there was a Taco Bell, I think it was, in the location where Starbucks is currently. There was an ongoing issue, I'll say, with the drive-through, because it was immediately adjacent to a resident. I was in the area just a couple days ago and I deliberately drove through that Starbucks location, and it seems that their speaker is, it's probably a better quality than the speaker was when we had that issue several years ago. I'm just wondering what the ordinance is at this time for the locations. I also want to acknowledge that there's quite an elevation change between the former Qdoba property and Russell. Like I said, there's a huge elevation change, and there's also trees along that side, so I don't anticipate there would be an issue with the drive-through speaker, but I wanted to bring that up for consideration. Is there currently any sort of ordinance for the distance of a drive-through speaker when adjacent to residential property?

Mr. Scott: No, there is nothing in the codes right now that speaks directly to a drive-through speaker, a speaker for a drive-through restaurant. I think we have some provisions that may speak more to music being played kind of business. Sometimes restaurants will play music outdoors, or you might have, like a loudspeaker system for a particular establishment. You know, so-and-so in line three type of thing, an announcement system. We do, to a certain degree, try to regulate that. I don't believe that's in the proposal before you tonight. It's just the drive-through speaker. If that's something that would be… I would be hard pressed, if anybody would complain about hearing that, if that was an issue, we would probably just address that with management, see if there's something they could do to turn down the volume of that a little bit. There is the elevation, like you said, there is a wall there, a retaining wall that kind of holds up Russell Avenue, for lack of a better term, on that site. And then, directly to the north, I believe there is an office building. Brill's office building. I don't know that there's any real close by residential other than what's on the other side of Russell, just behind the Starbucks. That would be the closest residential.

Ms. Dukelow: Right. I believe there's just one property, maybe two, that would be even considered adjacent.

Mr. Scott: Yeah.

Chair Lee: Brian, did the Qdoba not have a drive-through?

Mr. Scott: The Qdoba restaurant did not have a drive-through.

Chair Lee: I know Schlotzsky's did originally, but it was on the other side, the other elevation, wasn't it?

Mr. Scott: Correct. The Schlotzsky's did, but when Qdoba moved in, they took out that drive-through. That was not a component of their operation.

Chair Lee: Other questions of the applicant? [None.]

Mr. Scott: Do you all have the proposed motion that was sent earlier today?

Chair Lee: Yes.

Comm. Troppito: I'll make a motion of approval. I move that the Planning Commission approve the non-conforming situation permit for Application No. 20-04, allowing the applicant to make modifications to the exterior façade of the building at 6350 Johnson Drive, including installation of a drive-through window, once applicable building permits have been reviewed and issued.

Comm. Braden: Second.

The vote was taken (7-0). **The motion passed.**

Mr. March: Could I just interject? It's been a pleasure working with your staff on this. These are challenging times, and Bruce and Kaitlyn made this as painless as you can make this type of application, and the comments that we received from them were constructive, and I think resulted in a better site plan and a better project. So, thank you very much.

Old Business

Chair Lee: Any old business, Brian?

Mr. Scott: No.

Comm. Dukelow: May I ask a question? I was going to ask about the old Johnny's site. Is The Other Place still planning to occupy that?

Mr. Scott: No. The Other Place did not exercise their option to purchase the property.

Chair Lee: Oh. I was wondering why the For Sale sign was there.

Mr. Scott: Yeah, as you'll recall, we did that back in February, I believe, and it was right on the cusp of this whole pandemic. Just with the pandemic coming on and all the stay-in-place orders, and bars having to close and everything, they really saw a drop in their business at their other locations. They just decided that it would not be financially feasible at this time to purchase that property and open up another restaurant. That's kind of where we're at. We've had some folks call and inquire about the property. I think we may have a potential applicant looking to do something with that. I just heard about it today, so I don't have a whole lot of information on that.

Chair Lee: The apartments by Rock Creek, are those proceeding? What's the status on that?

Mr. Scott: Yes. They submitted their application for a preliminary development plan a few weeks ago. Kaitlyn and I have reviewed those plans, sent comments back. I just received our engineer's report on the stormwater and transportation review. I didn't get a chance to read it today, I was going to do it tomorrow, then send comments back to the applicant. They are proceeding towards the August 24th meeting. That's really their goal. I think they will probably hit that. If you've been following that, it's a Sunflower group. They are a pretty reputable developer here in the Kansas City area, really the larger Midwest. They've done projects in St. Louis, I think maybe Denver, Omaha. They are based here in Kansas City, and a lot of their projects are primarily multifamily. They've kind of developed a market niche for taking older properties in more densely urban areas and refurbishing them using historic tax credits, into, like, loft apartments, or some kind of apartments. That market has started to dry up a little bit for them, so they're looking for other projects, more out in the suburbs. They saw an opportunity with the Mission Bowl site for a potential multifamily project. It would be about 160 apartment units, kind of a mix of one bedroom, two bedroom, and studio-type apartments. It would have all the amenities that we've seen with some of the other applications of recent. There would actually be a pool on the top deck of the building, and outdoor pool, a workout facility, a general lounge setting with a large screen television, gourmet type of kitchen for the residents. Some of those types of amenities. That would be, like I said, at the old Mission Bowl site at 5399 Martway. We did a neighborhood meeting with the neighbors that lived behind the property, probably two months ago? Kaitlyn? Something like that.

Ms. Service: Yes.

Mr. Scott: I did not participate in that meeting, I was actually on vacation that week, but Kaitlyn and Laura did. They thought it went relatively well, and of course, there are folks who have lots of questions about what's being built in their back yard. Yeah, I think they're more curious than anything else. I didn't really sense an overwhelming feeling of opposition to the project.

Comm. Braden: Okay. How many stories?

Mr. Scott: They're asking for five. They want to basically build a building up and put parking on the ground floor, then four stories of apartment units.

Comm. Troppito: How far along are they on financing of this project?

Mr. Scott: That's a good question. I don't know that they've actually talked to a lender yet. I know they had some lenders that were interested.

Comm. Troppito: But no commitment yet, right?

Mr. Scott: I don't think there's any formal commitment on construction loan yet, not. There are some banks here in Mission that caught wind of what is being proposed and have gone so far as to reach out to the developer and say they are interested in giving a construction loan.

Comm. Troppito: Yes. That's why I asked.

Mr. Scott: That's my understanding. That's what the developer has told me.

Comm. Troppito: Which leads me to another point, when it's time to discuss it, I guess, under PC comments. I have a brief point to make about the Gateway project. Then or now?

Chair Lee: Go ahead. You've got the floor.

Comm. Troppito: Okay. Well, I suppose everyone has reviewed the KC Star article about the Gateway project. Of course, it was all Mission-centric, being about the Mission project, but the discussion, you know, which was reasonable, but the discussion I think really should have looked out a little bit further across the country, and across the state of Kansas. I mean, there are just literally thousands of construction projects on hold now, waiting construction. Why I bring that up is because in looking at that article on line, there were a lot of public comments there that I think dealt with some misconceptions, going way back to when the old Mission Mall was closed. Anyway, the main point is, if anyone cares to go to ConstructionConnect.com\delayed-projects, you will see a map, and you can click on any state in the United States and it will bring up a whole list of delayed projects, including those in the state of Kansas. So, the point is that Mission Gateway's issues with financing certainly aren't anything out of the ordinary with what's going on across the country related to coronavirus. It is having a financial impact on these construction projects. That's a point I think the City needs to make.

Mr. Scott: Yes, very much so. I try to bring that point home anytime I talk to somebody about the project. It's a complicated project with a lot of twists and turns, and COVID has really thrown it for a loop.

Comm. Troppito: Well, again, that's ConstructionConnect.com\delayed-projects. I'll send you the link, Brian.

Mr. Scott: Okay. Thank you for sharing.

Chair Lee: Very good.

Staff Updates

Mr. Scott informed the Commission that August 6 will be the first meeting with the steering committee to kick off the Comprehensive Land Use Plan update. The consultants will create a webpage regarding that plan update.

Comm. Troppito brought up environmental data reports. He requested staff look into the cost of acquiring such report. He would like to explore the cost of gaining online access for the City as a whole.

Comm. Dukelow brought up the corner of Lamar and Martway. Mr. Scott said it will be addressed in the near future.

ADJOURNMENT

With no other agenda items, **Comm. Dukelow moved and Comm. Christiansen seconded a motion to adjourn.** (Vote was unanimous). The **motion carried**. The meeting adjourned at 7:36 P.M.

MINUTES OF THE PLANNING COMMISSION MEETING
JULY 27, 2020

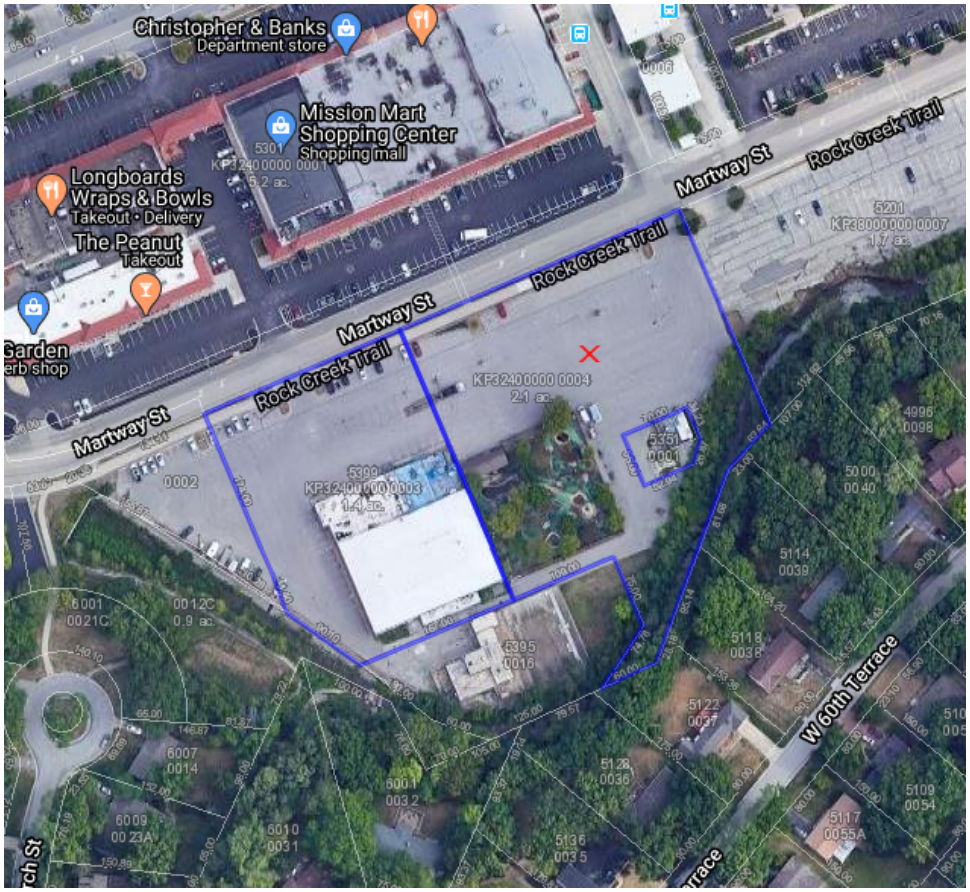
_____
Mike Lee, Chair

ATTEST:

_____
Audrey McClanahan, Secretary

STAFF REPORT
Planning Commission Meeting August 24, 2020

AGENDA ITEM NO.:	3-A.
PROJECT NUMBER / TITLE:	Application # 20-03
REQUEST:	Preliminary Development Plan for Mission Bowl Apartments
LOCATION:	5399 Martway St. - Lots 3 and 4 of Mission Mart Plat
APPLICANT:	Banks Floodman, Mission Apartments, LLC 901 New Hampshire St., Suite 201 Lawrence, KS 66044
PROPERTY OWNER:	Ridgeview North Associates LLC 5426 Martway St. Mission, KS 66205
STAFF CONTACT:	Kaitlyn Service, City Planner
ADVERTISEMENT:	8/4/20- The Legal Record newspaper
PUBLIC HEARING:	Planning Commission meeting, August 24, 2020



PROPERTY INFORMATION AND PROJECT BACKGROUND

The subject property, addressed as 5399 Martway, comprises two lots located near the southeast corner of Nall Avenue and Martway Street. The subject property is the site of the former Mission Bowl bowling alley and miniature golf course, constructed in 1958. The structure was severely damaged in a fire in 2015. Subsequent litigation impeded the restoration of the structure. The City declared the structure unsafe in December of 2019 and ordered that it be repaired or demolished.

The pending litigation involving the property was resolved earlier this year, and Ridgeview North Associates, LLC, owner of the adjacent Mission Mart shopping center, took control of the property. Ridgeview North has a contract pending to sell two of the lots that comprise the property to Mission Bowl, LLC (a development corporation created by the Sunflower Development Group) for the purpose of redeveloping the property into a multi-family housing project. Ridgview would keep the most westerly lot for overflow parking associated with the shopping center across the street. There is a cell tower, and associated equipment, located on the east side of the subject property. This cell tower is a separate parcel and not part of this arrangement.

The applicant, Mission Bowl, LLC, has now submitted a preliminary development plan to the City for the construction of a Class A, five-story apartment building on the two lots (approximately 3.45 acres) that it intends to purchase. Ground floor uses fronting Martway Street will include live-work units, lobby and leasing office, a screened parking garage, and parks. The proposal aims to create a linear park experience along the existing Rock Creek Trail by adding trees, landscaping and pedestrian amenities where none currently exist. A pocket fitness park and a small pocket dog park are proposed for the west side of the building. In addition to the garage parking on the first floor of the building, a surface parking lot is proposed behind the building.

Approximately 164 apartments will be located on floors two thru five. The apartments will be a complement of two bedroom, one bedroom, and studio units. Various resident amenities including theater room, fitness area, and clubhouse will also be located on these floors. And, a rooftop pool and patio is proposed for a portion of the fifth floor toward the back of the building.

The overall design of the building is intended to emulate some of the architectural characteristics found throughout downtown Mission including the strong horizontal lines, archways, brickwork and color palette found on many of the buildings along Johnson Drive and elsewhere. The building's location will offer access within walking and biking distance to many of the businesses and amenities within downtown Mission.

APPLICABLE COMPREHENSIVE LAND USE PLAN, MASTER PLANS, AND ZONING

The property is studied in the Comprehensive Plan, Rock Creek Redevelopment Plan, East Gateway Redevelopment Plan, and Smart Moves 3.0 Regional Transit Plan.

Comprehensive Land Use Plan

The Comprehensive Plan designates the site as future Medium-Density Mixed Use. This category primarily consists of medium-density attached residential housing, such as apartment dwellings. Additional uses include live-work, offices, and limited retail stores.

The Plan envisions a pedestrian-friendly area with Floor Area Ratios of 1.0 to 3.0. The district is intended to serve as a transition zone between low-density, residential neighborhoods and

areas of higher intensity development.

The proposed project is an apartment building with live-work spaces and a Floor Area Ratio of 1.05. Multi-family housing at this location would serve as a transition zone between the existing single-family residences to the south and higher intensity uses at the Mission Mart and Security Bank to the north. The proposal is in conformance with the intent of the Comprehensive Plan.

Floor Area Ratio

The floor area ratio (FAR) is the relationship between the total amount of usable floor area that a building has and the total area of the lot on which the building stands. A low ratio indicates auto-oriented design. A higher ratio indicates pedestrian-oriented design.

Walkable downtowns and healthy transit generally require FARs to be at least 1.0 to 3.0. FARs less than about 1.0 are thought to increase auto dependence and compromise walkability. A FAR of at least 1.0 is considered ideal for creating transportation choices.

For reference, the Target in Mission has an approximate FAR of 0.34. Mack True Value Hardware has an approximate FAR of 1.0.

$$\text{Floor Area Ratio} = \frac{\text{Total Building Floor Area}}{\text{Gross Lot Area}}$$

Rock Creek Redevelopment Master Plan

The Rock Creek Redevelopment Master Plan plan notes that the Mission Bowl property "provides redevelopment opportunities as it is largely covered by surface parking lots." While the area is currently a "sea of surface parking," the Plan views every redevelopment project as an opportunity to foster an active, pedestrian-friendly streetscape and reverse the trend of impermeability and storm water runoff. The Plan emphasizes a public realm and green infrastructure principles.

<u>Public Realm</u>

The Rock Creek Redevelopment Master Plan states that the success of the area is dependent upon a strongly defined public realm. Public realm comprises the streets, parks, green spaces and other outdoor places that are available for everyone to use. Public realm does not exist in isolation but in the context of its adjacent buildings, their uses and its location in a wider network of public and private space. The three key elements that influence the public realm are:

1. The Public Realm Itself - The Rock Creek Trail borders the Mission Bowl property on the north side. The proposed development aims to create a true linear park experience for pedestrians along this portion of the trail, rather than the feeling of simply walking on a wide sidewalk. Linear park features along the trail, such as landscaping, benches, planters, shade trees, bicycle racks, and pocket parks, are proposed to align with the city's vision of an "activated" street.

2. Buildings that Define the Public Realm - The plan encourages mixed-use buildings to capitalize on the existing personalized scale of the Johnson Drive Corridor. In the absence of ground floor public/commercial uses, the proposal uses the following building design techniques to aim for a vibrant pedestrian experience:

- Along Martway Street, 75% of the frontage is devoted to occupy-able live/work spaces, leasing office, and resident clubhouse amenities.
- The first floor of the building facade incorporates a large expanse of glass to

reinforce a sense of activity within that engages the pedestrian and provides a sense of safety.

- First floor patios and upper level balconies serve as "outdoor living rooms," encourage direct or indirect social interaction, and foster community connectedness.
- The proposed building incorporates architectural elements that relate to the human scale, such as the patios and entrances of the live-work units.
- A concentration of building details at sidewalk level creates visual interest and enhances the pedestrian environment.
- Proposed building is oriented to Martway Street and built to the build-to line. Parking is sited behind the building in the interior of the lot.

3. People who inhabit the public realm and the way they use the space - A vibrant public realm encourages residents to explore and experience their community. It also contributes to the city's competitiveness and the image of the city, attracting people to live, work, and visit Mission.

Green Infrastructure

The Rock Creek Redevelopment Master Plan acknowledges that when original development replaced native plant material with concrete, it increased flooding potential and put pressure on the city's stormwater infrastructure. Employing stormwater best management practices (BMPs) would reduce pressure on the city's stormwater infrastructure while providing environmental benefits, creating attractive streetscapes, and enhancing livability. The Plan calls for redevelopment that includes:

1. Less Impervious Surfaces - The proposed site improvements would decrease the amount of impervious area on the site by converting 0.47 acres of current impervious surface into landscaping and recreational open space, such as the linear trail park and pocket parks. The Stormwater Report submitted with the preliminary development plan application shows the existing and proposed surface areas:

Table 1: Summary of Surface Area Types[1]

	Impervious Surface	Building	Open Space	Total
Existing	2.99	0.48	0.13	3.60
Proposed	2.08	0.92	0.60	3.60
Change	-0.91	+0.44	+0.47	

[1] All areas in acres

The reduction of impervious areas would reduce peak stormwater runoff, which reduces flood risk, decreases water pollution, and decreases the volume of water handled by the city's stormwater infrastructure.

2. Water Quality - In addition to increased pervious surface and native landscaping,

structural stormwater BMP treatment is proposed to improve water quality. The proposed hydrodynamic separator is engineered to manage stormwater for water quality treatment. According to the Stormwater Report (see attached) a level of service of 1.88 would be achieved for the site, providing a small water quality benefit. The proposed BMPs would be privately maintained by the property owner.

3. Sustainable Techniques and Pedestrian Friendly Environments - Native and/ or drought resistant trees, shrubs, and plantings are proposed for the site. In addition to creating aesthetically pleasing pedestrian environments, landscaping provides shade and creates bio-climatic conditions which reduce heat-island effects and storm water runoff.

East Gateway Redevelopment Plan
When the plan was adopted in 2006, it was expected that the Mission Bowl business would remain. The plan suggests landscaping improvements to the site. The Future Land Use Map designates the Mission Bowl property as "future mixed use".

Overall, the plan calls for higher density mixed-use development and urban housing options. The plan echoes the community's desire for an active, pedestrian friendly, vibrant streetscape with quality landscaping and a strongly defined public realm.

Smart Moves 3.0 Regional Transit Plan
Smart Moves 3.0 is the Kansas City region's long-range plan for transit and mobility. It is a project of the Mid-America Regional Council (MARC) and its transit partners, including the agencies that coordinate to provide transit in Mission: Johnson County, Kansas; RideKC; and Kansas City Area Transit Authority (KCATA).

The Plan acts as a blueprint for cities that seek to:
- Support transit with their planning and zoning decisions.
- Empower residents to access jobs via transit.
- Decrease greenhouse gas emissions and other transportation-related pollutants.

The Mission Transit Center, adjacent to the site of the proposed development, is designated as a Mobility Hub because it is a converging point for public transit. Mobility hubs are also areas where there is an intensive concentration of working, living, shopping and/or playing in the form of mixed-use development. The transit-supportive strategies listed below are recommended for development near Mobility Hubs.

1. Parking - The Plan recommends that developments include bicycle parking for residents and employees. The proposed apartment building would include temporary outdoor bicycle parking, long-term indoor bicycle storage, and a bicycle repair station for residents.

The Plan cautions against including an excessive amount of vehicle parking because the spaces add to the cost of development and accelerate the depletion of available land. The number of parking spaces proposed by the application is exactly the minimum number of parking spaces required by city code.

2. Land Use - The Plan recognizes that efficient transit thrives on density. The Plan recommends cities consider density and mixed uses near Mobility Hubs. The proposed

development would increase the density of the parcel. The proposal is predominantly residential with accessory resident workspaces and leasing office.

3. Housing - The Plan notes it is easier for residents to rely on transit to commute or run errands if their homes are located close to transit and mobility hubs. Affordable housing options near transit services will better serve the needs of people who do not have a car, whether as a matter of personal preference or because of limitations (such as insufficient income or inability to drive).

The Plan recommends affordable and multi-housing options near Mobility Hubs. The proposed development would provide approximately 164 multi-family housing units. The City is in discussions with the applicant to consider having a certain number of units leased at a rate that meets the definition of affordable housing.

4. Transportation Options - The Plan suggests considering how well the site integrates with transit, pedestrian, and bicycle access. The site is near the Mission Transit Center, Rock Creek Trail, and walkable downtown, making it well connected to bicycle, pedestrian, and transit facilities.

Zoning Intent

The site is zoned Main Street District 2 "MS2." It is located in the East Gateway Overlay District and subject to the Mission, Kansas *Design Guidelines* for the Johnson Drive Corridor.

The MS2 District is intended to provide development opportunities consistent with the existing character surrounding the core of downtown Mission. MS2 encourages an active streetscape with a pedestrian friendly shopping environment and restricted automobile-oriented uses. The District intends to support the businesses in the downtown area by encouraging residential and office uses within mixed-use buildings.

<u>Surrounding properties are zoned and developed as follows:</u>

- North:"MS2" Main Street District 2
    - Mission Mart shopping center; RideKC Mission Transit Center; Security Bank of Kansas City
- East: "MS2" Main Street District 2
    - Parking lot for Security Bank of Kansas City
- South: "R-1" Single-Family Residential & "MS2" Main Street District 2
    - Single-family homes; Rock Creek; Johnson County Wastewater
- West: "MS2" Main Street District 2
    - Parking lot for The Peanut/ Mission Mart; Birch Park
- Other: "MS2" Main Street District 2
    - An existing land-locked cell tower parcel is surrounded by the subject property.

The East Gateway Overlay District is intended to ensure the City of Mission's downtown as an economically vibrant area with great appeal to area-wide patrons by limiting new auto service businesses, implementing design guidelines, ensuring that any new development or redevelopment is in conformance with the recommendations of the Future Land Use Map in the City's Comprehensive Plan and the HyettPalma's Downtown Action Agenda.

Mission's *Design Guidelines* for the Johnson Drive Corridor are intended to create a vibrant shopping and commercial district with a cohesive identity founded on its historic Mission style precedents, and variants appropriate to the context.

PLAN REVIEW
The zoning code includes regulations on permitted uses, height and area, parking, and development standards, and performance standards. The application complies with a majority of the conventional zoning code stipulations and requests three deviations in accordance with the standards for planned zoning districts.

Planned District and Deviation Requests
The Main Street District 2 "MS2" is a planned zoning district. Mission's planned zoning districts encourage innovative and imaginative development that supports the vision of the community and exceeds the quality of projects developed under conventional zoning. Planned zoning districts provide flexibility for deviations from conventional MS2 development standards when the deviations will:

1. Result in a development of greater quality than a development that conforms to the conventional development standards and

2. Result in a development that more closely aligns with the community vision outlined in the city's master plans, compared to a development that conforms to the conventional development standards.

The following deviations are requested:

Permitted Uses: The MS2 district allows residential uses as a part of a commercial or office building or complex. (§ 410.230(A)(3))

- Residential and office uses are permitted on the ground floor level of mixed-use buildings or complexes in order to support the businesses in the downtown area. (§ 410.220)

- Residential uses shall not consist of more than fifty percent (50%) of the ground level street frontage within any commercial or office building or complex. (§ 410.260(B))

The proposed building is residential with accessory ground-floor leasing office, resident workspaces, and business center. Because the proposed building is primarily residential without traditional office or retail uses, it would require a deviation.

The project narrative offers the following explanation: "In today's shifting retail and office environments, it is crucial to bring new residents closer to existing retail and office spaces, rather than to build more of the same uses that will dilute the vitality of the corridor as a whole." The applicant expresses desire to support, rather than compete with, existing businesses downtown.

When evaluating whether the proposed deviation would result in a higher quality project that better aligns with the community's plans, the following may be considered:

- One goal of the MS2 District is to support the businesses in the downtown area with residential uses.

- The Comprehensive Plan envisions this property will develop into medium-density apartments with accessory live-work spaces.

- The Comprehensive Plan intends for this property to serve as a transition zone between low-density residential neighborhoods and areas of higher intensity development. Multi-family housing at this location would serve as a transition zone between the existing single family residences to the south and higher intensity uses at the Mission Mart and Security Bank to the north. Omission of commercial uses, in favor of residential uses, offers the least potential to be intrusive to adjacent residences.

- The proposed building implements techniques from the Johnson Drive Design Guidelines to mimic the pedestrian-friendly experience of a mixed-use development. A leasing office and resident workspaces, and business center, are proposed for the ground floor behind a clear glass "storefront" appearance.

- The zoning code requires that residential areas in planned zoning districts be planned in a manner that will produce more usable open space, better recreational opportunities, safer and more attractive neighborhoods than under standard zoning and development techniques. The proposed development would add 0.47 acres of open recreational space, including two pocket parks and a linear park along Rock Creek Trail. (§ 405.080(A)(3))

Height and Density:
Height: The MS2 District promotes multi-story structures with top-floor setbacks. (§ 410.220) Conventional MS2 zoning limits building height to 3 stories and/or 45 feet. (§ 410.240(A)(1))

The project narrative states: "A deviation of two stories and 13-15 feet are proposed in order to make the project viable and contribute to the community at the highest level. This slight height deviation leads to a building that is of a suitable massing for the neighborhood. It is the correct size building to complement Mission Mart to the north, Security Bank, at +/- 95 feet tall, and the residential neighborhood to the south, with a ground plane approximately 30 feet above this site."

Density: This minimum lot area per multi-family dwelling is 1,245 square feet per unit (35 units per acre). Under conventional zoning, 121 units would be allowed on the 3.45 acre lot. (§ 410.240(A)(3))

While application materials list the acreage of the site as 3.17 acres, the official plat of the property, which is sealed by a Professional Surveyor and recorded with the Register of Deeds, indicates that actual acreage of the site is 3.45 acres. Additionally, application materials vary in the number of apartment units requested. Several application materials list 164 units, the Traffic Impact Study lists 166 units, and the signed application form lists 160-168.

A deviation of 47 units is required to allow 168 units on the 3.45 acre lot.

When evaluating whether the proposed deviations would result in a higher quality project that better aligns with the community's plans, the following may be considered:

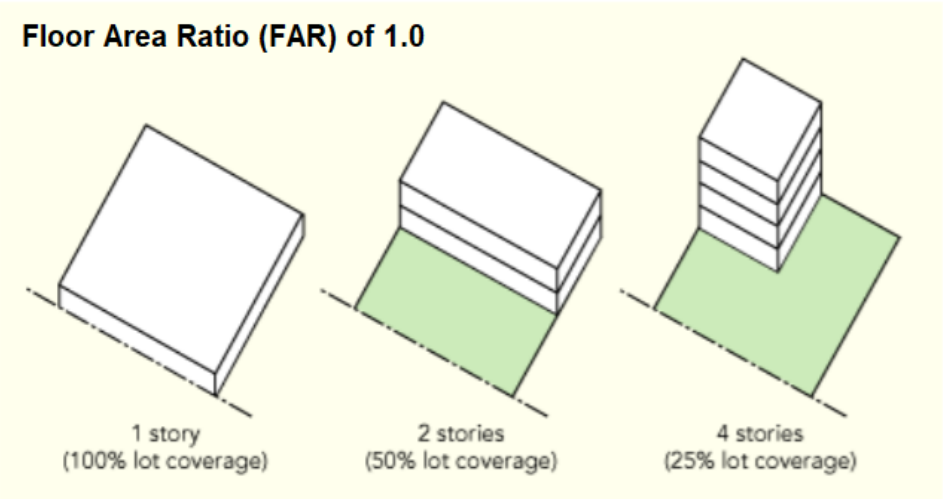
- The Comprehensive Plan envisions a medium density development with a Floor Area Ratio (FAR) of 1.0 to 3.0.
    - The application proposes a FAR of 1.05. This is nearly the lowest density FAR that would conform to the Comprehensive Plan. Development on the lower end of the target FAR range has the least potential to be intrusive to adjacent residences.

    - A minimum FAR of 1.0 without a height deviation would require the building to cover more of the lot, leaving insufficient room for parking. Without a height deviation, a deviation for parking would likely be necessary to achieve the target FAR. The application proposes sufficient parking in exchange for the height deviation.

    - A minimum FAR of 1.0 without a height deviation would require the building to cover more of the lot, depleting the land available for pervious surfaces, such as recreational open space and landscaping. Without a height deviation, increased impervious surfaces would likely be necessary to achieve the target FAR, which would have a negative impact on stormwater management. The application proposes reduced flood risk, decreased water pollution, and decreased pressure on the city's stormwater infrastructure in exchange for the height deviation.

    - A minimum FAR of 1.0 without a height deviation would require the building to cover more of the lot, which would bring the building closer to the residences, the floodplain, and Rock Creek to the south of the property.

Floor area ratio (FAR) *is the ratio of the floor area of a building to the area of the lot on which the building is located. For example, the diagram below illustrates three simple ways that a 1.0 FAR might be reached: one story covering the entire lot, 2 stories covering half of the lot, or 4 stories covering a quarter of the lot all result in the same FAR.*



- The Comprehensive Plan envisions the subject property as a transition zone between the higher intensity development to the north and the low-density residential

neighborhoods to the south.
    - High intensity: The Security Bank building is about 95 feet. The cell tower is about 160 feet.
    - Transition zone: The proposed building is about 58-61 feet.
    - Low intensity: The ground floor of the residences is about 30 feet above the ground floor of the Mission Bowl Property. The application includes a rendering showing the proposed building only slightly above a two-story home to the south of the subject property.

- The East Gateway Redevelopment Plan calls for higher density development and urban housing options.
- Smart Moves 3.0 Regional Transit Plan suggests density near the Mission Transit Center.
- The proposed building implements techniques from the Johnson Drive Design Guidelines to complement the proportion and scale of the surrounding area.
    - The proposed building is designed to reduce its perceived height by dividing the building mass into smaller scale components. The massing and overall configuration of the building is broken down by recessing and projecting elements.
    - Stories beyond the second story are articulated by the use of setbacks and a change of materials to enhance the proportion and scale of the overall façade.
    - The lower level of the building is differentiated architecturally from upper levels.
    - The proposed building incorporates architectural elements that relate to the human scale, such as the patios and entrances of the live-work units.
- Granting this deviation would not waive any other design requirements of the Johnson Drive Design Guidelines, which are also intended to reinforce a pedestrian scale streetscape and architectural styles that are compatible with the Johnson Drive corridor.

No further deviations are requested by the application.

Code Review: Standards of Development
The Planning Commission, in the process of approving the preliminary development plan, may approve use, height, and density deviations upon a finding that all of the following conditions have been met (§ 405.090):

1. The granting of the deviation will not adversely affect the rights of adjacent property owners.

    The requested deviations do not infringe upon the rights of other adjacent property owners to continue to reasonably use their own properties. The proposed development repeats a pattern already established in the surrounding downtown neighborhood of multi-story multi-family housing. Properties to the north, east, and west are commercial. A property within 200 feet of the proposal contains a +/-95 foot tall building. The

proposal is separated from residences to the south by the Johnson County Wastewater facility, Rock Creek, a significant distance, and a significant elevation change. Access easements to the cell tower, Johnson County Wastewater, and Mission Mart / The Peanut parking lot will be provided.

2. That the deviation desired will not adversely affect the public health, safety, morals, order, convenience, prosperity or general welfare.

The Stormwater Study and Traffic Impact Study concluded that the development, including the deviations, can occur without negative impact on stormwater or traffic.

The Traffic Impact Study found that all intersections are projected to operate at an acceptable level of service. The surrounding roadway network already has the adequate geometrics and traffic controls needed to serve the community. In some instances (particularly on evenings and weekends), this proposed residential development will likely create less traffic demand than the former bowling alley and miniature golf course.

The Stormwater Study found that the proposed development would provide the benefit of reducing peak stormwater runoff from the site. Additionally BMPs associated with the development would provide a water quality benefit.

3. The granting of the deviation will not be opposed to the general spirit and intent of this Title.

The requested deviations meet the spirit and intent of the code as discussed in the section above by providing residential uses to support the businesses in the downtown area and maintaining a pedestrian scale through design.

4. That it has been determined the granting of a deviation will not result in extraordinary public expense, create nuisances, cause fraud on or victimization of the public or conflict with existing federal or state laws.

The proposed deviations will not create additional public expense, nuisances, or violate other laws.

Conventional Zoning Code Compliance

Parking: For residential uses, the minimum number of off-street parking spaces shall be provided on the premises as follows:

1. Efficiency apartments — one (1) space per unit.
2. One (1) bedroom units — one (1) space per unit.
3. Two (2) or three (3) bedroom units — two (2) spaces per unit.
4. Four (4) bedroom units — two and one-half (2½) spaces per unit. (§ 410.250(B))

The submitted plan complies with this requirement by providing 197 parking spaces for the 164 units proposed. This includes garage parking on the first floor of the building and a surface parking lot behind the building. Access to the parking area would be from Martway Street. The application proposes:

- Live/Work - 7 Units - 14 parking spaces
- Efficiency - 72 Units - 72 parking spaces
- 1 Bedroom- 59 Units - 59 parking spaces

- 2 Bedroom- 26 Units - 52 parking spaces
- Total - 164 Units -197 parking spaces

Yards: For properties adjacent to properties zoned "R-1", a twenty-five (25) foot building setback from said properties is required. (§ 410.240(A)(2)). The proposed development exceeds the 25 foot setback requirement.

Landscaping: The property does not currently have any landscaping along Rock Creek Trail/ Martway Street or within the parking lot. The application includes a conceptual landscape plan that meets and exceeds the city code requirements listed below. A more detailed landscaping plan will be provided with the Final Development Plan application.

Minimum Tree Requirement: A minimum of one (1) tree is required for each fifty (50) feet of street frontage. This property has 519.08 feet of street frontage. Therefore a minimum of 11 trees are required within the landscaped area along Rock Creek Trail .

In addition, one (1) tree must be provided for every three thousand (3,000) square feet of landscaped open space. The proposal includes 26,136 square feet of open space, therefore 9 trees are required.

In addition, one (1) tree must be provided for each twenty (20) cars of parking area located dispersed in the parking area not at the perimeter. The proposal includes 197 parking spaces, therefore 10 trees are required.

In total, a minimum of 30 trees are required. Trees along Rock Creek Trail and within the parking lot are required to be medium or large deciduous trees, capable of providing shade at maturity. Tree species will be selected in accordance with the "Preferred Tree Species for Northeast Kansas" document published by the Kansas Forest Service.

Planting Requirement Within Parking Lot**:** Not less than six percent (6%) of the interior of a parking lot shall be landscaped. The landscaping and planting areas shall be reasonably dispersed throughout the parking lots. (§ 415 Article III)

Screening: City code requires screening and fencing at the locations noted below.

1. Parking garage
    - A patterned wood tone parking screen is proposed.
2. Swimming pool
    - The fifth floor amenity terrace is proposed to be screened by a wall and climbing perennial evergreen vines.
3. Along the south side/ rear property lines where the property abuts a residentially zoned district
    - Typically, the required screening would include evergreen trees and a solid fence at least six feet tall. However since the ground floor of the residences is about 30 feet above the ground floor of the Mission Bowl property, a 6 foot fence and plant material would not provide the desired screening effect. For screening, the application proposes to provide covered parking along the south side of the

property. Additionally, a trellis would be provided at the south end of parking stalls planted with climbing perennial evergreen vines.

4. Roof-mounted mechanical equipment
    - The submitted building elevations show that the roof-mounted mechanical equipment will be screened on all sides to the extent that such equipment will not be seen from adjacent property or street at normal eye level. The screen will be of a material that harmonizes with the building.
5. Trash bins:
    - The submitted plan shows that enclosure and screening methods will be used in connection with trash bins on the property. No trash bin will be visible from off the property and a permanent masonry or frame enclosure will be provided and maintained for each bin. (§ 415.030(A))

Lighting: The application notes that low impact site lighting will be incorporated to adequately light the site while not disturbing surrounding properties. A photometric plan will be submitted with the Final Development Plan application. The photometric plan will include the location, height, and style of all site lighting. The plans will include a point by point grid indicating the footcandle power of the light fixtures onto the site.

Any lights used to illuminate the parking area will be arranged, located, shielded and screened to direct light away from any adjoining or abutting residential districts. (§ 425.080)

Lighting associated with the swimming pool will be maintained in a manner so that it is not a nuisance to the neighborhood property. (§ 505.420)

Signs: City code allows three primary permanent signs, which may include wall signs, a projecting sign, and/ or a monument sign. Additionally one permanent pedestrian-oriented sign is allowed. The code also allows one temporary construction site identification sign and one temporary “now leasing” sign. If the applicant desires private sign criteria, the request will be made with the Final Development Application. If requested, private sign criteria would require Planning Commission approval. All signs require a sign permit. (Chapter 430)

DESIGN GUIDELINES FOR THE JOHNSON DRIVE CORRIDOR

The Johnson Drive Design Guidelines provide a wide range of recommended and required design elements applicable to the development. These include streetscaping and the relationship of buildings and their exterior facades to public streets as well as building materials and screening. Many of these details will be fully evaluated with the Final Development Plan application.

The overall design of the proposed building is intended to emulate the architectural styles found throughout downtown Mission, including horizontal datums, frame-and-infill, mosaic facades, and expressed corners. Additionally, the submitted plans show alignment with the following sections of the *Design Guidelines*:

Building Orientation and Siting: The proposed building is oriented to Martway Street, built to the property line, and extends the entire width of Martway Street. Building orientation creates a cohesive relationship with the street.

Parking: The proposed parking lot provides a minimum of 6% green space. The parking lot is screened from Martway Street via its location behind the building.

Parking Structures: Live-work units are included on the first floor along Martway Street. A patterned parking screen and landscaping enhances the pedestrian view.

Site Access: The Rock Creek Trail is 8 feet wide and compliant with Americans with Disabilities Act (ADA) requirements. Pedestrian amenities (landscaping, benches, planters, shade trees, bicycle racks, and pocket parks) are included.

Landscaping: Landscaping opportunities along Martway Street are capitalized on.

Building Facades: All visible facades are treated similarly with respect to color, material, form, and detailing. All visible facades respect the scale of immediately adjacent buildings. Building details are appropriately located to enhance pedestrian access. Wall surfaces incorporate features that create a pattern of shade and shadow.

Building Proportion and Scale: The building is compatible in scale and proportion with other buildings in the immediate context. The building incorporates elements, such as patios, that relate it to the human scale. The first floor is differentiated from upper levels using design treatments for the live-work units. The building is reduced in perceived scale by dividing the building mass into smaller components. The building uses mosaic facade to incorporate a sufficient sense of rhythm. The upper stories incorporate a setback.

Building Materials: Conceptual building elevations show masonry facade pillars and white masonry or stucco facade, complemented by wood tone facade highlights, terra cotta toned horizontals. Colors for exterior finishes are selected to provide visual unity. The predominant colors of the building matches or complements the natural yellow, pale tan, beige, brick, and brown tones existing throughout the corridor.

Windows: The first floor building front incorporates a large expanse of clear glass. Windows are not highly tinted or tinted in unnatural colors or with a reflective finish.

LIVE-WORK UNITS

A live-work unit is a single unit consisting of both a workspace and a residential space. Both spaces are occupied by the same tenant. The live-work unit is an old idea that has been modernized to meet the needs of entrepreneurs, small businesses and professionals. In the past, live-work units often meant a storekeeper lived in the apartment above their shop. The Mission Bowl Apartment application proposes a contemporary version of this.

The plan proposes approximately seven live-work units. The live-work units will front Martway with the workspaces located on the ground floor, accessible only from Martway and the Rock Creek Trail, and the live spaces located above, accessible only from the corridor on the second level. Each unit will contain an inner stair that connects the live and work spaces.

Staff proposes the following stipulations be applied to the live-work units:

1. The workspace component of live-work units are intended for use by the following occupations: accountants; architects; artists and artisans; attorneys, computer software and multimedia related professionals; consultants; engineers; fashion, graphic, interior and other designers; hair stylists; home-based office workers, insurance and real estate

agents; one-on-one instructors; photographers, and similar occupations.

2. All advertising for on-site workspace uses shall clearly state “by appointment only” if the live/work address is used.

3. The residential and the workspace space must be occupied by the same tenant, and no portion of the live/work unit may be rented or sold separately. The live-work unit shall be the primary dwelling of the occupant.

4. The external access for the workspace component shall be oriented to the street and shall have at least one external entrance/exit separate from the living space. The entrance to the workspace component shall be located on the ground level.

5. The workspace use is subject to the same performance standards as the underlying zoning district. Drive-up or drive-in service is not allowed.

6. No explosive, toxic, combustible or flammable materials in excess of what would be allowed incidental to normal residential use shall be stored or used on the premises.

Prohibited Uses in Live-Work Units:

1. Any use not permitted in zoning district where the live-work unit is located;
2. The retail sale of food and/or beverages with customers arriving on-site;
3. Entertainment, drinking, and public eating establishments;
4. Veterinary services, including grooming and boarding, and the breeding or care of animals for hire or for sale;
5. Businesses that involves the use of prescription drugs;
6. Adult-oriented businesses, astrology palmistry, massage, head shops, and similar uses;
7. Sales, repair or maintenance of vehicles, including automobiles, boats, motorcycles, aircraft, trucks, or recreational vehicles;
8. Trade or Private Schools. This excludes private instruction of up to two students at any one time (e.g., music lessons, tutoring).

ENGINEERING STUDIES

Traffic Impact Study

TranSystems engineering completed a Traffic Impact Study on behalf of the applicant. The purpose of this study was to assess the impact of the proposed development on the surrounding transportation system. All intersections are projected to operate at an acceptable level of service. No capacity improvements are identified to mitigate the addition of development traffic to the street network.

Traffic engineers from GBA reviewed the Traffic Impact Study on behalf of the City. GBA found the submitted report, its described traffic study and analysis procedures, and ultimately its conclusions and recommendations to be acceptable. The expected traffic impacts from this proposed apartment development will be relatively low. GBA agrees with the final assessment that the surrounding roadway network already has the adequate geometrics and traffic controls needed to serve the additional traffic from this development. GBA noted that in some instances (particularly on evenings and weekends), this proposed residential development will likely create less traffic demand than the former bowling alley and miniature golf course.

When asked about the impact of the live-work units on traffic, GBA advised that they would not

have an impact on overall traffic for the project. If anything, the live-work units will slightly decrease the trip generation, since those residents will not be commuting to an off-site job during peak A.M. and P.M hours. Also, the site plan shows a total of 164 dwelling units, while the Traffic Impact Study considered a slightly higher number of 166 units. GBA notes that this is a conservative approach.

Stormwater Report
A Stormwater Report was prepared by Uhl Engineering on behalf of the applicant. The report concluded:

- The proposed improvements will reduce the impervious area on site, and consequently the peak runoff from the site will be reduced.
- Stormwater Best Management Practices (BMP) treatment will be incorporated into the proposed site improvements. A level of service of 1.88 is proposed for the site. This is higher than the calculated required level of service of 0.
- No additional stormwater improvements are necessary as a result of the development.

The report recommends:

- Installation of private storm systems to route stormwater throughout the site.
- Installation of stormwater treatment BMP device to improve site stormwater quality.
- Stormwater detention be waived.

The report adds that off-site improvements will include the installation of a concrete big block wall along the southeast limits of the project site located in the stormwater drainage easement.

GBA engineering reviewed the Stormwater Report on behalf of the City.

Detention: GBA concurs with the waiver of detention requirements, as no additional impervious surfaces are proposed. Issuing a waiver for detention meets drainage criteria for this project as proposed.

BMPs: Permanent BMPs are proposed post-development as required by the City of Mission's National Pollutant Discharge Elimination System (NPDES) permit.

GBA noted that the report proposes an ADS Barracuda S6 in-line treatment unit, which is a hydrodynamic separator. However, the report does not provide design information. Uhl Engineering clarified via phone that a 0.5 inch rainfall produces a 1.76 cfs discharge from the parking lot. According to ADS's technical specifications, an S6 can treat up to approximately 2.5 cfs of peak flow. Therefore, per the manufacturer, the 'first flush' of stormwater can be treated for floatables, total suspended solids, and oil, using this size unit. The applicant will be required to formally document this information in a revised Stormwater Report to be submitted with the Final Development Application.

The revised Stormwater Report submitted with the Final Development Application must formally document final BMP design details, calculations, and precise locations in the Stormwater Report. The list below represents some of the details GBA and the City will be looking for in the final Stormwater Report.

- The report must specify design parameters (other than the level of service) such as the volume of stormwater stored (if any), the size of the proposed BMP, and the treatment capacity provided by each BMP for each targeted contaminant.
    - The report must show the size, location, treated area, contaminant removal efficiency, and volume of stormwater treated, including the overflow path for large events not intended for treatment.

    - The report must show how the BMPs will be maintained. If catch basin inserts or filter media are used, the report must specify how often will these measures be inspected and/or replaced.
- Plans must show the existing 100-year floodplain. Additionally, the plans must show the floodplain that will result from the Letter of Map Revision (LOMR) that will follow the City's work currently in progress at Rock Creek. The project currently underway will result in revised floodplain limits.
- Report must provide layout and details of the private stormwater infrastructure and discharges to Rock Creek. The private storm sewer system must be shown and tied together so that the number of outlets to the creek are minimized for future maintenance purposes.

City of Mission Public Works noted that a Floodplain Development Permit will be required for the proposed erosion control wall.

Code Review: Consideration of Site Plans
In accordance with Section 440.160 of the City Code, site plans shall be approved upon determination of the following criteria:

1. The site is capable of accommodating the building(s), parking areas and drives with appropriate open space.

    The building, parking area, driveways, and open space have been designed to meet codes and guidelines.

2. The plan provides for safe and easy ingress, egress and internal traffic circulation.

    There is adequate space on the site to allow for circulation of residents and the public. The Traffic Impact Study found that all intersections are projected to operate at an acceptable level of service. The surrounding roadway network already has the adequate geometrics and traffic controls needed to serve the community.

    The site is near the Mission Transit Center, Rock Creek Trail, and walkable downtown. The Rock Creek Trail accommodates pedestrians and bicycles and is ADA compliant. Pedestrian amenities are included.

3. The plan is consistent with good land planning and site engineering design principles.

    The proposed project is in conformance with the Johnson Drive Design Guidelines for building orientation and siting.

4. An appropriate degree of harmony will prevail between the architectural quality of the proposed building(s) and the surrounding neighborhood.

    The proposed project is subject to the *Design Guidelines* for the Johnson Drive corridor, which will ensure architectural harmony as the final site plan is prepared. The overall design of the proposed building emulates the architectural styles found throughout downtown Mission, including horizontal datums, frame-and-infill, mosaic facades, and expressed corners. Additionally, the submitted plans show alignment with the *Design Guidelines*.

5. The plan represents an overall development pattern that is consistent with the

Comprehensive Plan and other adopted planning policies.

The Comprehensive Plan envisions medium-density attached residential housing, such as apartment dwellings. Additional uses include live-work, offices, and limited retail stores. The Plan envisions a pedestrian-friendly area with Floor Area Ratios of 1.0 to 3.0. The district is intended to serve as a transition zone between low-density residential neighborhoods and areas of higher intensity development.

The proposed project is an apartment building with live-work spaces and a Floor Area Ratio of 1.05. Multi-family housing at this location would serve as a transition zone between the existing single-family residences to the south and higher intensity uses at the Mission Mart and Security Bank to the north. The proposal is in conformance with the intent of the Comprehensive Plan.

6. Right-of-way for any abutting thoroughfare has been dedicated pursuant to the provisions of Chapter 455.

Any required right-of-way changes for this site to accommodate such things as public sidewalks will be addressed with the Final Development Plan application.

Staff Recommendation

The proposed development conforms with the Comprehensive Plan, meets the overall intent of the "MS2" zoning district, and complies with the required findings for Section 405.090 and 440.160. Therefore, Staff recommends the Planning Commission recommend approval of the Preliminary Site Development Plan for Case # 20-03 Mission Bowl Apartments to the City Council with the following stipulations:

1. Approval of the requested deviation to height to allow a maximum building height of five stories and/ or 61 feet with the condition that the final development provide a minimum Floor Area Ratio of 1.0.

2. Approval of the requested deviation to density to allow a maximum of 168 apartment units on the 3.45 acre lot.

3. Approval of the requested deviation to allow the primary use of the development to be residential with the condition that the ground floor of the building along Martway Street include accessory uses that activate the streetscape, such as the leasing/ management office, live-work units, and resident amenities. The building shall continue to devote at least seventy-five percent (75%) of ground floor Martway Street frontage to such uses. The design of the building shall continue to include elements that mimic the pedestrian-friendly experience of a mixed-use development, such as a clear glass "storefront" appearance.

4. Lots 3 and 4 of the Mission Mart Plat must be replatted as one lot. Plat must include easements for the cell tower property, Johnson County Wastewater property, and the Mission Mart parking lot (directly west of the site).

5. Final Development Plan Application shall address all comments from Johnson County, Kansas Wastewater.

6. Final Development Plan Application shall include verification of coordination with the Fire

District.

7. Final Development Plan Application must include site plans, civil plans (including Stormwater Report), landscape plans, photometric plans, and architectural drawings (including building elevation, floor plan and wall section drawings).

8. The Stormwater Report must include BMP design details, calculations, and locations. Plans must show the existing 100-year floodplain and the floodplain that will result from the LOMR that will follow the work currently underway at Rock Creek. Report must provide stormwater infrastructure layout and details. All elements are subject to review and approval by the City.

9. A Floodplain Development Permit and all other associated permits are required prior to construction of the retaining wall. The wall must be designed so that it is uniform with the City's current and planned infrastructure along Rock Creek.

10. No development or construction shall be allowed within the 100-year floodplain with the exception of the retaining wall and associated grading and restoration.

11. Live-work units shall abide by the stipulations:
    a. The workspace component of live-work units are intended for use by the following occupations: accountants; architects; artists and artisans; attorneys, computer software and multimedia related professionals; consultants; engineers; fashion, graphic, interior and other designers; hair stylists; home-based office workers, insurance and real estate agents; one-on-one instructors; photographers, and similar occupations.

    b. All advertising for on-site workspace uses shall clearly state "by appointment only" if the live/work address is used.

    c. The residential and the workspace space must be occupied by the same tenant, and no portion of the live/work unit may be rented or sold separately. The live/work unit shall be the primary dwelling of the occupant.

    d. The external access for the workspace component shall be oriented to the street and shall have at least one external entrance/exit separate from the living space. The entrance to the workspace component shall be located on the ground level.

    e. The workspace use is subject to the same performance standards as the underlying zoning district. Drive-up or drive-in service is not allowed.

    f. No explosive, toxic, combustible or flammable materials in excess of what would be allowed incidental to normal residential use shall be stored or used on the premises.

12. The following is prohibited in live-work units:
    a. Any use not permitted in zoning district where the live-work unit is located;
    b. The retail sale of food and/or beverages with customers arriving on-site;
    c. Entertainment, drinking, and public eating establishments;
    d. Veterinary services, including grooming and boarding, and the breeding or care of animals for hire or for sale;
    e. Businesses that involves the use of prescription drugs;

f. Adult-oriented businesses, astrology palmistry, massage, head shops, and similar uses;
g. Sales, repair or maintenance of vehicles, including automobiles, boats, motorcycles, aircraft, trucks, or recreational vehicles;
h. Trade or Private Schools. This excludes private instruction of up to two students at any one time (e.g., music lessons, tutoring).

PLANNING COMMISSION ACTION
The Planning Commission will conduct a public hearing regarding this application at its regularly scheduled meeting on August 24, 2020 at 7:00. Said meeting will be conducted virtually via Zoom in order to adhere to COVID-119 social distancing requirements. All interested parties will be afforded an opportunity to speak at the public hearing. Upon conclusion of the meeting the Planning Commission will take action on the application as it deems appropriate. Such action may include denial, continuance, or recommendation of approval to the City Council.

CITY COUNCIL ACTION
The City Council will consider the recommendation of the Planning Commission at its regularly scheduled meeting on Wednesday, October 21, 2020.

PROTEST PETITION
Section 440.140(c) of the Mission Municipal Code provides criteria by which a protest petition may be submitted.

1. A protest against any rezoning or a special use permit application shall be filed in the office of the City Clerk not later than the end of the business day (5:00 P.M.) on the fourteenth (14th) day following the date of the conclusion of the Planning Commission's public hearing held pursuant to the publication notice. In order to be considered a "valid" protest, a protest petition must be timely filed and duly signed and verified by the owners of record of twenty percent (20%) or more of the property subject to the application or by the owners of record of twenty percent (20%) of the total area, excepting public streets and ways, required to be notified by Section 440.070. Verification of the genuineness and correctness of the signatures on the protest petition, either individually or collectively, shall be made by the person who has circulated protest petition.

2. The fourteen (14) day period for filing the protest petition shall begin with the day following the conclusion of the public hearing before the Planning Commission and shall end at 5:00 P.M. on the fourteenth (14th) calendar day thereafter. For purposes of calculating the fourteen (14) day period, weekends and holidays shall be counted. Provided however, if the filing deadline falls on a weekend, holiday or other non-business day for City offices, then the filing deadline shall be at 5:00 P.M. on the next regular business day.

3. Once a valid protest petition has been filed with the City, it may not be withdrawn unless every person who has signed the protest signs a verified affidavit which states and fully explains the rights being waived by the withdrawal of the protest petition. Such affidavits of withdrawal must be filed with the City Clerk on or before the last regular business day preceding the City Council meeting for which the protest applies.

SUNFLOWER
Development Group

August 7th, 2020

Brian Scott
6090 Woodson
Mission, KS 66202

Re: Mission Bowl Redevelopment

Mr. Scott,

It is our pleasure to propose the redevelopment plans for the former Mission Bowl site located at 5399 Martway St. Mission, KS 66205. This letter is a description of the project and outlines our intent to pursue land use and related approvals for the redevelopment of this 3.17 acres. We will approach this development with a team/feedback mentality. Although we understand we cannot implement every idea, we make it a priority to get feedback from the community we are investing and developing in. We hope that the project is something you and the City are excited about and feel as confident as we do that this will be a development that will complement the area while helping ensure the community continues to grow and prosper.

The project entails the construction of a Class A apartment building with rooftop pool. There will be a mix of studios, 1 bedroom and 2 bedroom units, for a total of approximately 164 apartments. The building is 4 stories of wood framed construction on top of a concrete podium structure which is primarily a parking garage and live/work units. There will be a secured parking garage below the apartment buildings and will be accessed on the site. The total parking count will be approximately 197 parking stalls.

Below is a list of the amenities:

- On-site Leasing and Management/Security
- Clubhouse
- Meeting Rooms and Work Stations
- Professionally designed interiors
- Nine and Ten foot ceilings
- Theater Room
- Quartz or granite countertops
- Fitness
- Coffee Bar

1125 Grand Blvd. Ste. 202
Kansas City, MO 64106

Office: (816) 581-3991
Fax: (816) 581-3999

- Dog Concierge
- Bike Storage and repair
- Dry Cleaning Concierge.
- Upgraded appliances
- In-unit washers and dryers
- Private patio/balcony (in one and two bedroom units)
- High-end cabinetry package

We believe in creating a community for the community. Our plan of a multi-family specific development is based on feedback and support from local office and retail owners. Instead of adding additional retail and office to compete, we felt the priority should be to encourage the new Mission residents to utilize the existing retail and office space in the area.

Ways to create community benefits?

We plan to energize and add value to the residents of Mission through a variety of ways, but below are the items we'd like to highlight.

- **Dog Park**- we plan to program a first class dog park that would allow both residents of the new project and pedestrians utilizing the Rock Creek Trail to use.
- **Retaining wall**- continuation of the improvements that the City has already initiated with the Rock Creek stormwater channel. The Redevelopment Project will include the construction of a concrete wall along the southeast portion of the Project Site adjacent to the creek channel, thereby preventing further erosion, stabilizing the underlying property, and improving the efficiency of the Rock Creek storm channel
- **Fitness Park**- We would plan on adding a fitness park just off the Rock Creek Trail. Our goal is to encourage an active healthy lifestyle while activating our site to engage and blend into the fantastic community around us.

Why Mission?

We believe in Mission. The proximity to food, work, trails and family activities make Mission an extremely desirable City for people looking to establish a community to call home. One of the first things we try to understand is the comprehensive plan. We do this to ensure the project will benefit and add value to the hardwork the City and its residents have put into growing their community. We believe that when complete, this project will fit the comprehensive plan by "realizing opportunities to increase building heights, would increase density make properties better utilized, and be aesthetic improvement." We feel this project will help execute the vision that Mission and its residents have for the community.

The project will also provide housing opportunities for individuals of all ages that are seeking maintenance free and secure rental opportunities within a high-density area near shops and restaurants. The development will serve as an anchor on the east-end of the City's downtown corridor, balancing the recently completed multi-family residential building known as "The Locale" on the west end of the corridor. The development will provide nearly 250 additional residents right in the heart of the City's downtown, and serve as a catalyst for energizing the downtown with retail, restaurant, and entertainment amenities that the City desires and that has been envisioned in past master plans for this area including the East Gateway Redevelopment Plan (2007) and the Mission/Rock Creek Master Plan (2006).

This Project Plan fulfills many of the longstanding components of Smart Growth, and mirrors recommendations from the recently-created Climate Action KC, Climate Action Playbook (2019) including:

- Prioritizing infill development to revitalize core areas and reduce adverse impacts on natural resources and infrastructure.

- Live/work units to activate an energy on Martway, while also connecting the Rock Creek trail with the project.

- Prioritizing Transit-Oriented Development (TOD) by supporting development projects near transit hubs or on transit corridors. TODs encourage great use of transit options, and result in less reliability on vehicles, thereby reducing carbon emissions and greenhouse gas. There is an existing bus transit stop across the street from the Project Site.

- Promoting walkability by promoting higher density development within core urbanized or sub-urbanized areas such as downtown corridors. The Redevelopment Project will connect where people live with where they work, play, and relax through sidewalks, streets, and placement of land uses that encourage alternative forms of transportation such as walking and bicycling.

We look forward to working with the neighbors, councilmembers and City staff as we continue through the development process. In the meantime, if there are any questions I can answer, please feel free to give me a call at 785.393.2102 or email me at bfloodman@sunflowerkc.com.

Sincerely,

Banks Floodman

Project Narrative

The Mission Bowl Redevelopment is located on the approximately 3.17 acres at 5399 Martway in downtown Mission, Kansas. The site is bordered by Martway and the Mission Mart Shopping Center to the north, parking lots to the east and west, and a Johnson County Wastewater facility and Rock Creek to the south. The site currently contains the shell of the former Mission Bowl bowling alley that caught fire in 2015 and has sat vacant since.

The proposed building will contain approximately 164 market rate residential apartments comprised of efficiency, one bedroom and two bedroom units as well as approximately seven Live/Work units. The Live/Work units will front Martway with the *work* spaces located on the ground floor, accessible only from Martway and the Rock Creek Trail, and the *live* spaces located above, accessible only from the corridor on the second level. Each unit will contain an inner stair that connects the live and work spaces. The building will also contain common clubhouse space that houses leasing offices, a coffee bar, workspaces, a business center, mail room, package storage, paw spa, fitness facility and social lounge. The building will also have a fifth level amenity terrace and swimming pool that will be screened from surrounding properties, visually and acoustically, with a planted evergreen screen wall. In addition to building amenities, the site will house a dog park and pocket fitness park directly accessible from the Rock Creek Trail.

This site will also fortify and improve the public space along this stretch of Martway and Rock Creek Trail. The existing trail on the site is strait, and fairly unadorned with no opportunities for public engagement. The proposed trail will meander slightly, taking a cue from the rest of the trail located to west of Nall Avenue. It will also offer opportunities for a pocket fitness park and public seating areas at buiding setbacks. These moves will encourage dialogue between the project and pedestrians and will greatly enhance the pedestrian experience of the current trail.

Architecturally, the project takes all of its inspiration from the direct context of the Johnson Drive corridor. From the horizontal nature of the built environment, to the organized and rythmic facade organization, to the celebrated corners, mosaic facades, screened parking, and active public realm. The design of this project is a celebration of the building's context and neighbors. The building design diligently follows the Mission Design Guidelines and East Gateway Redevelopment Plan. The characteristics of the built environment that make the Johnson Drive Corridor so unique and vital will create a mutually beneficial relationship between the project and it's context so as to make the project memorable. This is a building that the city and residents of Mission will be proud to call their own.

The project is seeking minor deviations from Mission zoning regulations. The site is zoned MS2 which allows residential uses as part of a commercial or office building complex. This building has residential and live/work units without traditional office or retail uses. In today's shifting retail and office environments, it is crucial to bring new residents closer to existing retail and office spaces, rather than to build more of the same uses that will dilute the vitality of the corridor as a whole. Conventional MS2 zoning limits building height to three stories and/or 45 feet. A deviation of two stories and 13-15 feet are proposed in order to make the project viable and contribute to the community at the highest level. This slight height deviation leads to a building that is of a suitable massing for the neighborhood. It is the correct size building to complement Mission Mart to the north, Security Bank, at +/- 95 feet tall, and the residential neighborhood to the south, with a ground plane approximately 30 feet above this site. MS2 zoning permits 35 units per acre, and a deviation of 18 units per acre is proposed for the site.

This multi-family and live/work project is the highest and best use possible for this site. It will create density and infrastructure to support and enhance its surrounding context. This project will engage, interact with, and activate the public realm of the neighborhood. Downtown Mission will be walkable from all points of the building, and easily accessible for the residents and live/work tenants. This project will positively impact the experience of living, working and shopping in Mission, transforming the site from a vacant, charred bowling alley to a state-of-the-art project in the heart of the city. The development team could not be more excited to work with city and residents to make this exciting and inspiring project a reality.

UNIT MATRIX

Live/Work - 7 Units - 4% - 14 parking spaces

Efficiency - 72 Units - 44 % - 72 parking spaces

1 BR - 59 Units - 36% - 59 parking spaces

2 BR - 26 Units - 16% - 52 parking spaces

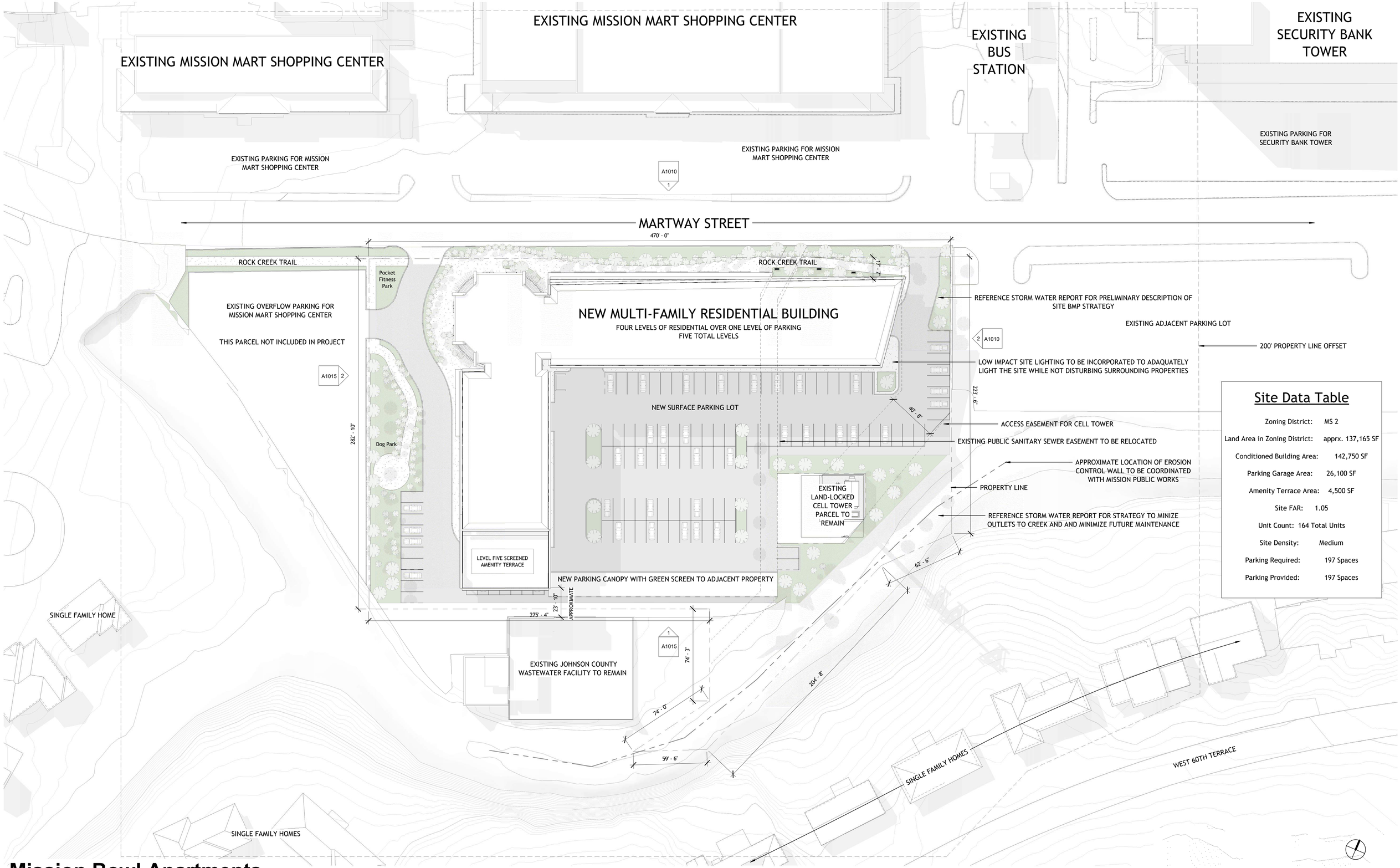
Total - 164 Units - 197 parking spaces

Mission Bowl Apartments

08/07/20

PDP PROJECT OVERVIEW

SUNFLOWER Development Group TREANORHL



Site Data Table

Zoning District:	MS 2
Land Area in Zoning District:	apprx. 137,165 SF
Conditioned Building Area:	142,750 SF
Parking Garage Area:	26,100 SF
Amenity Terrace Area:	4,500 SF
Site FAR:	1.05
Unit Count:	164 Total Units
Site Density:	Medium
Parking Required:	197 Spaces
Parking Provided:	197 Spaces

Mission Bowl Apartments

PDP Site Plan

1/32" = 1'-0"

08/07/20

SUNFLOWER Development Group

TREANORHL

PROPOSED MEANDERING NEW ROCK CREEK TRAIL TO COMPLEMENT COMPLETED MEANDERING ROCK CREEK TRAIL WEST OF NALL AVE.

365' - 3"

264' - 2"

MARTWAY ST

NEW CONSTRUCTION ORIENTED TO MARTWAY WITH CLUBHOUSE AMENITIES AND/OR RESIDENTIAL UNITS FRONTING MARTWAY ON THE FIRST FLOOR

PATIO SERVES AS "OUTDOOR LIVING ROOM"; ENCOURAGES DIRECT OR INDIRECT SOCIAL INTERACTION; FOSTERS COMMUNITY CONNECTEDNESS

GROUND FLOOR THAT FOSTERS AN ACTIVE, PEDESTRIAN FRIENDLY, VIBRANT STREETSCAPE

SCREENED PARKING

Pocket Fitness Park

ROCK CREEK TRAIL (PUBLIC ZONE)

(SEMI-PRIVATE ZONE)

LIVE/WORK WORK 625 SF

CLUBHOUSE 4,770 SF

RECEP.

LEASING

LOUNGE

BUSINESS CENTER

COFFEE BAR

WORK SP.

MAIL

PACKAGE STORAGE

POOL

POOL SPA

BIKE RACKS

TRASH

LOADING

PARKING - 34 GARAGE SPACES

LOCKABLE STORAGE

TOTAL PARKING - 197 SPACES

PARKING - 26 GARAGE SPACES

PARKING - 137 SURFACE SPACES

Dog Park

PARKING STRUCTURES AND PARKING LOTS SITED INTERNALLY BEHIND BUILDING OFF MARTWAY

ACCESS TO JOHNSON COUNTY WASTEWATER BUILDING

Approximate footprint of JCW lift station

Mission Bowl Apartments

Ground Floor

3/64" = 1'-0"

08/07/20

SUNFLOWER Development Group

TREANORHL

Mission Bowl Apartments

PDP WALL SECTION VIGNETTE

3/16" = 1'-0"

08/07/20

SUNFLOWER Development Group

TREANORHL

1 North Elevation
1/16" = 1'-0"

2 East Elevation
1/16" = 1'-0"

Mission Bowl Apartments

08/0720

PDP Elevations

1/16" = 1'-0"

SUNFLOWER Development Group

TREANORHL

1 South Elevation
1/16" = 1'-0"

Mission Bowl Apartments

2 West Elevation
1/16" = 1'-0"

PDP Elevations

1/16" = 1'-0"

08/07/20

SUNFLOWER Development Group

TREANORHL

18 NEW NATIVE AND/OR DROUGHT RESISTANT STREET TREE COLONNADE

COORDINATE WITH CITY TO LOCATE SEASONAL PLANTERS AND URNS, BENCHES, BIKE RACKS AND TRASH RECEPTACLES ALONG ROCK CREEK TRAIL

SEATING AND PLANTERS AT BUILDING SETBACK PER EAST GATEWAY REDEVELOPMENT PLAN

SIDEWALK 8' MIN.

MARTWAY STREET

NO EXISTING STREET TREES ON MARTWAY

ROCK CREEK TRAIL

Pocket Fitness Park

NATIVE AND/OR DROUGHT RESISTANT SHRUBS AND PLANTINGS INTERSPERSED AMONG STREET TREE COLONNADE

FIVE (5) STORY MULTI-FAMILY BUILDING

NEW NATIVE AND/OR DROUGHT RESISTANT STREET TREE SCREEN

Dog Park

NATIVE AND/OR DROUGHT RESISTANT SHRUBS AND PLANTINGS INTERSPERSED THROUGH DOG PARK

NEW NATIVE AND/OR DROUGHT RESISTANT PARKING LOT TREES

LEVEL FIVE AMENITY TERRACE TO BE SCREENED AND PLANTED WITH CLIMBING PERENNIAL EVERGREEN VINES

TRELLIS AT SOUTH END OF PARKING STALLS PLANTED WITH CLIMBING PERENNIAL EVERGREEN VINES

Mission Bowl Apartments

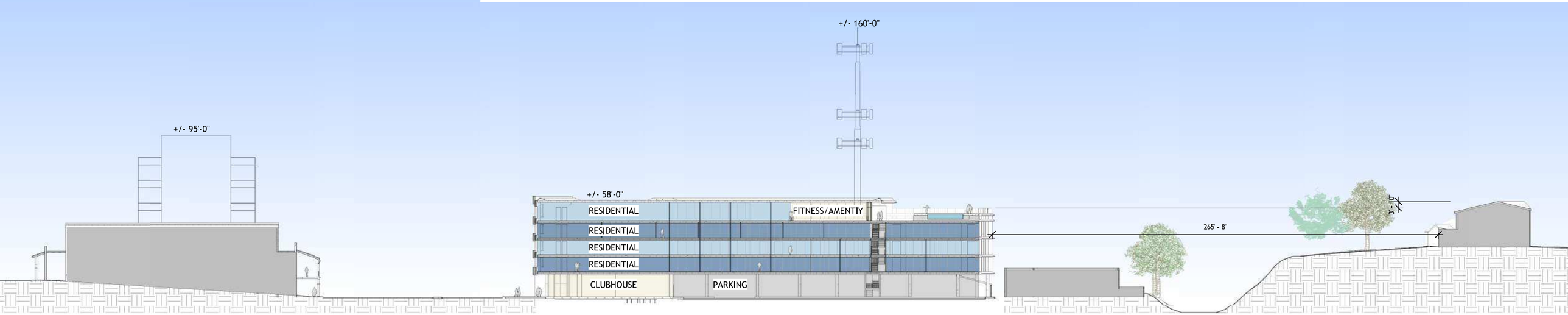
PDP Conceptual Landscape Plan

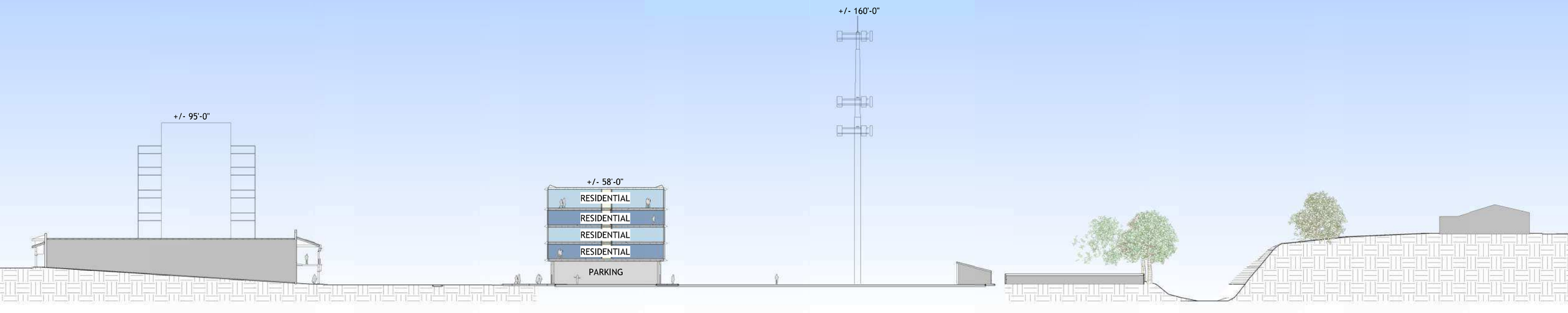
3/64" = 1'-0"

08/07/20

SUNFLOWER Development Group

TREANORHL


+/- 160'-0"
+/- 95'-0"
+/- 58'-0"
RESIDENTIAL
RESIDENTIAL
RESIDENTIAL
RESIDENTIAL
FITNESS/AMENTIY
CLUBHOUSE
PARKING
265' - 8"
31'-10"


+/- 160'-0"
+/- 95'-0"
+/- 58'-0"
RESIDENTIAL
RESIDENTIAL
RESIDENTIAL
RESIDENTIAL
PARKING

9801 Renner Boulevard
Lenexa, KS 66219

DESIGN MEMORANDUM

To: Kaitlyn Service; Brian Scott, CPM (City of Mission)

From: David J. Mennenga, P.E., PTOE (GBA)

Date: July 24, 2020

Subject: Review of Traffic Impact Study and Preliminary Site Plans
Sunflower Development Group apartments complex (5399 Martway Street)

As requested, GBA's traffic engineers have completed a review of the submitted Traffic Impact Study and preliminary site plans for the proposed Sunflower Development Group apartment complex. This development is proposed on the former Mission Bowl and Mini-Golf site located at 5399 Martway Street, generally to the southeast of the intersection of Nall Avenue with Martway Street.

Overall, we find the submitted TIS report, its described traffic study and analysis procedures, and ultimately its conclusions and recommendations to be acceptable. The expected traffic impacts from this proposed apartment development will be relatively low, and we agree with the consultant's final assessment that the surrounding roadway network already has the adequate geometrics and traffic controls needed to serve the additional traffic from this development. We believe it should also be noted that in some instances (particularly on evenings and weekends), this proposed residential development will likely create less traffic demand than the previous land uses on this property.

We offer the following general observations regarding the submitted Traffic Impact Study (TIS) report:

- For trip generation purposes the TIS considered a total of 166 dwelling units, resulting in a negligible increase in estimated development-related trips over the 164 dwelling units indicated on the site plans. This results in a slightly conservative approach to the traffic study analysis.
- The peak hour traffic counts performed by TranSystems in June 2020 at the study intersections were appropriately factored to account for the impacts of COVID-19. Since current traffic volumes are lower than expected due to reduced travel and ongoing work-from-home conditions, the peak hour traffic counts were inflated to account for these impacts. The A.M. peak hour traffic counts were increased by 50%, while the P.M. peak hour counts were increased by 25%. GBA's traffic engineers reviewed the October 2018 traffic counts at the Martway Street/Roeland Drive intersection from the Mission Gateway TIS previously submitted by Olsson Associates, and determined these adjustment factors to be appropriate. It should be noted that reference traffic counts were not provided within the TIS report appendices for any of the study intersections.
- In general, this proposed development is expected to generate just over 900 vehicle-trips per day. The estimated trip generations of 57 total (15 inbound, 42 outbound) A.M. trips and 73 total (45 inbound, 28 outbound) P.M. trips are actually less than the 100 vehicles per hour (vph) threshold typically used to indicate the need for a traffic study by nationally-accepted ITE standards.
- We concur with the trip distribution pattern and traffic assignment process provided in the TIS report. GBA independently confirmed that the anticipated Mission Gateway development-related traffic volumes have been appropriately assigned through these study intersections. Also, we

agree that the 0.5% annual traffic growth rate used over the 20-year design horizon to complete the Year 2040 analysis is appropriate for this generally mature and developed area of the City.

- Regarding the existing and anticipated traffic operations at the study intersections, we find two specific items of note:
    1. The TIS notes that the expected 95th-percentile vehicle queues for the northbound left-turn maneuver at the intersection of Nall Avenue with Johnson Drive is expected to increase from 71 feet in length during the existing P.M. peak hour to 81 feet during the future 2040 P.M. peak hour. We concur with the study conclusion that no geometric modifications are warranted to address this queuing condition, even though these vehicle queues may exceed the available turn bay storage for short durations during future peak conditions. Geometric changes to create additional storage for that movement cannot be made without detrimental impacts on the southbound left-turn storage for the Martway Street intersection due to the close spacing of these adjacent signalized intersections.
    2. The completed TIS analysis indicates that all the signalized study intersections will be expected to continue operating at LOS "C" or better during all the future traffic scenarios evaluated. While these results satisfy the City's desired criteria of LOS "D" or better for the overall intersection operations, we noted in the provided appendix of Synchro analyses that several specific side-street movements currently operate at LOS "E" (i.e., with average delays in excess of 55 seconds per vehicle) during both the A.M. and P.M. peak traffic hours, and will continue to do so in the future with average delays up to 70-72 seconds per vehicle.
        a. The eastbound through/right-turn movements on Martway Street at Nall Avenue (existing conditions through future 2040 scenario)
        b. The eastbound left-turn/right-turn movements on Martway Street at Roeland Drive (existing conditions through future 2040 scenario)
        c. The westbound movements from the Mission Gateway parking lot at Martway Street/Roeland Drive (existing + approved conditions through future 2040 scenario)

We offer the following traffic-related observations regarding the provided preliminary site plans:

- The site plan indicates a planned total of 164 dwelling units, which results in a Floor Area Ratio (FAR) of inhabitable building space to property acreage of 1.05.
- Without explicitly reviewing the City's parking code requirements, the site appears to provide adequate parking within on-site areas (i.e., parking garage, surface lot, and covered parking). 204 parking spaces are provided in excess of the 191 parking spaces required (per the applicant's site plan calculations). We have no specific concerns regarding the on-site circulation patterns within the internal parking areas.
- The alignment of the two proposed access driveways onto Martway Street (i.e., located approximately 600 feet and 1,000 feet east of the signalized Nall Avenue intersection) appears to be appropriate. These access drives are aligned with existing driveways across Martway Street to the north, thereby consolidating vehicle turning movements as much as the proposed development's property limits allow.
- Regarding the proposed site layout, we would only draw the City staff's attention to the proximity of the southeast corner of the surface parking lot to Rock Creek to ensure that proper set-backs are maintained from the adjacent stream channel.

Mission Bowl Apartments Traffic Impact Study

5399 Martway Street
Mission, Kansas

TranSystems
EXPERIENCE | Transportation

Prepared for:
Mission Bowl Apartments, LLC

Prepared by TranSystems
July 2020

TranSystems
2400 Pershing Road
Suite 400
Kansas City, MO 64108
Tel 816 329 8600
Fax 816 329 8601

www.transystems.com

July 16, 2020

Mr. Mike Treanor
Mission Bowl Apartments, LLC
P.O. Box 1797
901 New Hampshire, Suite 201
Lawrence, KS 66044

Re: Mission Bowl Apartments Traffic Impact Study
5399 Martway Street
Mission, Kansas

Dear Mr. Treanor:

In response to your request and authorization, TranSystems has completed a traffic impact study for the proposed multi-family residential development located at the site of the former Mission Bowl at 5399 Martway Street in Mission, Kansas. The purpose of this study was to assess the impact of the proposed development on the surrounding transportation system.

Included in this study is a discussion of the anticipated impact of the proposed development on the adjacent street network and identified improvements to mitigate deficiencies for the following scenarios:

- Existing Conditions
- Existing plus Approved Development Conditions
- Existing plus Approved plus Proposed Development Conditions
- Future Year 2040 Conditions

We trust that the enclosed information proves beneficial to you and the City of Mission in this phase of the development process. We appreciate the opportunity to be of service to you and will be available to review this study at your convenience.

Sincerely,
TRANSYSTEMS

By: _____ By: _____

Jeffrey J. Wilke, PE, PTOE Emma Martin, EIT

EHM:JJW/ehm/P101200187
Enclosure

Introduction

TranSystems has completed a traffic impact study for the proposed Mission Bowl Apartments multi-family residential development located at the site of the former Mission Bowl at 5399 Martway Street in Mission, Kansas. The purpose of this study was to assess the impact of the proposed development on the surrounding transportation system. The location of the development site relative to the major streets in the area is shown on ***Figure A-1*** in ***Appendix A***.

This study also contains a description of the proposed development and the surrounding transportation infrastructure along with trip generation estimates, trip distribution estimates, capacity analyses, and a summary of the findings.

Proposed Development Plan

The Mission Bowl Lofts is a proposed five-story building. There are 166 proposed apartment units. Access to the site will be provided from two existing drives along Martway Street. Site Drive 1 is located roughly 600 feet east of Nall Avenue and Site Drive 2 is roughly 1,000 feet east of Nall Avenue. Both drives provide full-access to the apartment's surface parking lot. The current development plan is included on ***Figure A-2*** in ***Appendix A*** for reference.

The development site is well positioned to provide access to several modes of transportation. The Mission Transit Center is located just north of the site across Martway Street. Many different RideKC bus routes stop at the Transit Center. The Rock Creek Trail provides a bicycle and pedestrian connection along the south side of Martway Street, adjacent to the site. The proposed development will include bicycle accommodations, such as bike racks and storage, as amenities.

Study Area

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

- Nall Avenue and Johnson Drive
- Nall Avenue and Martway Street
- Roeland Drive and Martway Street
- Site Driveways

Traffic Counts

The turning-movement traffic volume counts were collected on Thursday, June 18, 2020. The turning movement counts were collected from 7:00 – 9:00 A.M. and from 4:00 – 6:00 P.M. In general, the A.M. peak hour was between 7:45 – 8:45 A.M, and the P.M. peak hour was between 4:30 – 5:30 P.M.

Turning-movement traffic volume counts were modified to account for the abnormally low traffic volumes due to the COVID-19 pandemic. Existing traffic volumes were compared to previous counts within the study area. The A.M. peak hour traffic volumes were increased by 50% and the P.M. peak hour traffic

volumes were increased by 25% to be similar to the previous counts in the area. The modified existing lane configurations, traffic control devices, and estimated peak hour volumes have been illustrated in ***Figures A-3*** through ***A-5***.

Surrounding Street Network and Land Uses

The development site is located on the site of the former Mission Bowl building. The site is bounded by Martway Street on the north. There is a surface parking lot utilized by Security Bank directly to the east, and a commercial business building located to the west. The Martway Street corridor is generally lined with commercial businesses and restaurants. South of the fence line, the site is bounded by single-family residences.

Nall Avenue is classified as a minor arterial road by the Kansas Department of Transportation (KDOT). North of Shawnee Mission Parkway, the 60-foot roadway is three-lanes. Additional left- and right-turn lanes are added at major intersections. There is curb and gutter, along with a sidewalk on the west side of the street. The posted speed limit is 30 mph. The intersections with Johnson Drive and Martway Street are signalized.

Johnson Drive is classified by KDOT as a minor arterial road. West of Nall Avenue, Johnson Drive is an undivided, four-lane roadway. To the east, it is a three-lane street with a two-way center left-turn lane. There is curb and gutter. Sidewalk runs along both sides of the street, and there is some offset, diagonal street parking. The posted speed limit is 30 mph.

Adjacent to the site, Martway Street is a 36-foot, three-lane local street with a two-way center left-turn lane. It has curbs and gutters. The Rock Creek Trail runs parallel with the proposed site, but there is no sidewalk on the north side of the street. Roeland Drive has similar characteristics. The posted speed limit on both of these roadways is 25 mph. The intersection of Martway Street and Roeland Drive is signalized.

Approved Development

The latest Mission Gateway development plan was approved in February 2020. This development is located east of the proposed Mission Bowl development and is currently under construction. Mission Gateway includes both commercial, residential, office, and entertainment land uses. Since this approved development will add traffic to the study intersections when completed, the development trips from Mission Gateway are included in the analysis for the study development scenarios. The location of this project is included on the location map on ***Figure A-1*** in ***Appendix A***.

Analysis

The scope of analysis for the assessment of the proposed development's impact on the surrounding transportation system is based in large part on the recommended practices of the Institute of Transportation Engineers (ITE), as outlined in their Traffic Engineering Handbook. ITE is a nationally-recognized organization of transportation professionals with members from both private and public sectors. The analysis of the proposed development's impact included development of trip generation and trip distribution estimates as well as a traffic operations assessment for each study scenario.

Trip Generation

Trip generation estimates were prepared using the Institute of Transportation Engineer's Trip Generation, 10th Edition. ***Table 1*** shows the expected trips to be generated by the proposed development. Additional information related to trip generation is included in ***Appendix B***.

Table 1
Proposed Development Trip Generation

Land Use	Intensity	ITE Code	Average Weekday	A.M. Peak Hour			P.M. Peak Hour		
				Total	In	Out	Total	In	Out
Multi-Family Housing (Mid-Rise)	166 units	221	903	57	15	42	73	45	28
Total New Development Trips			**903**	**57**	**15**	**42**	**73**	**45**	**28**

Trip Distribution

The estimated trips generated by the proposed development were distributed onto the surrounding street network based on the trip distributions summarized in ***Table 2***. These distributions are based on traffic counts, the expected service area of the development and engineering judgment.

Table 2
Trip Distribution

Direction To/From	Percentage
North on Roeland Drive	15%
South on Roeland Drive	30%
West on Johnson Drive	15%
West on Martway Street	10%
South on Nall Avenue	30%
Total	**100%**

Traffic Operation Assessment

An assessment of traffic operations was made for the scenarios listed below.

- Existing Conditions
- Existing plus Approved Development Conditions
- Existing plus Approved plus Proposed Development Conditions
- Future Year (2040)

The study intersections were evaluated using the Synchro traffic analysis software package. Calculations were performed based on the methodologies outlined in the Highway Capacity Manual (HCM), 6th Edition, which is published by the Transportation Research Board. The operating conditions at an intersection are graded by the "level of service" experienced by drivers. Level of service (LOS) describes

the quality of traffic operating conditions and is rated from "A" to "F". LOS A represents the least congested condition with free-flow movement of traffic and minimal delays. LOS F generally indicates severely congested conditions with excessive delays to motorists. Intermediate grades of B, C, D, and E reflect incremental increases in the average delay per stopped vehicle. Delay is measured in seconds per vehicle. ***Table 3*** shows the upper limit of delay associated with each level of service for signalized and unsignalized intersections.

Table 3
Intersection Level of Service Delay Thresholds

Level of Service (LOS)	Signalized	Unsignalized
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

While LOS measurements apply to both signalized and unsignalized intersections, there are significant differences between how these intersections operate and how they are evaluated. LOS for signalized intersections reflects the operation of the intersection as a whole.

Unsignalized intersections, in contrast, are evaluated based on the movement groupings which are required to yield to other traffic. Typically, these are the left turns off of the major street and the side-street approaches for two-way stop-controlled intersections. At unsignalized intersections lower LOS ratings (D, E and F) do not, in themselves, indicate the need for additional improvements. Many times there are convenient alternative routes to avoid the longer delays. Other times the volumes on the unsignalized approaches are relatively minor when compared to the major street traffic, and improvements such as a traffic signal installation may increase the average delay to all users of the intersection.

The decision to install a traffic signal, which is often considered when lower LOS ratings are projected, should be based on engineering studies and the warrants for traffic signal installation as outlined in the Federal Highway Administration's Manual on Uniform Traffic Control Devices (MUTCD). Signals are typically not recommended in locations where there are convenient alternative paths, or if the installation of a traffic signal would have negative impacts on the surrounding transportation system.

The LOS rating deemed acceptable varies by community, facility type and traffic control device. Most communities in the region, such as the City of Mission, have identified LOS D as the minimum desirable goal for signalized intersections. However, at unsignalized intersections LOS D, E, or even F are often considered acceptable for low to moderate traffic volumes where the installation of a traffic signal is not warranted by the conditions at the intersection, or the location has been deemed undesirable for signalization.

Traffic queues were also evaluated as part of the analyses. Long traffic queues which extend beyond the amount of storage available, either between intersections or within turn lanes, can have significant impacts on operations. The projected vehicular queues were analyzed to ensure the analyses are reflective of the physical constraints of the study intersections and to identify if additional storage is needed for turn lanes.

Existing Conditions

The results of the existing conditions intersection analyses are summarized in ***Table 4***. The study intersections were evaluated with the lane configurations, traffic volumes, and traffic control devices shown on ***Figures A-3*** through ***A-5***. The Synchro output files are included in ***Appendix C***.

Table 4
Intersection Operational Analysis
Existing Conditions

Intersection	A.M. Peak Hour		P.M. Peak Hour	
Movement	LOS[1]	Delay[2]	LOS[1]	Delay[2]
Nall Avenue and Johnson Drive				
Traffic Signal	*C*	*33.0*	*C*	*32.3*
Nall Avenue and Martway Street				
Traffic Signal	*B*	*18.7*	*C*	*22.4*
Site Drive 1 and Martway Street				
Northbound	*A*	*9.9*	*B*	*11.5*
Southbound	*A*	*9.1*	*A*	*9.8*
Eastbound Left-Turn	*A*	*7.4*	*A*	*7.5*
Westbound Left-Turn	*A*	*0.0*	*A*	*0.0*
Site Drive 2 and Martway Street				
Northbound	*A*	*0.0*	*B*	*10.4*
Southbound	*A*	*9.5*	*A*	*9.8*
Eastbound Left-Turn	*A*	*7.4*	*A*	*7.5*
Westbound Left-Turn	*A*	*0.0*	*A*	*7.5*
Roeland Drive and Martway Street				
Traffic Signal	*B*	*12.6*	*C*	*24.8*

1 – Level of Service
2 – Delay in seconds per vehicle

The results in ***Table 4*** indicate that all study intersections currently operate at acceptable levels of service during the peak hours. During the P.M. peak hour, the northbound left-turn 95th percentile queue length at Johnson Drive and Nall Avenue is 71 feet. The short, 70 foot, turn bay is limited due to the short spacing between the signalized intersections. Lengthening this turn bay would reduce the 50 foot southbound left-turn lane at Martway Street and Nall Avenue. All other queues are contained within their designated lanes.

Existing plus Approved Development Conditions

The development trips generated by each approved development in the vicinity of the site were compiled to determine the effect of traffic from the approved but yet unbuilt Mission Gateway development. The lane configurations at the intersection of Martway Street and Roeland Drive were updated to reflect the proposed configurations from the approved study. The results of the Existing plus Approved Development

conditions intersection analyses are summarized in ***Table 5***. The study intersections were evaluated with the lane configurations, traffic volumes, and traffic control devices shown on ***Figures A-6*** through ***A-8***. The Synchro output files are included in ***Appendix C***.

Table 5
Intersection Operational Analysis
Existing plus Approved Development Conditions

Intersection	A.M. Peak Hour		P.M. Peak Hour	
Movement	LOS[1]	Delay[2]	LOS[1]	Delay[2]
Nall Avenue and Johnson Drive				
Traffic Signal	*C*	*33.0*	*C*	*32.4*
Nall Avenue and Martway Street				
Traffic Signal	*B*	*18.7*	*C*	*22.4*
Site Drive 1 and Martway Street				
Northbound	*A*	*9.9*	*B*	*11.5*
Southbound	*A*	*9.1*	*A*	*9.8*
Eastbound Left-Turn	*A*	*7.4*	*A*	*7.5*
Westbound Left-Turn	*A*	*0.0*	*A*	*0.0*
Site Drive 2 and Martway Street				
Northbound	*A*	*0.0*	*B*	*10.4*
Southbound	*A*	*9.5*	*A*	*9.8*
Eastbound Left-Turn	*A*	*7.4*	*A*	*7.5*
Westbound Left-Turn	*A*	*0.0*	*A*	*7.5*
Roeland Drive and Martway Street				
Traffic Signal	*B*	*19.3*	*C*	*26.8*

1 – Level of Service
2 – Delay in seconds per vehicle

The results in ***Table 5*** indicate that all study intersections are projected to operate at acceptable levels of service during the peak hours. During the P.M. peak hour, the northbound left-turn 95th percentile queue length at Johnson Drive and Nall Avenue is projected to be 72 feet. There is a nominal impact to the study intersections after the approved development traffic is added.

Existing plus Approved plus Proposed Development Conditions

The results of the Existing plus Approved plus Proposed Development conditions intersection analyses are summarized on the following page in ***Table 6***. Traffic volumes projected at the site driveways are low. As such, no left- or right-turn lanes are warranted at their of the site driveway locations. The study intersections were evaluated with the lane configurations, traffic volumes, and traffic control devices shown on ***Figures A-9*** through ***A-11***. The Synchro output files are included in ***Appendix C***.

The results in ***Table 6*** indicate that all study intersections are projected to operate at acceptable levels of service during the peak hours. The northbound left-turn 95th percentile queue length at Johnson Drive and Nall Avenue is projected to extend 74 feet during the P.M. peak hour. All queues are projected to be contained within their designated lane.

Table 6
Intersection Operational Analysis
Existing plus Approved plus Proposed Development Conditions

Intersection	A.M. Peak Hour		P.M. Peak Hour	
Movement	LOS[1]	Delay[2]	LOS[1]	Delay[2]
Nall Avenue and Johnson Drive				
Traffic Signal	*C*	*32.9*	*C*	*32.4*
Nall Avenue and Martway Street				
Traffic Signal	*B*	*19.8*	*C*	*23.0*
Site Drive 1 and Martway Street				
Northbound	*B*	*10.2*	*B*	*11.4*
Southbound	*A*	*9.2*	*B*	*10.0*
Eastbound Left-Turn	*A*	*7.4*	*A*	*7.5*
Westbound Left-Turn	*A*	*7.5*	*A*	*7.6*
Site Drive 2 and Martway Street				
Northbound	*A*	*9.4*	*B*	*10.1*
Southbound	*A*	*9.6*	*B*	*10.2*
Eastbound Left-Turn	*A*	*7.4*	*A*	*7.5*
Westbound Left-Turn	*A*	*7.4*	*A*	*7.6*
Roeland Drive and Martway Street				
Traffic Signal	*C*	*21.6*	*C*	*26.9*

1 – Level of Service
2 – Delay in seconds per vehicle

Future Year (2040) Conditions

This scenario provides an estimate of future traffic conditions in year 2040 by considering the addition of background traffic growth to the Existing plus Approved plus Proposed Development traffic volumes. To estimate future background traffic growth, the existing traffic volumes at the study intersections were assumed to increase at a rate of 0.5% per year. This modest growth rate is consistent with a mature developed area.

The results of the Future Year (2040) Conditions intersection analyses are summarized in ***Table 7***. The study intersections were evaluated with the lane configurations, traffic volumes, and traffic control devices shown on ***Figures A-12*** through ***A-14***. The Synchro output files are included in ***Appendix C***.

Table 7
Intersection Operational Analysis
Future Year 2040

Intersection	A.M. Peak Hour		P.M. Peak Hour	
Movement	LOS[1]	Delay[2]	LOS[1]	Delay[2]
Nall Avenue and Johnson Drive				
Traffic Signal	*C*	*32.6*	*C*	*32.8*
Nall Avenue and Martway Street				
Traffic Signal	*B*	*17.8*	*C*	*23.3*

Table 7 - Continued
Intersection Operational Analysis
Future Year 2040

Intersection	A.M. Peak Hour		P.M. Peak Hour	
Movement	LOS[1]	Delay[2]	LOS[1]	Delay[2]
Site Drive 1 and Martway Street				
Northbound	*B*	*10.4*	*B*	*11.7*
Southbound	*A*	*9.3*	*B*	*10.1*
Eastbound Left-Turn	*A*	*7.4*	*A*	*7.6*
Westbound Left-Turn	*A*	*7.6*	*A*	*7.6*
Site Drive 2 and Martway Street				
Northbound	*A*	*9.5*	*B*	*10.3*
Southbound	*A*	*9.7*	*B*	*10.4*
Eastbound Left-Turn	*A*	*7.4*	*A*	*7.5*
Westbound Left-Turn	*A*	*7.4*	*A*	*7.6*
Roeland Drive and Martway Street				
Traffic Signal	*C*	*21.4*	*C*	*26.8*

1 – Level of Service
2 – Delay in seconds per vehicle

The results in ***Table 7*** indicate that all study intersections are projected to operate at acceptable levels of service during the peak hours. The northbound left-turn 95th percentile queue length at Johnson Drive and Nall Avenue is projected to be 81 feet during the P.M. peak hour, which extends slightly past the existing turn bay length.

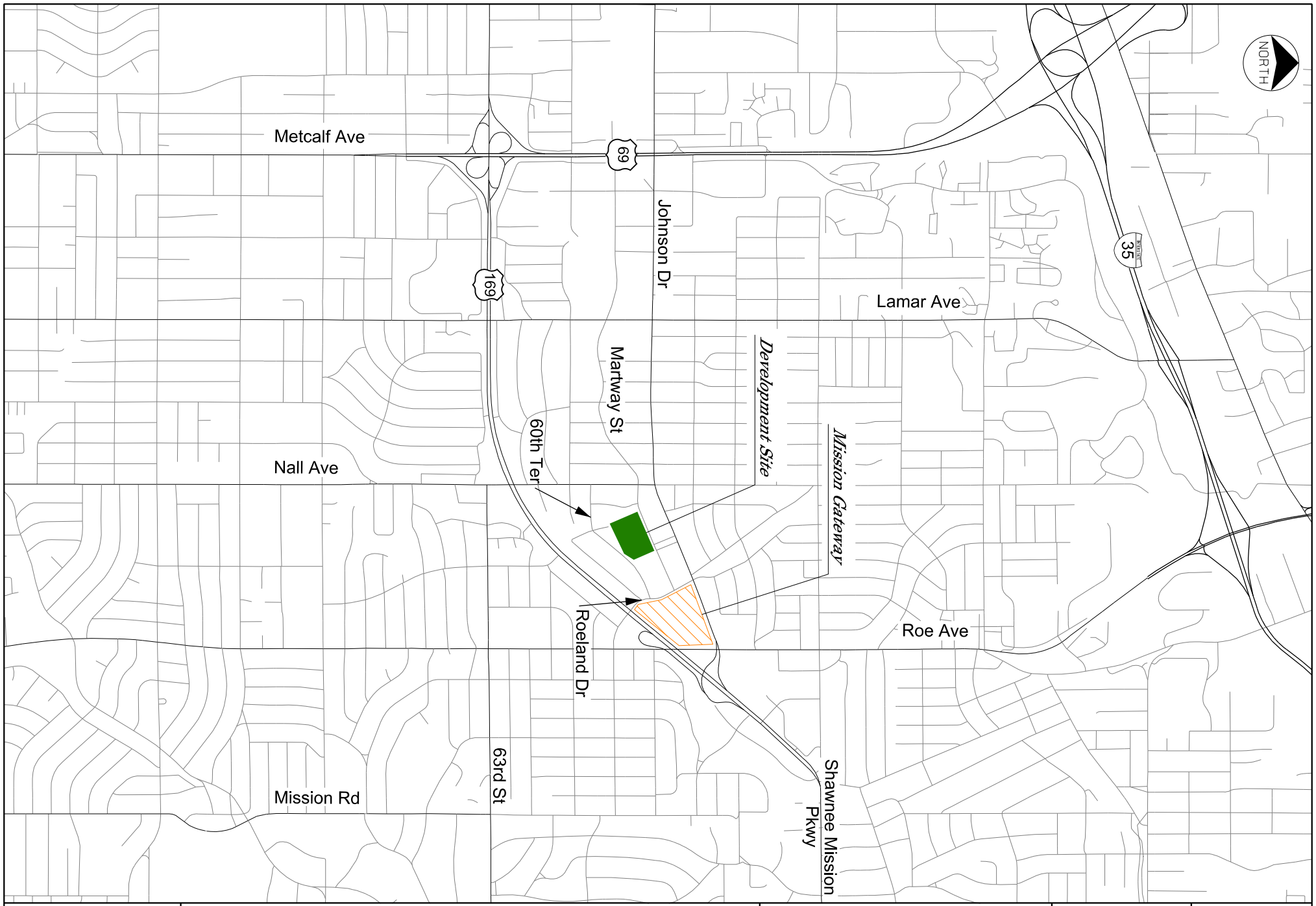
Summary

TranSystems has completed a traffic impact study for the proposed Mission Bowl Apartments multi-family residential development located at the site of the former Mission Bowl at 5399 Martway Street in Mission, Kansas. The purpose of this study was to assess the impact of the proposed development on the surrounding transportation system.

The proposed development is projected to generate 57 new trips during the A.M. peak hour and 73 new trips during the P.M. peak hour. The apartments will be accessed from two existing site driveways along Martway Street, roughly 600 feet and 1,000 feet east of Nall Avenue.

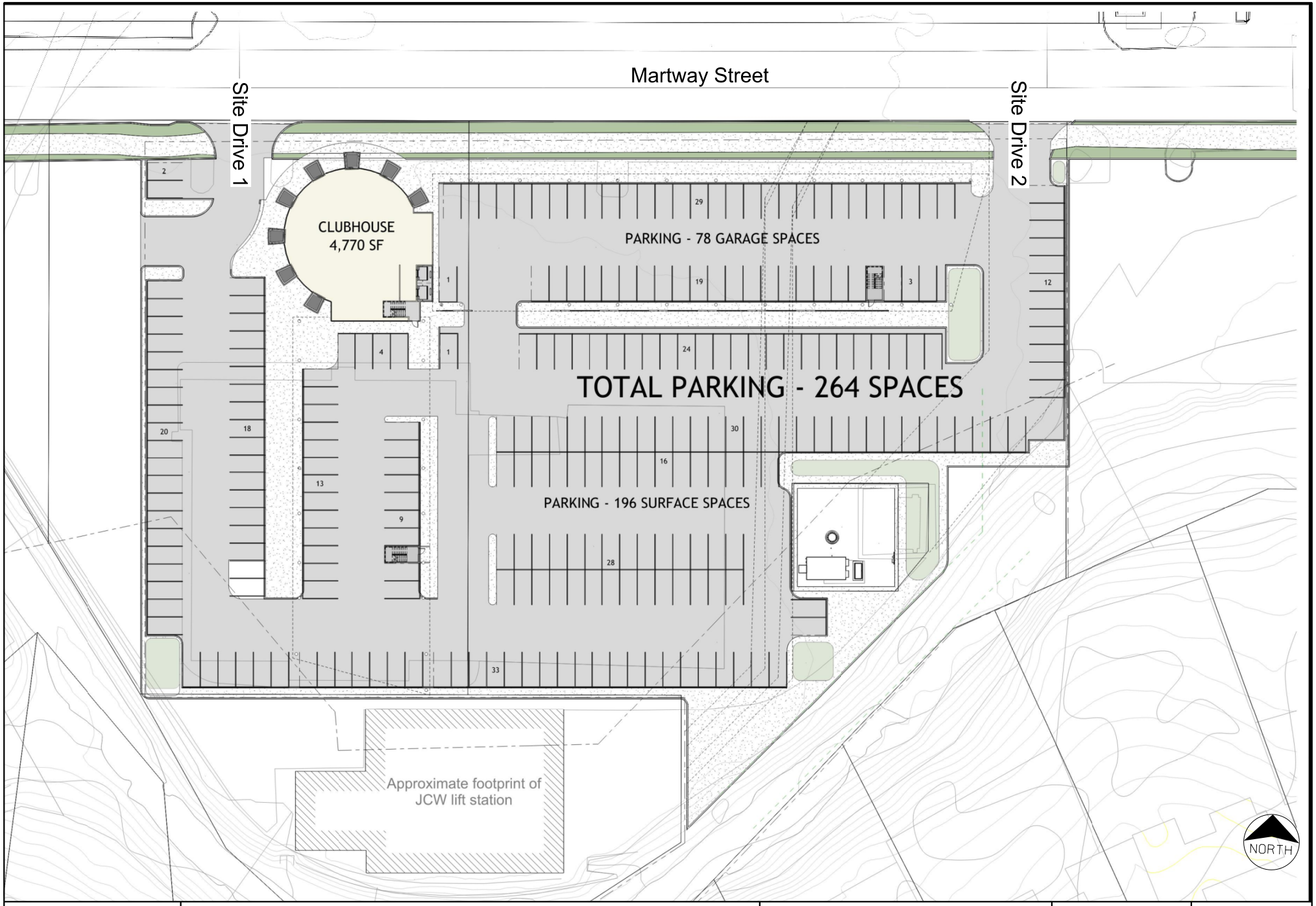
No capacity improvements are identified to mitigate the addition of development traffic to the street network. All intersections are projected to operate at an acceptable level of service. Due to the short spacing between the signalized intersections, the northbound left-turn lane 95th percentile queue length is projected to extend slightly past the existing turn bay length during the P.M. peak hour at the intersection of Nall Aveue and Johnson Drive. However, lengthening this turn bay would shorten the southbound left-turn bay at Nall Avenue and Martway Street.

Appendix A - Figures

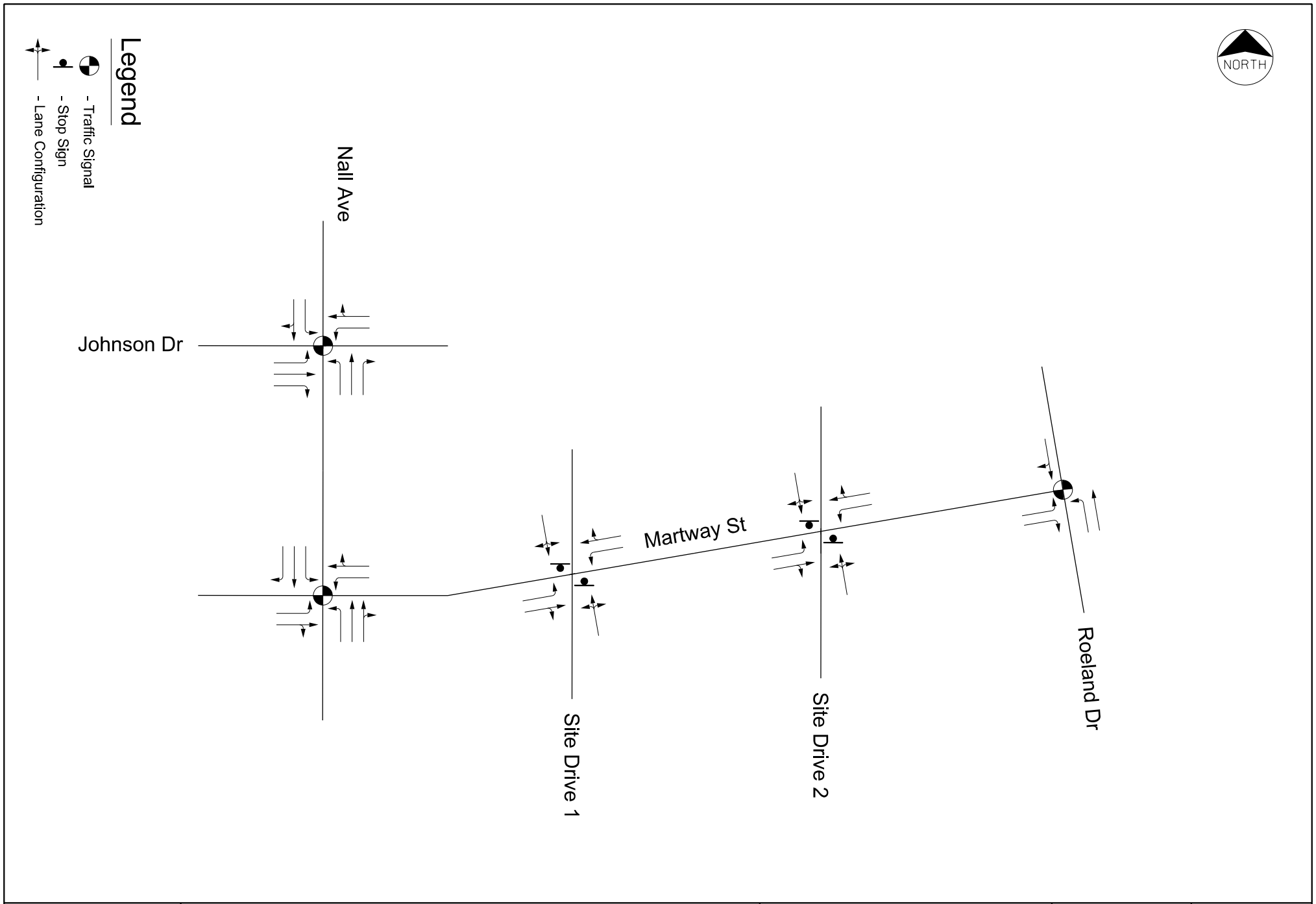


TranSystems	LOCATION MAP	Mission Bowl Lofts Traffic Impact Study Mission, Kansas	July 2020 No Scale	Figure A-1

pw:\\hq-pwint01.a-e.transyscorp.com:transyscorp-pw1\Documents\Projects_2020\KC101 - Kansas City\P101200187 - Mission Bowl Loft TIS\310.00 - Traffic\Configurations & Volume



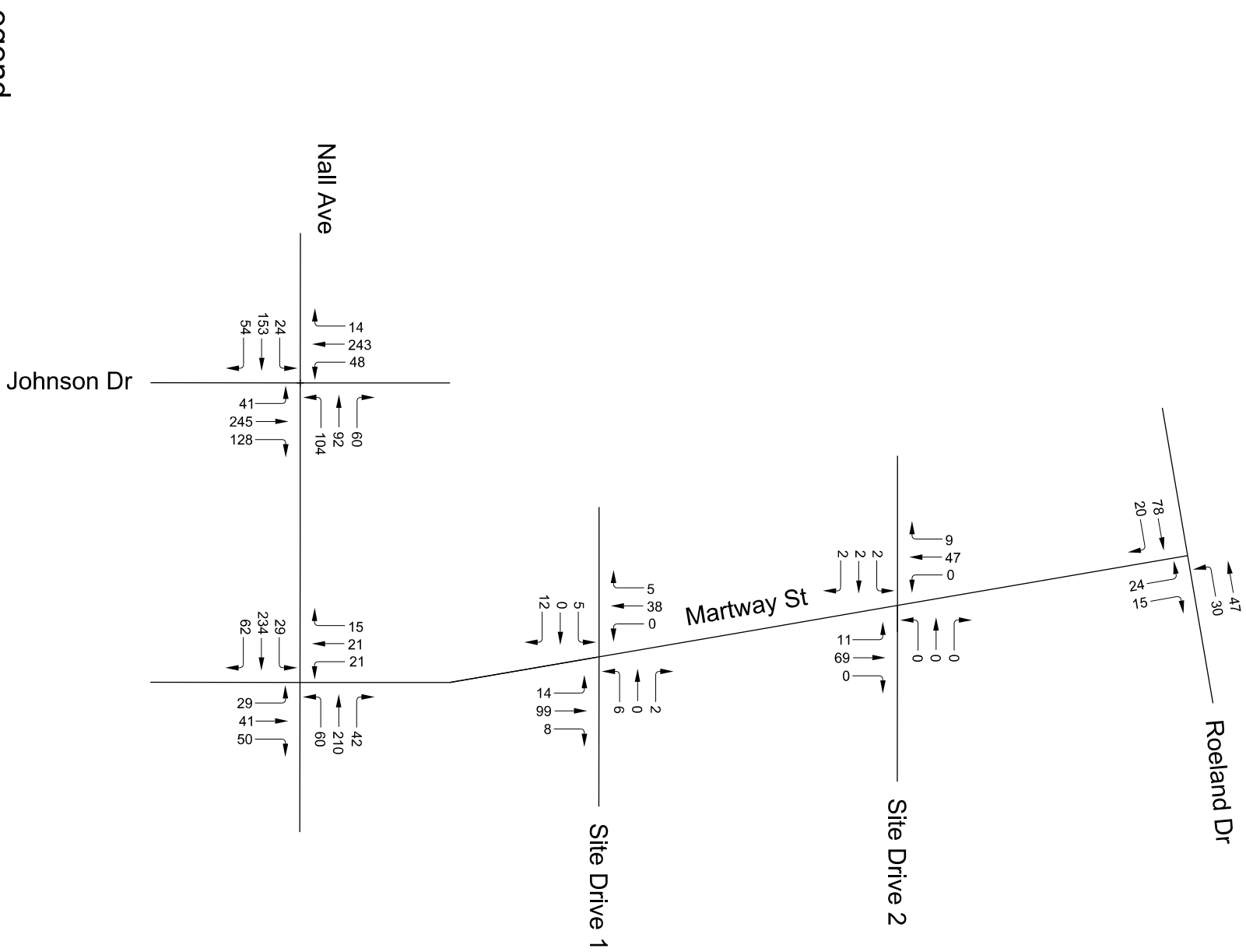
TranSystems	SITE PLAN	Mission Bowl Lofts Traffic Impact Study Mission, Kansas	July 2020 No Scale	Figure A-2



TranSystems	EXISTING CONDITIONS LANE CONFIGURATIONS	Mission Bowl Lofts Traffic Impact Study Mission, Kansas	July 2020 No Scale	Figure A-3

Legend

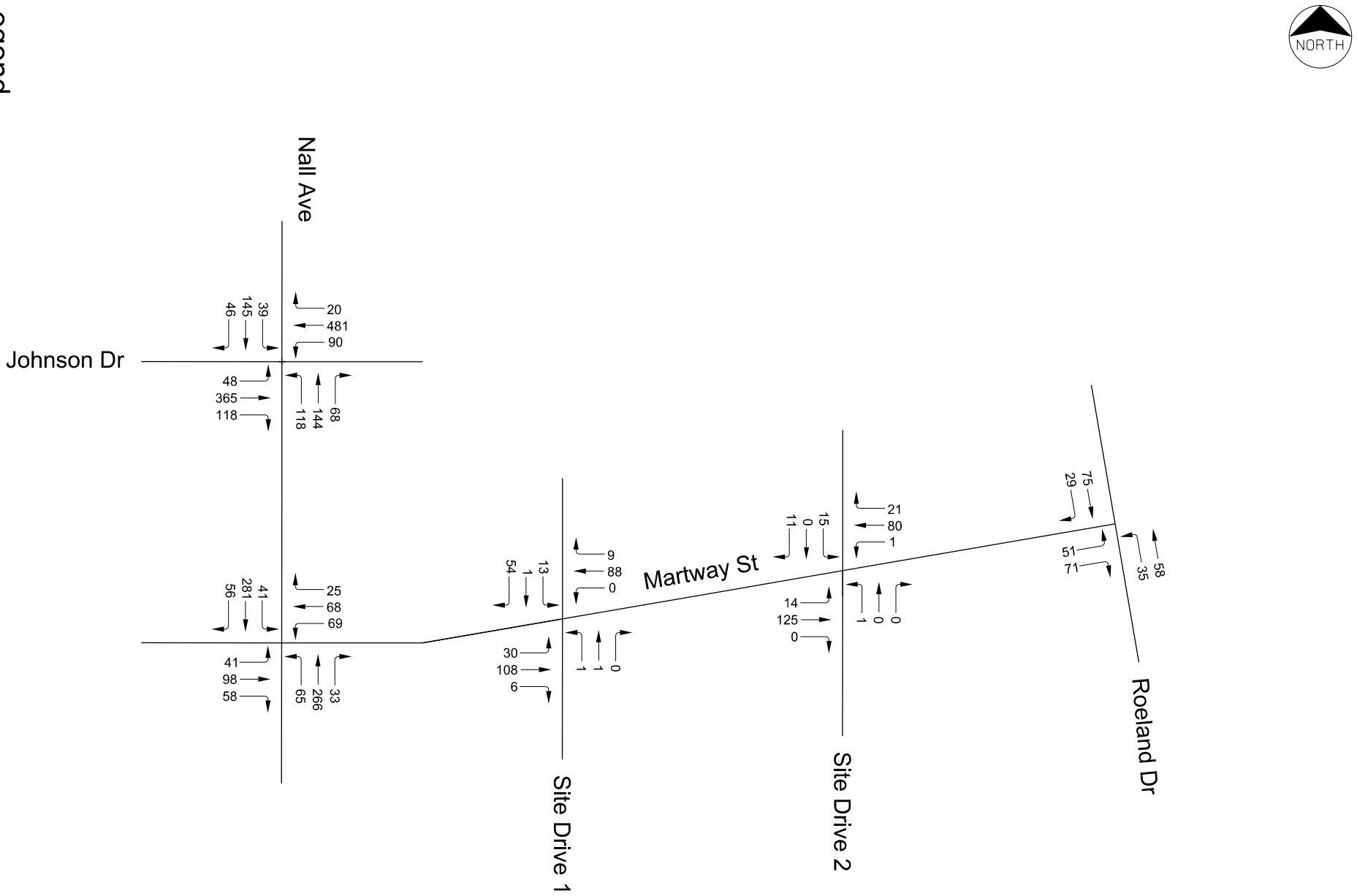
123 - Total Hourly Volume



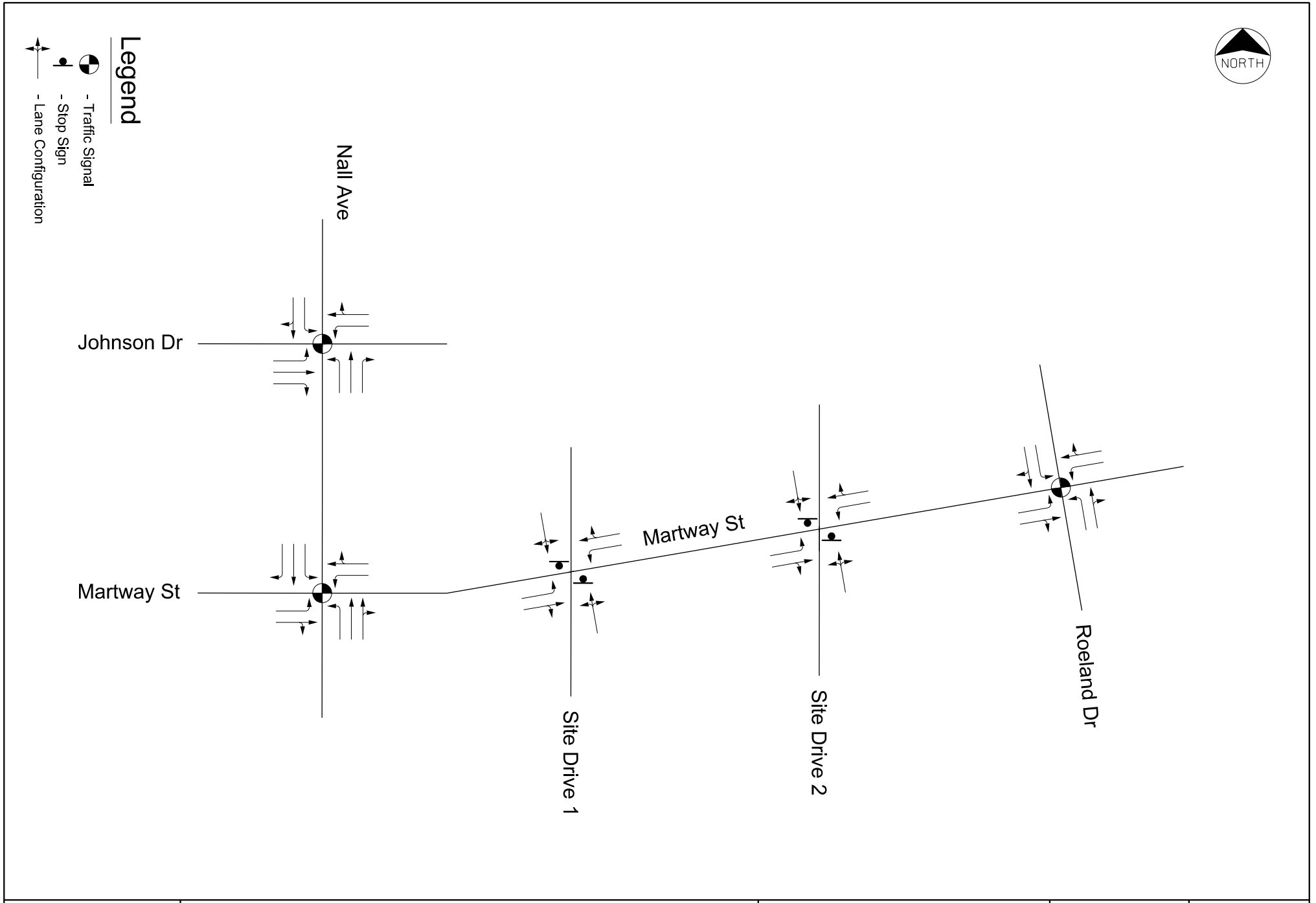
TranSystems	EXISTING CONDITIONS A.M. PEAK HOUR TRAFFIC VOLUMES	Mission Bowl Lofts Traffic Impact Study Mission, Kansas	July 2020 No Scale	Figure A-4

Legend

123 - Total Hourly Volume



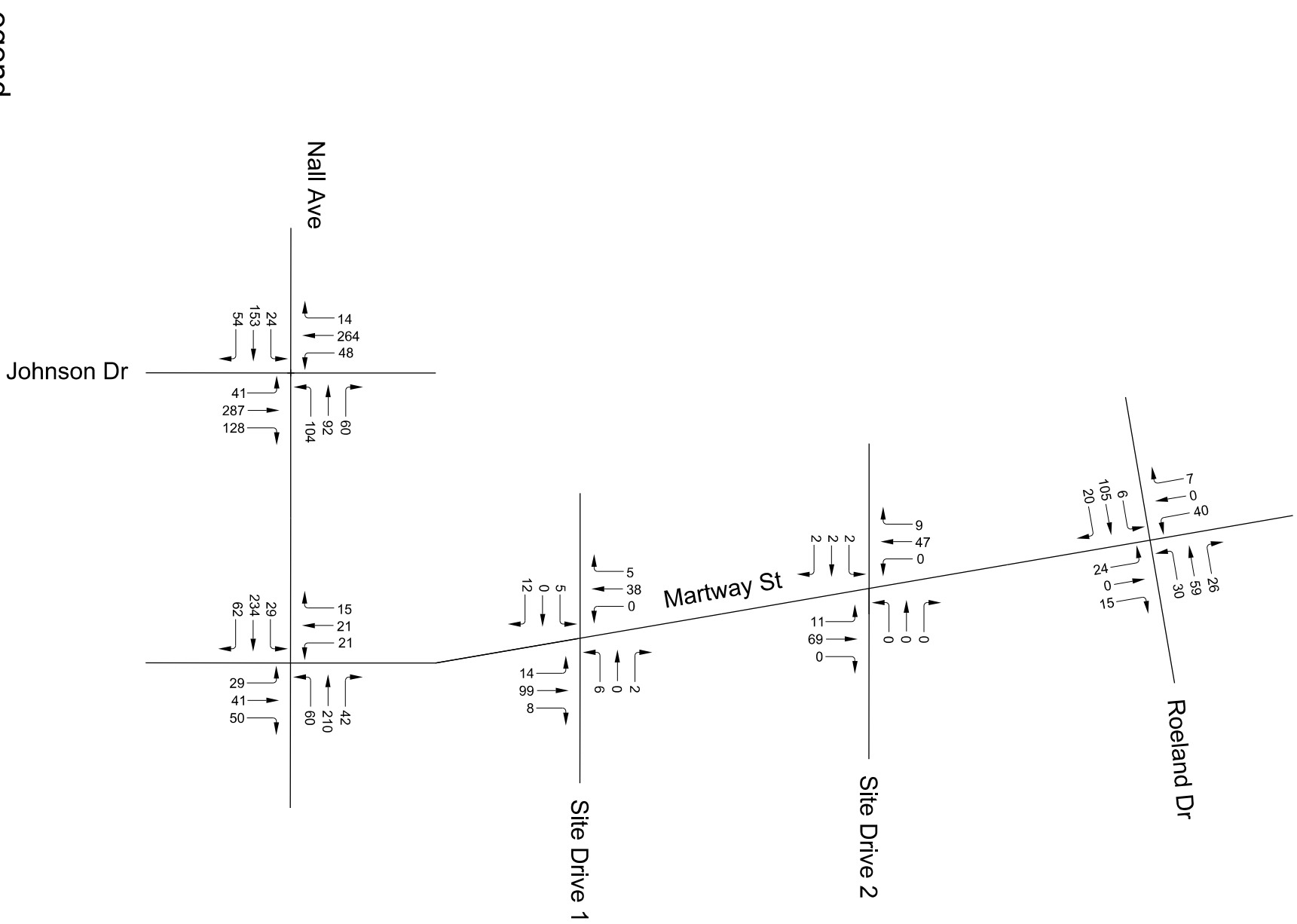
TranSystems	EXISTING CONDITIONS P.M. PEAK HOUR TRAFFIC VOLUMES	Mission Bowl Lofts Traffic Impact Study Mission, Kansas	July 2020 No Scale	Figure A-5



TranSystems	EXISTING PLUS APPROVED CONDITIONS LANE CONFIGURATIONS	Mission Bowl Lofts Traffic Impact Study Mission, Kansas	July 2020 No Scale	Figure A-6

Legend

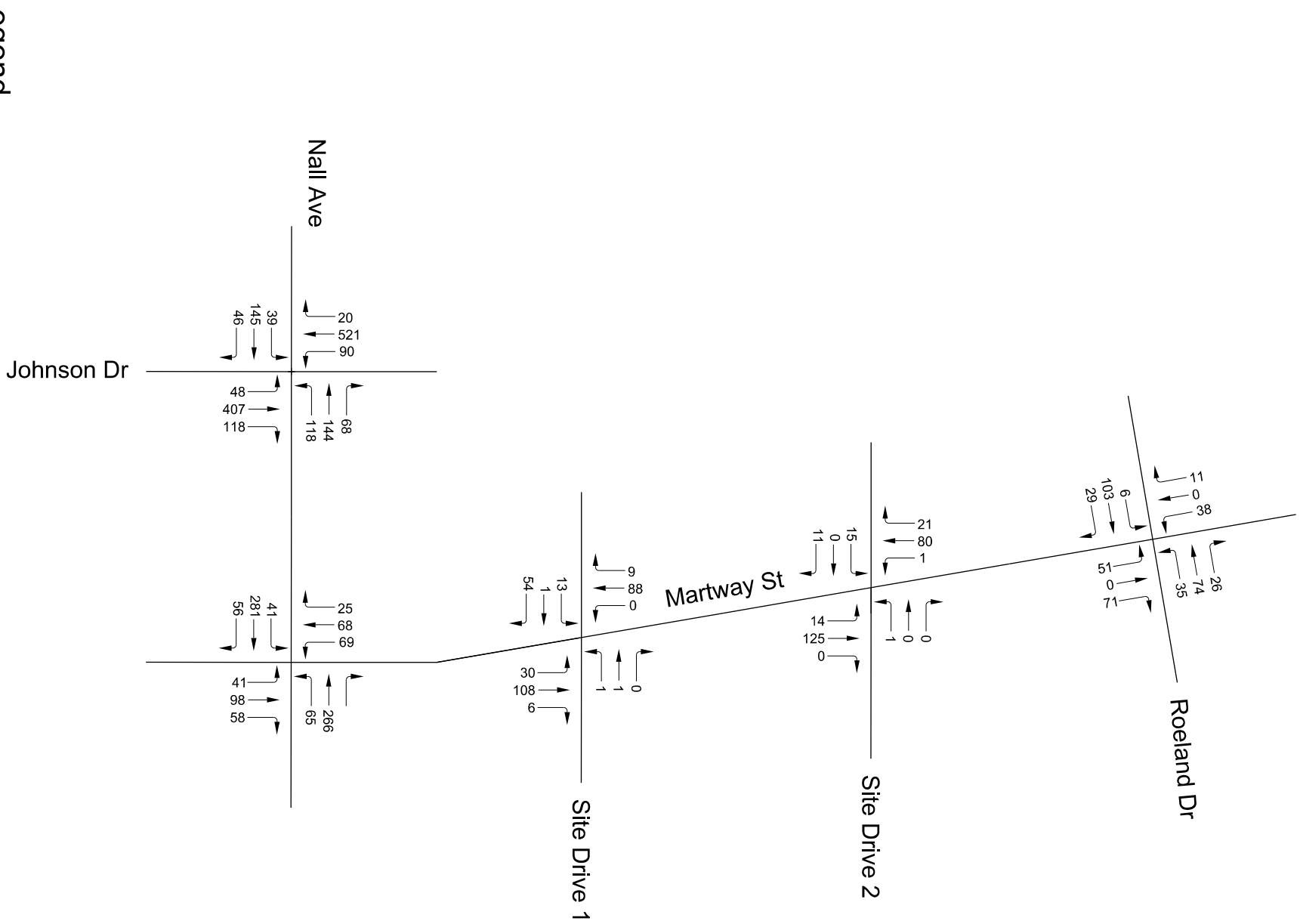
123 - Total Hourly Volume



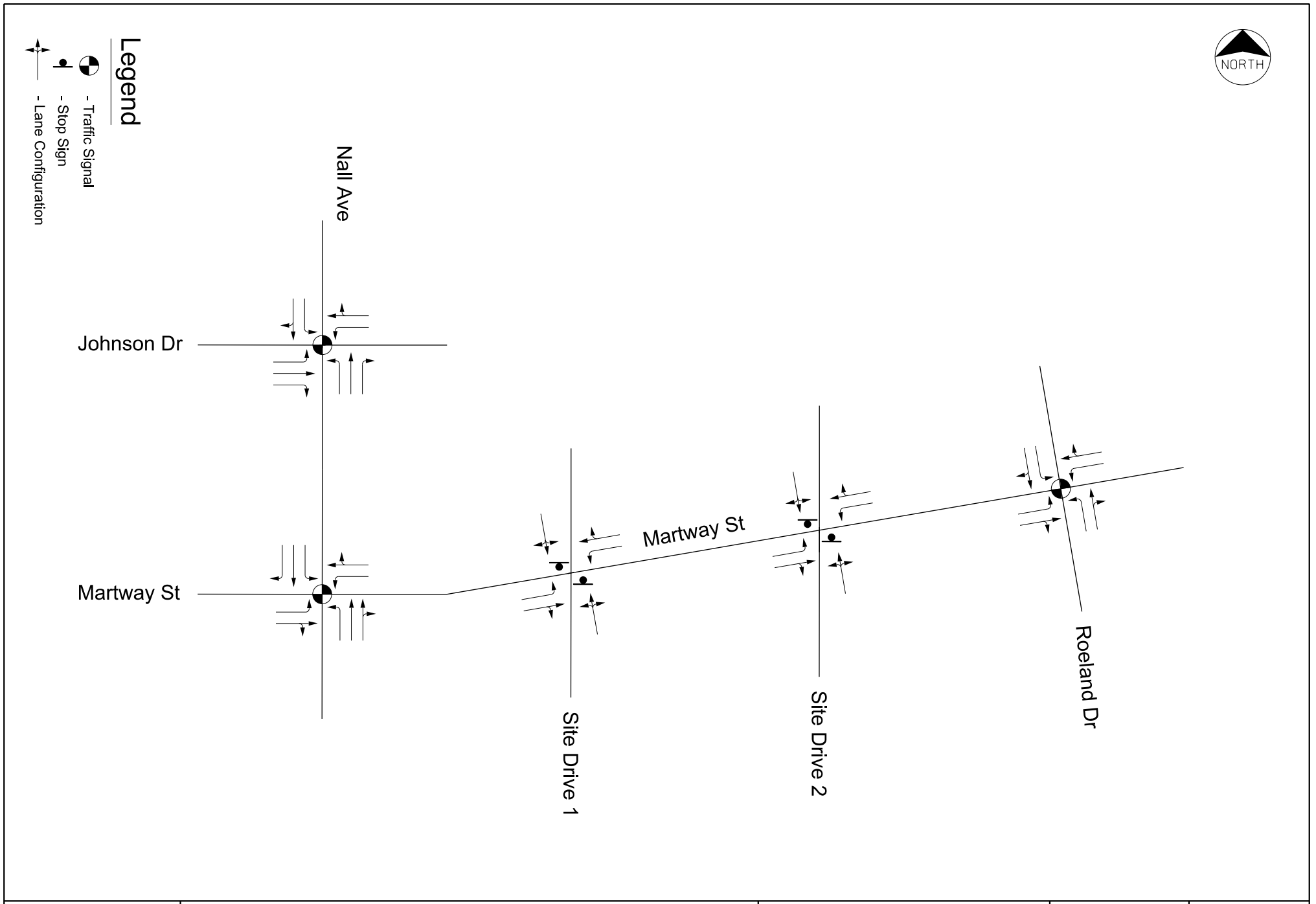
TranSystems	EXISTING PLUS APPROVED CONDITIONS A.M. PEAK HOUR TRAFFIC VOLUMES	Mission Bowl Lofts Traffic Impact Study Mission, Kansas	July 2020 No Scale	Figure A-7

Legend

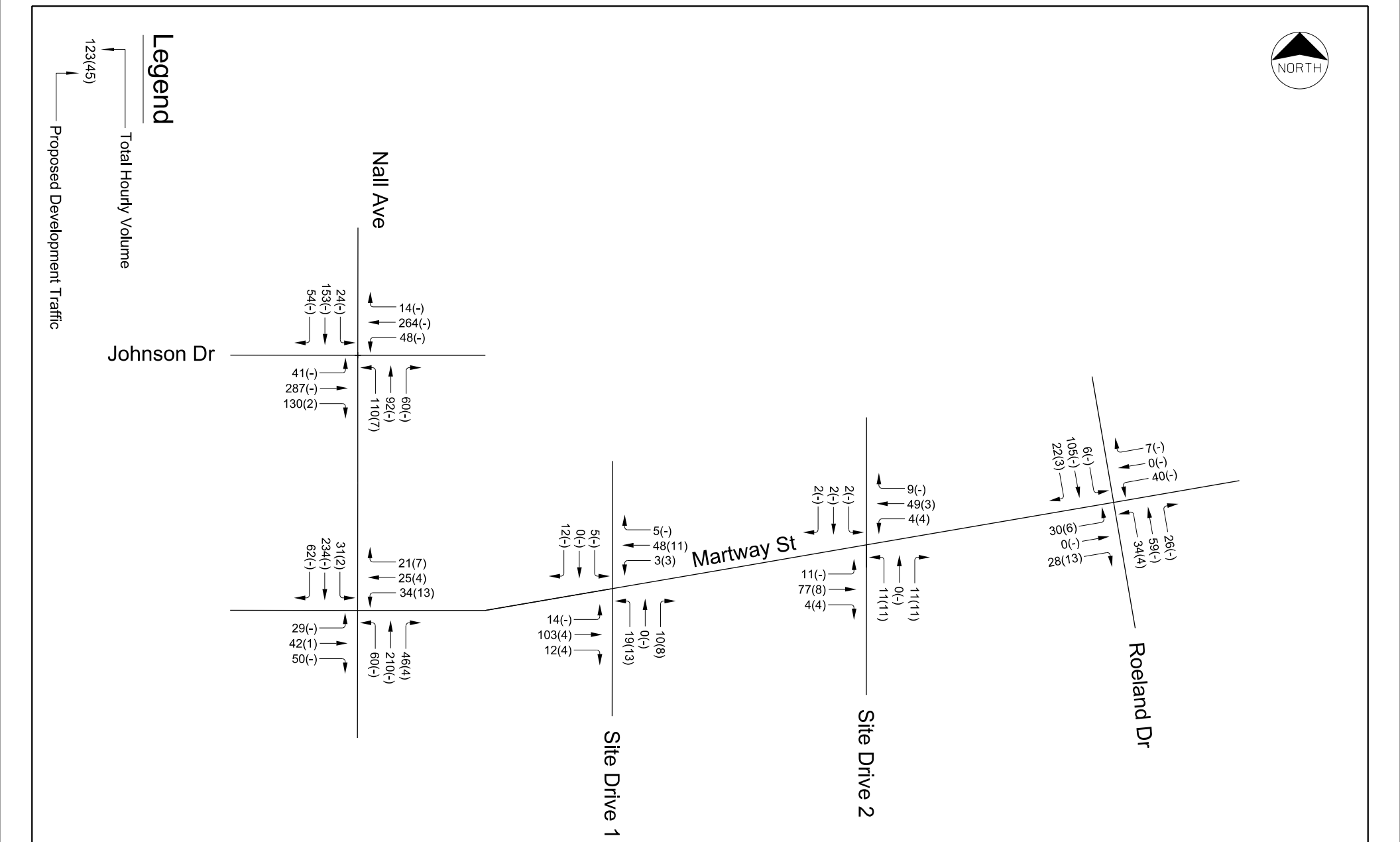
123 - Total Hourly Volume



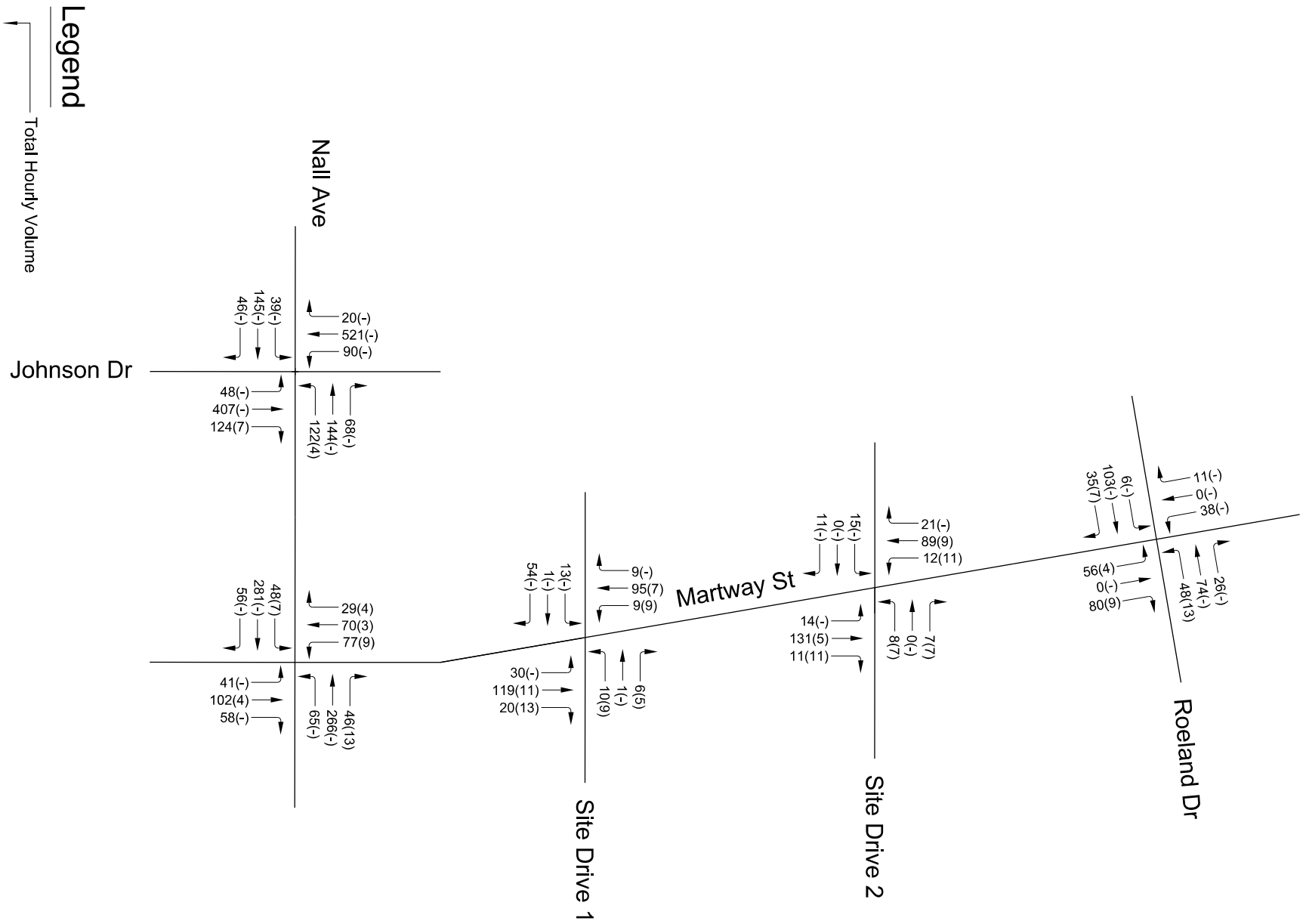
TranSystems	EXISTING PLUS APPROVED CONDITIONS P.M. PEAK HOUR TRAFFIC VOLUMES	Mission Bowl Lofts Traffic Impact Study Mission, Kansas	July 2020 No Scale	Figure A-8



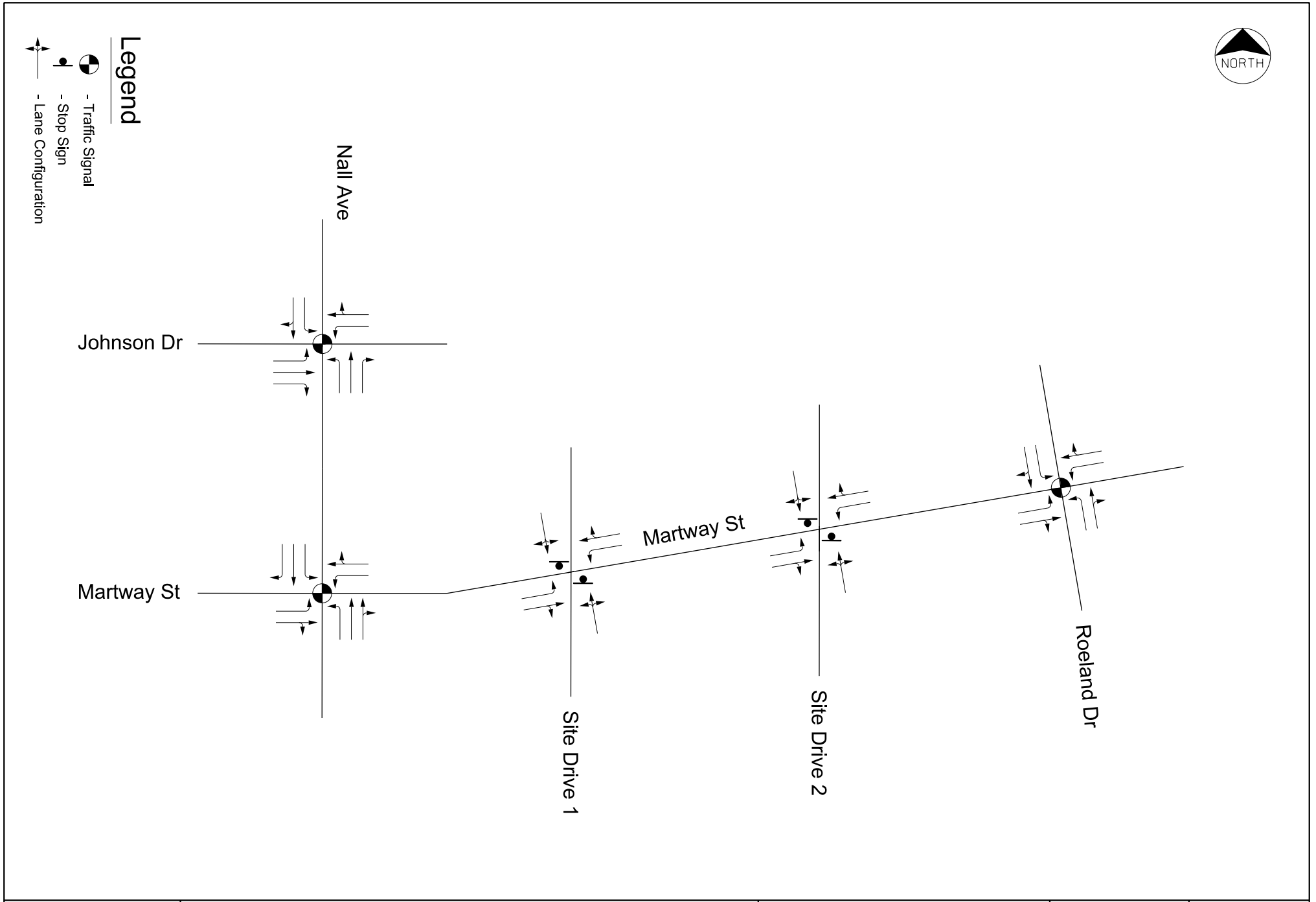
TranSystems	EXISTING PLUS APPROVED PLUS DEVELOPMENT LANE CONFIGURATIONS	Mission Bowl Lofts Traffic Impact Study Mission, Kansas	July 2020 No Scale	Figure A-9



TranSystems	EXISTING PLUS APPROVED PLUS DEVELOPMENT A.M. PEAK HOUR TRAFFIC VOLUMES	Mission Bowl Lofts Traffic Impact Study Mission, Kansas	July 2020 No Scale	Figure A-10



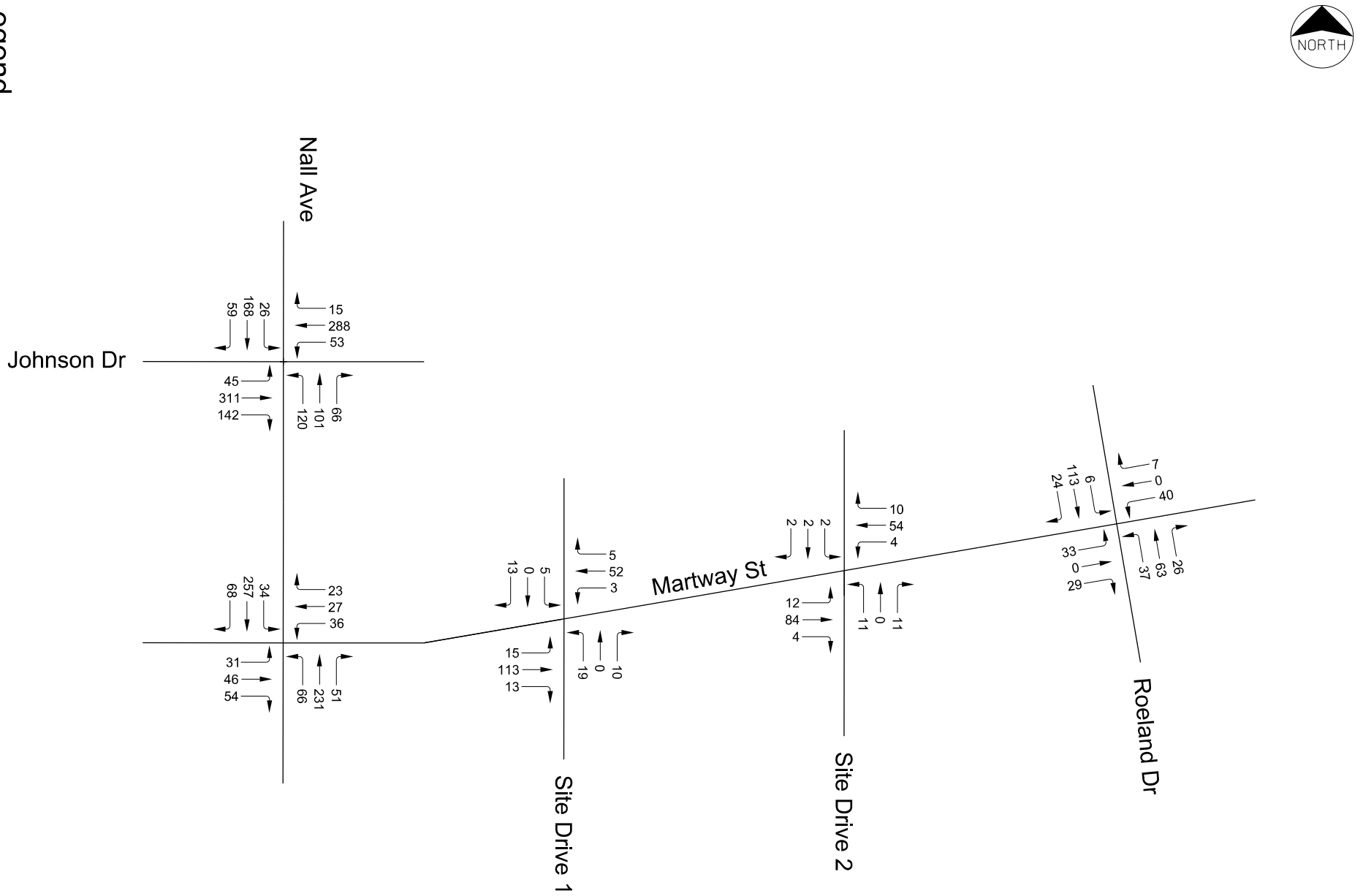
TranSystems	EXISTING PLUS APPROVED PLUS DEVELOPMENT P.M. PEAK HOUR TRAFFIC VOLUMES	Mission Bowl Lofts Traffic Impact Study Mission, Kansas	July 2020 No Scale	Figure A-11



TranSystems	FUTURE YEAR 2040 LANE CONFIGURATIONS	Mission Bowl Lofts Traffic Impact Study Mission, Kansas	July 2020 No Scale	Figure A-12

Legend

123 - Total Future Hourly Volume



TranSystems	FUTURE YEAR 2040 A.M. PEAK HOUR TRAFFIC VOLUMES	Mission Bowl Lofts Traffic Impact Study Mission, Kansas	July 2020 No Scale	Figure A-13

Legend

123 - Total Future Hourly Volume

TranSystems	FUTURE YEAR 2040 P.M. PEAK HOUR TRAFFIC VOLUMES	Mission Bowl Lofts Traffic Impact Study Mission, Kansas	July 2020 No Scale	Figure A-14

Appendix B – Trip Generation and Distribution

See attached worksheets.

Mission Bowl Lofts TIS
Mission, Kansas
Trip Generation

Land Use	Intensity	ITE Code	Daily	A.M. Peak Hour					P.M. Peak Hour				
				Total	% In	% Out	In	Out	Total	% In	% Out	In	Out
Multi-Family Housing (Mid-Rise)	166 units	221	903	57	26%	74%	15	42	73	61%	39%	45	28
Total New Proposed Development Trips			***903***	***57***			***15***	***42***	***73***			***45***	***28***

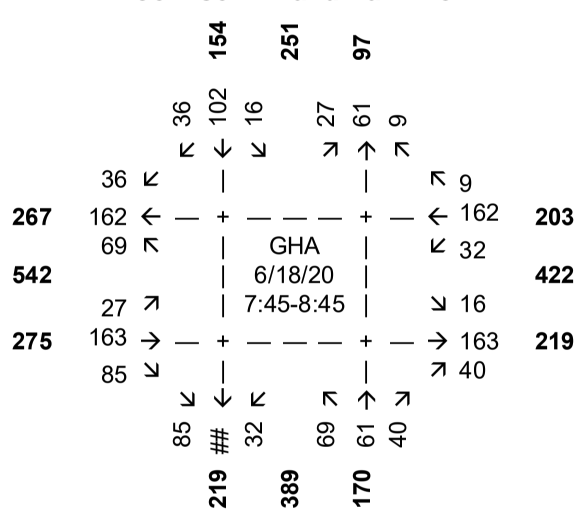
Notes -

- Trip generation estimates were developed using ITE's Trip Generation, 10th Edition.

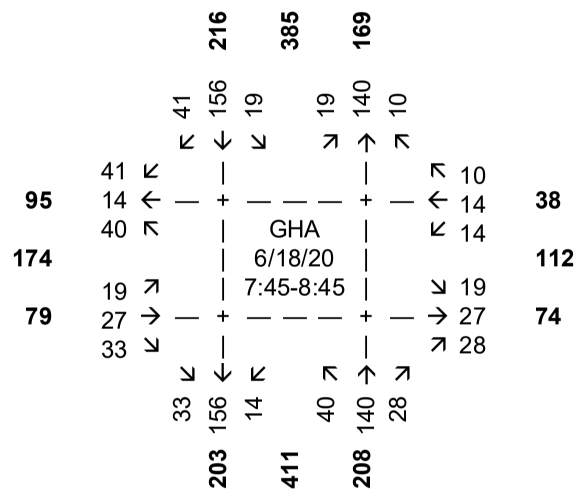
Mission Bowl Lofts TIS
Mission, Kansas

Existing Conditions
A.M. Peak Hour

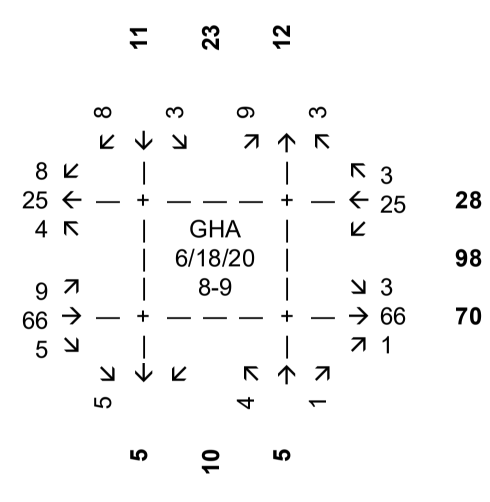
Johnson Dr and Nall Ave



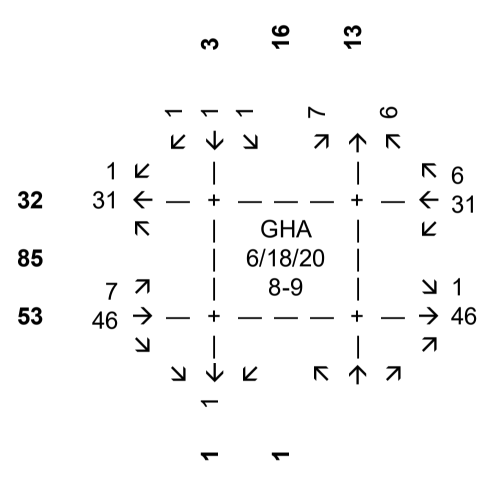
Martway St and Nall Ave



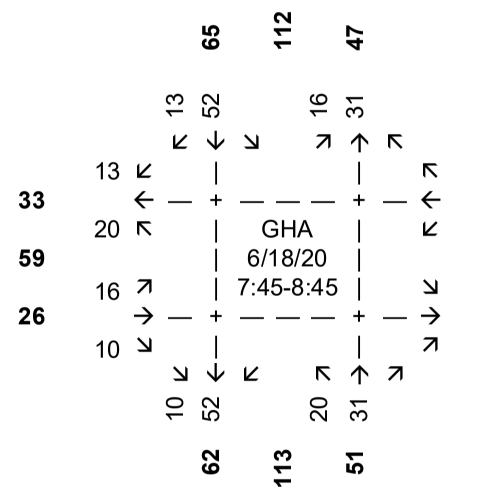
Martway St and Site Drive 1



Martway St and Site Drive 2



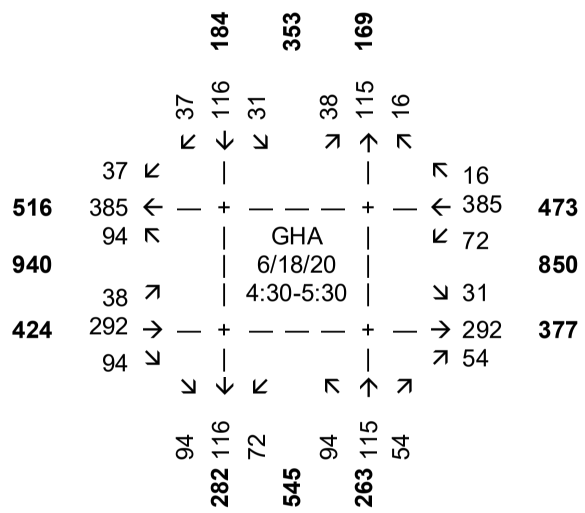
Martway St and Roeland Drive



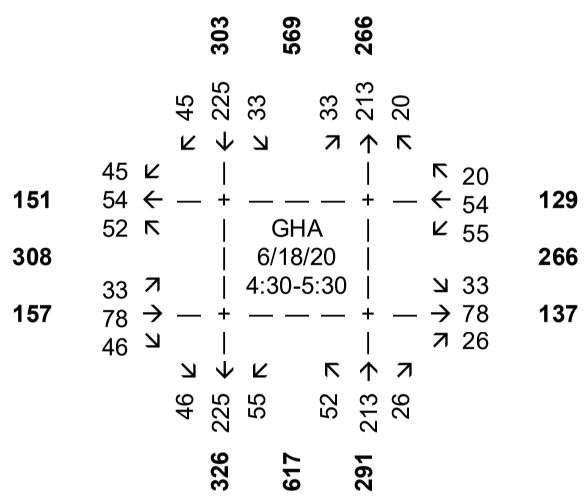
Mission Bowl Lofts TIS
Mission, Kansas

Existing Conditions
P.M. Peak Hour

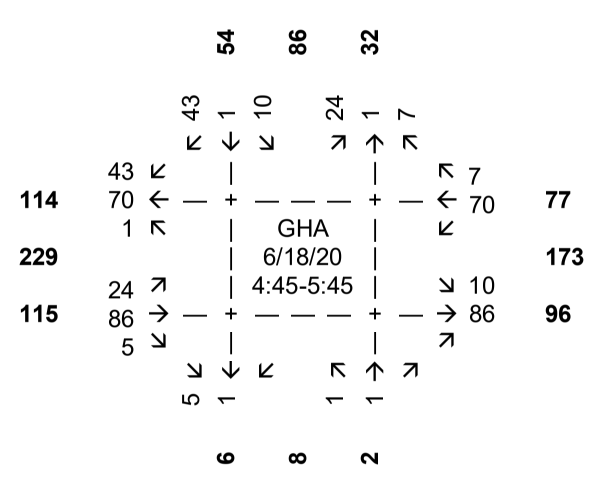
Johnson Dr and Nall Ave



Martway St and Nall Ave



Martway St and Site Drive 1



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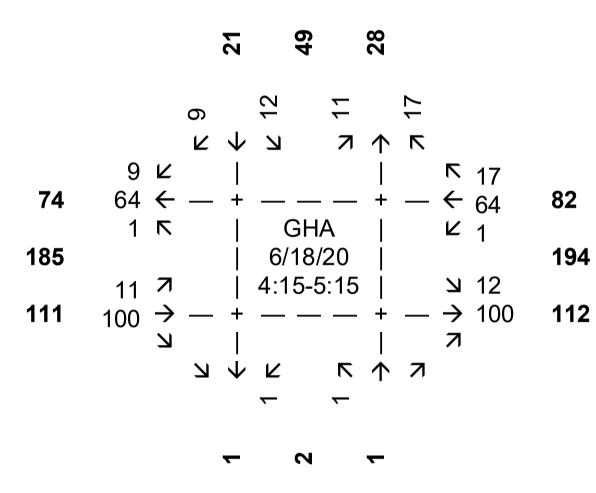
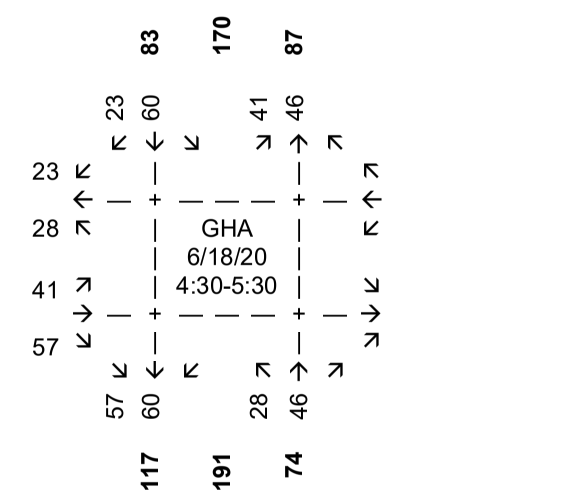


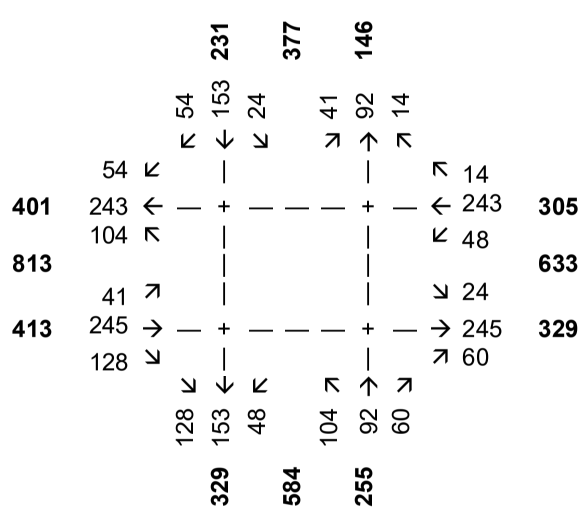
Martway St and Roeland Drive



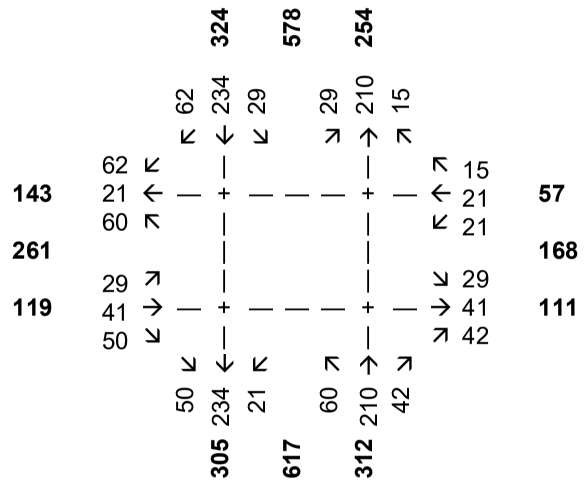
Mission Bowl Lofts TIS
Mission, Kansas

Existing Conditions
A.M. Peak Hour

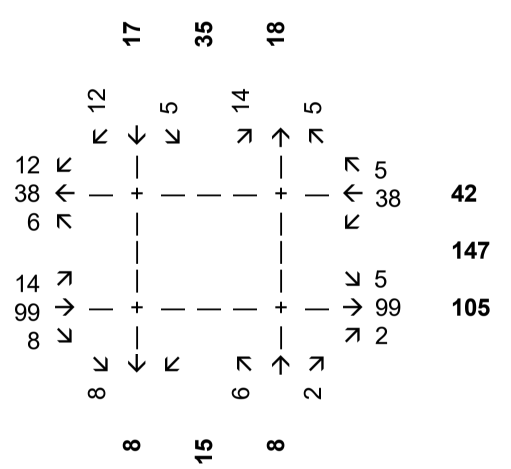
Johnson Dr and Nall Ave



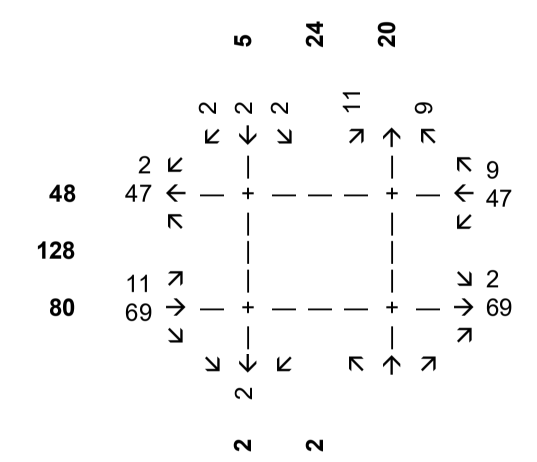
Martway St and Nall Ave



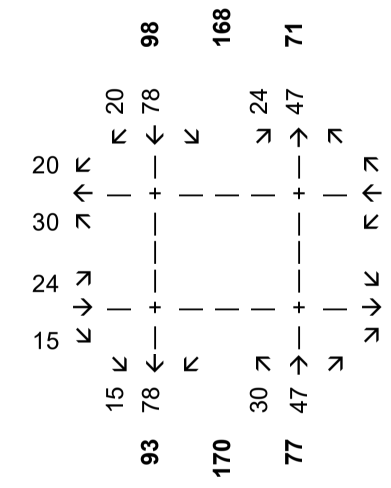
Martway St and Site Drive 1



Martway St and Site Drive 2



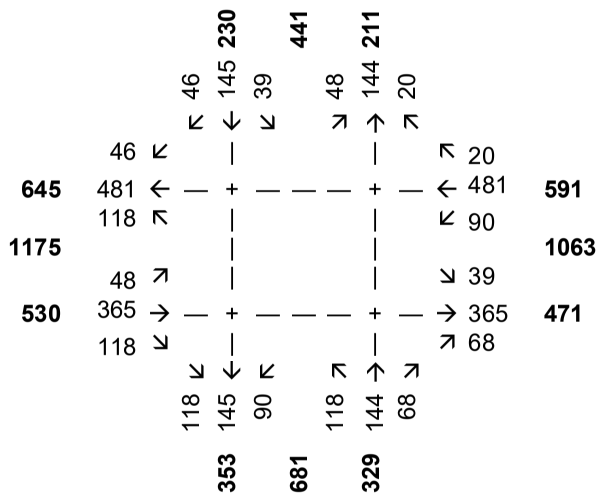
Martway St and Roeland Drive



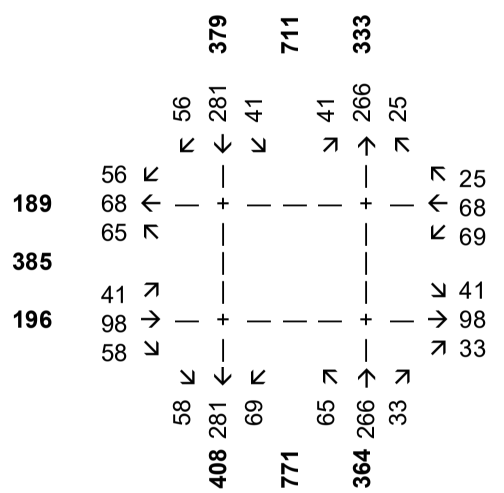
Mission Bowl Lofts TIS
Mission, Kansas

Existing Conditions
P.M. Peak Hour

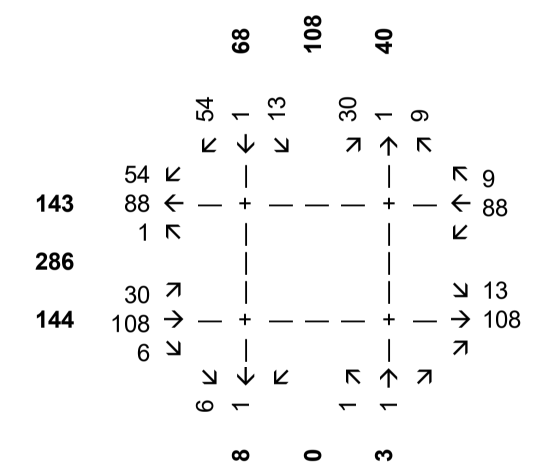
Johnson Dr and Nall Ave



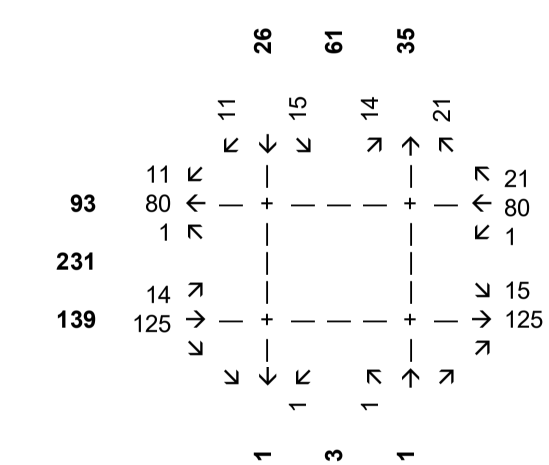
Martway St and Nall Ave



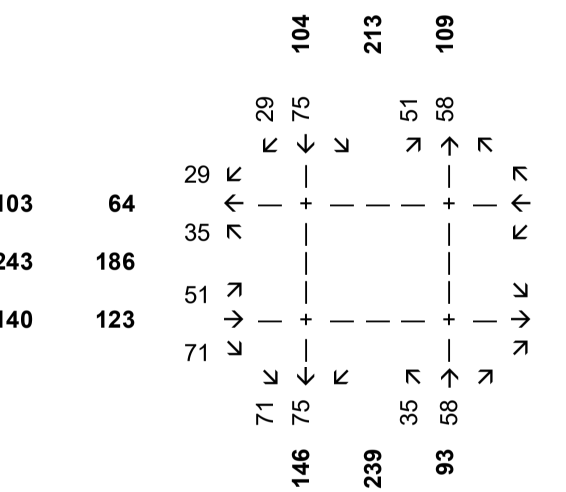
Martway St and Site Drive 1



Martway St and Site Drive 2



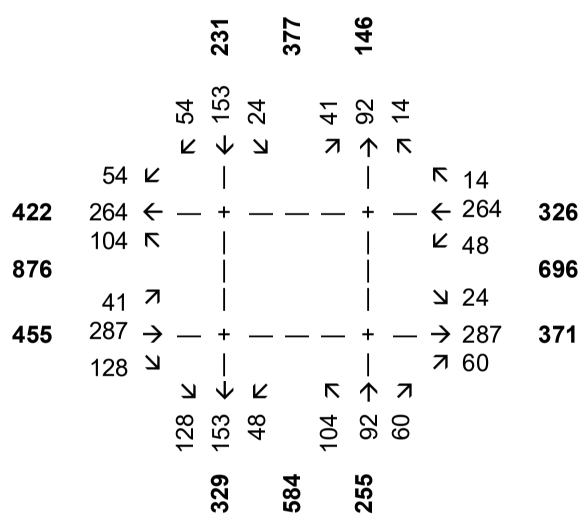
Martway St and Roeland Drive



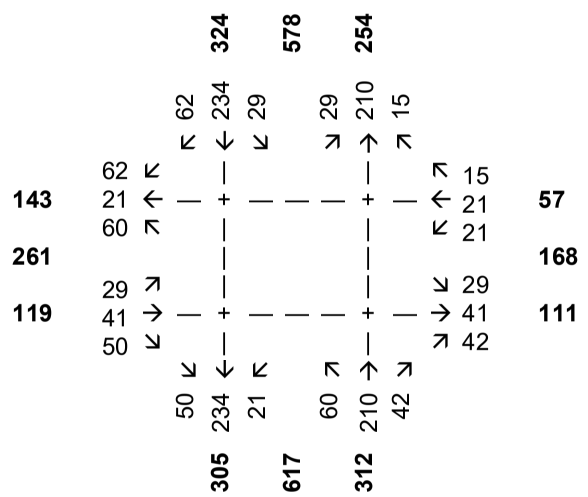
Mission Bowl Lofts TIS
Mission, Kansas

Existing + Approved Conditions
A.M. Peak Hour

Johnson Dr and Nall Ave



Martway St and Nall Ave



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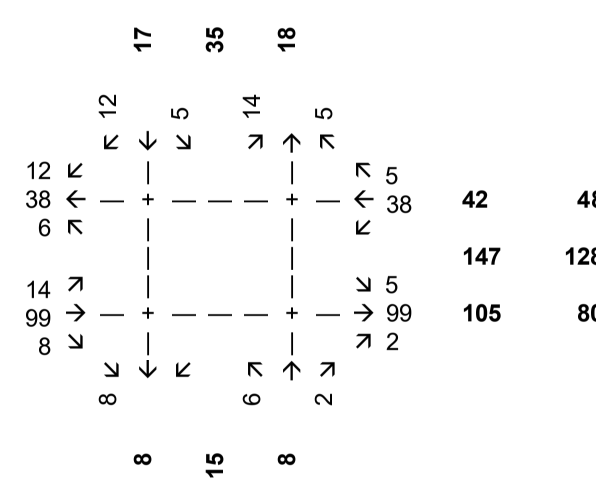

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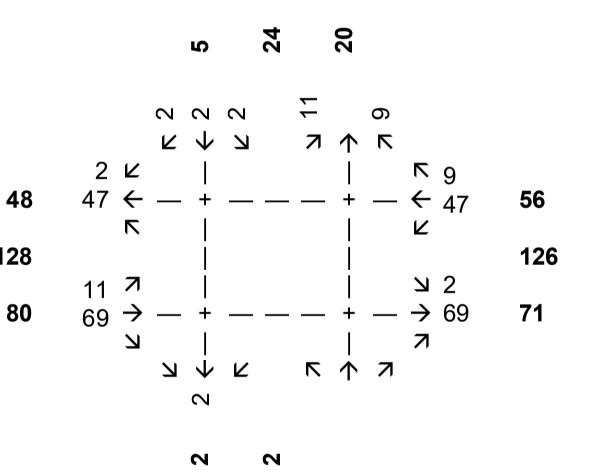

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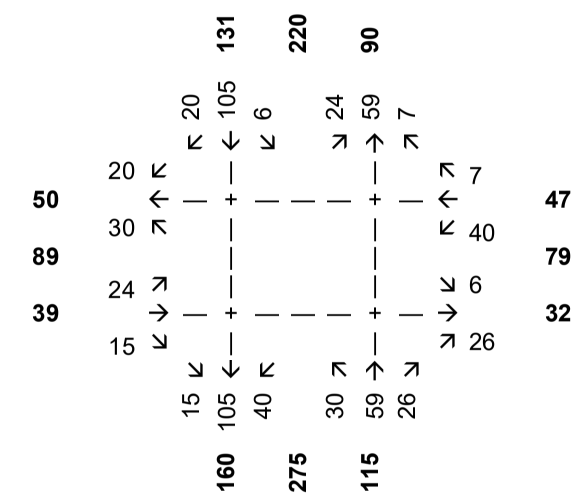
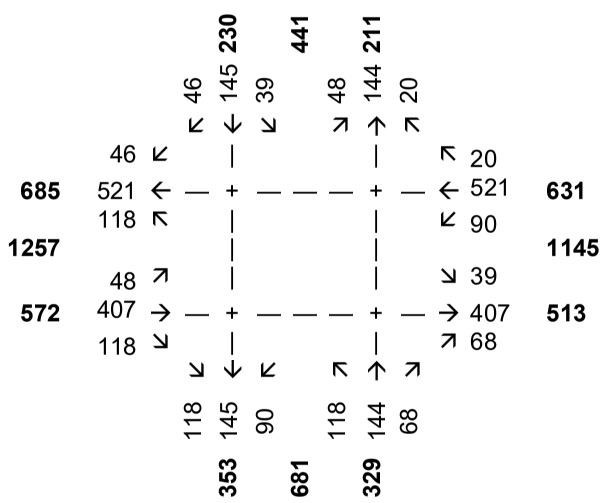


Mission Bowl Lofts TIS
Mission, Kansas

Existing + Approved Conditions
P.M. Peak Hour

Johnson Dr and Nall Ave



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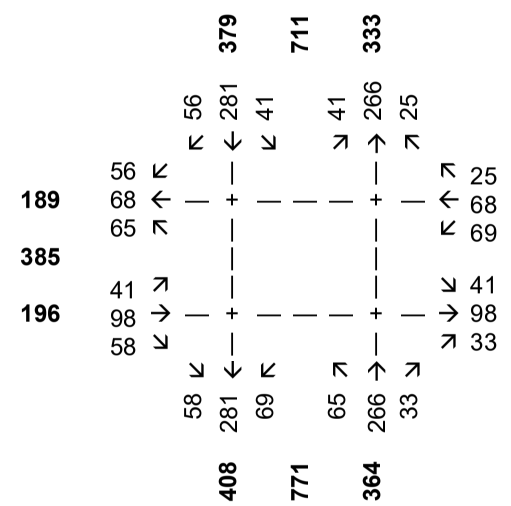

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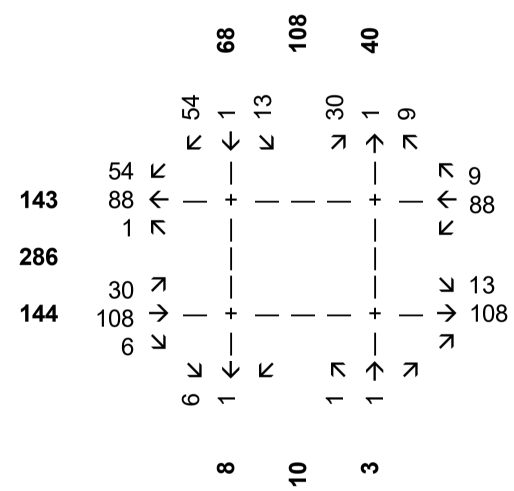

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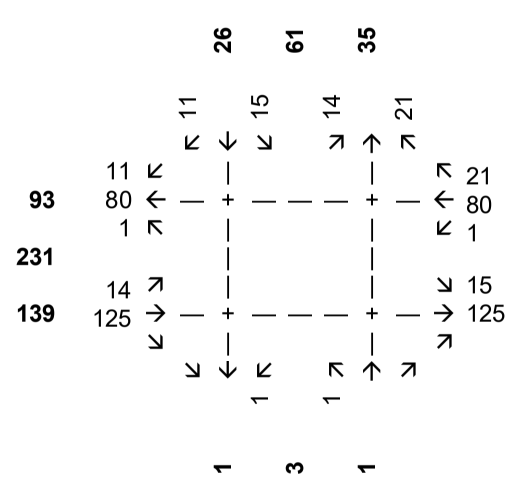

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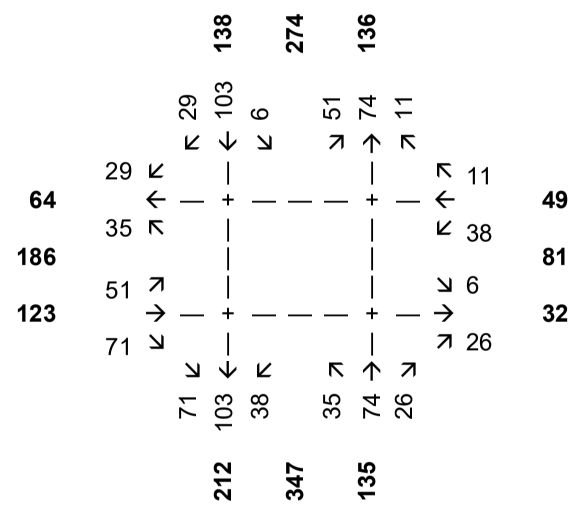
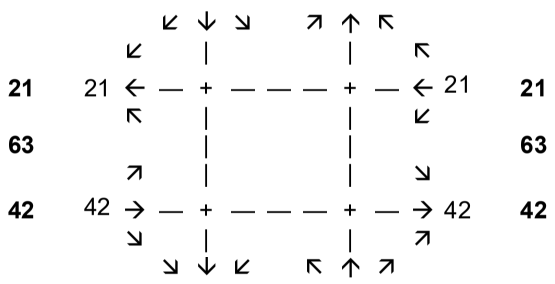


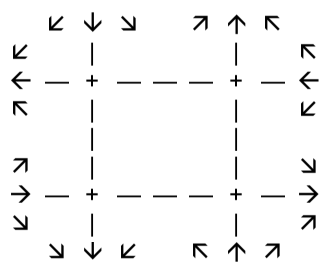
Mission Bowl Lofts TIS
Mission, Kansas

Mission Gateway Approved Conditions
A.M. Peak Hour

Johnson Dr and Nall Ave



Martway St and Nall Ave



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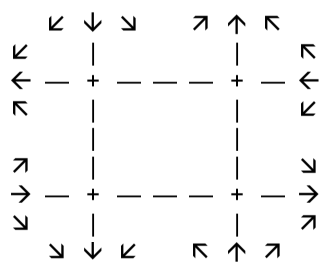

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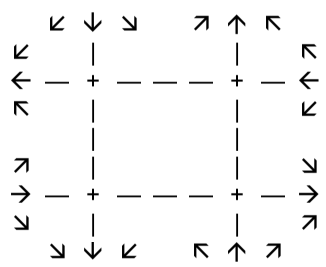

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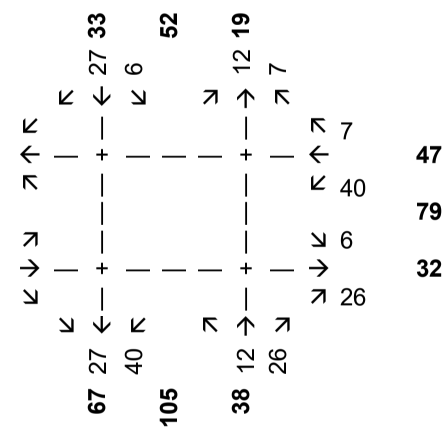
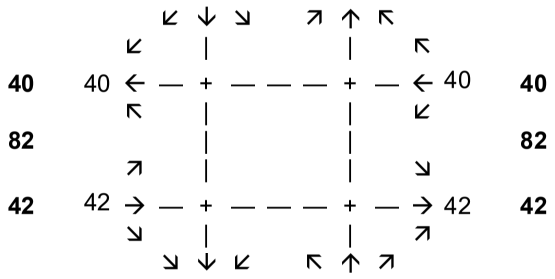


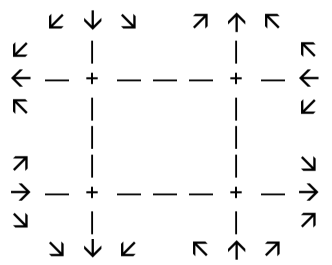
Mission Bowl Lofts TIS
Mission, Kansas

Mission Gateway Approved Conditions
P.M. Peak Hour

Johnson Dr and Nall Ave



Martway St and Nall Ave



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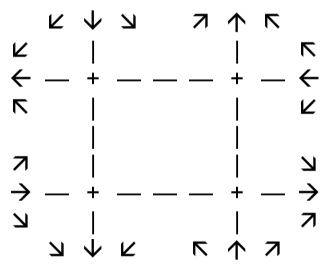

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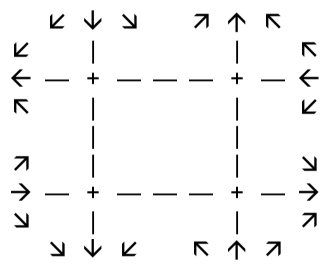

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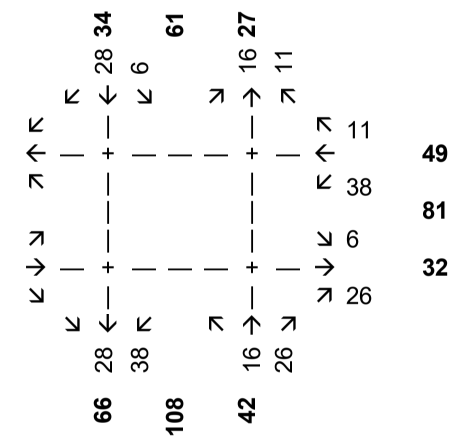
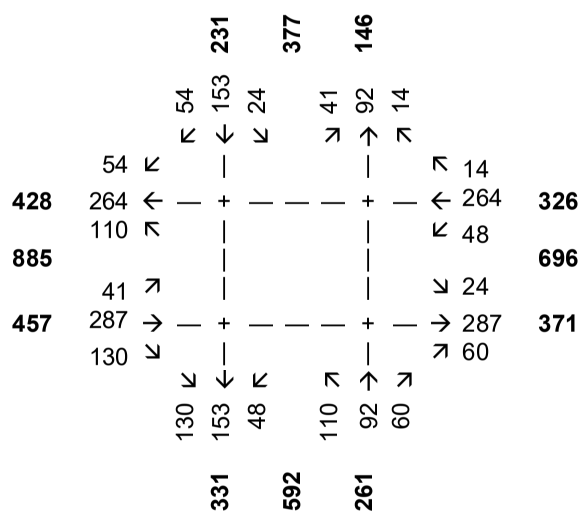


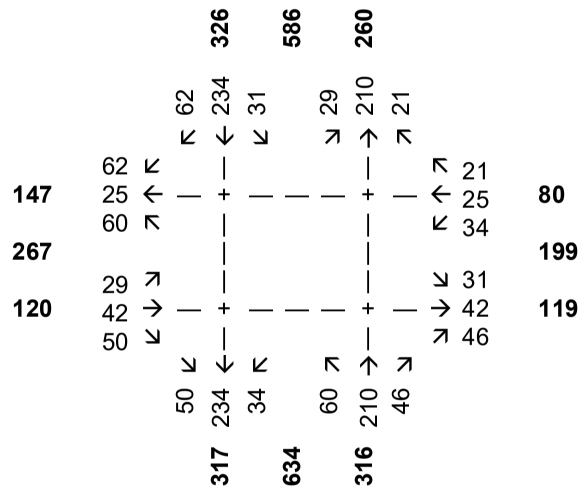
Mission Bowl Lofts TIS
Mission, Kansas

Existing + Approved + Development Conditions
A.M. Peak Hour

Johnson Dr and Nall Ave



Martway St and Nall Ave



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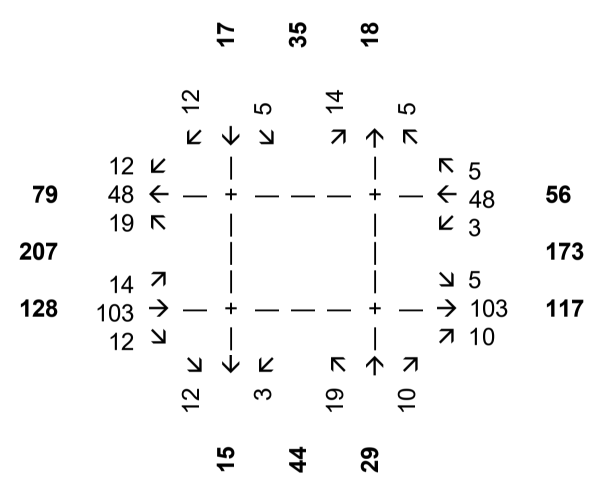

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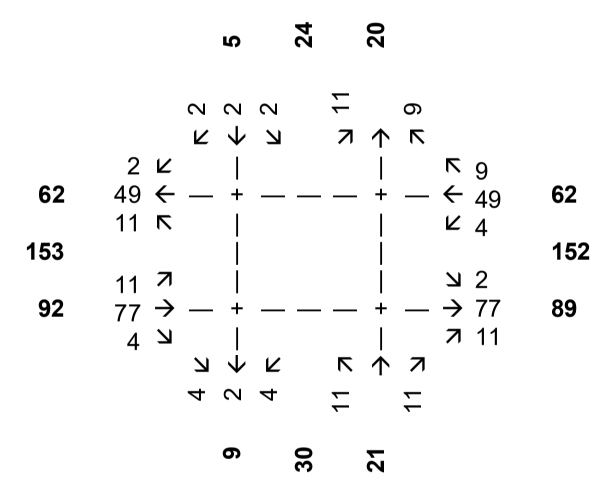

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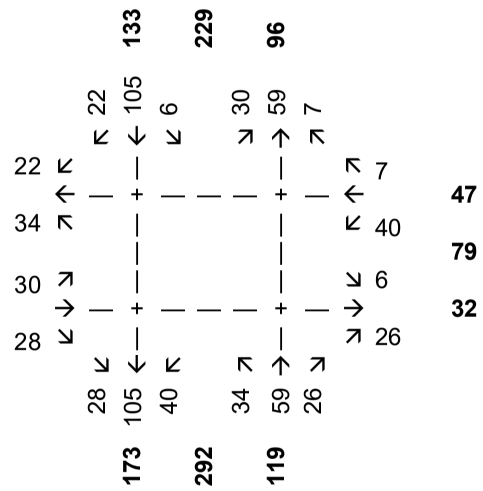
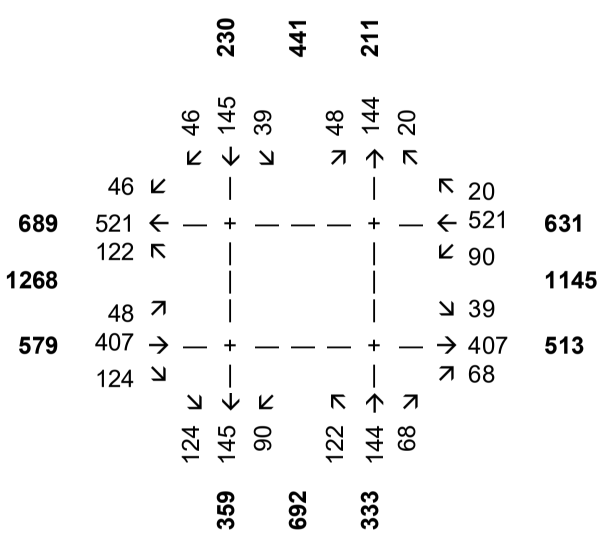


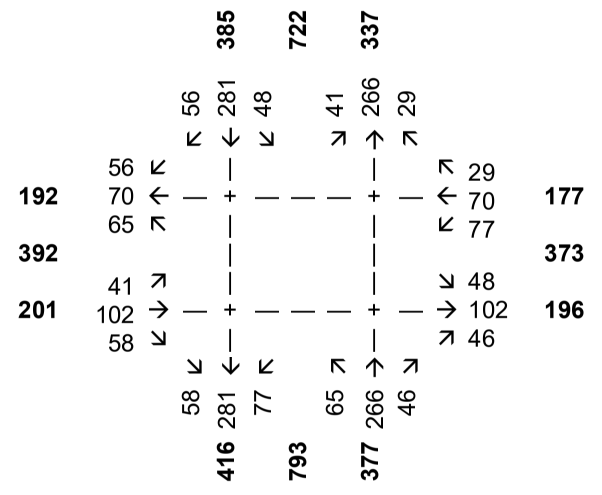
Mission Bowl Lofts TIS
Mission, Kansas

Existing + Approved + Development Conditions
P.M. Peak Hour

Johnson Dr and Nall Ave



Martway St and Nall Ave



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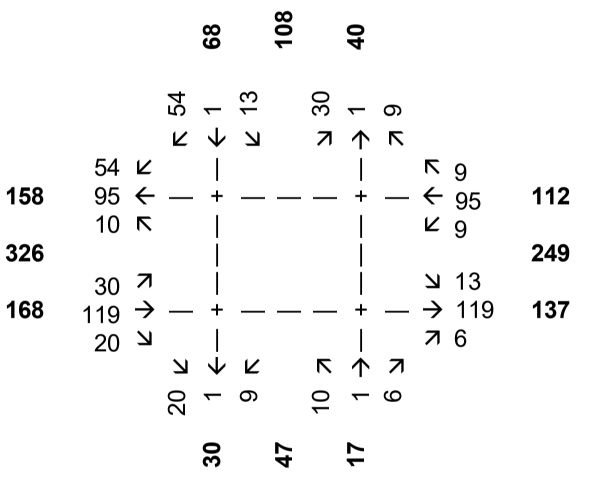

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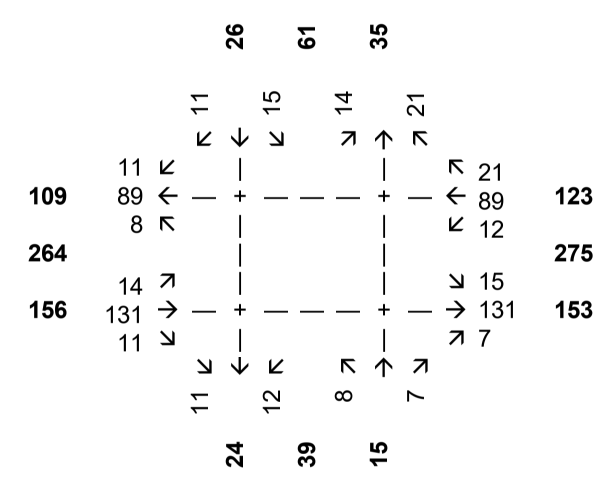

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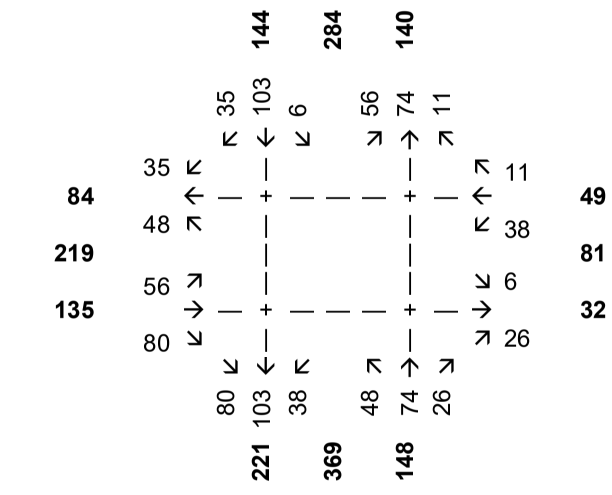
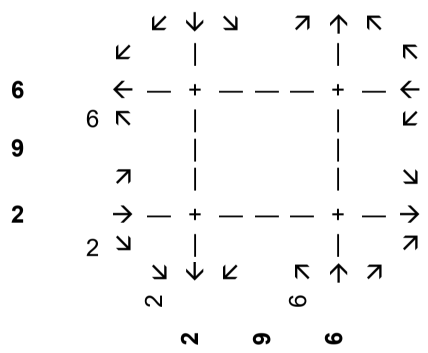


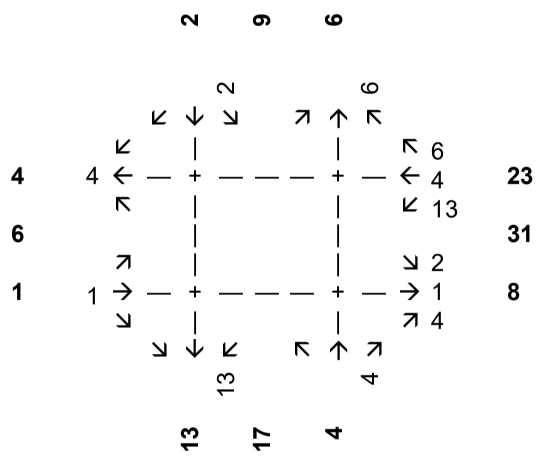
Mission Bowl Lofts TIS
Mission, Kansas

Development Trips
A.M. Peak Hour

Johnson Dr and Nall Ave



Martway St and Nall Ave



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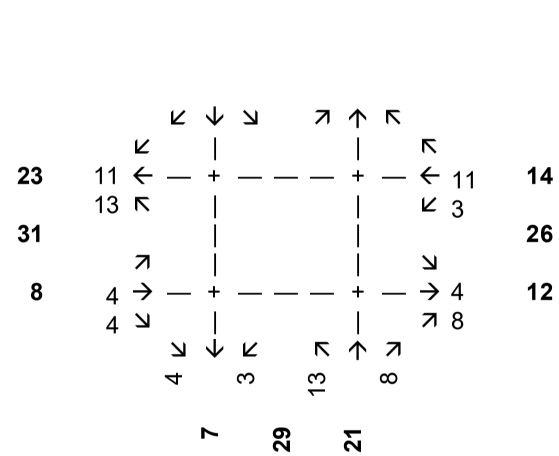

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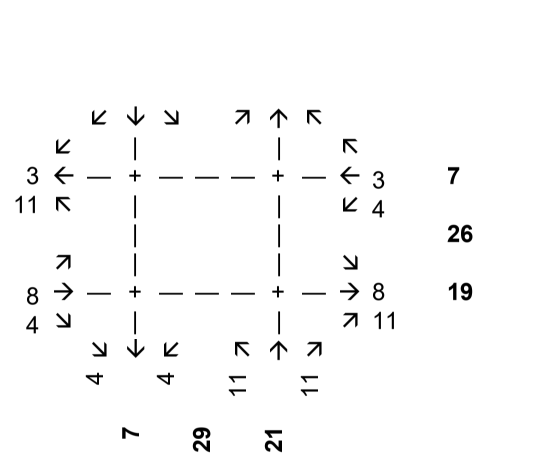

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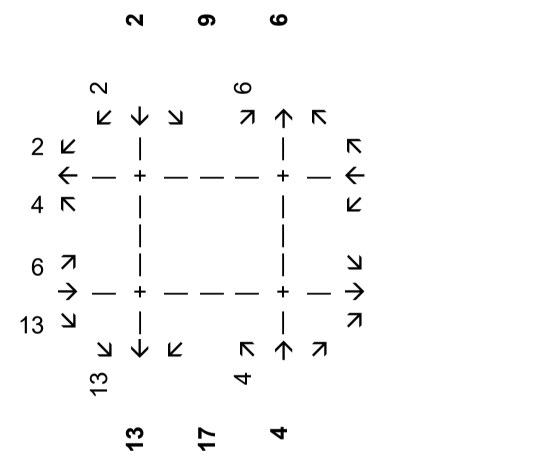
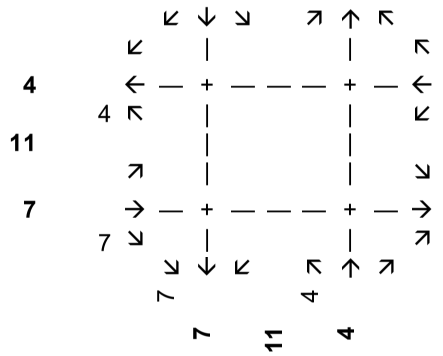


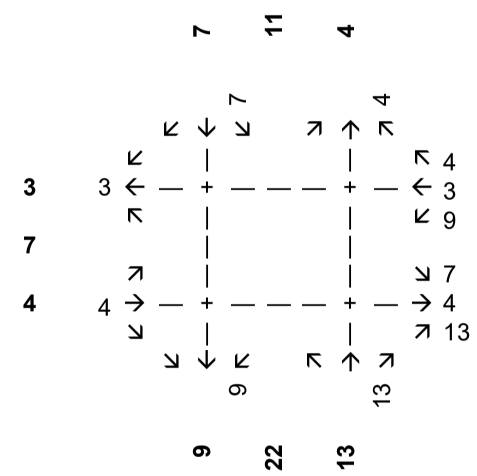
Mission Bowl Lofts TIS
Mission, Kansas

Development Trips
P.M. Peak Hour

Johnson Dr and Nall Ave



Martway St and Nall Ave



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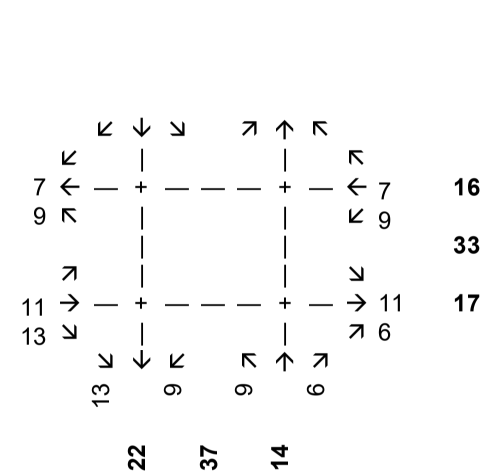

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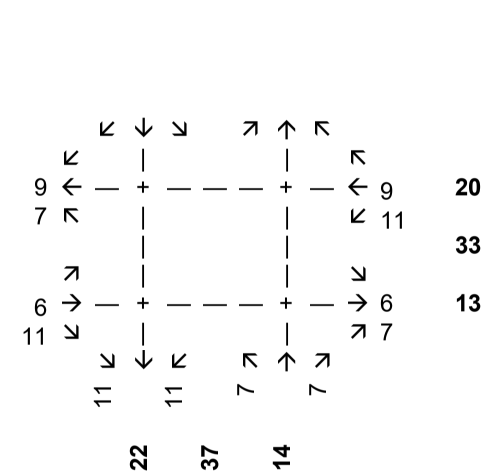

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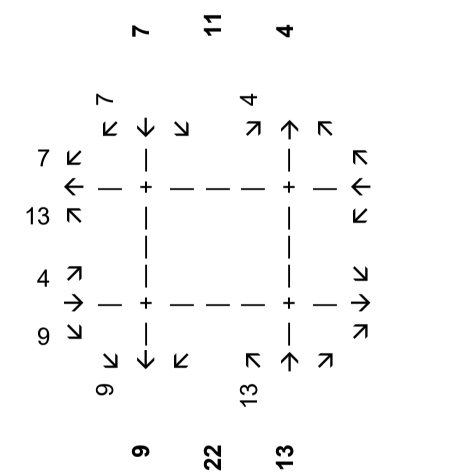
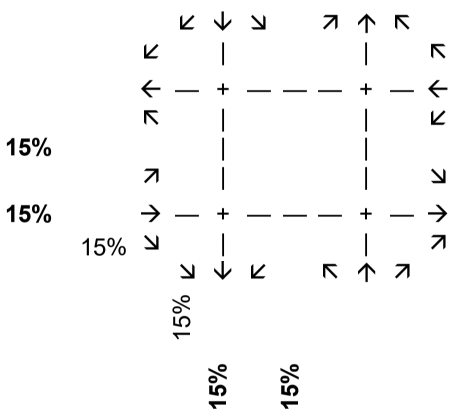


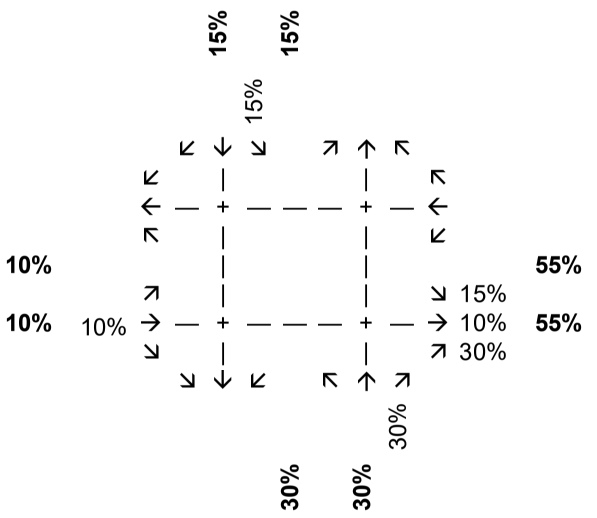
Mission Bowl Lofts TIS
Mission, Kansas

Trip Distribution
Inbound

Johnson Dr and Nall Ave



Martway St and Nall Ave



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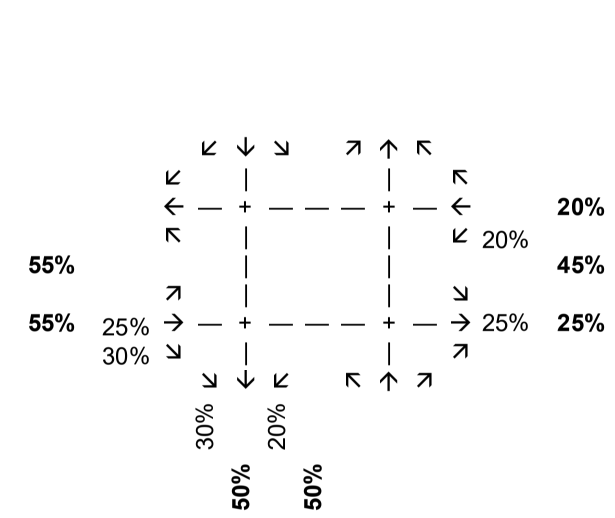

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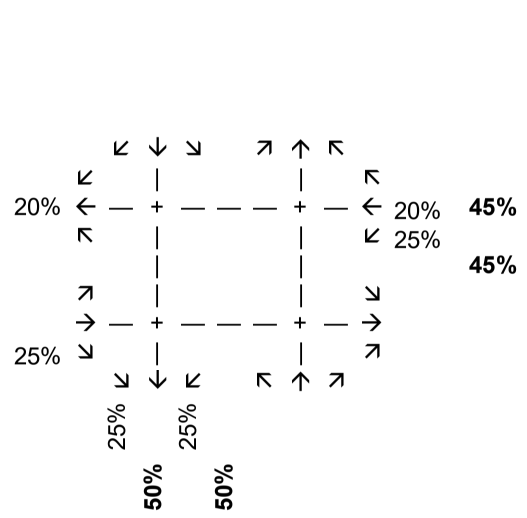
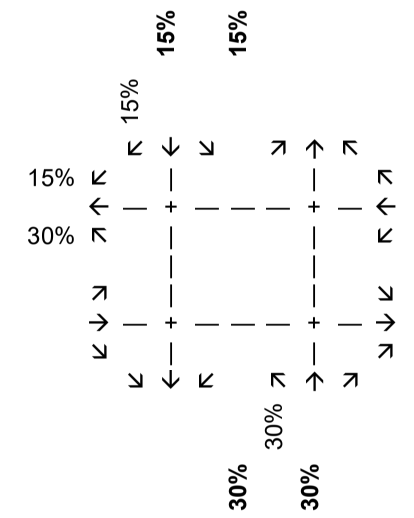


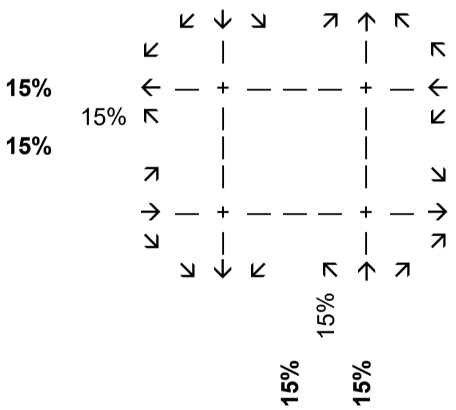
Martway St and Roeland Drive



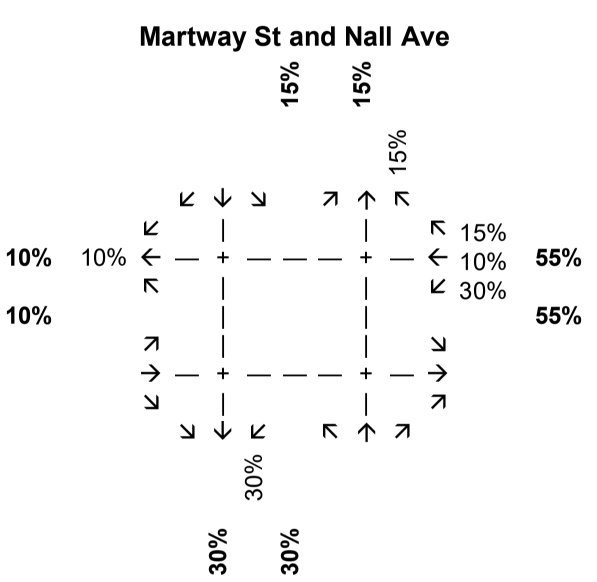
Mission Bowl Lofts TIS
Mission, Kansas

Trip Distribution
Outbound

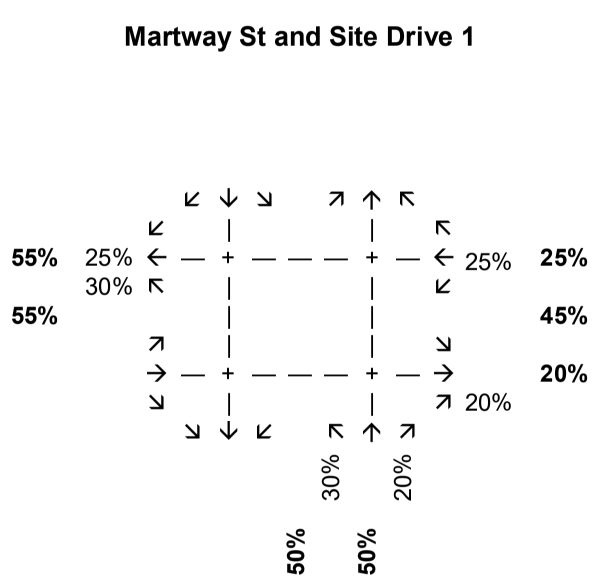
Johnson Dr and Nall Ave



Martway St and Nall Ave



Martway St and Site Drive 1



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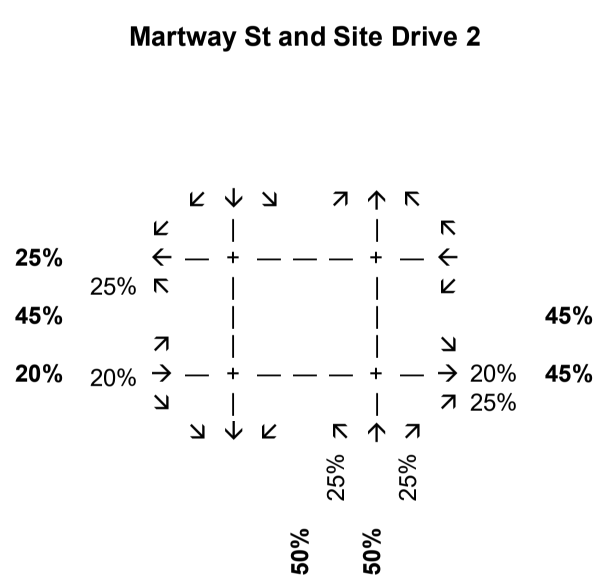

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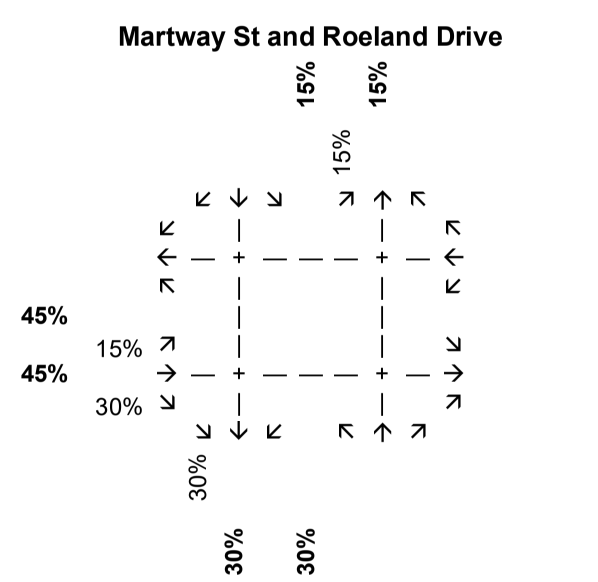
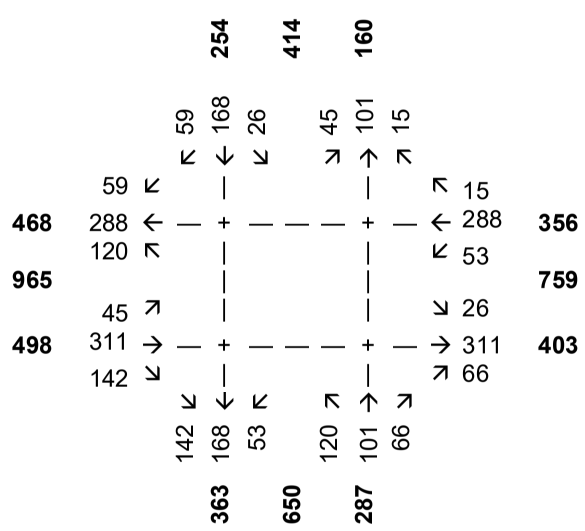


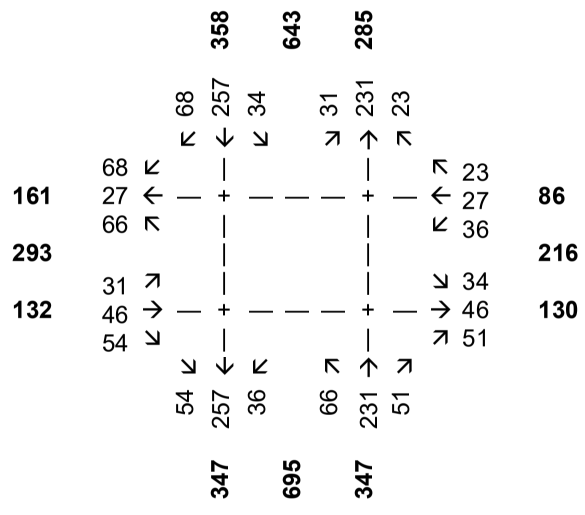
Mission Bowl Lofts TIS
Mission, Kansas

Future + Development Conditions
A.M. Peak Hour

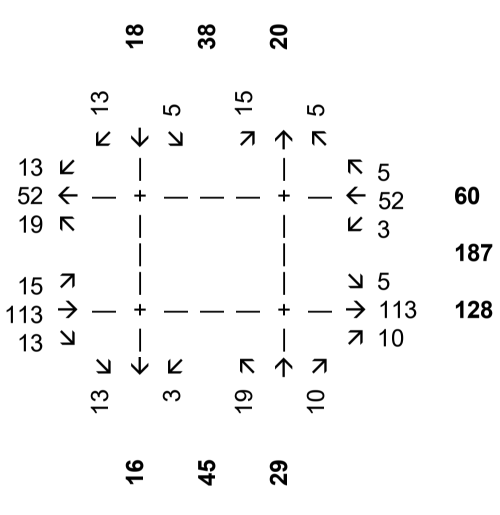
Johnson Dr and Nall Ave



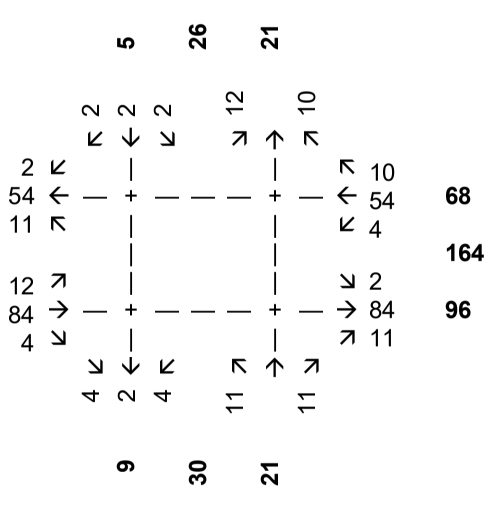
Martway St and Nall Ave



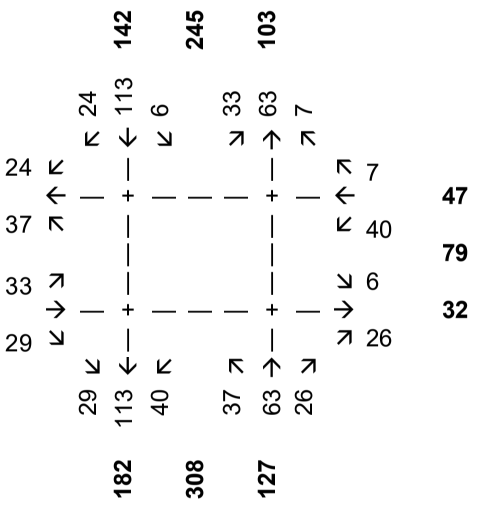
Martway St and Site Drive 1



Martway St and Site Drive 2



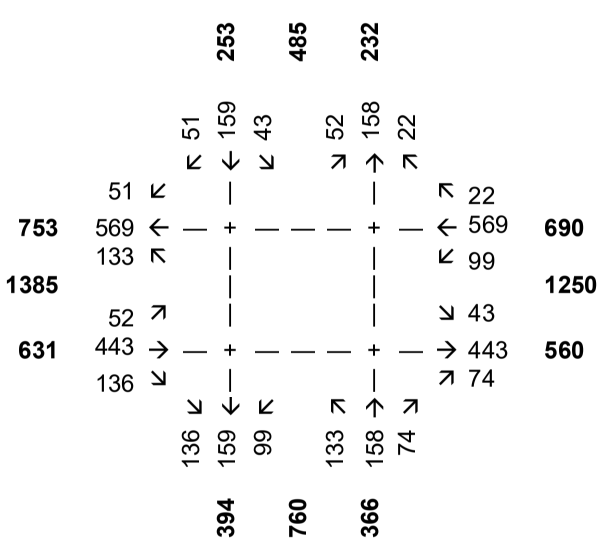
Martway St and Roeland Drive



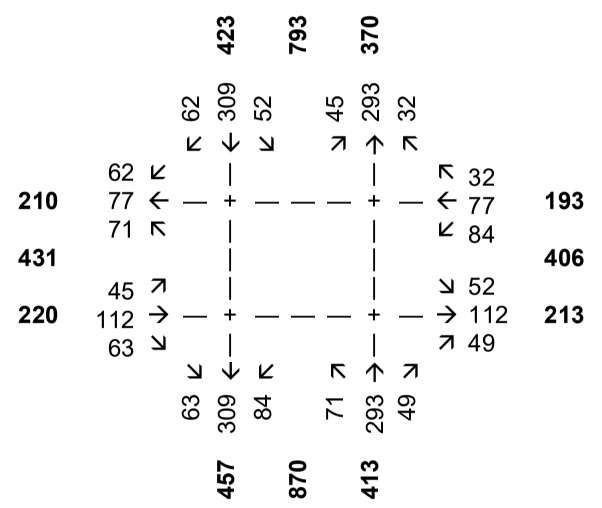
Mission Bowl Lofts TIS
Mission, Kansas

Future + Development Conditions
P.M. Peak Hour

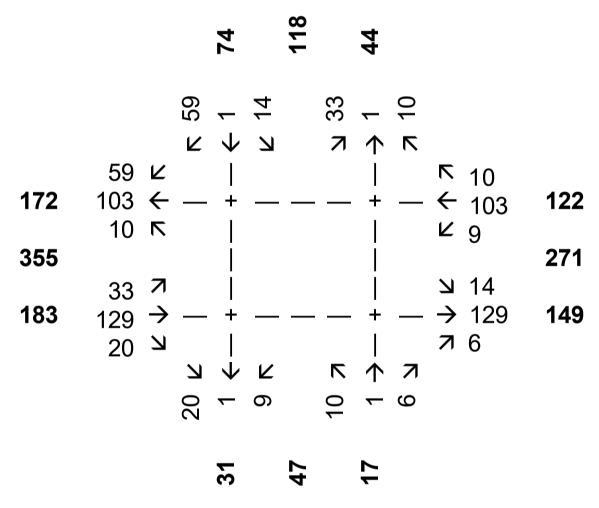
Johnson Dr and Nall Ave



Martway St and Nall Ave



Martway St and Site Drive 1



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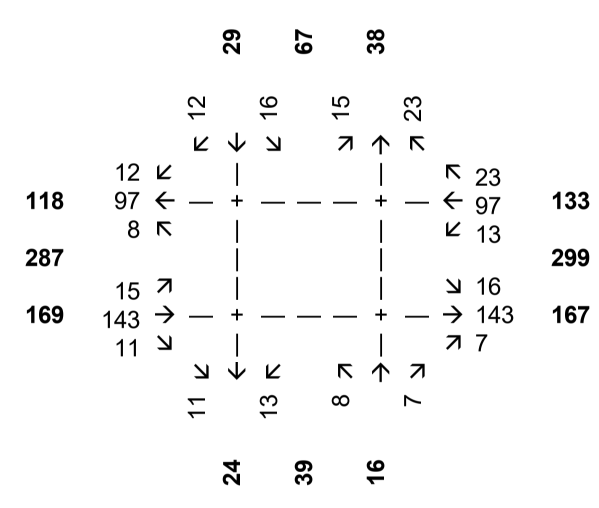
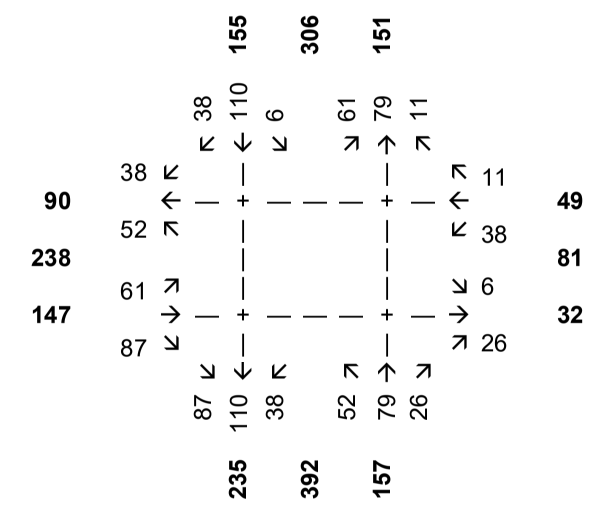


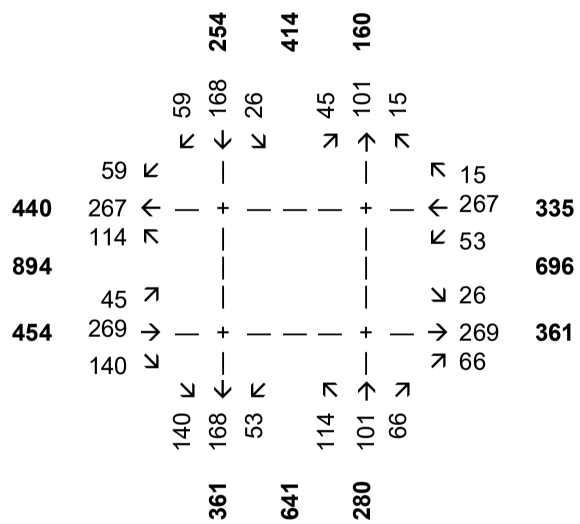
Martway St and Roeland Drive



Mission Bowl Lofts TIS
Mission, Kansas

Future Grown 2040 Volumes
A.M. Peak Hour

Johnson Dr and Nall Ave



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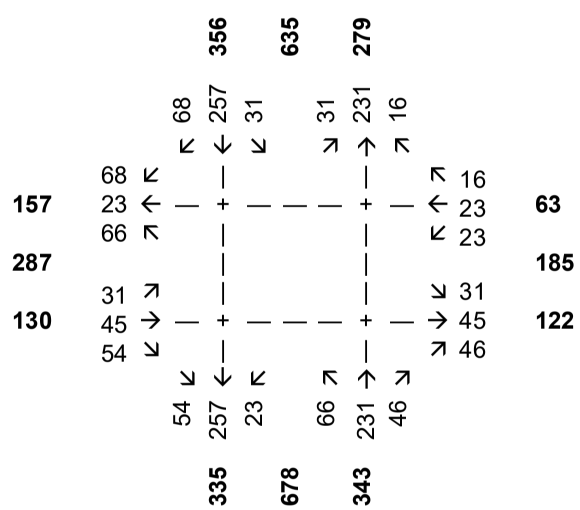

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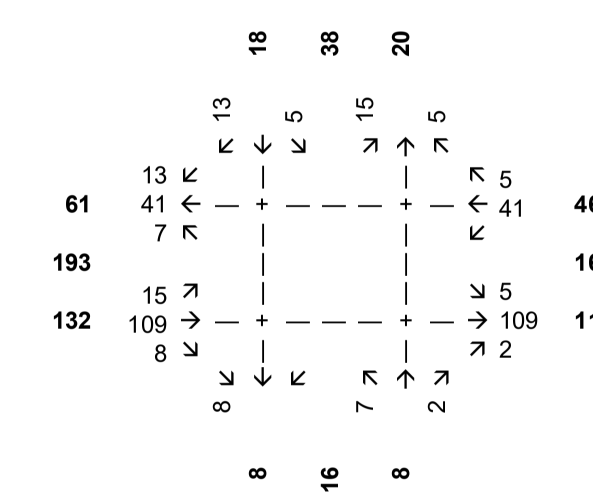

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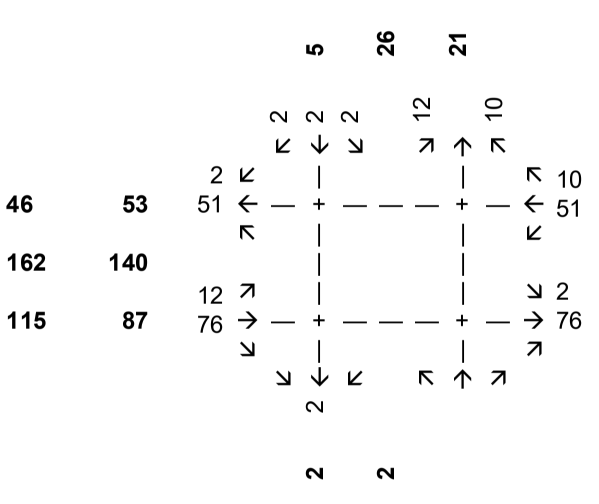

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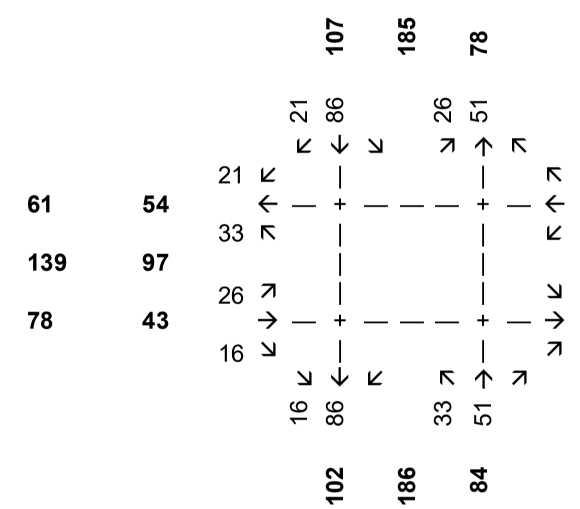
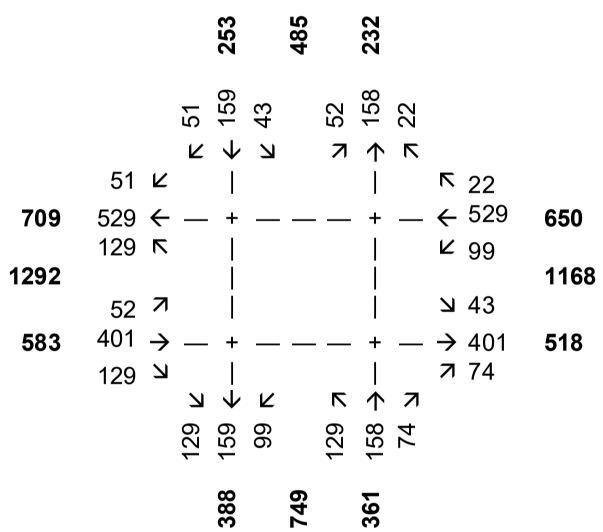


Mission Bowl Lofts TIS
Mission, Kansas

Future Grown 2040 Volumes
P.M. Peak Hour

Johnson Dr and Nall Ave



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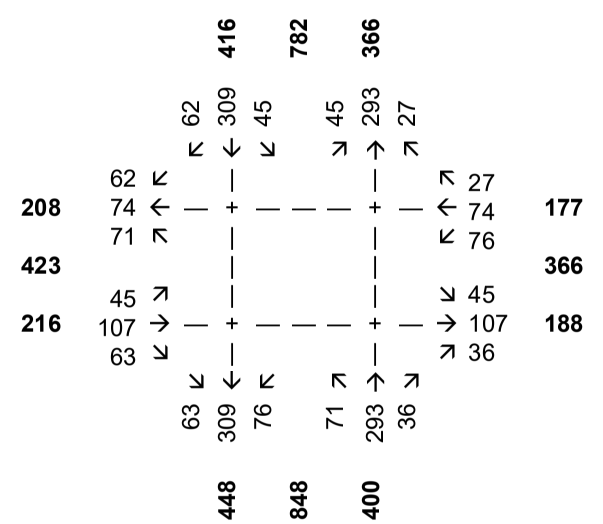

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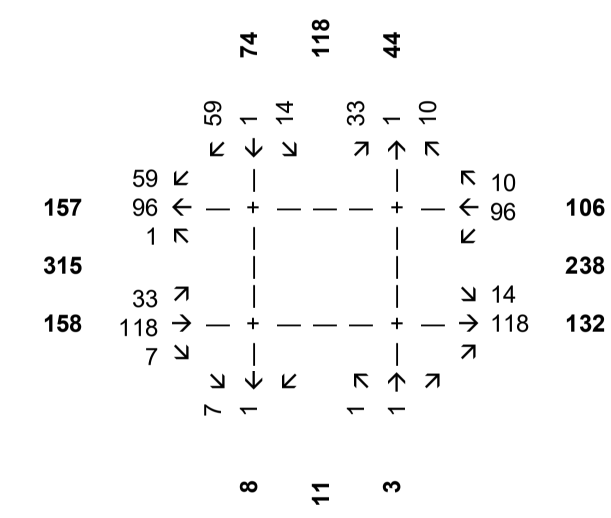

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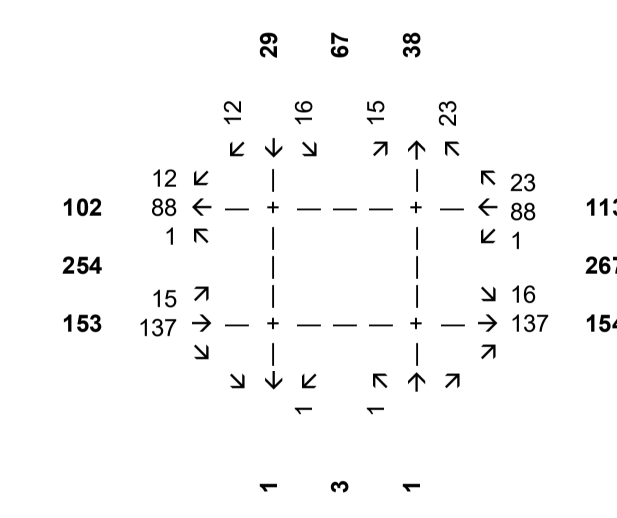

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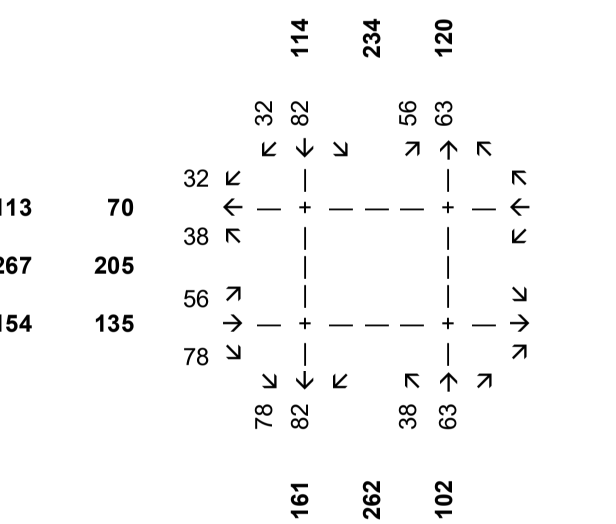
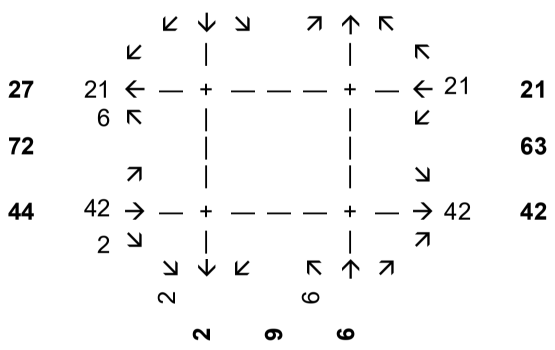


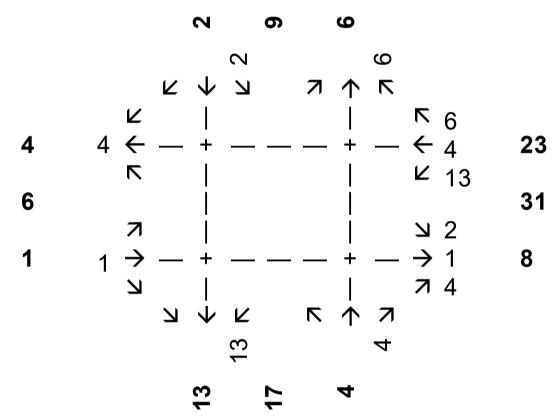
Mission Bowl Lofts TIS
Mission, Kansas

Approved + Development Trips
A.M. Peak Hour

Johnson Dr and Nall Ave



Martway St and Nall Ave



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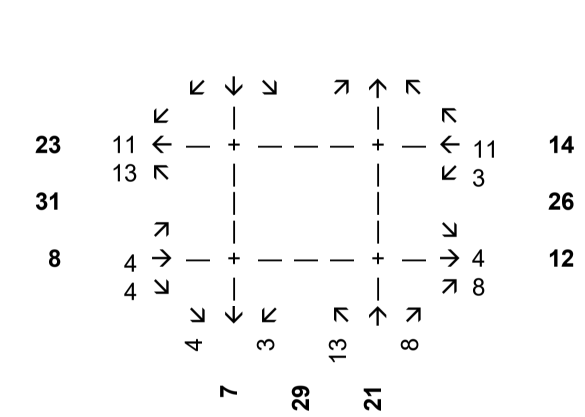

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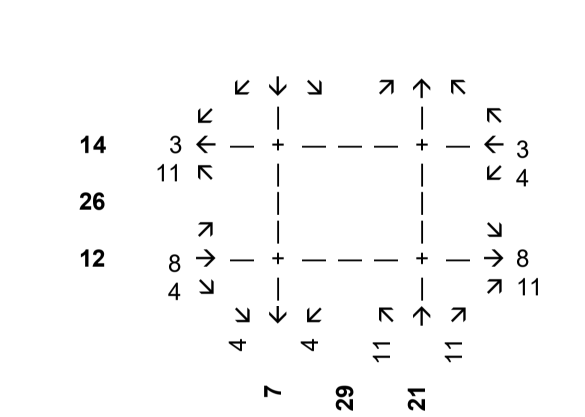

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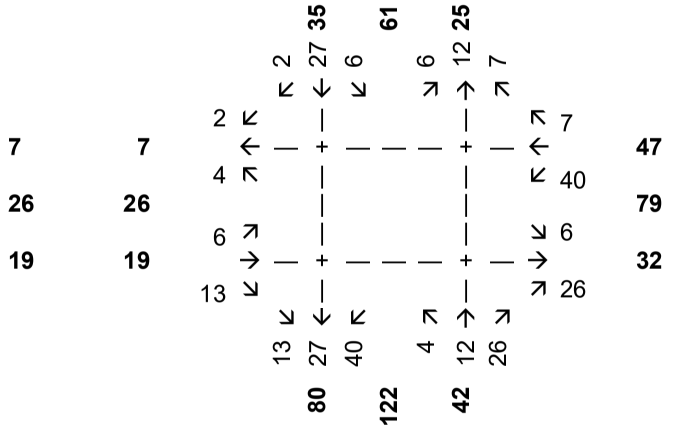
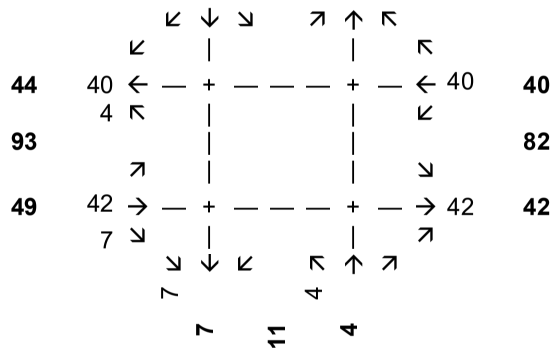


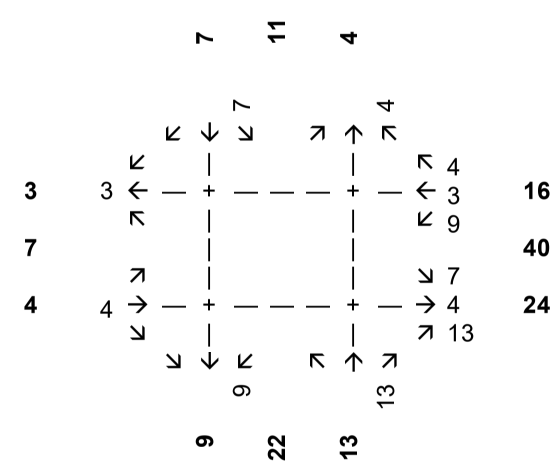
Mission Bowl Lofts TIS
Mission, Kansas

Approved + Development Trips
P.M. Peak Hour

Johnson Dr and Nall Ave



Martway St and Nall Ave



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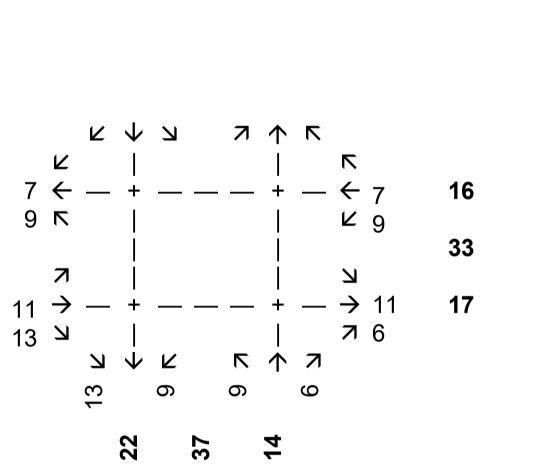

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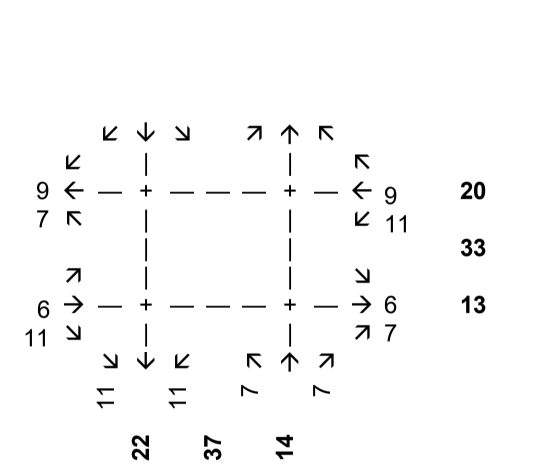

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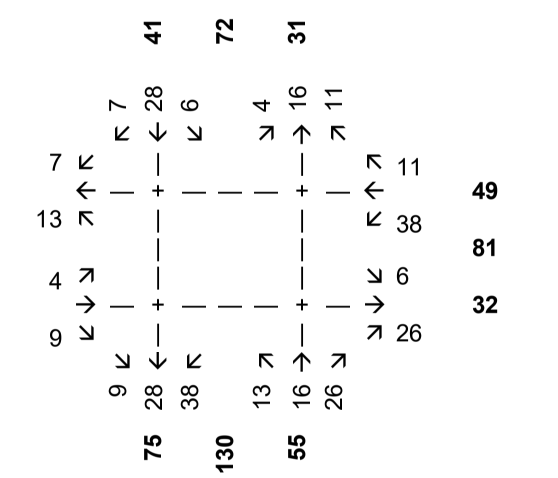
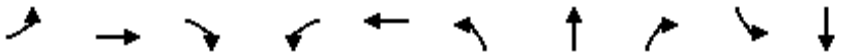


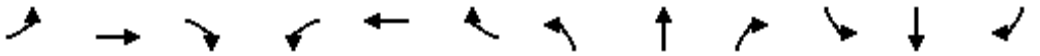
Appendix C – Capacity Analysis Reports

See attached worksheets.



Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	44	263	138	52	276	112	99	65	26	223
v/c Ratio	0.22	0.73	0.33	0.24	0.74	0.16	0.09	0.07	0.03	0.23
Control Delay	30.2	57.0	8.1	30.6	55.9	9.4	11.9	0.8	11.1	17.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.2	57.0	8.1	30.6	55.9	9.4	11.9	0.8	11.1	17.2
Queue Length 50th (ft)	25	194	0	29	202	28	26	1	7	84
Queue Length 95th (ft)	47	263	50	53	269	49	45	1	23	167
Internal Link Dist (ft)		202			232		200			299
Turn Bay Length (ft)	115		230	200		70		100	50	
Base Capacity (vph)	207	628	625	234	656	741	1098	972	802	966
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.21	0.42	0.22	0.22	0.42	0.15	0.09	0.07	0.03	0.23

Intersection Summary



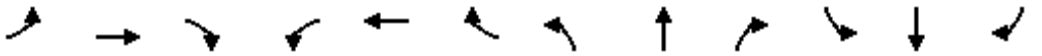
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	41	245	128	48	243	14	104	92	60	24	153	54
Future Volume (veh/h)	41	245	128	48	243	14	104	92	60	24	153	54
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	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	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	44	263	138	52	261	15	112	99	65	26	165	58
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, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	151	323	274	158	307	18	764	1157	980	838	795	279
Arrive On Green	0.03	0.17	0.17	0.03	0.18	0.18	0.07	1.00	1.00	0.02	0.60	0.60
Sat Flow, veh/h	1781	1870	1585	1781	1752	101	1781	1870	1585	1781	1322	465
Grp Volume(v), veh/h	44	263	138	52	0	276	112	99	65	26	0	223
Grp Sat Flow(s),veh/h/ln	1781	1870	1585	1781	0	1852	1781	1870	1585	1781	0	1787
Q Serve(g_s), s	2.4	16.2	9.5	2.9	0.0	17.3	2.9	0.0	0.0	0.7	0.0	6.8
Cycle Q Clear(g_c), s	2.4	16.2	9.5	2.9	0.0	17.3	2.9	0.0	0.0	0.7	0.0	6.8
Prop In Lane	1.00		1.00	1.00		0.05	1.00		1.00	1.00		0.26
Lane Grp Cap(c), veh/h	151	323	274	158	0	325	764	1157	980	838	0	1075
V/C Ratio(X)	0.29	0.81	0.50	0.33	0.00	0.85	0.15	0.09	0.07	0.03	0.00	0.21
Avail Cap(c_a), veh/h	205	631	535	238	0	656	891	1157	980	906	0	1075
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.67	1.67	1.67	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	40.1	47.8	45.0	40.0	0.0	48.0	8.2	0.0	0.0	8.5	0.0	10.9
Incr Delay (d2), s/veh	1.1	4.9	1.4	1.2	0.0	6.2	0.1	0.1	0.1	0.0	0.0	0.4
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	1.1	8.1	3.9	1.3	0.0	8.6	1.1	0.0	0.0	0.3	0.0	2.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	41.2	52.7	46.4	41.2	0.0	54.2	8.2	0.1	0.1	8.6	0.0	11.3
LnGrp LOS	D	D	D	D	A	D	A	A	A	A	A	B
Approach Vol, veh/h		445			328			276			249	
Approach Delay, s/veh		49.6			52.1			3.4			11.0	
Approach LOS		D			D			A			B	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	7.4	78.7	8.6	25.3	9.5	76.7	8.3	25.5
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	7.5	44.5	9.5	40.5	13.5	38.5	7.5	42.5
Max Q Clear Time (g_c+I1), s	2.7	2.0	4.9	18.2	4.9	8.8	4.4	19.3
Green Ext Time (p_c), s	0.0	0.8	0.0	2.1	0.2	1.4	0.0	1.7

Intersection Summary	
HCM 6th Ctrl Delay	33.0
HCM 6th LOS	C

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	32	102	23	40	67	280	32	260	69
v/c Ratio	0.17	0.57	0.14	0.27	0.08	0.11	0.04	0.20	0.06
Control Delay	42.5	41.4	41.8	37.6	4.6	6.3	5.1	7.3	1.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0
Total Delay	42.5	41.4	41.8	37.6	4.6	6.3	5.1	7.8	1.5
Queue Length 50th (ft)	21	41	16	18	11	34	4	42	1
Queue Length 95th (ft)	47	95	37	51	29	62	18	111	0
Internal Link Dist (ft)		57		294		318		200	
Turn Bay Length (ft)	130		130		90		50		
Base Capacity (vph)	216	442	197	427	911	2526	888	1319	1149
Starvation Cap Reductn	0	0	0	0	0	0	0	685	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	0.15	0.23	0.12	0.09	0.07	0.11	0.04	0.41	0.06

Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	29	41	50	21	21	15	60	210	42	29	234	62
Future Volume (veh/h)	29	41	50	21	21	15	60	210	42	29	234	62
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	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	32	46	56	23	23	17	67	233	47	32	260	69
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	180	61	74	126	74	55	790	2132	423	875	1330	1127
Arrive On Green	0.03	0.08	0.08	0.02	0.07	0.07	0.04	0.72	0.72	0.02	0.48	0.48
Sat Flow, veh/h	1781	768	935	1781	999	738	1781	2956	586	1781	1870	1585
Grp Volume(v), veh/h	32	0	102	23	0	40	67	138	142	32	260	69
Grp Sat Flow(s),veh/h/ln	1781	0	1702	1781	0	1737	1781	1777	1765	1781	1870	1585
Q Serve(g_s), s	2.0	0.0	7.0	1.4	0.0	2.6	1.2	2.8	2.9	0.6	9.6	2.8
Cycle Q Clear(g_c), s	2.0	0.0	7.0	1.4	0.0	2.6	1.2	2.8	2.9	0.6	9.6	2.8
Prop In Lane	1.00		0.55	1.00		0.43	1.00		0.33	1.00		1.00
Lane Grp Cap(c), veh/h	180	0	135	126	0	129	790	1281	1273	875	1330	1127
V/C Ratio(X)	0.18	0.00	0.76	0.18	0.00	0.31	0.08	0.11	0.11	0.04	0.20	0.06
Avail Cap(c_a), veh/h	273	0	404	227	0	413	909	1281	1273	967	1330	1127
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.67	0.67	0.67
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	0.97	0.97	0.97
Uniform Delay (d), s/veh	49.4	0.0	54.1	49.8	0.0	52.6	4.4	5.1	5.1	4.2	11.6	9.8
Incr Delay (d2), s/veh	0.5	0.0	8.4	0.7	0.0	1.4	0.0	0.2	0.2	0.0	0.3	0.1
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	0.9	0.0	3.4	0.7	0.0	1.2	0.4	1.0	1.0	0.2	4.4	1.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	49.8	0.0	62.5	50.5	0.0	54.0	4.4	5.2	5.2	4.2	11.9	9.9
LnGrp LOS	D	A	E	D	A	D	A	A	A	A	B	A
Approach Vol, veh/h		134			63			347			361	
Approach Delay, s/veh		59.5			52.7			5.1			10.8	
Approach LOS		E			D			A			B	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	7.8	91.0	7.2	14.0	9.0	89.9	7.8	13.4
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	9.5	54.5	9.5	28.5	12.5	51.5	9.5	28.5
Max Q Clear Time (g_c+I1), s	2.6	4.9	3.4	9.0	3.2	11.6	4.0	4.6
Green Ext Time (p_c), s	0.0	1.8	0.0	0.5	0.1	1.9	0.0	0.1

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

Intersection	
Int Delay, s/veh	1.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	14	99	8	0	38	5	6	0	2	5	0	12
Future Vol, veh/h	14	99	8	0	38	5	6	0	2	5	0	12
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
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	75	75	75	75	75	75	75	75	75	75	75	75
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	19	132	11	0	51	7	8	0	3	7	0	16

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	58	0	0	143	0	0	239	234	138	232	236	55
Stage 1	-	-	-	-	-	-	176	176	-	55	55	-
Stage 2	-	-	-	-	-	-	63	58	-	177	181	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1546	-	-	1440	-	-	715	666	910	723	665	1012
Stage 1	-	-	-	-	-	-	826	753	-	957	849	-
Stage 2	-	-	-	-	-	-	948	847	-	825	750	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1546	-	-	1440	-	-	697	658	910	714	657	1012
Mov Cap-2 Maneuver	-	-	-	-	-	-	697	658	-	714	657	-
Stage 1	-	-	-	-	-	-	816	744	-	946	849	-
Stage 2	-	-	-	-	-	-	933	847	-	812	741	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.9	0	9.9	9.1
HCM LOS			A	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	740	1546	-	-	1440	-	-	901
HCM Lane V/C Ratio	0.014	0.012	-	-	-	-	-	0.025
HCM Control Delay (s)	9.9	7.4	-	-	0	-	-	9.1
HCM Lane LOS	A	A	-	-	A	-	-	A
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0.1

Intersection	
Int Delay, s/veh	1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	11	69	1	0	47	9	0	0	0	2	2	2
Future Vol, veh/h	11	69	1	0	47	9	0	0	0	2	2	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
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	81	81	81	81	81	81	81	81	81	81	81	81
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	14	85	1	0	58	11	0	0	0	2	2	2

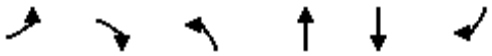
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	69	0	0	86	0	0	180	183	86	178	178	64
Stage 1	-	-	-	-	-	-	114	114	-	64	64	-
Stage 2	-	-	-	-	-	-	66	69	-	114	114	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1532	-	-	1510	-	-	782	711	973	784	716	1000
Stage 1	-	-	-	-	-	-	891	801	-	947	842	-
Stage 2	-	-	-	-	-	-	945	837	-	891	801	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1532	-	-	1510	-	-	773	705	973	779	710	1000
Mov Cap-2 Maneuver	-	-	-	-	-	-	773	705	-	779	710	-
Stage 1	-	-	-	-	-	-	883	794	-	938	842	-
Stage 2	-	-	-	-	-	-	940	837	-	883	794	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	1	0	0	9.5
HCM LOS			A	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	-	1532	-	-	1510	-	-	813
HCM Lane V/C Ratio	-	0.009	-	-	-	-	-	0.009
HCM Control Delay (s)	0	7.4	-	-	0	-	-	9.5
HCM Lane LOS	A	A	-	-	A	-	-	A
HCM 95th %tile Q(veh)	-	0	-	-	0	-	-	0

Lane Group	EBL	EBR	NBL	NBT	SBT
Lane Group Flow (vph)	27	17	34	53	110
v/c Ratio	0.25	0.15	0.03	0.03	0.07
Control Delay	56.7	24.2	1.3	1.2	2.6
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	56.7	24.2	1.3	1.2	2.6
Queue Length 50th (ft)	20	0	2	4	14
Queue Length 95th (ft)	51	23	7	10	30
Internal Link Dist (ft)	534			370	274
Turn Bay Length (ft)	115		115		
Base Capacity (vph)	464	428	1186	1701	1561
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.06	0.04	0.03	0.03	0.07

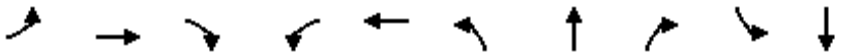
Intersection Summary



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	24	15	30	47	78	20
Future Volume (veh/h)	24	15	30	47	78	20
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	27	17	34	53	88	22
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	57	51	1157	1670	1195	299
Arrive On Green	0.03	0.03	0.03	0.89	0.83	0.83
Sat Flow, veh/h	1781	1585	1781	1870	1444	361
Grp Volume(v), veh/h	27	17	34	53	0	110
Grp Sat Flow(s),veh/h/ln	1781	1585	1781	1870	0	1805
Q Serve(g_s), s	1.8	1.3	0.3	0.4	0.0	1.3
Cycle Q Clear(g_c), s	1.8	1.3	0.3	0.4	0.0	1.3
Prop In Lane	1.00	1.00	1.00			0.20
Lane Grp Cap(c), veh/h	57	51	1157	1670	0	1493
V/C Ratio(X)	0.47	0.33	0.03	0.03	0.00	0.07
Avail Cap(c_a), veh/h	468	416	1397	1670	0	1493
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	57.1	56.8	1.0	0.7	0.0	1.9
Incr Delay (d2), s/veh	6.0	3.8	0.0	0.0	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.9	1.2	0.0	0.1	0.0	0.4
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	63.0	60.6	1.1	0.7	0.0	2.0
LnGrp LOS	E	E	A	A	A	A
Approach Vol, veh/h	44			87	110	
Approach Delay, s/veh	62.1			0.9	2.0	
Approach LOS	E			A	A	

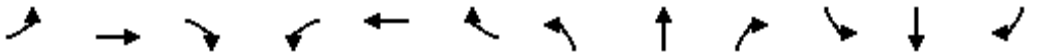
Timer - Assigned Phs		2		4	5	6
Phs Duration (G+Y+Rc), s		111.7		8.3	7.9	103.8
Change Period (Y+Rc), s		4.5		4.5	4.5	4.5
Max Green Setting (Gmax), s		79.5		31.5	19.5	55.5
Max Q Clear Time (g_c+I1), s		2.4		3.8	2.3	3.3
Green Ext Time (p_c), s		0.3		0.1	0.0	0.7

Intersection Summary		
HCM 6th Ctrl Delay		12.6
HCM 6th LOS		B



Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	52	397	128	98	545	128	157	74	42	208
v/c Ratio	0.27	0.63	0.20	0.34	0.82	0.25	0.20	0.10	0.08	0.31
Control Delay	20.0	36.4	3.8	21.2	44.5	17.0	22.0	1.2	20.7	30.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0
Total Delay	20.0	36.4	3.8	21.2	44.5	17.0	22.5	1.2	20.7	30.6
Queue Length 50th (ft)	22	249	0	43	379	43	55	1	17	110
Queue Length 95th (ft)	39	306	32	64	454	71	130	5	44	205
Internal Link Dist (ft)		527			232		200			299
Turn Bay Length (ft)	115		230	200		70		100	50	
Base Capacity (vph)	195	858	802	290	857	533	769	709	553	670
Starvation Cap Reductn	0	0	0	0	0	0	311	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.27	0.46	0.16	0.34	0.64	0.24	0.34	0.10	0.08	0.31

Intersection Summary



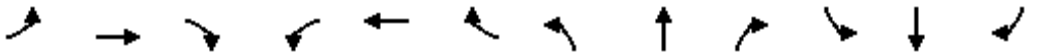
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	48	365	118	90	481	20	118	144	68	39	145	46
Future Volume (veh/h)	48	365	118	90	481	20	118	144	68	39	145	46
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	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	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	52	397	128	98	523	22	128	157	74	42	158	50
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	162	579	491	261	583	25	580	855	724	612	588	186
Arrive On Green	0.03	0.31	0.31	0.05	0.33	0.33	0.09	0.76	0.76	0.03	0.43	0.43
Sat Flow, veh/h	1781	1870	1585	1781	1782	75	1781	1870	1585	1781	1362	431
Grp Volume(v), veh/h	52	397	128	98	0	545	128	157	74	42	0	208
Grp Sat Flow(s),veh/h/ln	1781	1870	1585	1781	0	1857	1781	1870	1585	1781	0	1793
Q Serve(g_s), s	2.4	22.3	7.3	4.5	0.0	33.5	4.8	2.8	1.4	1.6	0.0	8.9
Cycle Q Clear(g_c), s	2.4	22.3	7.3	4.5	0.0	33.5	4.8	2.8	1.4	1.6	0.0	8.9
Prop In Lane	1.00		1.00	1.00		0.04	1.00		1.00	1.00		0.24
Lane Grp Cap(c), veh/h	162	579	491	261	0	608	580	855	724	612	0	774
V/C Ratio(X)	0.32	0.69	0.26	0.38	0.00	0.90	0.22	0.18	0.10	0.07	0.00	0.27
Avail Cap(c_a), veh/h	198	862	730	268	0	859	635	855	724	638	0	774
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.67	1.67	1.67	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	0.99	0.99	0.99	1.00	0.00	1.00
Uniform Delay (d), s/veh	31.0	36.3	31.1	28.2	0.0	38.4	16.4	8.0	7.9	17.7	0.0	21.9
Incr Delay (d2), s/veh	1.1	1.4	0.3	0.9	0.0	9.2	0.2	0.5	0.3	0.0	0.0	0.9
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	1.1	10.5	2.9	2.0	0.0	16.8	1.9	1.2	0.6	0.7	0.0	4.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	32.1	37.7	31.4	29.1	0.0	47.6	16.6	8.5	8.2	17.7	0.0	22.8
LnGrp LOS	C	D	C	C	A	D	B	A	A	B	A	C
Approach Vol, veh/h		577			643			359			250	
Approach Delay, s/veh		35.8			44.8			11.3			21.9	
Approach LOS		D			D			B			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.3	59.3	10.7	41.7	11.3	56.3	8.6	43.8
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	5.5	34.5	6.7	55.3	10.5	29.5	6.5	55.5
Max Q Clear Time (g_c+I1), s	3.6	4.8	6.5	24.3	6.8	10.9	4.4	35.5
Green Ext Time (p_c), s	0.0	1.1	0.0	3.3	0.1	1.1	0.0	3.7

Intersection Summary	
HCM 6th Ctrl Delay	32.3
HCM 6th LOS	C

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	43	164	73	98	68	348	43	296	59
v/c Ratio	0.17	0.68	0.35	0.40	0.09	0.16	0.06	0.25	0.06
Control Delay	35.1	56.8	39.3	43.6	7.4	10.3	6.5	9.5	0.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0
Total Delay	35.1	56.8	39.3	43.6	7.4	10.3	6.5	10.1	0.6
Queue Length 50th (ft)	26	106	45	60	16	54	7	62	0
Queue Length 95th (ft)	53	170	80	109	37	91	21	122	0
Internal Link Dist (ft)		500		294		318		200	
Turn Bay Length (ft)	130		130		90		50		
Base Capacity (vph)	276	435	221	435	789	2189	759	1171	1031
Starvation Cap Reductn	0	0	0	0	0	0	0	528	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	0.16	0.38	0.33	0.23	0.09	0.16	0.06	0.46	0.06

Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	41	98	58	69	68	25	65	266	65	41	281	56
Future Volume (veh/h)	41	98	58	69	68	25	65	266	65	41	281	56
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	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	43	103	61	73	72	26	68	280	68	43	296	59
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	221	126	75	174	172	62	726	1866	445	754	1216	1030
Arrive On Green	0.03	0.11	0.11	0.05	0.13	0.13	0.04	0.66	0.66	0.03	0.65	0.65
Sat Flow, veh/h	1781	1101	652	1781	1312	474	1781	2845	679	1781	1870	1585
Grp Volume(v), veh/h	43	0	164	73	0	98	68	173	175	43	296	59
Grp Sat Flow(s),veh/h/ln	1781	0	1753	1781	0	1785	1781	1777	1748	1781	1870	1585
Q Serve(g_s), s	2.5	0.0	11.0	4.3	0.0	6.1	1.5	4.5	4.6	0.9	7.9	1.6
Cycle Q Clear(g_c), s	2.5	0.0	11.0	4.3	0.0	6.1	1.5	4.5	4.6	0.9	7.9	1.6
Prop In Lane	1.00		0.37	1.00		0.27	1.00		0.39	1.00		1.00
Lane Grp Cap(c), veh/h	221	0	201	174	0	234	726	1165	1146	754	1216	1030
V/C Ratio(X)	0.19	0.00	0.82	0.42	0.00	0.42	0.09	0.15	0.15	0.06	0.24	0.06
Avail Cap(c_a), veh/h	305	0	416	229	0	424	845	1165	1146	839	1216	1030
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	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	0.97	0.97	0.97
Uniform Delay (d), s/veh	44.9	0.0	51.9	44.4	0.0	47.9	6.4	7.9	7.9	6.3	8.7	7.6
Incr Delay (d2), s/veh	0.4	0.0	7.9	1.6	0.0	1.2	0.1	0.3	0.3	0.0	0.5	0.1
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	1.2	0.0	5.3	2.0	0.0	2.8	0.5	1.7	1.8	0.3	3.2	0.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	45.3	0.0	59.8	46.0	0.0	49.1	6.4	8.2	8.2	6.3	9.2	7.7
LnGrp LOS	D	A	E	D	A	D	A	A	A	A	A	A
Approach Vol, veh/h		207			171			416			398	
Approach Delay, s/veh		56.8			47.8			7.9			8.7	
Approach LOS		E			D			A			A	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.3	83.2	10.3	18.2	9.0	82.5	8.3	20.2
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	9.5	54.5	9.5	28.5	12.5	51.5	9.5	28.5
Max Q Clear Time (g_c+I1), s	2.9	6.6	6.3	13.0	3.5	9.9	4.5	8.1
Green Ext Time (p_c), s	0.0	2.3	0.0	0.8	0.1	2.1	0.0	0.5

Intersection Summary	
HCM 6th Ctrl Delay	22.4
HCM 6th LOS	C

Intersection	
Int Delay, s/veh	3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	30	108	6	0	88	9	1	1	0	13	1	54
Future Vol, veh/h	30	108	6	0	88	9	1	1	0	13	1	54
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
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	80	80	80	80	80	80	80	80	80	80	80	80
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	38	135	8	0	110	11	1	1	0	16	1	68

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	121	0	0	143	0	0	365	336	139	332	335	116
Stage 1	-	-	-	-	-	-	215	215	-	116	116	-
Stage 2	-	-	-	-	-	-	150	121	-	216	219	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1467	-	-	1440	-	-	591	585	909	621	585	936
Stage 1	-	-	-	-	-	-	787	725	-	889	800	-
Stage 2	-	-	-	-	-	-	853	796	-	786	722	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1467	-	-	1440	-	-	537	570	909	608	570	936
Mov Cap-2 Maneuver	-	-	-	-	-	-	537	570	-	608	570	-
Stage 1	-	-	-	-	-	-	767	706	-	866	800	-
Stage 2	-	-	-	-	-	-	790	796	-	764	703	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	1.6	0	11.5	9.8
HCM LOS			B	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	553	1467	-	-	1440	-	-	841
HCM Lane V/C Ratio	0.005	0.026	-	-	-	-	-	0.101
HCM Control Delay (s)	11.5	7.5	-	-	0	-	-	9.8
HCM Lane LOS	B	A	-	-	A	-	-	A
HCM 95th %tile Q(veh)	0	0.1	-	-	0	-	-	0.3

Intersection	
Int Delay, s/veh	1.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	14	125	1	1	80	21	1	0	0	15	0	11
Future Vol, veh/h	14	125	1	1	80	21	1	0	0	15	0	11
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
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	91	91	91	91	91	91	91	91	91	91	91	91
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	15	137	1	1	88	23	1	0	0	16	0	12

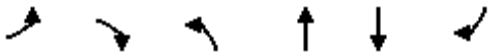
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	111	0	0	138	0	0	276	281	138	270	270	100
Stage 1	-	-	-	-	-	-	168	168	-	102	102	-
Stage 2	-	-	-	-	-	-	108	113	-	168	168	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1479	-	-	1446	-	-	676	627	910	683	636	956
Stage 1	-	-	-	-	-	-	834	759	-	904	811	-
Stage 2	-	-	-	-	-	-	897	802	-	834	759	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1479	-	-	1446	-	-	662	620	910	678	629	956
Mov Cap-2 Maneuver	-	-	-	-	-	-	662	620	-	678	629	-
Stage 1	-	-	-	-	-	-	826	751	-	895	810	-
Stage 2	-	-	-	-	-	-	885	801	-	826	751	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.7	0.1	10.4	9.8
HCM LOS			B	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	662	1479	-	-	1446	-	-	773
HCM Lane V/C Ratio	0.002	0.01	-	-	0.001	-	-	0.037
HCM Control Delay (s)	10.4	7.5	-	-	7.5	-	-	9.8
HCM Lane LOS	B	A	-	-	A	-	-	A
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0.1

Lane Group	EBL	EBR	NBL	NBT	SBT
Lane Group Flow (vph)	53	73	36	60	107
v/c Ratio	0.40	0.39	0.03	0.04	0.07
Control Delay	58.1	21.2	1.7	1.7	3.0
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	58.1	21.2	1.7	1.7	3.0
Queue Length 50th (ft)	41	7	3	5	14
Queue Length 95th (ft)	81	48	9	13	32
Internal Link Dist (ft)	534			320	274
Turn Bay Length (ft)	115		115		
Base Capacity (vph)	464	469	1149	1628	1476
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.11	0.16	0.03	0.04	0.07

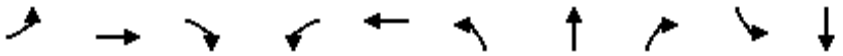
Intersection Summary



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	51	71	35	58	75	29
Future Volume (veh/h)	51	71	35	58	75	29
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	53	73	36	60	77	30
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	114	101	1117	1611	1018	397
Arrive On Green	0.06	0.06	0.03	0.86	0.79	0.79
Sat Flow, veh/h	1781	1585	1781	1870	1281	499
Grp Volume(v), veh/h	53	73	36	60	0	107
Grp Sat Flow(s),veh/h/ln	1781	1585	1781	1870	0	1781
Q Serve(g_s), s	3.4	5.4	0.4	0.6	0.0	1.6
Cycle Q Clear(g_c), s	3.4	5.4	0.4	0.6	0.0	1.6
Prop In Lane	1.00	1.00	1.00			0.28
Lane Grp Cap(c), veh/h	114	101	1117	1611	0	1415
V/C Ratio(X)	0.47	0.72	0.03	0.04	0.00	0.08
Avail Cap(c_a), veh/h	468	416	1355	1611	0	1415
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	54.2	55.1	1.6	1.2	0.0	2.7
Incr Delay (d2), s/veh	3.0	9.3	0.0	0.0	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.7	5.0	0.1	0.1	0.0	0.5
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	57.2	64.4	1.6	1.2	0.0	2.8
LnGrp LOS	E	E	A	A	A	A
Approach Vol, veh/h	126			96	107	
Approach Delay, s/veh	61.4			1.4	2.8	
Approach LOS	E			A	A	

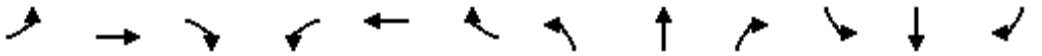
Timer - Assigned Phs		2		4	5	6
Phs Duration (G+Y+Rc), s		107.8		12.2	8.0	99.9
Change Period (Y+Rc), s		4.5		4.5	4.5	4.5
Max Green Setting (Gmax), s		79.5		31.5	19.5	55.5
Max Q Clear Time (g_c+I1), s		2.6		7.4	2.4	3.6
Green Ext Time (p_c), s		0.4		0.3	0.0	0.7

Intersection Summary		
HCM 6th Ctrl Delay		24.8
HCM 6th LOS		C



Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	44	309	138	52	299	112	99	65	26	223
v/c Ratio	0.21	0.77	0.31	0.25	0.72	0.17	0.09	0.07	0.03	0.24
Control Delay	27.8	56.2	7.3	28.6	52.0	10.4	13.6	0.9	12.5	19.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	27.8	56.2	7.3	28.6	52.0	10.4	13.6	0.9	12.5	19.1
Queue Length 50th (ft)	24	226	0	28	215	29	27	1	8	90
Queue Length 95th (ft)	45	299	48	51	281	49	46	1	24	177
Internal Link Dist (ft)		202			232		200			299
Turn Bay Length (ft)	115		230	200		70		100	50	
Base Capacity (vph)	219	628	625	230	655	711	1054	936	770	922
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.20	0.49	0.22	0.23	0.46	0.16	0.09	0.07	0.03	0.24

Intersection Summary



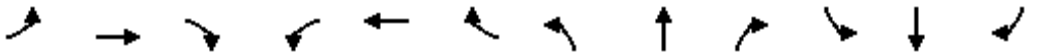
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	41	287	128	48	264	14	104	92	60	24	153	54
Future Volume (veh/h)	41	287	128	48	264	14	104	92	60	24	153	54
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	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	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	44	309	138	52	284	15	112	99	65	26	165	58
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, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	164	365	309	155	348	18	735	1115	945	809	764	268
Arrive On Green	0.03	0.20	0.20	0.03	0.20	0.20	0.07	1.00	1.00	0.02	0.58	0.58
Sat Flow, veh/h	1781	1870	1585	1781	1761	93	1781	1870	1585	1781	1322	465
Grp Volume(v), veh/h	44	309	138	52	0	299	112	99	65	26	0	223
Grp Sat Flow(s),veh/h/ln	1781	1870	1585	1781	0	1854	1781	1870	1585	1781	0	1787
Q Serve(g_s), s	2.3	19.1	9.2	2.8	0.0	18.5	3.1	0.0	0.0	0.7	0.0	7.2
Cycle Q Clear(g_c), s	2.3	19.1	9.2	2.8	0.0	18.5	3.1	0.0	0.0	0.7	0.0	7.2
Prop In Lane	1.00		1.00	1.00		0.05	1.00		1.00	1.00		0.26
Lane Grp Cap(c), veh/h	164	365	309	155	0	366	735	1115	945	809	0	1032
V/C Ratio(X)	0.27	0.85	0.45	0.34	0.00	0.82	0.15	0.09	0.07	0.03	0.00	0.22
Avail Cap(c_a), veh/h	218	631	535	235	0	656	860	1115	945	877	0	1032
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.67	1.67	1.67	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	38.2	46.6	42.6	38.3	0.0	46.1	9.2	0.1	0.1	9.6	0.0	12.2
Incr Delay (d2), s/veh	0.9	5.4	1.0	1.3	0.0	4.5	0.1	0.2	0.1	0.0	0.0	0.5
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	1.1	9.5	3.7	1.3	0.0	9.0	1.1	0.1	0.0	0.3	0.0	3.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	39.1	52.0	43.6	39.6	0.0	50.6	9.3	0.3	0.2	9.7	0.0	12.7
LnGrp LOS	D	D	D	D	A	D	A	A	A	A	A	B
Approach Vol, veh/h		491			351			276			249	
Approach Delay, s/veh		48.5			48.9			3.9			12.4	
Approach LOS		D			D			A			B	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	7.4	76.1	8.6	27.9	9.6	73.8	8.3	28.2
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	7.5	44.5	9.5	40.5	13.5	38.5	7.5	42.5
Max Q Clear Time (g_c+I1), s	2.7	2.0	4.8	21.1	5.1	9.2	4.3	20.5
Green Ext Time (p_c), s	0.0	0.8	0.0	2.3	0.2	1.4	0.0	1.8

Intersection Summary	
HCM 6th Ctrl Delay	33.0
HCM 6th LOS	C

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	32	102	23	40	67	280	32	260	69
v/c Ratio	0.17	0.57	0.14	0.27	0.08	0.11	0.04	0.20	0.06
Control Delay	42.5	41.4	39.0	35.2	4.6	6.3	4.9	7.2	1.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0
Total Delay	42.5	41.4	39.0	35.2	4.6	6.3	4.9	7.7	1.4
Queue Length 50th (ft)	21	41	15	17	11	34	3	42	1
Queue Length 95th (ft)	47	95	37	51	29	62	18	111	0
Internal Link Dist (ft)		57		294		318		200	
Turn Bay Length (ft)	130		130		90		50		
Base Capacity (vph)	216	442	197	427	911	2526	888	1319	1149
Starvation Cap Reductn	0	0	0	0	0	0	0	678	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	0.15	0.23	0.12	0.09	0.07	0.11	0.04	0.41	0.06

Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	29	41	50	21	21	15	60	210	42	29	234	62
Future Volume (veh/h)	29	41	50	21	21	15	60	210	42	29	234	62
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	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	32	46	56	23	23	17	67	233	47	32	260	69
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	180	61	74	126	74	55	790	2132	423	875	1330	1127
Arrive On Green	0.03	0.08	0.08	0.02	0.07	0.07	0.04	0.72	0.72	0.02	0.48	0.48
Sat Flow, veh/h	1781	768	935	1781	999	738	1781	2956	586	1781	1870	1585
Grp Volume(v), veh/h	32	0	102	23	0	40	67	138	142	32	260	69
Grp Sat Flow(s),veh/h/ln	1781	0	1702	1781	0	1737	1781	1777	1765	1781	1870	1585
Q Serve(g_s), s	2.0	0.0	7.0	1.4	0.0	2.6	1.2	2.8	2.9	0.6	9.6	2.8
Cycle Q Clear(g_c), s	2.0	0.0	7.0	1.4	0.0	2.6	1.2	2.8	2.9	0.6	9.6	2.8
Prop In Lane	1.00		0.55	1.00		0.43	1.00		0.33	1.00		1.00
Lane Grp Cap(c), veh/h	180	0	135	126	0	129	790	1281	1273	875	1330	1127
V/C Ratio(X)	0.18	0.00	0.76	0.18	0.00	0.31	0.08	0.11	0.11	0.04	0.20	0.06
Avail Cap(c_a), veh/h	273	0	404	227	0	413	909	1281	1273	967	1330	1127
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.67	0.67	0.67
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	0.97	0.97	0.97
Uniform Delay (d), s/veh	49.4	0.0	54.1	49.8	0.0	52.6	4.4	5.1	5.1	4.2	11.6	9.8
Incr Delay (d2), s/veh	0.5	0.0	8.4	0.7	0.0	1.4	0.0	0.2	0.2	0.0	0.3	0.1
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	0.9	0.0	3.4	0.7	0.0	1.2	0.4	1.0	1.0	0.2	4.4	1.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	49.8	0.0	62.5	50.5	0.0	54.0	4.4	5.2	5.2	4.2	11.9	9.9
LnGrp LOS	D	A	E	D	A	D	A	A	A	A	B	A
Approach Vol, veh/h		134			63			347			361	
Approach Delay, s/veh		59.5			52.7			5.1			10.8	
Approach LOS		E			D			A			B	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	7.8	91.0	7.2	14.0	9.0	89.9	7.8	13.4
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	9.5	54.5	9.5	28.5	12.5	51.5	9.5	28.5
Max Q Clear Time (g_c+I1), s	2.6	4.9	3.4	9.0	3.2	11.6	4.0	4.6
Green Ext Time (p_c), s	0.0	1.8	0.0	0.5	0.1	1.9	0.0	0.1

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

Intersection	
Int Delay, s/veh	1.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	14	99	8	0	38	5	6	0	2	5	0	12
Future Vol, veh/h	14	99	8	0	38	5	6	0	2	5	0	12
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
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	75	75	75	75	75	75	75	75	75	75	75	75
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	19	132	11	0	51	7	8	0	3	7	0	16

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	58	0	0	143	0	0	239	234	138	232	236	55
Stage 1	-	-	-	-	-	-	176	176	-	55	55	-
Stage 2	-	-	-	-	-	-	63	58	-	177	181	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1546	-	-	1440	-	-	715	666	910	723	665	1012
Stage 1	-	-	-	-	-	-	826	753	-	957	849	-
Stage 2	-	-	-	-	-	-	948	847	-	825	750	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1546	-	-	1440	-	-	697	658	910	714	657	1012
Mov Cap-2 Maneuver	-	-	-	-	-	-	697	658	-	714	657	-
Stage 1	-	-	-	-	-	-	816	744	-	946	849	-
Stage 2	-	-	-	-	-	-	933	847	-	812	741	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.9	0	9.9	9.1
HCM LOS			A	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	740	1546	-	-	1440	-	-	901
HCM Lane V/C Ratio	0.014	0.012	-	-	-	-	-	0.025
HCM Control Delay (s)	9.9	7.4	-	-	0	-	-	9.1
HCM Lane LOS	A	A	-	-	A	-	-	A
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0.1

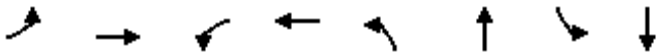
Intersection	
Int Delay, s/veh	1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	11	69	1	0	47	9	0	0	0	2	2	2
Future Vol, veh/h	11	69	1	0	47	9	0	0	0	2	2	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
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	81	81	81	81	81	81	81	81	81	81	81	81
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	14	85	1	0	58	11	0	0	0	2	2	2

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	69	0	0	86	0	0	180	183	86	178	178	64
Stage 1	-	-	-	-	-	-	114	114	-	64	64	-
Stage 2	-	-	-	-	-	-	66	69	-	114	114	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1532	-	-	1510	-	-	782	711	973	784	716	1000
Stage 1	-	-	-	-	-	-	891	801	-	947	842	-
Stage 2	-	-	-	-	-	-	945	837	-	891	801	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1532	-	-	1510	-	-	773	705	973	779	710	1000
Mov Cap-2 Maneuver	-	-	-	-	-	-	773	705	-	779	710	-
Stage 1	-	-	-	-	-	-	883	794	-	938	842	-
Stage 2	-	-	-	-	-	-	940	837	-	883	794	-

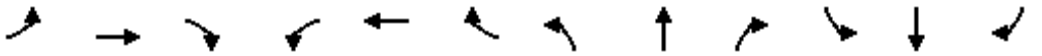
Approach	EB	WB	NB	SB
HCM Control Delay, s	1	0	0	9.5
HCM LOS			A	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	-	1532	-	-	1510	-	-	813
HCM Lane V/C Ratio	-	0.009	-	-	-	-	-	0.009
HCM Control Delay (s)	0	7.4	-	-	0	-	-	9.5
HCM Lane LOS	A	A	-	-	A	-	-	A
HCM 95th %tile Q(veh)	-	0	-	-	0	-	-	0



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	27	17	43	8	34	94	7	140
v/c Ratio	0.25	0.02	0.41	0.01	0.03	0.07	0.01	0.10
Control Delay	55.2	0.1	63.2	0.0	4.6	3.5	8.7	7.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	55.2	0.1	63.2	0.0	4.6	3.5	8.7	7.0
Queue Length 50th (ft)	20	0	32	0	6	12	2	34
Queue Length 95th (ft)	51	0	69	0	17	31	8	69
Internal Link Dist (ft)		534		159		165		274
Turn Bay Length (ft)	115				115			
Base Capacity (vph)	346	958	306	1061	1002	1443	976	1372
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.08	0.02	0.14	0.01	0.03	0.07	0.01	0.10

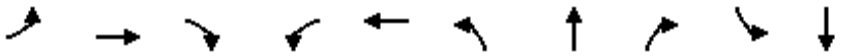
Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	24	0	15	40	0	7	30	59	26	6	105	20
Future Volume (veh/h)	24	0	15	40	0	7	30	59	26	6	105	20
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	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	27	0	17	43	0	8	34	66	28	7	118	22
Peak Hour Factor	0.89	0.92	0.89	0.92	0.92	0.92	0.89	0.89	0.92	0.92	0.89	0.89
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	57	0	51	61	0	54	1028	1024	434	1044	1158	216
Arrive On Green	0.03	0.00	0.03	0.03	0.00	0.03	0.03	0.82	0.82	0.76	0.76	0.76
Sat Flow, veh/h	1781	0	1585	1781	0	1585	1781	1246	529	1302	1533	286
Grp Volume(v), veh/h	27	0	17	43	0	8	34	0	94	7	0	140
Grp Sat Flow(s),veh/h/ln	1781	0	1585	1781	0	1585	1781	0	1775	1302	0	1819
Q Serve(g_s), s	1.8	0.0	1.3	2.9	0.0	0.6	0.5	0.0	1.2	0.2	0.0	2.4
Cycle Q Clear(g_c), s	1.8	0.0	1.3	2.9	0.0	0.6	0.5	0.0	1.2	0.2	0.0	2.4
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.30	1.00		0.16
Lane Grp Cap(c), veh/h	57	0	51	61	0	54	1028	0	1458	1044	0	1374
V/C Ratio(X)	0.47	0.00	0.33	0.71	0.00	0.15	0.03	0.00	0.06	0.01	0.00	0.10
Avail Cap(c_a), veh/h	349	0	310	393	0	350	1149	0	1458	1044	0	1374
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	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	57.1	0.0	56.8	57.4	0.0	56.3	2.5	0.0	2.0	3.6	0.0	3.9
Incr Delay (d2), s/veh	6.0	0.0	3.8	14.1	0.0	1.2	0.0	0.0	0.1	0.0	0.0	0.1
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	0.9	0.0	0.6	1.5	0.0	0.3	0.1	0.0	0.3	0.0	0.0	0.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	63.0	0.0	60.6	71.5	0.0	57.5	2.5	0.0	2.1	3.6	0.0	4.0
LnGrp LOS	E	A	E	E	A	E	A	A	A	A	A	A
Approach Vol, veh/h		44			51			128			147	
Approach Delay, s/veh		62.1			69.3			2.2			4.0	
Approach LOS		E			E			A			A	

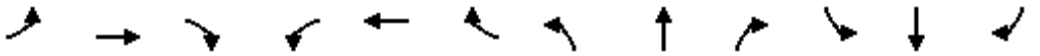
Timer - Assigned Phs		2		4	5	6		8				
Phs Duration (G+Y+Rc), s		103.1		8.3	7.9	95.2		8.6				
Change Period (Y+Rc), s		4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s		56.5		23.5	11.5	40.5		26.5				
Max Q Clear Time (g_c+I1), s		3.2		3.8	2.5	4.4		4.9				
Green Ext Time (p_c), s		0.6		0.1	0.0	0.8		0.1				

Intersection Summary												
HCM 6th Ctrl Delay			19.3									
HCM 6th LOS			B									



Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	52	442	128	98	588	128	157	74	42	208
v/c Ratio	0.29	0.66	0.19	0.35	0.82	0.26	0.21	0.11	0.08	0.33
Control Delay	19.3	35.8	3.5	20.2	42.6	18.1	23.3	1.3	22.2	32.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0
Total Delay	19.3	35.8	3.5	20.2	42.6	18.1	23.7	1.3	22.2	32.4
Queue Length 50th (ft)	21	275	0	41	401	44	56	1	18	115
Queue Length 95th (ft)	37	334	30	62	477	72	137	5	46	208
Internal Link Dist (ft)		527			232		200			299
Turn Bay Length (ft)	115		230	200		70		100	50	
Base Capacity (vph)	182	877	817	279	888	506	737	683	527	637
Starvation Cap Reductn	0	0	0	0	0	0	285	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.29	0.50	0.16	0.35	0.66	0.25	0.35	0.11	0.08	0.33

Intersection Summary



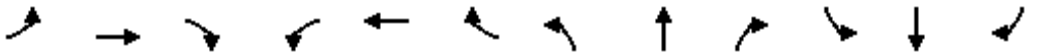
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	48	407	118	90	521	20	118	144	68	39	145	46
Future Volume (veh/h)	48	407	118	90	521	20	118	144	68	39	145	46
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	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	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	52	442	128	98	566	22	128	157	74	42	158	50
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	163	627	531	259	628	24	549	810	687	583	554	175
Arrive On Green	0.03	0.33	0.33	0.05	0.35	0.35	0.10	0.72	0.72	0.03	0.41	0.41
Sat Flow, veh/h	1781	1870	1585	1781	1788	70	1781	1870	1585	1781	1362	431
Grp Volume(v), veh/h	52	442	128	98	0	588	128	157	74	42	0	208
Grp Sat Flow(s),veh/h/ln	1781	1870	1585	1781	0	1858	1781	1870	1585	1781	0	1793
Q Serve(g_s), s	2.3	24.7	7.0	4.3	0.0	36.1	5.0	3.2	1.7	1.6	0.0	9.3
Cycle Q Clear(g_c), s	2.3	24.7	7.0	4.3	0.0	36.1	5.0	3.2	1.7	1.6	0.0	9.3
Prop In Lane	1.00		1.00	1.00		0.04	1.00		1.00	1.00		0.24
Lane Grp Cap(c), veh/h	163	627	531	259	0	652	549	810	687	583	0	729
V/C Ratio(X)	0.32	0.71	0.24	0.38	0.00	0.90	0.23	0.19	0.11	0.07	0.00	0.29
Avail Cap(c_a), veh/h	184	881	746	265	0	890	602	810	687	608	0	729
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.67	1.67	1.67	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	0.99	0.99	0.99	1.00	0.00	1.00
Uniform Delay (d), s/veh	29.8	34.7	28.9	26.9	0.0	37.0	17.8	9.9	9.6	19.4	0.0	23.9
Incr Delay (d2), s/veh	1.1	1.5	0.2	0.9	0.0	9.7	0.2	0.5	0.3	0.1	0.0	1.0
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	1.0	11.6	2.7	1.9	0.0	18.1	2.0	1.4	0.7	0.7	0.0	4.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	30.9	36.2	29.1	27.8	0.0	46.6	18.1	10.4	10.0	19.5	0.0	24.9
LnGrp LOS	C	D	C	C	A	D	B	B	A	B	A	C
Approach Vol, veh/h		622			686			359			250	
Approach Delay, s/veh		34.3			43.9			13.0			24.0	
Approach LOS		C			D			B			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.3	56.5	10.6	44.7	11.5	53.3	8.6	46.6
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	5.5	33.5	6.5	56.5	10.5	28.5	5.5	57.5
Max Q Clear Time (g_c+I1), s	3.6	5.2	6.3	26.7	7.0	11.3	4.3	38.1
Green Ext Time (p_c), s	0.0	1.1	0.0	3.6	0.1	1.0	0.0	4.1

Intersection Summary	
HCM 6th Ctrl Delay	32.4
HCM 6th LOS	C

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	43	164	73	98	68	348	43	296	59
v/c Ratio	0.17	0.68	0.35	0.40	0.09	0.16	0.06	0.25	0.06
Control Delay	35.1	56.8	38.4	42.9	7.4	10.3	5.5	8.4	0.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0
Total Delay	35.1	56.8	38.4	42.9	7.4	10.3	5.5	8.9	0.2
Queue Length 50th (ft)	26	106	45	59	16	54	6	60	0
Queue Length 95th (ft)	53	170	80	110	37	91	19	112	0
Internal Link Dist (ft)		500		294		318		200	
Turn Bay Length (ft)	130		130		90		50		
Base Capacity (vph)	276	435	221	435	789	2189	759	1171	1031
Starvation Cap Reductn	0	0	0	0	0	0	0	514	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	0.16	0.38	0.33	0.23	0.09	0.16	0.06	0.45	0.06

Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	41	98	58	69	68	25	65	266	65	41	281	56
Future Volume (veh/h)	41	98	58	69	68	25	65	266	65	41	281	56
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	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	43	103	61	73	72	26	68	280	68	43	296	59
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	221	126	75	174	172	62	726	1866	445	754	1216	1030
Arrive On Green	0.03	0.11	0.11	0.05	0.13	0.13	0.04	0.66	0.66	0.03	0.65	0.65
Sat Flow, veh/h	1781	1101	652	1781	1312	474	1781	2845	679	1781	1870	1585
Grp Volume(v), veh/h	43	0	164	73	0	98	68	173	175	43	296	59
Grp Sat Flow(s),veh/h/ln	1781	0	1753	1781	0	1785	1781	1777	1748	1781	1870	1585
Q Serve(g_s), s	2.5	0.0	11.0	4.3	0.0	6.1	1.5	4.5	4.6	0.9	7.9	1.6
Cycle Q Clear(g_c), s	2.5	0.0	11.0	4.3	0.0	6.1	1.5	4.5	4.6	0.9	7.9	1.6
Prop In Lane	1.00		0.37	1.00		0.27	1.00		0.39	1.00		1.00
Lane Grp Cap(c), veh/h	221	0	201	174	0	234	726	1165	1146	754	1216	1030
V/C Ratio(X)	0.19	0.00	0.82	0.42	0.00	0.42	0.09	0.15	0.15	0.06	0.24	0.06
Avail Cap(c_a), veh/h	305	0	416	229	0	424	845	1165	1146	839	1216	1030
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	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	0.97	0.97	0.97
Uniform Delay (d), s/veh	44.9	0.0	51.9	44.4	0.0	47.9	6.4	7.9	7.9	6.3	8.7	7.6
Incr Delay (d2), s/veh	0.4	0.0	7.9	1.6	0.0	1.2	0.1	0.3	0.3	0.0	0.5	0.1
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	1.2	0.0	5.3	2.0	0.0	2.8	0.5	1.7	1.8	0.3	3.2	0.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	45.3	0.0	59.8	46.0	0.0	49.1	6.4	8.2	8.2	6.3	9.2	7.7
LnGrp LOS	D	A	E	D	A	D	A	A	A	A	A	A
Approach Vol, veh/h		207			171			416			398	
Approach Delay, s/veh		56.8			47.8			7.9			8.7	
Approach LOS		E			D			A			A	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.3	83.2	10.3	18.2	9.0	82.5	8.3	20.2
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	9.5	54.5	9.5	28.5	12.5	51.5	9.5	28.5
Max Q Clear Time (g_c+I1), s	2.9	6.6	6.3	13.0	3.5	9.9	4.5	8.1
Green Ext Time (p_c), s	0.0	2.3	0.0	0.8	0.1	2.1	0.0	0.5

Intersection Summary	
HCM 6th Ctrl Delay	22.4
HCM 6th LOS	C

Intersection	
Int Delay, s/veh	3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	30	108	6	0	88	9	1	1	0	13	1	54
Future Vol, veh/h	30	108	6	0	88	9	1	1	0	13	1	54
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
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	80	80	80	80	80	80	80	80	80	80	80	80
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	38	135	8	0	110	11	1	1	0	16	1	68

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	121	0	0	143	0	0	365	336	139	332	335	116
Stage 1	-	-	-	-	-	-	215	215	-	116	116	-
Stage 2	-	-	-	-	-	-	150	121	-	216	219	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1467	-	-	1440	-	-	591	585	909	621	585	936
Stage 1	-	-	-	-	-	-	787	725	-	889	800	-
Stage 2	-	-	-	-	-	-	853	796	-	786	722	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1467	-	-	1440	-	-	537	570	909	608	570	936
Mov Cap-2 Maneuver	-	-	-	-	-	-	537	570	-	608	570	-
Stage 1	-	-	-	-	-	-	767	706	-	866	800	-
Stage 2	-	-	-	-	-	-	790	796	-	764	703	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	1.6	0	11.5	9.8
HCM LOS			B	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	553	1467	-	-	1440	-	-	841
HCM Lane V/C Ratio	0.005	0.026	-	-	-	-	-	0.101
HCM Control Delay (s)	11.5	7.5	-	-	0	-	-	9.8
HCM Lane LOS	B	A	-	-	A	-	-	A
HCM 95th %tile Q(veh)	0	0.1	-	-	0	-	-	0.3

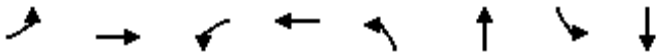
Intersection	
Int Delay, s/veh	1.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	14	125	1	1	80	21	1	0	0	15	0	11
Future Vol, veh/h	14	125	1	1	80	21	1	0	0	15	0	11
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
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	91	91	91	91	91	91	91	91	91	91	91	91
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	15	137	1	1	88	23	1	0	0	16	0	12

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	111	0	0	138	0	0	276	281	138	270	270	100
Stage 1	-	-	-	-	-	-	168	168	-	102	102	-
Stage 2	-	-	-	-	-	-	108	113	-	168	168	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1479	-	-	1446	-	-	676	627	910	683	636	956
Stage 1	-	-	-	-	-	-	834	759	-	904	811	-
Stage 2	-	-	-	-	-	-	897	802	-	834	759	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1479	-	-	1446	-	-	662	620	910	678	629	956
Mov Cap-2 Maneuver	-	-	-	-	-	-	662	620	-	678	629	-
Stage 1	-	-	-	-	-	-	826	751	-	895	810	-
Stage 2	-	-	-	-	-	-	885	801	-	826	751	-

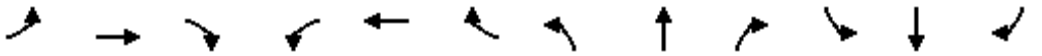
Approach	EB	WB	NB	SB
HCM Control Delay, s	0.7	0.1	10.4	9.8
HCM LOS			B	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	662	1479	-	-	1446	-	-	773
HCM Lane V/C Ratio	0.002	0.01	-	-	0.001	-	-	0.037
HCM Control Delay (s)	10.4	7.5	-	-	7.5	-	-	9.8
HCM Lane LOS	B	A	-	-	A	-	-	A
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0.1



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	53	73	41	12	36	104	7	136
v/c Ratio	0.40	0.08	0.41	0.01	0.04	0.07	0.01	0.10
Control Delay	55.3	0.2	63.7	0.0	5.5	4.4	9.7	7.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	55.3	0.2	63.7	0.0	5.5	4.4	9.7	7.9
Queue Length 50th (ft)	40	0	31	0	7	16	2	33
Queue Length 95th (ft)	82	0	67	0	19	39	9	71
Internal Link Dist (ft)		534		206		320		274
Turn Bay Length (ft)	115				115			
Base Capacity (vph)	390	987	280	1009	966	1393	927	1303
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.14	0.07	0.15	0.01	0.04	0.07	0.01	0.10

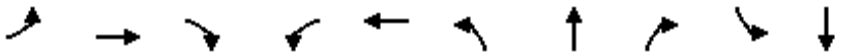
Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	51	0	71	38	0	11	35	74	26	6	103	29
Future Volume (veh/h)	51	0	71	38	0	11	35	74	26	6	103	29
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	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	53	0	73	41	0	12	36	76	28	7	106	30
Peak Hour Factor	0.97	0.92	0.97	0.92	0.92	0.92	0.97	0.97	0.92	0.92	0.97	0.97
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	116	0	103	62	0	55	987	1027	378	991	1012	286
Arrive On Green	0.06	0.00	0.06	0.03	0.00	0.03	0.03	0.79	0.79	0.72	0.72	0.72
Sat Flow, veh/h	1781	0	1585	1781	0	1585	1781	1304	480	1290	1402	397
Grp Volume(v), veh/h	53	0	73	41	0	12	36	0	104	7	0	136
Grp Sat Flow(s),veh/h/ln	1781	0	1585	1781	0	1585	1781	0	1784	1290	0	1799
Q Serve(g_s), s	3.4	0.0	5.4	2.7	0.0	0.9	0.6	0.0	1.6	0.2	0.0	2.7
Cycle Q Clear(g_c), s	3.4	0.0	5.4	2.7	0.0	0.9	0.6	0.0	1.6	0.2	0.0	2.7
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.27	1.00		0.22
Lane Grp Cap(c), veh/h	116	0	103	62	0	55	987	0	1406	991	0	1298
V/C Ratio(X)	0.46	0.00	0.71	0.67	0.00	0.22	0.04	0.00	0.07	0.01	0.00	0.10
Avail Cap(c_a), veh/h	393	0	350	379	0	337	1106	0	1406	991	0	1298
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	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	54.1	0.0	55.0	57.2	0.0	56.4	3.4	0.0	2.9	4.7	0.0	5.0
Incr Delay (d2), s/veh	2.8	0.0	8.7	11.7	0.0	2.0	0.0	0.0	0.1	0.0	0.0	0.2
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	1.6	0.0	2.4	1.4	0.0	0.4	0.2	0.0	0.5	0.0	0.0	1.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	56.9	0.0	63.7	68.9	0.0	58.3	3.4	0.0	3.0	4.7	0.0	5.2
LnGrp LOS	E	A	E	E	A	E	A	A	A	A	A	A
Approach Vol, veh/h		126			53			140			143	
Approach Delay, s/veh		60.8			66.5			3.1			5.2	
Approach LOS		E			E			A			A	

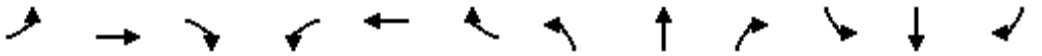
Timer - Assigned Phs		2		4	5	6		8				
Phs Duration (G+Y+Rc), s		99.1		12.3	8.0	91.1		8.6				
Change Period (Y+Rc), s		4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s		54.5		26.5	11.5	38.5		25.5				
Max Q Clear Time (g_c+I1), s		3.6		7.4	2.6	4.7		4.7				
Green Ext Time (p_c), s		0.6		0.5	0.0	0.8		0.1				

Intersection Summary												
HCM 6th Ctrl Delay			26.8									
HCM 6th LOS			C									



Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	44	309	140	52	299	118	99	65	26	223
v/c Ratio	0.21	0.76	0.31	0.25	0.72	0.17	0.09	0.07	0.03	0.24
Control Delay	28.0	55.8	7.2	28.9	52.1	10.5	13.3	0.9	12.3	19.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	28.0	55.8	7.2	28.9	52.1	10.5	13.3	0.9	12.3	19.1
Queue Length 50th (ft)	24	225	0	28	213	32	28	0	8	91
Queue Length 95th (ft)	46	298	48	51	283	56	50	1	24	176
Internal Link Dist (ft)		382			232		200			299
Turn Bay Length (ft)	115		230	200		70		100	50	
Base Capacity (vph)	218	675	663	218	687	711	1055	938	769	920
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.20	0.46	0.21	0.24	0.44	0.17	0.09	0.07	0.03	0.24

Intersection Summary



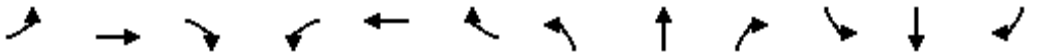
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	41	287	130	48	264	14	110	92	60	24	153	54
Future Volume (veh/h)	41	287	130	48	264	14	110	92	60	24	153	54
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	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	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	44	309	140	52	284	15	118	99	65	26	165	58
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, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	165	366	311	156	349	18	735	1114	944	806	760	267
Arrive On Green	0.03	0.20	0.20	0.03	0.20	0.20	0.07	0.99	0.99	0.02	0.58	0.58
Sat Flow, veh/h	1781	1870	1585	1781	1761	93	1781	1870	1585	1781	1322	465
Grp Volume(v), veh/h	44	309	140	52	0	299	118	99	65	26	0	223
Grp Sat Flow(s),veh/h/ln	1781	1870	1585	1781	0	1854	1781	1870	1585	1781	0	1787
Q Serve(g_s), s	2.3	19.1	9.3	2.8	0.0	18.5	3.3	0.0	0.0	0.7	0.0	7.3
Cycle Q Clear(g_c), s	2.3	19.1	9.3	2.8	0.0	18.5	3.3	0.0	0.0	0.7	0.0	7.3
Prop In Lane	1.00		1.00	1.00		0.05	1.00		1.00	1.00		0.26
Lane Grp Cap(c), veh/h	165	366	311	156	0	367	735	1114	944	806	0	1028
V/C Ratio(X)	0.27	0.84	0.45	0.33	0.00	0.81	0.16	0.09	0.07	0.03	0.00	0.22
Avail Cap(c_a), veh/h	219	678	575	221	0	687	856	1114	944	874	0	1028
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.67	1.67	1.67	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	38.1	46.5	42.6	38.2	0.0	46.0	9.2	0.1	0.1	9.8	0.0	12.4
Incr Delay (d2), s/veh	0.9	5.3	1.0	1.2	0.0	4.4	0.1	0.2	0.1	0.0	0.0	0.5
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	1.1	9.5	3.8	1.3	0.0	9.0	1.2	0.1	0.0	0.3	0.0	3.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	39.0	51.8	43.6	39.5	0.0	50.4	9.3	0.3	0.3	9.8	0.0	12.9
LnGrp LOS	D	D	D	D	A	D	A	A	A	A	A	B
Approach Vol, veh/h		493			351			282			249	
Approach Delay, s/veh		48.3			48.8			4.1			12.5	
Approach LOS		D			D			A			B	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	7.4	76.0	8.6	28.0	9.8	73.5	8.3	28.3
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	7.5	42.5	8.5	43.5	13.5	36.5	7.5	44.5
Max Q Clear Time (g_c+I1), s	2.7	2.0	4.8	21.1	5.3	9.3	4.3	20.5
Green Ext Time (p_c), s	0.0	0.8	0.0	2.4	0.2	1.3	0.0	1.9

Intersection Summary	
HCM 6th Ctrl Delay	32.9
HCM 6th LOS	C

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	32	103	38	51	67	284	34	260	69
v/c Ratio	0.17	0.57	0.22	0.31	0.08	0.11	0.04	0.20	0.06
Control Delay	41.6	41.9	40.9	34.4	4.9	6.6	4.3	6.4	1.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0
Total Delay	41.6	41.9	40.9	34.4	4.9	6.6	4.3	6.9	1.2
Queue Length 50th (ft)	21	42	25	21	12	35	3	39	0
Queue Length 95th (ft)	47	96	52	60	30	63	16	98	1
Internal Link Dist (ft)		337		294		318		200	
Turn Bay Length (ft)	130		130		90		50		
Base Capacity (vph)	219	441	199	429	903	2502	879	1308	1140
Starvation Cap Reductn	0	0	0	0	0	0	0	662	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	0.15	0.23	0.19	0.12	0.07	0.11	0.04	0.40	0.06

Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	29	42	50	34	25	21	60	210	46	31	234	62
Future Volume (veh/h)	29	42	50	34	25	21	60	210	46	31	234	62
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	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	32	47	56	38	28	23	67	233	51	34	260	69
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	182	62	74	140	78	64	780	2072	445	862	1315	1114
Arrive On Green	0.03	0.08	0.08	0.03	0.08	0.08	0.04	0.71	0.71	0.02	0.47	0.47
Sat Flow, veh/h	1781	777	926	1781	950	780	1781	2910	625	1781	1870	1585
Grp Volume(v), veh/h	32	0	103	38	0	51	67	141	143	34	260	69
Grp Sat Flow(s),veh/h/ln	1781	0	1704	1781	0	1730	1781	1777	1758	1781	1870	1585
Q Serve(g_s), s	2.0	0.0	7.1	2.3	0.0	3.3	1.2	3.0	3.1	0.6	9.7	2.8
Cycle Q Clear(g_c), s	2.0	0.0	7.1	2.3	0.0	3.3	1.2	3.0	3.1	0.6	9.7	2.8
Prop In Lane	1.00		0.54	1.00		0.45	1.00		0.36	1.00		1.00
Lane Grp Cap(c), veh/h	182	0	136	140	0	143	780	1265	1252	862	1315	1114
V/C Ratio(X)	0.18	0.00	0.76	0.27	0.00	0.36	0.09	0.11	0.11	0.04	0.20	0.06
Avail Cap(c_a), veh/h	275	0	405	228	0	411	899	1265	1252	953	1315	1114
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.67	0.67	0.67
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	0.97	0.97	0.97
Uniform Delay (d), s/veh	48.7	0.0	54.1	48.8	0.0	52.1	4.6	5.4	5.4	4.5	12.0	10.2
Incr Delay (d2), s/veh	0.5	0.0	8.3	1.0	0.0	1.5	0.0	0.2	0.2	0.0	0.3	0.1
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	0.9	0.0	3.4	1.1	0.0	1.5	0.4	1.1	1.1	0.2	4.4	1.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	49.2	0.0	62.4	49.8	0.0	53.6	4.7	5.6	5.6	4.5	12.3	10.3
LnGrp LOS	D	A	E	D	A	D	A	A	A	A	B	B
Approach Vol, veh/h		135			89			351			363	
Approach Delay, s/veh		59.3			52.0			5.4			11.2	
Approach LOS		E			D			A			B	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	7.9	89.9	8.1	14.1	9.0	88.9	7.8	14.4
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	9.5	54.5	9.5	28.5	12.5	51.5	9.5	28.5
Max Q Clear Time (g_c+I1), s	2.6	5.1	4.3	9.1	3.2	11.7	4.0	5.3
Green Ext Time (p_c), s	0.0	1.8	0.0	0.5	0.1	1.9	0.0	0.2

Intersection Summary	
HCM 6th Ctrl Delay	19.8
HCM 6th LOS	B

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	14	103	12	3	48	5	19	0	10	5	0	12
Future Vol, veh/h	14	103	12	3	48	5	19	0	10	5	0	12
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
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	75	75	75	75	75	75	75	75	75	75	75	75
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	19	137	16	4	64	7	25	0	13	7	0	16

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	71	0	0	153	0	0	267	262	145	266	267	68
Stage 1	-	-	-	-	-	-	183	183	-	76	76	-
Stage 2	-	-	-	-	-	-	84	79	-	190	191	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1529	-	-	1428	-	-	686	643	902	687	639	995
Stage 1	-	-	-	-	-	-	819	748	-	933	832	-
Stage 2	-	-	-	-	-	-	924	829	-	812	742	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1529	-	-	1428	-	-	667	633	902	669	629	995
Mov Cap-2 Maneuver	-	-	-	-	-	-	667	633	-	669	629	-
Stage 1	-	-	-	-	-	-	809	739	-	922	830	-
Stage 2	-	-	-	-	-	-	907	827	-	790	733	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.8	0.4	10.2	9.2
HCM LOS			B	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	733	1529	-	-	1428	-	-	870
HCM Lane V/C Ratio	0.053	0.012	-	-	0.003	-	-	0.026
HCM Control Delay (s)	10.2	7.4	-	-	7.5	-	-	9.2
HCM Lane LOS	B	A	-	-	A	-	-	A
HCM 95th %tile Q(veh)	0.2	0	-	-	0	-	-	0.1

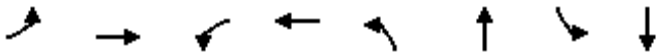
Intersection	
Int Delay, s/veh	2.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	11	77	4	4	49	9	11	0	11	2	2	2
Future Vol, veh/h	11	77	4	4	49	9	11	0	11	2	2	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
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	81	81	81	81	81	81	81	81	81	81	81	81
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	14	95	5	5	60	11	14	0	14	2	2	2

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	71	0	0	100	0	0	204	207	98	209	204	66
Stage 1	-	-	-	-	-	-	126	126	-	76	76	-
Stage 2	-	-	-	-	-	-	78	81	-	133	128	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1529	-	-	1493	-	-	754	690	958	748	692	998
Stage 1	-	-	-	-	-	-	878	792	-	933	832	-
Stage 2	-	-	-	-	-	-	931	828	-	870	790	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1529	-	-	1493	-	-	743	682	958	730	684	998
Mov Cap-2 Maneuver	-	-	-	-	-	-	743	682	-	730	684	-
Stage 1	-	-	-	-	-	-	870	785	-	925	830	-
Stage 2	-	-	-	-	-	-	923	826	-	850	783	-

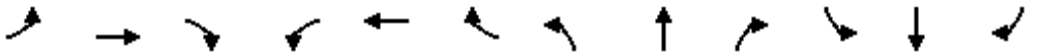
Approach	EB	WB	NB	SB
HCM Control Delay, s	0.9	0.5	9.4	9.6
HCM LOS			A	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	837	1529	-	-	1493	-	-	783
HCM Lane V/C Ratio	0.032	0.009	-	-	0.003	-	-	0.009
HCM Control Delay (s)	9.4	7.4	-	-	7.4	-	-	9.6
HCM Lane LOS	A	A	-	-	A	-	-	A
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	0



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	34	31	43	8	38	94	7	143
v/c Ratio	0.30	0.04	0.41	0.01	0.04	0.07	0.01	0.11
Control Delay	56.2	0.1	63.4	0.0	5.0	3.8	9.0	7.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	56.2	0.1	63.4	0.0	5.0	3.8	9.0	7.6
Queue Length 50th (ft)	26	0	32	0	7	12	2	35
Queue Length 95th (ft)	58	0	69	0	19	32	9	72
Internal Link Dist (ft)		534		272		285		274
Turn Bay Length (ft)	115				115			
Base Capacity (vph)	361	963	303	1051	973	1404	947	1328
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.09	0.03	0.14	0.01	0.04	0.07	0.01	0.11

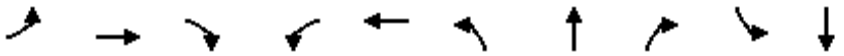
Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	30	0	28	40	0	7	34	59	26	6	105	22
Future Volume (veh/h)	30	0	28	40	0	7	34	59	26	6	105	22
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	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	34	0	31	43	0	8	38	66	28	7	118	25
Peak Hour Factor	0.89	0.92	0.89	0.92	0.92	0.92	0.89	0.89	0.92	0.92	0.89	0.89
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	66	0	58	61	0	54	1019	1018	432	1035	1121	237
Arrive On Green	0.04	0.00	0.04	0.03	0.00	0.03	0.03	0.82	0.82	0.75	0.75	0.75
Sat Flow, veh/h	1781	0	1585	1781	0	1585	1781	1246	529	1302	1496	317
Grp Volume(v), veh/h	34	0	31	43	0	8	38	0	94	7	0	143
Grp Sat Flow(s),veh/h/ln	1781	0	1585	1781	0	1585	1781	0	1775	1302	0	1813
Q Serve(g_s), s	2.2	0.0	2.3	2.9	0.0	0.6	0.5	0.0	1.2	0.2	0.0	2.6
Cycle Q Clear(g_c), s	2.2	0.0	2.3	2.9	0.0	0.6	0.5	0.0	1.2	0.2	0.0	2.6
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.30	1.00		0.17
Lane Grp Cap(c), veh/h	66	0	58	61	0	54	1019	0	1450	1035	0	1358
V/C Ratio(X)	0.52	0.00	0.53	0.71	0.00	0.15	0.04	0.00	0.06	0.01	0.00	0.11
Avail Cap(c_a), veh/h	364	0	324	393	0	350	1137	0	1450	1035	0	1358
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	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	56.7	0.0	56.8	57.4	0.0	56.3	2.6	0.0	2.1	3.8	0.0	4.1
Incr Delay (d2), s/veh	6.2	0.0	7.3	14.1	0.0	1.2	0.0	0.0	0.1	0.0	0.0	0.2
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	1.1	0.0	1.0	1.5	0.0	0.3	0.2	0.0	0.4	0.0	0.0	0.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	62.9	0.0	64.0	71.5	0.0	57.5	2.7	0.0	2.2	3.8	0.0	4.3
LnGrp LOS	E	A	E	E	A	E	A	A	A	A	A	A
Approach Vol, veh/h		65			51			132			150	
Approach Delay, s/veh		63.4			69.3			2.3			4.2	
Approach LOS		E			E			A			A	

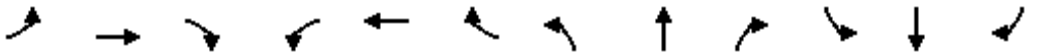
Timer - Assigned Phs		2		4	5	6		8				
Phs Duration (G+Y+Rc), s		102.5		8.9	8.1	94.4		8.6				
Change Period (Y+Rc), s		4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s		55.5		24.5	11.5	39.5		26.5				
Max Q Clear Time (g_c+I1), s		3.2		4.3	2.5	4.6		4.9				
Green Ext Time (p_c), s		0.6		0.2	0.0	0.9		0.1				

Intersection Summary												
HCM 6th Ctrl Delay			21.6									
HCM 6th LOS			C									



Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	52	442	135	98	588	133	157	74	42	208
v/c Ratio	0.29	0.66	0.21	0.35	0.82	0.27	0.21	0.11	0.08	0.33
Control Delay	19.3	35.8	3.9	20.2	42.6	18.3	22.7	1.2	22.2	32.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.2	0.4	0.0	0.0	0.0
Total Delay	19.3	35.8	3.9	20.2	42.6	18.4	23.2	1.2	22.2	32.5
Queue Length 50th (ft)	21	275	0	41	401	46	55	0	18	115
Queue Length 95th (ft)	37	334	34	62	477	74	86	5	46	208
Internal Link Dist (ft)		527			232		200			299
Turn Bay Length (ft)	115		230	200		70		100	50	
Base Capacity (vph)	182	877	817	279	888	507	737	683	526	635
Starvation Cap Reductn	0	0	0	0	0	67	284	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.29	0.50	0.17	0.35	0.66	0.30	0.35	0.11	0.08	0.33

Intersection Summary



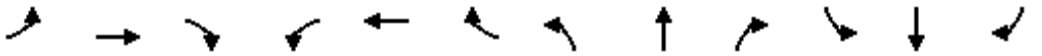
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	48	407	124	90	521	20	122	144	68	39	145	46
Future Volume (veh/h)	48	407	124	90	521	20	122	144	68	39	145	46
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	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	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	52	442	135	98	566	22	133	157	74	42	158	50
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	163	627	531	258	628	24	550	810	687	581	551	174
Arrive On Green	0.03	0.33	0.33	0.05	0.35	0.35	0.10	0.72	0.72	0.03	0.40	0.40
Sat Flow, veh/h	1781	1870	1585	1781	1788	70	1781	1870	1585	1781	1362	431
Grp Volume(v), veh/h	52	442	135	98	0	588	133	157	74	42	0	208
Grp Sat Flow(s),veh/h/ln	1781	1870	1585	1781	0	1858	1781	1870	1585	1781	0	1793
Q Serve(g_s), s	2.3	24.7	7.4	4.3	0.0	36.1	5.2	3.2	1.7	1.6	0.0	9.4
Cycle Q Clear(g_c), s	2.3	24.7	7.4	4.3	0.0	36.1	5.2	3.2	1.7	1.6	0.0	9.4
Prop In Lane	1.00		1.00	1.00		0.04	1.00		1.00	1.00		0.24
Lane Grp Cap(c), veh/h	163	627	531	258	0	652	550	810	687	581	0	726
V/C Ratio(X)	0.32	0.71	0.25	0.38	0.00	0.90	0.24	0.19	0.11	0.07	0.00	0.29
Avail Cap(c_a), veh/h	184	881	746	265	0	890	599	810	687	607	0	726
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.67	1.67	1.67	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	0.99	0.99	0.99	1.00	0.00	1.00
Uniform Delay (d), s/veh	29.8	34.7	29.0	26.9	0.0	37.0	17.8	9.9	9.6	19.5	0.0	24.1
Incr Delay (d2), s/veh	1.1	1.5	0.2	0.9	0.0	9.7	0.2	0.5	0.3	0.1	0.0	1.0
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	1.0	11.6	2.9	1.9	0.0	18.1	2.0	1.4	0.7	0.7	0.0	4.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	30.9	36.2	29.3	27.8	0.0	46.6	18.0	10.4	10.0	19.6	0.0	25.0
LnGrp LOS	C	D	C	C	A	D	B	B	A	B	A	C
Approach Vol, veh/h		629			686			364			250	
Approach Delay, s/veh		34.3			43.9			13.1			24.1	
Approach LOS		C			D			B			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.3	56.5	10.6	44.7	11.7	53.1	8.6	46.6
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	5.5	33.5	6.5	56.5	10.5	28.5	5.5	57.5
Max Q Clear Time (g_c+I1), s	3.6	5.2	6.3	26.7	7.2	11.4	4.3	38.1
Green Ext Time (p_c), s	0.0	1.1	0.0	3.7	0.1	1.0	0.0	4.1

Intersection Summary	
HCM 6th Ctrl Delay	32.4
HCM 6th LOS	C

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	43	168	81	105	68	328	51	296	59
v/c Ratio	0.17	0.69	0.36	0.39	0.09	0.15	0.07	0.26	0.06
Control Delay	33.9	56.9	37.6	40.3	8.1	11.3	6.9	9.9	0.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0
Total Delay	33.9	56.9	37.6	40.3	8.1	11.3	6.9	10.5	0.6
Queue Length 50th (ft)	26	109	50	62	16	54	7	62	0
Queue Length 95th (ft)	52	175	86	111	39	93	25	127	0
Internal Link Dist (ft)		500		294		318		200	
Turn Bay Length (ft)	130		130		90		50		
Base Capacity (vph)	270	450	251	494	760	2159	746	1152	1015
Starvation Cap Reductn	0	0	0	0	0	0	0	503	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	0.16	0.37	0.32	0.21	0.09	0.15	0.07	0.46	0.06

Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	41	102	58	77	70	29	65	266	46	48	281	56
Future Volume (veh/h)	41	102	58	77	70	29	65	266	46	48	281	56
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	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	43	107	61	81	74	31	68	280	48	51	296	59
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	225	131	75	183	173	72	717	1964	332	762	1202	1019
Arrive On Green	0.03	0.12	0.12	0.05	0.14	0.14	0.04	0.65	0.65	0.03	0.64	0.64
Sat Flow, veh/h	1781	1118	637	1781	1252	524	1781	3040	515	1781	1870	1585
Grp Volume(v), veh/h	43	0	168	81	0	105	68	162	166	51	296	59
Grp Sat Flow(s),veh/h/ln	1781	0	1756	1781	0	1776	1781	1777	1778	1781	1870	1585
Q Serve(g_s), s	2.5	0.0	11.2	4.7	0.0	6.5	1.5	4.3	4.4	1.1	8.1	1.7
Cycle Q Clear(g_c), s	2.5	0.0	11.2	4.7	0.0	6.5	1.5	4.3	4.4	1.1	8.1	1.7
Prop In Lane	1.00		0.36	1.00		0.30	1.00		0.29	1.00		1.00
Lane Grp Cap(c), veh/h	225	0	205	183	0	245	717	1148	1149	762	1202	1019
V/C Ratio(X)	0.19	0.00	0.82	0.44	0.00	0.43	0.09	0.14	0.14	0.07	0.25	0.06
Avail Cap(c_a), veh/h	294	0	432	259	0	481	807	1148	1149	828	1202	1019
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	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	0.97	0.97	0.97
Uniform Delay (d), s/veh	44.6	0.0	51.7	43.8	0.0	47.4	6.7	8.3	8.3	6.5	9.1	8.0
Incr Delay (d2), s/veh	0.4	0.0	7.8	1.7	0.0	1.2	0.1	0.3	0.3	0.0	0.5	0.1
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	1.2	0.0	5.4	2.2	0.0	3.0	0.6	1.7	1.7	0.4	3.3	0.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	45.0	0.0	59.5	45.5	0.0	48.6	6.7	8.5	8.6	6.6	9.6	8.1
LnGrp LOS	D	A	E	D	A	D	A	A	A	A	A	A
Approach Vol, veh/h		211			186			396			406	
Approach Delay, s/veh		56.6			47.2			8.2			9.0	
Approach LOS		E			D			A			A	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.6	82.0	10.8	18.5	9.0	81.6	8.3	21.1
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	8.5	52.5	11.5	29.5	10.5	50.5	8.5	32.5
Max Q Clear Time (g_c+I1), s	3.1	6.4	6.7	13.2	3.5	10.1	4.5	8.5
Green Ext Time (p_c), s	0.0	2.1	0.1	0.8	0.1	2.1	0.0	0.5

Intersection Summary	
HCM 6th Ctrl Delay	23.0
HCM 6th LOS	C

Intersection	
Int Delay, s/veh	3.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	30	119	20	9	95	9	10	1	6	13	1	54
Future Vol, veh/h	30	119	20	9	95	9	10	1	6	13	1	54
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
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	80	80	80	80	80	80	80	80	80	80	80	80
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	38	149	25	11	119	11	13	1	8	16	1	68

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	130	0	0	174	0	0	419	390	162	389	397	125
Stage 1	-	-	-	-	-	-	238	238	-	147	147	-
Stage 2	-	-	-	-	-	-	181	152	-	242	250	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1455	-	-	1403	-	-	544	545	883	570	540	926
Stage 1	-	-	-	-	-	-	765	708	-	856	775	-
Stage 2	-	-	-	-	-	-	821	772	-	762	700	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1455	-	-	1403	-	-	491	526	883	549	522	926
Mov Cap-2 Maneuver	-	-	-	-	-	-	491	526	-	549	522	-
Stage 1	-	-	-	-	-	-	745	690	-	834	769	-
Stage 2	-	-	-	-	-	-	754	766	-	734	682	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	1.3	0.6	11.4	10
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	585	1455	-	-	1403	-	-	810
HCM Lane V/C Ratio	0.036	0.026	-	-	0.008	-	-	0.105
HCM Control Delay (s)	11.4	7.5	-	-	7.6	-	-	10
HCM Lane LOS	B	A	-	-	A	-	-	B
HCM 95th %tile Q(veh)	0.1	0.1	-	-	0	-	-	0.3

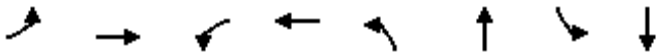
Intersection	
Int Delay, s/veh	1.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	14	131	11	12	89	21	8	0	7	15	0	11
Future Vol, veh/h	14	131	11	12	89	21	8	0	7	15	0	11
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
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	91	91	91	91	91	91	91	91	91	91	91	91
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	15	144	12	13	98	23	9	0	8	16	0	12

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	121	0	0	156	0	0	322	327	150	320	322	110
Stage 1	-	-	-	-	-	-	180	180	-	136	136	-
Stage 2	-	-	-	-	-	-	142	147	-	184	186	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1467	-	-	1424	-	-	631	591	896	633	595	943
Stage 1	-	-	-	-	-	-	822	750	-	867	784	-
Stage 2	-	-	-	-	-	-	861	775	-	818	746	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1467	-	-	1424	-	-	614	580	896	618	584	943
Mov Cap-2 Maneuver	-	-	-	-	-	-	614	580	-	618	584	-
Stage 1	-	-	-	-	-	-	814	743	-	858	777	-
Stage 2	-	-	-	-	-	-	842	768	-	803	739	-

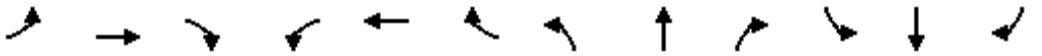
Approach	EB	WB	NB	SB
HCM Control Delay, s	0.7	0.7	10.1	10.2
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	720	1467	-	-	1424	-	-	723
HCM Lane V/C Ratio	0.023	0.01	-	-	0.009	-	-	0.04
HCM Control Delay (s)	10.1	7.5	-	-	7.6	-	-	10.2
HCM Lane LOS	B	A	-	-	A	-	-	B
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	0.1



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	58	82	41	12	49	104	7	142
v/c Ratio	0.42	0.09	0.41	0.01	0.05	0.08	0.01	0.12
Control Delay	56.0	0.2	63.8	0.0	5.7	4.6	10.2	8.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	56.0	0.2	63.8	0.0	5.7	4.6	10.2	8.6
Queue Length 50th (ft)	44	0	31	0	9	16	2	35
Queue Length 95th (ft)	85	0	67	0	25	40	9	76
Internal Link Dist (ft)		534		206		320		274
Turn Bay Length (ft)	115				115			
Base Capacity (vph)	390	989	278	1003	942	1345	867	1213
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.15	0.08	0.15	0.01	0.05	0.08	0.01	0.12

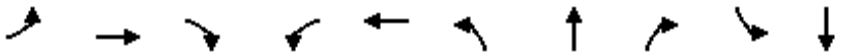
Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	56	0	80	38	0	11	48	74	26	6	103	35
Future Volume (veh/h)	56	0	80	38	0	11	48	74	26	6	103	35
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	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	58	0	82	41	0	12	49	76	28	7	106	36
Peak Hour Factor	0.97	0.92	0.97	0.92	0.92	0.92	0.97	0.97	0.92	0.92	0.97	0.97
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	127	0	113	62	0	55	974	1019	375	977	949	322
Arrive On Green	0.07	0.00	0.07	0.03	0.00	0.03	0.03	0.78	0.78	0.71	0.71	0.71
Sat Flow, veh/h	1781	0	1585	1781	0	1585	1781	1304	480	1290	1335	453
Grp Volume(v), veh/h	58	0	82	41	0	12	49	0	104	7	0	142
Grp Sat Flow(s),veh/h/ln	1781	0	1585	1781	0	1585	1781	0	1784	1290	0	1789
Q Serve(g_s), s	3.8	0.0	6.1	2.7	0.0	0.9	0.8	0.0	1.6	0.2	0.0	3.0
Cycle Q Clear(g_c), s	3.8	0.0	6.1	2.7	0.0	0.9	0.8	0.0	1.6	0.2	0.0	3.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.27	1.00		0.25
Lane Grp Cap(c), veh/h	127	0	113	62	0	55	974	0	1394	977	0	1271
V/C Ratio(X)	0.46	0.00	0.73	0.67	0.00	0.22	0.05	0.00	0.07	0.01	0.00	0.11
Avail Cap(c_a), veh/h	393	0	350	379	0	337	1100	0	1394	977	0	1271
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	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	53.5	0.0	54.6	57.2	0.0	56.4	3.6	0.0	3.0	5.1	0.0	5.5
Incr Delay (d2), s/veh	2.6	0.0	8.5	11.7	0.0	2.0	0.0	0.0	0.1	0.0	0.0	0.2
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	1.8	0.0	2.7	1.4	0.0	0.4	0.3	0.0	0.5	0.1	0.0	1.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	56.0	0.0	63.1	68.9	0.0	58.3	3.7	0.0	3.1	5.1	0.0	5.6
LnGrp LOS	E	A	E	E	A	E	A	A	A	A	A	A
Approach Vol, veh/h		140			53			153			149	
Approach Delay, s/veh		60.2			66.5			3.3			5.6	
Approach LOS		E			E			A			A	

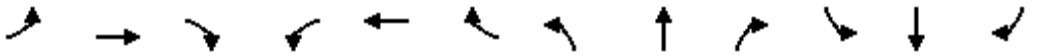
Timer - Assigned Phs		2		4	5	6		8				
Phs Duration (G+Y+Rc), s		98.3		13.1	8.5	89.8		8.6				
Change Period (Y+Rc), s		4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s		54.5		26.5	12.5	37.5		25.5				
Max Q Clear Time (g_c+I1), s		3.6		8.1	2.8	5.0		4.7				
Green Ext Time (p_c), s		0.6		0.6	0.0	0.8		0.1				

Intersection Summary												
HCM 6th Ctrl Delay			26.9									
HCM 6th LOS			C									



Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	48	334	153	57	326	129	109	71	28	244
v/c Ratio	0.24	0.78	0.32	0.29	0.74	0.20	0.11	0.08	0.04	0.27
Control Delay	28.1	55.2	6.8	29.3	51.8	10.8	13.3	0.9	12.8	20.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	28.1	55.2	6.8	29.3	51.8	10.8	13.3	0.9	12.8	20.4
Queue Length 50th (ft)	25	243	0	30	232	35	31	0	9	104
Queue Length 95th (ft)	48	317	48	55	304	59	53	2	26	198
Internal Link Dist (ft)		382			372		200			299
Turn Bay Length (ft)	115		230	200		70		100	50	
Base Capacity (vph)	202	675	671	203	687	674	1038	924	737	898
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.24	0.49	0.23	0.28	0.47	0.19	0.11	0.08	0.04	0.27

Intersection Summary



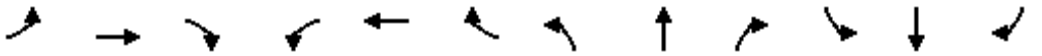
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	45	311	142	53	288	15	120	101	66	26	168	59
Future Volume (veh/h)	45	311	142	53	288	15	120	101	66	26	168	59
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	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	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	48	334	153	57	310	16	129	109	71	28	181	63
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, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	166	393	333	158	374	19	698	1083	918	774	737	256
Arrive On Green	0.03	0.21	0.21	0.04	0.21	0.21	0.08	0.97	0.97	0.03	0.56	0.56
Sat Flow, veh/h	1781	1870	1585	1781	1763	91	1781	1870	1585	1781	1326	461
Grp Volume(v), veh/h	48	334	153	57	0	326	129	109	71	28	0	244
Grp Sat Flow(s),veh/h/ln	1781	1870	1585	1781	0	1854	1781	1870	1585	1781	0	1787
Q Serve(g_s), s	2.5	20.6	10.1	3.0	0.0	20.2	3.8	0.3	0.2	0.8	0.0	8.4
Cycle Q Clear(g_c), s	2.5	20.6	10.1	3.0	0.0	20.2	3.8	0.3	0.2	0.8	0.0	8.4
Prop In Lane	1.00		1.00	1.00		0.05	1.00		1.00	1.00		0.26
Lane Grp Cap(c), veh/h	166	393	333	158	0	394	698	1083	918	774	0	993
V/C Ratio(X)	0.29	0.85	0.46	0.36	0.00	0.83	0.18	0.10	0.08	0.04	0.00	0.25
Avail Cap(c_a), veh/h	203	678	575	206	0	688	797	1083	918	826	0	993
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.67	1.67	1.67	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	37.0	45.6	41.4	37.2	0.0	45.2	10.0	0.8	0.8	10.7	0.0	13.7
Incr Delay (d2), s/veh	1.0	5.2	1.0	1.4	0.0	4.5	0.1	0.2	0.2	0.0	0.0	0.6
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	1.2	10.2	4.1	1.4	0.0	9.8	1.4	0.2	0.1	0.3	0.0	3.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	38.0	50.8	42.4	38.5	0.0	49.7	10.1	1.0	1.0	10.7	0.0	14.3
LnGrp LOS	D	D	D	D	A	D	B	A	A	B	A	B
Approach Vol, veh/h		535			383			309			272	
Approach Delay, s/veh		47.2			48.0			4.8			13.9	
Approach LOS		D			D			A			B	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	7.5	74.0	8.8	29.7	10.3	71.2	8.5	30.0
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	6.5	44.5	7.5	43.5	12.5	38.5	6.5	44.5
Max Q Clear Time (g_c+I1), s	2.8	2.3	5.0	22.6	5.8	10.4	4.5	22.2
Green Ext Time (p_c), s	0.0	0.9	0.0	2.6	0.2	1.5	0.0	2.0

Intersection Summary	
HCM 6th Ctrl Delay	32.6
HCM 6th LOS	C

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	34	111	40	56	73	314	38	286	76
v/c Ratio	0.16	0.59	0.22	0.27	0.09	0.13	0.05	0.23	0.07
Control Delay	39.9	43.9	38.7	30.9	5.4	7.3	4.7	7.1	1.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0
Total Delay	39.9	43.9	38.7	30.9	5.4	7.3	4.7	7.7	1.3
Queue Length 50th (ft)	22	49	26	22	13	40	4	44	0
Queue Length 95th (ft)	48	105	54	61	33	72	18	109	0
Internal Link Dist (ft)		337		294		318		200	
Turn Bay Length (ft)	130		130		90		50		
Base Capacity (vph)	241	427	207	416	841	2418	831	1261	1102
Starvation Cap Reductn	0	0	0	0	0	0	0	618	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	0.14	0.26	0.19	0.13	0.09	0.13	0.05	0.44	0.07

Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	31	46	54	36	27	23	66	231	51	34	257	68
Future Volume (veh/h)	31	46	54	36	27	23	66	231	51	34	257	68
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	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	34	51	60	40	30	26	73	257	57	38	286	76
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	186	66	78	141	80	70	782	2045	446	833	1303	1104
Arrive On Green	0.03	0.08	0.08	0.03	0.09	0.09	0.04	0.70	0.70	0.03	0.70	0.70
Sat Flow, veh/h	1781	783	921	1781	925	801	1781	2901	632	1781	1870	1585
Grp Volume(v), veh/h	34	0	111	40	0	56	73	156	158	38	286	76
Grp Sat Flow(s),veh/h/ln	1781	0	1705	1781	0	1726	1781	1777	1757	1781	1870	1585
Q Serve(g_s), s	2.1	0.0	7.7	2.4	0.0	3.7	1.4	3.4	3.5	0.7	6.6	1.8
Cycle Q Clear(g_c), s	2.1	0.0	7.7	2.4	0.0	3.7	1.4	3.4	3.5	0.7	6.6	1.8
Prop In Lane	1.00		0.54	1.00		0.46	1.00		0.36	1.00		1.00
Lane Grp Cap(c), veh/h	186	0	144	141	0	150	782	1252	1238	833	1303	1104
V/C Ratio(X)	0.18	0.00	0.77	0.28	0.00	0.37	0.09	0.12	0.13	0.05	0.22	0.07
Avail Cap(c_a), veh/h	277	0	391	228	0	396	885	1252	1238	921	1303	1104
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	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	0.97	0.97	0.97
Uniform Delay (d), s/veh	48.2	0.0	53.8	48.3	0.0	51.7	4.6	5.7	5.7	4.6	6.5	5.8
Incr Delay (d2), s/veh	0.5	0.0	8.3	1.1	0.0	1.5	0.1	0.2	0.2	0.0	0.4	0.1
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	1.0	0.0	3.6	1.1	0.0	1.7	0.5	1.3	1.3	0.2	2.6	0.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	48.7	0.0	62.1	49.4	0.0	53.2	4.6	5.9	6.0	4.6	6.9	5.9
LnGrp LOS	D	A	E	D	A	D	A	A	A	A	A	A
Approach Vol, veh/h		145			96			387			400	
Approach Delay, s/veh		59.0			51.6			5.7			6.5	
Approach LOS		E			D			A			A	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.1	89.1	8.2	14.7	9.1	88.1	7.9	14.9
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	9.5	55.5	9.5	27.5	11.5	53.5	9.5	27.5
Max Q Clear Time (g_c+I1), s	2.7	5.5	4.4	9.7	3.4	8.6	4.1	5.7
Green Ext Time (p_c), s	0.0	2.0	0.0	0.5	0.1	2.1	0.0	0.2

Intersection Summary	
HCM 6th Ctrl Delay	17.8
HCM 6th LOS	B

Intersection	
Int Delay, s/veh	2.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	15	113	13	3	52	5	19	0	10	5	0	13
Future Vol, veh/h	15	113	13	3	52	5	19	0	10	5	0	13
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
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	75	75	75	75	75	75	75	75	75	75	75	75
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	20	151	17	4	69	7	25	0	13	7	0	17

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	76	0	0	168	0	0	289	284	160	287	289	73
Stage 1	-	-	-	-	-	-	200	200	-	81	81	-
Stage 2	-	-	-	-	-	-	89	84	-	206	208	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1523	-	-	1410	-	-	663	625	885	665	621	989
Stage 1	-	-	-	-	-	-	802	736	-	927	828	-
Stage 2	-	-	-	-	-	-	918	825	-	796	730	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1523	-	-	1410	-	-	644	615	885	647	611	989
Mov Cap-2 Maneuver	-	-	-	-	-	-	644	615	-	647	611	-
Stage 1	-	-	-	-	-	-	792	726	-	915	826	-
Stage 2	-	-	-	-	-	-	899	823	-	774	721	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.8	0.4	10.4	9.3
HCM LOS			B	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	711	1523	-	-	1410	-	-	862
HCM Lane V/C Ratio	0.054	0.013	-	-	0.003	-	-	0.028
HCM Control Delay (s)	10.4	7.4	-	-	7.6	-	-	9.3
HCM Lane LOS	B	A	-	-	A	-	-	A
HCM 95th %tile Q(veh)	0.2	0	-	-	0	-	-	0.1

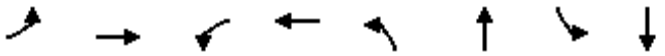
Intersection	
Int Delay, s/veh	2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	12	84	4	4	54	10	11	0	11	2	2	2
Future Vol, veh/h	12	84	4	4	54	10	11	0	11	2	2	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
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	81	81	81	81	81	81	81	81	81	81	81	81
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	15	104	5	5	67	12	14	0	14	2	2	2

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	79	0	0	109	0	0	222	226	107	227	222	73
Stage 1	-	-	-	-	-	-	137	137	-	83	83	-
Stage 2	-	-	-	-	-	-	85	89	-	144	139	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1519	-	-	1481	-	-	734	673	947	728	677	989
Stage 1	-	-	-	-	-	-	866	783	-	925	826	-
Stage 2	-	-	-	-	-	-	923	821	-	859	782	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1519	-	-	1481	-	-	723	664	947	711	668	989
Mov Cap-2 Maneuver	-	-	-	-	-	-	723	664	-	711	668	-
Stage 1	-	-	-	-	-	-	857	775	-	916	824	-
Stage 2	-	-	-	-	-	-	915	819	-	838	774	-

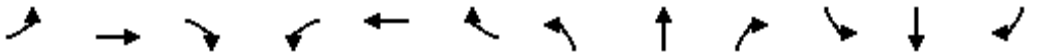
Approach	EB	WB	NB	SB
HCM Control Delay, s	0.9	0.4	9.5	9.7
HCM LOS			A	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	820	1519	-	-	1481	-	-	766
HCM Lane V/C Ratio	0.033	0.01	-	-	0.003	-	-	0.01
HCM Control Delay (s)	9.5	7.4	-	-	7.4	-	-	9.7
HCM Lane LOS	A	A	-	-	A	-	-	A
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	0



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	37	33	43	8	42	99	7	154
v/c Ratio	0.31	0.04	0.41	0.01	0.04	0.07	0.01	0.12
Control Delay	56.1	0.1	63.5	0.0	5.1	4.0	9.3	8.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	56.1	0.1	63.5	0.0	5.1	4.0	9.3	8.1
Queue Length 50th (ft)	28	0	32	0	7	14	2	38
Queue Length 95th (ft)	62	0	69	0	20	35	9	78
Internal Link Dist (ft)		534		272		285		274
Turn Bay Length (ft)	115				115			
Base Capacity (vph)	346	949	302	1040	963	1405	918	1293
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.11	0.03	0.14	0.01	0.04	0.07	0.01	0.12

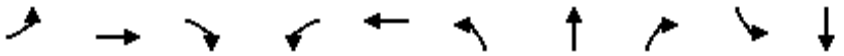
Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	33	0	29	40	0	7	37	63	26	6	113	24
Future Volume (veh/h)	33	0	29	40	0	7	37	63	26	6	113	24
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	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	37	0	33	43	0	8	42	71	28	7	127	27
Peak Hour Factor	0.89	0.92	0.89	0.92	0.92	0.92	0.89	0.89	0.92	0.92	0.89	0.89
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	67	0	60	61	0	54	1008	1041	411	1028	1117	237
Arrive On Green	0.04	0.00	0.04	0.03	0.00	0.03	0.03	0.82	0.82	0.75	0.75	0.75
Sat Flow, veh/h	1781	0	1585	1781	0	1585	1781	1276	503	1296	1495	318
Grp Volume(v), veh/h	37	0	33	43	0	8	42	0	99	7	0	154
Grp Sat Flow(s),veh/h/ln	1781	0	1585	1781	0	1585	1781	0	1780	1296	0	1813
Q Serve(g_s), s	2.4	0.0	2.5	2.9	0.0	0.6	0.6	0.0	1.3	0.2	0.0	2.8
Cycle Q Clear(g_c), s	2.4	0.0	2.5	2.9	0.0	0.6	0.6	0.0	1.3	0.2	0.0	2.8
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.28	1.00		0.18
Lane Grp Cap(c), veh/h	67	0	60	61	0	54	1008	0	1452	1028	0	1354
V/C Ratio(X)	0.55	0.00	0.55	0.71	0.00	0.15	0.04	0.00	0.07	0.01	0.00	0.11
Avail Cap(c_a), veh/h	349	0	310	393	0	350	1123	0	1452	1028	0	1354
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	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	56.7	0.0	56.8	57.4	0.0	56.3	2.7	0.0	2.2	3.9	0.0	4.2
Incr Delay (d2), s/veh	6.9	0.0	7.8	14.1	0.0	1.2	0.0	0.0	0.1	0.0	0.0	0.2
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	1.2	0.0	1.1	1.5	0.0	0.3	0.2	0.0	0.4	0.0	0.0	1.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	63.7	0.0	64.5	71.5	0.0	57.5	2.7	0.0	2.2	3.9	0.0	4.4
LnGrp LOS	E	A	E	E	A	E	A	A	A	A	A	A
Approach Vol, veh/h		70			51			141			161	
Approach Delay, s/veh		64.1			69.3			2.4			4.3	
Approach LOS		E			E			A			A	

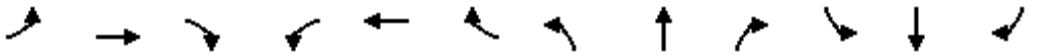
Timer - Assigned Phs		2		4	5	6		8				
Phs Duration (G+Y+Rc), s		102.4		9.0	8.3	94.1		8.6				
Change Period (Y+Rc), s		4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s		56.5		23.5	11.5	40.5		26.5				
Max Q Clear Time (g_c+I1), s		3.3		4.5	2.6	4.8		4.9				
Green Ext Time (p_c), s		0.6		0.2	0.0	0.9		0.1				

Intersection Summary												
HCM 6th Ctrl Delay			21.4									
HCM 6th LOS			C									



Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	57	482	148	108	642	145	172	80	47	228
v/c Ratio	0.33	0.68	0.21	0.39	0.85	0.32	0.25	0.12	0.10	0.39
Control Delay	19.2	34.7	3.6	19.5	42.8	20.2	23.8	1.6	23.9	36.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.1	0.5	0.0	0.0	0.0
Total Delay	19.2	34.7	3.6	19.5	42.8	20.3	24.2	1.6	23.9	36.0
Queue Length 50th (ft)	22	293	0	43	434	51	61	0	21	136
Queue Length 95th (ft)	39	364	35	65	531	81	92	7	51	233
Internal Link Dist (ft)		527			232		200			299
Turn Bay Length (ft)	115		230	200		70		100	50	
Base Capacity (vph)	174	877	823	280	888	464	695	650	484	584
Starvation Cap Reductn	0	0	0	0	0	30	244	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.33	0.55	0.18	0.39	0.72	0.33	0.38	0.12	0.10	0.39

Intersection Summary



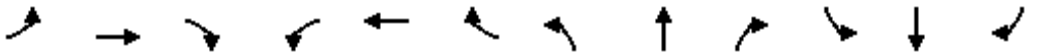
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	52	443	136	99	569	22	133	158	74	43	159	51
Future Volume (veh/h)	52	443	136	99	569	22	133	158	74	43	159	51
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	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	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	57	482	148	108	618	24	145	172	80	47	173	55
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	164	677	574	266	679	26	497	752	637	532	501	159
Arrive On Green	0.04	0.36	0.36	0.05	0.38	0.38	0.11	0.67	0.67	0.03	0.37	0.37
Sat Flow, veh/h	1781	1870	1585	1781	1788	69	1781	1870	1585	1781	1360	432
Grp Volume(v), veh/h	57	482	148	108	0	642	145	172	80	47	0	228
Grp Sat Flow(s),veh/h/ln	1781	1870	1585	1781	0	1858	1781	1870	1585	1781	0	1793
Q Serve(g_s), s	2.4	26.6	7.9	4.5	0.0	39.3	5.9	4.3	2.2	1.9	0.0	11.0
Cycle Q Clear(g_c), s	2.4	26.6	7.9	4.5	0.0	39.3	5.9	4.3	2.2	1.9	0.0	11.0
Prop In Lane	1.00		1.00	1.00		0.04	1.00		1.00	1.00		0.24
Lane Grp Cap(c), veh/h	164	677	574	266	0	705	497	752	637	532	0	660
V/C Ratio(X)	0.35	0.71	0.26	0.41	0.00	0.91	0.29	0.23	0.13	0.09	0.00	0.35
Avail Cap(c_a), veh/h	186	881	746	271	0	890	555	752	637	549	0	660
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.67	1.67	1.67	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	0.99	0.99	0.99	1.00	0.00	1.00
Uniform Delay (d), s/veh	28.7	32.9	26.9	25.3	0.0	35.3	19.7	12.5	12.2	22.1	0.0	27.4
Incr Delay (d2), s/veh	1.3	1.9	0.2	1.0	0.0	11.4	0.3	0.7	0.4	0.1	0.0	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	1.1	12.4	3.1	2.0	0.0	19.9	2.4	1.8	0.9	0.8	0.0	5.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	30.0	34.8	27.2	26.3	0.0	46.7	20.0	13.2	12.6	22.2	0.0	28.9
LnGrp LOS	C	C	C	C	A	D	C	B	B	C	A	C
Approach Vol, veh/h		687			750			397			275	
Approach Delay, s/veh		32.7			43.7			15.6			27.7	
Approach LOS		C			D			B			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.5	52.7	10.9	48.0	12.5	48.7	8.8	50.1
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	5.1	33.7	6.7	56.5	11.9	26.9	5.7	57.5
Max Q Clear Time (g_c+I1), s	3.9	6.3	6.5	28.6	7.9	13.0	4.4	41.3
Green Ext Time (p_c), s	0.0	1.2	0.0	4.0	0.1	1.0	0.0	4.2

Intersection Summary	
HCM 6th Ctrl Delay	32.8
HCM 6th LOS	C

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	47	184	88	115	75	360	55	325	65
v/c Ratio	0.17	0.70	0.37	0.35	0.11	0.18	0.08	0.30	0.07
Control Delay	33.0	57.4	36.3	37.6	8.8	12.5	6.3	9.8	0.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0
Total Delay	33.0	57.4	36.3	37.6	8.8	12.5	6.3	10.5	0.3
Queue Length 50th (ft)	28	122	53	67	19	62	9	72	0
Queue Length 95th (ft)	54	189	91	119	44	106	25	128	0
Internal Link Dist (ft)		500		294		318		200	
Turn Bay Length (ft)	130		130		90		50		
Base Capacity (vph)	285	464	260	524	681	2052	678	1093	967
Starvation Cap Reductn	0	0	0	0	0	0	0	450	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	0.16	0.40	0.34	0.22	0.11	0.18	0.08	0.51	0.07

Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	45	112	63	84	77	32	71	293	49	52	309	62
Future Volume (veh/h)	45	112	63	84	77	32	71	293	49	52	309	62
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	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	47	118	66	88	81	34	75	308	52	55	325	65
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	235	143	80	190	188	79	676	1926	321	725	1176	997
Arrive On Green	0.03	0.13	0.13	0.06	0.15	0.15	0.04	0.63	0.63	0.04	0.63	0.63
Sat Flow, veh/h	1781	1127	630	1781	1251	525	1781	3047	509	1781	1870	1585
Grp Volume(v), veh/h	47	0	184	88	0	115	75	178	182	55	325	65
Grp Sat Flow(s),veh/h/ln	1781	0	1757	1781	0	1776	1781	1777	1779	1781	1870	1585
Q Serve(g_s), s	2.7	0.0	12.3	5.1	0.0	7.1	1.8	4.9	5.0	1.3	9.4	1.9
Cycle Q Clear(g_c), s	2.7	0.0	12.3	5.1	0.0	7.1	1.8	4.9	5.0	1.3	9.4	1.9
Prop In Lane	1.00		0.36	1.00		0.30	1.00		0.29	1.00		1.00
Lane Grp Cap(c), veh/h	235	0	222	190	0	266	676	1123	1124	725	1176	997
V/C Ratio(X)	0.20	0.00	0.83	0.46	0.00	0.43	0.11	0.16	0.16	0.08	0.28	0.07
Avail Cap(c_a), veh/h	288	0	447	260	0	511	748	1123	1124	774	1176	997
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	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95
Uniform Delay (d), s/veh	43.6	0.0	51.1	42.6	0.0	46.4	7.3	9.0	9.0	7.1	10.0	8.6
Incr Delay (d2), s/veh	0.4	0.0	7.6	1.8	0.0	1.1	0.1	0.3	0.3	0.0	0.6	0.1
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	1.2	0.0	5.9	2.4	0.0	3.2	0.7	1.9	2.0	0.5	3.9	0.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	44.0	0.0	58.8	44.3	0.0	47.5	7.4	9.3	9.4	7.1	10.6	8.7
LnGrp LOS	D	A	E	D	A	D	A	A	A	A	B	A
Approach Vol, veh/h		231			203			435			445	
Approach Delay, s/veh		55.8			46.1			9.0			9.9	
Approach LOS		E			D			A			A	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.7	80.4	11.3	19.7	9.1	80.0	8.5	22.5
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	7.5	52.5	11.5	30.5	9.5	50.5	7.5	34.5
Max Q Clear Time (g_c+I1), s	3.3	7.0	7.1	14.3	3.8	11.4	4.7	9.1
Green Ext Time (p_c), s	0.0	2.3	0.1	0.9	0.1	2.3	0.0	0.6

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

Intersection	
Int Delay, s/veh	3.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	33	129	20	9	103	10	10	1	6	14	1	59
Future Vol, veh/h	33	129	20	9	103	10	10	1	6	14	1	59
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
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	80	80	80	80	80	80	80	80	80	80	80	80
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	41	161	25	11	129	13	13	1	8	18	1	74

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	142	0	0	186	0	0	451	420	174	418	426	136
Stage 1	-	-	-	-	-	-	256	256	-	158	158	-
Stage 2	-	-	-	-	-	-	195	164	-	260	268	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1441	-	-	1388	-	-	519	525	869	545	520	913
Stage 1	-	-	-	-	-	-	749	696	-	844	767	-
Stage 2	-	-	-	-	-	-	807	762	-	745	687	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1441	-	-	1388	-	-	463	506	869	524	501	913
Mov Cap-2 Maneuver	-	-	-	-	-	-	463	506	-	524	501	-
Stage 1	-	-	-	-	-	-	728	677	-	820	761	-
Stage 2	-	-	-	-	-	-	735	756	-	716	668	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	1.4	0.6	11.7	10.1
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	558	1441	-	-	1388	-	-	793
HCM Lane V/C Ratio	0.038	0.029	-	-	0.008	-	-	0.117
HCM Control Delay (s)	11.7	7.6	-	-	7.6	-	-	10.1
HCM Lane LOS	B	A	-	-	A	-	-	B
HCM 95th %tile Q(veh)	0.1	0.1	-	-	0	-	-	0.4

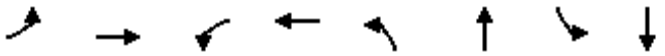
Intersection	
Int Delay, s/veh	1.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	15	143	11	13	97	23	8	0	7	16	0	12
Future Vol, veh/h	15	143	11	13	97	23	8	0	7	16	0	12
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
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	91	91	91	91	91	91	91	91	91	91	91	91
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	16	157	12	14	107	25	9	0	8	18	0	13

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	132	0	0	169	0	0	349	355	163	347	349	120
Stage 1	-	-	-	-	-	-	195	195	-	148	148	-
Stage 2	-	-	-	-	-	-	154	160	-	199	201	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1453	-	-	1409	-	-	606	571	882	607	575	931
Stage 1	-	-	-	-	-	-	807	739	-	855	775	-
Stage 2	-	-	-	-	-	-	848	766	-	803	735	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1453	-	-	1409	-	-	588	559	882	592	563	931
Mov Cap-2 Maneuver	-	-	-	-	-	-	588	559	-	592	563	-
Stage 1	-	-	-	-	-	-	798	731	-	846	767	-
Stage 2	-	-	-	-	-	-	828	758	-	787	727	-

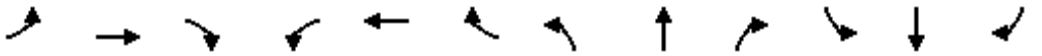
Approach	EB	WB	NB	SB
HCM Control Delay, s	0.7	0.7	10.3	10.4
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	696	1453	-	-	1409	-	-	701
HCM Lane V/C Ratio	0.024	0.011	-	-	0.01	-	-	0.044
HCM Control Delay (s)	10.3	7.5	-	-	7.6	-	-	10.4
HCM Lane LOS	B	A	-	-	A	-	-	B
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	0.1



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	63	90	41	12	54	109	7	152
v/c Ratio	0.44	0.10	0.41	0.01	0.06	0.08	0.01	0.13
Control Delay	56.4	0.2	63.9	0.0	5.8	4.8	10.5	8.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	56.4	0.2	63.9	0.0	5.8	4.8	10.5	8.9
Queue Length 50th (ft)	49	0	31	0	10	17	2	39
Queue Length 95th (ft)	91	0	67	0	27	43	9	82
Internal Link Dist (ft)		534		206		320		274
Turn Bay Length (ft)	115				115			
Base Capacity (vph)	390	980	276	990	932	1341	858	1207
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.16	0.09	0.15	0.01	0.06	0.08	0.01	0.13

Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	61	0	87	38	0	11	52	79	26	6	110	38
Future Volume (veh/h)	61	0	87	38	0	11	52	79	26	6	110	38
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	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	63	0	90	41	0	12	54	81	28	7	113	39
Peak Hour Factor	0.97	0.92	0.97	0.92	0.92	0.92	0.97	0.97	0.92	0.92	0.97	0.97
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	137	0	122	62	0	55	957	1031	356	964	935	323
Arrive On Green	0.08	0.00	0.08	0.03	0.00	0.03	0.03	0.78	0.78	0.70	0.70	0.70
Sat Flow, veh/h	1781	0	1585	1781	0	1585	1781	1328	459	1284	1329	459
Grp Volume(v), veh/h	63	0	90	41	0	12	54	0	109	7	0	152
Grp Sat Flow(s),veh/h/ln	1781	0	1585	1781	0	1585	1781	0	1788	1284	0	1788
Q Serve(g_s), s	4.1	0.0	6.7	2.7	0.0	0.9	0.9	0.0	1.7	0.2	0.0	3.3
Cycle Q Clear(g_c), s	4.1	0.0	6.7	2.7	0.0	0.9	0.9	0.0	1.7	0.2	0.0	3.3
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.26	1.00		0.26
Lane Grp Cap(c), veh/h	137	0	122	62	0	55	957	0	1387	964	0	1258
V/C Ratio(X)	0.46	0.00	0.74	0.67	0.00	0.22	0.06	0.00	0.08	0.01	0.00	0.12
Avail Cap(c_a), veh/h	393	0	350	379	0	337	1081	0	1387	964	0	1258
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	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	53.0	0.0	54.2	57.2	0.0	56.4	3.8	0.0	3.2	5.3	0.0	5.8
Incr Delay (d2), s/veh	2.4	0.0	8.4	11.7	0.0	2.0	0.0	0.0	0.1	0.0	0.0	0.2
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	1.9	0.0	3.0	1.4	0.0	0.4	0.3	0.0	0.6	0.1	0.0	1.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	55.4	0.0	62.6	68.9	0.0	58.3	3.9	0.0	3.3	5.3	0.0	5.9
LnGrp LOS	E	A	E	E	A	E	A	A	A	A	A	A
Approach Vol, veh/h		153			53			163			159	
Approach Delay, s/veh		59.7			66.5			3.5			5.9	
Approach LOS		E			E			A			A	
Timer - Assigned Phs		2		4	5	6		8				
Phs Duration (G+Y+Rc), s		97.6		13.7	8.7	89.0		8.6				
Change Period (Y+Rc), s		4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s		54.5		26.5	12.5	37.5		25.5				
Max Q Clear Time (g_c+I1), s		3.7		8.7	2.9	5.3		4.7				
Green Ext Time (p_c), s		0.7		0.6	0.1	0.9		0.1				
Intersection Summary												
HCM 6th Ctrl Delay			26.8									
HCM 6th LOS			C									

9801 Renner Boulevard,
Suite 300
Lenexa, KS 66219

MEMORANDUM

To: Kaitlyn Service, Brian Scott, MPPA, CPM, City of Mission
From: Amy Dietz, P.E. - GBA
Date: 8/13/2020
Subject: Review #2 of Stormwater Report: Sunflower Group Apartments
East of Martway Street and Nall Avenue, former Mission Bowl site

GBA performed a review of the Stormwater Report as prepared for the Sunflower Apartment Building. The property is situated on the former site of the Mission Bowl and Mini Golf, 5399 Martway Street. The following comments were noted during the review.

BMP Comments

- The report proposed ADS's Barracuda S6 in-line treatment unit was selected, but no design information was given.
    - Lee Ryherd clarified over the phone that a 0.5 inch rainfall produces a 1.76 cfs discharge from the parking lot. According to ADS's technical specifications, an S6 can treat up to approximately 2.5 cfs of peak flow. Therefore, per the manufacturer, the 'first flush' of stormwater can be treated for floatables, total suspended solids, and oil, using this size unit.

Conclusions

If further clarification of these comments are needed, Amy Dietz can be contacted at (913) 577-8371.

cc: Dave Mennenga, GBA

STORMWATER REPORT

Site Improvements
Mission Bowl Apartments
5399 Martway Street
Mission, Johnson County, Kansas

Prepared By:

Uhl Engineering, Inc.
4121 West 83rd Street, Suite 156
Prairie Village, Kansas 66208

Prepared For:

Mission Bowl Apartments, LLC.
1125 Grand Blvd #202
Kansas City, Mo 64106
Attn: Jason Swords

July 9th, 2020
Revised August 7th, 2020

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July, 9th 2020
Revised August 7th, 2020

Celia Duran
City Engineer
4775 Lamar Avenue
Mission KS 66202

Stormwater Report - Site Improvements
Mission Bowl Apartments
Mission, Kansas

Dear Celia:

This report is a summary of existing and proposed stormwater conditions based on planned improvements at the Mission Bowl site located at 5399 Martway Street.

A. SUMMARY

The proposed site is the former location of the Mission Bowl and Mini Golf. The existing building and site has been vacant since a fire in April of 2015 heavily damaged the structure.

Mission Bowl Apartments, LLC is proposing to demolish the existing building and construct a multi-story residential / apartment building with associated parking, utility service connections, landscaping and site recreational improvements.

The City of Mission has stipulated that stormwater detention for any added stormwater runoff and stormwater treatment is required.

B. BACKGROUND

The site runoff currently flows away from the existing building - uncontrolled. The northern sub drainage basin flow to a stormwater system in the Martway Street right-of-way. Two catch basins along the north curb line of the private asphalt parking lot capture flow and route to the Martway stormwater. A small area of the site flows out of the driveway entrance to a curb inlet.

The western drainage basin flows to a grate inlet located on the west side of the existing asphalt parking lot, discharging directly to Rock Creek.

The eastern drainage sub basin flows uncontrolled to Rock Creek.

C. IDENTIFICATION OF DOWNSTREAM DRAINAGE ISSUES

Downstream channel improvements are currently under construction (by others). These improvements will add a concrete block wall, reduce downstream erosion in Rock Creek, and improve the 100-year floodplain relative to the proposed channel (ATTACHMENT B). The Public Works Director has informed us neither Bid Alternative 1 nor Bid Alternative 2 were accepted by the City for the 2020 Rock Creek Channel Improvements.

D. CORPS OF ENGINEERS REQUIREMENTS

No permitting through the Army Corps of Engineers is required for this project.

E. FEMA/DWR REQUIREMENTS

The current FEMA Flood Insurance Map (FIRM) is based on a Letter of Map Revision (LOMR) done in 2008 in connection with the Martway Street stormwater improvements. This map shows that a northern portion of the property is protected from the 100-year floodplain by a wall in the Rock Creek Channel (ATTACHMENTS C & D). The height of the wall is such that the water surface associated with the 100-year storm event will not reach the site.

The proposed improvements to the Rock Creek Channel indicated that the 100-year flood plain will be altered and contained in the proposed channel (ATTACHMENT B). This would limit the floodplain and floodway to the existing drainage easement along the exterior of the site.

F. STREAM CORRIDORS

No City ordinances for natural streams and preservation of stream corridors were indicated for this project.

G. PROPOSED ON-SITE DRAINAGE SYSTEM

Existing:

The existing site currently flows uncontrolled to the North, East and West away from the existing building. The north half of the site flow to a public system located in the Martway Street right-of-way.

The western part of the site sheet flows to an existing catch basin located behind a channel wall along Rock Creek. The Eastern part of the site sheet flows uncontrolled directly to Rock Creek. This sub drainage basin includes a 16,600 SF mini golf course with surfaces of compacted rock and artificial turf (ATTACHMENT A, existing drainage conditions exhibit).

The site contains Sharpsburg-Urban soil, in the hydraulic C soil group (USDA soil report, ATTACHMENT E).

Rock Creek channel upgrades and improvements are currently under construction and are scheduled to be finished during the summer of 2020 (ATTACHMENT B).

An existing 24” corrugated metal pipe, located along the eastern property line, is due to be abandoned as part of the 2020 Rock Creek Channel Improvements.

Proposed On-site:

The proposed site development will include a five-story residential building (40,000 SF per floor) with associated parking facilities. The proposed site improvements also include the addition of recreational features such as a dog / pocket park along the Martway Street. The existing and proposed surface areas are shown in Table 1:

Table 1: Summary of Surface Area Types[1]

	Impervious Surface	Building	Open Space	Total
Existing	2.99	0.48	0.13	3.60
Proposed	2.08	0.92	0.60	3.60
Change	-0.91	+0.44	+0.47	

[1] All areas in acres

The proposed site improvements would decrease the amount of impervious area on the site. Landscaping and added recreational features are example of the types of improvements that would lower the site impervious area.

The two existing catch basins along the north curb line will be modified and utilized to capture flow from the northern portion of the property and maintain the flow to the Martway storm sewer.

A private stormwater system is part of the proposed site improvements. Downspouts from the proposed apartment building and inlets in the parking area will be routed to the private stormwater system, discharging to Rock Creek at the southeast part of the site.

Off-site:

Site improvements will include the installation of a concrete big block wall along the southeast limits of the project site located in the stormwater drainage easement. These improvements were designed with the Rock Creek Channel Improvements (Alternative Bid #2 Sheet 25 ATTACHMENT B). These improvements are contingent on final construction bid pricing for this (private) project.

No off-site storm drainage improvements are proposed in the Martway Street public right of way.

H. PROPOSED STORMWATER TREATMENT

Stormwater Treatment was calculated by using Worksheet 1A (MARC BMP Manual 2012). The proposed site improvements would decrease the amount of impervious surface area on site (ATTACHMENT F). A level of service on 1.9 is proposed for the site. This would meet the required calculated level of service for this development.

The City of Mission has requested that an element of stormwater treatment be included with the site improvements. Stormwater treatment improvements will capture pollutants & contaminates and improve stormwater quality.

An inline media filtration devise will be incorporated within the private stormwater drainage system. The system was sized to treat the parking area on the south of the property that will flow through a private storm system and discharge into Rock Creek.

An ADS Barracuda S6 has been selected to be used for stormwater treatment on this site. This devise was sized to treat the "first flush" treatment value. Additional runoff will bypass the treatment area and continue down the system (ATTACHMENT G). The system should be inspected for maintenance every 2-3 years, see ATTACHMENT G for details.

I. FLOOD CONTROL DETENTION

- Under the existing conditions, the composite curve number (CN) value is 96.7*, and the entire site flows uncontrolled.
- The overall site impervious area will decrease. Proposed pervious surface areas include the addition of a dog park, pocket park and site landscaping.
- Under the proposed conditions, the composite curve number (CN) value decreases to 93.9* due to the added recreational site improvements and decreased pavement on site.

** weighted 'CN' calculations found in ATTACHMENT H*

By lowering the overall impervious area on site, and lowering the overall site peak runoff (Table 2 and ATTACHMENT H), the Developer requests that stormwater detention be waived. TR-55 (Hydraflow Hydrographs 2018) was used to determine the flow rates for the existing and proposed conditions.

Table 2: Summary of Flows from the Site

Existing (Site)	**Site "CN" Value**	**Peak Flow (cfs)**	**Runoff Volume (cuft)**	**Change**
Q_2	96.7	10.19 cfs	22,485 cuft	n/a
Q_{10}	96.7	20.50 cfs	47,328 cuft	n/a
Q_{100}	96.7	38.86 cfs	92,509 cuft	n/a
Proposed (Site)	**Site "CN" Value**	**Peak Flow (cfs)**	**Runoff Volume (cuft)**	**Change**
Q_2	93.9	9.13 cfs	19,850 cuft	-11.72 %
Q_{10}	93.9	19.46 cfs	43,874 cuft	-7.29 %
Q_{100}	93.9	38.02 cfs	88,478 cuft	-4.36 %

J. Conclusions

- The proposed improvements will reduce the impervious area on site, and consequently the peak runoff from the site will be reduced.
- Stormwater BMP/treatment will be incorporated into the proposed site improvements. A level of service of 1.88 is proposed for the site, this is higher than the calculated required level of service of 0.
- No additional stormwater improvements are necessary as a result of the development.

K. Recommendations

- Installation of private storm systems to route stormwater thought site.
- Installation of stormwater treatment BMP devise to improve site stormwater quality.
- Stormwater detention be waived.

If you have any questions or comments regarding the contents of this report, please contact me directly at 913-385-2670.

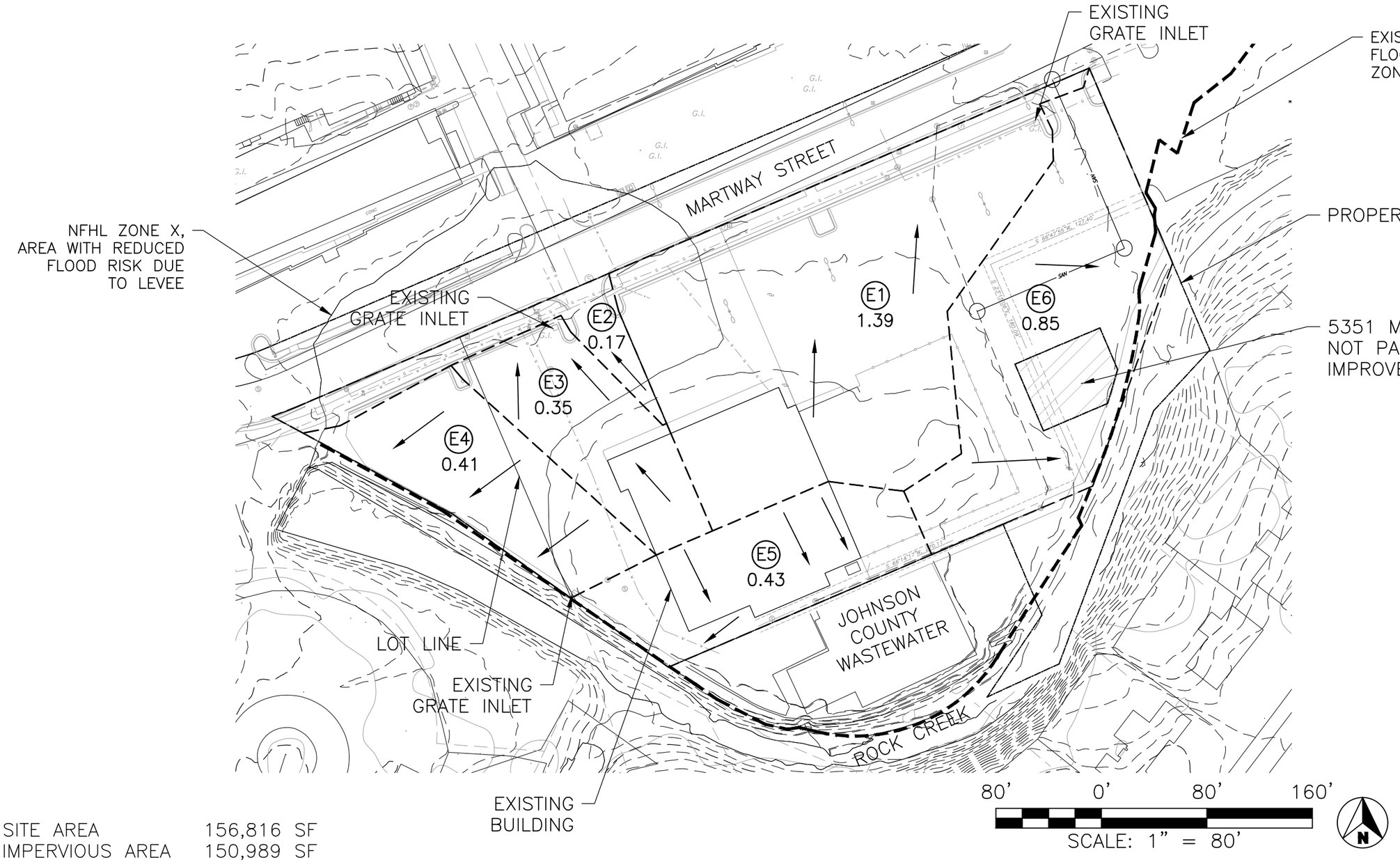
Sincerely,

Lee J. Ryherd P.E.
UHL ENGINEERING, INC.

Enclosures:
ATTACHMENT A: Existing and Proposed Site Plan
ATTACHMENT B: 2020 Rock Creek Channel Improvement Plans (GBA)
ATTACHMENT C: FEMA FIRM Panel
ATTACHMENT D: FEMA LOMR, February 2012
ATTACHMENT E: USDS Soil Map
ATTACHMENT F: Level of Service Calculations
ATTACHMENT G: Stormwater Treatment Details
ATTACHMENT H: Site Hydrographs

ATTACHMENT A

Existing and Proposed Site Plan



SITE AREA	156,816 SF
IMPERVIOUS AREA	150,989 SF
E1	1.39 ACRES
E2	0.17 ACRES
E3	0.35 ACRES
E4	0.41 ACRES
E5	0.43 ACRES
E6	0.85 ACRES
TOTAL	3.60 ACRES

MISSION BOWL APARTMENTS EXISTING DRAINAGE CONDITIONS

PROFESSIONAL SEAL:

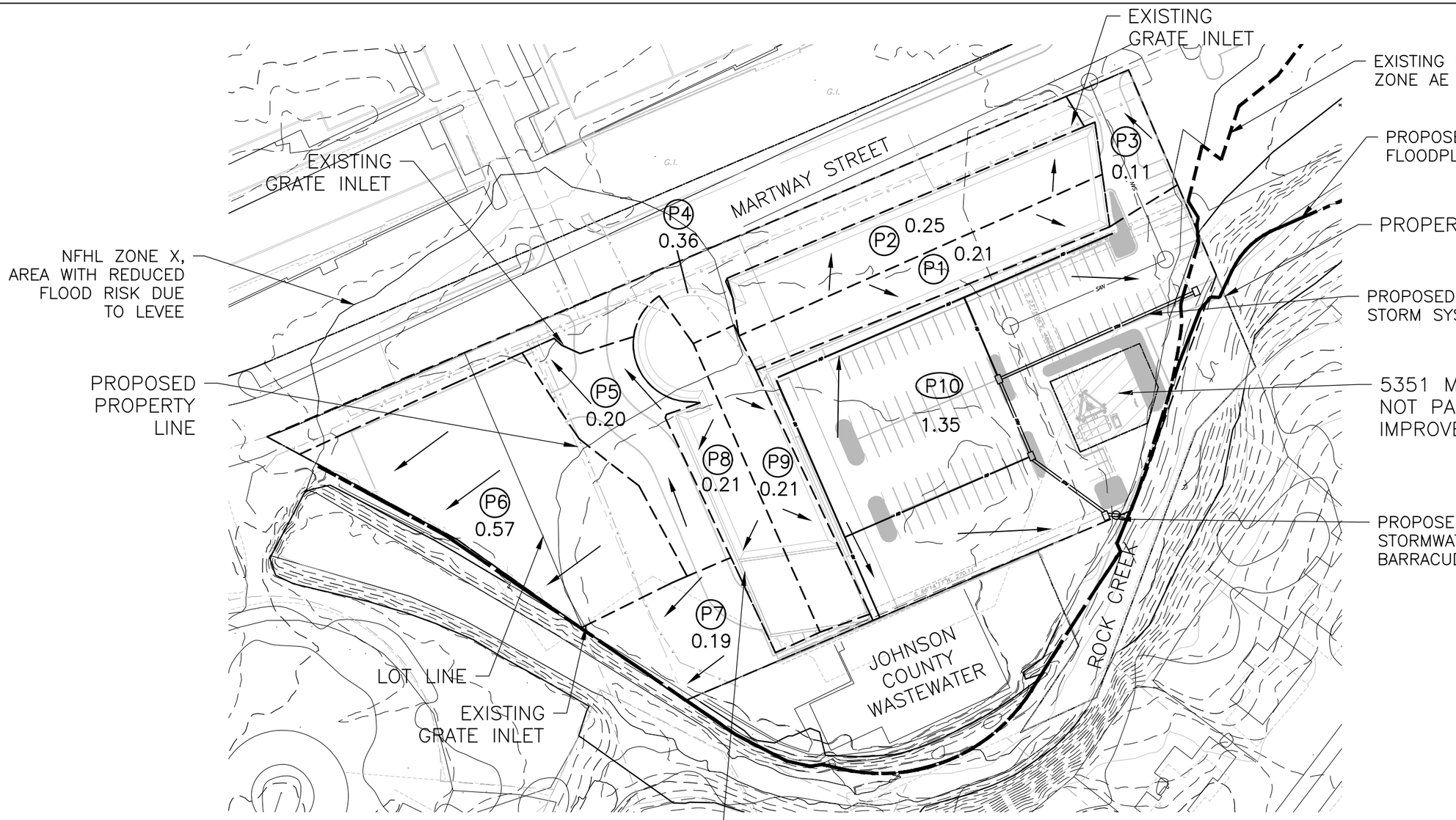
COMPANY:
UHL ENGINEERING, INC.
4121 W. 83rd Street, Suite 156
Prairie Village, Kansas
(913) 385-2670
www.uhlengineering.com

PROJECT:
MISSION BOWL APARTMENTS
5399 Martway Street
Mission, Kansas

OWNER:

DATE	REVISION/DESCRIPTION

ISSUE DATE: 07 AUG 2020
DESIGNED BY: LJR
DRAWN BY: LJR
CHECKED BY: TSU
SHEET NAME:
EXISTING DRAINAGE
SHEET NUMBER:



SITE AREA	156,816 SF
IMPERVIOUS AREA	131,356 SF
P1	0.21 ACRES
P2	0.25 ACRES
P3	0.11 ACRES
P4	0.36 ACRES
P5	0.20 ACRES
P6	0.57 ACRES
P7	0.19 ACRES
P8	0.21 ACRES
P9	0.21 ACRES
P10	1.35 ACRES
TOTAL	3.60 ACRES

MISSION BOWL APARTMENTS
PROPOSED DRAINAGE CONDITIONS

PROFESSIONAL SEAL:

COMPANY:
UHL ENGINEERING, INC.
4121 W. 83rd Street, Suite 156
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SHEET NUMBER:

ATTACHMENT B

2020 Rock Creek Channel Improvements Plans

City of Mission, Kansas

Rock Creek Channel Improvements

with Roeland Court Townhomes Site Improvements

INDEX OF SHEETS

GENERAL NOTES

All construction shall conform to the Kansas City Metropolitan Chapter of the American Public Works Association (APWA) Standard Specifications, latest addition. Applicable specifications to this project are included in the project manual. The Standard Specifications shall be considered a binding reference to all work and thus incorporated into the project specifications by reference hereof.

Prior to mobilization the contractor shall provide door hangers notifying adjacent landowners of the proposed work including on-site contact person's name and phone number.

The Contractor shall erect and maintain throughout construction, orange colored temporary construction fence around the construction limit perimeter (2,500 linear feet are estimated). The fence material shall be 48" in height and made of high density polyethylene plastic with a nominal mesh opening size of 1.25 inches square. Prior to temporary construction fence installation, the contractor shall stake the fence locations in the field for review by the City. The temporary fence location should be moved or modified to accommodate the placement of erosion control devices (wattles and mulch berms) such that concentrated water on the slopes is minimized and to prevent accumulation of sediments on the plastic temporary construction fencing. Construction equipment, materials or personal vehicles may not be parked or stored outside of the construction limits delineated by the temporary construction fence.

All manholes, catch basins, utility valves and meter pits within grading limits shall be adjusted or rebuilt to grade as required. No separate payment will be made for adjustments not noted in the plan notation and callouts.

Driveways, sidewalk, and other areas inside and outside the construction limits damaged by the contractor shall be restored to a condition equal to or better than that existed before damage occurred at the Contractors expense.

The Contractor shall provide at least one (1) chemically-treated, portable toilet unit, "Satellite" as manufactured by the Satellite Corporation, or equal, for every 20 workmen on the job site. (In no case shall less than one (1) be provided). The unit(s) shall remain on the site during all active phases of construction. The Contractor shall enforce the use of the facilities by all personnel at the site. The unit shall be obscured from public view to the greatest extent practicable.

Several residents where fences are to be removed have dogs. Temporary construction fencing shall be placed in a way that contains the dogs for those specific landowners. The Contractor shall inspect the temporary construction fencing in the presence of each property owner after initial placement. The Contractor shall be responsible for maintenance of the temporary construction fencing as required to contain the property owner's dog.

Blasting shall not be allowed to complete any of the work detailed in these drawings.

PERMITS

The Contractor shall be responsible for obtaining all required construction permits (other than those provided by the City of Mission), paying all fees and for otherwise complying with all applicable regulations governing the work.

The Contractor shall prepare and submit a traffic control plan to the Engineer and local municipalities as required. The contractor shall be responsible for providing and maintaining all traffic handling measures necessary for safe ingress and egress of construction equipment on to the public roadways in the construction access locations indicated on the plans. All temporary traffic control in conjunction with construction will be in conformance with the Manual of Unified Traffic Control Devices, latest edition.

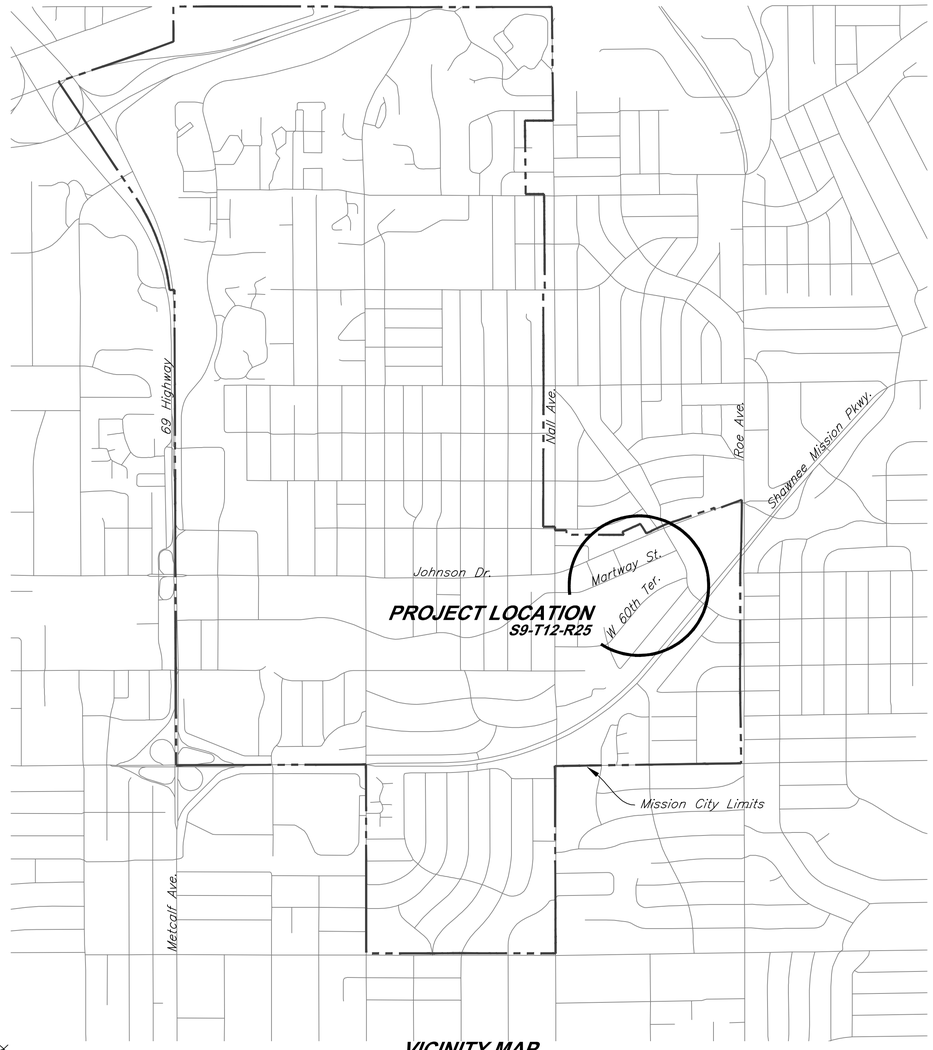
The Contractor shall comply with the conditions of the Nationwide Permits granted to the City by the Corps of Engineers under Section 404 of the Clean Water Act (33 USC 1344). A copy of the permit is provided in the project manual.

The majority of the project site is located within the Federally defined floodplain and floodway. Excess project materials, if any, must be disposed of outside said limits. Graded elevations exceeding those shown on the plans (±0.3') may result in a violation of the project "no rise" certification and Kansas Department of Agriculture Division of Water Resources permits.

Backfill material within the Federally defined floodway shall be compacted to obtain 90% of maximum density as determined by ASTM D698.

The Contractor shall halt construction immediately and contact the Kansas State Historical Society should artifacts of questionable historical relevance be discovered during excavation.

The Stormwater Pollution Prevention Plan (SWPPP) for the project is provided in the project manual. The Contractor shall comply with the conditions of the NOI and SWPPP as required by the NPDES permit. A copy of Stormwater Pollution Prevention Plan is required to be on site at all times during construction. The Contractor is responsible for constructing and maintaining erosion control measures in accordance with SWPPP to the satisfaction of the City of Mission.



VICINITY MAP

Scale: 1" = 1,000'

LEGEND

PROPOSED RETAINING WALL	PROJECT BASELINE
PROPOSED PERMANENT EASEMENT	EXISTING EASEMENT
PROPOSED FENCE	EXISTING FENCE
PROPOSED CONTOUR (910)	EXISTING CONTOUR 910
PROPOSED STORM SEWER	SAVE TREE
PROPOSED CONSTRUCTION LIMITS	REMOVE TREE
PROPOSED SPOT GRADE 899	PROPERTY PIN
CROSS SECTION	WATER VALVE
EXISTING GAS LINE G	FIRE HYDRANT
EXISTING WATER LINE W	GAS METER
EXISTING SANITARY SEWER SAN	TELEPHONE PEDESTAL
EXISTING STORM SEWER SWS	POWER POLE with GUY WIRE
EXISTING UNDERGROUND ELECTRIC UGE	LIGHT POLE
EXISTING OVERHEAD ELECTRIC OHE	SIGN
EXISTING UNDERGROUND TV UGTV	YARD LIGHT
EXISTING OVERHEAD TV OHTV	STREET LIGHT
EXISTING UNDERGROUND TELEPHONE UGT	GUY ANCHOR
EXISTING PROPERTY LINE	BUSH
	PROJECT BENCHMARK
	EXISTING SPOT GRADE +911.25
	EXISTING RIFFLE
	EXISTING RIPRAP
	EXISTING SHALE
	EXISTING GRAVEL BAR
	EXISTING POOL

**Typical all sheets – dark linetypes indicate proposed features, whereas lighter linetypes indicate existing features.

PREPARED & SUBMITTED BY:
GEORGE BUTLER ASSOCIATES, INC.
9801 RENNER BOULEVARD
LENEXA, KANSAS 66219-9745

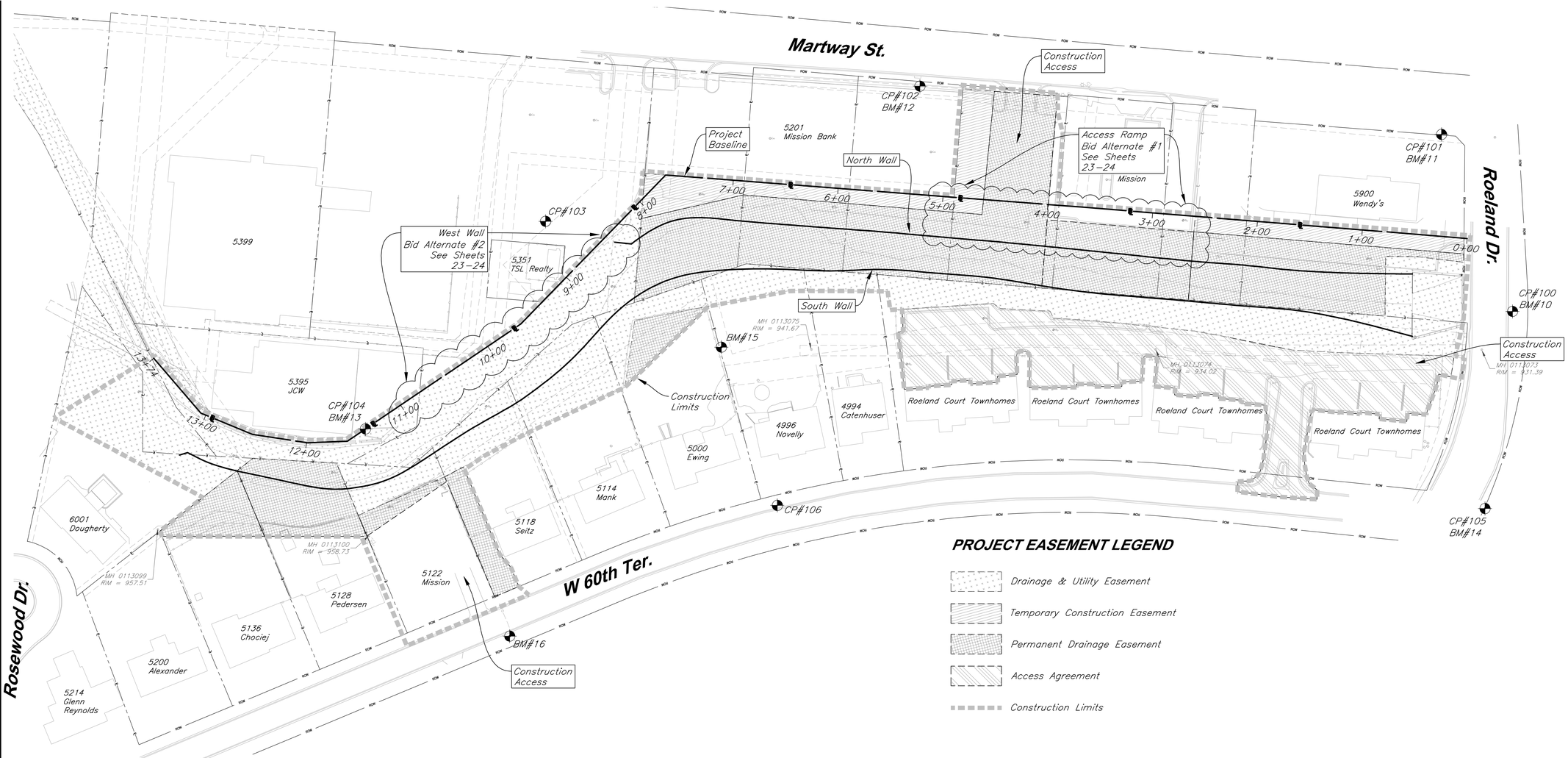
PAUL D. MILLER — 18606 — 2-17-2020 — KANSAS PROFESSIONAL ENGINEER

PROJECT ENGINEER: Paul D. Miller, P.E., C.F.M. **DATE:**

APPROVED BY:
CITY OF MISSION

DIRECTOR OF PUBLIC WORKS: Celia Duran, P.E. **DATE:**

GEORGE BUTLER ASSOCIATES, INC.
Engineers · Architects



PROJECT EASEMENT LEGEND

- Drainage & Utility Easement
- Temporary Construction Easement
- Permanent Drainage Easement
- Access Agreement
- Construction Limits

GENERAL LAYOUT AND SURVEY CONTROL NOTES

The Contractor shall carefully preserve all monuments, reference points, stakes, and bench marks set for project control, and in case of destruction of same through carelessness or negligence on the part of the Contractor, he will be charged with the resulting expense of replacement and responsibility for any mistakes or loss of time caused thereby.

The Contractor is responsible for the protection of all property corners and section corners. Any property corners or section corners disturbed or damaged by construction activities shall be reset by a registered land surveyor licensed in the State of Kansas, at the Contractor's expense.

Ongoing construction is occurring within the JCW Martway pump station facility which has one way access from west to east. Prior to accessing Rock Creek near the West Wall, the Rock Creek contractor shall coordinate construction access with JCW and / or its contractor working within the pump station facility.

PROJECT CONTROL POINTS

Coordinates shown hereon:

Modified State Plane (Project Ground Coordinates), NAD83
1501 – Kansas North, U.S. Feet
Vertical – NAVD88, U.S. Feet

CAF: 1.0000747
The coordinate values of all features have been scaled from a base point, known as CP #100

To get to State Plane Distances:
Scale drawing by the above referenced CAF (0.9999253); holding point #100 as the base point.

BM #15 – Set RR Spike in East face of Power Pole in back yard of #4996 W. 60th Terrace

N – 268347.97
E – 2265316.00
Z – 940.33

BM #16 – Set chiseled "+" on North bonnet bolt of fire hydrant on South side of W. 60th Terrace between #5109 & #5117

N – 268009.49
E – 2265279.06
Z – 958.82

CP #100 (Also BM #10) – Set chiseled "+" on NE corner of curb inlet on East side of Roeland Drive, just East of headwall spanning Rock Creek

N– 268753.62
E– 2265950.62
Z– 930.03

R1.) West 22.03' to centerline of Roeland Drive
R2.) SE 23.10' to centerline of "Bell Systems" manhole lid
R3.) NW 43.04' to centerline of "Bell Systems" manhole lid

CP #101 (Also BM #11) – Set chiseled "+" on sidewalk at SW corner of Roeland Drive and Martway Street

N– 268865.56
E– 2265808.07
Z– 926.94

R1.) WSW 15.60' to outside corner of retaining wall w/ railing
R2.) NNW 11.80' to South back of curb of Martway Street
R3.) SE 10.91' to near face of Wendy's sign

CP #102 (Also BM #12) – Set chiseled "+" on concrete stairs on South side of Martway Street directly South of #5201 Johnson Drive

N– 268567.29
E– 2265355.52
Z– 929.70

R1.) NNW 9.50' to South back of curb of Martway Street
R2.) ENE 48.97' to West face of street light
R3.) WSW 41.67' to centerline of Spectrum vault

CP #103 – Set cotton gin spindle in asphalt parking lot on South side of Martway just North of cell tower rock wall

N– 268368.03
E– 2265111.47
Z– 932.82

R1.) South 26.27' to NW corner of cell tower rock wall
R2.) ESE 29.79' to NE corner of cell tower rock wall
R3.) West 86.61' to corner of barbed wire fence

CP #104 (Also BM #13) – Found chiseled square cut on North edge of 12" wide headwall near SE corner of wastewater treatment plant on North side of Rock Creek

N– 268111.48
E– 2265061.76
Z– 936.37

R1.) SW 14.39' to SE corner of concrete wall for wastewater treatment plant
R2.) NNW 99.20' to wood plank fence
R3.) SW 16.62' to corner post of chain link fence

CP #105 (Also BM #14) – Set chiseled "+" on NE corner of curb inlet on East side of Roeland Drive in line with projected North back of curb of W. 60th Terrace

N– 268578.25
E– 2266021.65
Z– 943.63

R1.) SW 48.55' to centerline of "InRoad" water valve
R2.) West 46.50' to centerline of "InRoad" manhole lid
R3.) South 44.31' to centerline of manhole lid on East side of Roeland Drive in grass

CP #106 – Set ½" Iron Bar w/ GBA Control Point Cap in line with back of curb line at #4996 W. 60th Terrace

N– 268224.30
E– 2265437.35
Z– 956.40

R1.) South 1.30' to North back of curb on West 60th Terrace
R2.) NW 18.15' to South face of 24: oak tree
R3.) NE 33.25' to West edge of concrete drive at #4996 West 60th Terrace

50' 0' 50' 100'
SCALE : 1 INCH = 50 FEET

GBA
architects
engineers
9801 Renner Boulevard
Lenexa, Kansas 66219
913.492.0400
www.gbateam.com

Rock Creek Channel Improvements

City of Mission, Kansas

DOUGLAS M. MILLER
16506
2-17-2020
KANSAS
PROFESSIONAL ENGINEER

REVISION

Conceptual – 9/23/2019

Preliminary 50% – 10/10/2019

Preliminary 90% – 12/17/2019

Final – 2/6/2020

Bid Set – 2/17/2020

PROJECT NUMBER
14321.00

DATE
2/17/2020

DESIGNED
PDM, MLG, ACL

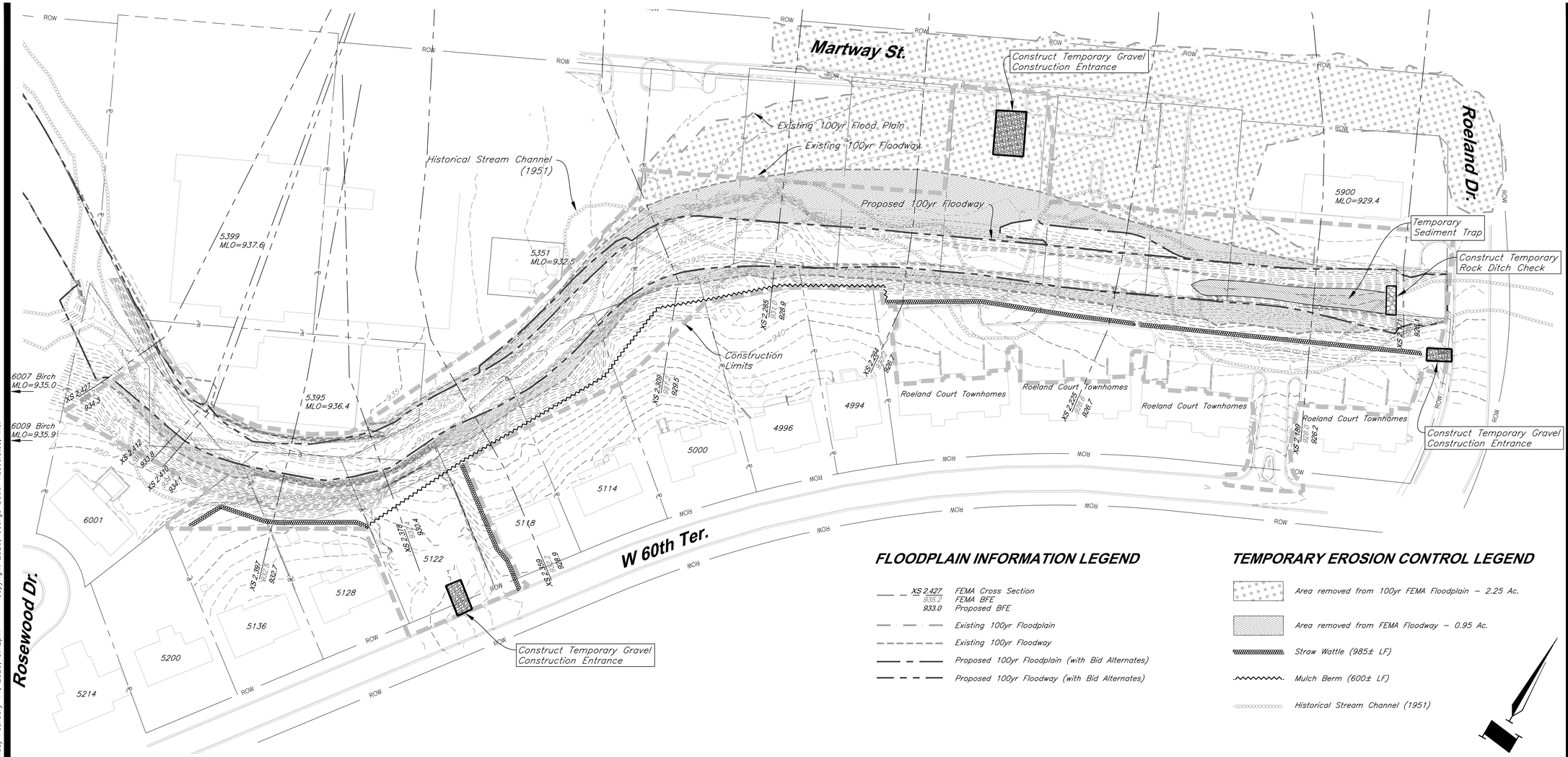
DRAWN
ACL

REVIEWED
PDM

SHEET TITLE

General Layout

SHEET NUMBER
02



FLOODPLAIN INFORMATION LEGEND

- XS 2.427 / 935.2 / 933.0 — FEMA Cross Section / FEMA BFE / Proposed BFE
- Existing 100yr Floodplain
- Existing 100yr Floodway
- Proposed 100yr Floodplain (with Bid Alternates)
- Proposed 100yr Floodway (with Bid Alternates)

TEMPORARY EROSION CONTROL LEGEND

- Area removed from 100yr FEMA Floodplain – 2.25 Ac.
- Area removed from FEMA Floodway – 0.95 Ac.
- Straw Wattle (985± LF)
- Mulch Berm (600± LF)
- Historical Stream Channel (1951)

50' 0' 50' 100'

SCALE : 1 INCH = 50 FEET

EROSION CONTROL NOTES

All disturbed areas in this project shall be restored per APWA Section 2400.

Contractor shall utilize Best Management Practices to control erosion and sediment migration into storm drainage structures or channels. Contractor shall evaluate drainage patterns and provide erosion control devices necessary. Contractor shall keep 150 LF of 8" wattle on site for temporary slope protection during construction. The wattle may be moved at the direction of the Engineer for temporary erosion control during construction. Remove when site is 70% revegetated.

Seeding and fertilizer shall precede installation of erosion control blankets. Blankets to be laid and stapled per manufacturer's specifications. Do not stretch blankets.

Contractor is responsible for constructing and maintaining erosion control measures in accordance with City specifications and to the satisfaction of the City.

Inspect controls within 24 hours of rainfall events ½" or greater, but not less than every 14 days, per KDHE.

Accumulated sediment shall be removed and the barrier maintained as needed to prevent sedimentation bypass of the barrier.

Temporary erosion control measures are to remain in place until sufficient ground cover has been established to prevent erosion.

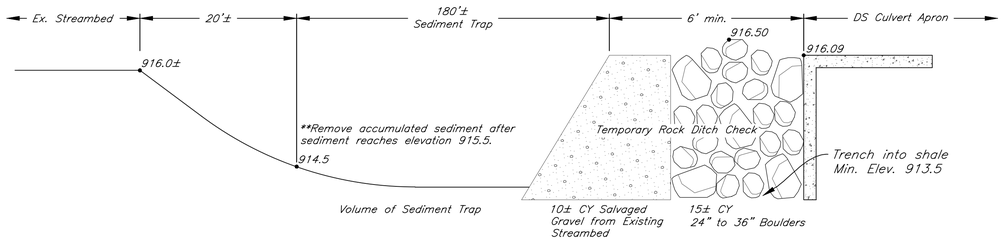
The contractor is responsible for mulching, seeding, and fertilizing. All backfill shall be tamped and 6" of organic top soil placed thereafter followed by seeding or sodding as required by the specifications.

Any sediment tracked out onto the public roadway shall be cleaned up at the end of each work day.

If voids become clogged with sediment, the construction entrance shall be top dressed with 2"–4" clean gravel.

SEQUENCE OF CONSTRUCTION ACTIVITIES

1. Sequence of Major Activities
   a) Install initial straw wattles and other temporary BMP controls as shown on construction documents.
   b) As field conditions change, the contractor is responsible for adjusting and relocating BMP's to prevent sediment from leaving the site.
   c) Begin clearing no more than 21 days before construction in that vicinity.
   d) Temporary mulching and seeding of disturbed areas, no longer than 7 days following construction of channel improvements in that vicinity, per KDHE.
   e) Complete grading and install permanent seeding in disturbed areas.
   f) Remove accumulated sediment from temporary siltation collection areas and straw wattles.
   g) After completion of all construction activities and sites is stabilized, remove straw wattles and rock check dams, and reseed disturbed areas.
   h) Notify City of Mission Public Works Department when site is stabilized, they will submit a "Notice of Termination," to KDHE for the project.
2. Timing of Controls/Measures: As detailed in the sequence of major activities, the construction of the initial temporary BMP's shall precede the start of any grading. Once construction activities have ceased permanently, the open areas will be permanently seeded or sodded. After the disturbed site is stabilized, the accumulated sediment will be removed from control features and mulched or seeded. Excess sediment shall be disposed of on–site in relatively non–erodible areas.



PROFILE OF TEMPORARY SEDIMENT TRAP / ROCK DITCH CHECK

Not to Scale

*See sheet 11 for temporary rock ditch check cross section.

GBA
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Rock Creek Channel Improvements

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PROJECT NUMBER
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DATE
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DESIGNED
PDM, MLG, ACL

DRAWN
ACL

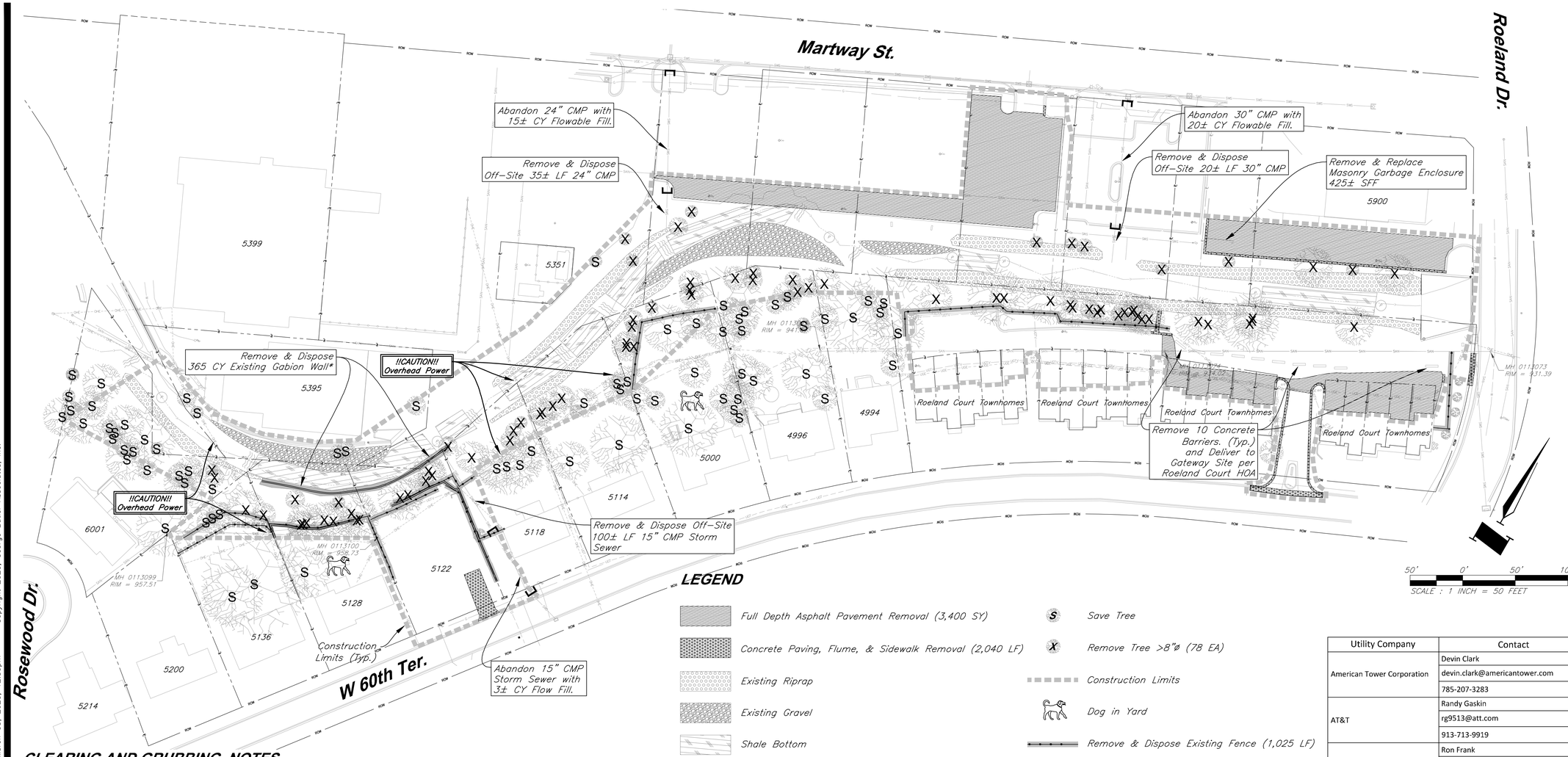
REVIEWED
PDM

SHEET TITLE

Erosion Control Plan

SHEET NUMBER

03



LEGEND

- Full Depth Asphalt Pavement Removal (3,400 SY)
- Concrete Paving, Flume, & Sidewalk Removal (2,040 LF)
- Existing Riprap
- Existing Gravel
- Shale Bottom
- Pool
- Riffle
- S — Save Tree
- X — Remove Tree >8"ø (78 EA)
- Construction Limits
- Dog in Yard
- Remove & Dispose Existing Fence (1,025 LF)
- Remove & Reset Existing Fence (115 LF)
- Remove & Dispose Existing Retaining Wall

CLEARING AND GRUBBING NOTES

The Contractor shall remove and dispose of all trees and rubbish in conflict with the proposed construction. Clearing and grubbing operation and disposal of all debris therefrom shall be performed by the Contractor in strict accordance with all local, state, and federal laws, codes, and ordinances. Open burning of debris shall not be permitted.

The estimated vegetative clearing and grubbing areas is 0.9 acre including 78 trees greater than 8" in diameter. (43 – 8" to 15", 30 – 15" – 24" and 5 > 24")

Contractor shall protect all existing trees and vegetation shown to remain. Trees shown to remain within the grading limits shall be preserved and protected from construction equipment.

Trees marked with an "X" shall be removed only as required for work within easements. Trees marked with "S" shall be fenced or barricaded off for protection during construction operations.

Trees in conflict with construction on the south side of the creek shall be ground into mulch chips and stockpiled on site. Mulch shall be shredded into small particles not greater than 3" long and 1" wide. Stock piled mulch shall be used for temporary erosion control mulch berms, protection of the native restoration plantings, and mixed into the top soil within Zone 2 areas prior to final slope grading to supplement organic content and enhance insect production.

Due to limited areas for storage, stripping and stockpiling of existing topsoil is not required. Areas to be restored with vegetation shall receive 6" imported topsoil. All backfills shall be tamped and organic top soil placed thereafter followed by seeding as required by the Plans and Specifications. All fills outside the primary low flow stream channel shall be topsoiled and graded to drain then seeded and mulched or blanketed with erosion control blanket as specified.

The Contractor shall salvage and re use in–situ riprap and gravel materials identified on the plans for construction of proposed erosion protection at retaining wall keyways and parallel to proposed drainage flumes. The Engineer estimates that approximately 400 cubic yards of salvaged materials are on site and that 50 cubic yards of materials are proposed for erosion protection. Salvage materials volumes exceeding that required for the proposed erosion protection shown on the plan should be utilized to reshape the primary creek channel as required or placed in fill areas deemed acceptable to the Geotechnical Engineer.

The Contractor shall, without extra compensation, furnish competent workers and the necessary tools to make all test holes and exploration required at any time for the purpose of determining the location of existing structures beneath the ground surface which might conflict or interfere with this work.

Unless otherwise noted on the drawings, any existing structures, fence, rubble, foundations, etc., within the construction limit shall be removed and disposed by the Contractor.

**At the Contractors option, gabion stone may be salvaged and used for temporary construction entrances and/or channel shaping as needed. Existing gravel and existing riprap may also be salvaged and used for channel shaping as needed. Stone materials used for channel shaping shall have a field observed uniformity coefficient exceeding 6.*

Kansas 811 — Know what's below. Call 811 before you dig.

Utility Conflict Information - The Contractor shall coordinate with the affected utility and provide payment to the utility owner as required.

ID #	Address	Owner	Engineer Comment
29110	NE Corner 5136 W 60th Terrace	AT&T	Pole within easement. Guy anchor 20' NW of pole is not in easement and conflicts with proposed grading. Evergy to perform bracing as required for grading around guy anchors. Evergy fee to be paid by Contractor.
29099	NE Corner 5128 W 60th Terrace	AT&T	Pole not within easement. Evergy to remove luminaire. Fee for removal is by land owner.
29055	NW Corner 5118 W 60th Terrace	Evergy	Pole not within easement. Evergy to perform bracing as required for adjacent storm sewer excavation and grading. Evergy fee to be paid by Contractor.
29066	NE Corner 5118 W 60th Terrace	AT&T	Pole within easement. Two guy anchors (20' NW and 20' NE), both within easement. The NW guy anchor is in conflict with proposed grading. (1.0' Cut). AT&T to perform temporary bracing and pole relocation as required for grading around NW guy anchor. Evergy fee to be paid by contractor, AT&T will not charge a fee.
29077	NE Corner 5114 W 60th Terrace	Evergy	Pole within easement. Guy anchor 20'NE of the pole is within the easement and conflicts with proposed grading (1.0' cut). Evergy to perform bracing as required for grading around guy anchor. Evergy fee to be paid by contractor.
N/A	Back of 5000, 5114, 5118, 5122, 5128 & 5316 60th Terrace	Consolidated	Mostly (90%) outside easement, ~ 450' of underground wire and four (4) pedestals to be abandon per Consolidated, UGTV on Plan. Consolidated will not charge a fee.
N/A	Back of Roeland Court Townhomes	Charter	Partially in easement. Aerial drop connected to tree to be abandon per Consolidated, OHTV on Plan. Charter will not charge a fee for abandonment/relocation.
N/A	SW Corner 5118 W 60th Terrace	KGS	Service line in conflict with storm sewer construction. Gas main in ROW may or may not be in conflict with storm sewer construction. Contractor shall contact KGS (Brant Rise - 913-599-8961) two days prior to excavation. The contractor shall backfill any excavated area within 12" of the KGS gas main with sand meeting ASTM C-33 - Fine Aggregate.
N/A	SW Corner 5118 W 60th Terrace	Google	Fiber line within ROW is not active as of November 2019. May or may not be in conflict with storm sewer construction.
MMPS	5395 Martway	JCW	Ongoing pump station upgrades may require access coordination when constructing West Wall (Bid Alternate #2)
WPL	5900 Martway	Wendy's	Two parking lot lights in conflict with construction shall be removed and reset by the Contractor. Costs to remove, store, set new foundations and restore electricity to the parking lot lights shall be included in the Contractors bid.

UTILITY NOTES

Known underground structures, telephone conduit, gas, water and sewer pipes, etc., close enough to be affected by the work, are shown on the plans, although others may exist. The locations shown are believed to be reasonably correct, but do not purport to be absolutely so. Before starting work, the Contractor shall notify all utilities involved, and shall request them for cooperation effort to avoid breaking utility lines. The utility shall be notified immediately should a break occur in a line during construction under this contract. Any lines so broken by the Contractor shall be repaired according to the utility company's standards at the expense of the Contractor.

Some existing private sanitary sewer facilities serving buildings are not shown. The Contractor shall be responsible for verifying the location of all active service connections. Only active service connections shall be reinstated. The Contractor shall be held responsible for any damages done to these facilities during construction, and shall maintain continuous service to all buildings.

The Contractor shall be held responsible for contacting all utility companies for field location of all underground utility lines, whether shown on these plans or not, prior to any excavation.

Utility Company	Contact
American Tower Corporation	Devin Clark
	devin.clark@americantower.com
	785-207-3283
AT&T	Randy Gaskin
	rg9513@att.com
	913-713-9919
Charter/Spectrum	Ron Frank
	ron.frank@charter.com
	816-215-8864
Consolidated	Brian Auldridge
	Brian.Auldridge@consolidated.com
	913-356-6580
Evergy	Terrell McKinney
	terrell.mckinney@evergy.com
	816-308-1325
Google Fiber	Lauren Marcucci
	lmarcucci@google.com
	913-663-1900
Johnson County Wastewater	Mike Piller (for Underground Facilities)
	mike.piller@jcw.org
	218-269-5437
	Charles Strauss (for Pump Station Access)
	Charles.strauss@jcw.org
	913-715-8758
Kansas Gas	Fred Hetherington
	Fred.Hetherington@onegas.com
	913-216-5051
Mission	Brent Morton (for Street Lights)
	bmorton@missionks.org
	913-676-8380
WaterOne	Daniel Sullivan
	dsullivan@waterone.org
	913-895-5617
Windstream	Hugh Carroll
	hugh.carroll@windstream.com
	314-614-8364

GBA architects engineers
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Rock Creek Channel Improvements

City of Mission, Kansas

PATRICK L. DOUGLASS — NUMBER 25975 — STATE OF KANSAS — PROFESSIONAL ENGINEER — 3-5-2020

REVISION

Conceptual – 9/23/2019

Preliminary 50% – 10/10/2019

Preliminary 90% – 12/17/2019

Final – 2/6/2020

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Addendum #2 – 3/5/2020

PROJECT NUMBER
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DATE
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DESIGNED
PDM, MLG, ACL

DRAWN
ACL

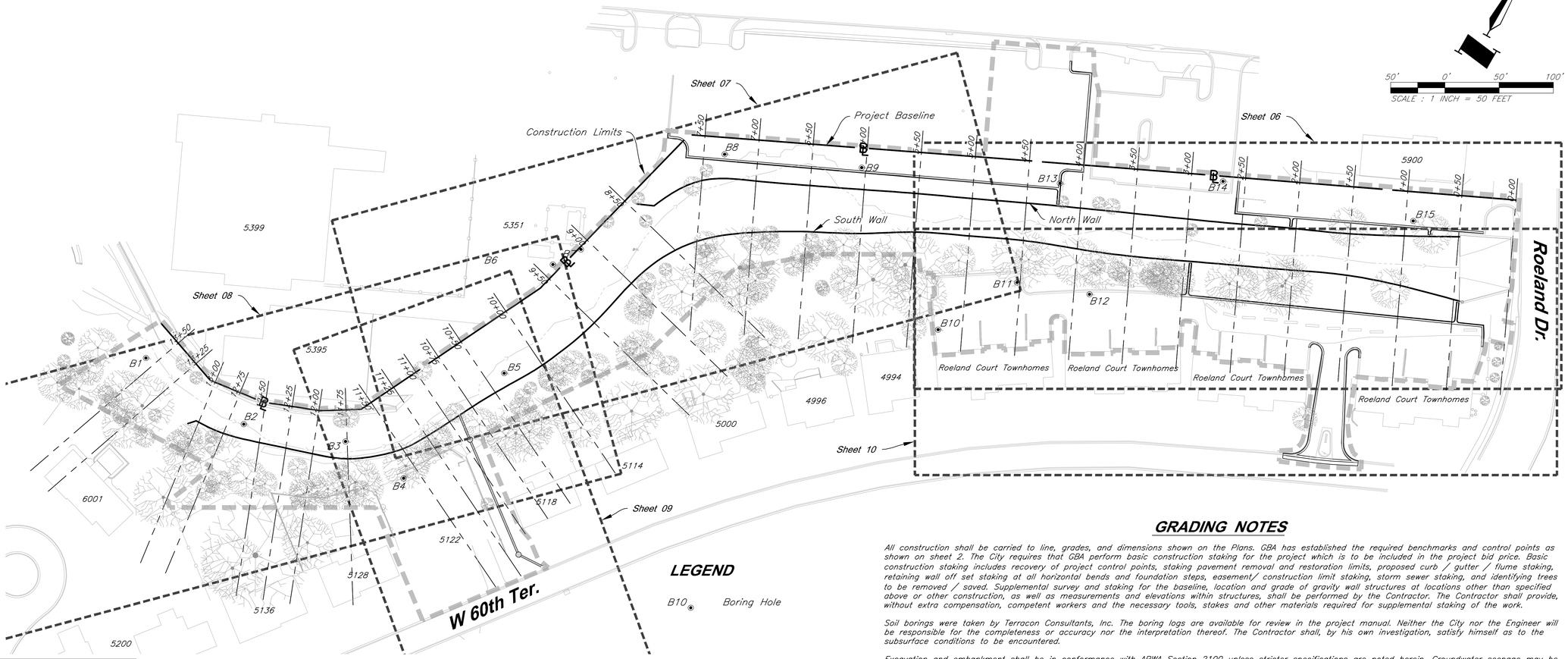
REVIEWED
PDM

SHEET TITLE

Demolition Plan

SHEET NUMBER

04R



LEGEND

B10 ⊙ Boring Hole

Project Baseline Station Table		
Station	Northing	Easting
0+00.00	268792.04	2265878.49
0+50.00	268770.63	2265833.30
1+00.00	268749.22	2265788.12
1+50.00	268727.81	2265742.94
2+00.00	268706.40	2265697.75
2+50.00	268684.99	2265652.57
3+00.00	268663.58	2265607.38
3+50.00	268642.18	2265562.20
3+64.38	268636.02	2265549.21
4+00.00	268620.63	2265517.08
4+50.00	268599.04	2265471.98
5+00.00	268577.44	2265426.89
5+50.00	268555.85	2265381.79
6+00.00	268534.25	2265336.69
6+50.00	268512.65	2265291.60
7+00.00	268491.06	2265246.50
7+50.00	268469.46	2265201.41
7+64.51	268463.19	2265188.32
8+00.00	268428.79	2265179.62
8+50.00	268380.32	2265167.37
9+00.00	268331.84	2265155.12
9+06.02	268326.00	2265153.64
9+50.00	268283.37	2265142.85
9+61.69	268272.04	2265139.98
10+00.00	268237.59	2265123.22
10+50.00	268192.63	2265101.34
11+00.00	268147.67	2265079.46
11+50.00	268102.71	2265057.58
11+61.22	268092.63	2265052.67
12+00.00	268072.18	2265019.73
12+50.00	268053.93	2264973.18
12+52.08	268053.17	2264971.24
13+00.00	268046.89	2264923.74
13+05.05	268046.23	2264918.73
13+50.00	268061.03	2264876.29
13+73.90	268068.90	2264853.72

GRADING NOTES

All construction shall be carried to line, grades, and dimensions shown on the Plans. GBA has established the required benchmarks and control points as shown on sheet 2. The City requires that GBA perform basic construction staking for the project which is to be included in the project bid price. Basic construction staking includes recovery of project control points, staking pavement removal and restoration limits, proposed curb / gutter / flume staking, retaining wall off set staking at all horizontal bends and foundation steps, easement/ construction limit staking, storm sewer staking, and identifying trees to be removed / saved. Supplemental survey and staking for the baseline, location and grade of gravity wall structures at locations other than specified above or other construction, as well as measurements and elevations within structures, shall be performed by the Contractor. The Contractor shall provide, without extra compensation, competent workers and the necessary tools, stakes and other materials required for supplemental staking of the work.

Soil borings were taken by Terracon Consultants, Inc. The boring logs are available for review in the project manual. Neither the City nor the Engineer will be responsible for the completeness or accuracy nor the interpretation thereof. The Contractor shall, by his own investigation, satisfy himself as to the subsurface conditions to be encountered.

Excavation and embankment shall be in conformance with APWA Section 2100 unless stricter specifications are noted herein. Groundwater seepage may be encountered at or immediately above the limestone/shale or soil/bedrock interface. If water seepage is encountered within excavation, use of temporary dewatering techniques may be necessary at no additional cost to the Owner.

Due to the nature of a changing stream environment, subsurface conditions encountered in construction may vary widely. No additional payment will be made for rock excavation. The Contractor is solely responsible for determining the amount of rock excavation, if any, to be included in his bid. Excavation work shall include the removal and subsequent handling of all materials excavated or otherwise removed in performance of the work, regardless of the type, character, composition, or condition thereof.

Estimated earthwork quantities were calculated using the average end area formula with cross sections and by profiles and details shown on the plans; an embankment inflation factor was not used to account for waste and compaction. Excavation volumes include retaining wall displacement, trench spoils for manholes, pipes, wall foundations, and channel shaping but exclude temporary excavation for trench safety benching, gabion rock or salvaged riprap / gravel. Fill volumes include slope grading above retaining walls, topsoil, and channel shaping but exclude any pavement or pavement subgrade.

	Excavation (C.Y.)	On Site Fill (C.Y.)	Imported Rock (C.Y)	Surplus to be hauled off site (C.Y.)
Base Bid Only	16,200	6,075	5,200	10,685
+Alternate #1	380	−100	0	480
+Alternate #2	2,020	460	400	1,560
Base + Alt 1&2	18,600	6,535	5,600	12,725

It is the Contractor's responsibility to verify said earthwork quantities via his own resources, it is estimated that the grading shown on these plans will result in a surplus of material.

Combined excavation, hauling and placing operations shall be such that the materials, when compacted, will be blended sufficiently to secure the best practicable degree of compaction and stability, in the fills, individual loads shall be deposited to insure that the more pervious materials shall be placed in the outside portions of the fill. Stones or boulders measuring greater than 12 inches in any dimension shall not be placed in the upper 3 feet of fill or in stump holes, around pipe and structures, and in other restricted areas.

Where it is impracticable to use rolling equipment, the material shall be compacted by means of equipment approved by the Geotechnical Engineer to a density of 95% of the maximum density obtained at optimum moisture content as determined by the Standard Compaction−Test, ASTM D−698.

Proposed grades are to finish grade. Grade slopes shall be as shown on the plans with a maximum slope of 2:1. Finish grading shall be reasonably smooth and merge with the adjacent terrain without noticeable break to the elevations indicated.

Topsoil suitable to support seeding or sodding shall be spread to a depth of 6" over all areas disturbed during construction and compacted by light rolling. All disturbed areas shall be turfed as indicated on the turf restoration sheet.

The Owner has retained and will compensate a Geotechnical Engineer that will provide foundation observations and materials testing services during construction. The Geotechnical Engineer will observe and approve foundation bearing materials where soft or compromised materials are encountered at the footing bearing elevation, provide four Standard Proctor Test of on site materials / granular backfill materials, twenty soil compaction testing for foundations, six asphalt tests (Marshall, stability, temperature, density, gradation) and concrete tests (temperature, slump, air, compressive/flexural strength) a maximum of three times and rock anchor pull out testing for Wall D. Compensation for the performance of these geotechnical engineering services should not be included in the bid prices.

Under areas to be paved, the backfill materials shall be compacted in such a manner so as to obtain 95% of maximum density at optimum moisture plus or minus 2%, as determined by ASTM D698. Required compaction and percentage of maximum density must be obtained before pavement is placed.

Outside of areas to be paved, the backfill material shall be compacted so as to obtain 90% of maximum density at optimum moisture plus or minus 2%, as determined by ASTM D698.

Backfill shall be compacted in uniform lifts in accordance with the specifications. Periodic compaction tests shall be taken at locations designated by the Engineer. All backfill which does not meet the required density, shall be re−excavated and re−compacted until the required density is obtained. Tests taken only at the top of the fill will not be accepted.

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Rock Creek Channel Improvements

City of Mission, Kansas

DOUGLAS L. CAMPBELL
16506
2-17-2020
KANSAS
PROFESSIONAL ENGINEER

REVISION

Conceptual − 9/23/2019

Preliminary 50% − 10/10/2019

Preliminary 90% − 12/17/2019

Final − 2/6/2020

Bid Set − 2/17/2020

PROJECT NUMBER
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2/17/2020

DESIGNED
PDM, MLG, ACL

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ACL

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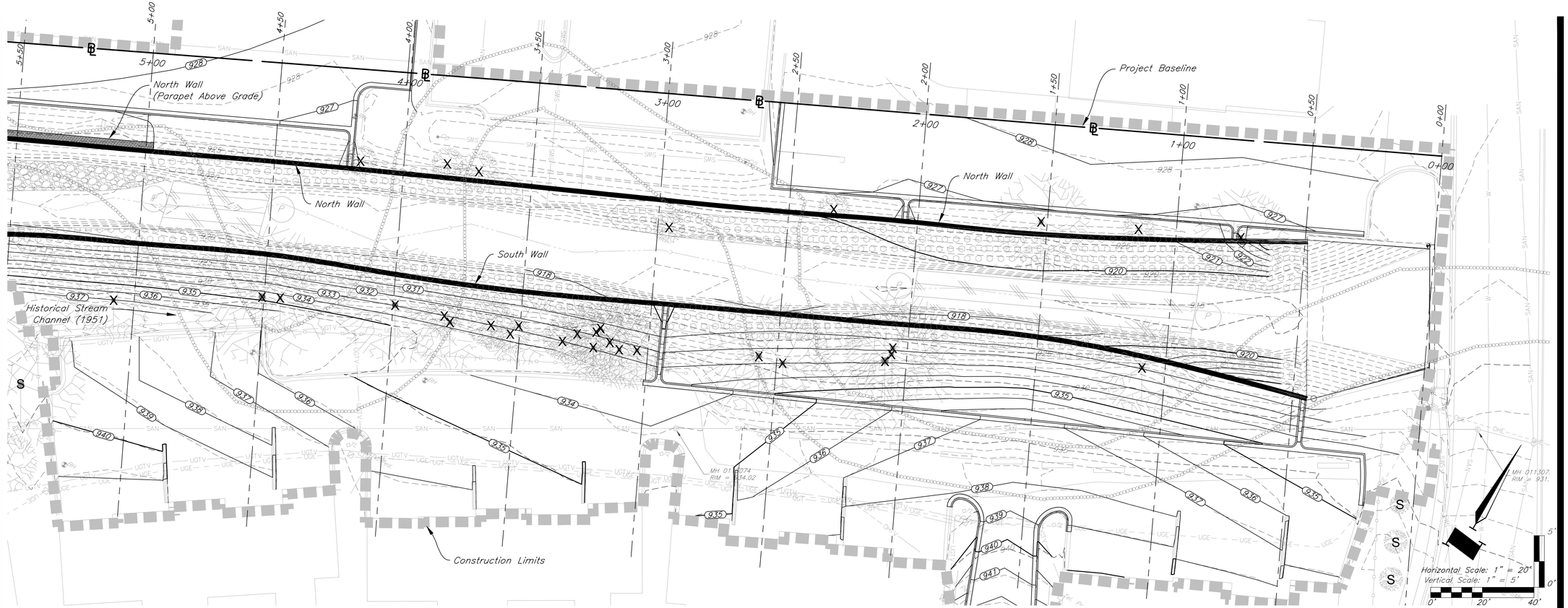
PDM

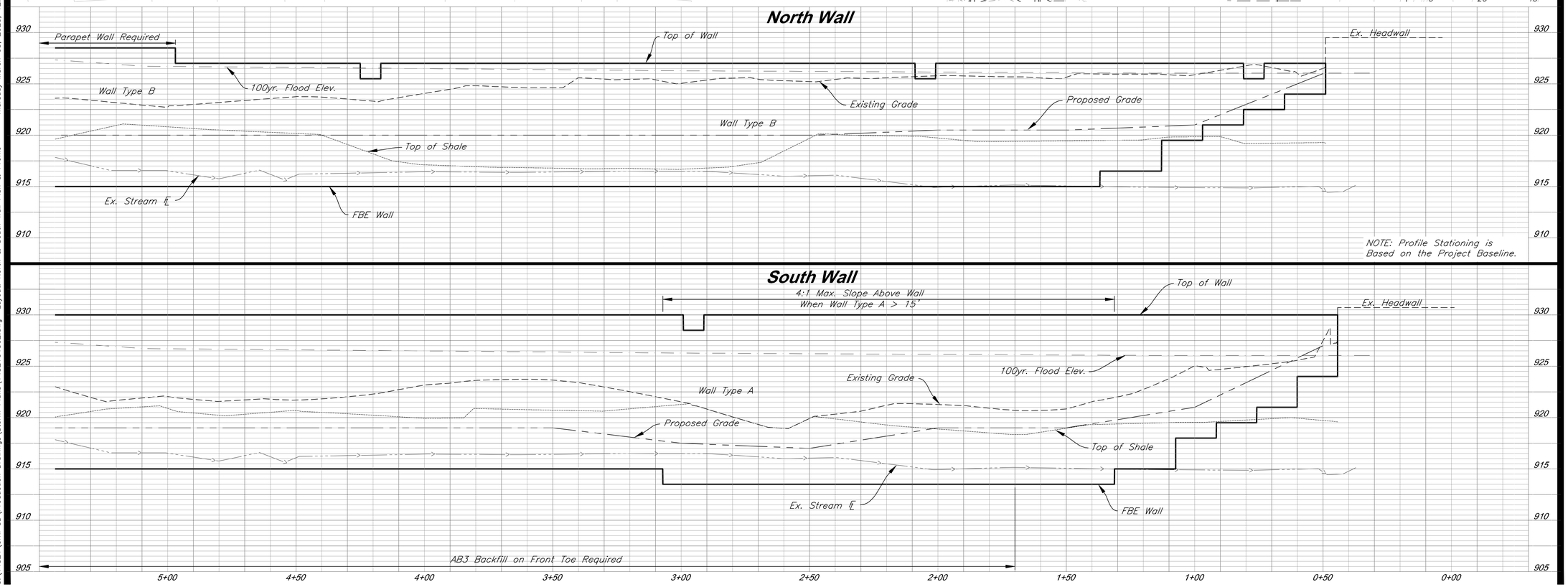
SHEET TITLE

Construction Layout

SHEET NUMBER

05





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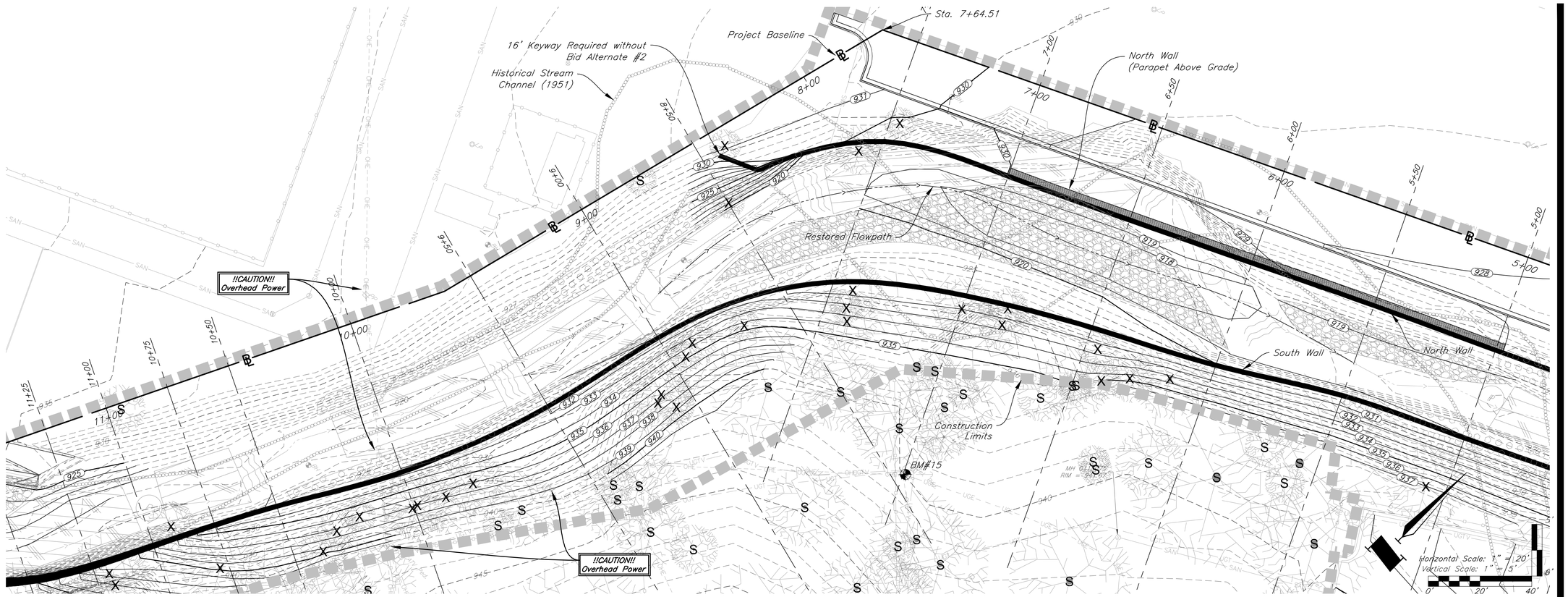
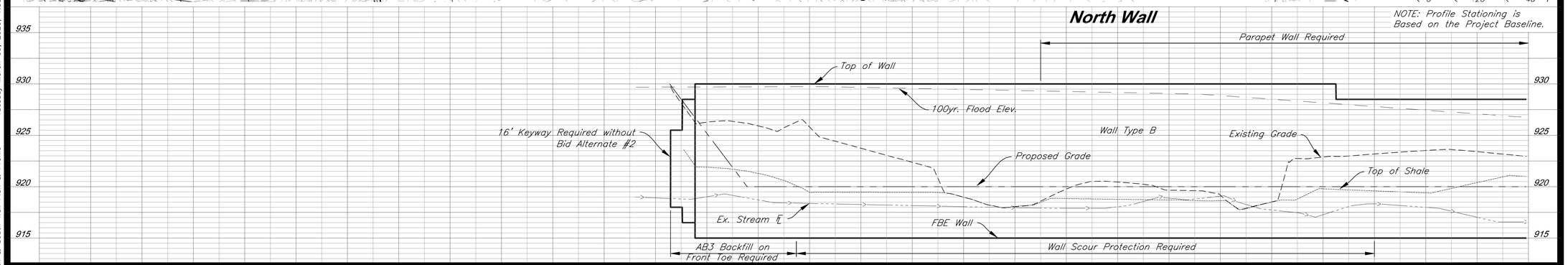
SHEET TITLE

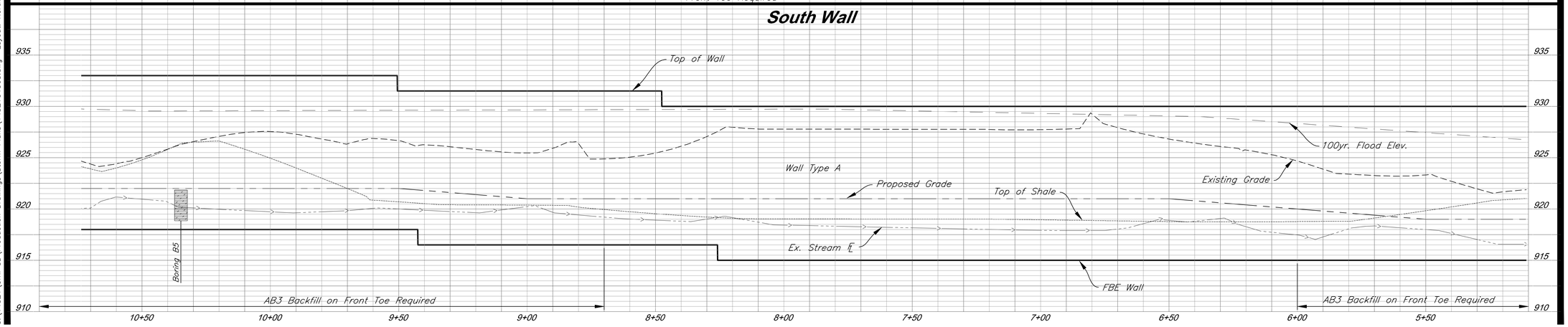
North & South Wall Plan & Profile

SHEET NUMBER

06R







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Rock Creek Channel Improvements

City of Mission, Kansas

P. DOUGLAS GILLILAND, 25013, STATE OF KANSAS, PROFESSIONAL ENGINEER, 3-5-2020

REVISION

Conceptual – 9/23/2019

Preliminary 50% – 10/10/2019

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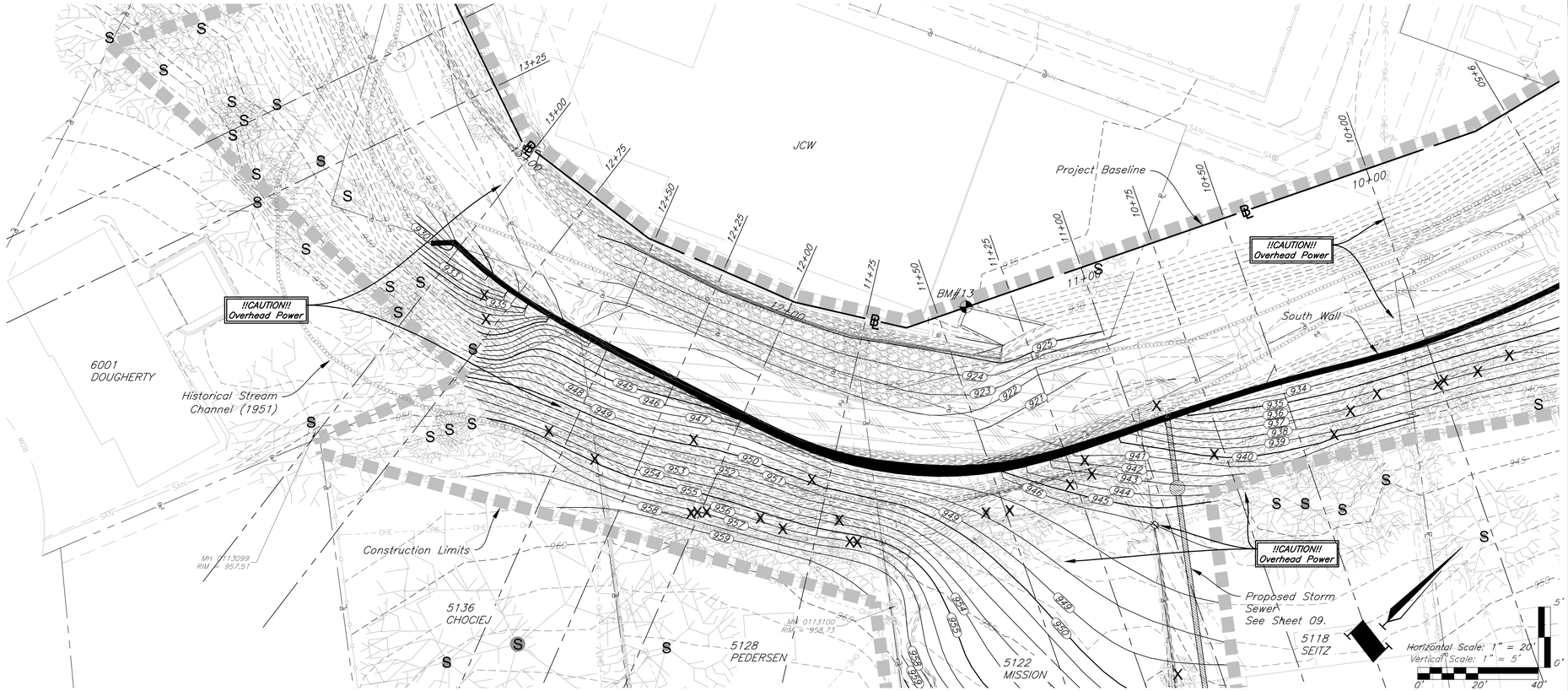
SHEET TITLE

North & South Wall Plan & Profile

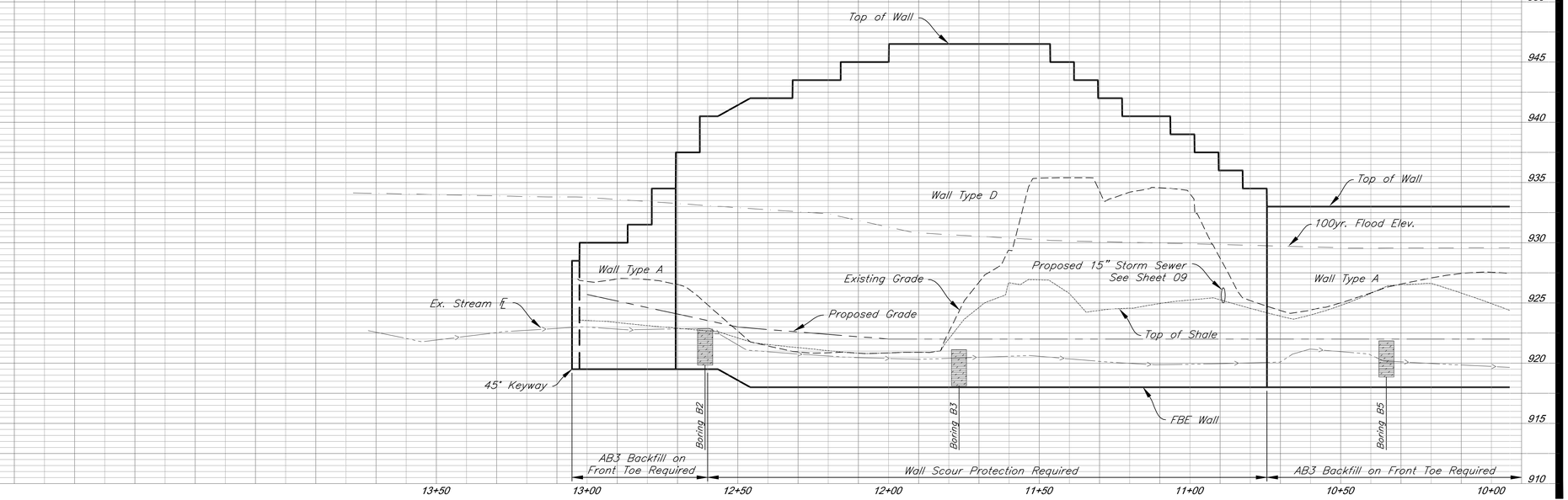
SHEET NUMBER

07R



South Wall

NOTE: Profile Stationing is Based on the Project Baseline.



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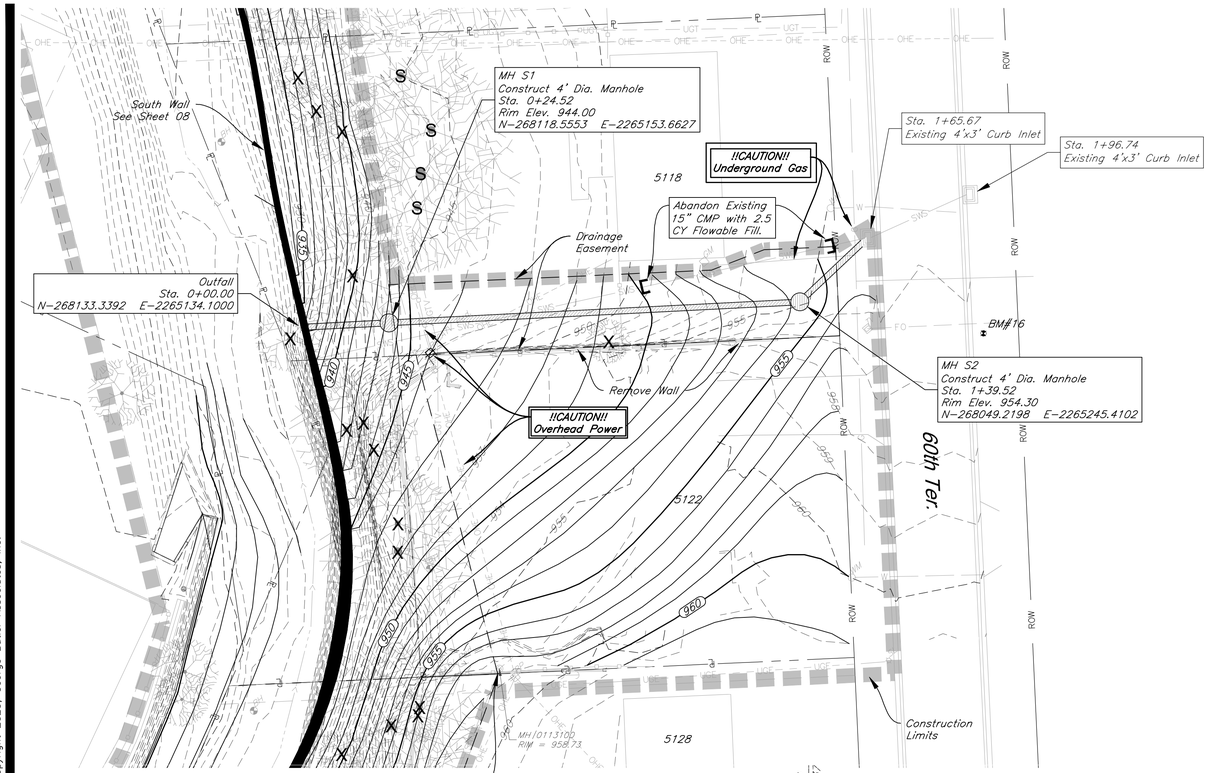
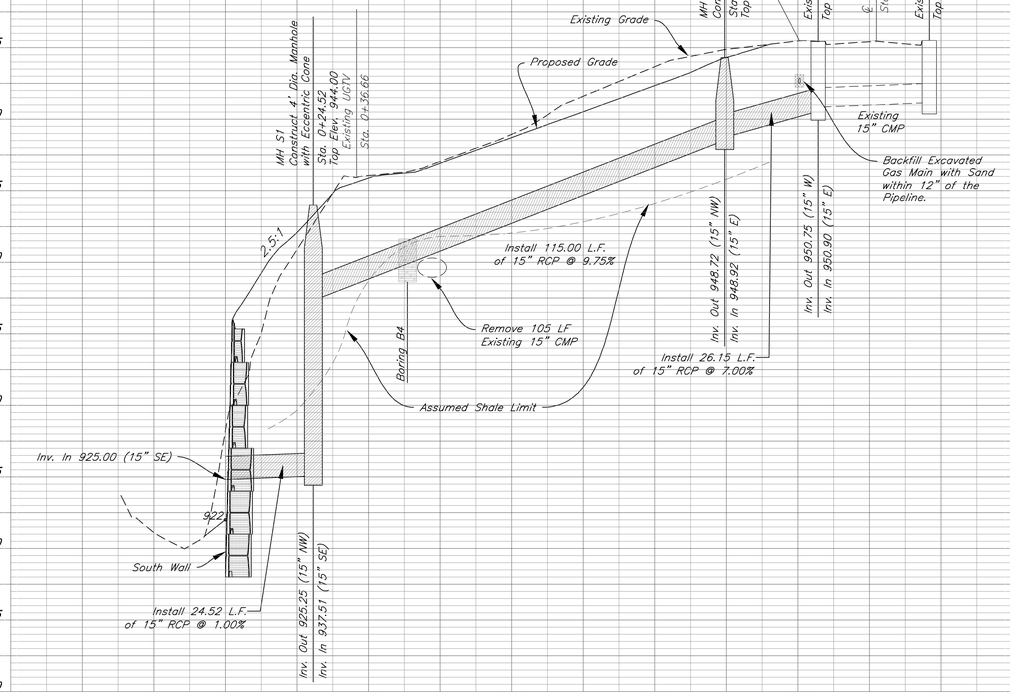
SHEET TITLE

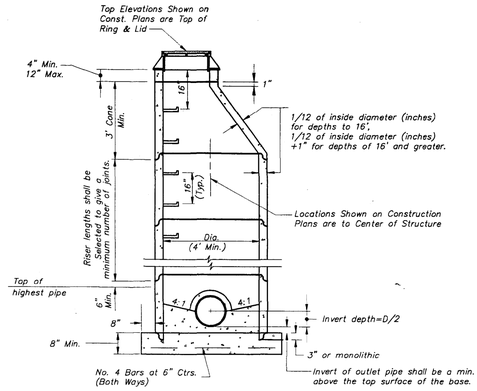
North & South Wall Plan & Profile

SHEET NUMBER

08R



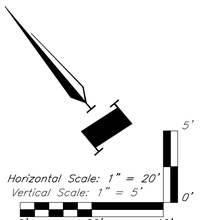




STANDARD PRECAST MANHOLE
(ECCENTRIC CONE)

GENERAL NOTES:

1. All manholes are to be precast concrete and of Eccentric Cone type unless otherwise specified.
2. Manhole top adjustments shall be accomplished by the use of concrete adjustment rings.
3. Top of manhole casting shall be set flush and on same slope as finished surface or as directed by the Engineer.
4. Reinforcement in all sections shall equal or exceed A.S.T.M. C-478 specifications.
5. The engineer shall designate modifications for manholes with special designs.
6. The inside diameter of the manhole shall be 4'-0" for pipe diameters from 12" thru 24", 5'-0" for pipe diameters from 27" thru 36", and 6'-0" for pipe diameters 42" thru 48".
8. Clearance Tolerance of Pipe Openings: The Maximum Allowable Pipe Opening on a Horizontal Axis Shall be the Outside Diameter of the Pipe Plus 12". The Maximum Allowable Pipe Opening on Vertical Axis Shall be the Outside Diameter Plus 8". The Minimum Clearance Between the Outside Surface of an Installed pipe and the Concrete of the Manhole Shall be 2".
9. Installation of Pipe Openings: All required pipe openings shall be plant cast in manhole units. Field alterations of openings will be permitted provided walls are scored with a masonry saw to a depth sufficient to sever reinforcing steel. A chipping hammer may then be used to remove the concrete. Minimum distance between any two adjacent pipes shall be 4".
10. No direct payment for shaping floor or connecting pipes as shown on plans.
11. Ring & Cover to be Neenah R-1736, Clay & Bailey #2008, Deeter #1316, or approved equal. (Casting may vary by municipality, refer to plans & contract documents.)



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Rock Creek Channel Improvements

City of Mission, Kansas

REVISION
Conceptual – 9/23/2019
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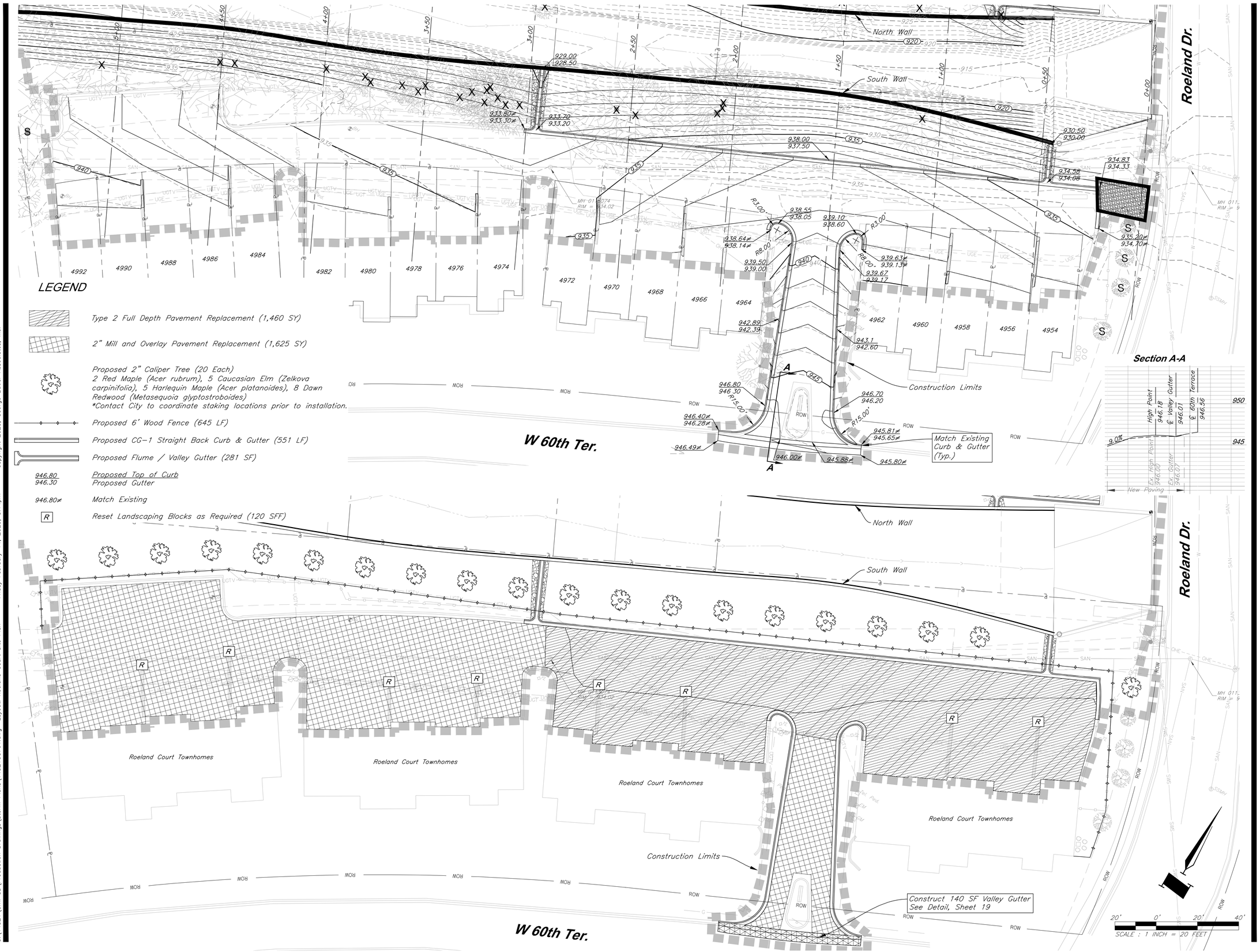
PDM

SHEET TITLE

Storm Sewer Plan & Profile

SHEET NUMBER

09R



LEGEND

- Type 2 Full Depth Pavement Replacement (1,460 SY)
- 2" Mill and Overlay Pavement Replacement (1,625 SY)
- Proposed 2" Caliper Tree (20 Each)
  2 Red Maple (Acer rubrum), 5 Caucasian Elm (Zelkova carpinifolia), 5 Harlequin Maple (Acer platanoides), 8 Dawn Redwood (Metasequoia glyptostroboides)
  *Contact City to coordinate staking locations prior to installation.
- Proposed 6' Wood Fence (645 LF)
- Proposed CG-1 Straight Back Curb & Gutter (551 LF)
- Proposed Flume / Valley Gutter (281 SF)
- 946.80 / 946.30 — Proposed Top of Curb / Proposed Gutter
- 946.80≠ — Match Existing
- R — Reset Landscaping Blocks as Required (120 SFF)

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Rock Creek Channel Improvements

City of Mission, Kansas

P. DOUGLAS MILLER
NUMBER
16506
2-17-2020
KANSAS
PROFESSIONAL ENGINEER

REVISION

Conceptual – 9/23/2019

Preliminary 50% – 10/10/2019
HOA Comments – 11/26/2019
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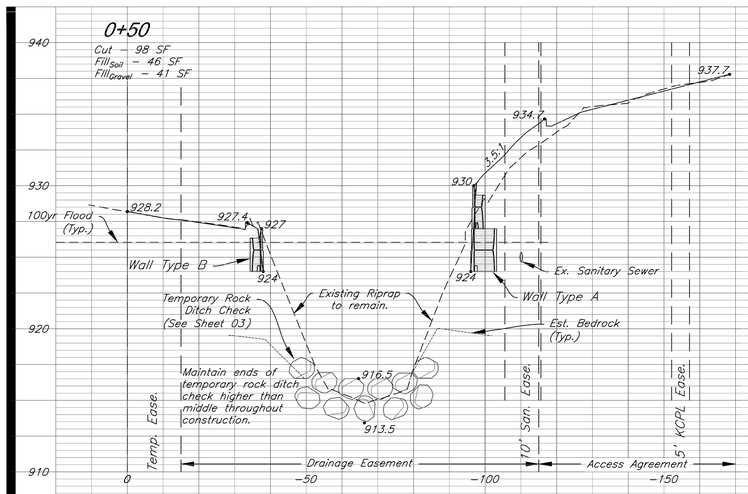
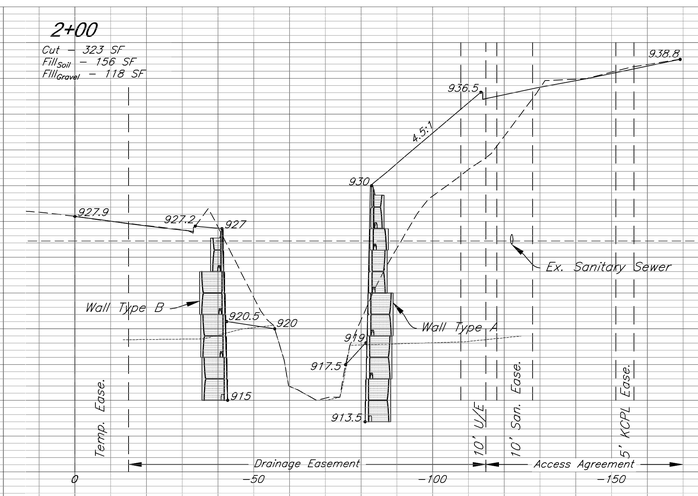
PDM
SHEET TITLE

Roeland Court Site Plan

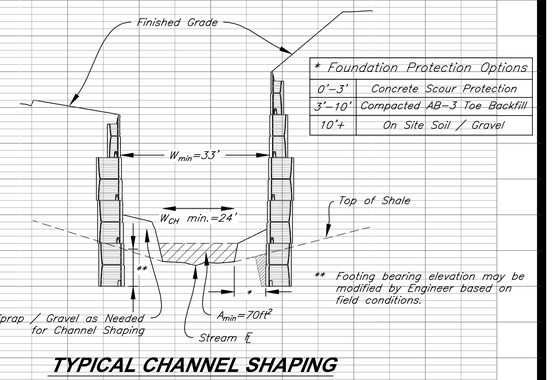
SHEET NUMBER
10





Grade disturbed stream banks to no greater than 1.5h:1v slope.

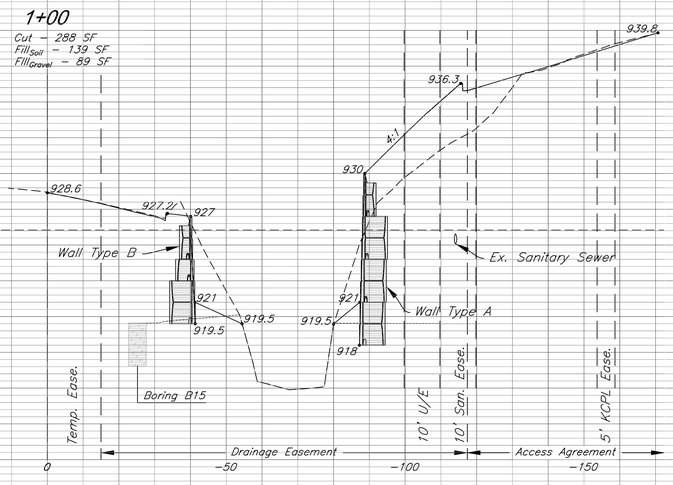
The design and restoration techniques specified are particularly sensitive to abrupt transitions, locations of existing trees, root balls, cross section, and profile. Final stream cross section may be modified by the Engineer via field order.

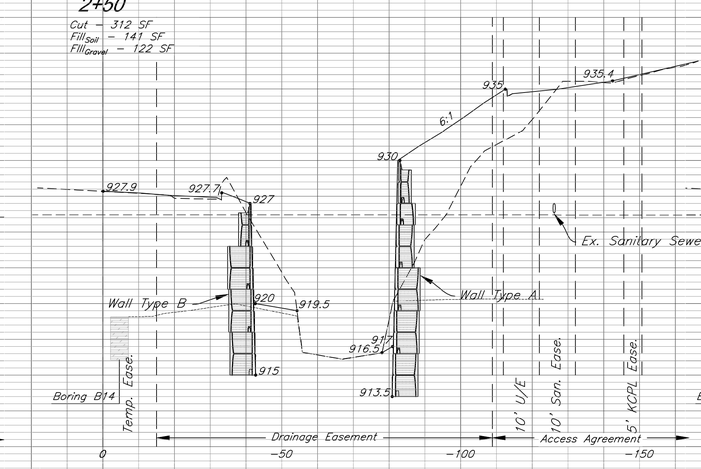


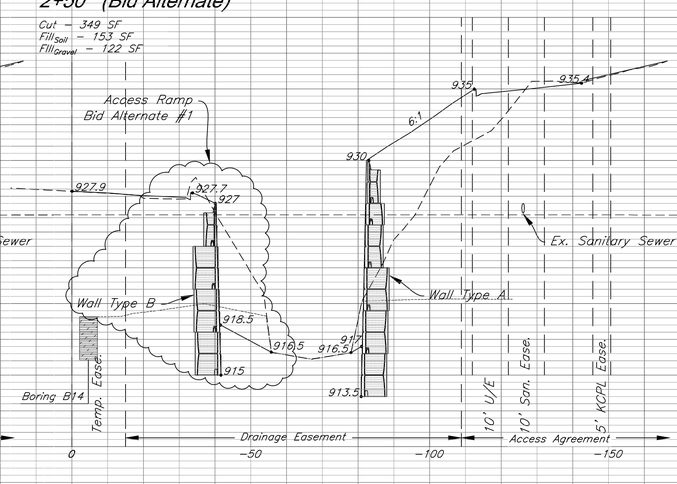
* Foundation Protection Options	
0'–3'	Concrete Scour Protection
3'–10'	Compacted AB–3 Toe Backfill
10'+	On Site Soil / Gravel

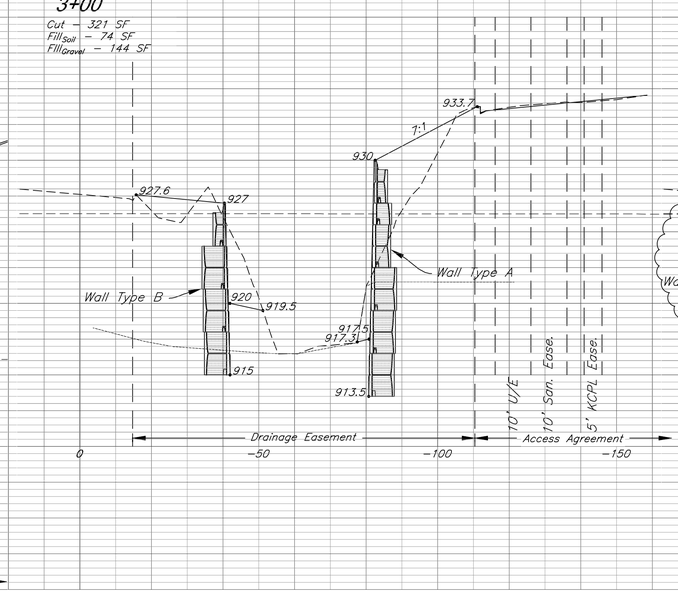
** Footing bearing elevation may be modified by Engineer based on field conditions.

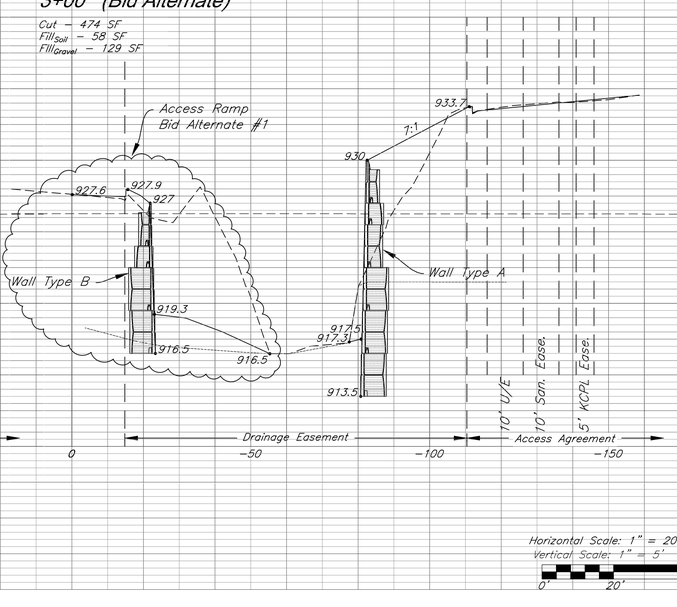
TYPICAL CHANNEL SHAPING











Horizontal Scale: 1" = 20'
Vertical Scale: 1" = 5'
0' 20' 40'
5'
0'

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Rock Creek Channel Improvements

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ACL

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PDM

SHEET TITLE

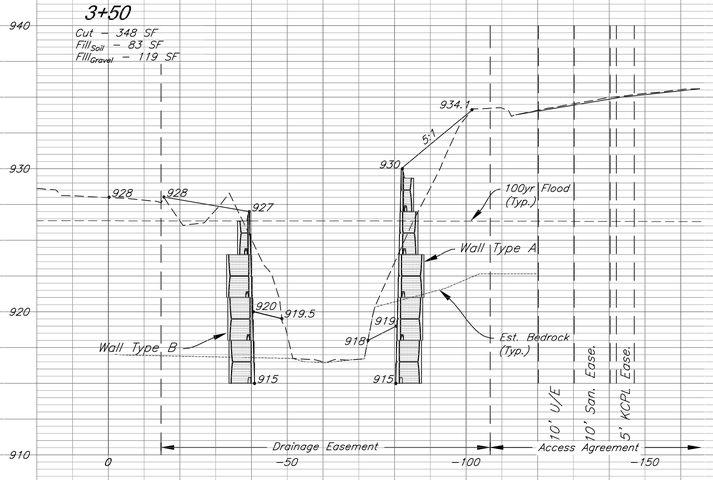
Channel Cross Sections

SHEET NUMBER

11

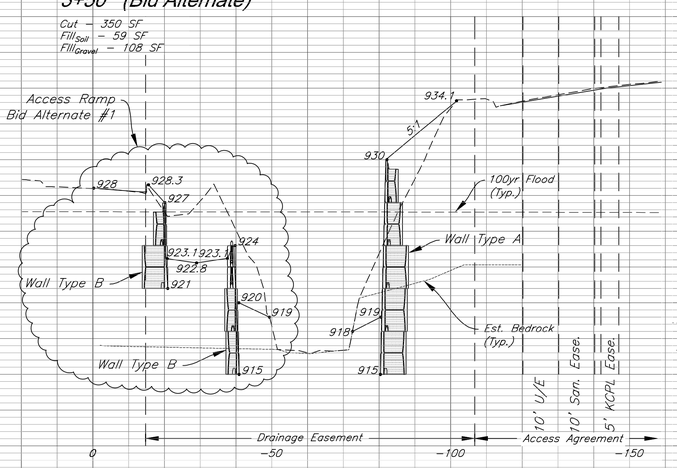
3+50

Cut – 348 SF
Fill$_{Soil}$ – 83 SF
Fill$_{Gravel}$ – 119 SF



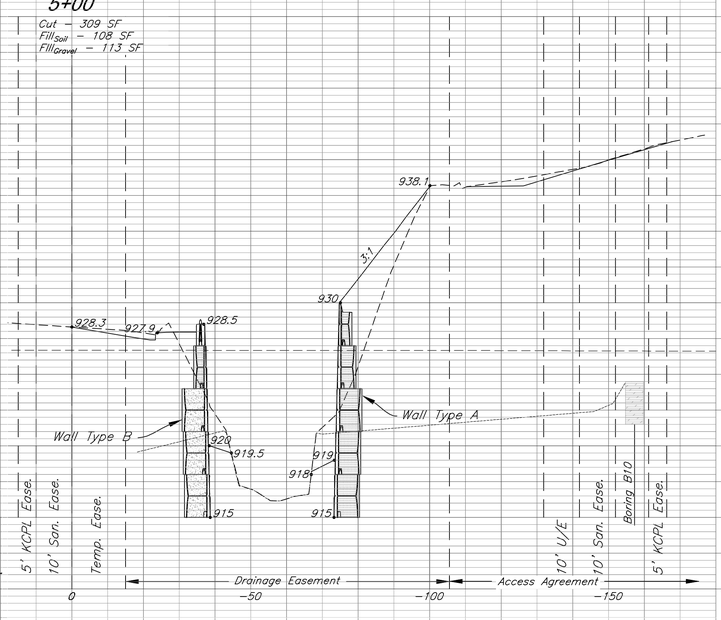
3+50 (Bid Alternate)

Cut – 350 SF
Fill$_{Soil}$ – 59 SF
Fill$_{Gravel}$ – 108 SF



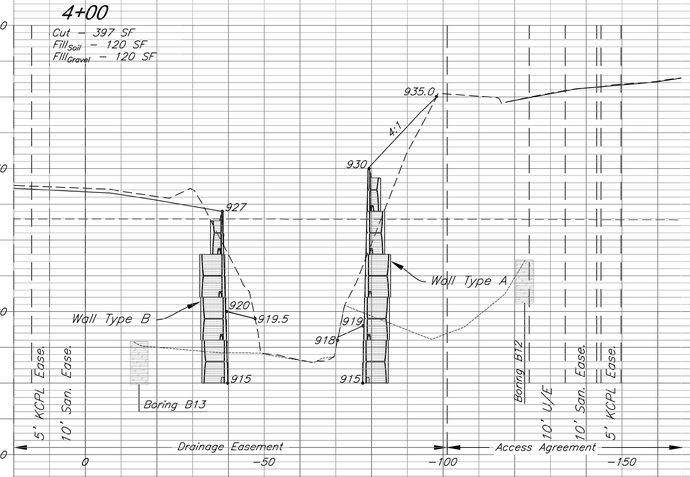
5+00

Cut – 309 SF
Fill$_{Soil}$ – 108 SF
Fill$_{Gravel}$ – 113 SF



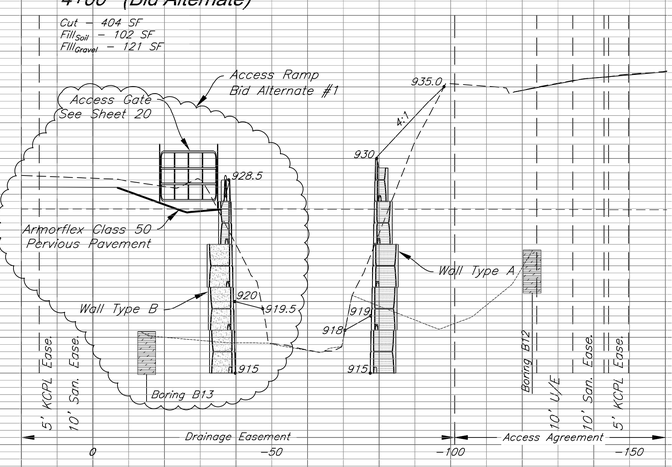
4+00

Cut – 397 SF
Fill$_{Soil}$ – 120 SF
Fill$_{Gravel}$ – 120 SF



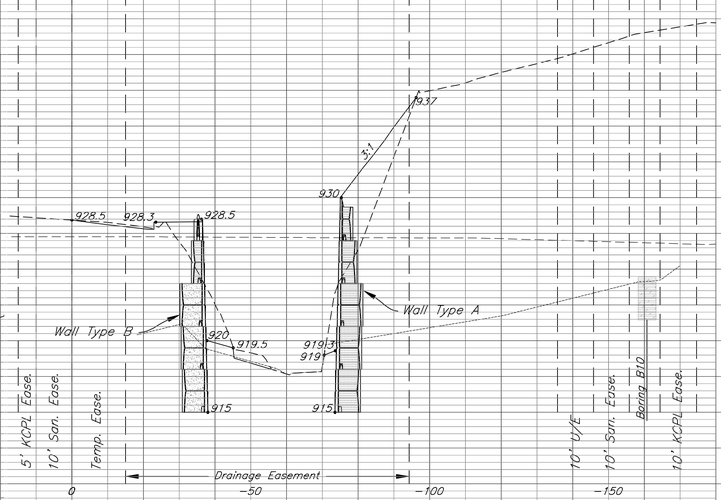
4+00 (Bid Alternate)

Cut – 404 SF
Fill$_{Soil}$ – 102 SF
Fill$_{Gravel}$ – 121 SF



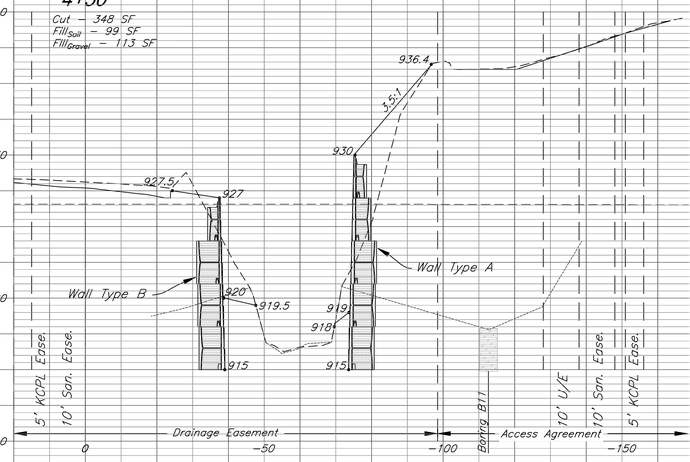
5+50

Cut – 318 SF
Fill$_{Soil}$ – 122 SF
Fill$_{Gravel}$ – 98 SF



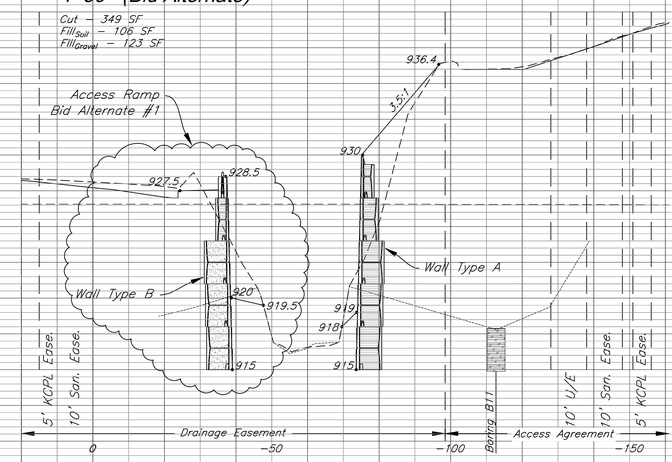
4+50

Cut – 348 SF
Fill$_{Soil}$ – 99 SF
Fill$_{Gravel}$ – 113 SF



4+50 (Bid Alternate)

Cut – 349 SF
Fill$_{Soil}$ – 106 SF
Fill$_{Gravel}$ – 123 SF



Horizontal Scale: 1" = 20'
Vertical Scale: 1" = 5'

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Rock Creek Channel Improvements

City of Mission, Kansas

DOUGLAS L. BUTLER
16506
2-17-2020
KANSAS
PROFESSIONAL ENGINEER

REVISION

Conceptual – 9/23/2019

Preliminary 50% – 10/10/2019

Preliminary 90% – 12/17/2019

Final – 2/6/2020

Bid Set – 2/17/2020

PROJECT NUMBER
14321.00

DATE
2/17/2020

DESIGNED
PDM, MLG, ACL

DRAWN
ACL

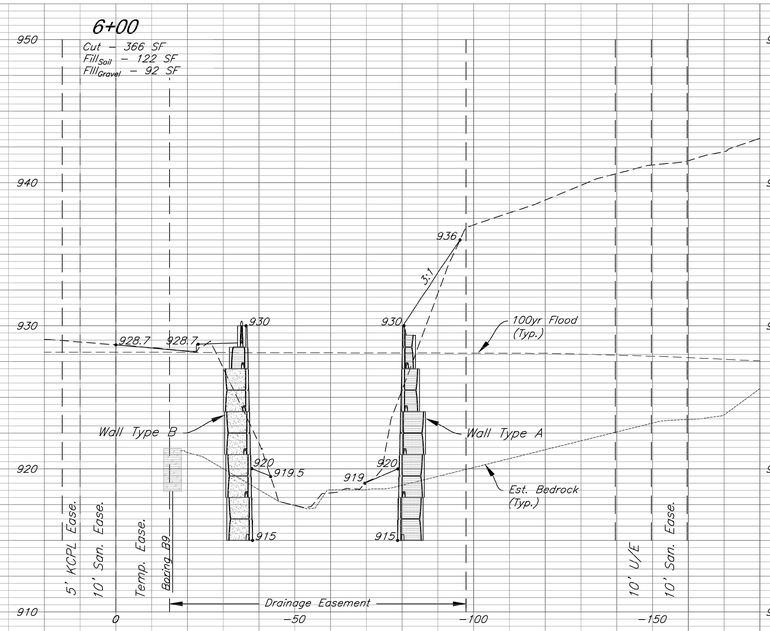
REVIEWED
PDM

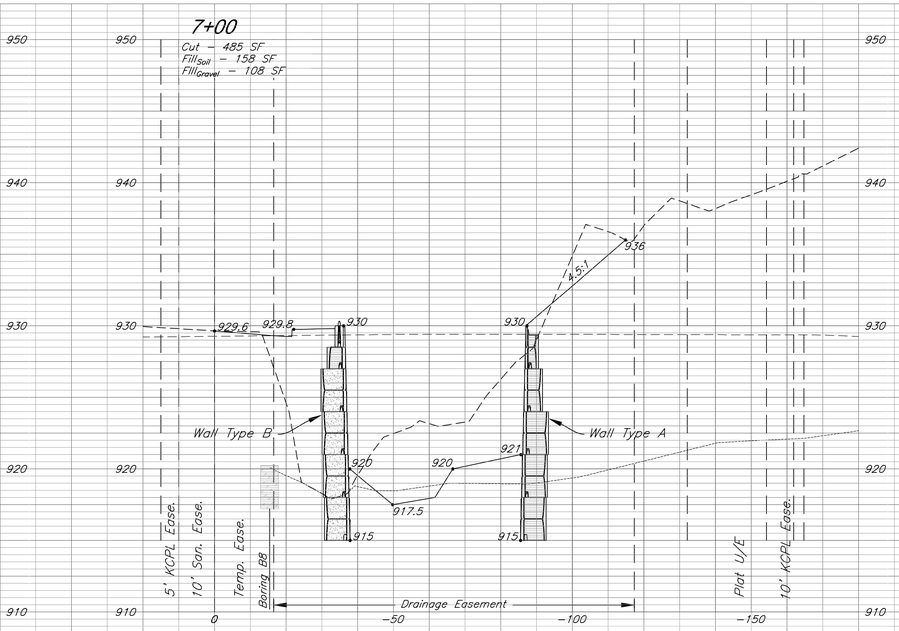
SHEET TITLE

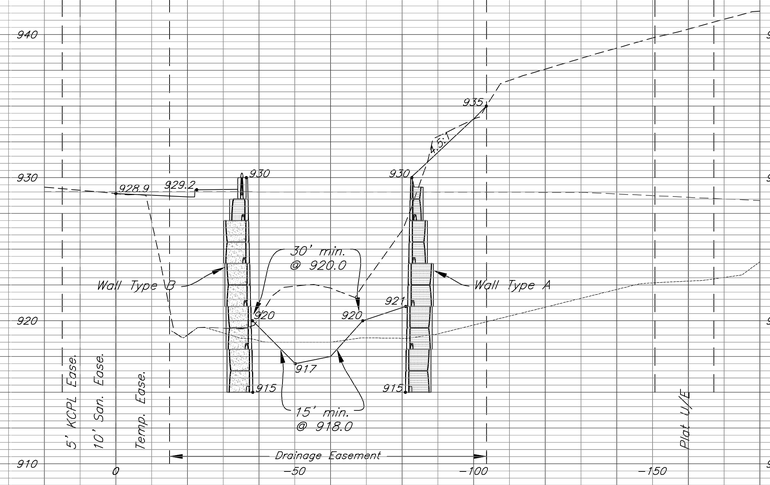
Channel Cross Sections

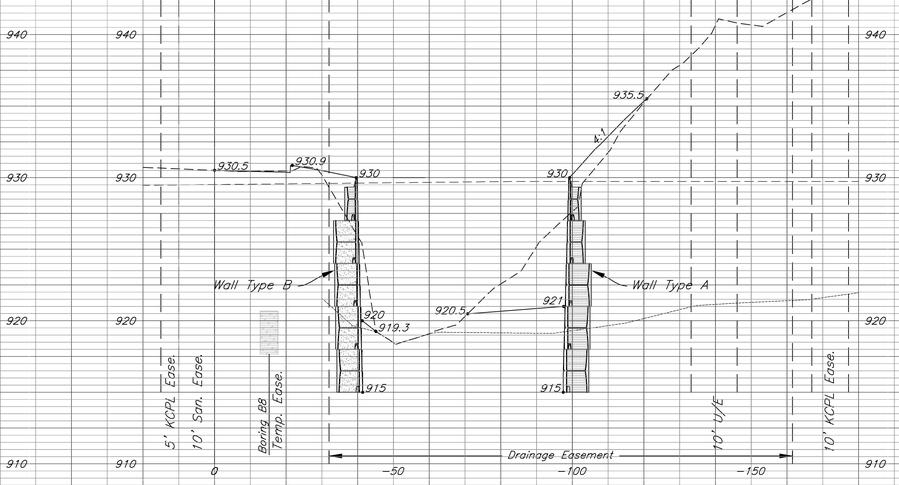
SHEET NUMBER

12









Horizontal Scale: 1" = 20'
Vertical Scale: 1" = 5'
0' 20' 40'
5' 0'

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Rock Creek Channel Improvements

City of Mission, Kansas

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REVISION

Conceptual – 9/23/2019

Preliminary 50% – 10/10/2019

Preliminary 90% – 12/17/2019

Final – 2/6/2020

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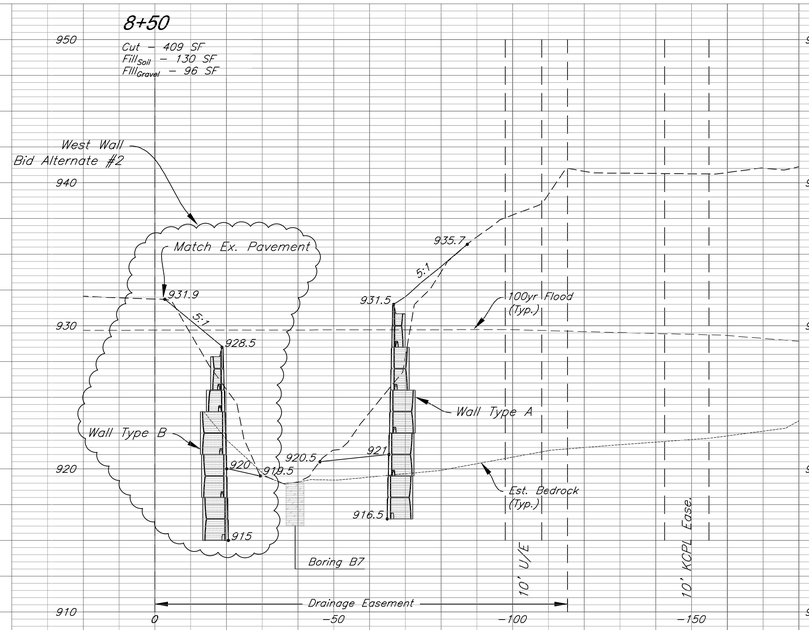
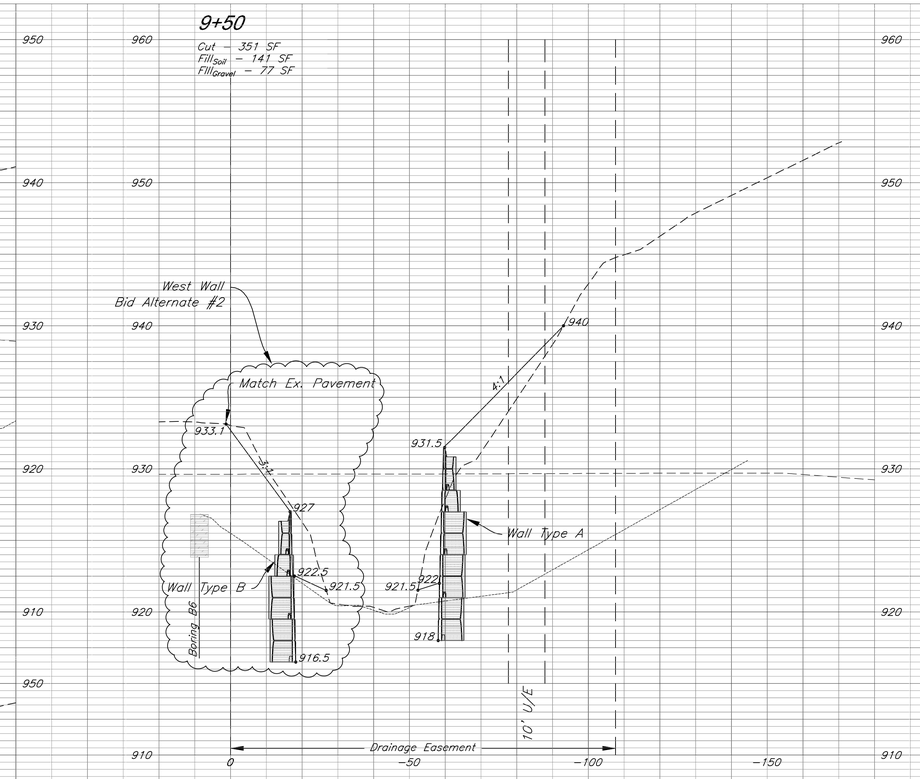
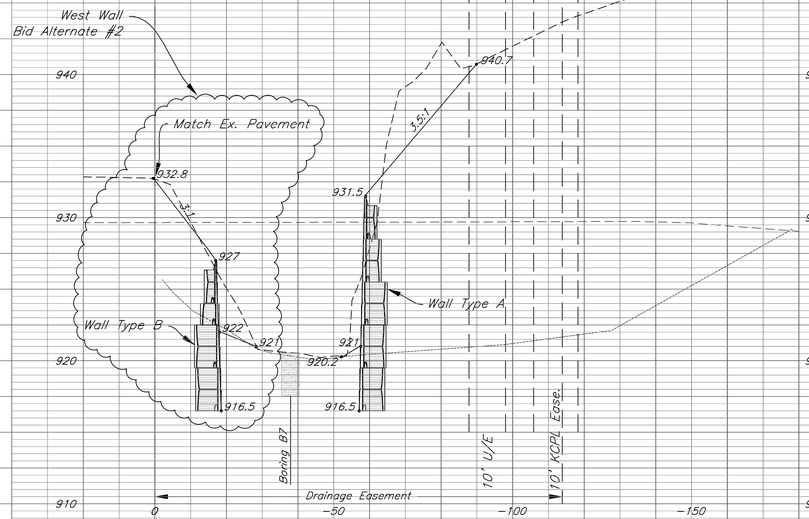
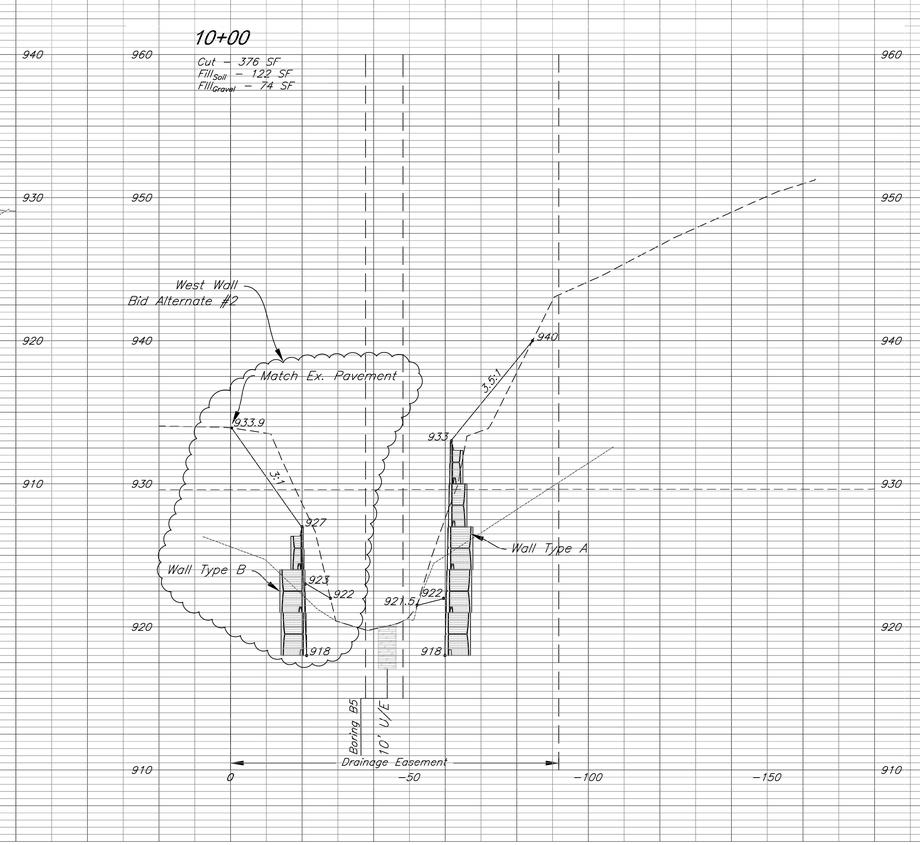
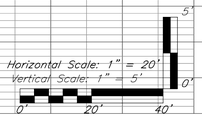
13











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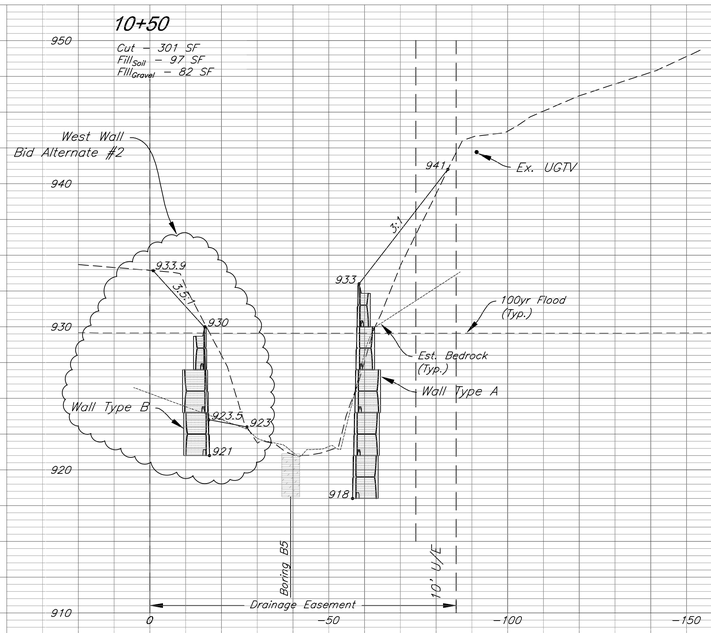
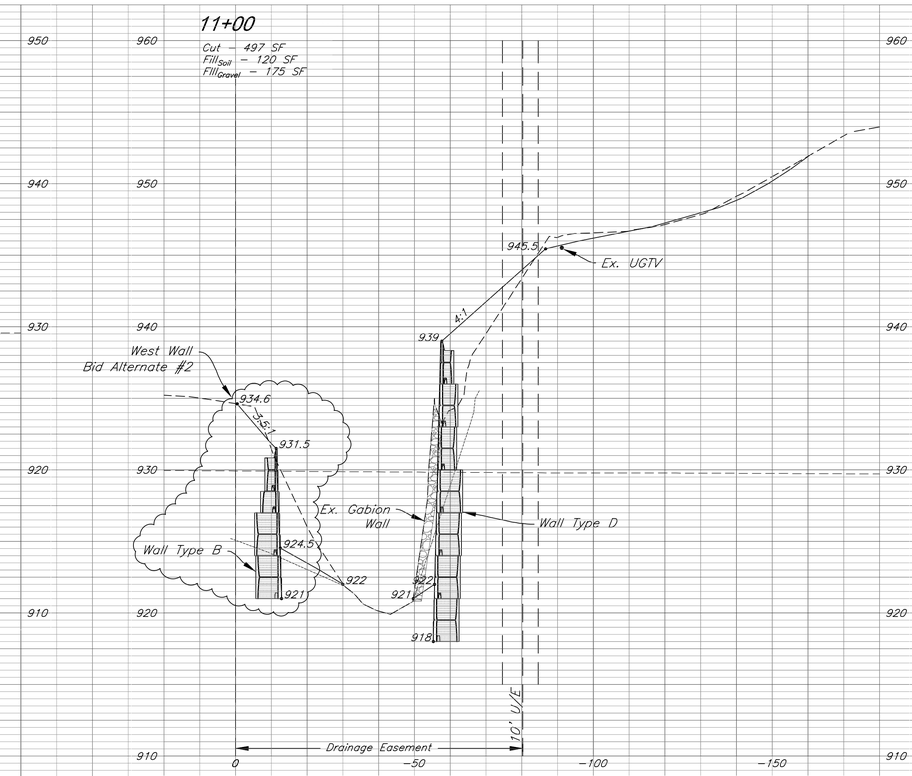
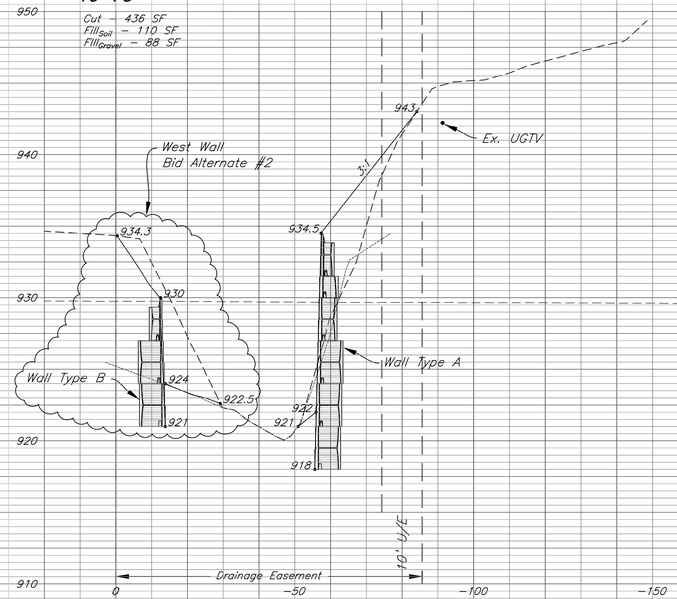
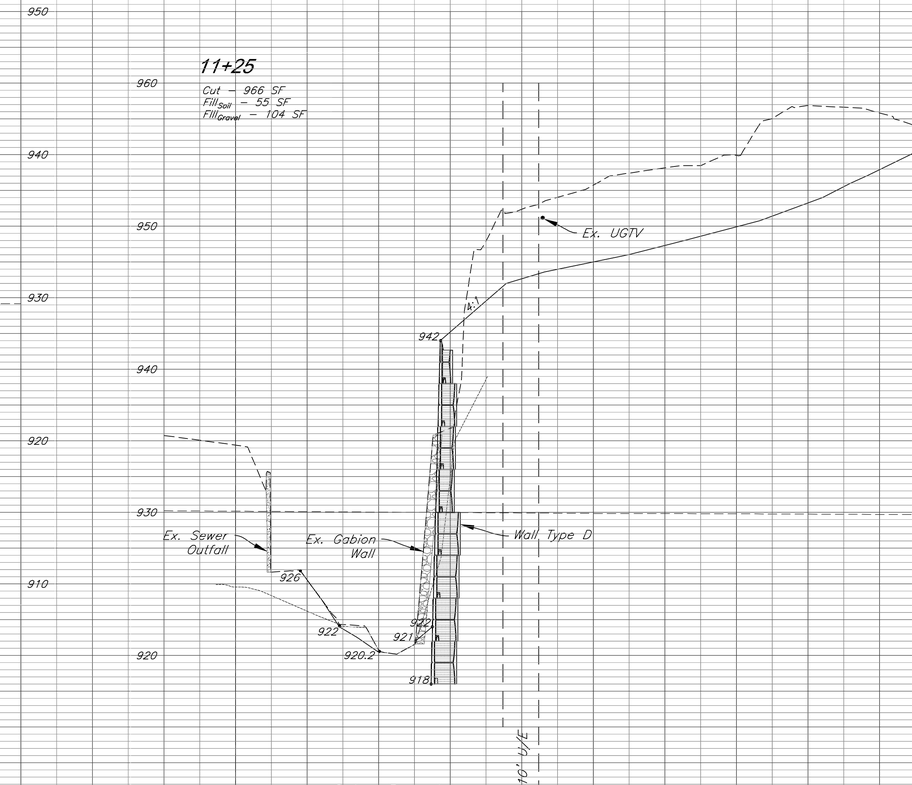
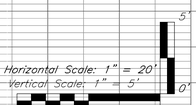
14











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Channel Cross Sections

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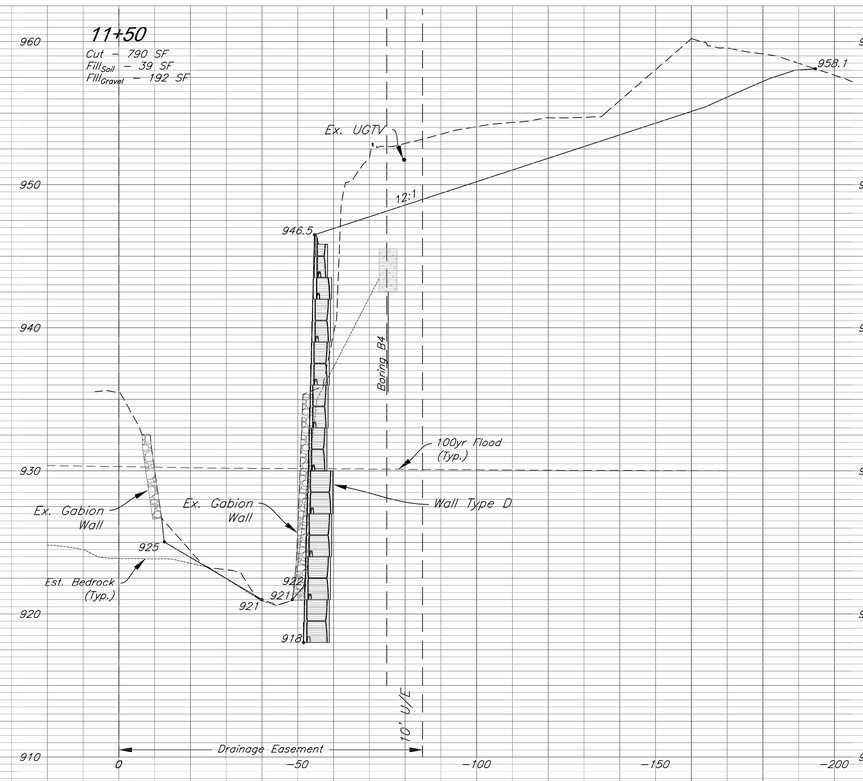
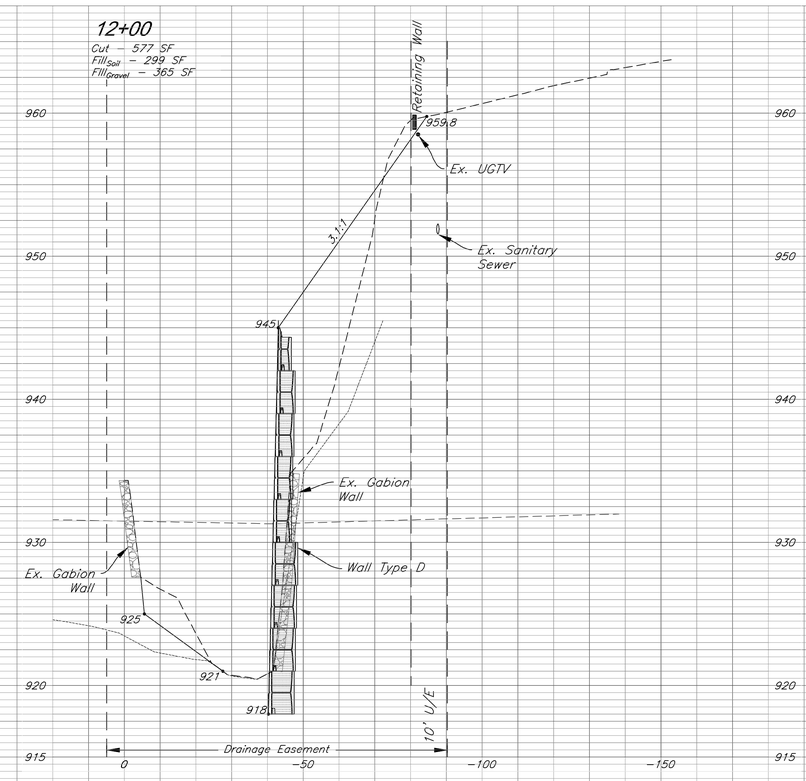
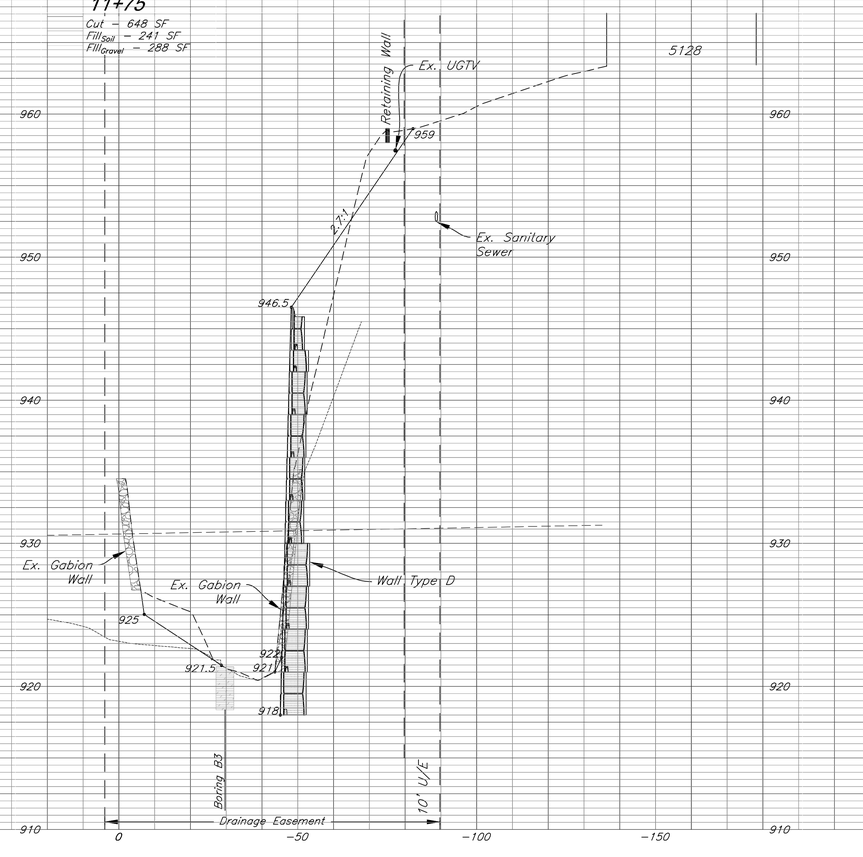
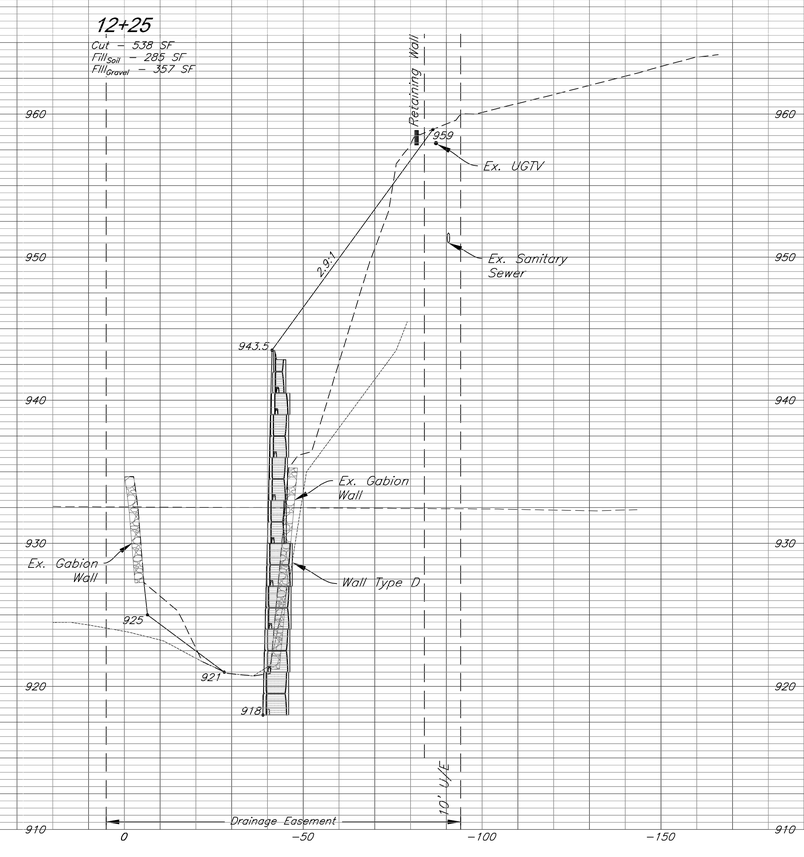
15









Horizontal Scale: 1" = 20'
Vertical Scale: 1" = 5'
0' 20' 40'
5'
0'

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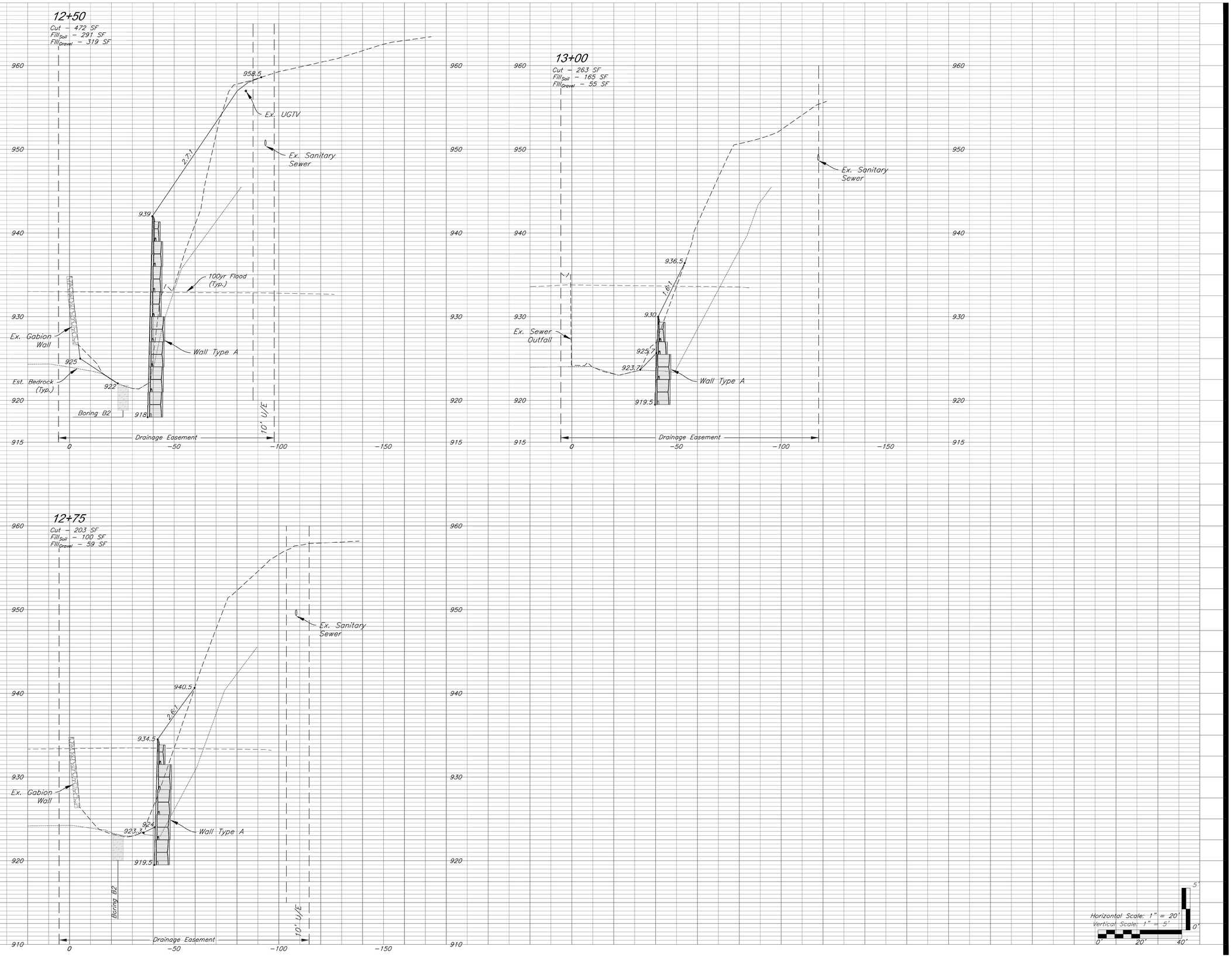
Channel Cross Sections

SHEET NUMBER

16



G:\14321\Civil 3D\Production Drawings\Storm Plans\14321025052b.dwg Layout: Channel Cross Sections — Friday February 14, 2020, 3:17pm —

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Channel Cross Sections

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Materials

Retaining wall components shown on the plans were laid out utilizing the Stone Strong Modular Block System. Base bid prices should include the Stone Strong System, however, other wall manufacturers may be considered by the Owner. The Engineer has evaluated the retained earth envelope using the Coulomb earth pressure theory for concept design of bearing pressures, overturning and sliding loads; soil and loading assumptions shown hereon.

Bid prices for selected wall manufacturer shall include shop drawing submittal providing design calculations and detailed shop drawings sealed by a Licensed Professional Engineer in the State of Kansas. The submittal shall be reviewed and approved by GBA and the Owner prior to manufacturing and/or delivery.

Contractor shall check the materials upon delivery to assure that proper materials have been received. Contractor shall protect the materials from damage. Damaged material shall not be incorporated into the wall or the reinforced soil embankments. Contractor shall prevent excessive mud, concrete, adhesives and other substances that may adhere from coming in contact with the materials. Exposed faces of precast modular block units shall be reasonably free of chips, cracks, or stains when viewed from a distance of 10 feet.

Foundation Stabilization / Granular Base where required shall consist of dense graded crushed aggregate, AB-3 or equal with a minimum unit weight of 130 lb/ft³. A minimum of 75% of coarse material shall have 2 or more fractured faces and shall meet the following gradation:

US Standard Sieve Size	Percent Passing
1-1/2"	80-100
3/4"	50-90
#4	0-40
#200	0-10

Gravel unit fill and granular backfill shall consist of a screened crushed aggregate with a minimum unit weight of 110 lb/ft³. A minimum of 75% of coarse material shall have 2 or more fractured faces. Gravel unit fill material shall meet the following gradation (KDOT BD-1 or equal):

US Standard Sieve Size	Percent Passing
1-1/2"	100
3/4"	50-75
#4	0-10
#8	0-5

Drain tile shall be a perforated or slotted 4" PVC or perforated HDPE pipe. The drain tile should be daylighted at low points and/or periodically along the wall alignment not exceeding 200 feet between discharge points and include a rodent guard at daylighted locations. Drain tile shall be located generally 5.5 feet above footing bearing elevation.

Provide a non-woven geotextile filter for separation from backfill surrounding the gravel envelope, as shown in details. The geotextile fabric shall be Mirafi 160N Series or approved equal. The geotextile shall be a needle punched non-woven fabric with a minimum grab tensile strength of 120 pounds, and maximum opening size of 0.21mm.

Field installed tail extensions (mass extender) are prohibited.

Execution

Excavate and dewater as required for installation of the retaining wall system. Excavate to the base level for a sufficient distance behind the face to permit installation of the base. Slope or shore excavation as necessary for safety and for conformance with applicable OSHA requirements.

Place the first course of block units directly on shale or optional wall base. Check units for level and alignment. Units shall be within 1/8 inch of level from end to end and from front to back. Adjacent units should be in contact. If possible, begin placing units at the lowest section of the wall. Fill all voids between and within the blocks with specified unit fill per the details.

Place backfill behind the units in maximum loose lifts of 8 inches and compact. Compact all granular backfill to a minimum of 95 percent of the maximum dry density (Modified Proctor). For cohesive soils, the moisture content at the time of compaction should be adjusted to within -2 and +3 percent of optimum. Place backfill in successive lifts until level with the top of the facing unit. Remove all excess aggregate and other materials from the top of the units before laying up the next course.

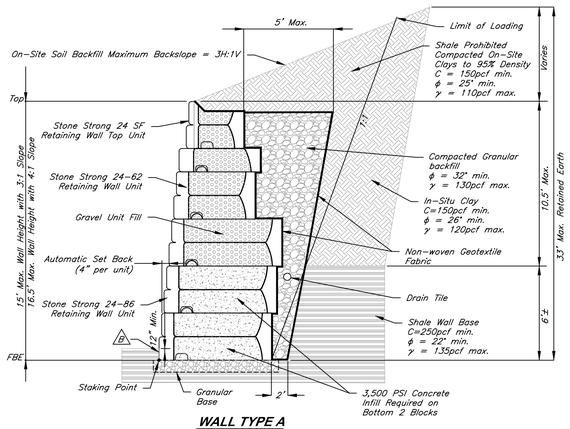
For Geosynthetic Strap reinforced walls, place the required Geosynthetic Strap or approved equal at the locations and elevations shown on the plans or the shop drawings. Geosynthetic Strap reinforcement shall be placed horizontally on compacted backfill. The length of the Geosynthetic Strap is measured from the front face of the wall. Extend the grid onto the front face flange of the facing unit. Orient the Geosynthetic Strap with the strong axis (machine direction) placed perpendicular to the wall face. Geosynthetic Strap shall not be spliced by any means in the roll direction. Geosynthetic Straps shall be placed side by side to provide complete coverage along the wall face. No overlap is required between adjacent grids on straight sections of the wall. On convex curves, place a minimum of 3 inches of backfill material between overlapping Geosynthetic Strap layers. Pull Geosynthetic Straps taught and stake or hold the loose end in place before placing the next course of backfill. Backfill shall be placed, spread, and compacted in such a manner that minimizes the development of wrinkles in the Geosynthetic Strap and/or movement of the Geosynthetic Strap. Do not operate equipment directly on the Geosynthetic Strap. A minimum backfill depth of 6 inches should be placed before operating equipment over the grids. Place the next course of precast modular block units in running bond with the previous course. Place the web recess over the alignment hoop protruding from the unit below, and pull the unit forward to contact the hoop. Batter should be within ¼ inch tolerance (4 inches from 24 SF unit below, 2 inches from 6 SF unit below). Continue placing successive courses to the elevations shown on the plans. Construct wall in level stages, placing the units at each course for the entire length of the wall, if possible. Unit fill and backfill should be placed to the level of the top of the facing unit before placing the next course. Provide temporary swales to divert runoff away from wall excavation and away from face. Final grade above and below the retaining wall shall provide for positive drainage and prevent ponding. Protect completed wall from other construction. Do not operate large equipment or store materials above the wall that exceed the design surcharge loads.

⚠: For lower wall sections that have uncompromised shale present that is less than 15 feet in length from the front face of the wall, generally below elevations of 935, Bidders are to assume 75 rock anchors.

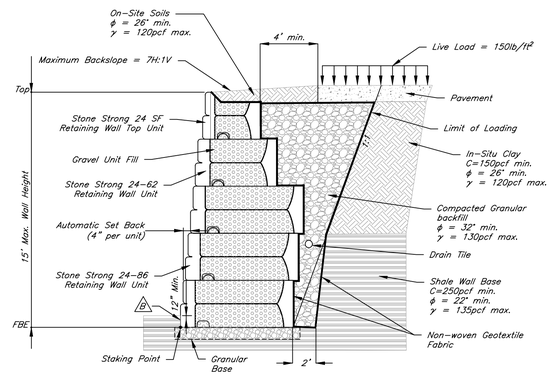
When distance between wall face and uncompromised shale is between 15 and 20 feet in length, the Geotechnical Engineer shall determine strap/anchorage method based on field conditions. If Geotechnical Engineer determines additional rock anchors are required, payment for additional anchors will be based on unit bid price for rock anchors.

When distance between wall face and uncompromised shale exceeds 20 feet in length, generally above elevation 935, a Geosynthetic Strap Reinforcement system, Paraweb 2D-50 or approved equal, shall be utilized as shown in the details.

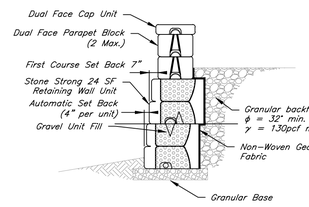
Stone Strong pattern shall be Chiseled Granite.



WALL TYPE A
Not to Scale

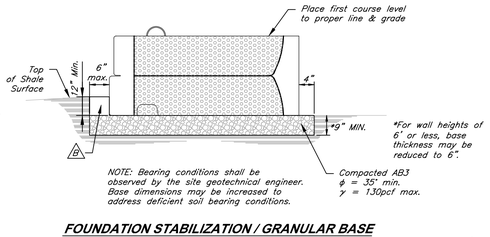


WALL TYPE B
Not to Scale



DUAL FACE PARAPET WALL
(Where required on Plan and Profile)
Not to Scale

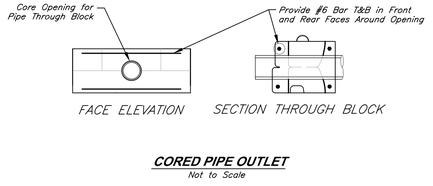
Omit 24 SF Top Block for areas where parapet is defined on Plan and Profile and utilize Dual Face Parapet Wall Detail.



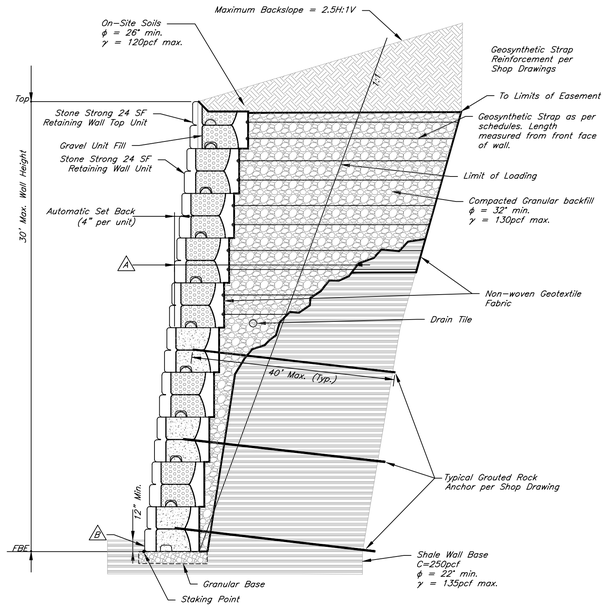
FOUNDATION STABILIZATION / GRANULAR BASE
Not to Scale

Ⓐ Distance to Toe of Stream	Foundation Protection
0'-3'	Concrete Scour Protection
3'-10'	Compacted AB-3 Toe Backfill
10'+	On Site Soil / Gravel

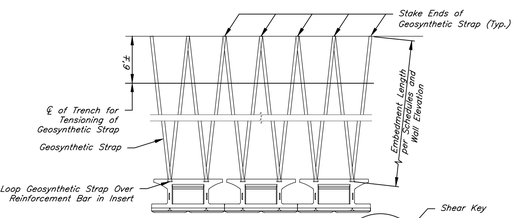
AVOID OVEREXCAVATION OF FOUNDATION SHALES. Sawcut recommended. 6" maximum tolerance in front of walls. Bottom block shall be keyed into shale.



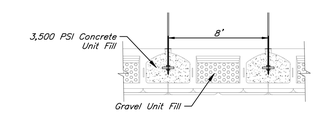
CORED PIPE OUTLET
Not to Scale



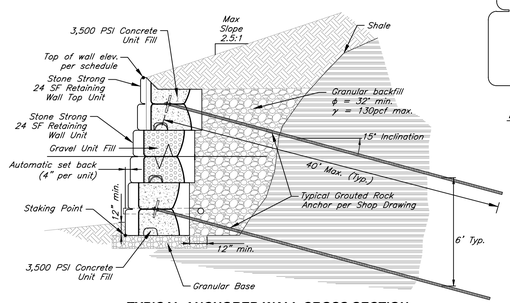
WALL TYPE D
Not to Scale



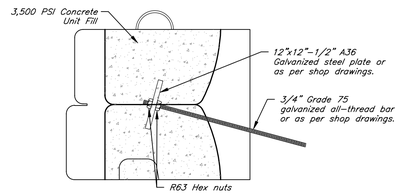
GEOSYNTHETIC STRAP INSTALLATION SCHEMATIC
Not to Scale



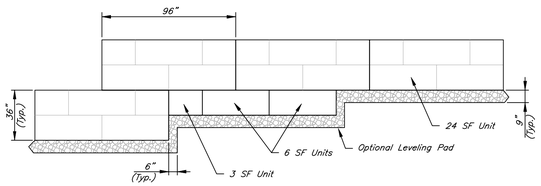
ROCK ANCHOR LAYOUT
Not to Scale



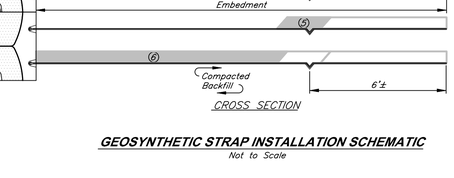
TYPICAL ANCHORED WALL CROSS SECTION
Not to Scale



ROCK ANCHOR CONNECTION
Not to Scale



WALL BASE STEP
Not to Scale



FOOTING SCOUR PROTECTION
(Where required on Plan and Profile)
Not to Scale

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Rock Creek Channel Improvements

City of Mission, Kansas

REVISION
Conceptual – 9/23/2019
Preliminary 50% – 10/10/2019
Preliminary 90% – 12/17/2019
Final – 2/6/2020
Bid Set – 2/17/2020
Addendum #2 – 3/5/2020

PROJECT NUMBER
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DATE
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PDM, MLG, ACL

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ACL

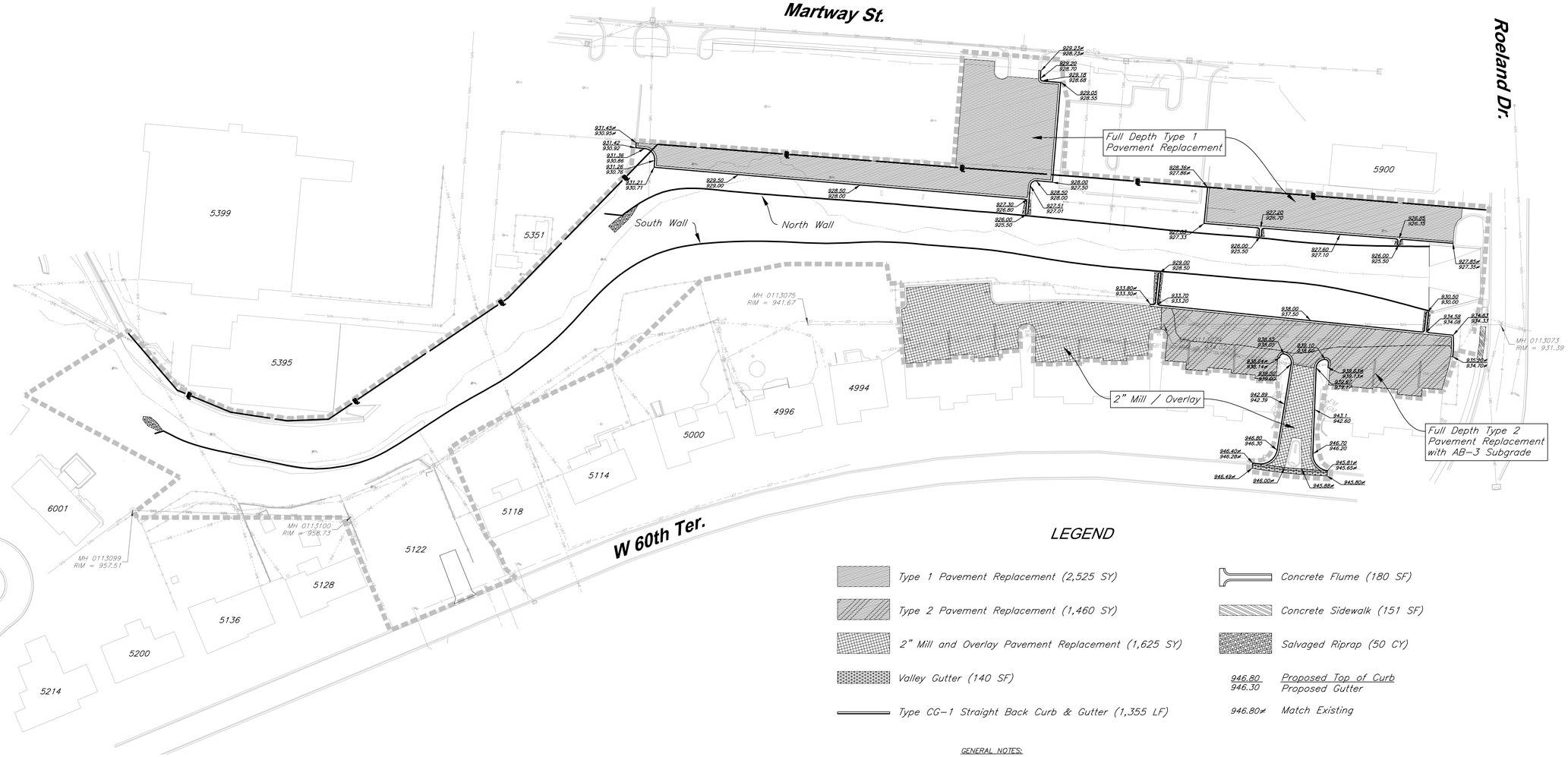
REVIEWED
PDM

SHEET TITLE

Modular Wall Sections

SHEET NUMBER

18R



LEGEND

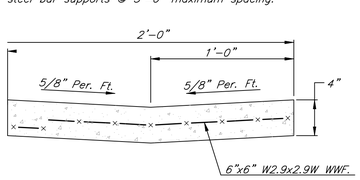
- Type 1 Pavement Replacement (2,525 SY)
- Type 2 Pavement Replacement (1,460 SY)
- 2" Mill and Overlay Pavement Replacement (1,625 SY)
- Valley Gutter (140 SF)
- Type CG-1 Straight Back Curb & Gutter (1,355 LF)
- Concrete Flume (180 SF)
- Concrete Sidewalk (151 SF)
- Salvaged Riprap (50 CY)
- 946.80 Proposed Top of Curb
- 946.30 Proposed Gutter
- 946.80≠ Match Existing

GENERAL NOTES:

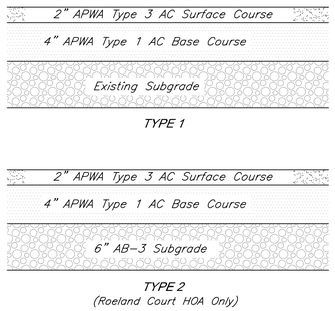
1. ¼" Isolation Joints with ⅜" dia. x 2' smooth dowels shall be placed at radius points and at 150' intervals. These dowel bars shall be greased and wrapped on one end with expansion tubes.
2. 1" deep Contraction Joints shall be installed at approximately 10' intervals. These joints shall pass across the entire curb section.
3. Fix dowel bars with bar supports.
4. Depth of curb shall be a minimum of 8" through the handicap access ramp.
5. Concrete shall conform to Standard Specifications Section 2208.2.B.
6. Asphaltic concrete surface course shall conform to Standard Specifications Section 2205.2.

½" premolded expansion joints shall be placed at points of curvature, curb returns, curb inlets, and at 250' centers. The expansion joints shall be doweled. Contraction joints shall be 2" deep, and placed at 15' intervals equally spaced between expansion joints.

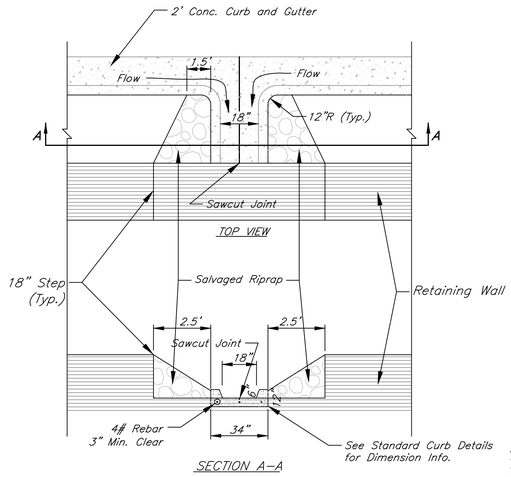
All reinforcing steel shall be supported on fabricated steel bar supports @ 3'-0" maximum spacing.



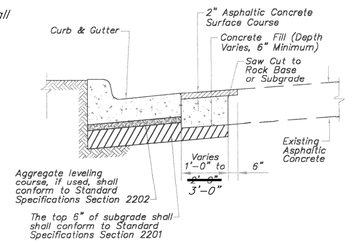
VALLEY GUTTER DETAIL
Not to Scale



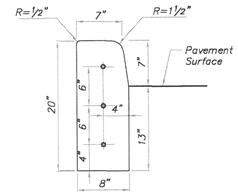
PAVEMENT SECTIONS
Not to Scale



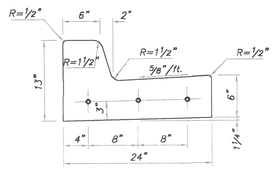
CONCRETE FLUME DETAIL
Not to Scale



CURB REPLACEMENT DETAIL



STRAIGHT CURB
(TYPE C-1)



STRAIGHT BACK CURB & GUTTER
(TYPE CG-1)

50' 0' 50' 100'
SCALE : 1 INCH = 50 FEET

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Rock Creek Channel Improvements
City of Mission, Kansas

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16506
2-17-2020
KANSAS
PROFESSIONAL ENGINEER

REVISION
Conceptual – 9/23/2019
Preliminary 50% – 10/10/2019
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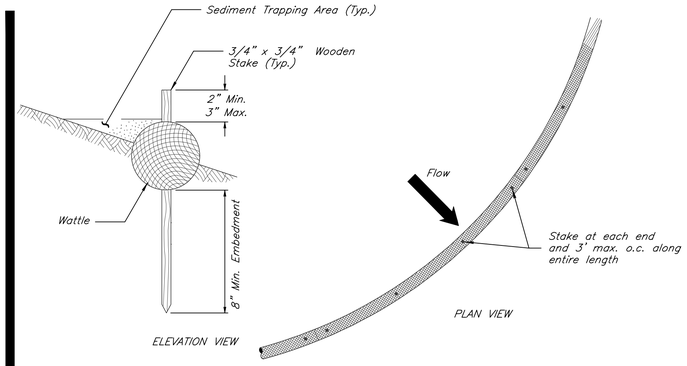
SHEET TITLE

Hardscaping Plan

SHEET NUMBER
19

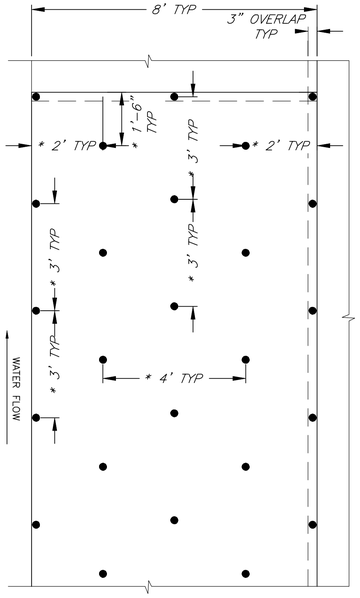


NOTES

1. Install wattles where shown on plan.
2. Wattles shall be inspected regularly, and immediately after a runoff producing rainfall, to ensure they remain thoroughly entrenched and in contact with the soil.
3. When sediment fills the area behind the wattles to 1/2 the height of the wattles, the Contractor shall remove the sediment.
4. Install wattles snugly into the trench. Abut adjacent Wattles tightly, end to end, without overlapping the ends.
5. Pilot holes may be driven through the Wattle and into the soil, when soil conditions require.
6. After final seeding stakes shall be installed every three feet on bench wattles.
7. Wattles shall be removed once vegetation establishes to 70% density.

WATTLE INSTALLATION

Not to Scale



TYP. ECB OVERLAP PATTERN

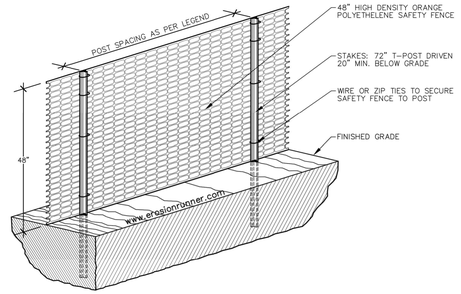
Not to Scale

PERIMETER AND TREE PROTECTION TEMPORARY FENCING

48" Safety Fence, 72" T-Posts

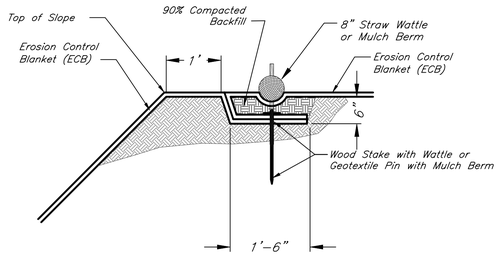
LEGEND

SAF12	48" ORANGE FENCE, 12 FEET O.C.
SAF11	48" ORANGE FENCE, 11 FEET O.C..
SAF10	48" ORANGE FENCE, 10 FEET O.C.
SAF9	48" ORANGE FENCE, 9 FEET O.C.
SAF8	48" ORANGE FENCE, 8 FEET O.C..
SAF7	48" ORANGE FENCE, 7 FEET O.C.
SAF6	48" ORANGE FENCE, 6 FEET O.C.



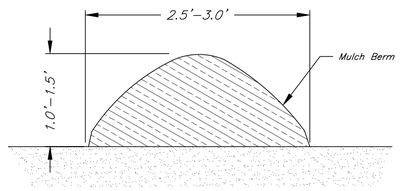
www.erosionrunner.com

1. ALL SENSITIVE AREAS SHALL BE PROTECTED AS PER PLAN.
2. ALL TREES IN THE CONSTRUCTION AREA NOT SPECIFICALLY DESIGNATED FOR REMOVAL SHALL BE PRESERVED AND PROTECTED WITH HIGH VISIBILITY FENCE AS PER PLAN.
3. WHEN PRACTICABLE, INSTALL HIGH VISIBILITY 3 FEET OUTSIDE OF THE DRIP LINE OF THE TREE.
4. SAFETY FENCE SHOULD BE FASTENED SECURELY TO THE T-POSTS.
5. THE FENCING MUST REMAIN IN PLACE DURING ALL PHASES OF CONSTRUCTION; ANY CHANGE OF THE PROTECTIVE FENCING MUST BE APPROVED.

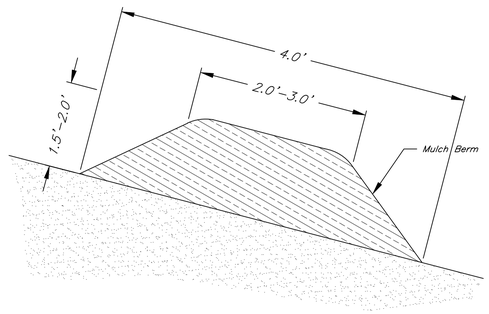


TYP. ECB TOP OF BANK ANCHORING SYSTEM

Not to Scale



MULCH BERM
CROSS SECTION

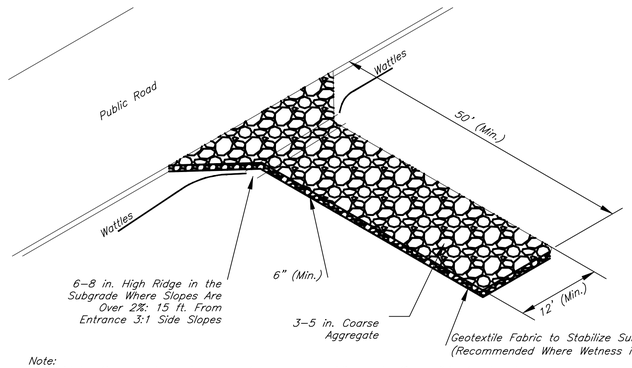


TRAPEZOIDAL MULCH BERM
CROSS SECTION

1. The erosion control berm shall be placed, uncompacted in a windrow at locations shown on the plans or as directed by the Engineer. The mulch berm shall be parallel to the slope, or around the perimeter of other affected areas. A trapezoidal mulch berm maybe required for steep slopes or areas requiring maximum filtration as directed by the Engineer. Do not use mulch berms in any runoff channel. In extreme conditions a second berm shall be constructed on the slope as directed by the Engineer.
2. Place mulch berms on denuded areas as soon as possible. Temporary seeding shall be applied / established above the mulch berms when necessary for additional erosion control.
3. If sediment fills the area behind the mulch berm to 1/2 the height, the contractor shall remove the sediment and plugged mulch and reshape the berm with new mulch as needed to restore filtration properties.
4. If the berm is to be left as a permanent filter or part of the natural landscape, the berm may be seeded during application of permanent vegetation.

MULCH BERM

Not to Scale



Note:
1. Avoid locating on steep slopes or at curves on public roads. If possible, locate where permanent roads will eventually be constructed.
2. Remove all vegetation and other unsuitable material from the subgrade area, grade and crown for positive drainage.
3. If slope towards the road exceeds 2%, construct a 6-8 inch high ridge with 3:1 side slopes across the approach approximately 15 feet from the entrance to divert runoff away from public road.
4. Aggregate size shall be 3-5 inch wash stone
5. Pad design thickness 6 inches minimum. Width – 12 feet minimum or full width roadway, whichever is greater. Length – 50 feet minimum.
6. Washing Facility (Optional): Level area with minimum of 3 inches of washed stone.

TEMPORARY GRAVELCONSTRUCTION ENTRANCE

Not to Scale

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Rock Creek Channel Improvements

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REVISION

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DATE
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PDM, MLG, ACL

DRAWN
ACL

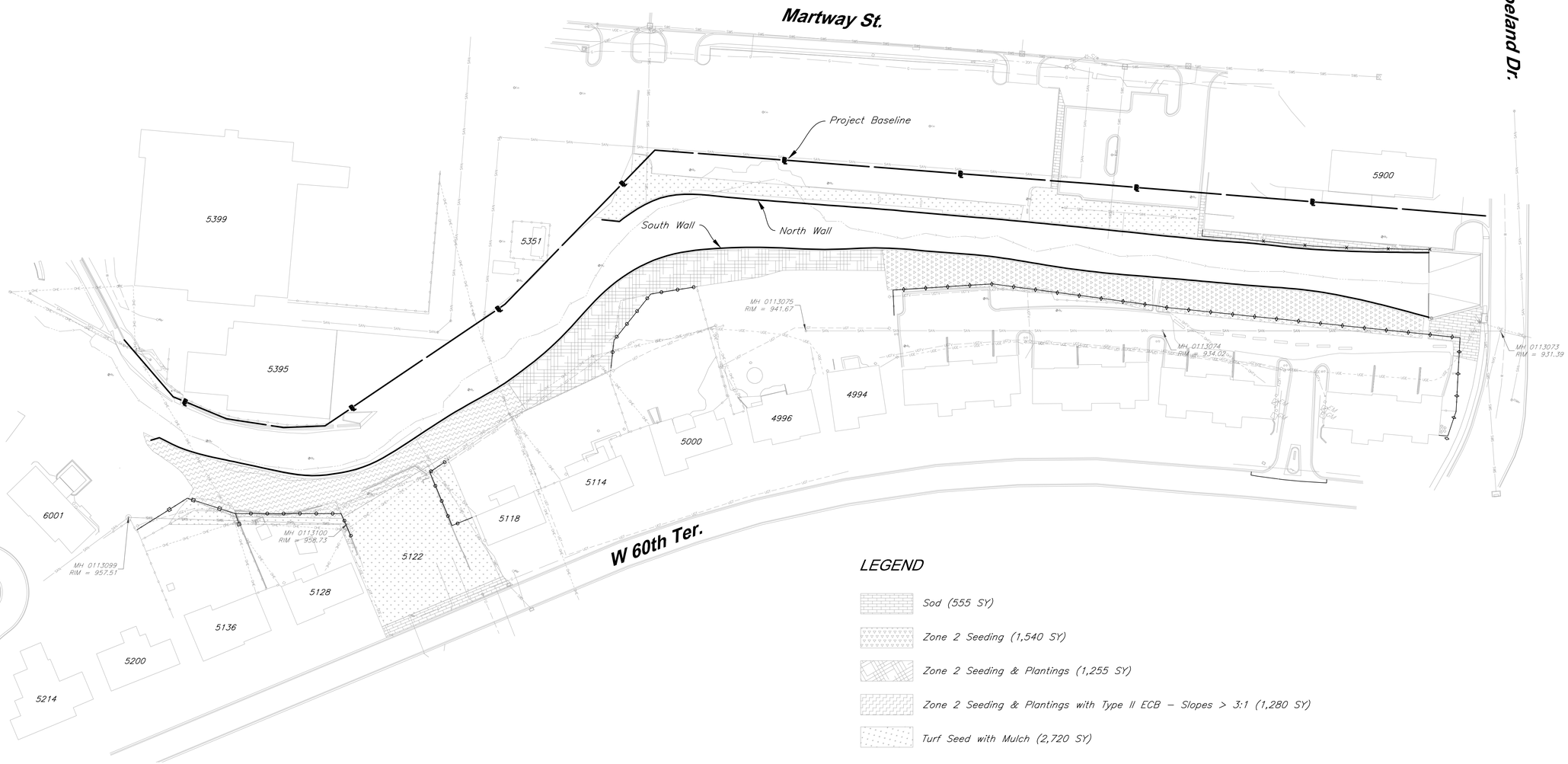
REVIEWED
PDM

SHEET TITLE

Civil Details

SHEET NUMBER

20



LEGEND

- Sod (555 SY)
- Zone 2 Seeding (1,540 SY)
- Zone 2 Seeding & Plantings (1,255 SY)
- Zone 2 Seeding & Plantings with Type II ECB – Slopes > 3:1 (1,280 SY)
- Turf Seed with Mulch (2,720 SY)
- Construct 6' Wood Fence (645 LF)
- Construct 4' Chainlink Fence (340 LF)
- Construct 4' Black Chainlink Fence (210 LF)
- Reset 6' Wood Fence (115 LF)

RESTORATION NOTES

Restored slopes exceeding 3H:1V shall be protected with Curlex II Fibrenet Erosion Control Blanket. The ECB application area is primarily limited to that above Wall D shown on the restoration plan.

Disturbance areas in City right-of-way shall be sodded.

50' 0' 50' 100'

SCALE : 1 INCH = 50 FEET

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Rock Creek Channel Improvements

City of Mission, Kansas

DOUGLAS A. ECKERT 16506 2-17-2020 KANSAS PROFESSIONAL ENGINEER

REVISION

Conceptual – 9/23/2019

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DRAWN
ACL

REVIEWED
PDM

SHEET TITLE

Turf Restoration

SHEET NUMBER

21

NATIVE SEEDING AND RESTORATION PLANTINGS

SUBMITTALS

The Contractor shall provide certifications or shop drawings on all materials prior to commencing with the native seeding and restoration operation. Work done prior to the Engineer's review of the submittals will be considered unacceptable and shall be removed at the sole cost of the Contractor. Submittals should include:

Native Seed: All producer native seed tags and component native seed analysis certificate shall be submitted to the Engineer for acceptance. The native seed mix certificate shall include the following information: Date of Harvest, Mo. & Yr. Date of Harvest; Location of Harvest (Gen. Area); Genus species Identification; Common Name; Seed Lot #; Packaged Quantity (Bulk); Identification of Seed Supplier; Supplier Certification Number; State of Supplier Registration; Percent PLS Per Seed Lot; Percent Germination; Percent Hard Seed; Percent Foreign Matter (Inert); Percent Weed Seed; I.D. & % of Noxious Weed Seed; Date of Seed Testing; and Identification of Seed Testing Company. Any species substitutions by the Contractor shall be approved by the Engineer.

Vegetative Mulch: A weight certificate or delivery ticket for each load of vegetative mulch to be used shall be submitted to the Engineer. The certificate shall be used to verify application rates.

Wood Cellulose Fiber Mulch: A full product fact sheet from the manufacturer shall be submitted to the Engineer for acceptance.

Native Plantings: Tree / shrub producer's name and address and a certificate of inspection substantiating materials comply with specified requirements shall be submitted. The native planting certificate shall include the following information: Date of Harvest; Location of Harvest (Gen. Area); Genus species Identification; Common Name; Caliper/Size; Supplier Name & Address; and State of Supplier Registration. Any species substitutions by the Contractor shall be approved by the Engineer. The Engineer reserves the right to inspect tree and shrub plantings at the place of growth for compliance with type and quality. Note: hybridized and cultivar species are not acceptable and will be rejected by the Engineer.

Fertilizer: Product specification sheets from the fertilizer manufacturers shall be submitted to the Engineer for acceptance.

Mycorrhizal Inoculant: Product specification sheets from the mycorrhizal manufacturers shall be submitted to the Engineer for acceptance.

Herbicide: A product specification sheet from the herbicide manufacturer shall be submitted to the Engineer for acceptance.

Plant Shelter: A product specification sheet from the plant shelter manufacturer shall be submitted to the Engineer for acceptance.
Imported Topsoil: If imported topsoil is necessary, a product specification sheet shall be submitted to the Engineer for acceptance.

SOIL PREPARATION

If present, eliminate all existing herbaceous plant materials within disturbance zone by applying a post-emergent herbicide per manufacturer's instruction. Repeat application as required to attain herbicide effectiveness. Follow manufacturer's instruction regarding the wait period necessary before the soil inoculants, native seeding and plantings can be installed. A post-emergent herbicide shall be provided as an individual or combination of chemicals rated for environmental use in and around water. The herbicide shall be delivered to the jobsite in the original manufacturer's container bearing the EPA-registered label.

Prior to finish grading and tilling, the Contractor shall restore the topsoil on the excavated areas to a depth of 6". The existing topsoil shall be replaced with 1) existing topsoil placed in a segregated stockpile prior to excavations or 2) imported topsoil from a suitable location.

When the topsoil is placed for use, it shall be free from tree roots, clay balls, 1-inch diameter and greater stones, and other materials that hinder grading, planting, and maintenance operations and shall be free from noxious and other objectionable weed seeds and toxic substances. Imported topsoil shall be a loamy mixture having at least 90 percent passing the No. 10 sieve, contain not less than 3.0 percent organic matter, contain not less than 12 percent clay and not exceed 55 percent sand. The pH of the sample shall not be lower than 5.0 or higher than 8.0. The pH shall be determined with a calibrated pH meter, on that portion of the sample passing the No. 10 sieve in accordance with the "Suggested Methods of Test for Hydrogen Ion Concentration (pH) of Soils" included in the procedures for Testing Soil issued in 1970, by ASTM.

The Contractor shall finish grade the restoration areas to lines and grades shown on the Drawings, or if not shown, to those which existed prior to the area being disturbed. Special attention shall be directed to assure proper surface drainage. The area shall be smoothed by raking or dragging. Before disking or harrowing the soil, the fertilizer with mycorrhizae shall be distributed uniformly at the rate defined in the plan documents. Incorporate into the soil to a depth of at least 2-inches by disking or harrowing methods. Fertilizer rate is equivalent to 50 pounds per 1,000 square feet. The surface shall be tilled to a depth of at least 2-inches by disking, harrowing or other approved methods until the topsoil is suitable for seeding. The seed bed shall be free from all rock (1-inch and larger in diameter), tree roots and limbs, clay balls, construction debris, weeds and trash. Areas tilled shall be maintained until seeding and mulching is complete to insure a smooth area with no gullies or depressions. Approval of the seed bed shall be obtained from the Engineer before seeding is started.

Fertilizer for native seeding shall consist of a controlled release, 5-3-1 (Nitrogen, Phosphate, Potassium) mixture with 1.00% soil penetrant and mycorrhizae added, uniform in composition free flowing and suitable for application with approved equipment, delivered to the site in convenient containers, each fully labeled, conforming to the applicable state fertilizer laws, bearing the name, trade mark, or trade name, and a warranty of the producer.

The planting fertilizer in tablet form shall be organic 12-8-8 controlled release fertilizer with no less than 20% humus, provided in, delivered to the site in convenient containers, each fully labeled, conforming to applicable state fertilizer laws, bearing the name, trade name, or trademark and warranty of the producer. During installation of containerized plantings, uniformly mix soil backfill with planting fertilizer at a rate of 1 tablet for tubelings and 3 tablets for 3 gallon plantings

The planting mycorrhizal inoculant in granular form shall have the minimum active ingredient of endomycorrhizal (am) fungi (Glomus intraradices) at 6,810 spores per pound. During installation of the containerized and bareroot plantings, apply mycorrhizal inoculant at the bottom of the hole and directly to the lower half of plant roots at a rate of ½ cup for tubelings, ¼ cup for 3 gallon, and 1/8 cup for bare root plantings.

The Contractor shall utilize a seed drill designed and equipped to handle the fluffy seed of native grass species and ensure accurate placement to a depth that will not inhibit emergence. The implement shall be capable of calibration, and the Contractor shall field demonstrate the accuracy of the field implement in placing the specified quantity of native seed. On small areas and areas too steep for the safe operation of conventional seeding equipment, the Contractor may use hydraulic seeders or by broadcasting with hand raking. Immediately following the completion of native seed placement, the entire area shall be compacted by means of a cultipacker implement to provide no less than 90 pounds of weight per lineal foot of implement width.

The native seeding and plantings shall be coordinated with the installation of rolled erosion control products such as erosion control blankets and turf reinforcement mats. In areas where rolled erosion control products shall be used, mulch will not be required; however, phased topsoil placement shall be necessary.

Mulch may be either the vegetative type or wood cellulose fiber type. The vegetative type shall be the cereal straw from stalks of oats, rye, wheat or barley and shall be free of prohibited and noxious weed seeds. Wood cellulose fiber shall contain no germination or growth inhibiting ingredients and shall be dyed an appropriate color to aid in visual metering in its application. It shall be easily and evenly dispersed and suspended when agitated in water, and when sprayed uniformly on the soil surface, shall form a blotterlike cover, which readily absorbs the water and allows infiltration to the underlying soil. The mulch material shall be supplied in packages of not more than 100 pounds gross weight and shall be marked by the manufacturer to show the air dry weight content. (Air dry weight shall contain no more than 10 per cent moisture). Mulching shall be done within 24 hours following the native seeding operation except in the case of wood cellulose fiber type mulch. After compaction of the surface, mulch shall be uniformly spread at the rate of two (2) tons per acre by means of a mechanical spreader or other approved means. As soon as the mulch is spread it shall be anchored to the soil a minimum depth of 1.5-inches by use of a mulch crimper, set nearly straight, or a similar approved implement. Discs of the anchoring tool shall be set approximately 9-inches apart. Anchoring shall be accomplished by not more than two passes of the implement.

Wood chip mulch shall surround each Zone 2 planting at a 1-foot radius to a depth of 3-inches to help retain moisture and reduce weed growth. Keep wood mulch away from tree or shrub stems to prevent stem decay and pest problems.

NATIVE SEEDING AND PLANTINGS

All work shall be performed by a native restoration Contractor regularly engaged in restoration work,and having personnel who are experienced and qualified in the work required. The work shall not be started until all construction and testing, finish grading, and topsoil placement has been completed and access to the work area(s) is no longer required by the Contractor. Once started, the work shall continue in an expeditious manner until complete. When conditions delay native seeding or restoration plantings, erosion control measures shall be enacted to prevent soil erosion by runoff or wind carry. Native seeding and/or restoration planting shall be completed only as the weather and installation periods permit. Dormant seeding and planting operations shall not be permitted when the ground surface is frozen.

The native seeding operation shall be accomplished with equipment suitable for herbicide spraying, preparing the seed bed, sowing the seed, soil inoculation, spreading the vegetative type mulch, spreading the emulsion type mulch, or spreading the wood cellulose fiber mulch. Equipment necessary for the proper preparation of the ground surface and for handling and placing all required materials shall be of a size appropriate for the areas to be work, on hand, and in good condition. On small areas and areas too steep for the safe operation of conventional seeding equipment, the Contractor may use hydraulic seeders or by broadcasting with hand raking.

All native seeding and restoration planting work shall be completed during the following time periods:

Timing of Native Seeding and Planting

Product	Month											
	J	F	M	A	M	J	J	A	S	O	N	D
Native Seed (Normal)												
Native Seed (Fall and Dormant)												
Plantings - 3 gallon / Tubelings												
Plantings - Bareroot / Branch Cuttings												

▩ - optimum period
▨ - acceptable period

Zones: The following zones will be used for defining appropriate locations for native seed, shrubs, and trees and shall be identified on the Drawings.
Zone 2 is defined as riparian and woodland areas.

Native seeds shall comply with the requirements of the applicable state seed laws. Seeds shall be free of prohibited weed seeds and the completed mix shall not have more than 1 percent total of other weed seeds. Seeds shall be delivered to the site in convenient containers, each fully labeled, bearing the name, trade name, or trade mark, and a warranty of the producer and a certificate of the percentage of the purity and germination of each kind of seed specified. Native seeds shall be from local Midwest origin. The native seeding mixtures and the rate of placing pure live seed shall be as specified on the Drawings.

The following formula shall be used to determine the amount of commercial seed required to provide each kind of seed for the specified quantities of pure live seeds:

Pounds of Seed Required = 10,000 x Pure Live Seed (lbs. per acre) / Purity (Percent) x Germination (Percent)

All plant material shall be fully protected from wind and sun desiccation during transport (tarps, protective boxes, caps, etc.). Upon arrival at the planting site and prior to planting, plants shall be temporarily stored in a cool, shaded (dark), and wind-protected areas. Plants shall be protected from heat buildup; sun, air, and wind desiccation; freezing; and animal predation at all times. The roots should be kept cool and moist to prevent desiccation and maintain good plant health until they are installed. All plants shall be handled so as to eliminate potential stress or injury. All native plant material shall be healthy, vigorous, and free from any signs of insect, disease, mechanical injury, or signs of environmental or other stress. Plant roots shall be firm and moist with light-colored root tips. Native tree and shrub species and plant size shall be those specified on the Drawings.

Hand excavate or auger a hole to the dimensions shown in the plan documents. The width of the hole should be at least three (3) times the diameter of the container. When digging in poorly drained clay soil, it is important to avoid 'glazing'. Glazing occurs when the sides and bottom of a hole become smoothed forming a barrier, through which water has difficulty passing. To break up the glaze, use a fork to work the bottom and drag the points along the sides of the completed hole. Remove plant from container and check the roots. If the roots are tightly compressed or 'potbound', use fingers or a blunt instrument (to minimize root tearing) to carefully tease the fine roots away from the tight mass and then spread the roots prior to planting. In the case of extremely woody compacted roots, it may be necessary to use a spade to open up the bottom half of the root system. The root system is then pulled apart or "butterflied" prior to planting. Loosening the root structure in this way is extremely important in the case of container plants. Failure to do so may result in the roots 'girdling' and killing the tree. Place plant into hole in an upright, straight position. Incorporate required quantity of specified fertilizer and mycorrhizal inoculant with existing topsoil backfill. Tamp as necessary to minimize settling. Ensure that plant identification tag remains on specimen. Attach a short piece of visible survey tape to the tree or shrub to facilitate future inspection of the plants.

Trees shall be installed on 20 foot centers and shrubs shall be installed on 10 foot centers. Zone 2 planting density is approximately 3 trees and 9 shrubs per 100 square yards.

Water used in this work shall be furnished by the Contractor and will be suitable for irrigation and free from ingredients harmful to plant life. All watering equipment required for the work shall be furnished by the Contractor. Water from adjacent fire hydrants or public water lines shall be metered. Written approval from the property owner shall be obtained prior to the use of suitable water from ponds or creeks. Seeded areas completed during the normal seeding period shall be thoroughly watered within 24 hours from rainfall and/or supplemental water provided by the Contractor. All seeded areas shall be kept thoroughly watered by the Contractor as required to achieve three healthy specified native grass plants per square foot one calendar year after acceptance. All seeded areas shall be maintained until acceptance. Maintenance shall include repair of erosion damage, reseeding, maintenance of erosion control material, and watering.

Plantings shall be immediately watered at the time of installation. In addition, during the first growing season, they should be watered at least once a week in the absence of rain, more often during the height of the summer. Regular deep soakings are better than frequent light wettings. Moisture should reach a depth of 12 to 18 inches below the soil surface to encourage ideal root growth. Maintain watering as required to achieve required survivability.

The Contractor shall restore the project site to conditions equal to or better than those existing prior to entry. The Contractor shall maintain adequate safety signs, barricades and lights until final restoration of work area is completed. Excess material shall be removed from the site including material which has washed in the stream beds, storm water facilities, streets, etc. Restore surface and sub-surface drainage and provide temporary wash checks where necessary. Remove all rock (1-inch and larger in diameter), tree roots and limbs, clay balls, construction debris, weeds and trash.

The native seeded area shall be kept free of traffic until accepted. If at any time before acceptance by the Engineer, any portion of the seeded surface becomes gulled or otherwise damaged, or the seeding has been damaged or destroyed by the Contractor's operations, the affected portion shall be repaired to re-establish the specified condition prior to the acceptance of the work. The Contractor shall notify the property owner prior to beginning the seeding operation. The Owner shall be notified immediately of any damage to the restored areas by other parties.

All planted areas shall be kept thoroughly watered by the Contractor as required to achieve a survivability rate of 80% one calendar year after acceptance. The Contractor shall be fully responsible for the condition of the restoration work for one calendar year after acceptance or until written notification that his obligation to maintain the plantings is terminated.

The Contractor shall unconditionally guarantee the following: For one calendar year after acceptance, no less than 3 healthy specified native grass plants per square foot within each of the restoration zones. As a minimum requirement, all native seeded areas must be equal to or better than adjacent, undisturbed areas. For two growing seasons (spring to fall) after acceptance, a native planting survival rate of no less than 80% within each of the restoration zones.

The Contractor shall be responsible for maintaining the installed turf grass seed and sod until all areas are complete and accepted by the Owner. Maintenance of sodded areas shall include watering, weeding, mowing to a 2½ inch height after growth has exceeded 3 inches and prior to a 4 inch growth, replacement and installation of sod as originally specified for sodded areas failing to survive, and repair of rutting, should that occur. Clippings from mowing which mat on the grass are to be removed.

The Contractor shall guarantee all vegetative restoration work and materials (including all landscaping trees, seeded and sodded areas) and for a period of one full growing season (Spring to Fall) after the date of final acceptance of the project. During the guarantee period, all turf which dies or exhibits weed growth or undesirable grasses, free of eroded areas, bare spots, diseases and insects, shall be replaced with like material at the expense of the Contractor. Contractor to replace as originally specified areas which have failed to survive, as often as required, to establish the seeded/sodded lawn area until accepted, at no additional compensation. Contractor to repair and replace to original condition all damages to property resultant from the sodding operation and all damages as a result from the remedying of these defects, without additional compensation.

Zone 2 – Native Plantings for Riparian / Woodland Restoration:

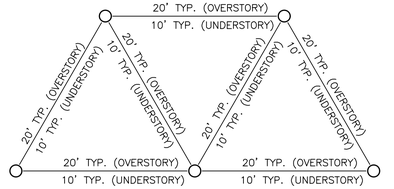
Scientific Name	Common Name	Plant Size (gallon)	Type
Celtis occidentalis	Hackberry	3	Tree
Aesculus glabra	Ohio Buckeye	3	Tree
Quercus macrocarpa	Bur Oak	3	Tree
Quercus rubra	Northern Red Oak	3	Tree
Juglans nigra	Black Walnut	3	Tree
Cercis canadensis	Eastern Redbud	3	Shrub
Cornus drummondii	Rough-leaf Dogwood	3	Shrub
Amelanchier arborea	Serviceberry	3	Shrub
Viburnum prunifolium	Blackhaw	3	Shrub

Notes:
1. The Contractor shall provide and install native plantings per the technical project specifications and at the specified locations on the Drawings.
2. No species substitutions or altering planting sizes without Engineer and/or Owner approval.
3. Select no less than 3 species of trees and no less than 3 species of shrubs.
4. Trees shall be installed on 20 foot centers and shrubs shall be installed on 10 foot centers. Zone 2 planting density is approximately 3 trees and 9 shrubs per 100 square yards. Per the plant spacing detail, an estimated 96 trees and 288 shrubs are anticipated to be installed within Zone 2. The Contractor is responsible for determining the final quantity of plantings required.

Zone 2 - Native Seed Mix for Riparian / Woodland Restoration:

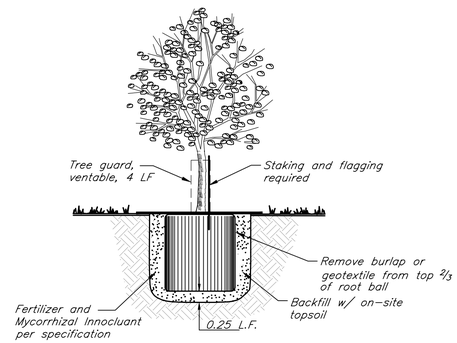
Scientific Name	Common Name	# Pure Live Seed / Acre
Elymus canadensis	Canada Wild-Rye	20
Elymus virginicus	Virginia Wild-Rye	4
Panicum virgatum	Switchgrass	2
Bromus pubescens	Hairy Woodland Brome	4
Rudbeckia subtomentosa	Sweet Coneflower	0.2
Penstemon digitalis	Foxglove Beardtongue	0.2
Solidago speciosa	Showy Goldenrod	0.2
Avena sativa	Common Oats (Temporary Cover – Normal Only)	30
Triticum aestivum	Regreen Sterile Wheat (Temporary Cover – Fall and Dormant Only)	20

Notes:
1. The Contractor shall provide and install native seed per the technical project specifications and at the specified locations on the Drawings.
2. No species substitutions or altering PLS seeding rates without Engineer and/or Owner approval.



ZONE 2 TYP. PLANT SPACING DETAIL

Not to Scale



TYP. NATIVE TREE / SHRUB PLANTING DETAIL

Not to scale

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Rock Creek Channel Improvements

City of Mission, Kansas

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Preliminary 50% – 10/10/2019

Preliminary 90% – 12/17/2019

Final – 2/6/2020

Bid Set – 2/17/2020

PROJECT NUMBER
14321.00

DATE
2/17/2020

DESIGNED
PDM, MLG, ACL
DRAWN
ACL
REVIEWED
PDM

SHEET TITLE

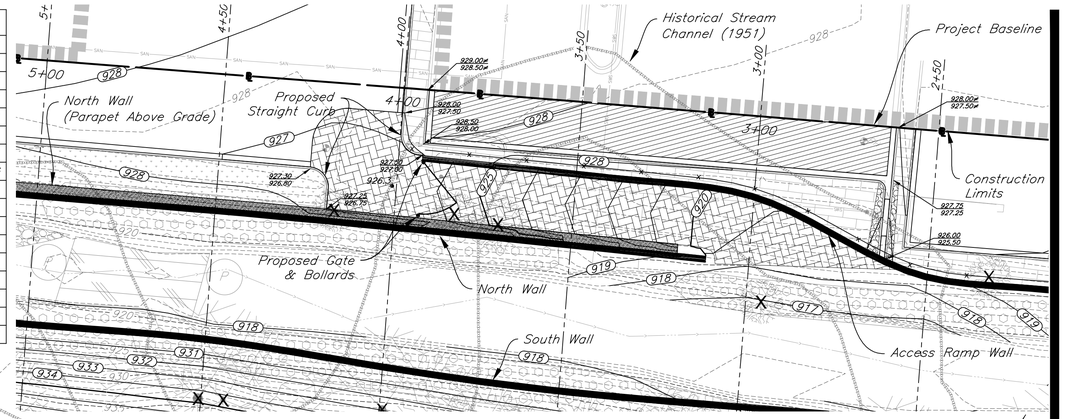
Restoration Details

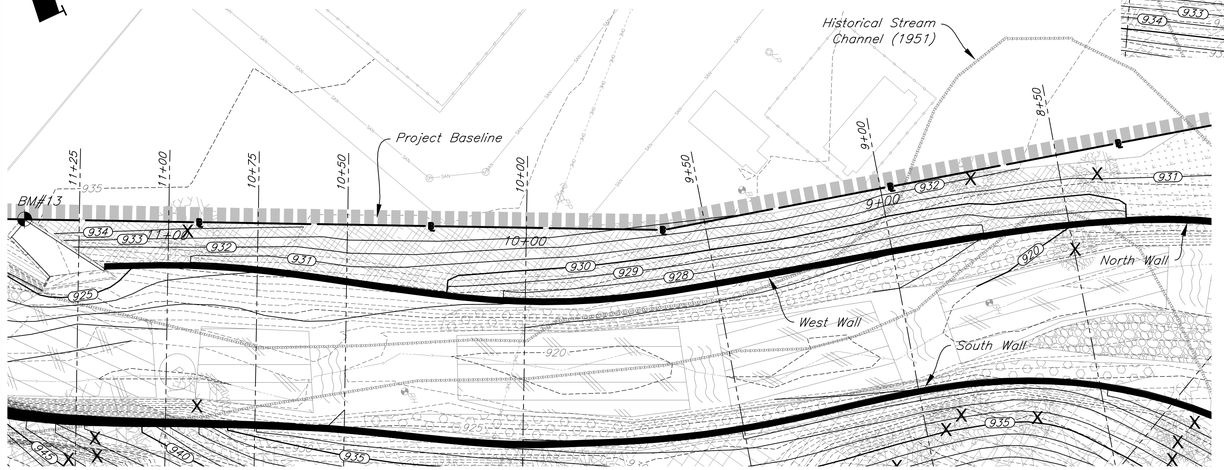
SHEET NUMBER

22

Bid Alternate 2- West Wall Extension - Quantities		
4' Temporary Construction Fencing & Tree Protection	350	LF
Vegetation Clearing and Grubbing	0.1	Ac
Excavation	2,020	CY
Compacted Fill (On site soils)	460	CY
Haul Off Unsuitable Soil	1,560	CY
4" Underdrain	290	LF
Granular Backfill	390	CY
Big Block Retaining Wall	2,856	SFF
Imported Topsoil	90	CY
Zone 2 Native Seeding w Plantings	525	SY

Bid Alternate 1 - Access Ramp Quantities		
Remove & Dispose 6" Asphalt	1,710	SF
Remove & Dispose Concrete Curb & Gutter	315	SF
Excavation	380	CY
Compacted Fill (On site soils)	-100	CY
Haul Off Unsuitable Soil	480	CY
4" Underdrain	85	LF
Granular Backfill	0	CY
Big Block Retaining Wall	294	SFF
Pervious Pavement	330	SY
Concrete Flume	60	SF
Concrete Curb and Gutter	155	LF
Type 1 Asphalt Paving	191	SY
14' Gate & Bollards	1	LS
48" Chain Link Fence	140	LF
Imported Topsoil	-60	CY
Mulching / Seeding	-465	SY
Sod	95	SY





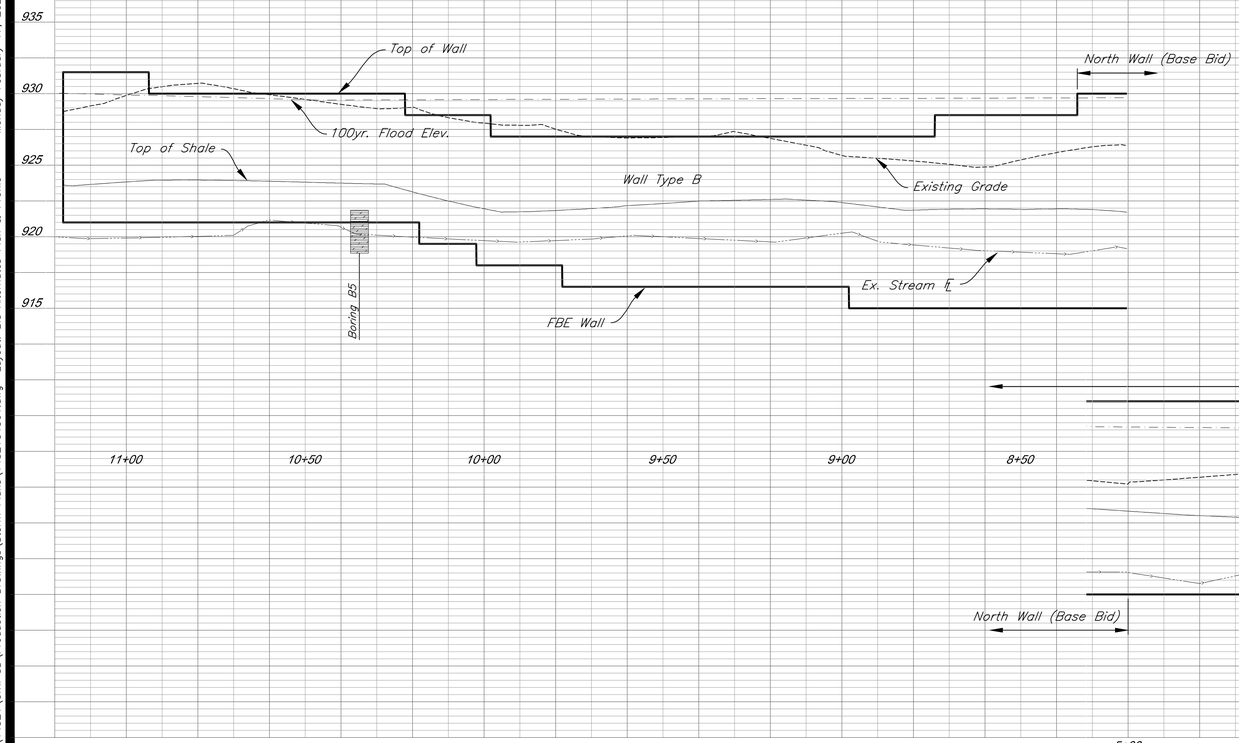
LEGEND

- Type 1 Pavement Replacement
- Pervious Pavement
- Type CG-1 Straight Back Curb & Gutter
- Type C-1 Straight Curb
- Concrete Flume
- Salvaged Riprap
- Sod
- Zone 2 Seeding & Plantings
- Construct 4' Black Chainlink Fence

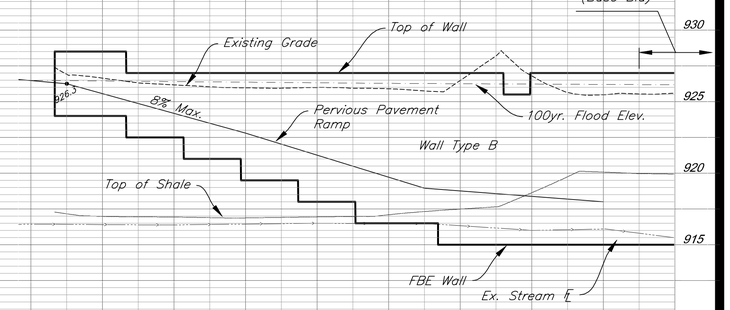
946.80 Proposed Top of Curb
946.30 Proposed Gutter
946.80≠ Match Existing

Horizontal Scale: 1" = 20'
Vertical Scale: 1" = 5'

West Wall (Bid Alternate #2)

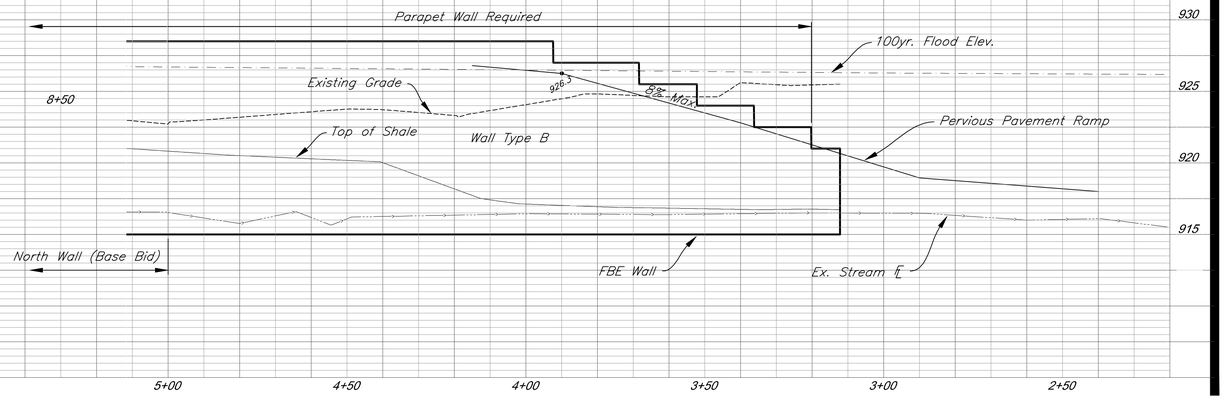


Access Ramp Wall (Bid Alternate #1)



NOTE: Profile Stationing is Based on the Project Baseline.

North Wall (Bid Alternate #1)



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DRAWN
ACL

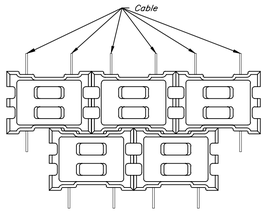
REVIEWED
PDM

SHEET TITLE

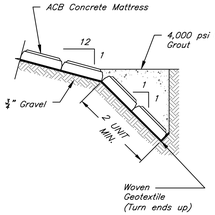
Bid Alternates Plan & Profile

SHEET NUMBER

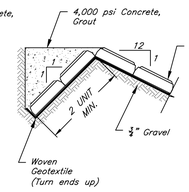
23



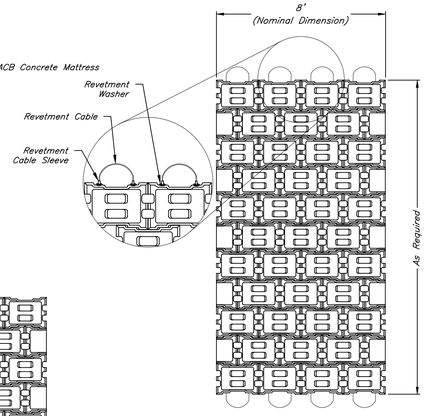
PLAN



TOE TERMINATION
Not to Scale



TOP TERMINATION
Not to Scale



TYP. 50 MAT
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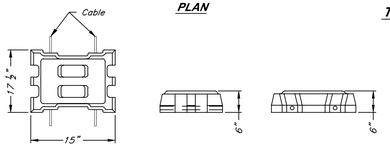
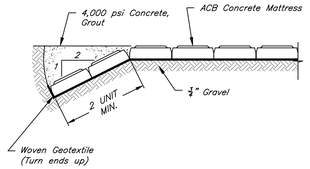


TYP. 50 BLOCK
Not to Scale



FLANK TERMINATION
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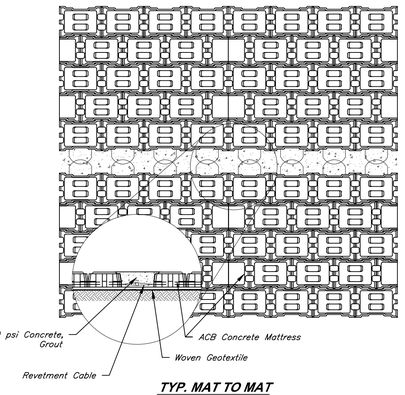
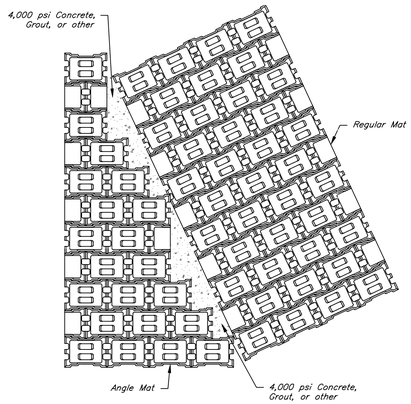


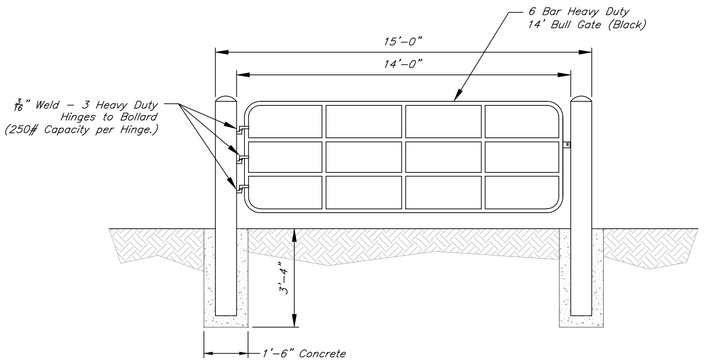
TYP. MAT TO MAT
Not to Scale



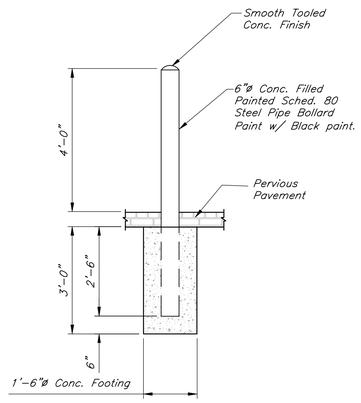
NOTE:
Angle mats will be constructed by omitting the required units so the required mat dimensions can be obtained.

TYP. ANGLE MAT
Not to Scale

ARTICULATING CONCRETE BLOCK (ACB) SYSTEM



ACCESS GATE DETAIL
Not to Scale



BOLLARD DETAILS
Not to Scale

Materials

Articulating Concrete Block (ACB) components shown on the plans were laid out utilizing the Armortech Open Block Class 50 System by Contech. Base bid prices should include the Armoretch Open Block Class 50, however, other ACB manufacturers may be considered by the Owner.

The Contractor shall furnish all labor, materials, equipment, and incidentals required for, and perform all operations in connection with, the installation of the pervious pavement mat system in accordance with the lines, grades, design and dimensions shown on the Contract Drawings and as specified herein.

The Contractor shall furnish manufacturer's certificates of compliance for ACB/mats, revetment cable, geotextile, and any revetment cable fittings and connectors. The Contractor shall also furnish the manufacturer's specifications, literature, preliminary shop drawings for the layout of the mats, installation and safety instructions, and any recommendations, if applicable, that are specifically related to the project.

All ACB mats shall be prefabricated as an assembly of concrete blocks having specific hydraulic capacities, and laced with revetment cables. Individual units in the system shall be staggered and interlocked for enhanced stability. The mats shall be constructed of open cell units. The open cell units have two (2) vertical openings of rectangular cross section with sufficient wall thickness to resist cracking during shipping and installation. Parallel strands of cable shall extend through a minimum of two (2) cable ducts in each block allowing for longitudinal binding of the units within a mat. Each row of units shall be laterally offset by one–half of a block width from the adjacent row so that any given block is cabled to four other blocks (two in the row above and two in the row below).

Each block shall incorporate interlocking surfaces that minimize lateral displacement of the blocks within the mats when they are lifted by the longitudinal revetment cables. The interlocking surfaces must not protrude beyond the perimeter of the blocks to such an extent that they reduce the flexibility or articulation capability of the ACB mats or become damaged or broken when the mats are lifted during shipment or placement. Once the mats are in place, the interlocking surfaces shall minimize the lateral displacement of the blocks even if the cables should become damaged or removed. The mats must be able to flex a minimum of 18° between any given row or column of blocks in the uplift direction and 45° in the downward direction. The cables inserted into the mats shall form lifting loops at one end of the mat with the corresponding cable ends spliced together to form a lifting loop at the other end of the mat. The cables shall be inserted after sufficient time has been allowed for the concrete to complete the curing process.

The ACB mats shall be placed on a woven geotextile fabric as specified herein. Under no circumstances shall the gotextile fabric be permanently affixed or otherwise adhered to the blocks or mats; i.e., the geotextile fabric shall be independent of the block system. The geotextile fabric shall be Mirafi Filterweave 402 Series or approved equal. The geotextile shall be a woven fabric with a minimum grab tensile strength of 350 pounds, minimum percent open area of 10%, and opening size of 40mm.

At the time of delivery to the work site, the ACB units shall conform to the following physical requirements:

Minimum Compressive Strength per unit – 3,500 lb/in²
Maximum per unit Absorbtion – 11.7 lb/ft³

Units will be sampled and tested in accordance with ASTM D 6684, Standard Specification for Materials and Manufacture of Articulating Concrete Block (ACB) Revetment Systems.

All units shall be sound and free of defects which would interfere with the proper placement of the unit, or which would impair the performance of the system. Surface cracks incidental to the usual methods of manufacture, or surface chipping resulting from customary methods of handling in shipment and delivery, shall not be deemed grounds for rejection. Cracks exceeding 0.25 inches (.635 cm) in width and/or 1.0 inch (2.54 cm) in depth shall be deemed grounds for rejection. Chipping resulting in a weight loss exceeding 10% of the average weight of a concrete unit shall be deemed grounds for rejection. Blocks rejected prior to delivery from the point of manufacture shall be replaced at the manufacturer's expense. Blocks rejected at the job site shall be repaired with structural grout or replaced upon request at the expense of the contractor.

Revetment cable shall be constructed of preformed galvanized aircraft cable (GAC). The cables shall be made from individual wires and strands that have been formed during the manufacture into the shape they have in finished cable. Cable shall consist of a core construction comprised of multi wire strands. The size of the revetment cable shall be selected such that the minimum acceptable strength is at least five (5) times that required for lifting of the mats. The revetment cable shall exhibit resistance to mild concentrations of acids, alkalis, and solvents. Fittings such as sleeves and stops shall be aluminum, and the washers shall be galvanized steel or plastic. Furthermore, depending on material availability, the cable type can be interchanged while always ensuring the required factor of safety for the cable. Selection of cable and fittings shall be made in a manner that ensures a safe design factor for mats being lifted from both ends, thereby forming a catenary. Consideration shall be taken for the bending of the cables around hooks or pins during lifting. Revetment cable splicing fittings shall be selected so that the resultant splice shall provide a minimum of 75% of the minimum rated cable strength.

Execution

All subgrade preparation shall be performed in accordance with the current version of ASTM D 6884, Standard Practice for Installation of Articulating Concrete Block (ACB) Revetment Systems. The slope shall be graded to a smooth plane surface to ensure that intimate contact is achieved between the slope face and the geotextile (filter fabric), and between the geotextile and the entire bottom surface of the individual ACBs. All slope deformities, roots, grade stakes, and stones which project normal to the local slope face must be re–graded or removed. No holes, "pockmarks", slope board teeth marks, footprints, or other voids greater than 1 inch in depth normal to the local slope face shall be permitted. No grooves or depressions greater than 1 inch in depth normal to the local slope face with a dimension exceeding 1.0 foot in any direction shall be permitted. Where such areas are evident, they shall be brought to grade by placing compacted homogeneous material. Excavation and preparation for all termination trenches or aprons shall be done in accordance to the lines, grades and dimensions shown in the Drawings. The termination trench hinge–point at the top of the slope shall be uniformly graded so that no dips or bumps greater than 1 inch over or under the local grade occur. The width of the termination trench hinge–point shall also be graded uniformly to assure intimate contact between all ACBs and the underlying grade at the hinge–point. Immediately prior to placing the filter fabric and ACB mats, the prepared subgrade shall be inspected by the Engineer. No fabric or blocks shall be placed thereon until that area has been approved by each of these parties.

All placement and preparation should be performed in accordance with the current version of ASTM D 6884, Standard Practice for Installation of Articulating Concrete Block (ACB) Revetment Systems. Filter Fabric, or filtration geotextile, as specified elsewhere, will be placed within the limits of ACBs shown on the Drawings. The filtration geotextile will be placed directly on the prepared area, in intimate contact with the subgrade, and free of folds or wrinkles. The geotextile will not be walked on or disturbed when the result is a loss of intimate contact between the ACB and the geotextile or between the geotextile and the subgrade. The geotextile filter fabric will be placed so that the upstream strip of fabric overlaps the downstream strip. The longitudinal and transverse joints will be overlapped at least one and a half (1.5) feet for dry installations and at least three (3) feet for below–water installations. The geotextile will extend at least one (1) foot beyond the top and bottom revetment termination points. If ACBs are assembled and placed as large mattresses, the top lap edge of the geotextile should not occur in the same location as a space between ACB mats unless the space is concrete filled.

ACB placement and preparation should be performed in accordance with the current version of ASTM D 6884, Standard Practice for Installation of Articulating Concrete Block (ACB) Revetment Systems. ACB block/mats, as specified in Part 2:A of these Specifications, will be constructed within the specified lines and grades shown on the Drawings. Field installation shall be consistent with the way the system was installed in preparation for hydraulic testing pursuant to the current version of ASTM D 7277, Standard Test Method for Performance Testing of Articulating Concrete Block (ACB) Revetment Systems for Hydraulic Stability in Open Channel Flow. Any external restraints, anchors, or other ancillary components (such as synthetic drainage mediums) shall be employed as they were during testing; e.g., if the hydraulic testing installation utilized a drainage layer, then the field installation must also utilize a drainage layer. This does not preclude the use of other section components for other purposes, e.g., a geogrid for strengthening the subgrade for vehicular loading, or an intermediate filter layer of sand to protect very fine–grained native soils. The subgrade shall be prepared in such a manner as to produce a smooth plane surface prior to placement of the ACBs or mats. No individual block within the plane of placed ACBs will protrude more than 0.5 inches. ACBs should be flush and develop intimate contact with the subgrade section, as approved by the EOR. Proposed hand placing is only to be used in limited areas, specifically identified by the EOR or manufacturers' mat layout drawings, as approved by the EOR. If assembled and placed as large mattresses, the ACB mats will be attached to a spreader bar or other approved device to aid in the lifting and placing of the mats in their proper position. The equipment used should have adequate capacity to place the mats without bumping, dragging, tearing or otherwise damaging the underlying fabric. The mats will be placed side–by–side, so that the mats abut each other, and/or end–to–end. Mat seams or openings between mats greater than two (2) inches will be backfilled with 4000 p.s.i. non–shrink grout, concrete or other material approved by the EOR. Whether placed by hand or in large mattresses, distinct changes in grade that results in a discontinuous revetment surface in the direction of flow will require backfill at the grade change location so as to produce a continuous surface. Termination trenches will be backfilled and compacted flush with the top of the blocks. The integrity of the trench backfill must be maintained so as to ensure a surface that is flush with the top surface of the ACBs for its entire service life. Termination trenches will be backfilled as shown on the Drawings. Backfilling and compaction of trenches will be completed in a timely fashion. The cells or openings in the ACBs will be backfilled with ¾" gravel (KDOT BD–1 or approved equal).

Operations and Maintenance

All equipment and vehicles driving on the ACB shall have rubber tires or rubber tracks. If a steel tracked machine is to be driven on the ACB, temporary protection in the form of plywood or equivalent shall be placed atop the ACB system.

Maximum gross vehicular loading shall not exceed 40,000 pounds per vehicle.

Trees and other woody vegetation that takes root within the open cells shall be removed or cut to prevent cracking of ACBs.

Occasional mowing or brush cutting is recommended.

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PDM, MLG, ACL

DRAWN
ACL

REVIEWED
PDM

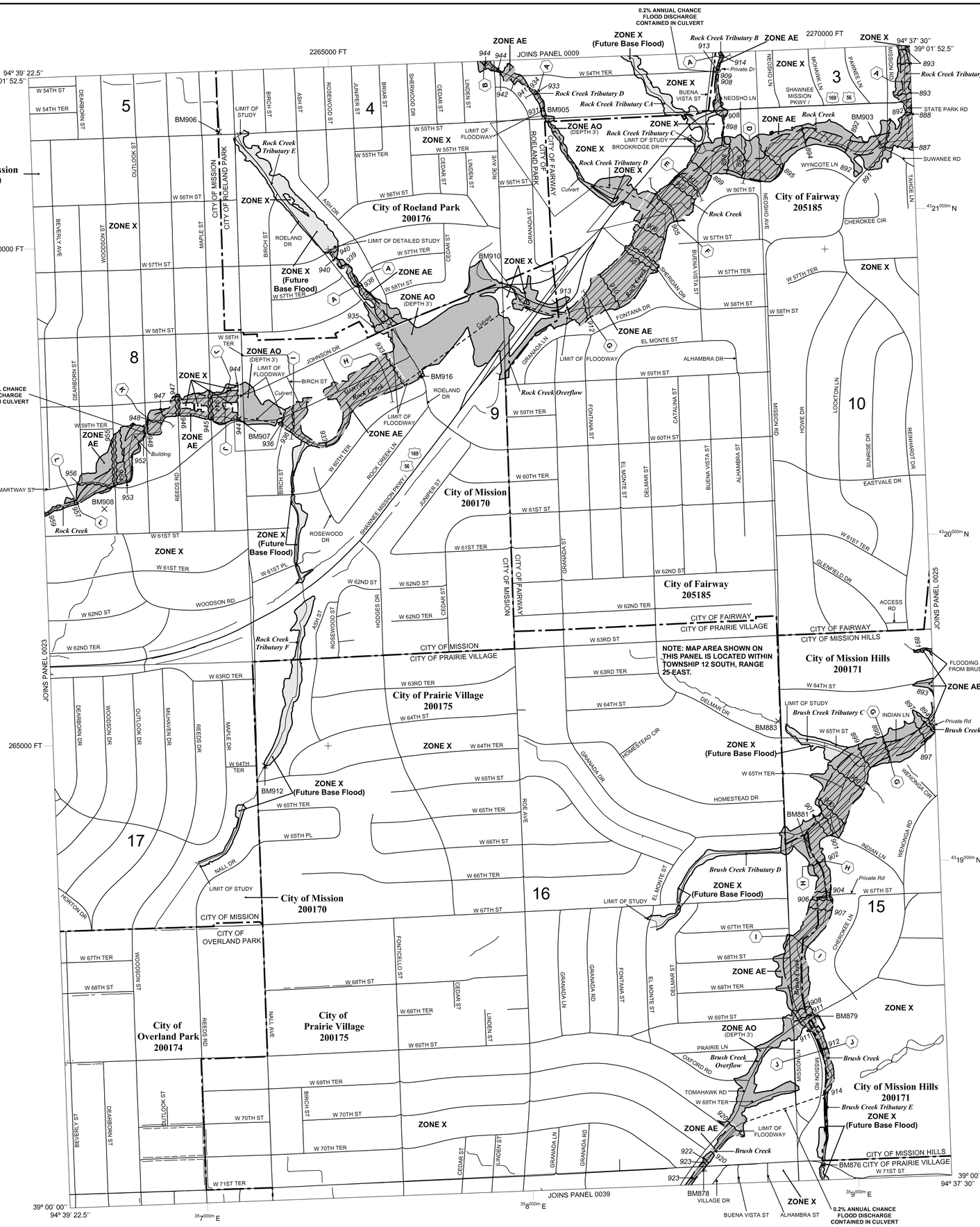
SHEET TITLE

Access Ramp Details

SHEET NUMBER
24

ATTACHMENT C

FEMA FIRM Panel



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 ~~~	Base Flood Elevation line and value; elevation in feet*
(EL 987)	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
$^{49}89^{000m}$ N	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.

N

MAP SCALE 1" = 500'

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

ATTACHMENT D

FEMA LOMR, February 2012

Federal Emergency Management Agency

Washington, D.C. 20472

September 16, 2011

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

The Honorable Adrienne Foster
Mayor, City of Roeland Park
City Hall
4600 West 51st Street
Roeland Park, KS 66205

IN REPLY REFER TO:
Case No.: 11-07-1190P
Community Name: City of Roeland Park, KS
Community No.: 200176
Effective Date of
This Revision: February 8, 2012

91 7199 9991 7030 3178 8076

Dear Mayor Foster:

The Flood Insurance Study Report and Flood Insurance Rate Map for your community have been revised by this Letter of Map Revision (LOMR). Please use the enclosed annotated map panel(s) revised by this LOMR for floodplain management purposes and for all flood insurance policies and renewals issued in your community.

Additional documents are enclosed which provide information regarding this LOMR. Please see the List of Enclosures below to determine which documents are included. Other attachments specific to this request may be included as referenced in the Determination Document. If you have any questions regarding floodplain management regulations for your community or the National Flood Insurance Program (NFIP) in general, please contact the Consultation Coordination Officer for your community. If you have any technical questions regarding this LOMR, please contact the Director, Mitigation Division of the Department of Homeland Security's Federal Emergency Management Agency (FEMA) in Kansas City, Missouri, at (816) 283-7002, or the FEMA Map Assistance Center toll free at 1-877-336-2627 (1-877-FEMA MAP). Additional information about the NFIP is available on our website at http://www.fema.gov/nfip.

Sincerely,

Siamak Esfandiary, Ph.D., P.E., CFM
Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

For: Luis Rodriguez, P.E., Chief
Engineering Management Branch
Federal Insurance and Mitigation Administration

List of Enclosures:

Letter of Map Revision Determination Document
Annotated Flood Insurance Rate Map
Annotated Flood Insurance Study Report

cc: Mr. Charles E. Sievert, P.E.
Black & Veatch
8400 Ward Parkway
Kansas City, MO 64114

Mr. Mike Flickinger
Planning and Zoning Administrator
City of Roeland Park
4600 West 51st Street
Roeland Park, KS 66205

The Honorable Jerry Wiley
Mayor, City of Fairway
4210 Shawnee Mission Parkway
Suite 100
Fairway, KS 66205

Mr. Mike Scanlon
Mission City Administrator
City Hall
6090 Woodson Road
Mission, KS 66202

Mr. Tom Morey, CFM
Kansas Dept. of Agriculture
109 SW 9th Street, 2nd Floor
Topeka, KS 66612-1283

The Honorable Laura McConwell
Mayor, City of Mission
City Hall
6090 Woodson Road
Mission, KS 66202

Federal Emergency Management Agency

Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT

COMMUNITY AND REVISION INFORMATION		PROJECT DESCRIPTION	BASIS OF REQUEST
COMMUNITY	City of Roeland Park Johnson County Kansas	CHANNELIZATION CULVERT LEVEE	FLOODWAY HYDRAULIC ANALYSIS HYDROLOGIC ANALYSIS LEVEE CERTIFICATION NEW TOPOGRAPHIC DATA
	COMMUNITY NO.: 200176		
IDENTIFIER	Gateway & Nall Avenue to Roeland Dr. Phase 1 Storm Improvements	APPROXIMATE LATITUDE & LONGITUDE: 39.021, -94.646 SOURCE: USGS QUADRANGLE DATUM: NAD 27	

ANNOTATED MAPPING ENCLOSURES	ANNOTATED STUDY ENCLOSURES
TYPE: FIRM* NO.: 20091C0024G DATE: August 3, 2009	DATE OF EFFECTIVE FLOOD INSURANCE STUDY: August 03, 2009 PROFILE(S): 344P, 345P, AND 349P FLOODWAY DATA TABLE: TABLE 6 SUMMARY OF DISCHARGES TABLE: TABLE 3

Enclosures reflect changes to flooding sources affected by this revision.
* FIRM - Flood Insurance Rate Map

FLOODING SOURCE(S) & REVISED REACH(ES) See Page 2 for Additional Flooding Sources

Rock Creek - from approximately 350 feet downstream of Shawnee Mission Parkway / U.S. 56 / U.S. 169 to approximately 340 feet upstream of Rock Creek Tributary F

SUMMARY OF REVISIONS

Flooding Source	Effective Flooding	Revised Flooding	Increases	Decreases
Rock Creek	Zone AE	Zone AE	YES	YES
	Zone X (unshaded)	Zone X (unshaded)	YES	YES
	BFEs	BFEs	YES	YES
	Floodway	Floodway	YES	YES

* BFEs - Base Flood Elevations

DETERMINATION

This document provides the determination from the Department of Homeland Security's Federal Emergency Management Agency (FEMA) regarding a request for a Letter of Map Revision (LOMR) for the area described above. Using the information submitted, we have determined that a revision to the flood hazards depicted in the Flood Insurance Study (FIS) report and/or National Flood Insurance Program (NFIP) map is warranted. This document revises the effective NFIP map, as indicated in the attached documentation. Please use the enclosed annotated map panels revised by this LOMR for floodplain management purposes and for all flood insurance policies and renewals in your community.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 6730 Santa Barbara Court, Elkridge, MD 21075. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

Siamak Esfandiary, Ph.D., P.E., CFM, Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

Federal Emergency Management Agency

Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

OTHER FLOODING SOURCES AFFECTED BY THIS REVISION

FLOODING SOURCE(S) & REVISED REACH(ES)

Rock Creek - from approximately 350 feet downstream of Shawnee Mission Parkway / U.S. 56 / U.S. 169 to approximately 340 feet upstream of Rock Creek Tributary F

Rock Creek Tributary E - from the confluence with Rock Creek to approximately 250 feet downstream of West 57th Street

Rock Creek Tributary F - from the confluence with Rock Creek to approximately 95 feet upstream of the confluence with Rock Creek

SUMMARY OF REVISIONS

Flooding Source	Effective Flooding	Revised Flooding	Increases	Decreases
Rock Creek	Zone AO	Zone AE	NONE	YES
Rock Creek Tributary E	Zone AE	Zone AE	NONE	YES
	Floodway	Floodway	YES	YES
	BFEs	BFEs	YES	YES
Rock Creek Tributary F	Zone X (unshaded)	Zone X (unshaded)	NONE	YES

* BFEs - Base Flood Elevations

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 6730 Santa Barbara Court, Elkridge, MD 21075. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

Siamak Esfandiary, Ph.D., P.E., CFM, Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

OTHER COMMUNITIES AFFECTED BY THIS REVISION

CID Number: 200170 **Name:** City of Mission, Kansas

AFFECTED MAP PANELS	AFFECTED PORTIONS OF THE FLOOD INSURANCE STUDY REPORT
TYPE: FIRM* NO.: 20091C0024G DATE: August 3, 2009	DATE OF EFFECTIVE FLOOD INSURANCE STUDY: August 3, 2009 PROFILE(S): 344P, 345P, AND 349P FLOODWAY DATA TABLE: TABLE 6 SUMMARY OF DISCHARGES TABLE: TABLE 3

CID Number: 205185 **Name:** City of Fairway, Kansas

AFFECTED MAP PANELS	AFFECTED PORTIONS OF THE FLOOD INSURANCE STUDY REPORT
TYPE: FIRM* NO.: 20091C0024G DATE: August 3, 2009	DATE OF EFFECTIVE FLOOD INSURANCE STUDY: August 3, 2009 PROFILE(S): 344P, 345P, AND 349P FLOODWAY DATA TABLE: TABLE 3 FLOODWAY DATA TABLE: TABLE 6

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 6730 Santa Barbara Court, Elkridge, MD 21075. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

Siamak Esfandiary, Ph.D., P.E., CFM, Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

COMMUNITY INFORMATION

APPLICABLE NFIP REGULATIONS/COMMUNITY OBLIGATION

We have made this determination pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (P.L. 93-234) and in accordance with the National Flood Insurance Act of 1968, as amended (Title XIII of the Housing and Urban Development Act of 1968, P.L. 90-448), 42 U.S.C. 4001-4128, and 44 CFR Part 65. Pursuant to Section 1361 of the National Flood Insurance Act of 1968, as amended, communities participating in the NFIP are required to adopt and enforce floodplain management regulations that meet or exceed NFIP criteria. These criteria, including adoption of the FIS report and FIRM, and the modifications made by this LOMR, are the minimum requirements for continued NFIP participation and do not supersede more stringent State/Commonwealth or local requirements to which the regulations apply.

We provide the floodway designation to your community as a tool to regulate floodplain development. Therefore, the floodway revision we have described in this letter, while acceptable to us, must also be acceptable to your community and adopted by appropriate community action, as specified in Paragraph 60.3(d) of the NFIP regulations.

NFIP regulations Subparagraph 60.3(b)(7) requires communities to ensure that the flood-carrying capacity within the altered or relocated portion of any watercourse is maintained. This provision is incorporated into your community's existing floodplain management ordinances; therefore, responsibility for maintenance of the altered or relocated watercourse, including any related appurtenances such as bridges, culverts, and other drainage structures, rests with your community. We may request that your community submit a description and schedule of maintenance activities necessary to ensure this requirement.

COMMUNITY REMINDERS

We based this determination on the 1-percent-annual-chance discharges computed in the submitted hydrologic model. Future development of projects upstream could cause increased discharges, which could cause increased flood hazards. A comprehensive restudy of your community's flood hazards would consider the cumulative effects of development on discharges and could, therefore, indicate that greater flood hazards exist in this area.

Your community must regulate all proposed floodplain development and ensure that permits required by Federal and/or State/Commonwealth law have been obtained. State/Commonwealth or community officials, based on knowledge of local conditions and in the interest of safety, may set higher standards for construction or may limit development in floodplain areas. If your State/Commonwealth or community has adopted more restrictive or comprehensive floodplain management criteria, those criteria take precedence over the minimum NFIP requirements.

We will not print and distribute this LOMR to primary users, such as local insurance agents or mortgage lenders; instead, the community will serve as a repository for the new data. We encourage you to disseminate the information in this LOMR by preparing a news release for publication in your community's newspaper that describes the revision and explains how your community will provide the data and help interpret the NFIP maps. In that way, interested persons, such as property owners, insurance agents, and mortgage lenders, can benefit from the information.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 6730 Santa Barbara Court, Elkridge, MD 21075. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

Siamak Esfandiary, Ph.D., P.E., CFM, Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

Federal Emergency Management Agency

Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

We have designated a Consultation Coordination Officer (CCO) to assist your community. The CCO will be the primary liaison between your community and FEMA. For information regarding your CCO, please contact:

Mr. Robert G. Bissell
Director, Mitigation Division
Federal Emergency Management Agency, Region VII
9221 Ward Parkway, Suite 300
Kansas City, MO 64114-3372
(816) 283-7002

STATUS OF THE COMMUNITY NFIP MAPS

We will not physically revise and republish the FIRM and FIS report for your community to reflect the modifications made by this LOMR at this time. When changes to the previously cited FIRM panel(s) and FIS report warrant physical revision and republication in the future, we will incorporate the modifications made by this LOMR at that time.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 6730 Santa Barbara Court, Elkridge, MD 21075. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

Siamak Esfandiary, Ph.D., P.E., CFM, Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

Federal Emergency Management Agency

Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

PUBLIC NOTIFICATION OF REVISION

PUBLIC NOTIFICATION

FLOODING SOURCE	LOCATION OF REFERENCED ELEVATION	BFE (FEET NAVD 88)		MAP PANEL NUMBER(S)
		EFFECTIVE	REVISED	
Rock Creek Tributary E	Approximately 570 feet downstream of West 57th Street	936	937	20091C0024G
	Approximately 1,040 feet downstream of West 57th Street	935	932	20091C0024G

Within 90 days of the second publication in the local newspaper, a citizen may request that we reconsider this determination. Any request for reconsideration must be based on scientific or technical data. Therefore, this letter will be effective only after the 90-day appeal period has elapsed and we have resolved any appeals that we receive during this appeal period. Until this LOMR is effective, the revised BFEs presented in this LOMR may be changed.

A notice of changes will be published in the *Federal Register*. A short notice also will be published in your local newspaper on or about the dates listed below. Please refer to FEMA's website at https://www.floodmaps.fema.gov/fhm/Scripts/bfe_main.asp for a more detailed description of proposed BFE changes, which will be posted approximately within two weeks of the date of this letter

LOCAL NEWSPAPER
Name: The Legal Record
Dates: October 4, 2011 and October 11, 2011

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 6730 Santa Barbara Court, Elkridge, MD 21075. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

Siamak Esfandiary, Ph.D., P.E., CFM, Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

Table 3 - Summary of Discharges (*Continued*)

Flooding Source and Location	Drainage Area (square miles)	Peak Discharges (cubic feet per second) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance		0.2-Percent-Annual-Chance
				Existing	Future	
NORTH BRANCH INDIAN CREEK TRIBUTARY B						
Approximately 1,150 feet upstream of the confluence with North Branch Indian Creek	1.64	1,969	3,013	3,552	3,682	4,753
At Westgate Road	1.20	1,775	2,706	3,125	3,238	4,071
Approximately 550 feet upstream of Hauser Street	1.07	1,675	2,494	2,887	2,998	3,767
PICKERING CREEK						
At West 159th Street	3.89	1,485	3,879	4,622	5,840	6,471
At West 167th Street	1.49	798	2,316	2,752	3,593	3,821
PICKERING CREEK TRIBUTARY A						
At the confluence of Pickering Creek Tributary AA	1.34	1,179	2,545	2,938	3,534	3,871
Approximately 3,200 feet upstream of the confluence of Pickering Creek Tributary AA	0.80	699	1,591	1,845	2,279	2,449
ROCK CREEK						
Approximately 1,100 feet upstream of the confluence with Brush Creek	4.47	4,684	7,552	8,103	*	10,418
Just upstream of the confluence of Rock Creek Tributary B	3.56	4,515	6,906	7,386	*	9,319
Approximately 1,075 feet upstream of Sheridan Drive	2.76	3,615	5,438	5,763	*	7,235
At the confluence of Rock Creek Tributary G	0.44	850	1,275	1,357	*	1,718
At Lamar Avenue	0.26	420	639	681	*	867
ROCK CREEK TRIBUTARY A						
At Shawnee Mission Parkway	0.53	916	1,409	1,506	*	1,967
At West 53rd Street	0.26	466	735	787	*	1,020
Approximately 1,300 feet upstream of West 52nd Place	0.16	292	456	488	*	629
ROCK CREEK TRIBUTARY B						
At Shawnee Mission Parkway	0.13	199	314	336	*	435
ROCK CREEK TRIBUTARY D						
At West 55th Street	0.30	519	805	861	*	1,107

* Data not available

REVISED TO REFLECT LOMR EFFECTIVE FEB 8, 2012

AREA REVISED

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION				
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	EXISTING CONDITIONS (FEET NAVD)	FUTURE CONDITIONS (FEET NAVD)	EXISTING CONDITIONS WITHOUT FLOODWAY (FEET NAVD)	EXISTING CONDITIONS WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
ROCK CREEK (CONTINUED)									
H	10,977[1]	83	424	10.6	928.6	*	928.6	928.6	0.0
I	12,294[1]	52	378	8.3	935.7	*	935.7	935.7	0.0
J	13,674[1]	137	426	6.1	948.0	*	948.0	928.0	0.0
K	15,110[1]	39	167	12.5	956.9	*	956.9	957.0	0.1
ROCK CREEK TRIBUTARY A									
A	605[2]	90	738	2.0	893.0	*	893.0	893.4	0.4
B	1,672[2]	54	102	7.7	902.4	*	902.4	902.5	0.1
C	2,716[2]	83	138	3.6	924.5	*	924.5	924.7	0.2
ROCK CREEK TRIBUTARY B									
A	1,008[2]	25	30	5.6	913.9	*	913.9	914.0	0.1
B	1,667[2]	17	25	6.7	932.2	*	932.2	932.6	0.4
ROCK CREEK TRIBUTARY D									
A	322[3]	36	100	6.9	932.8	*	932.8	932.8	0.0
B	916[3]	60	212	3.3	944.5	*	944.5	945.1	0.6
C	2,208[3]	98	312	2.2	961.1	*	961.1	961.5	0.4

AREA REVISED

AREA REVISED BY LOMR DATED AUG 4, 2009

[1]Feet above confluence with Brush Creek
[2]Feet above confluence with Rock Creek
[3]Feet above West 55th Street
*Data not available

REVISED TO REFLECT LOMR EFFECTIVE FEB 8, 2012

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

JOHNSON COUNTY, KS AND INCORPORATED AREAS

FLOODWAY DATA

ROCK CREEK – ROCK CREEK TRIBUTARY A – ROCK CREEK TRIBUTARY B – ROCK CREEK TRIBUTARY D

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION				
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	EXISTING CONDITIONS (FEET NAVD)	FUTURE CONDITIONS (FEET NAVD)	EXISTING CONDITIONS WITHOUT FLOODWAY (FEET NAVD)	EXISTING CONDITIONS WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
ROCK CREEK TRIBUTARY E									
A	1,891[1]	23	124	8.9	937.0	*	937.0	937.5	0.5
SPOON CREEK									
A	685[2]	250	2,263	4.4	820.6	820.7	820.6	821.5	0.9
B	2,298[2]	329	2,833	3.5	827.3	827.9	827.3	827.9	0.6
C	3,253[2]	183	1,179	8.4	830.0	830.5	830.0	830.9	0.9
D	4,058[2]	85	1,113	8.9	837.3	838.5	837.3	838.2	0.9
E	5,295[2]	442	3,158	3.1	840.0	841.3	840.0	841.0	1.0
F	5,955[2]	454	3,143	3.2	840.6	841.7	840.6	841.6	1.0
G	7,482[2]	256	1,450	6.8	842.5	843.5	842.5	843.1	0.6
H	8,069[2]	280	1,473	6.7	845.8	846.2	845.8	846.1	0.3
I	9,120[2]	255	1,478	6.7	850.6	851.5	850.6	850.8	0.2
J	10,402[2]	245	1,905	5.2	856.0	856.7	856.0	856.9	0.9
K	11,294[2]	256	2,186	4.5	860.2	860.8	860.2	861.1	0.9
L	12,204[2]	230	1,389	7.1	861.8	862.3	861.8	862.7	0.9
M	13,733[2]	440	2,039	4.8	868.3	868.7	868.3	869.3	1.0
N	15,262[2]	348	2,099	4.6	872.5	872.9	872.5	873.4	0.9
O	17,503[2]	430	2,037	4.7	876.9	877.3	876.9	877.3	0.4
P	17,939[2]	480	2,686	3.6	878.1	878.6	878.1	878.7	0.6
Q	19,346[2]	350	1,637	5.9	879.2	879.6	879.2	879.8	0.6
R	20,143[2]	480	2,510	3.9	880.9	881.3	880.9	881.8	0.9
S	21,431[2]	400	1,684	5.7	884.6	885.0	884.6	885.3	0.7

[1]Feet above confluence with Rock Creek
[2]Feet above confluence with Kill Creek
*Data not available

AREA REVISED

REVISED TO REFLECT LOMR EFFECTIVE FEB 8, 2012

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

JOHNSON COUNTY, KS AND INCORPORATED AREAS

FLOODWAY DATA

ROCK CREEK TRIBUTARY E – SPOON CREEK

AREA REVISED

ELEVATION IN FEET (NAVD 88)

970
960
950
940
930
920
910
900
890
880

6,500
7,000
7,500
8,000
8,500
9,000
9,500
10,000
10,500
11,000
11,500
12,000
12,500
13,000

STREAM DISTANCE IN FEET FEET

SHERIDAN DRIVE

SHAWNEE MISSION PARKWAY / U.S. 56 / U.S. 169

LIMIT OF FLOODWAY

CONFLUENCE OF ROCK CREEK TRIBUTARY E

LIMIT OF FLOODWAY

NOTE: 0.2% ANNUAL CHANCE FLOOD CONTAINED IN CULVERT

CONFLUENCE OF ROCK CREEK TRIBUTARY F

AREA REVISED BY LOMR DATED AUG 4, 2009

NOTE: THE 2% ANNUAL CHANCE FLOOD PROFILE IS TOO CLOSE TO THE 1% ANNUAL CHANCE FLOOD ELEVATION TO BE SHOWN SEPARATELY

CULVERT

CULVERT

NOTE: 0.2% ANNUAL CHANCE FLOOD CONTAINED IN CULVERT

REVISED TO REFLECT LOMR EFFECTIVE FEB 8, 2012

LEGEND
- 0.2% ANNUAL CHANCE FLOOD
- 1% ANNUAL CHANCE FLOOD
- 2% ANNUAL CHANCE FLOOD
- 10% ANNUAL CHANCE FLOOD
- STREAM BED
- CROSS SECTION LOCATION

E F G H I

FLOOD PROFILES (EXISTING CONDITIONS)

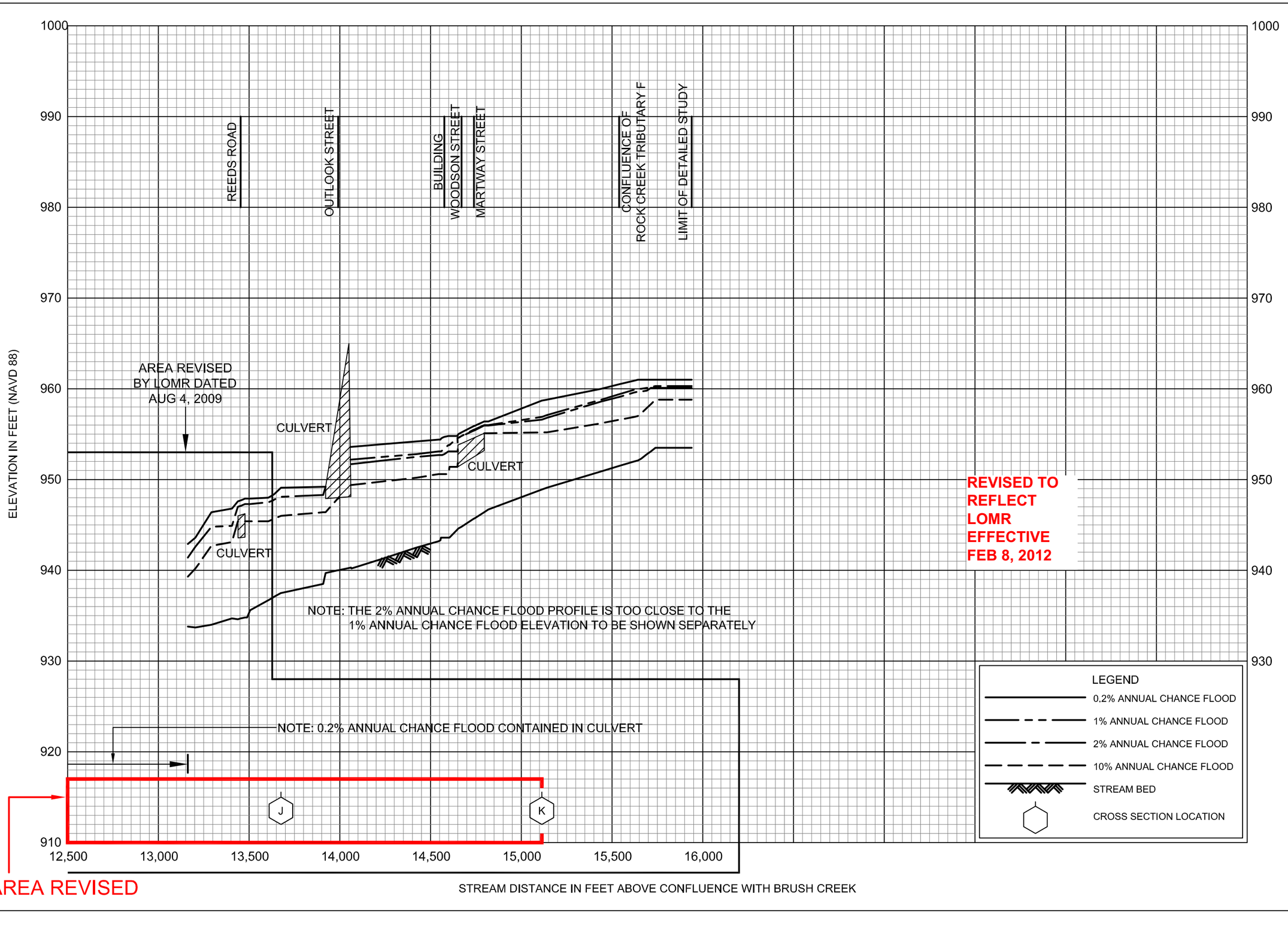
ROCK CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

JOHNSON COUNTY, KS

AND INCORPORATED AREAS

344P



FLOOD PROFILES (EXISTING CONDITIONS)

ROCK CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

JOHNSON COUNTY, KS

AND INCORPORATED AREAS

345P

AREA REVISED

ELEVATION IN FEET (NAVD 88)

960
955
950
945
940
935
930
925
920
915

LIMIT OF FLOODWAY

WEST 57TH STREET

LIMIT OF DETAILED STUDY

WEIR

REVISED TO REFLECT LOMR EFFECTIVE FEB 8, 2012

NOTE: THE 2% ANNUAL CHANCE FLOOD PROFILE IS TOO CLOSE TO THE 1% ANNUAL CHANCE FLOOD ELEVATION TO BE SHOWN SEPARATELY

NOTE: 0.2% ANNUAL CHANCE FLOOD CONTAINED IN CULVERT

A

LEGEND

- 0.2% ANNUAL CHANCE FLOOD
- 1% ANNUAL CHANCE FLOOD
- 2% ANNUAL CHANCE FLOOD
- 10% ANNUAL CHANCE FLOOD
- STREAM BED
- CROSS SECTION LOCATION

1,200 1,400 1,600 1,800 2,000 2,200 2,400 2,600 2,800

STREAM DISTANCE IN FEET ABOVE CONFLUENCE WITH ROCK CREEK

FLOOD PROFILES (EXISTING CONDITIONS)

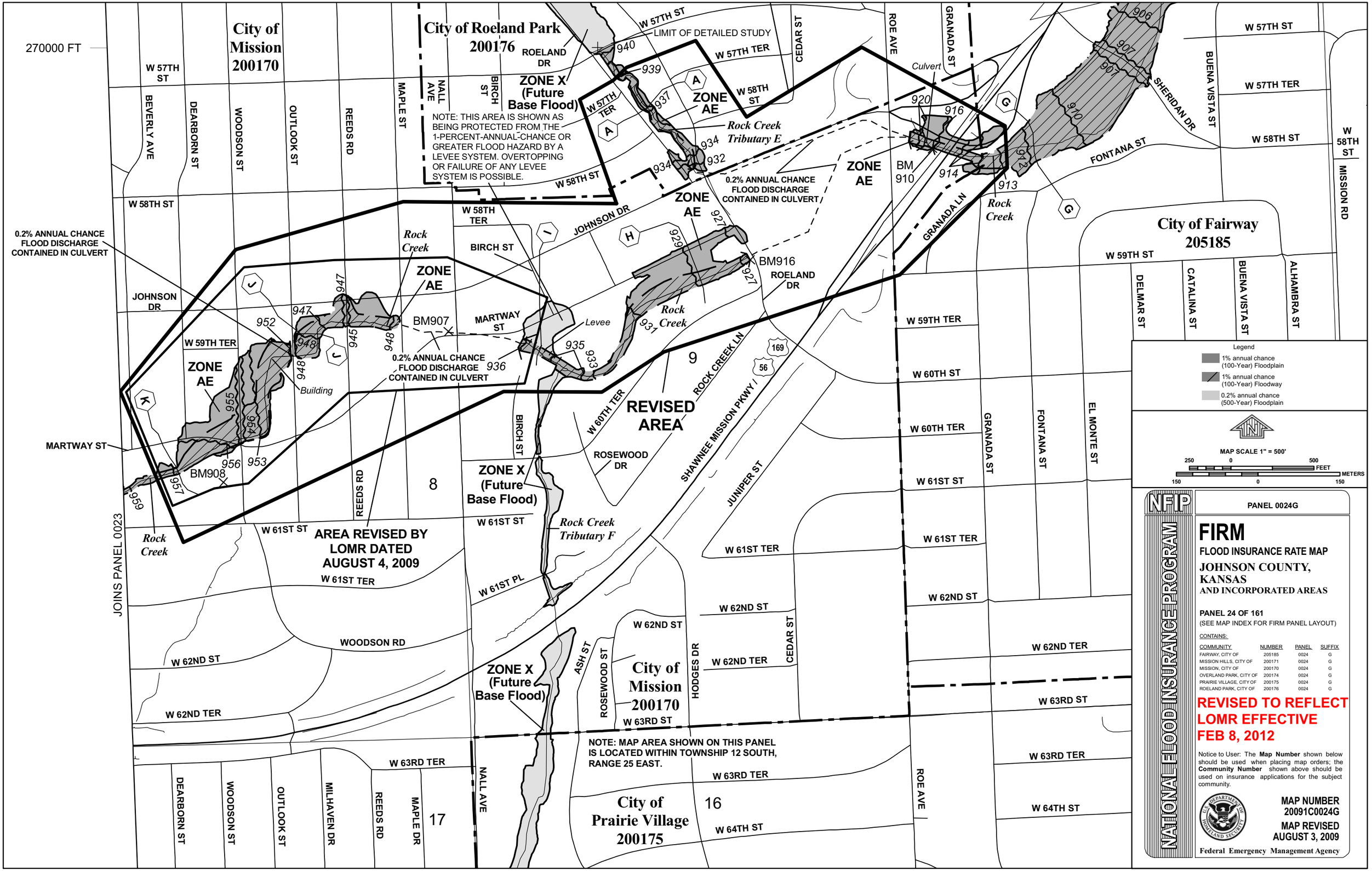
ROCK CREEK TRIBUTARY E

FEDERAL EMERGENCY MANAGEMENT AGENCY

JOHNSON COUNTY, KS

AND INCORPORATED AREAS

349P


270000 FT
City of Mission 200170
City of Roeland Park 200176
City of Fairway 205185
City of Prairie Village 200175
LIMIT OF DETAILED STUDY
NOTE: THIS AREA IS SHOWN AS BEING PROTECTED FROM THE 1-PERCENT-ANNUAL-CHANCE OR GREATER FLOOD HAZARD BY A LEVEE SYSTEM. OVERTOPPING OR FAILURE OF ANY LEVEE SYSTEM IS POSSIBLE.
ZONE X (Future Base Flood)
ZONE AE
0.2% ANNUAL CHANCE FLOOD DISCHARGE CONTAINED IN CULVERT
REVISED AREA
AREA REVISED BY LOMR DATED AUGUST 4, 2009
JOINS PANEL 0023
Rock Creek
Rock Creek Tributary E
Rock Creek Tributary F
Levee
Culvert
Building
BM907
BM908
BM910
BM916
W 57TH ST
W 57TH TER
W 58TH ST
W 58TH TER
W 59TH ST
W 59TH TER
W 60TH ST
W 60TH TER
W 61ST ST
W 61ST TER
W 61ST PL
W 62ND ST
W 62ND TER
W 63RD ST
W 63RD TER
W 64TH ST
BEVERLY AVE
DEARBORN ST
WOODSON ST
OUTLOOK ST
REEDS RD
MAPLE ST
NALL AVE
BIRCH ST
CEDAR ST
ROE AVE
GRANADA ST
SHERIDAN DR
BUENA VISTA ST
FONTANA ST
MISSION RD
GRANADA LN
JOHNSON DR
ROELAND DR
MARTWAY ST
ROCK CREEK LN
SHAWNEE MISSION PKWY
JUNIPER ST
ROSEWOOD DR
WOODSON RD
ASH ST
HODGES DR
DELMAR ST
CATALINA ST
ALHAMBRA ST
EL MONTE ST
MILHAVEN DR
MAPLE DR
169
56
Legend
1% annual chance (100-Year) Floodplain
1% annual chance (100-Year) Floodway
0.2% annual chance (500-Year) Floodplain
MAP SCALE 1" = 500'
250 0 500 FEET
150 0 150 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
REVISED TO REFLECT LOMR EFFECTIVE FEB 8, 2012
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

ATTACHMENT E

USDS Soil Map

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

June 25, 2020

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.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

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Contents

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: 1:1,160 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 18, Sep 16, 2019

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

Date(s) aerial images were photographed: Jul 17, 2019—Sep 25, 2019

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	3.3	100.0%
Totals for Area of Interest		**3.3**	**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

References

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ATTACHMENT F

Level of Service Calculations

WORKSHEET 1A: REQUIRED LEVEL OF SERVICE - DEVELOPED SITE

Project: Mission Bowl
Location: Mission, Kansas

By: LJR
Checked:

1 Required Treatment Area

A Total Area Disturbed by Redevelopment Activity (Ac.)

Disturbed Area Discription	Acres
Parking expansion	3.6
1A Totals:	3.6

B Existing Impervious Area Inside Disturbed Area (Ac.)

Existing Impervious Area Descripiton	Acres
Existing Parking Lot	2.74
Existing Building	0.48
Existing Mini Golf	0.38
1B Totals:	3.6

C Required Treatment Area (Ac.)

"1A" Totals Less "1B" Total "1C" 0

2 Percent Impervious in Postdevelopment Condition and Level of Service (LS)

A Total Postdevelopment Impervious Area Inside Disturbed Area

Postdevelopment Impervious Area Description	Acres
Proposed Bulding	0.92
Parking	1.49
2A Totals:	2.41

B Existing Impervious Area Inside Disturbed Area (Ac.)

1B Totals: 3.6

C Net Increse in Impervious Area (Ac.)

2A Total Less 1B Total 2C: -1.19

D Percent Impervious

Net Increse in Impervious Area / Required Treatment Area 0

2C/1C * 100 % #DIV/0!

(Round to Integer)

E Level of Service

Use Percent Impervious to Enter Table 4.3 LS: 0

3 Minimum Required Total Value of BMP Package

Total Value Rating = LS * Required Teatment Area

VR= 0

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

Project: Mission Bowl | By: LJR | Date: 8/7/2020
Location: Mission, Kansas | Checked: | Date:

1 **Required LS =** **0**

Note: Various BMP's may alter CN of proposed development, and LS; recalculate both if applicable.

2 **Proposed BMP Option Package No.** _____

Cover/BMP Description	Treatment Area	VR from Table 5 or 6[1]	Product of CN x Area
Proposed Southern Parking Lot	1.35	5	6.75
No Treatment	2.25	0	0
Total:	3.6	Total:	6.75

Weighted VR: 1.88 di
= total production/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.

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

TREATMENT VOLUME WORKSHEET

Project: Mission Bowl
Location: Mission KS

By: LJR
Checked:

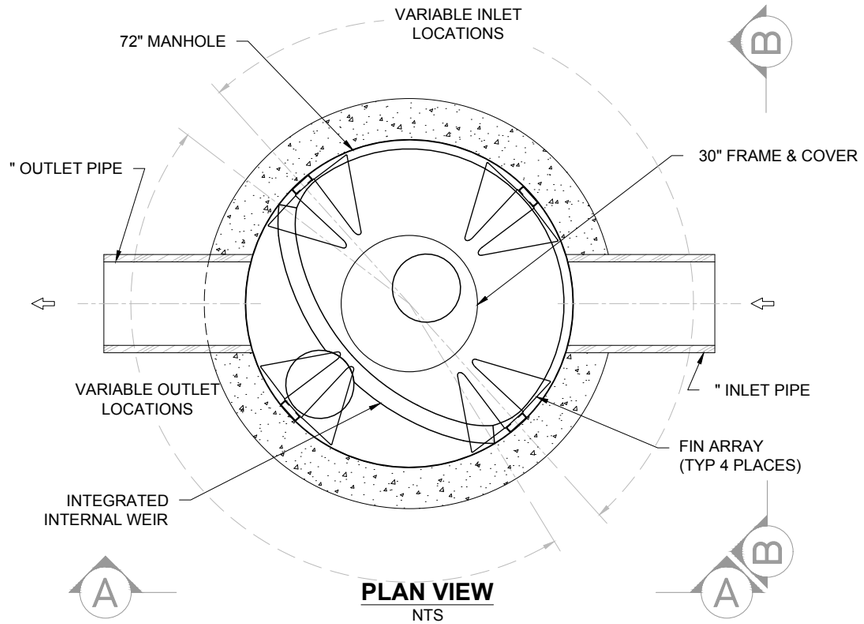
I. Water Quality Volume

WQv=P*Rv
WQv= Water Quality Volume (in.)
P = Rainfall event in inches (1.37 in.)
Rv = Volumetric runoff coefficient
Rv=0.005+0.009(% Impervious)

Total Tributary Area	1.35	Ac
Impervious Area	1.25	
% Impervious	92.59259	
WQv=	1.148517	in
Treatment Vol.	5628.31	cu ft

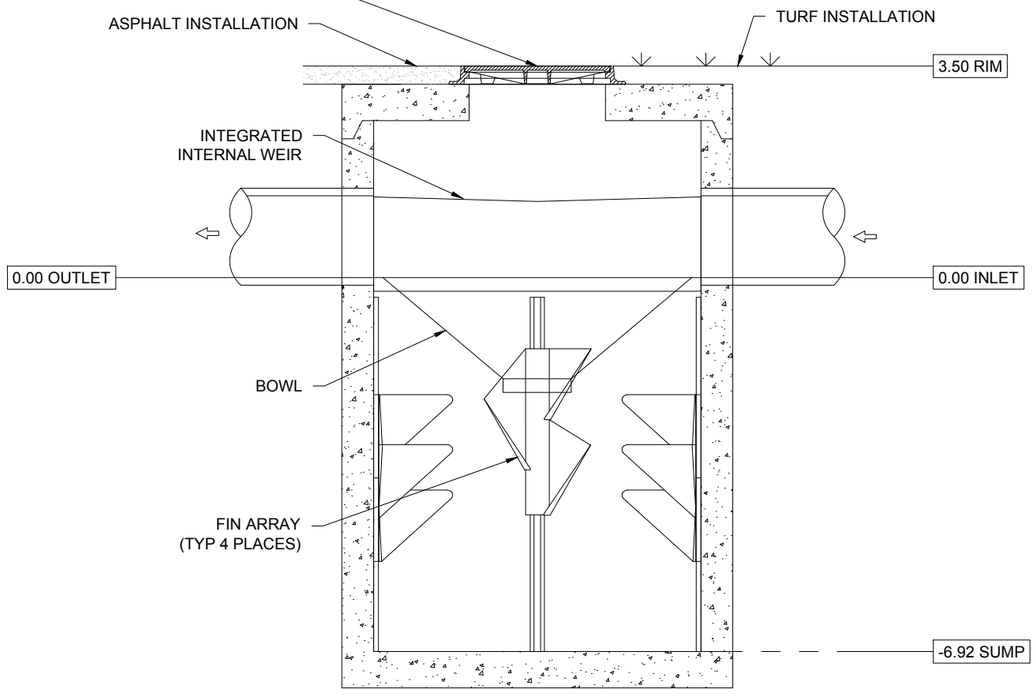
ATTACHMENT G

Stormwater Treatment Details

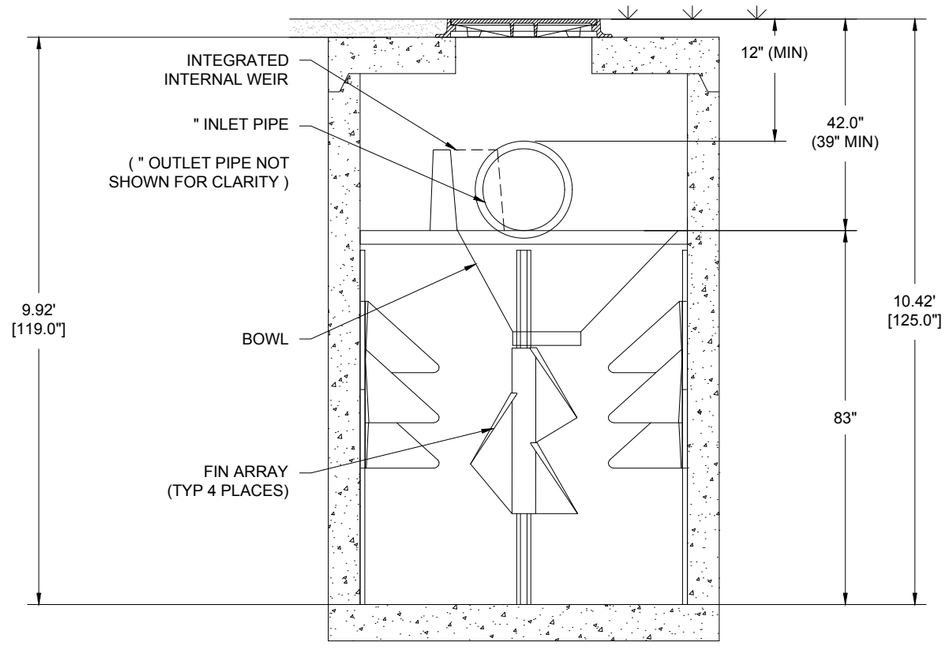


PLAN VIEW
NTS

BARRACUDA S6	
UNIT ID	
PEAK FLOW RATE (CFS)	
TREATMENT FLOW RATE (CFS)	



SECTION VIEW A-A
NTS



SECTION VIEW B-B
NTS

BARRACUDA S6
STANDARD DETAIL

DATE: 12/18/17 DRAWN: EKH
PROJECT #: CHECKED: ----

REV	DWN	CKD	DESCRIPTION

1030 Deer Hollow Drive
Mount Airy, MD 21771
1-800-BAYSAVER
1-800-229-7283
barracuda

4640 TRUEMAN BLVD
HILLIARD, OH 43026
ADS® ADVANCED DRAINAGE SYSTEMS, INC.

NOT TO SCALE

Hydrodynamic Separator Performance According to the MARC Manual

Introduction:

In October 2012 the Kansas City Mid America Regional Council (MARC) released the Manual of Best Management Practices for Storm Water Quality. This manual goes on to describe a variety of construction BMP's Advantages, disadvantages, design considerations, and maintenance practices. One BMP discussed is a Hydrodynamic Separator (Section 8.12 Hydro Dynamic Separation).

As per the MARC Manual:

Hydrodynamic separators, also known as swirl concentrators or vortex separators, describe a wide variety of proprietary devices that have been developed in recent years. They are modifications of traditional oil/particle separators that typically target coarse solids and large oil droplets. While most of these systems utilize vortex enhanced sedimentation, others use circular screening systems or engineered cylindrical sedimentation. Vortex separation was originally developed for use in combined sewer overflows.

ADS promotes three hydrodynamic separators in the MARC manual regulated area. The selection of which hydrodynamic separator to use on a project varies based on the factors of treatment flow rate, maximum flow rate, configuration of the units (inline vs offline) and cost. The Baysaver Barracuda, Hydro International (HIL) Downstream Defender and HIL First Defense High Capacity would be included under the MARC manual's classification of a hydrodynamic separator.

Value Rating system:

In order to assess the effectiveness of a particular BMP relative to another, the MARC manual outlines a 10 point value rating system. This 10 point rating system is based on 4 criteria: Water Quality Value, Volume Reduction, Temperature Reduction, Oils/Floatables Reduction. Water Quality Value is assessed on a scale of 1-5 by the expected median concentration (mg/L) of Total Suspended Solids (TSS). Volume reduction is assessed on a scale of 0-2 with significant infiltration or evaporation scoring full marks. Temperature Reduction is assessed on a scale of -1 through 1. A device that increases runoff temperature scores a -1, a device that does not change the runoff temp scores a 0, and a device that reduces runoff temperature scores a 1. Finally the device is awarded a score of 0-2 with respect to its ability to significantly reduce oils and floatable debris. Adding these scores up for the specific BMP will lead to a value between 0-10 points.

ADS Hydrodynamic Separator Value Rating Calculation as determined by the MARC manual.

TABLE 4.5
Value Rating Calculations

A	Water Quality Value Rating System	0	1	2	3	4+
	Median Concentration of TSS in Effluent (milligrams per liter)	> 100 mg/L	50 - 100 mg/L	20 - 50 mg/L	10 - 20 mg/L	<10 mg/L
B	Volume Reduction Rating System	0	1		2	
		Little or no volume reduction	Moderate infiltration or evaporation		Significant infiltration and evaporation	
C	Temperature Reduction Rating System	-1	0		1	
		Runoff temperature increases	Runoff temperature is unchanged		Runoff temperature decreases	
D	Oils/Floatables Reduction Rating System	0	1		2	
		Little or no oils/floatables reduction	Moderate capture or reduction of oils/floatables		Significant capture or reduction of oils/floatables	

Note:
Value Rating Calculation: VR = A + B + C + D

Table 1: Value Rating Calculations as taken from the MARC Manual.

Water Quality Value: Water quality rating is assessed by analyzing the median concentration of TSS as sampled from the devices effluent discharge [Table 4.5. Manual of Best Management Practices for Storm Water Quality, 4-11]. Each hydrodynamic separator has their own respective test reports for hydraulic loading and particle size iterations. A nationally recognized and accepted organization that has standardized the testing procedure, particle size and loading for hydrodynamic separators is New Jersey Department of Environmental Protection (NJDEP). NJDEP works in conjunction with New Jersey Corporation of Advanced Technology (NJCAT) to provide a listing of NJCAT Laboratory verified and NJDEP certified devices. When viewing NJCAT and NJDEP's respective website, the verified/certificate devices list could be observed as well as the specific test reports that are linked in the table. Please note that New Jersey utilizes a standardized particle size that is typically smaller (lower number of microns) particle size than what is shown on MARC Manual Reports. The Water Quality Value Rating will generally show a VR of 3 or 4 points for hydrodynamic separators from these test reports. The MARC Manual caps the hydrodynamic separator unit currently at 3 points of VR for Water Quality however, so these test results would correspond to a **Water Quality Value Rating of 3 points**.

Volume Reduction Rating: Not applicable for separators. **Volume Reduction Rating of 0 point**.

Temperature Reduction Rating: Not applicable for separators. Allow this BMP device is an underground unit, due to the short amount of time that the stormwater is in the separator unit, no temperature reduction is generally awarded to this device. **Temperature Reduction Rating of 0 point**.

Oils/Floatables Reduction Rating: The Oils/Floatables reduction is determined on a sliding scale of 0-2. Hydrodynamic separators are widely known to be one of the premier devices for the removal of oil and floatables. The separators were commonly referred to as oil / sand separators prior to the renaming of the device as a hydrodynamic separator. In the technical test reports, oil capacity (i.e. the storage potential for oils) could be determined. The storage potential for floatables could be determined as well. The basis for removing oils and floatables would be reliant on a practical maintenance interval and then the requirement for this category would be met for the service life of the device. Third party technical reports, such as NJCAT/NJDEP, could show these results based on which device is being specified. This corresponds to a **Oils/Floatables Reduction Rating of 2 points.**

MARC VALUE Rating: Per Table 1, MARC values are determined by the following formula

$$VR = A + B + C + D$$

Where

A = Water quality value
B = Volume reduction
C = Temperature reduction
D = Oil and floatables reduction

In the case of the ADS hydrodynamic separators:

$$VR = 3 + 0 + 0 + 2 = 5$$

Per the MARC manual, the three stated ADS hydrodynamic separators should be assessed a **5 point** value rating**.**

Maintenance Guide

BaySaver Barracuda™

July 2017

One of the advantages of the BaySaver Barracuda is the ease of maintenance. Like any system that collects pollutants, the BaySaver Barracuda must be maintained for continued effectiveness. Maintenance is a simple procedure performed using a vacuum truck or similar equipment. The systems were designed to minimize the volume of water removed during routine maintenance, reducing disposal costs.

Contractors can access the pollutants stored in the manhole through the manhole cover. This allows them to gain vacuum hose access to the bottom of the manhole to remove sediment and trash. There is no confined space entry necessary for inspection or maintenance.

The entire maintenance procedure typically takes from 2 to 4 hours, depending on the size of the system, the captured material, and the capacity of the vacuum truck.

Local regulations may apply to the maintenance procedure. Safe and legal disposal of pollutants is the responsibility of the maintenance contractor. Maintenance should be performed only by a qualified contractor.

Inspection and Cleaning Cycle

Periodic inspection is needed to determine the need for and frequency of maintenance. You should begin inspecting as soon as construction is complete and thereafter on an annual basis. Typically, the system needs to be cleaned every 1-3 years.

Excessive oils, fuels or sediments may reduce the maintenance cycle. Periodic inspection is important.

Determining When to Clean

To determine the sediment depth, the maintenance contractor should lower a stadia rod into the manhole until it contacts the top of the captured sediment and mark that spot on the rod. Then push the probe through to the bottom of the sump and mark that spot to determine sediment depth.

Maintenance should occur when the sediment has reached the levels indicated in the Storage Capacity Chart.

BaySaver Barracuda Storage Capacities

Model	Manhole Diameter	Treatment Chamber Capacity	Standard Sediment Capacity (20" depth)	NJDEP Sediment Capacity (50% of standard depth)
S3	36"	212 gallons	0.44 cubic yards	0.22 cubic yards
S4	48"	564 gallons	0.78 cubic yards	0.39 cubic yards
S5	60"	881 gallons	1.21 cubic yards	0.61 cubic yards
S6	72"	1269 gallons	1.75 cubic yards	0.88 cubic yards
S8	96"	3835 gallons	3.10 cubic yards	1.55 cubic yards
S10	120"	7496 gallons	4.85 cubic yards	2.43 cubic yards

Maintenance Instructions

1. Remove the manhole cover to provide access to the pollutant storage. Pollutants are stored in the sump, below the bowl assembly visible from the surface. You'll access this area through the 10" diameter access cylinder.

2. Use a vacuum truck or other similar equipment to remove all water, debris, oils and sediment. See figure 1.
3. Use a high pressure hose to clean the manhole of all the remaining sediment and debris. Then, use the vacuum truck to remove the water.
4. Fill the cleaned manhole with water until the level reaches the invert of the outlet pipe.
5. Replace the manhole cover.
6. Dispose of the polluted water, oils, sediment and trash at an approved facility.
   - Local regulations prohibit the discharge of solid material into the sanitary system. Check with the local sewer authority for authority to discharge the liquid.
   - Some localities treat the pollutants as leachate. Check with local regulators about disposal requirements.
   - Additional local regulations may apply to the maintenance procedure.

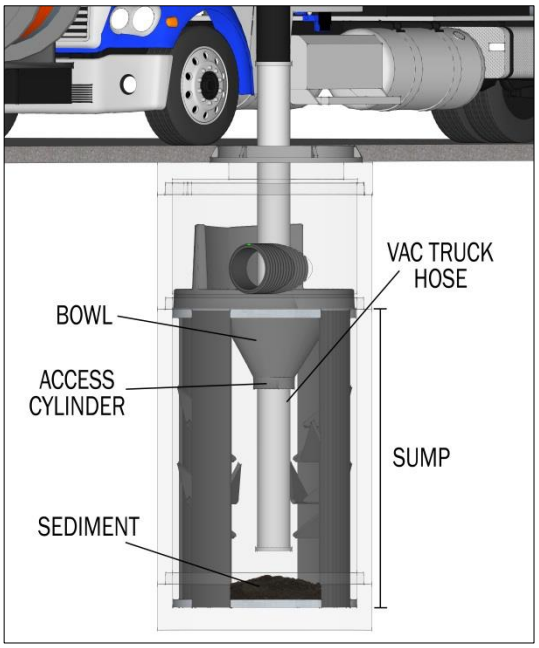
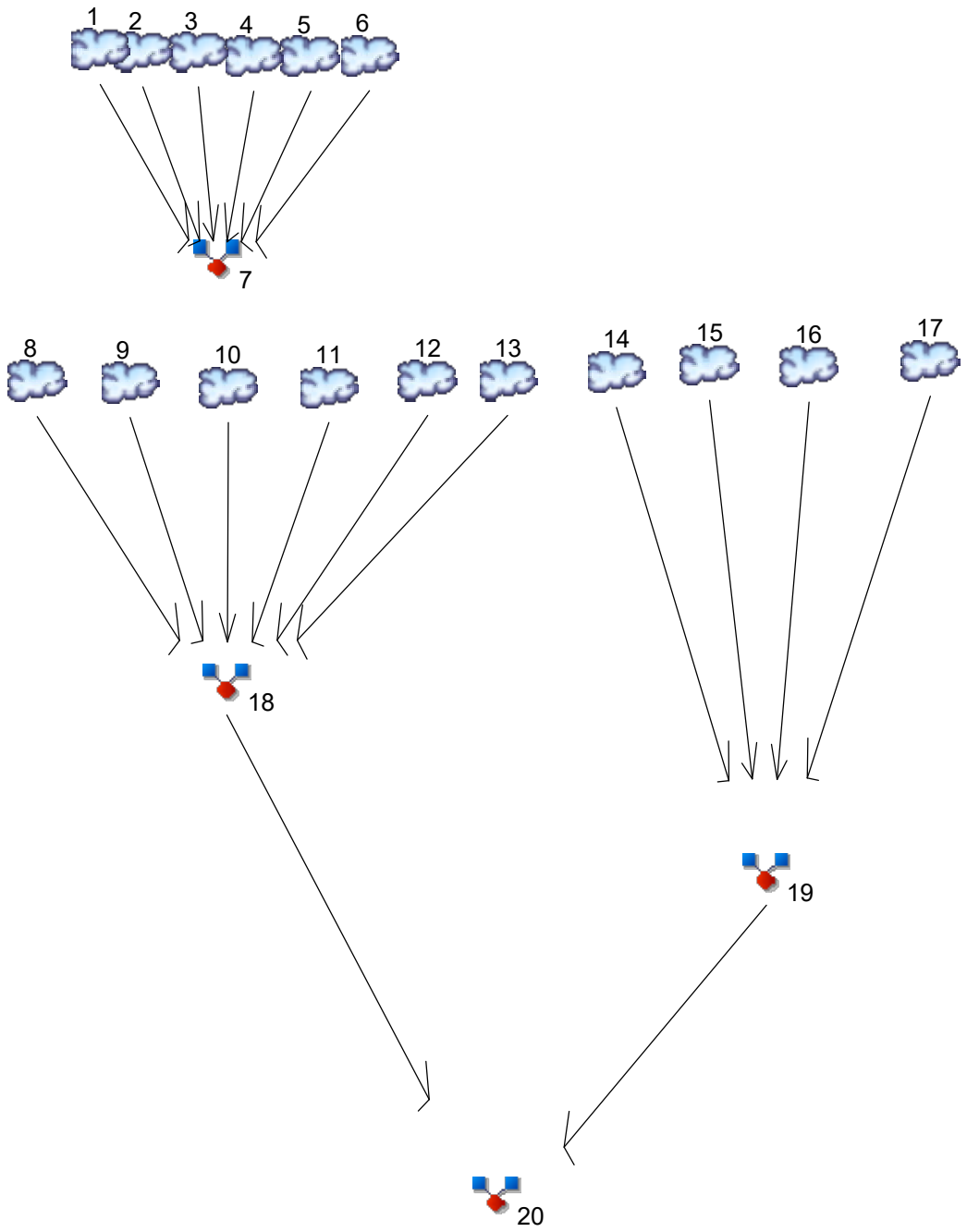


Figure 1

ATTACHMENT H

Site Hydrographs

Watershed Model Schematic



Legend

Hyd.	Origin	Description
1	SCS Runoff	E1
2	SCS Runoff	E2
3	SCS Runoff	E3
4	SCS Runoff	E4
5	SCS Runoff	E5
6	SCS Runoff	E6
7	Combine	Existing
8	SCS Runoff	P1
9	SCS Runoff	P2
10	SCS Runoff	P3
11	SCS Runoff	P4
12	SCS Runoff	P5
13	SCS Runoff	P6
14	SCS Runoff	P7
15	SCS Runoff	P8
16	SCS Runoff	P9
17	SCS Runoff	P10
18	Combine	Proposed North
19	Combine	Proposed South
20	Combine	Proposed Site

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	-------	3.975	-------	-------	7.946	-------	-------	15.03	E1
2	SCS Runoff	------	-------	0.454	-------	-------	0.948	-------	-------	1.822	E2
3	SCS Runoff	------	-------	1.001	-------	-------	2.001	-------	-------	3.783	E3
4	SCS Runoff	------	-------	1.172	-------	-------	2.344	-------	-------	4.432	E4
5	SCS Runoff	------	-------	1.230	-------	-------	2.458	-------	-------	4.648	E5
6	SCS Runoff	------	-------	2.355	-------	-------	4.805	-------	-------	9.154	E6
7	Combine	1, 2, 3, 4, 5, 6	-------	10.19	-------	-------	20.50	-------	-------	38.86	Existing
8	SCS Runoff	------	-------	0.616	-------	-------	1.211	-------	-------	2.276	P1
9	SCS Runoff	------	-------	0.733	-------	-------	1.441	-------	-------	2.710	P2
10	SCS Runoff	------	-------	0.197	-------	-------	0.517	-------	-------	1.102	P3
11	SCS Runoff	------	-------	0.544	-------	-------	1.554	-------	-------	3.473	P4
12	SCS Runoff	------	-------	0.513	-------	-------	1.098	-------	-------	2.132	P5
13	SCS Runoff	------	-------	1.462	-------	-------	3.130	-------	-------	6.076	P6
14	SCS Runoff	------	-------	0.270	-------	-------	0.795	-------	-------	1.808	P7
15	SCS Runoff	------	-------	0.616	-------	-------	1.211	-------	-------	2.276	P8
16	SCS Runoff	------	-------	0.616	-------	-------	1.211	-------	-------	2.276	P9
17	SCS Runoff	------	-------	3.574	-------	-------	7.293	-------	-------	13.89	P10
18	Combine	8, 9, 10, 11, 12, 13,	-------	4.058	-------	-------	8.952	-------	-------	17.77	Proposed North
19	Combine	14, 15, 16, 17,	-------	5.071	-------	-------	10.51	-------	-------	20.25	Proposed South
20	Combine	18, 19	-------	9.129	-------	-------	19.46	-------	-------	38.02	Proposed Site

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	3.975	2	716	8,836	------	------	------	E1
2	SCS Runoff	0.454	2	716	969	------	------	------	E2
3	SCS Runoff	1.001	2	716	2,225	------	------	------	E3
4	SCS Runoff	1.172	2	716	2,606	------	------	------	E4
5	SCS Runoff	1.230	2	716	2,733	------	------	------	E5
6	SCS Runoff	2.355	2	716	5,116	------	------	------	E6
7	Combine	10.19	2	716	22,485	1, 2, 3, 4, 5, 6	------	------	Existing
8	SCS Runoff	0.616	2	716	1,410	------	------	------	P1
9	SCS Runoff	0.733	2	716	1,678	------	------	------	P2
10	SCS Runoff	0.197	2	716	398	------	------	------	P3
11	SCS Runoff	0.544	2	718	1,089	------	------	------	P4
12	SCS Runoff	0.513	2	716	1,078	------	------	------	P5
13	SCS Runoff	1.462	2	716	3,073	------	------	------	P6
14	SCS Runoff	0.270	2	718	540	------	------	------	P7
15	SCS Runoff	0.616	2	716	1,410	------	------	------	P8
16	SCS Runoff	0.616	2	716	1,410	------	------	------	P9
17	SCS Runoff	3.574	2	716	7,764	------	------	------	P10
18	Combine	4.058	2	716	8,727	8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19	------	------	Proposed North
19	Combine	5.071	2	716	11,123		------	------	Proposed South
20	Combine	9.129	2	716	19,850		------	------	Proposed Site

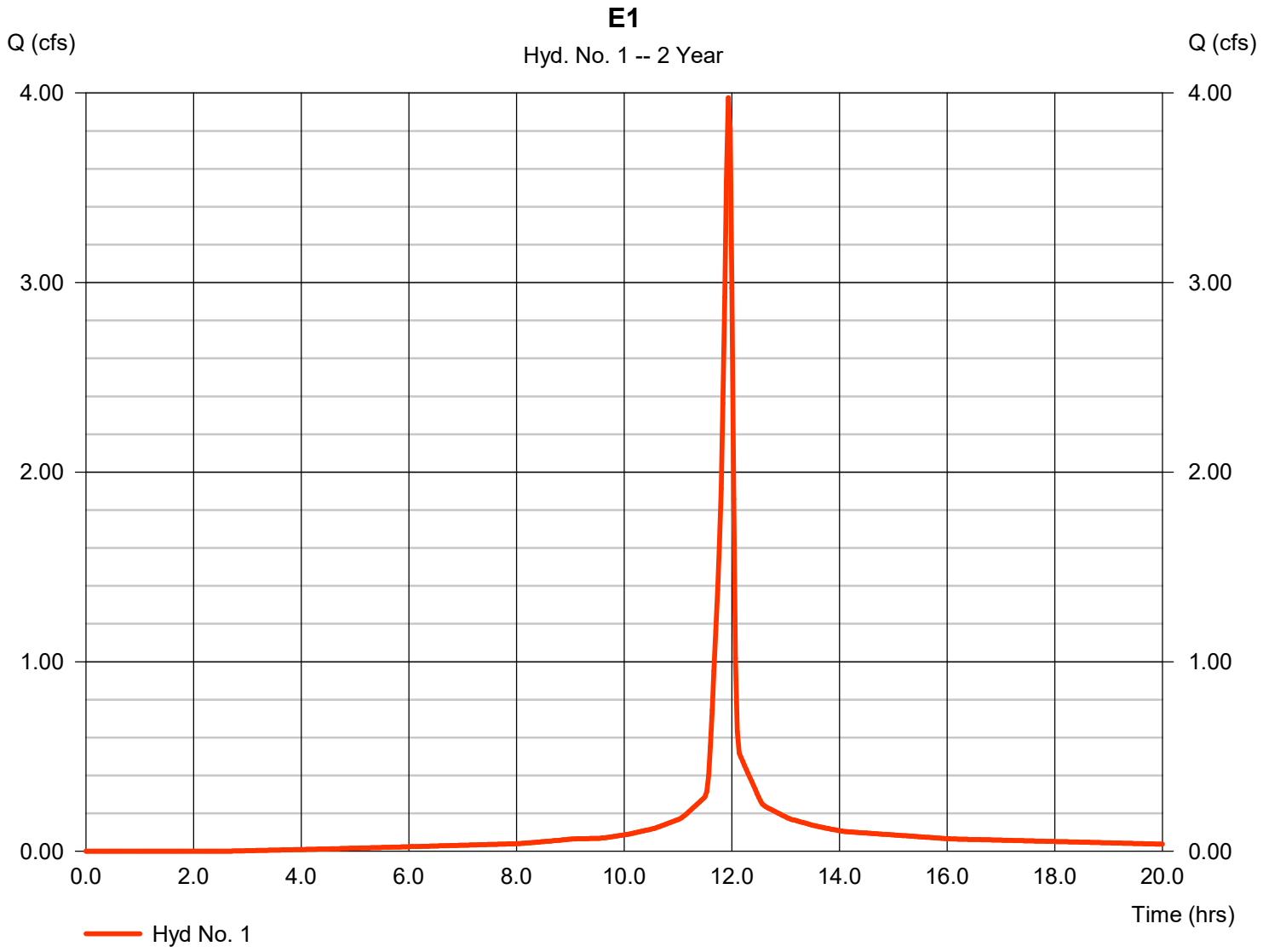
Hydrograph Report

Hyd. No. 1

E1

Hydrograph type	= SCS Runoff	Peak discharge	= 3.975 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 8,836 cuft
Drainage area	= 1.390 ac	Curve number	= 97*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.360 x 98) + (0.030 x 74)] / 1.390



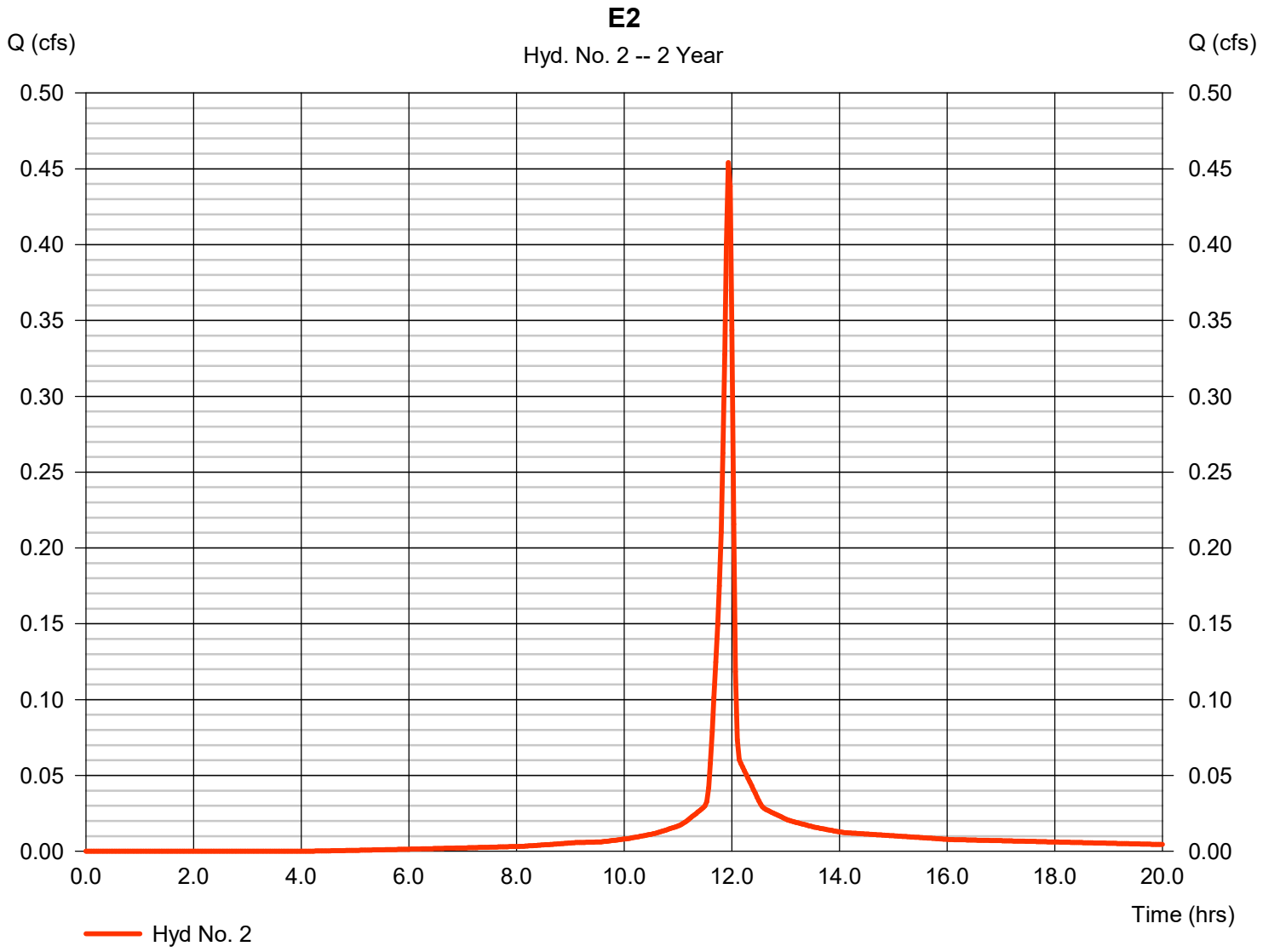
Hydrograph Report

Hyd. No. 2

E2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.454 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 969 cuft
Drainage area	= 0.170 ac	Curve number	= 95*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.150 x 98) + (0.020 x 74)] / 0.170



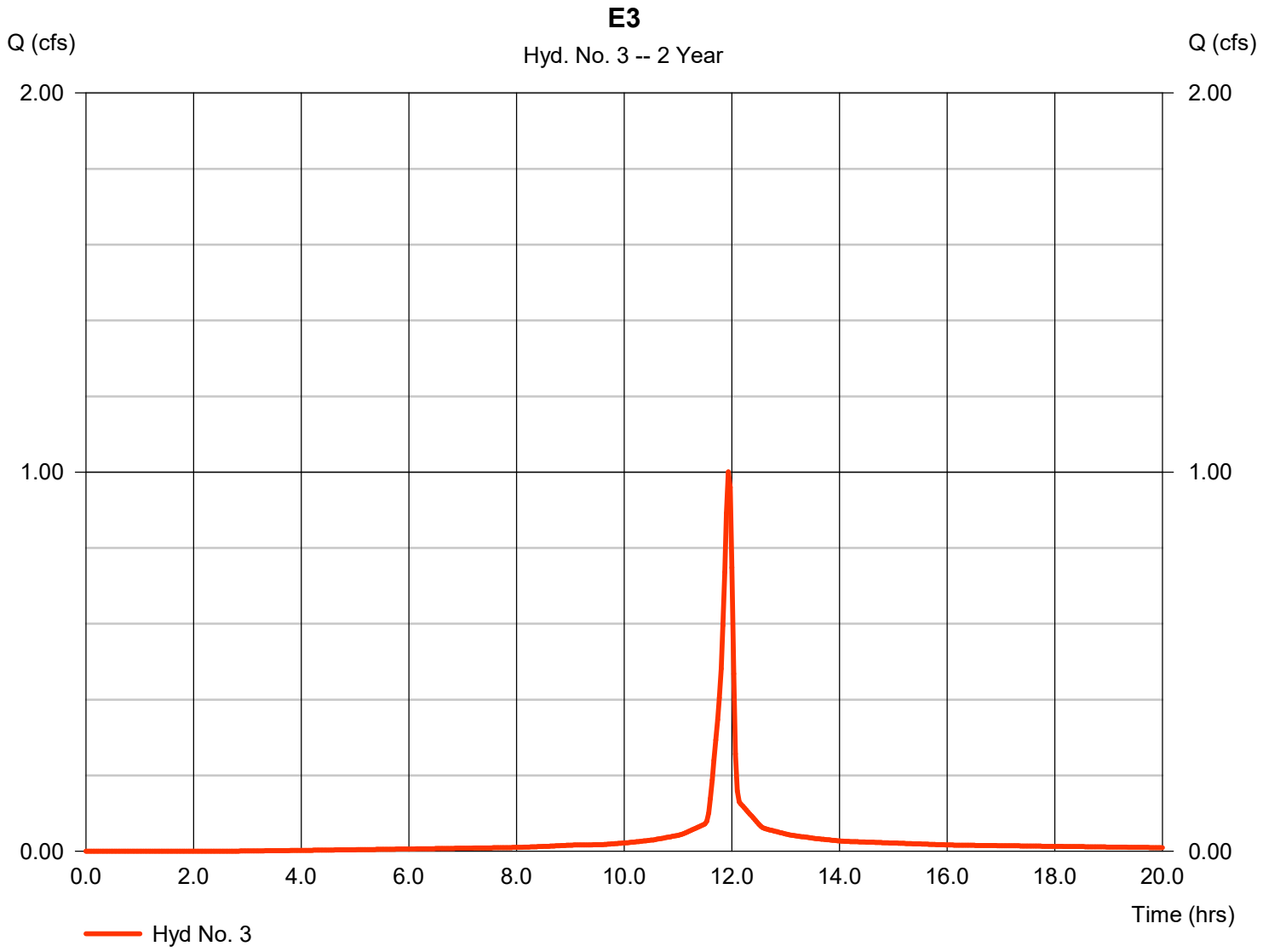
Hydrograph Report

Hyd. No. 3

E3

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.001 cfs
Storm frequency	=	2 yrs	Time to peak	=	11.93 hrs
Time interval	=	2 min	Hyd. volume	=	2,225 cuft
Drainage area	=	0.350 ac	Curve number	=	97*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.20 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.340 x 98) + (0.010 x 74)] / 0.350



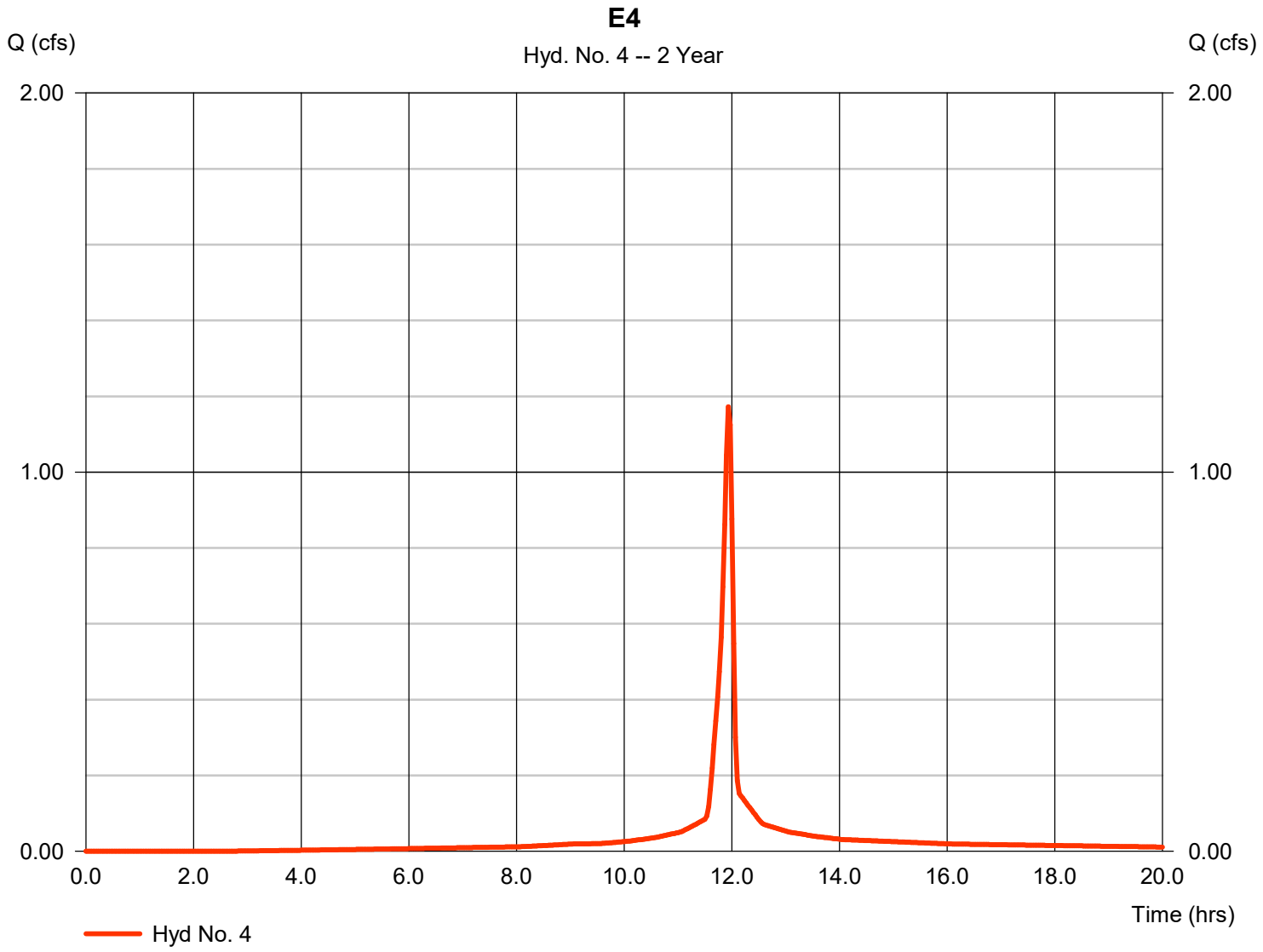
Hydrograph Report

Hyd. No. 4

E4

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.172 cfs
Storm frequency	=	2 yrs	Time to peak	=	11.93 hrs
Time interval	=	2 min	Hyd. volume	=	2,606 cuft
Drainage area	=	0.410 ac	Curve number	=	97*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.20 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.400 x 98) + (0.010 x 74)] / 0.410



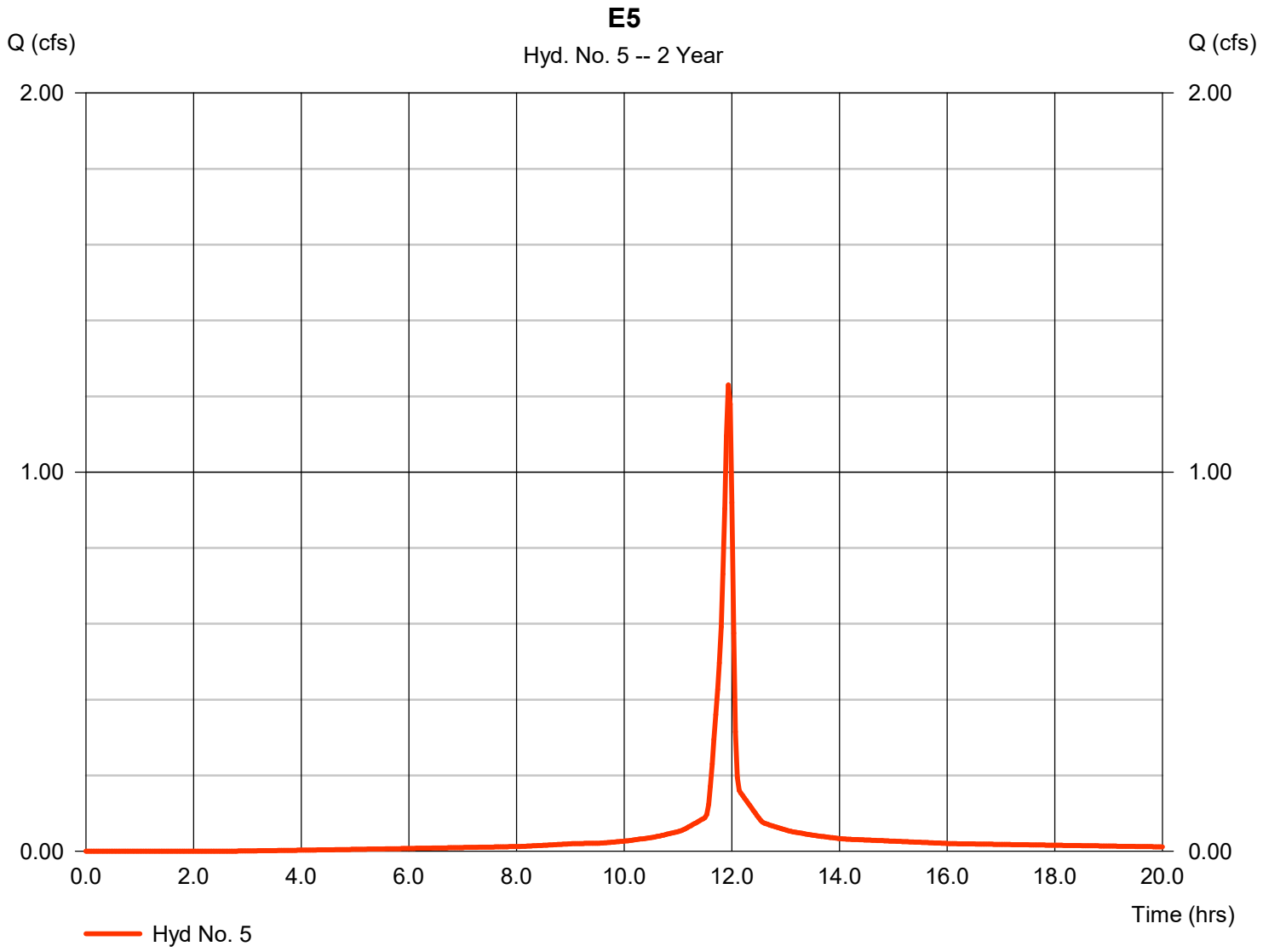
Hydrograph Report

Hyd. No. 5

E5

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.230 cfs
Storm frequency	=	2 yrs	Time to peak	=	11.93 hrs
Time interval	=	2 min	Hyd. volume	=	2,733 cuft
Drainage area	=	0.430 ac	Curve number	=	97*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.20 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.420 x 98) + (0.010 x 74)] / 0.430



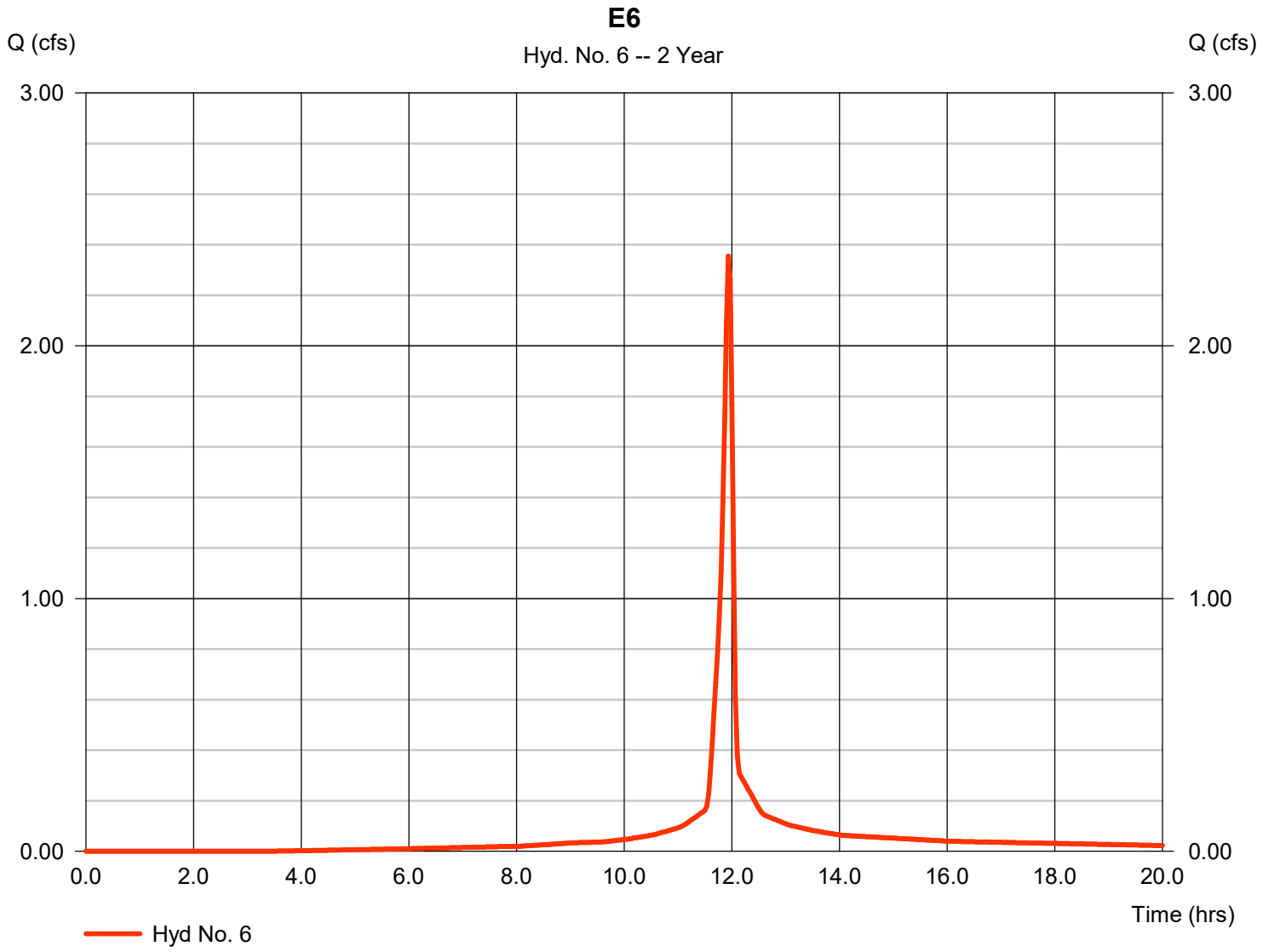
Hydrograph Report

Hyd. No. 6

E6

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.355 cfs
Storm frequency	=	2 yrs	Time to peak	=	11.93 hrs
Time interval	=	2 min	Hyd. volume	=	5,116 cuft
Drainage area	=	0.850 ac	Curve number	=	96*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.20 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.790 x 98) + (0.060 x 74)] / 0.850

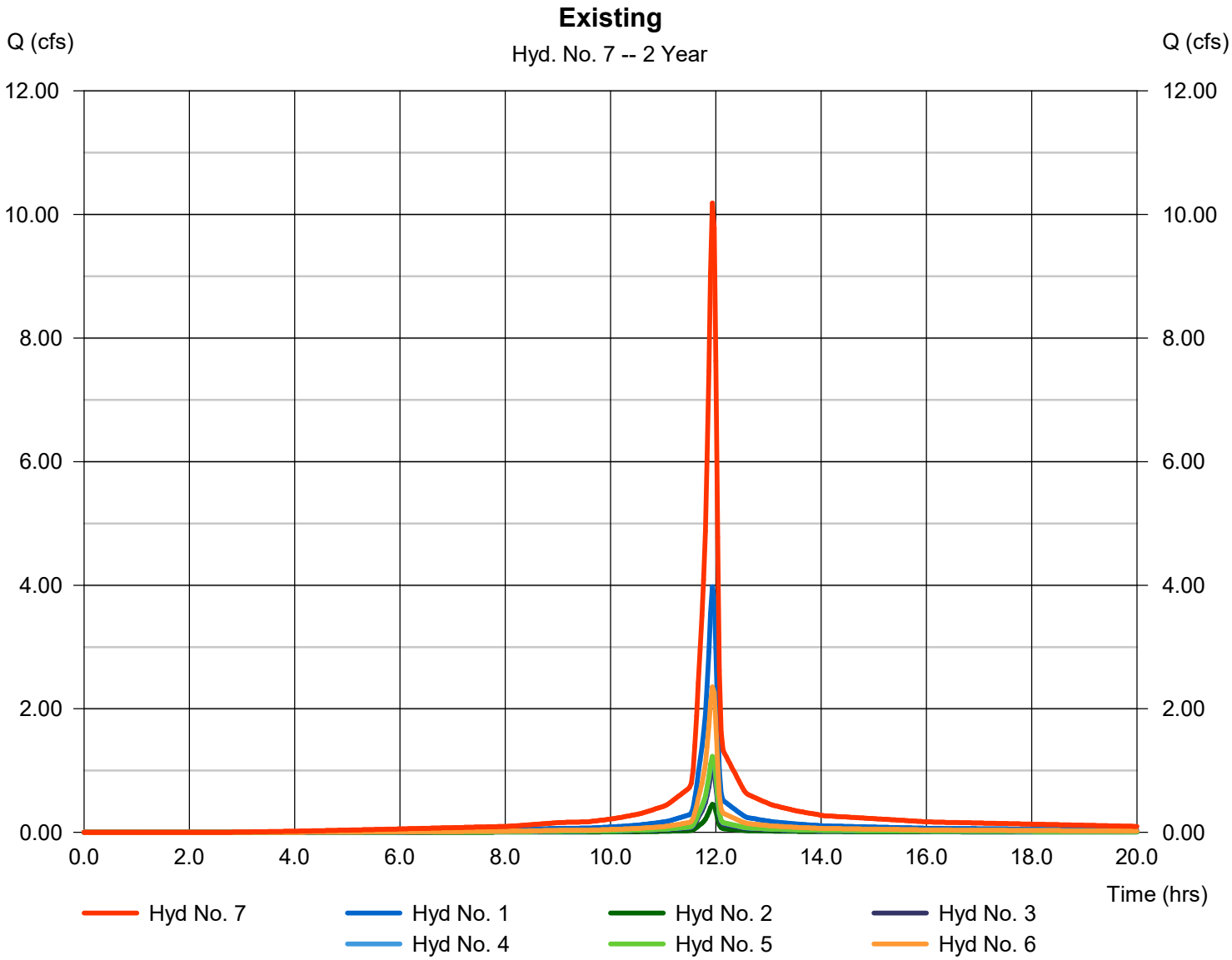


Hydrograph Report

Hyd. No. 7

Existing

Hydrograph type	= Combine	Peak discharge	= 10.19 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 22,485 cuft
Inflow hyds.	= 1, 2, 3, 4, 5, 6	Contrib. drain. area	= 3.600 ac



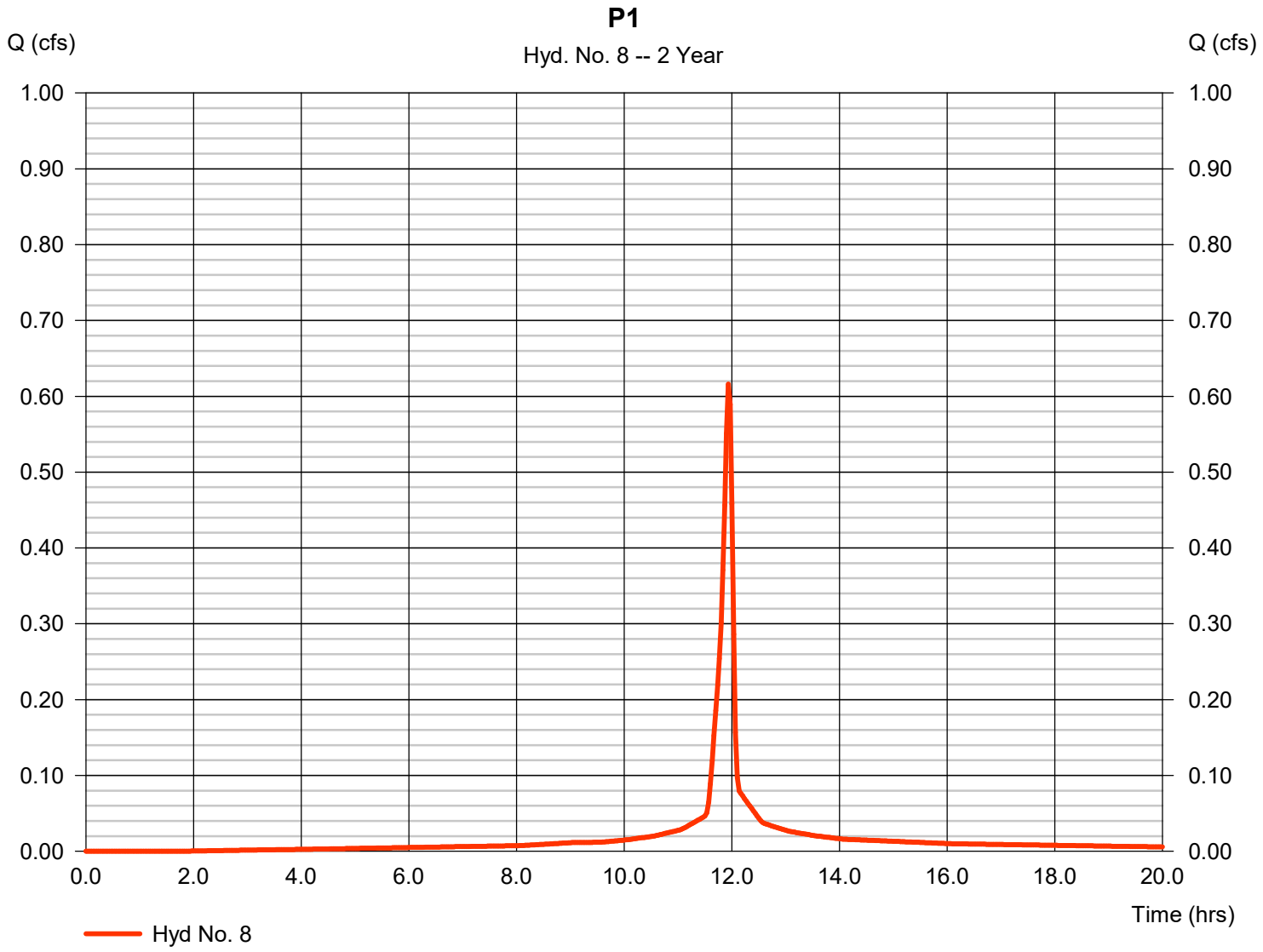
Hydrograph Report

Hyd. No. 8

P1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.616 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 1,410 cuft
Drainage area	= 0.210 ac	Curve number	= 98*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.210 x 98)] / 0.210

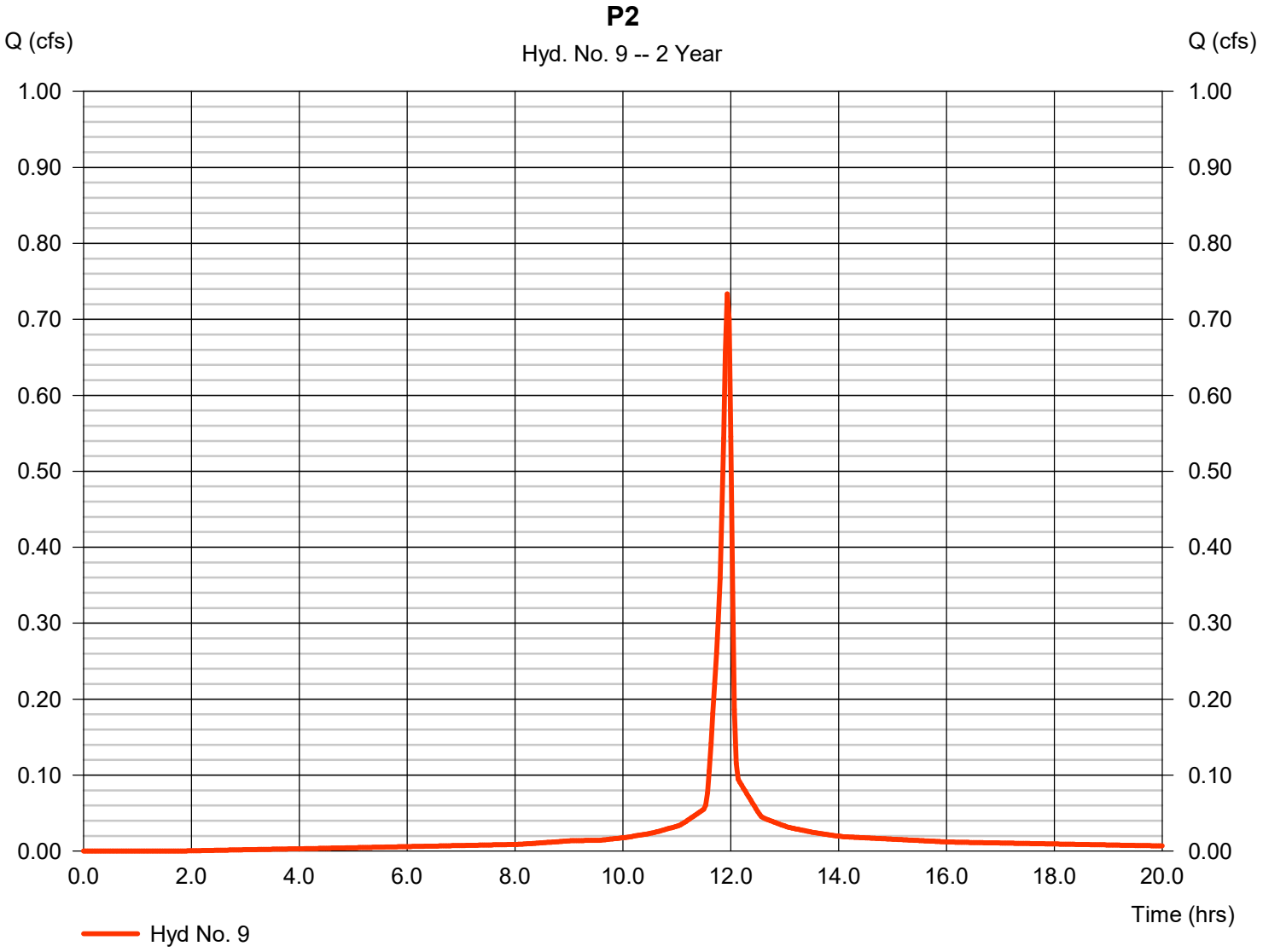


Hydrograph Report

Hyd. No. 9

P2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.733 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 1,678 cuft
Drainage area	= 0.250 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



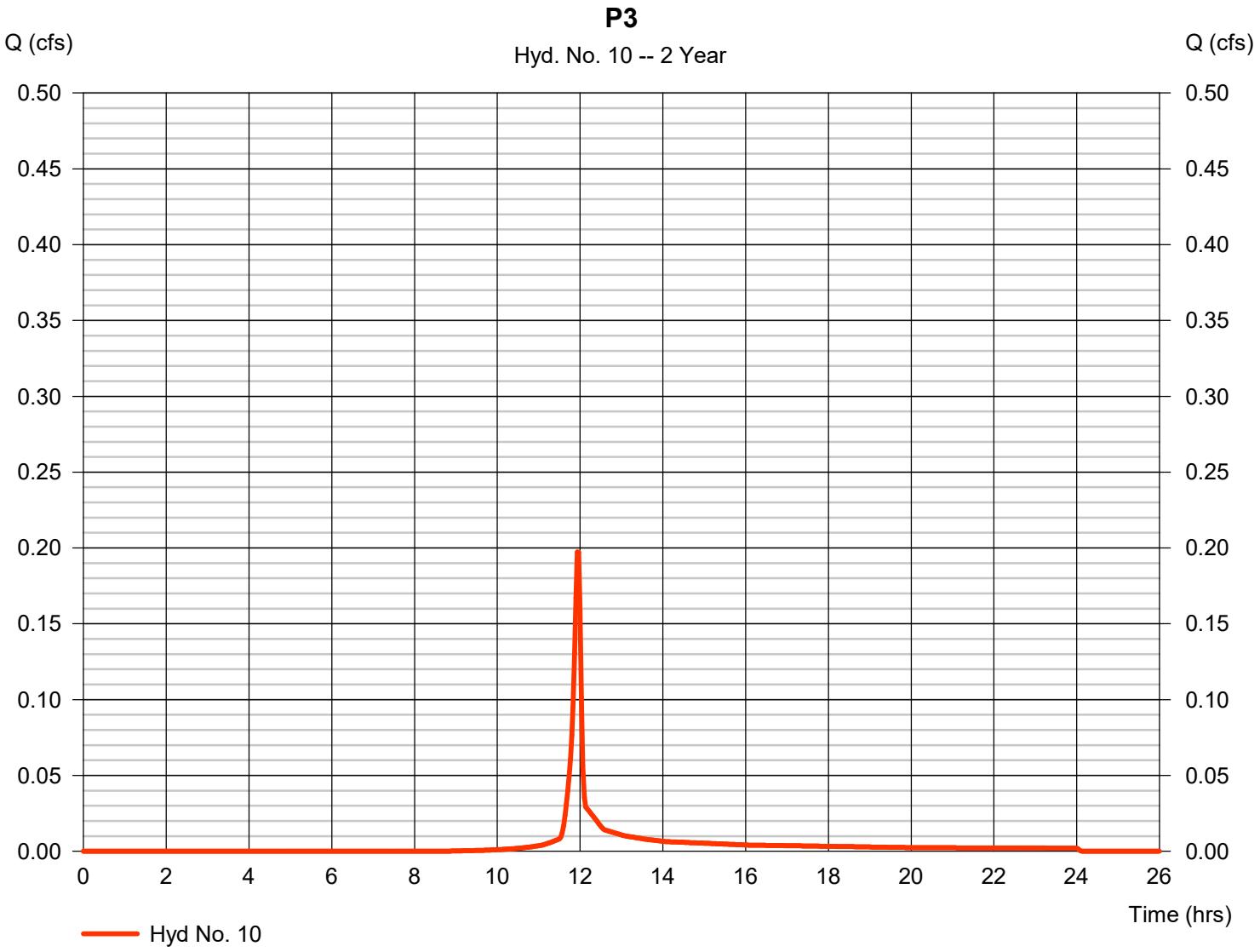
Hydrograph Report

Hyd. No. 10

P3

Hydrograph type	= SCS Runoff	Peak discharge	= 0.197 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 398 cuft
Drainage area	= 0.110 ac	Curve number	= 87*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.050 x 74) + (0.060 x 98)] / 0.110



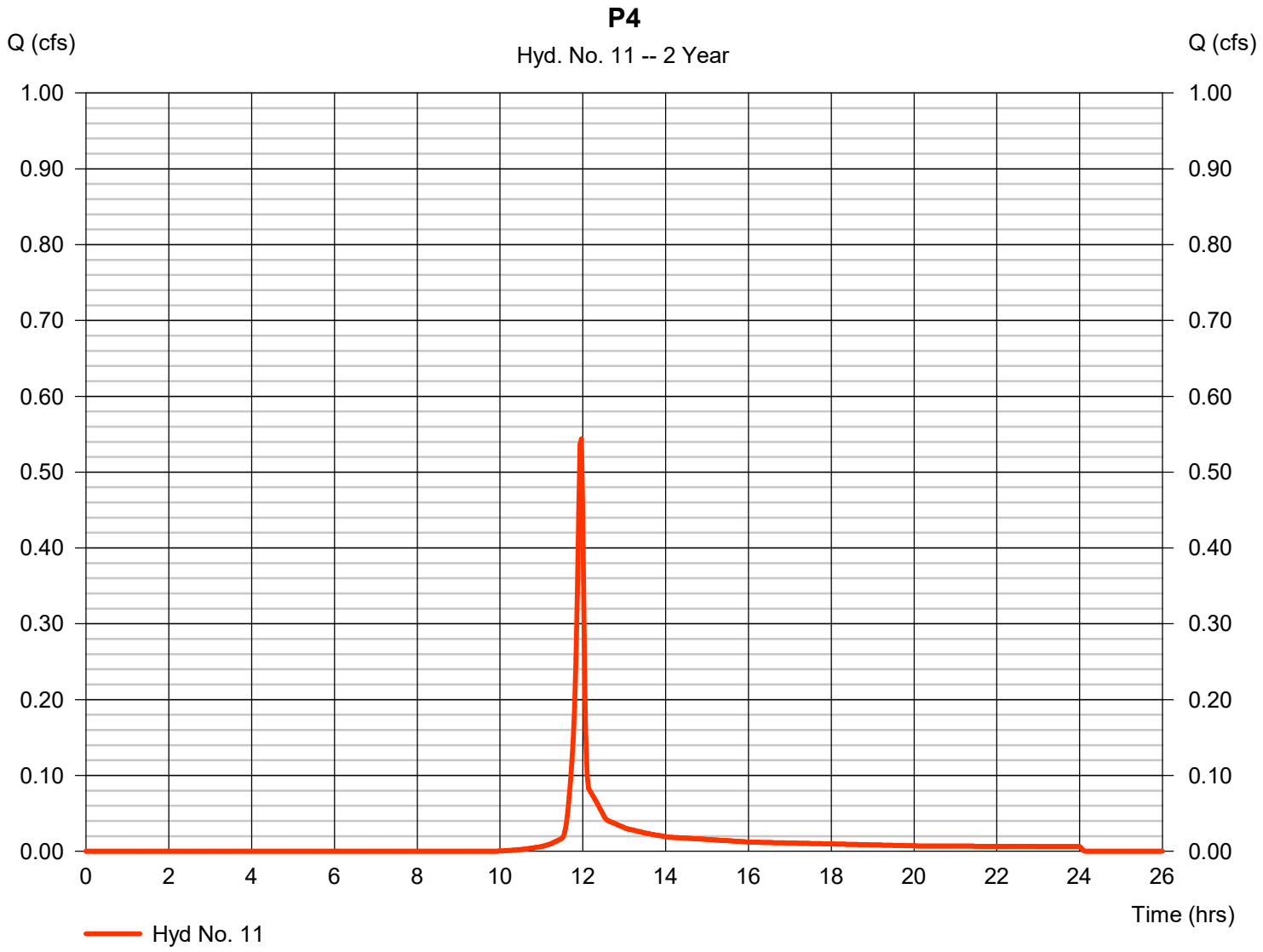
Hydrograph Report

Hyd. No. 11

P4

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.544 cfs
Storm frequency	=	2 yrs	Time to peak	=	11.97 hrs
Time interval	=	2 min	Hyd. volume	=	1,089 cuft
Drainage area	=	0.360 ac	Curve number	=	84*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.20 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.210 x 74) + (0.150 x 98)] / 0.360



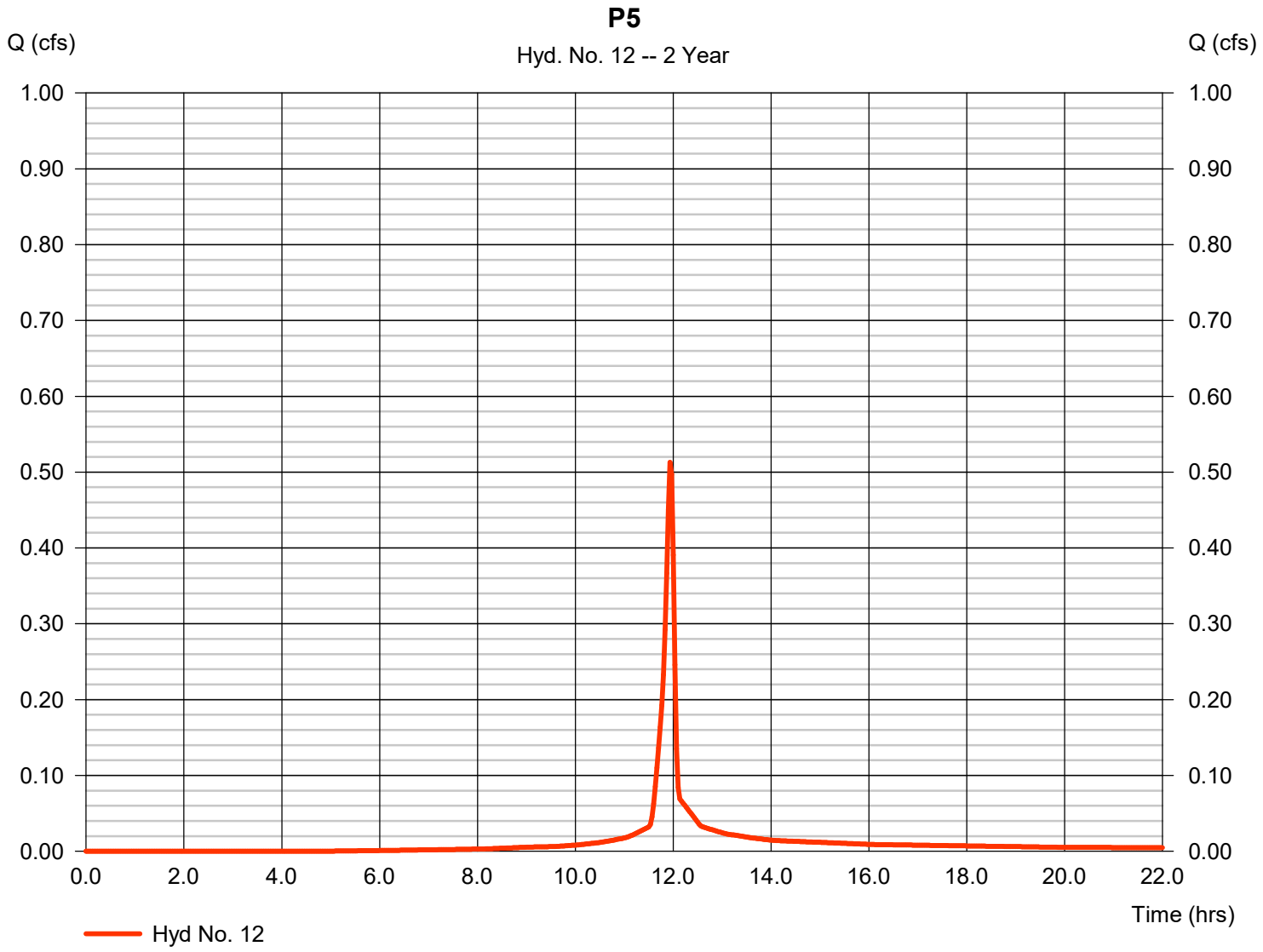
Hydrograph Report

Hyd. No. 12

P5

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.513 cfs
Storm frequency	=	2 yrs	Time to peak	=	11.93 hrs
Time interval	=	2 min	Hyd. volume	=	1,078 cuft
Drainage area	=	0.200 ac	Curve number	=	94*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.20 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.030 x 74) + (0.170 x 98)] / 0.200



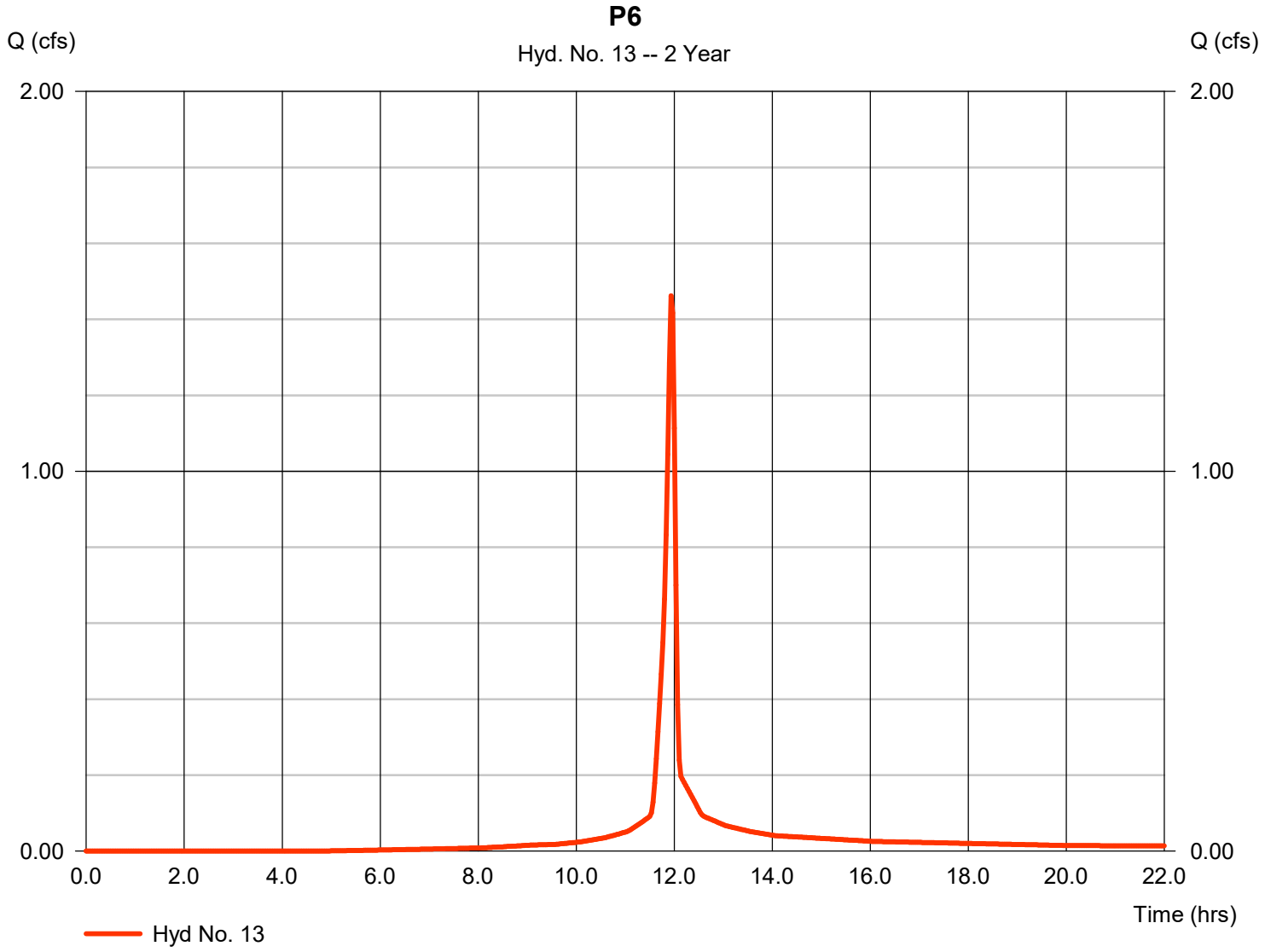
Hydrograph Report

Hyd. No. 13

P6

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.462 cfs
Storm frequency	=	2 yrs	Time to peak	=	11.93 hrs
Time interval	=	2 min	Hyd. volume	=	3,073 cuft
Drainage area	=	0.570 ac	Curve number	=	94*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.20 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.100 x 75) + (0.470 x 98)] / 0.570



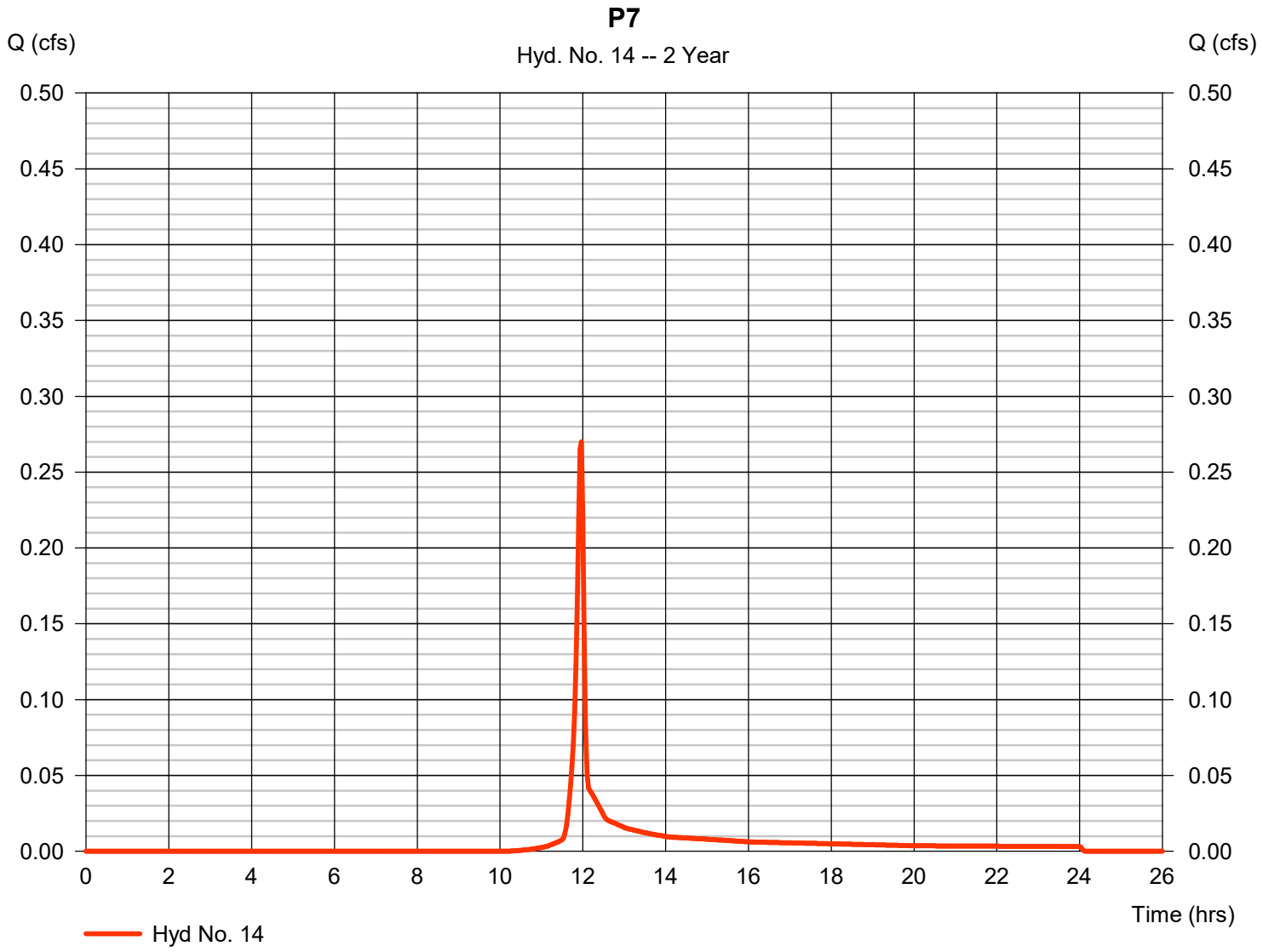
Hydrograph Report

Hyd. No. 14

P7

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.270 cfs
Storm frequency	=	2 yrs	Time to peak	=	11.97 hrs
Time interval	=	2 min	Hyd. volume	=	540 cuft
Drainage area	=	0.190 ac	Curve number	=	83*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.20 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.120 x 74) + (0.070 x 98)] / 0.190



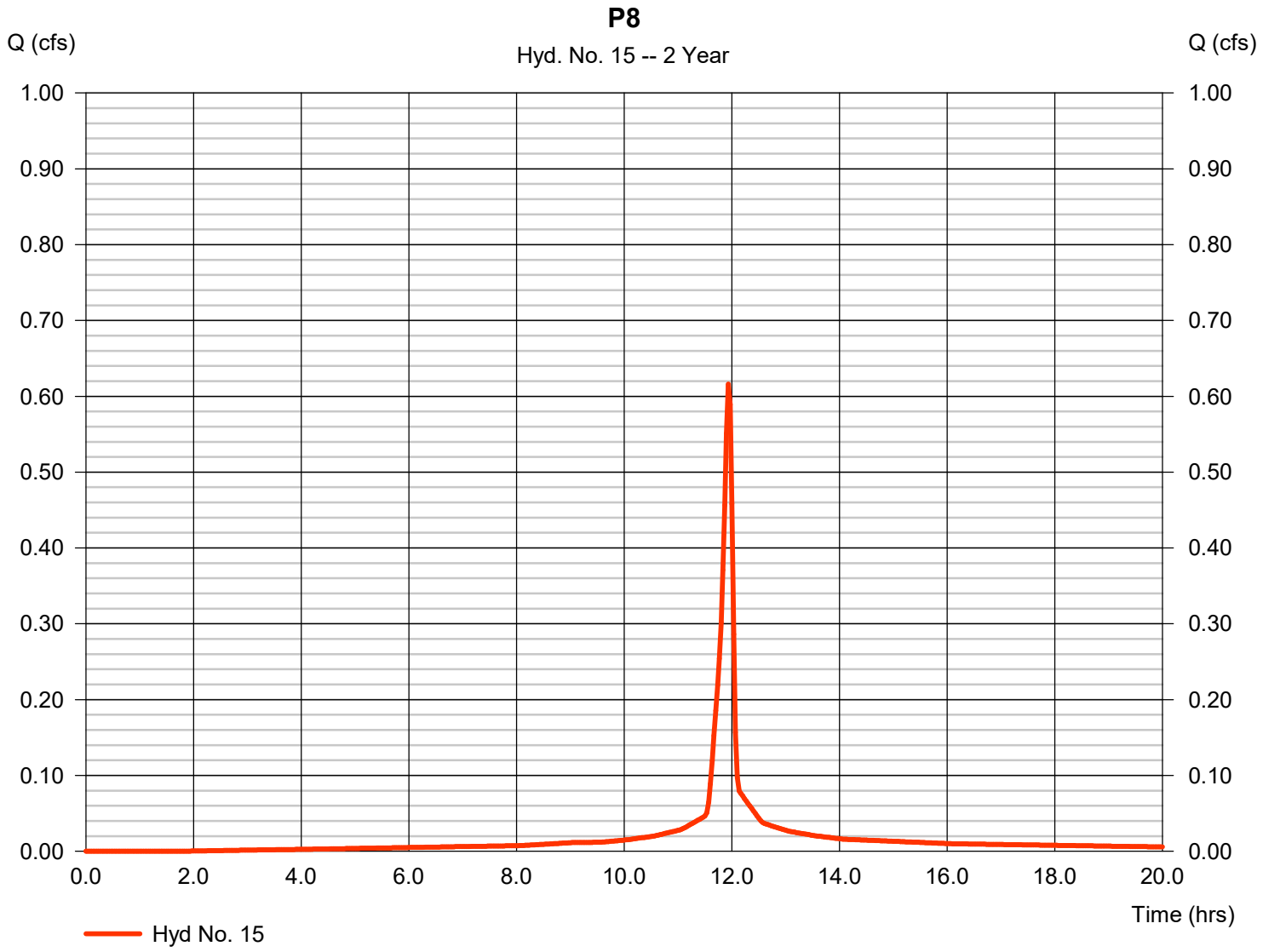
Hydrograph Report

Hyd. No. 15

P8

Hydrograph type	= SCS Runoff	Peak discharge	= 0.616 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 1,410 cuft
Drainage area	= 0.210 ac	Curve number	= 98*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.210 x 98)] / 0.210



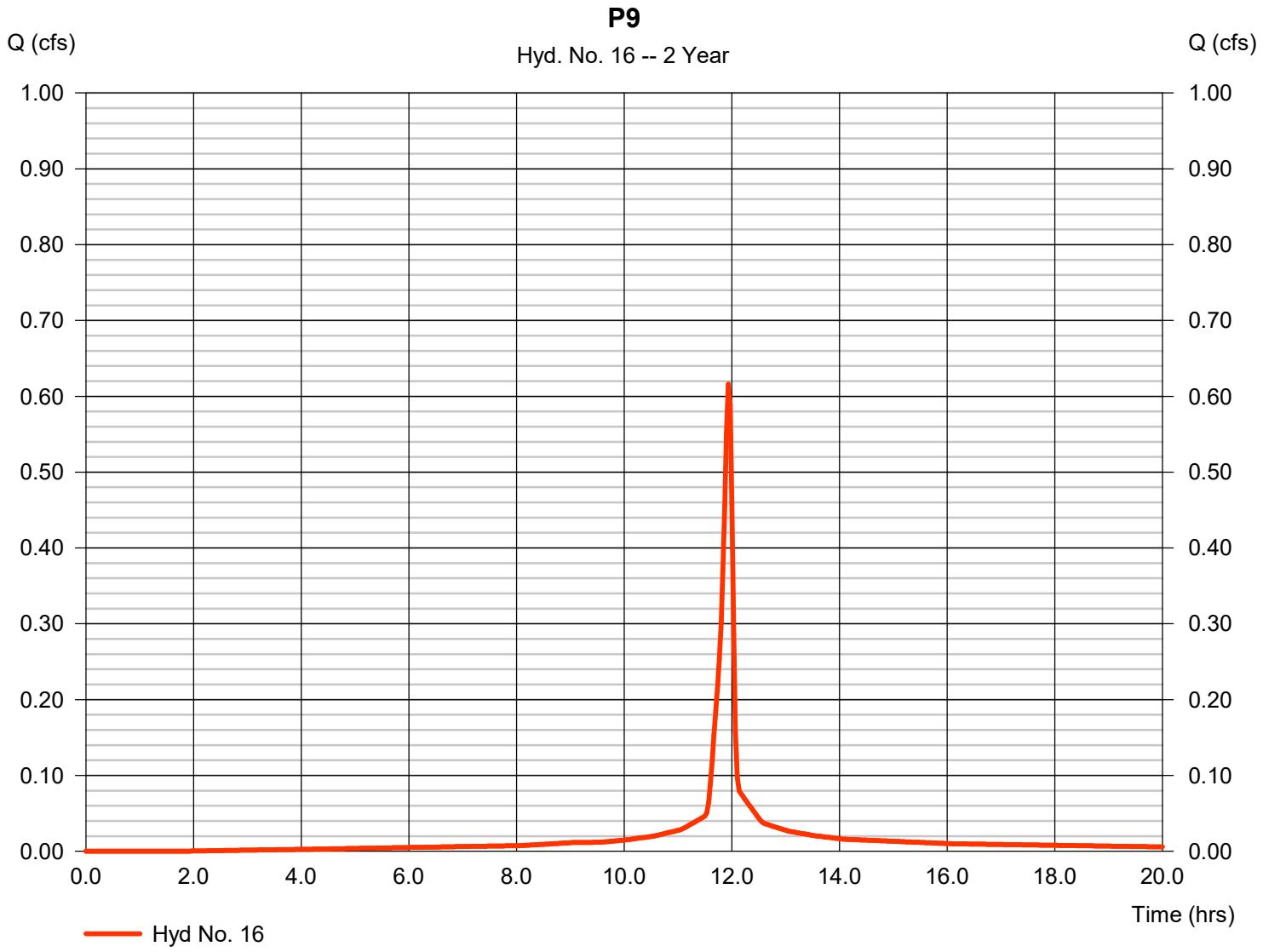
Hydrograph Report

Hyd. No. 16

P9

Hydrograph type	= SCS Runoff	Peak discharge	= 0.616 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 1,410 cuft
Drainage area	= 0.210 ac	Curve number	= 98*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.210 x 98)] / 0.210



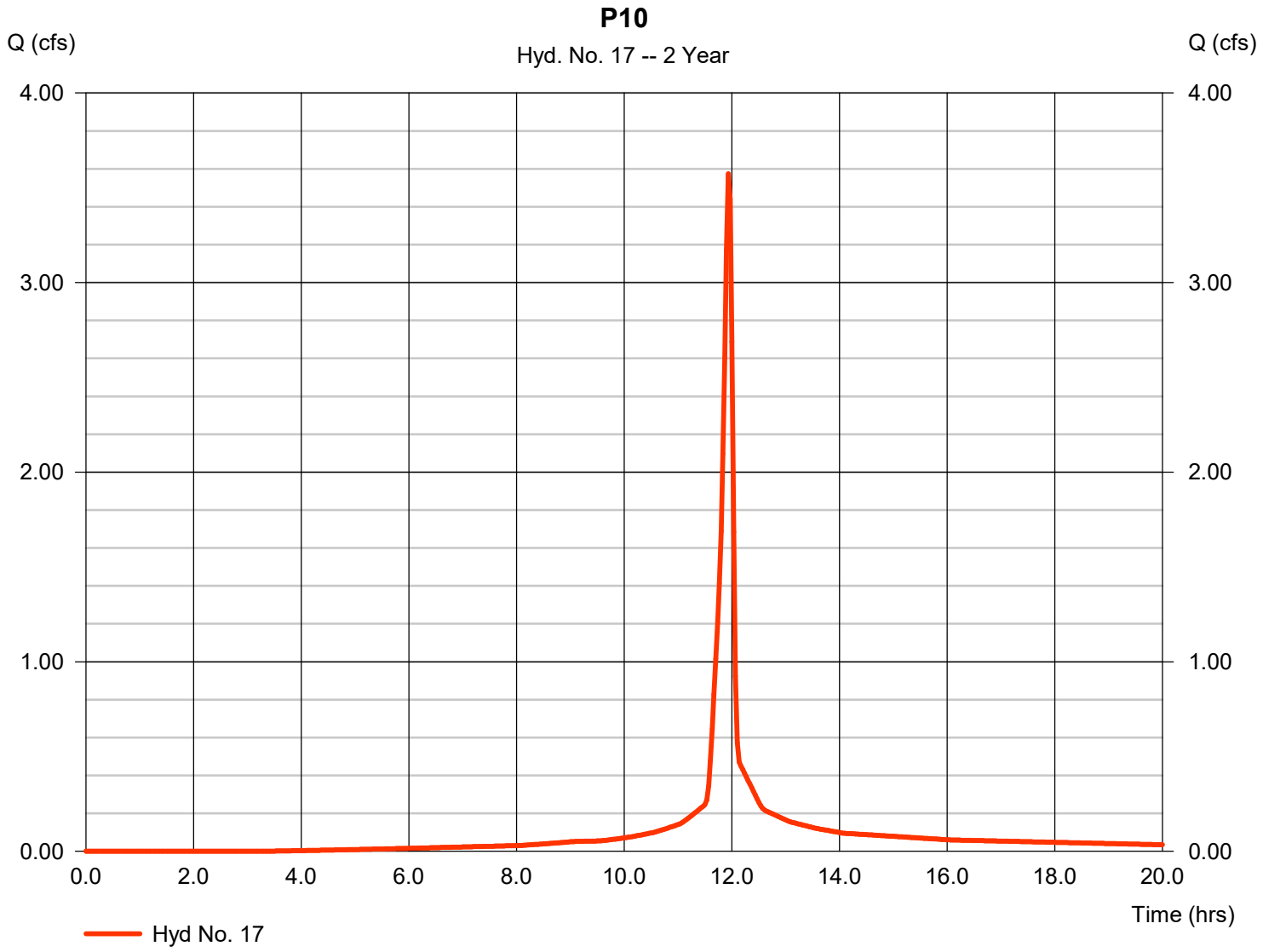
Hydrograph Report

Hyd. No. 17

P10

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.574 cfs
Storm frequency	=	2 yrs	Time to peak	=	11.93 hrs
Time interval	=	2 min	Hyd. volume	=	7,764 cuft
Drainage area	=	1.290 ac	Curve number	=	96*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.20 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.090 x 74) + (1.200 x 98)] / 1.290

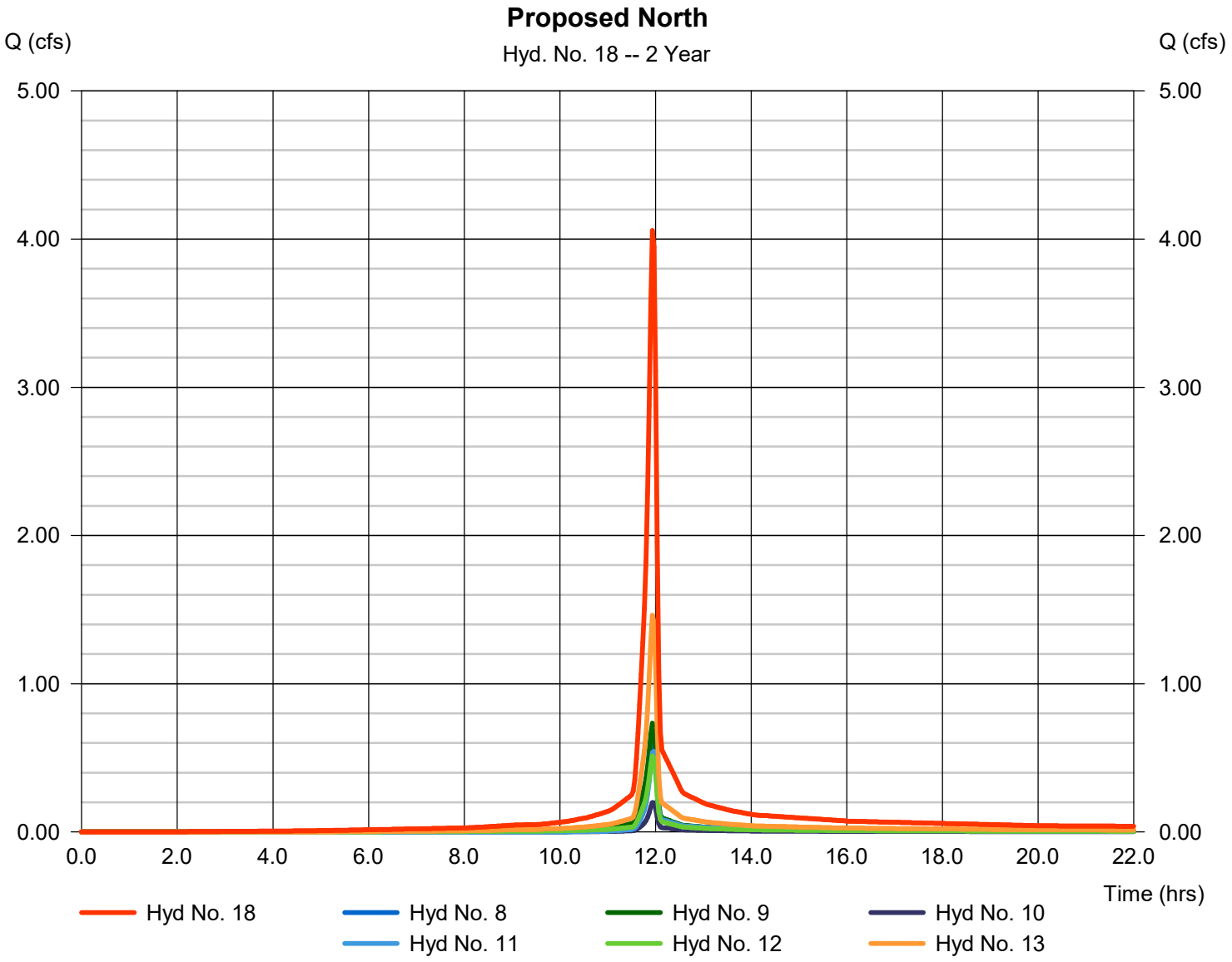


Hydrograph Report

Hyd. No. 18

Proposed North

Hydrograph type	= Combine	Peak discharge	= 4.058 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 8,727 cuft
Inflow hyds.	= 8, 9, 10, 11, 12, 13	Contrib. drain. area	= 1.700 ac

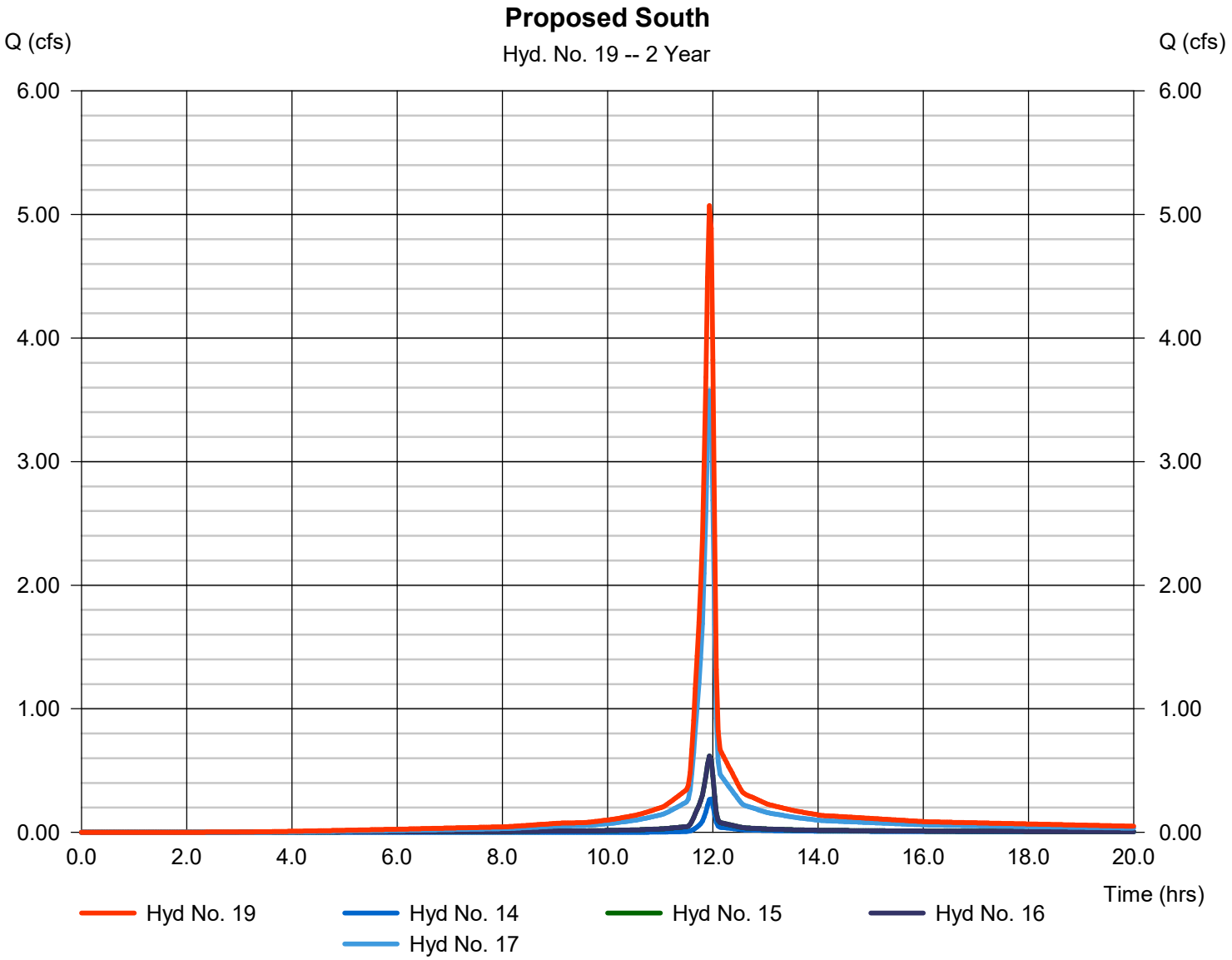


Hydrograph Report

Hyd. No. 19

Proposed South

Hydrograph type	= Combine	Peak discharge	= 5.071 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 11,123 cuft
Inflow hyds.	= 14, 15, 16, 17	Contrib. drain. area	= 1.900 ac

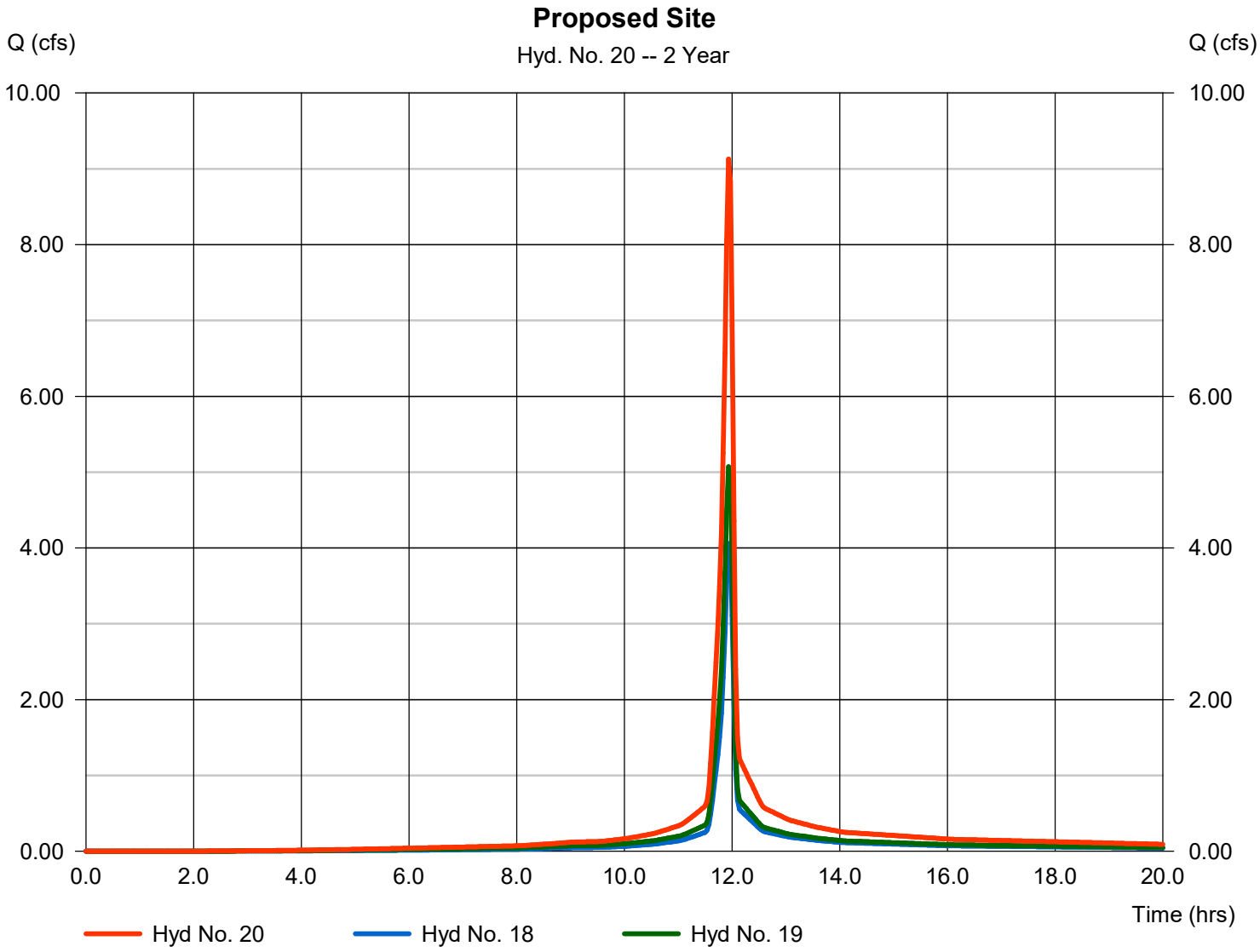


Hydrograph Report

Hyd. No. 20

Proposed Site

Hydrograph type	= Combine	Peak discharge	= 9.129 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 19,850 cuft
Inflow hyds.	= 18, 19	Contrib. drain. area	= 0.000 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	7.946	2	716	18,449	------	------	------	E1
2	SCS Runoff	0.948	2	716	2,128	------	------	------	E2
3	SCS Runoff	2.001	2	716	4,645	------	------	------	E3
4	SCS Runoff	2.344	2	716	5,442	------	------	------	E4
5	SCS Runoff	2.458	2	716	5,707	------	------	------	E5
6	SCS Runoff	4.805	2	716	10,957	------	------	------	E6
7	Combine	20.50	2	716	47,328	1, 2, 3, 4, 5, 6	------	------	Existing
8	SCS Runoff	1.211	2	716	2,869	------	------	------	P1
9	SCS Runoff	1.441	2	716	3,415	------	------	------	P2
10	SCS Runoff	0.517	2	716	1,073	------	------	------	P3
11	SCS Runoff	1.554	2	716	3,176	------	------	------	P4
12	SCS Runoff	1.098	2	716	2,430	------	------	------	P5
13	SCS Runoff	3.130	2	716	6,924	------	------	------	P6
14	SCS Runoff	0.795	2	716	1,619	------	------	------	P7
15	SCS Runoff	1.211	2	716	2,869	------	------	------	P8
16	SCS Runoff	1.211	2	716	2,869	------	------	------	P9
17	SCS Runoff	7.293	2	716	16,629	------	------	------	P10
18	Combine	8.952	2	716	19,888	8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19	------	------	Proposed North
19	Combine	10.51	2	716	23,986		------	------	Proposed South
20	Combine	19.46	2	716	43,874		------	------	Proposed Site

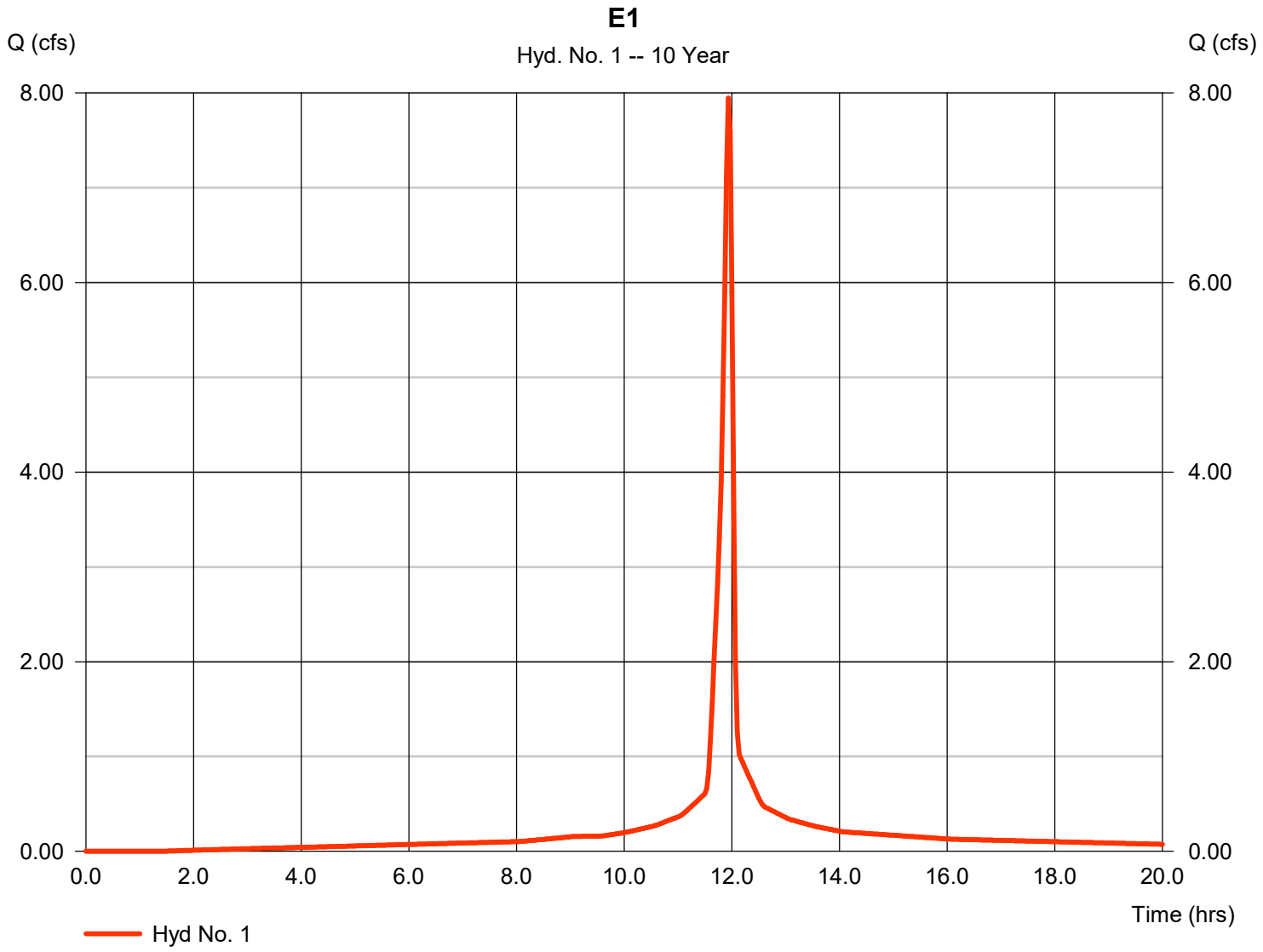
Hydrograph Report

Hyd. No. 1

E1

Hydrograph type	= SCS Runoff	Peak discharge	= 7.946 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 18,449 cuft
Drainage area	= 1.390 ac	Curve number	= 97*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.25 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.360 x 98) + (0.030 x 74)] / 1.390



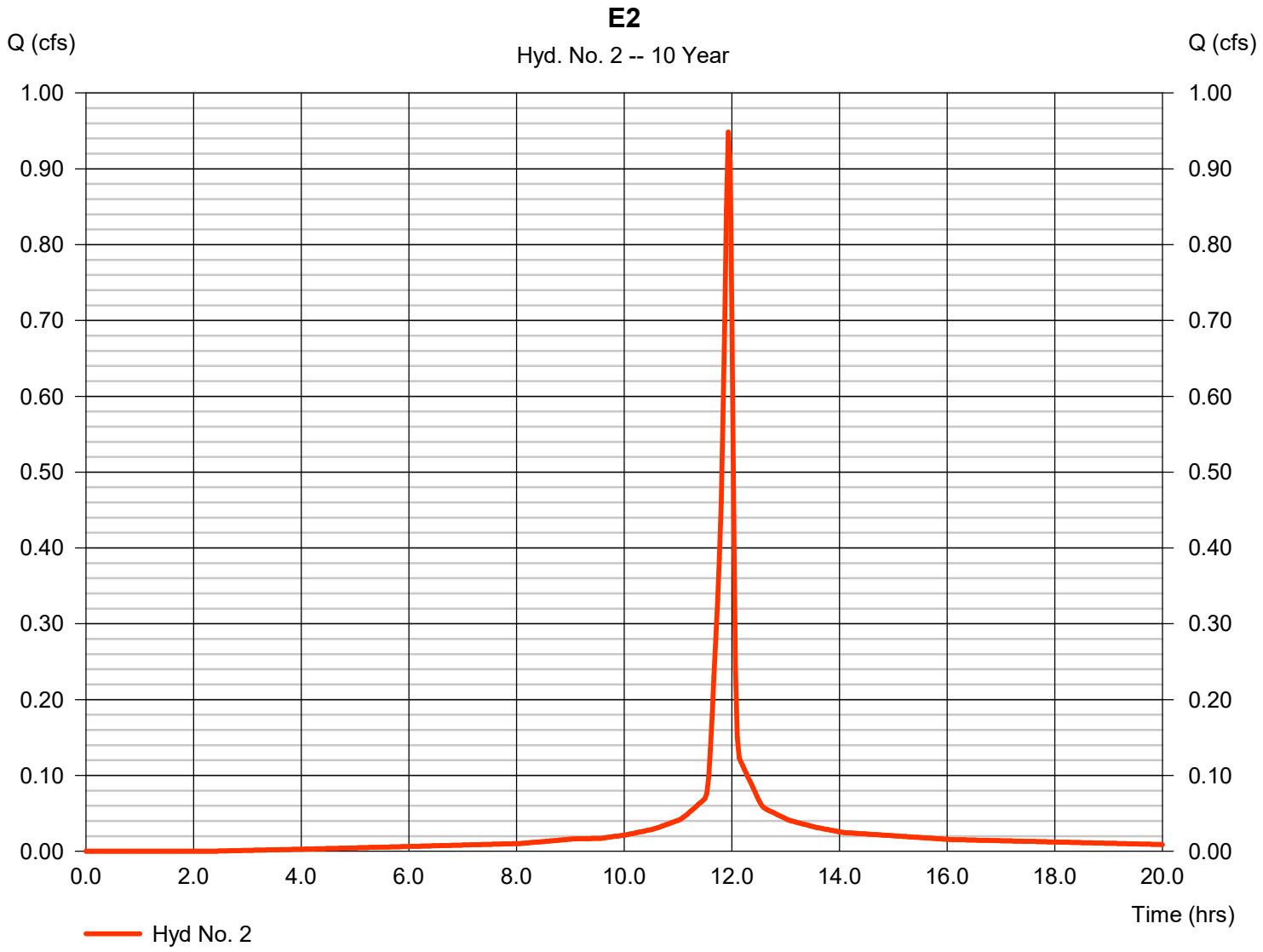
Hydrograph Report

Hyd. No. 2

E2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.948 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 2,128 cuft
Drainage area	= 0.170 ac	Curve number	= 95*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.25 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.150 x 98) + (0.020 x 74)] / 0.170



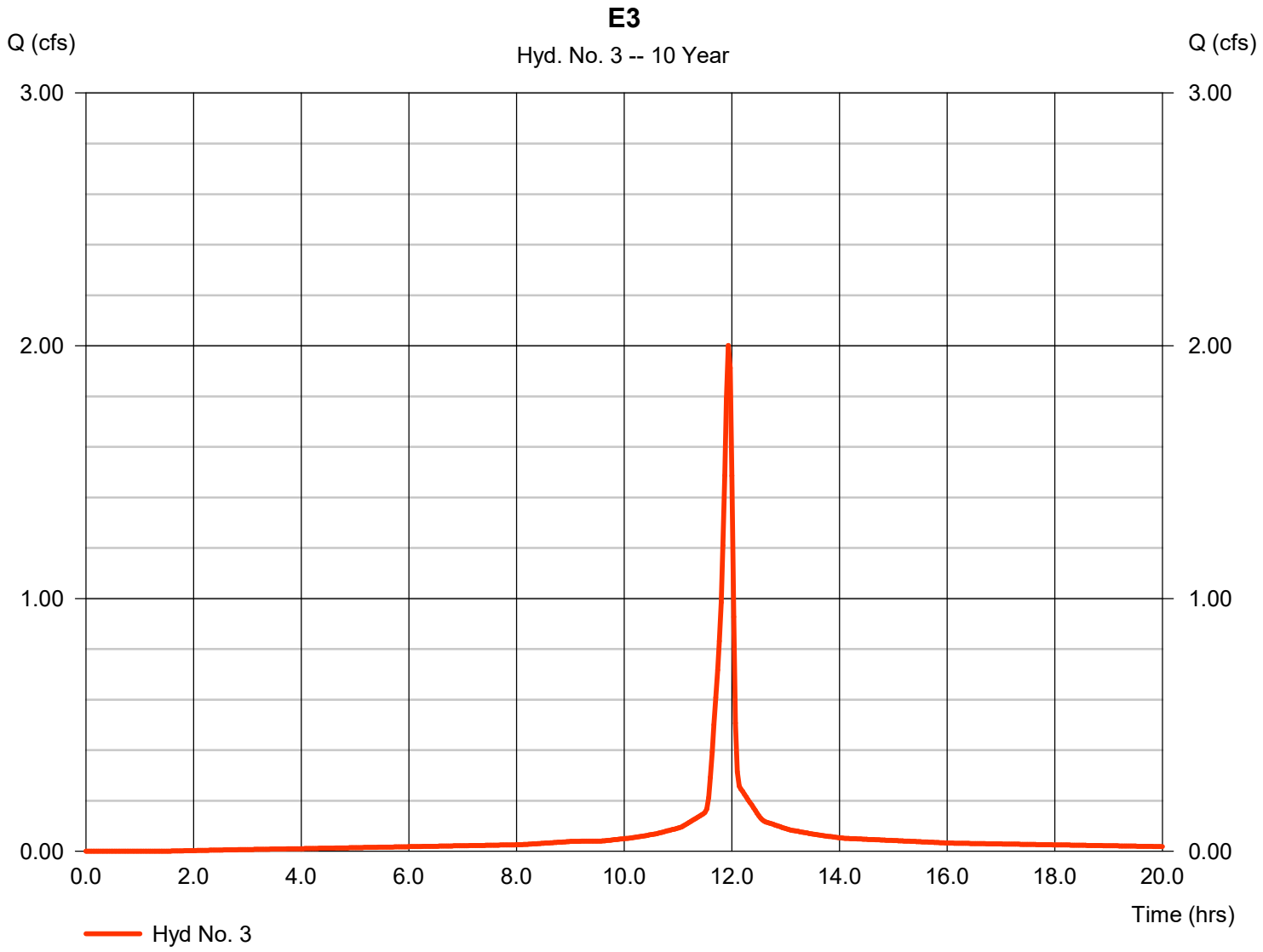
Hydrograph Report

Hyd. No. 3

E3

Hydrograph type	= SCS Runoff	Peak discharge	= 2.001 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 4,645 cuft
Drainage area	= 0.350 ac	Curve number	= 97*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.25 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.340 x 98) + (0.010 x 74)] / 0.350



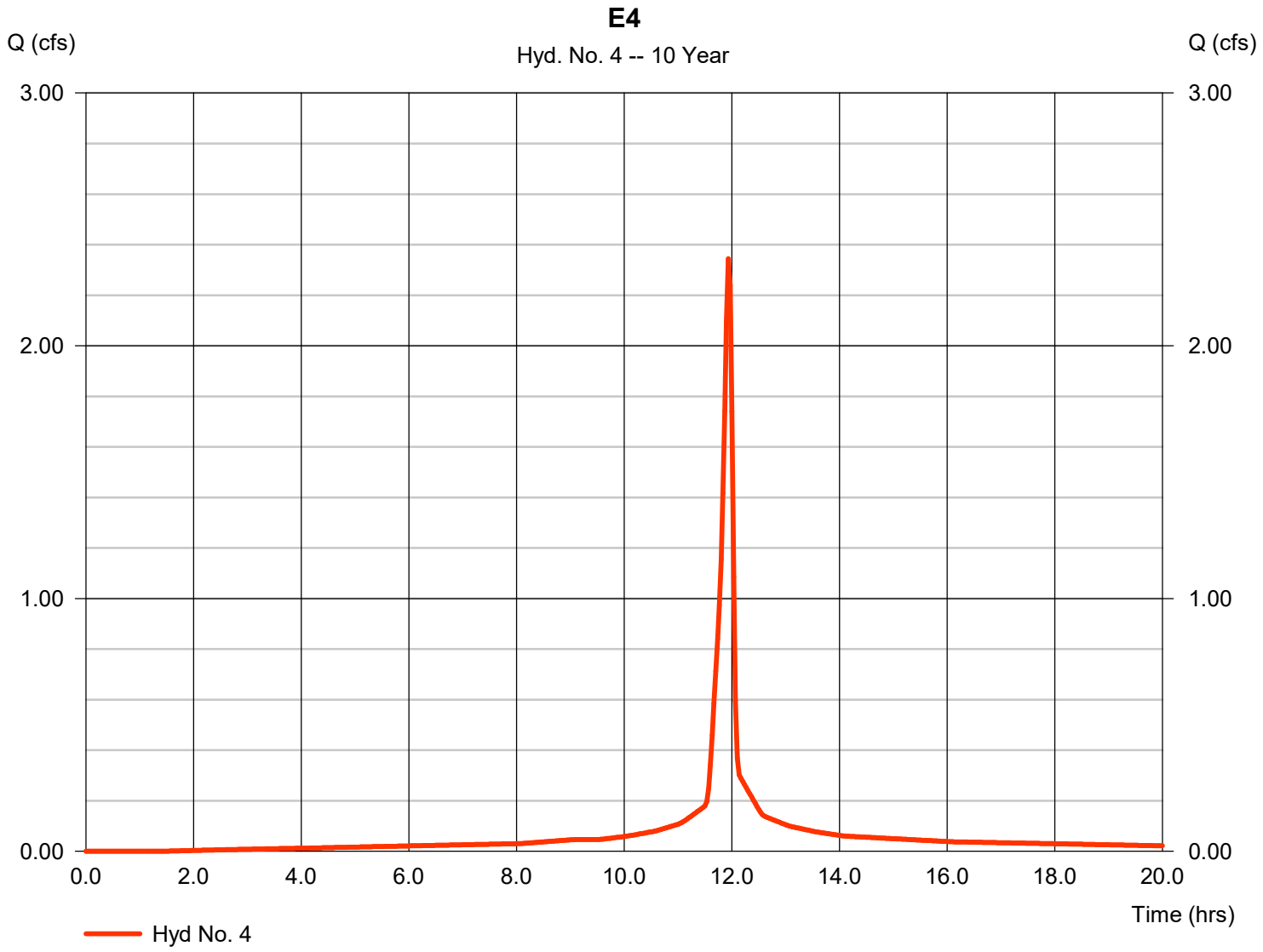
Hydrograph Report

Hyd. No. 4

E4

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.344 cfs
Storm frequency	=	10 yrs	Time to peak	=	11.93 hrs
Time interval	=	2 min	Hyd. volume	=	5,442 cuft
Drainage area	=	0.410 ac	Curve number	=	97*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	4.25 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.400 x 98) + (0.010 x 74)] / 0.410



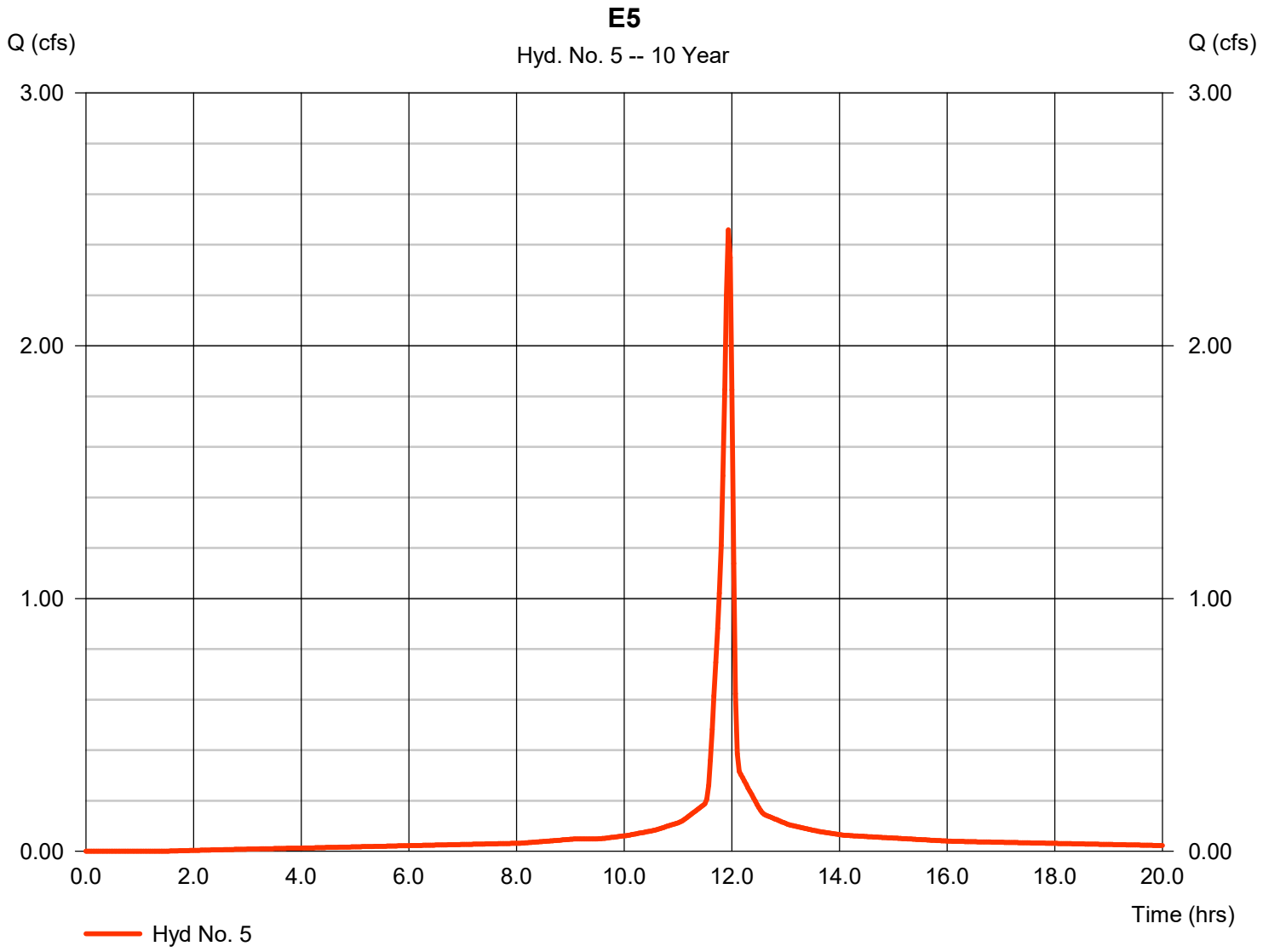
Hydrograph Report

Hyd. No. 5

E5

Hydrograph type	= SCS Runoff	Peak discharge	= 2.458 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 5,707 cuft
Drainage area	= 0.430 ac	Curve number	= 97*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.25 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.420 x 98) + (0.010 x 74)] / 0.430



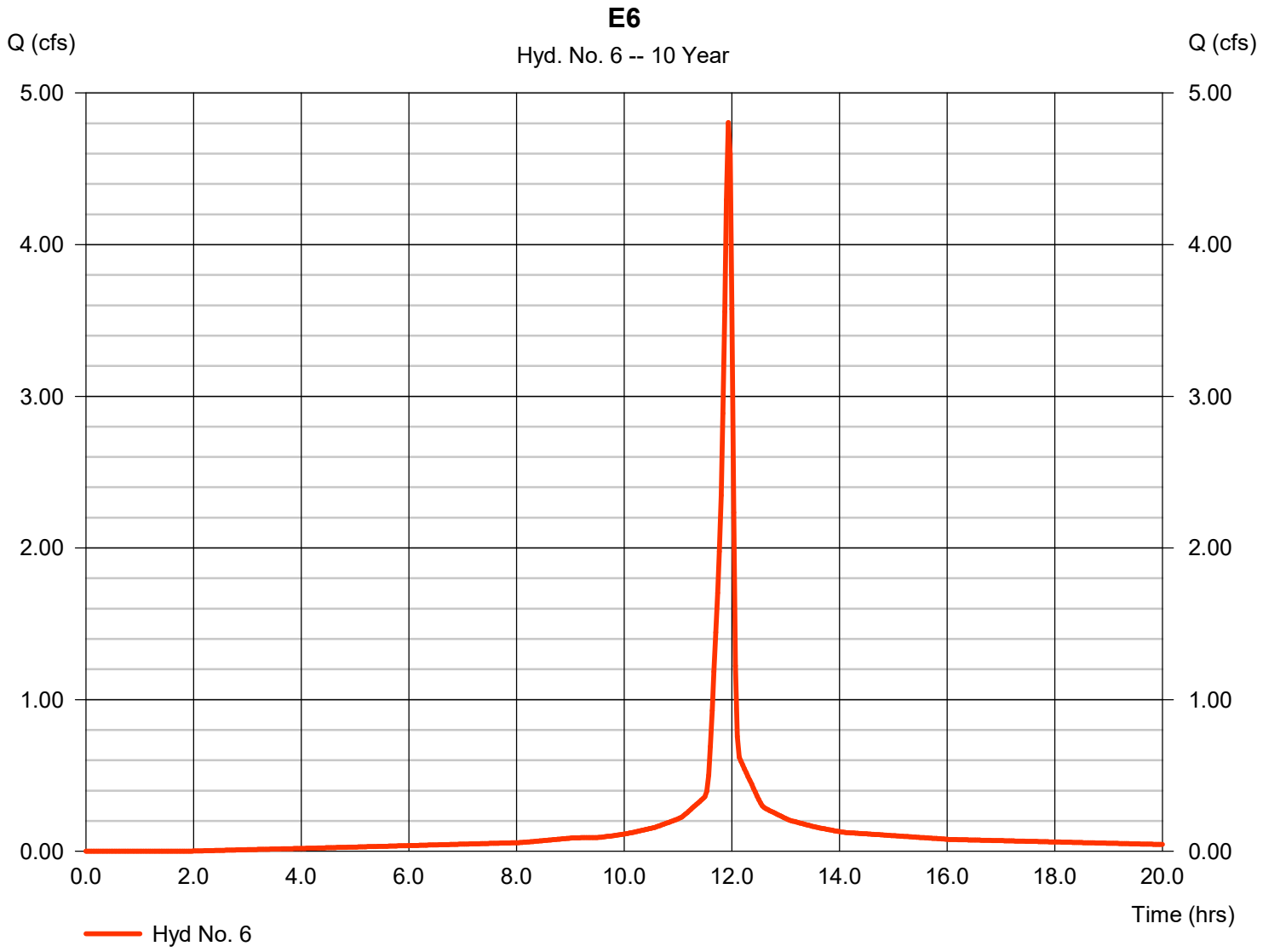
Hydrograph Report

Hyd. No. 6

E6

Hydrograph type	= SCS Runoff	Peak discharge	= 4.805 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 10,957 cuft
Drainage area	= 0.850 ac	Curve number	= 96*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.25 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.790 x 98) + (0.060 x 74)] / 0.850

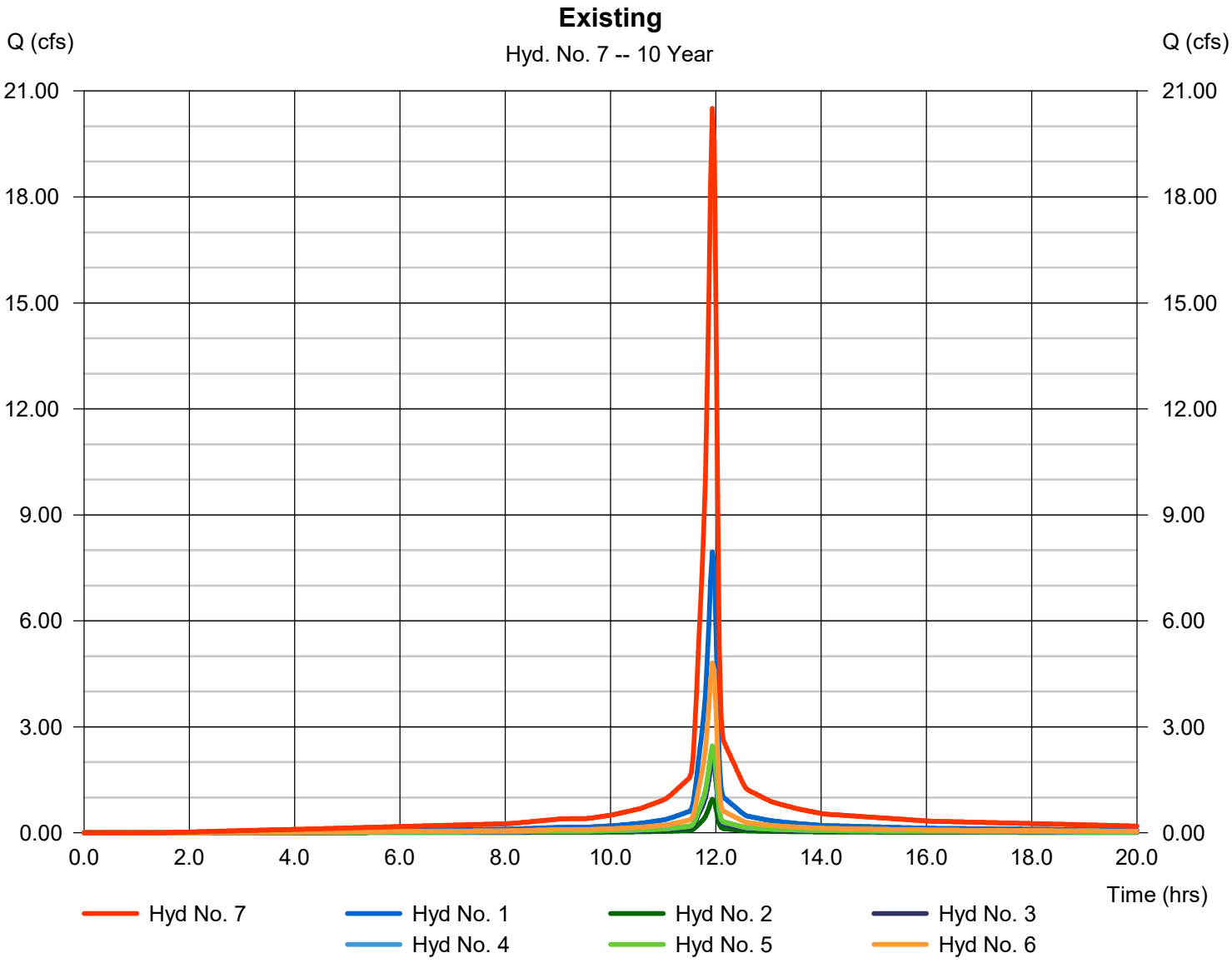


Hydrograph Report

Hyd. No. 7

Existing

Hydrograph type	= Combine	Peak discharge	= 20.50 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 47,328 cuft
Inflow hyds.	= 1, 2, 3, 4, 5, 6	Contrib. drain. area	= 3.600 ac



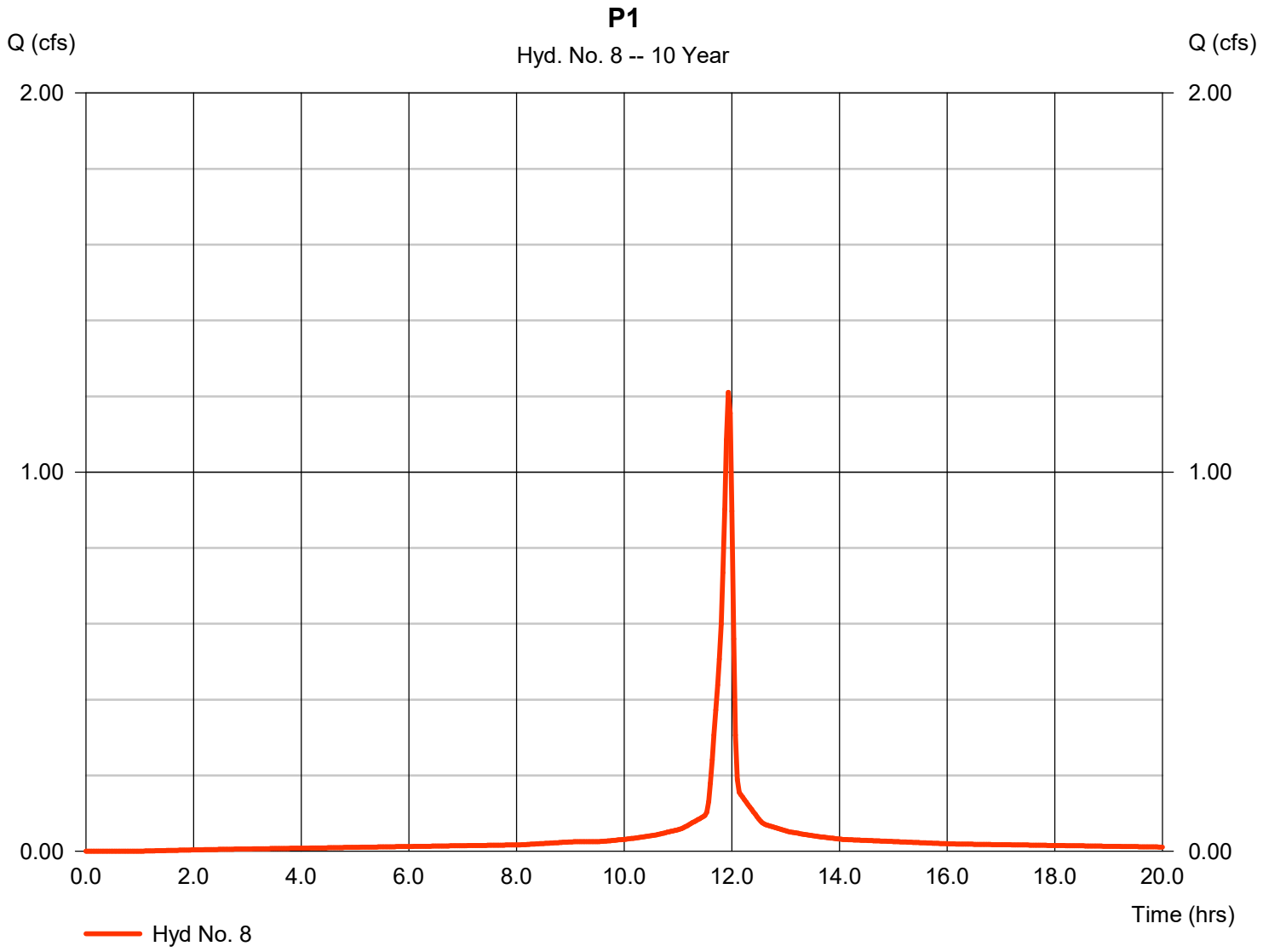
Hydrograph Report

Hyd. No. 8

P1

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.211 cfs
Storm frequency	=	10 yrs	Time to peak	=	11.93 hrs
Time interval	=	2 min	Hyd. volume	=	2,869 cuft
Drainage area	=	0.210 ac	Curve number	=	98*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	4.25 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.210 x 98)] / 0.210

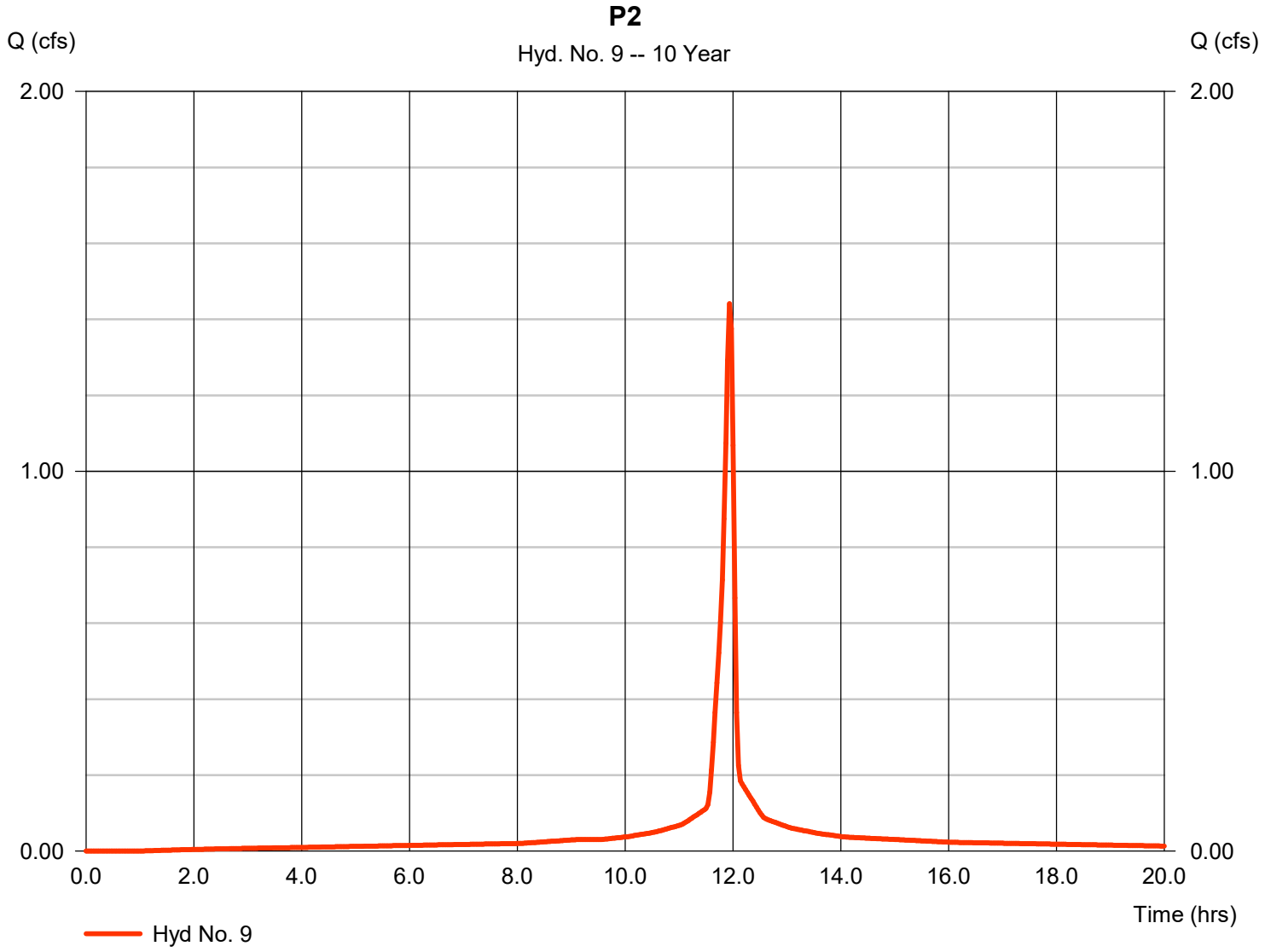


Hydrograph Report

Hyd. No. 9

P2

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.441 cfs
Storm frequency	=	10 yrs	Time to peak	=	11.93 hrs
Time interval	=	2 min	Hyd. volume	=	3,415 cuft
Drainage area	=	0.250 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	4.25 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



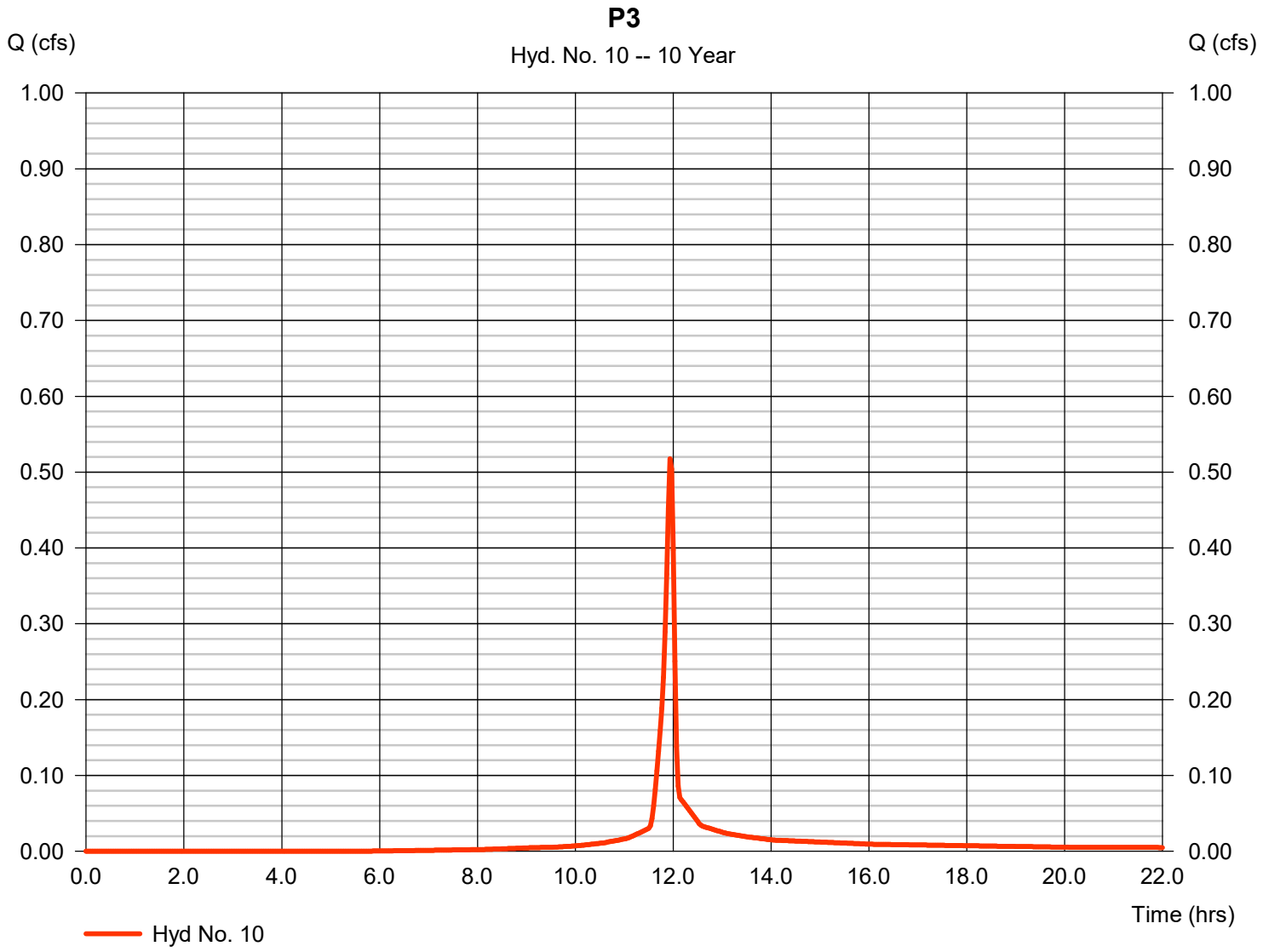
Hydrograph Report

Hyd. No. 10

P3

Hydrograph type	= SCS Runoff	Peak discharge	= 0.517 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 1,073 cuft
Drainage area	= 0.110 ac	Curve number	= 87*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.25 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.050 x 74) + (0.060 x 98)] / 0.110



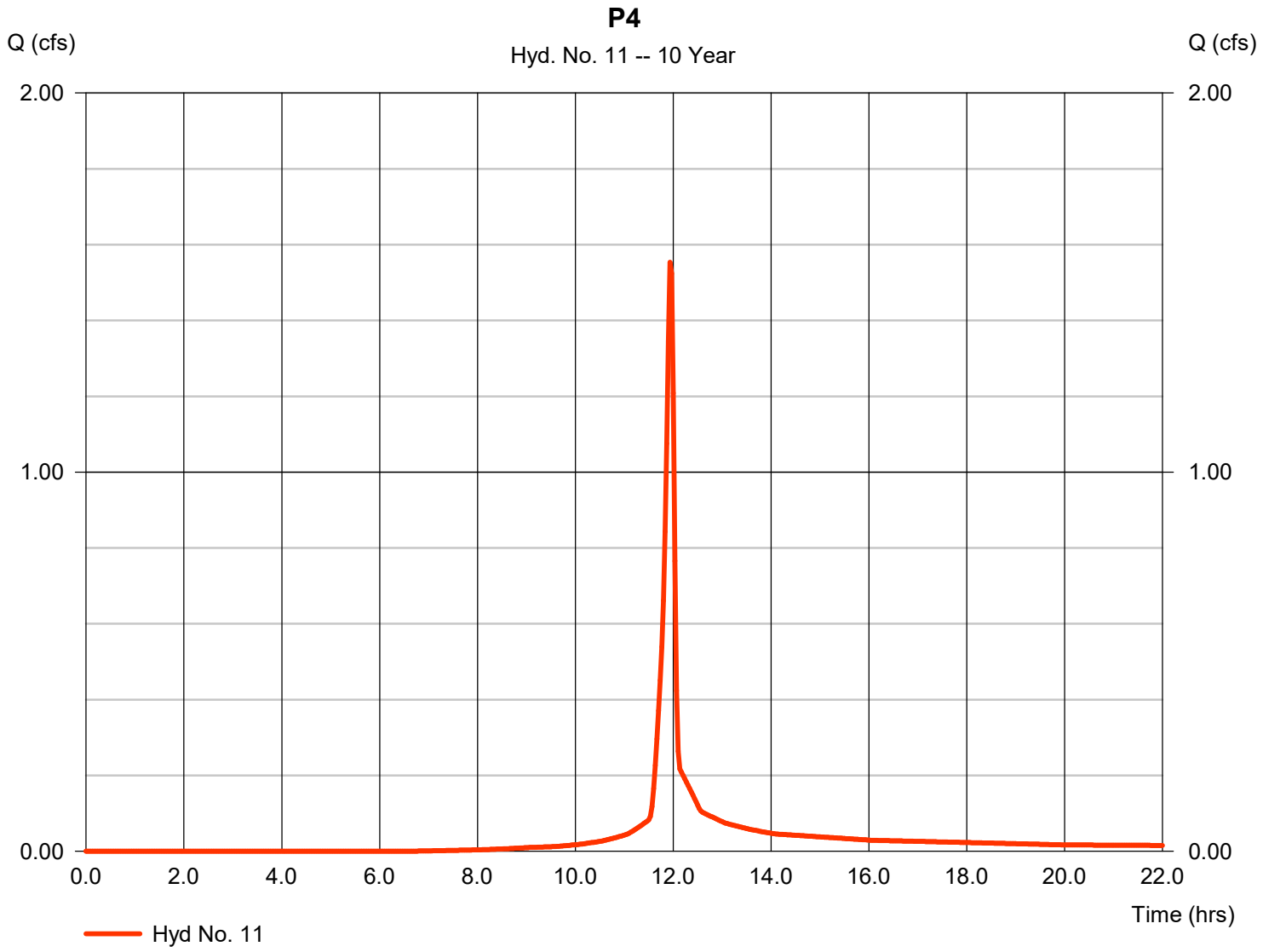
Hydrograph Report

Hyd. No. 11

P4

Hydrograph type	= SCS Runoff	Peak discharge	= 1.554 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 3,176 cuft
Drainage area	= 0.360 ac	Curve number	= 84*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.25 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.210 x 74) + (0.150 x 98)] / 0.360



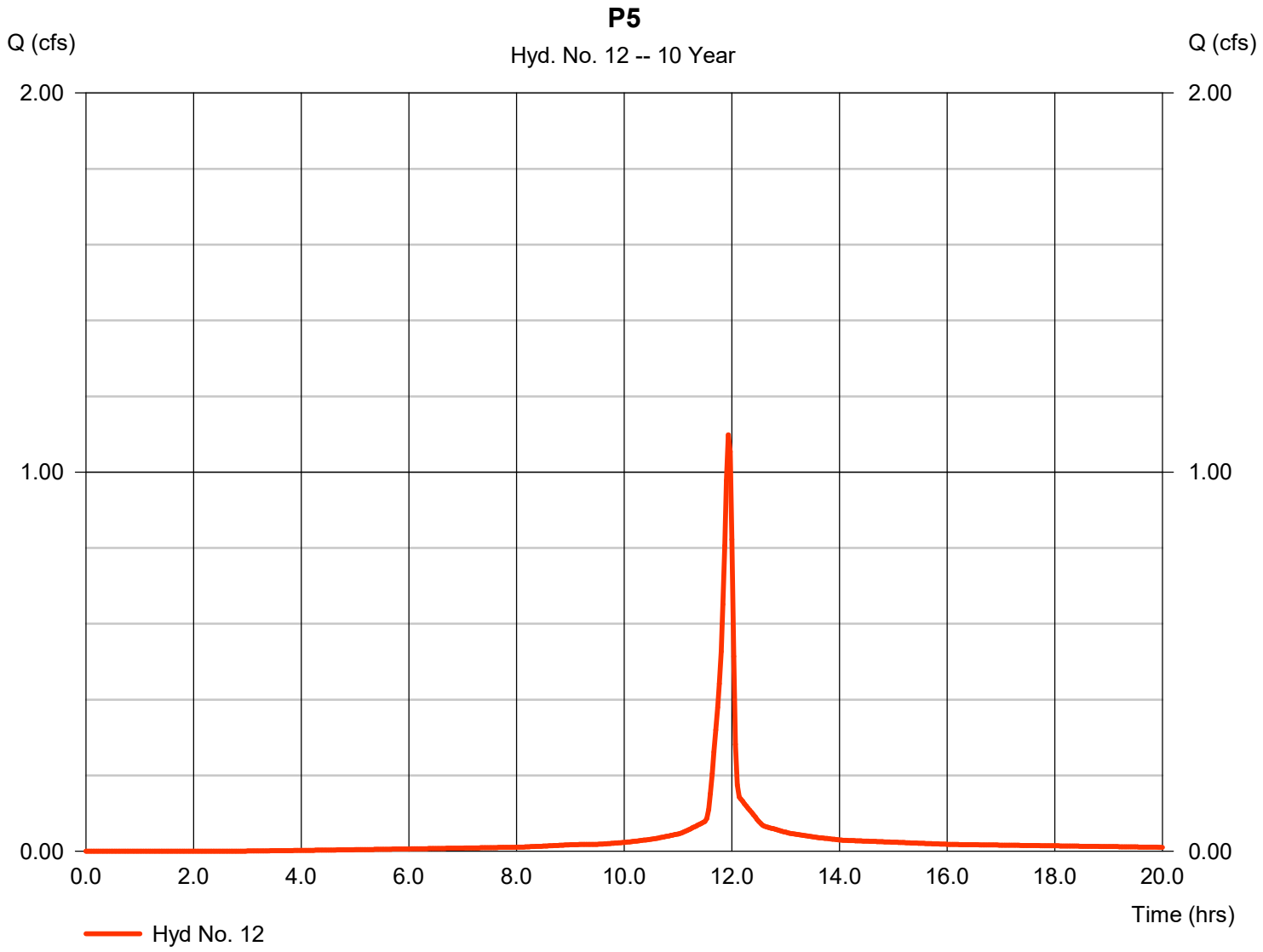
Hydrograph Report

Hyd. No. 12

P5

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.098 cfs
Storm frequency	=	10 yrs	Time to peak	=	11.93 hrs
Time interval	=	2 min	Hyd. volume	=	2,430 cuft
Drainage area	=	0.200 ac	Curve number	=	94*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	4.25 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.030 x 74) + (0.170 x 98)] / 0.200



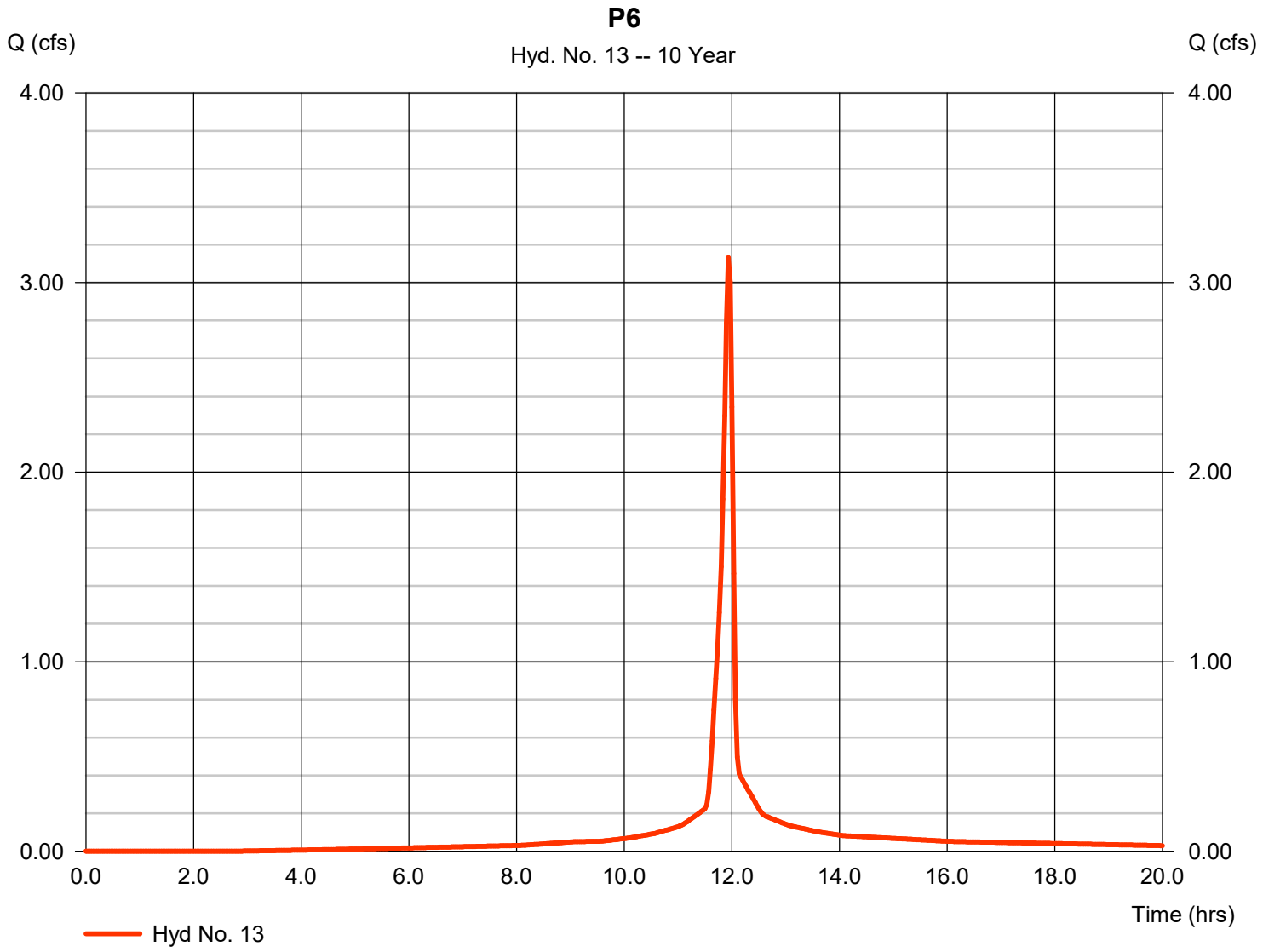
Hydrograph Report

Hyd. No. 13

P6

Hydrograph type	= SCS Runoff	Peak discharge	= 3.130 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 6,924 cuft
Drainage area	= 0.570 ac	Curve number	= 94*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.25 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.100 x 75) + (0.470 x 98)] / 0.570



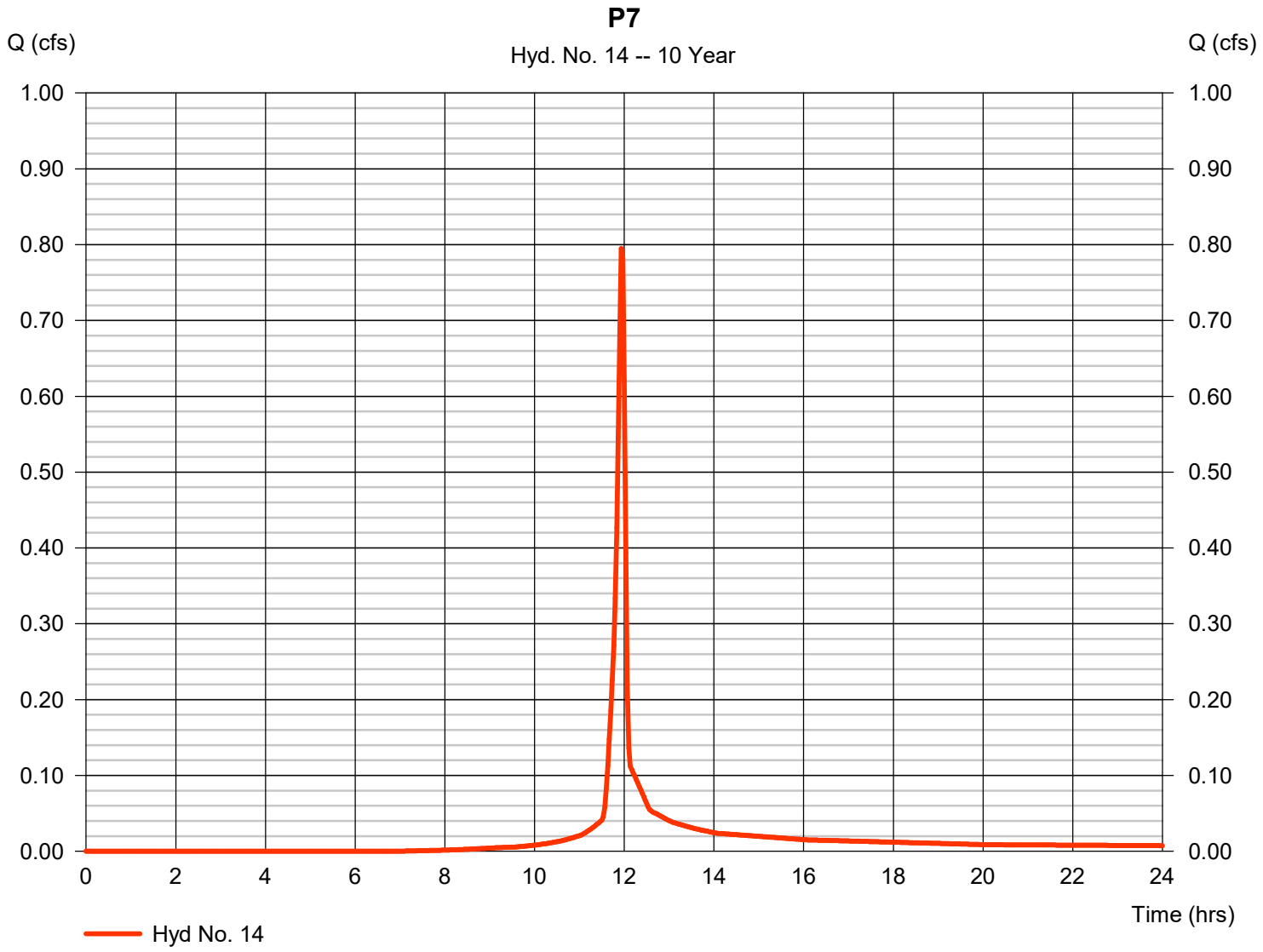
Hydrograph Report

Hyd. No. 14

P7

Hydrograph type	= SCS Runoff	Peak discharge	= 0.795 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 1,619 cuft
Drainage area	= 0.190 ac	Curve number	= 83*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.25 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.120 x 74) + (0.070 x 98)] / 0.190



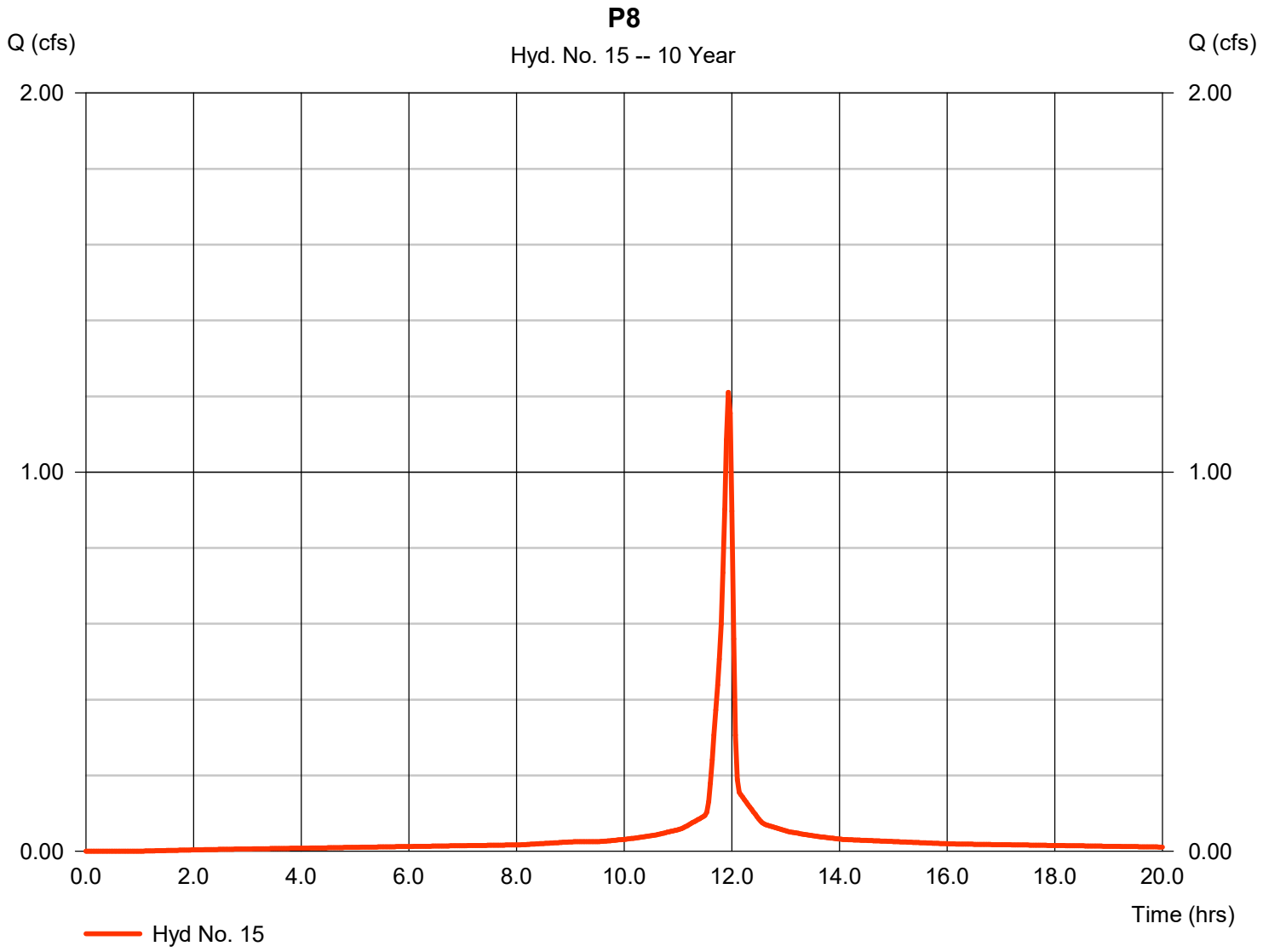
Hydrograph Report

Hyd. No. 15

P8

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.211 cfs
Storm frequency	=	10 yrs	Time to peak	=	11.93 hrs
Time interval	=	2 min	Hyd. volume	=	2,869 cuft
Drainage area	=	0.210 ac	Curve number	=	98*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	4.25 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.210 x 98)] / 0.210



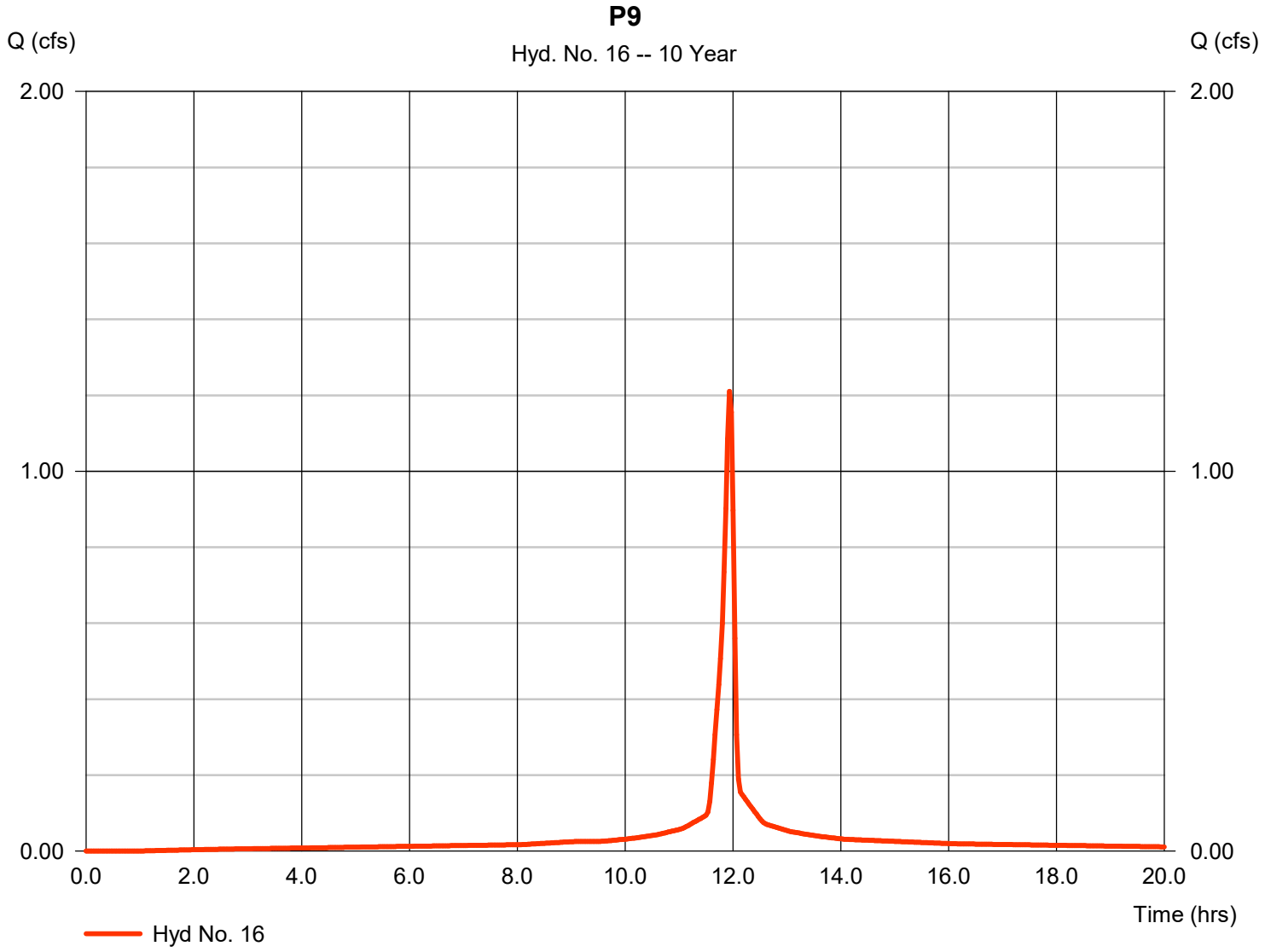
Hydrograph Report

Hyd. No. 16

P9

Hydrograph type	= SCS Runoff	Peak discharge	= 1.211 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 2,869 cuft
Drainage area	= 0.210 ac	Curve number	= 98*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.25 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.210 x 98)] / 0.210



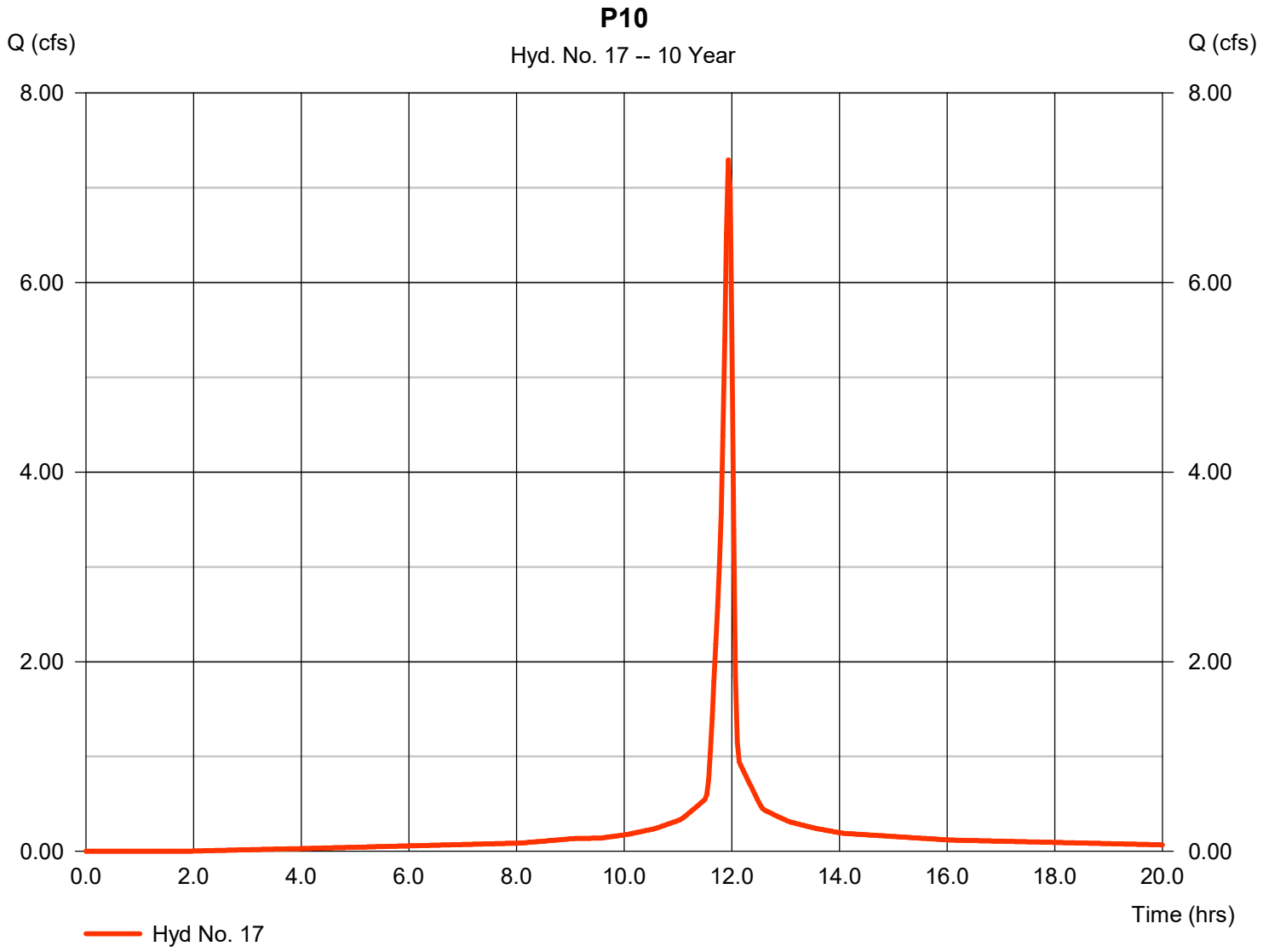
Hydrograph Report

Hyd. No. 17

P10

Hydrograph type	=	SCS Runoff	Peak discharge	=	7.293 cfs
Storm frequency	=	10 yrs	Time to peak	=	11.93 hrs
Time interval	=	2 min	Hyd. volume	=	16,629 cuft
Drainage area	=	1.290 ac	Curve number	=	96*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	4.25 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.090 x 74) + (1.200 x 98)] / 1.290

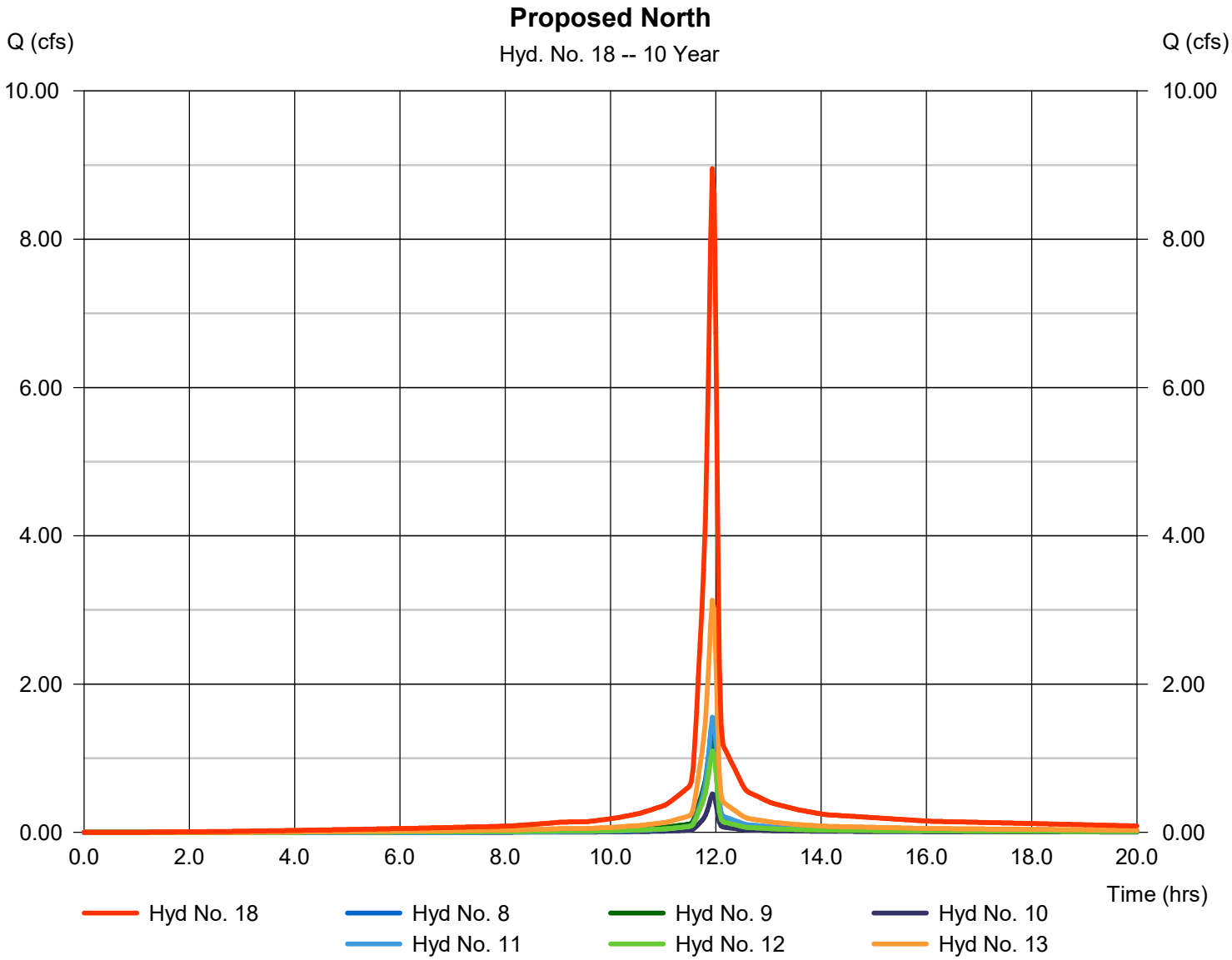


Hydrograph Report

Hyd. No. 18

Proposed North

Hydrograph type	= Combine	Peak discharge	= 8.952 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 19,888 cuft
Inflow hyds.	= 8, 9, 10, 11, 12, 13	Contrib. drain. area	= 1.700 ac

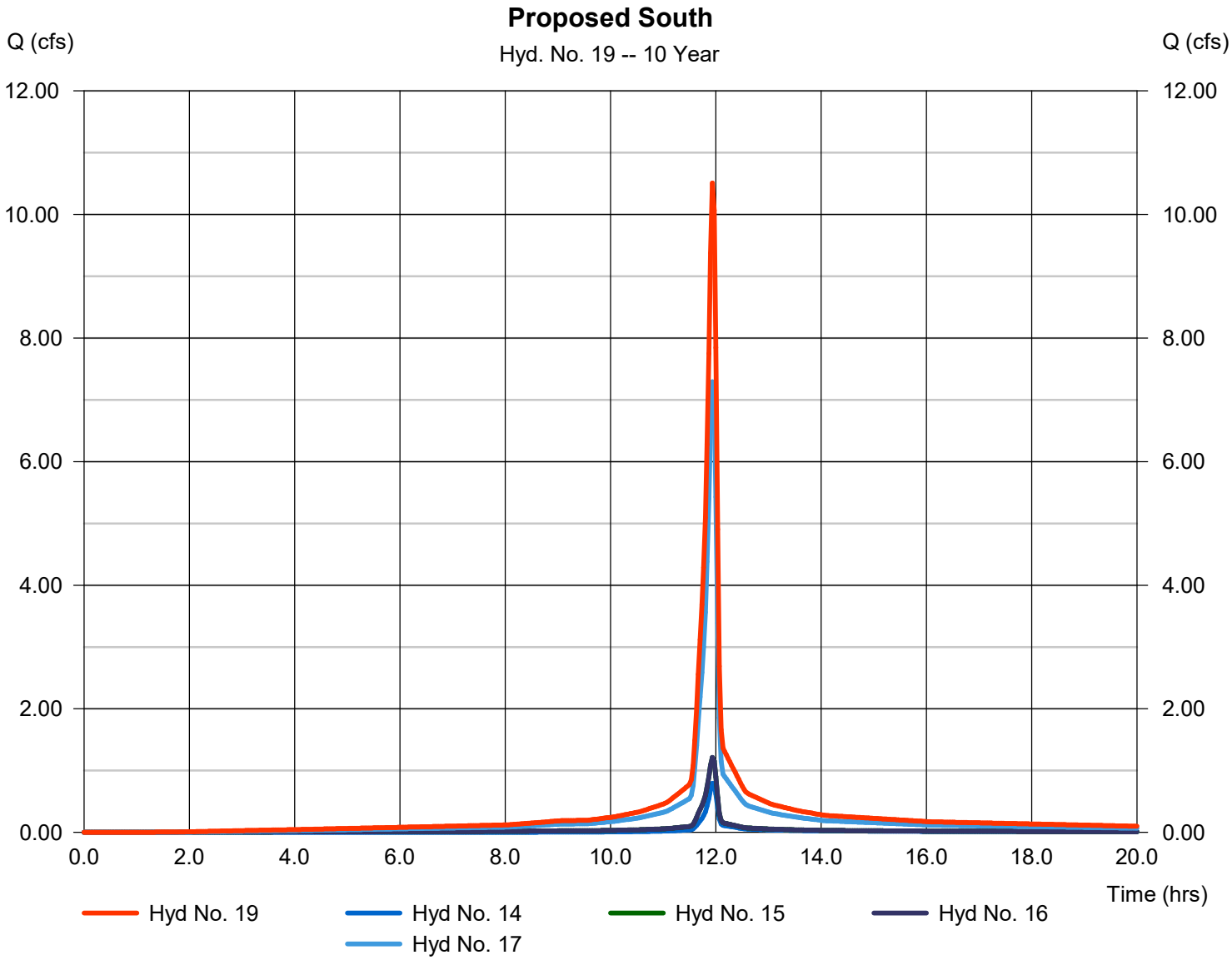


Hydrograph Report

Hyd. No. 19

Proposed South

Hydrograph type	= Combine	Peak discharge	= 10.51 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 23,986 cuft
Inflow hyds.	= 14, 15, 16, 17	Contrib. drain. area	= 1.900 ac

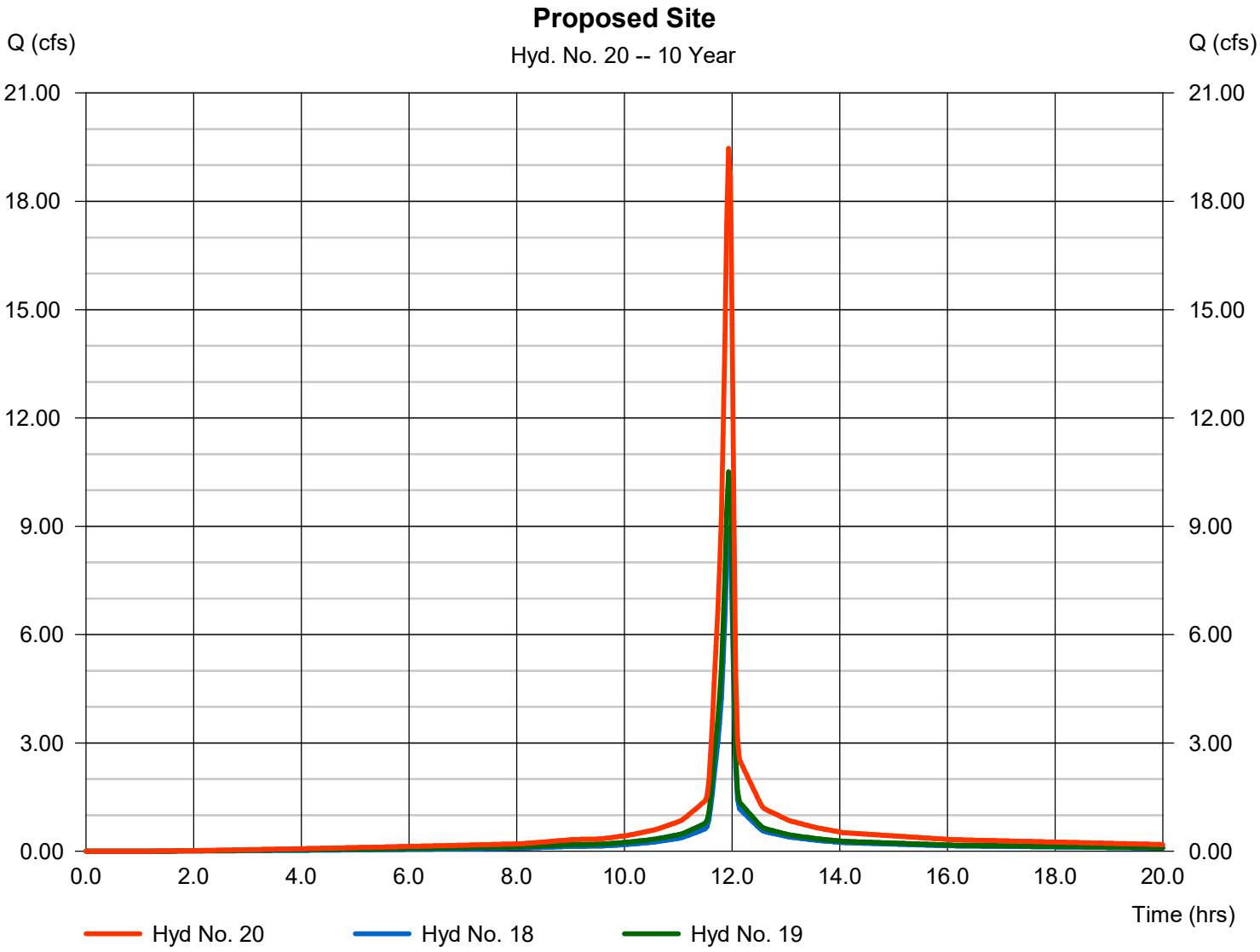


Hydrograph Report

Hyd. No. 20

Proposed Site

Hydrograph type	= Combine	Peak discharge	= 19.46 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 43,874 cuft
Inflow hyds.	= 18, 19	Contrib. drain. area	= 0.000 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	15.03	2	716	35,906	------	------	------	E1
2	SCS Runoff	1.822	2	716	4,253	------	------	------	E2
3	SCS Runoff	3.783	2	716	9,041	------	------	------	E3
4	SCS Runoff	4.432	2	716	10,591	------	------	------	E4
5	SCS Runoff	4.648	2	716	11,108	------	------	------	E5
6	SCS Runoff	9.154	2	716	21,611	------	------	------	E6
7	Combine	38.86	2	716	92,509	1, 2, 3, 4, 5, 6	------	------	Existing
8	SCS Runoff	2.276	2	716	5,510	------	------	------	P1
9	SCS Runoff	2.710	2	716	6,560	------	------	------	P2
10	SCS Runoff	1.102	2	716	2,396	------	------	------	P3
11	SCS Runoff	3.473	2	716	7,409	------	------	------	P4
12	SCS Runoff	2.132	2	716	4,922	------	------	------	P5
13	SCS Runoff	6.076	2	716	14,029	------	------	------	P6
14	SCS Runoff	1.808	2	716	3,834	------	------	------	P7
15	SCS Runoff	2.276	2	716	5,510	------	------	------	P8
16	SCS Runoff	2.276	2	716	5,510	------	------	------	P9
17	SCS Runoff	13.89	2	716	32,798	------	------	------	P10
18	Combine	17.77	2	716	40,826	8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19	------	------	Proposed North
19	Combine	20.25	2	716	47,652		------	------	Proposed South
20	Combine	38.02	2	716	88,478		------	------	Proposed Site

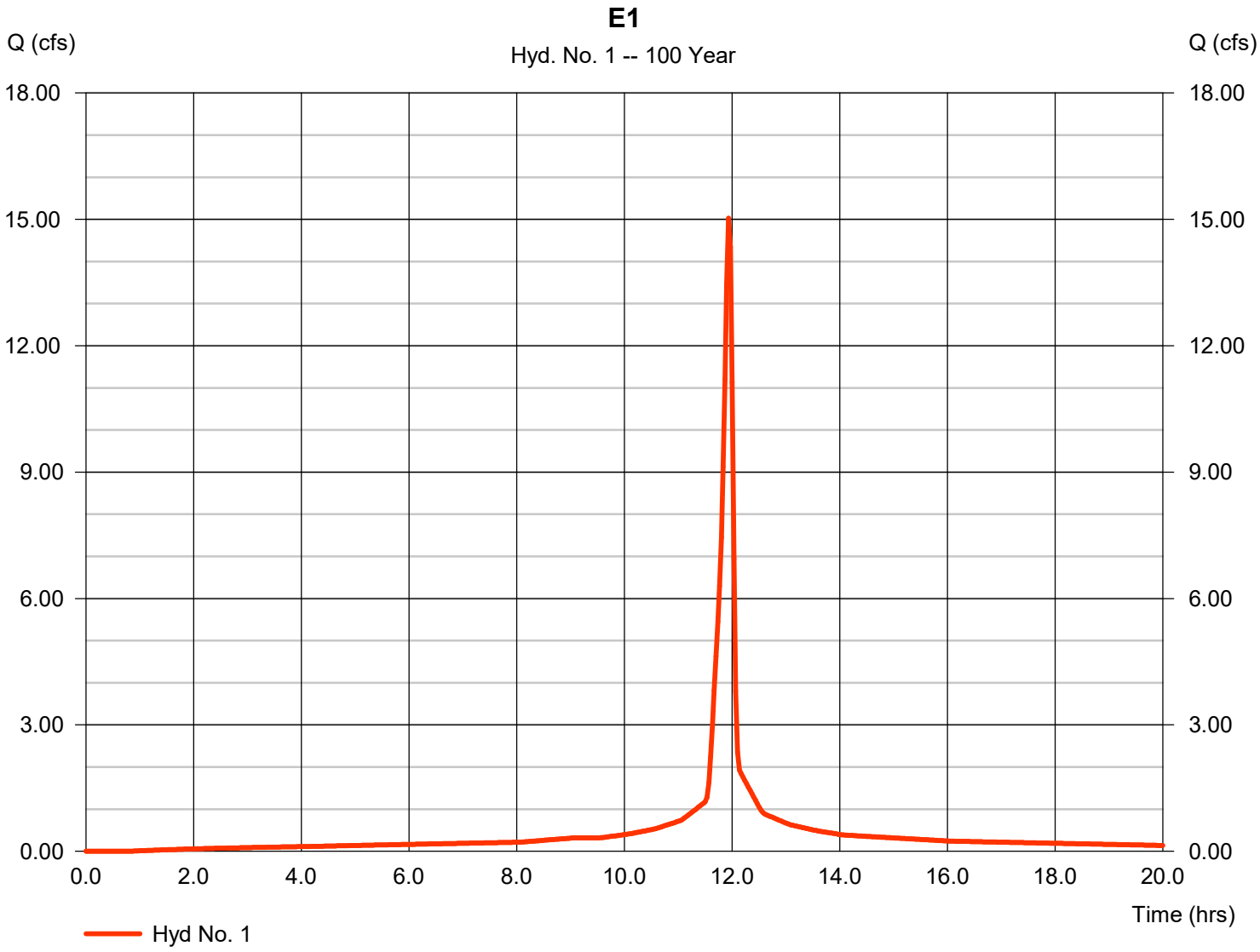
Hydrograph Report

Hyd. No. 1

E1

Hydrograph type	=	SCS Runoff	Peak discharge	=	15.03 cfs
Storm frequency	=	100 yrs	Time to peak	=	11.93 hrs
Time interval	=	2 min	Hyd. volume	=	35,906 cuft
Drainage area	=	1.390 ac	Curve number	=	97*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	7.95 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(1.360 x 98) + (0.030 x 74)] / 1.390



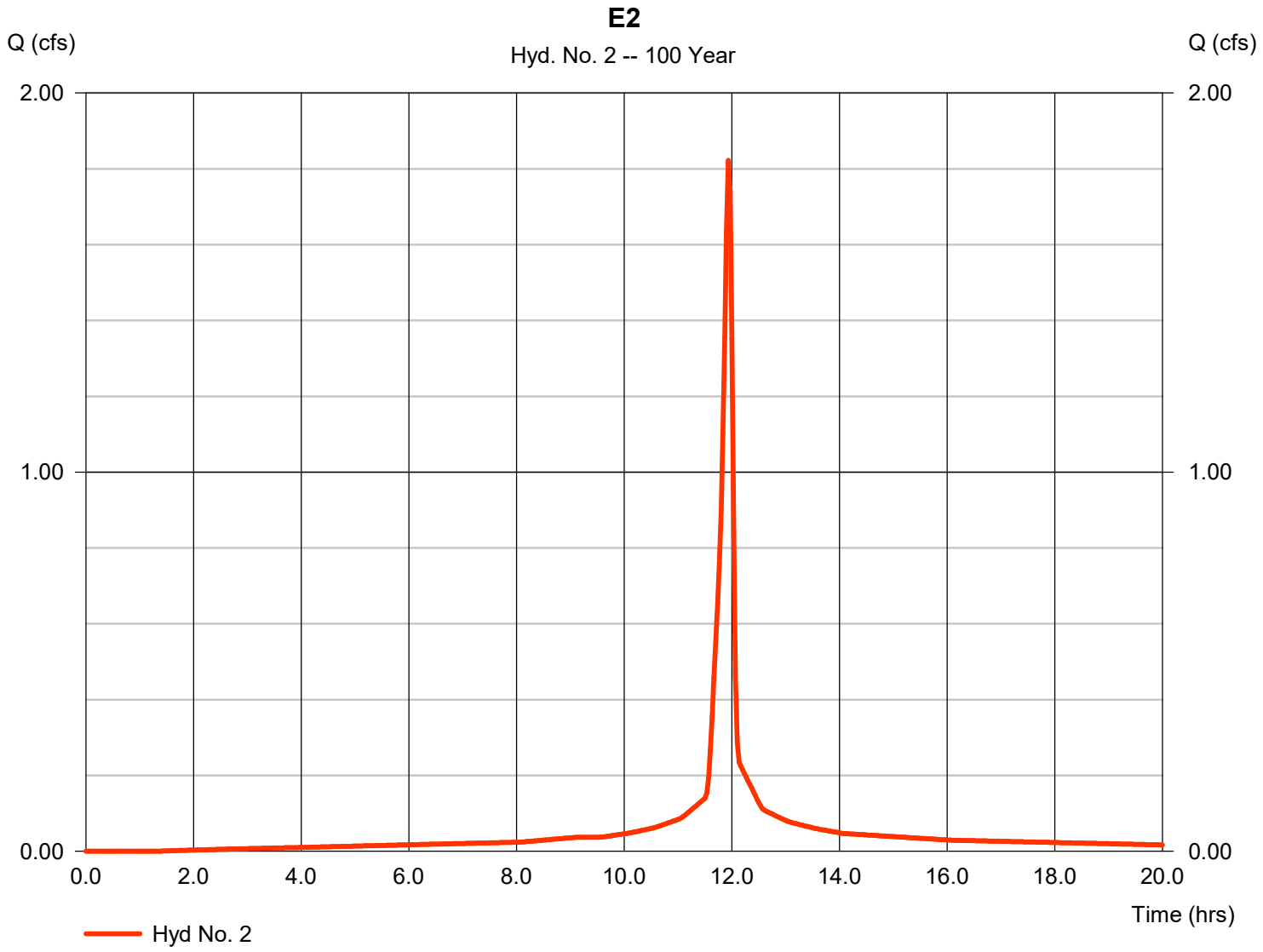
Hydrograph Report

Hyd. No. 2

E2

Hydrograph type	= SCS Runoff	Peak discharge	= 1.822 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 4,253 cuft
Drainage area	= 0.170 ac	Curve number	= 95*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.95 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.150 x 98) + (0.020 x 74)] / 0.170



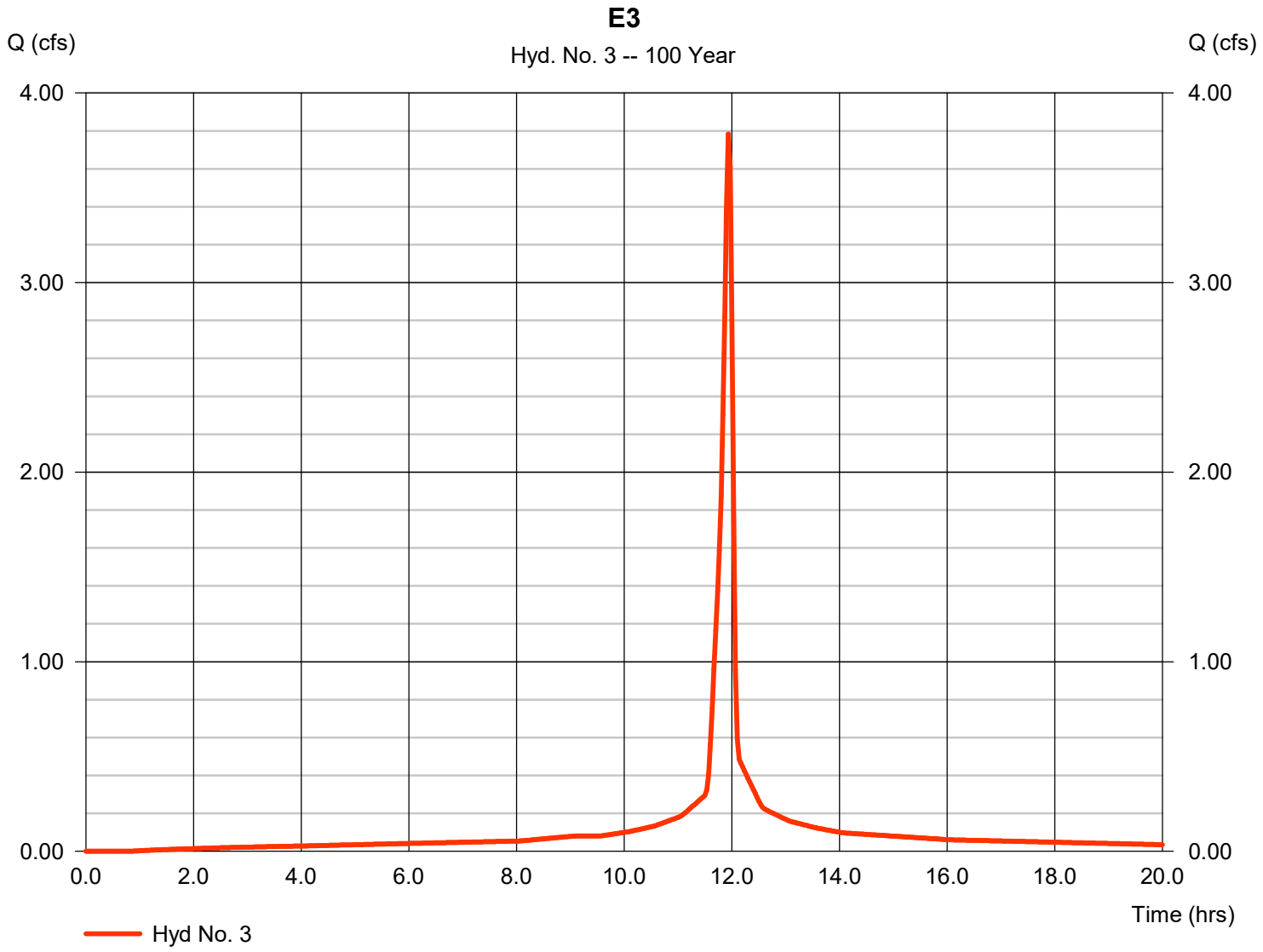
Hydrograph Report

Hyd. No. 3

E3

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.783 cfs
Storm frequency	=	100 yrs	Time to peak	=	11.93 hrs
Time interval	=	2 min	Hyd. volume	=	9,041 cuft
Drainage area	=	0.350 ac	Curve number	=	97*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	7.95 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.340 x 98) + (0.010 x 74)] / 0.350



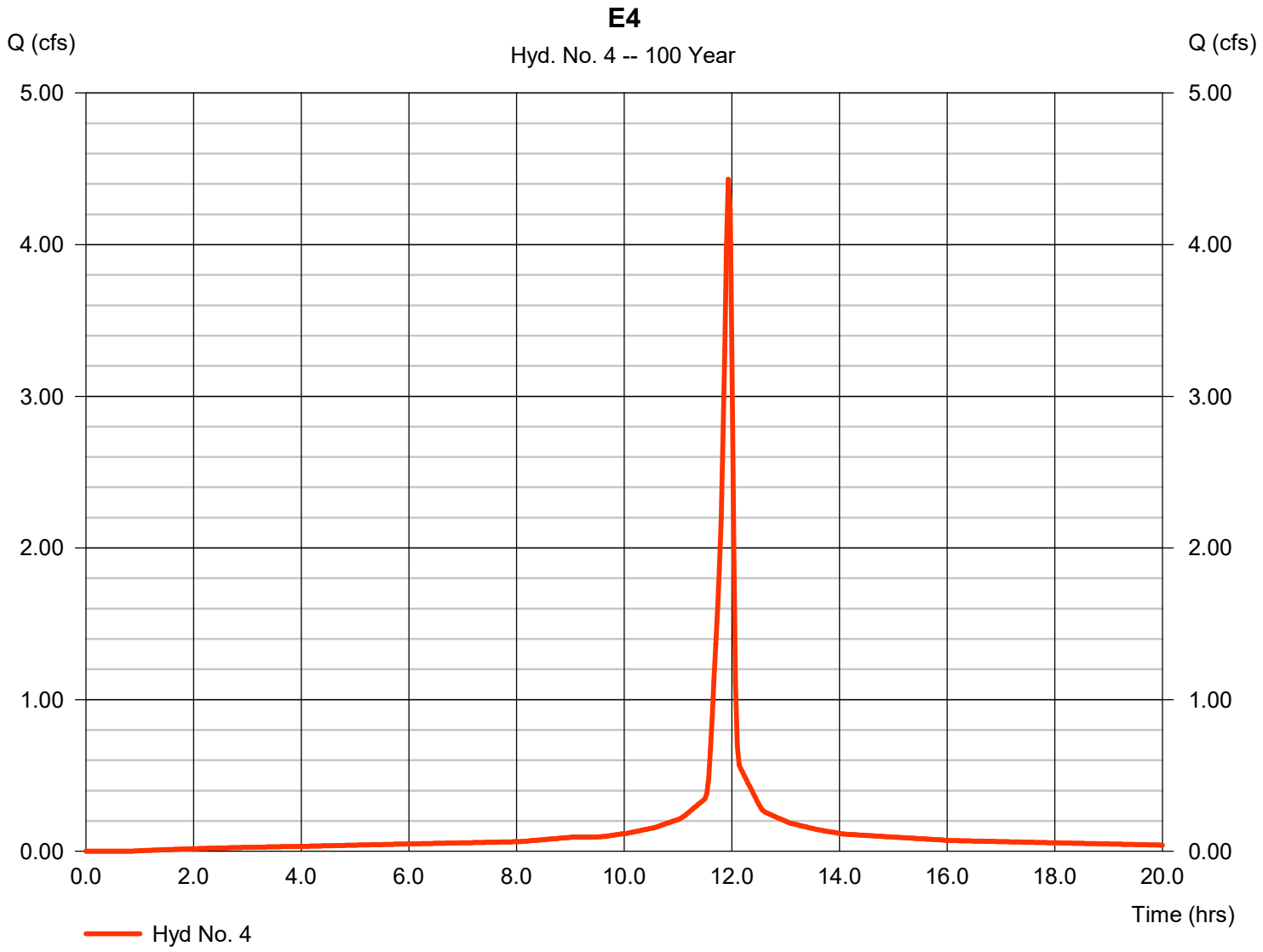
Hydrograph Report

Hyd. No. 4

E4

Hydrograph type	= SCS Runoff	Peak discharge	= 4.432 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 10,591 cuft
Drainage area	= 0.410 ac	Curve number	= 97*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.95 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.400 x 98) + (0.010 x 74)] / 0.410



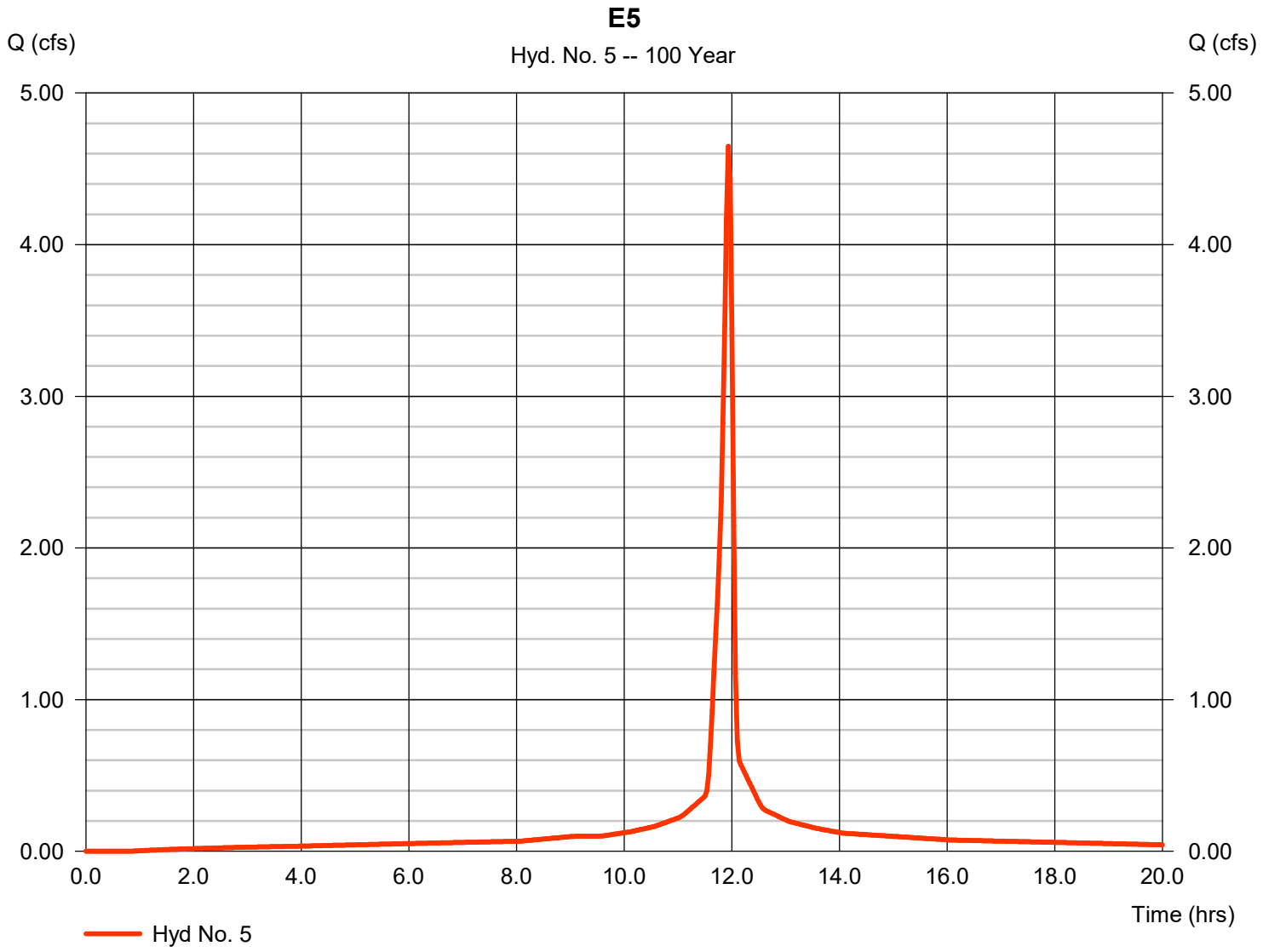
Hydrograph Report

Hyd. No. 5

E5

Hydrograph type	=	SCS Runoff	Peak discharge	=	4.648 cfs
Storm frequency	=	100 yrs	Time to peak	=	11.93 hrs
Time interval	=	2 min	Hyd. volume	=	11,108 cuft
Drainage area	=	0.430 ac	Curve number	=	97*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	7.95 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.420 x 98) + (0.010 x 74)] / 0.430



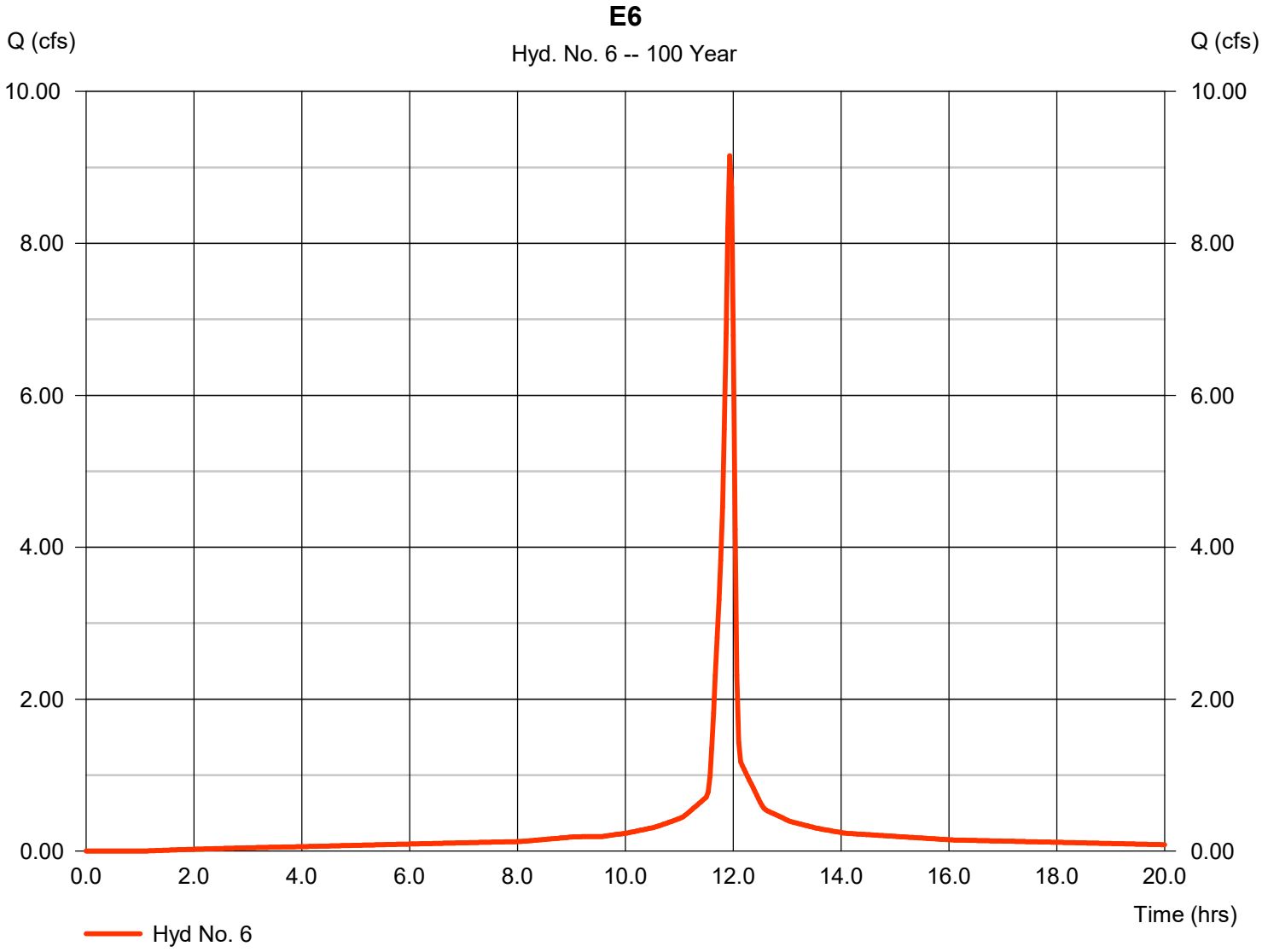
Hydrograph Report

Hyd. No. 6

E6

Hydrograph type	= SCS Runoff	Peak discharge	= 9.154 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 21,611 cuft
Drainage area	= 0.850 ac	Curve number	= 96*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.95 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.790 x 98) + (0.060 x 74)] / 0.850

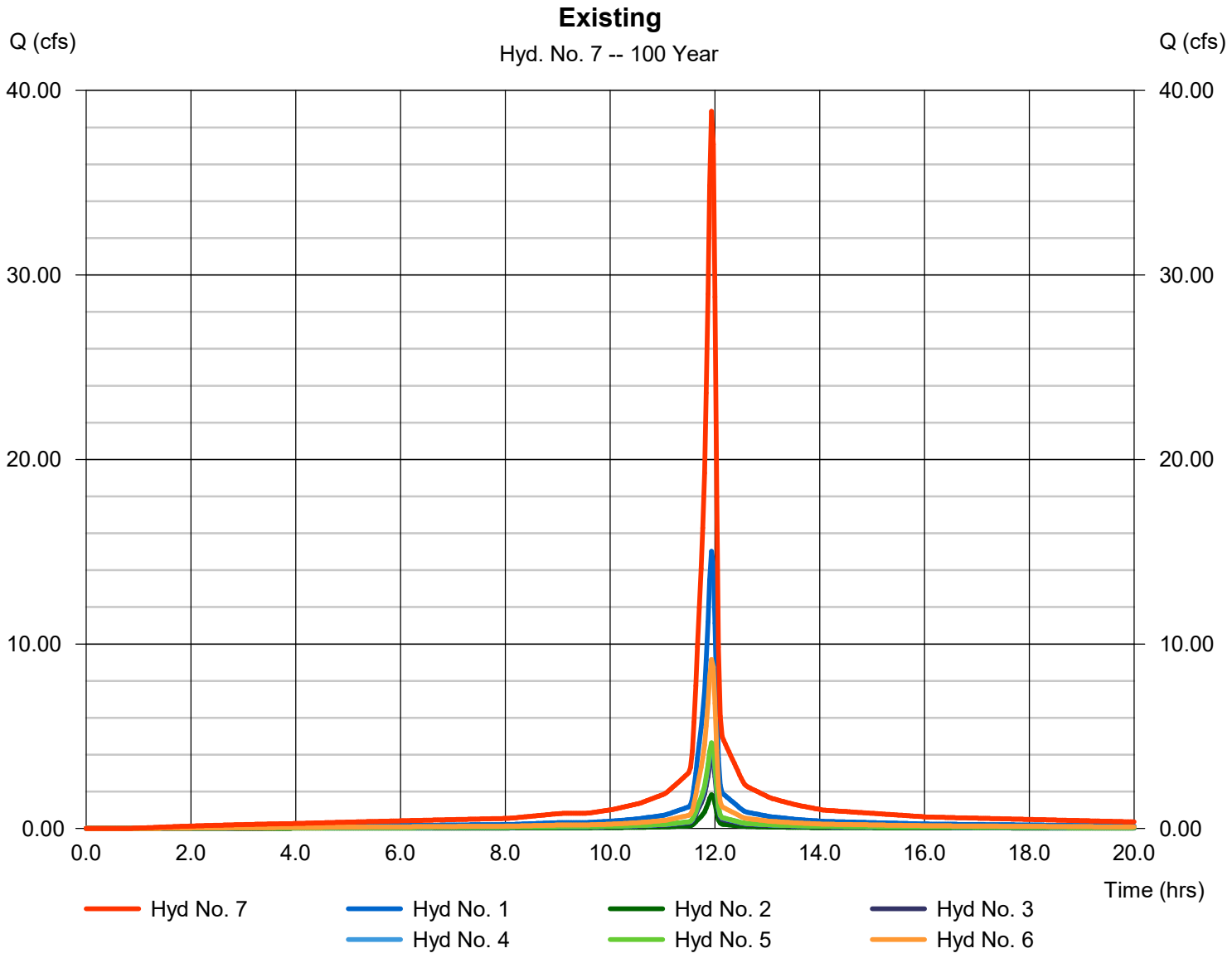


Hydrograph Report

Hyd. No. 7

Existing

Hydrograph type	= Combine	Peak discharge	= 38.86 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 92,509 cuft
Inflow hyds.	= 1, 2, 3, 4, 5, 6	Contrib. drain. area	= 3.600 ac



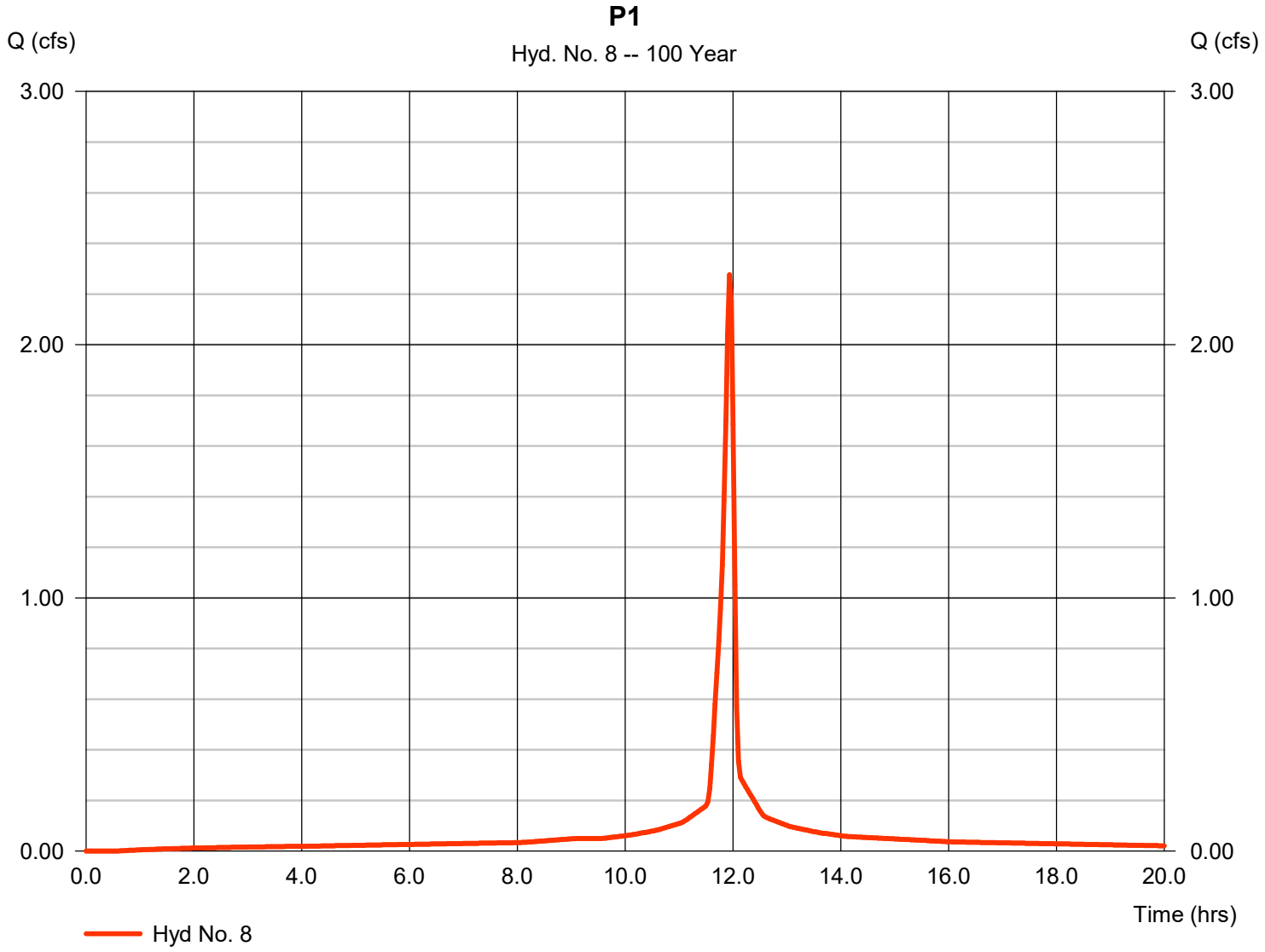
Hydrograph Report

Hyd. No. 8

P1

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.276 cfs
Storm frequency	=	100 yrs	Time to peak	=	11.93 hrs
Time interval	=	2 min	Hyd. volume	=	5,510 cuft
Drainage area	=	0.210 ac	Curve number	=	98*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	7.95 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.210 x 98)] / 0.210

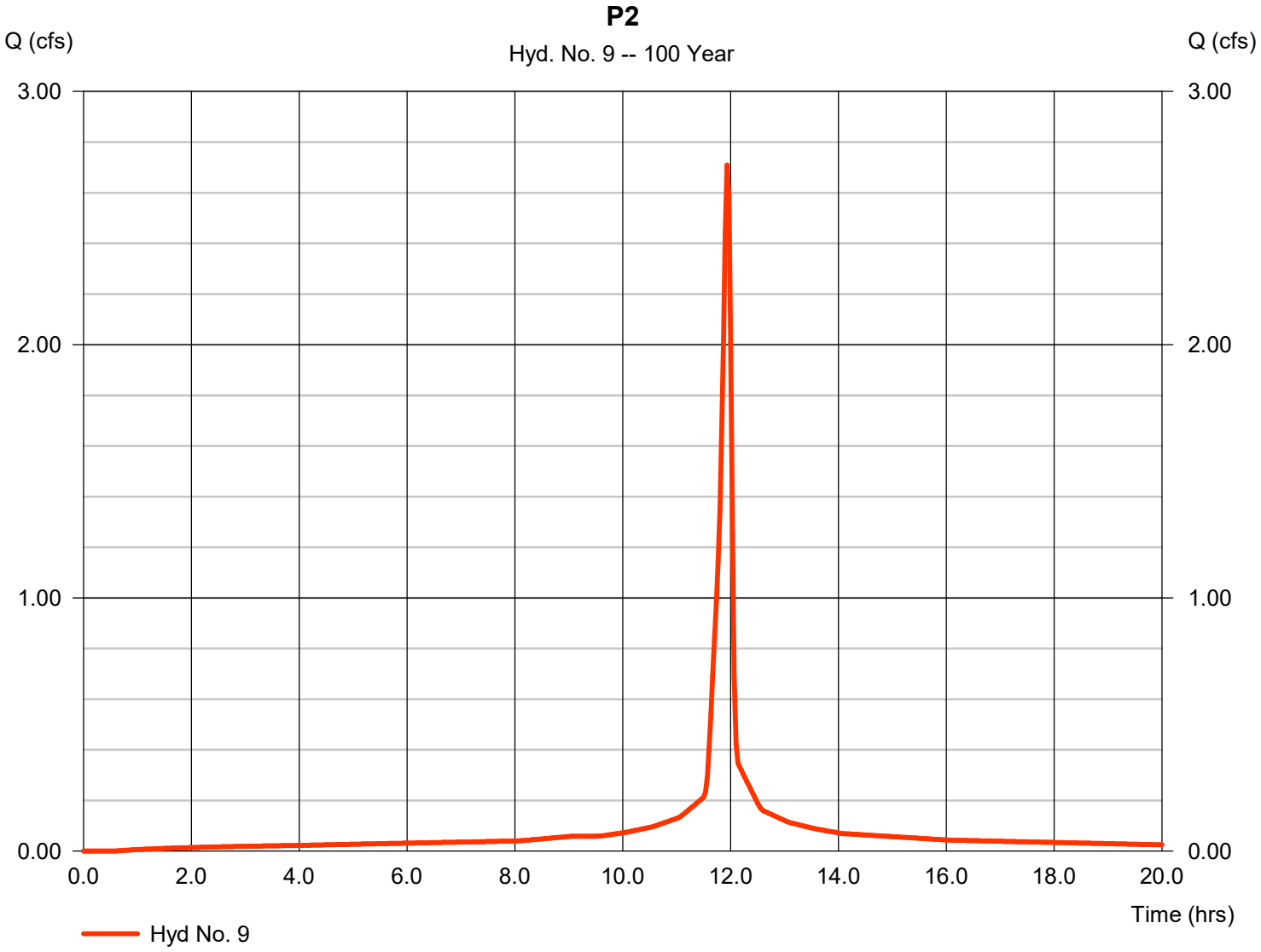


Hydrograph Report

Hyd. No. 9

P2

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.710 cfs
Storm frequency	=	100 yrs	Time to peak	=	11.93 hrs
Time interval	=	2 min	Hyd. volume	=	6,560 cuft
Drainage area	=	0.250 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	7.95 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



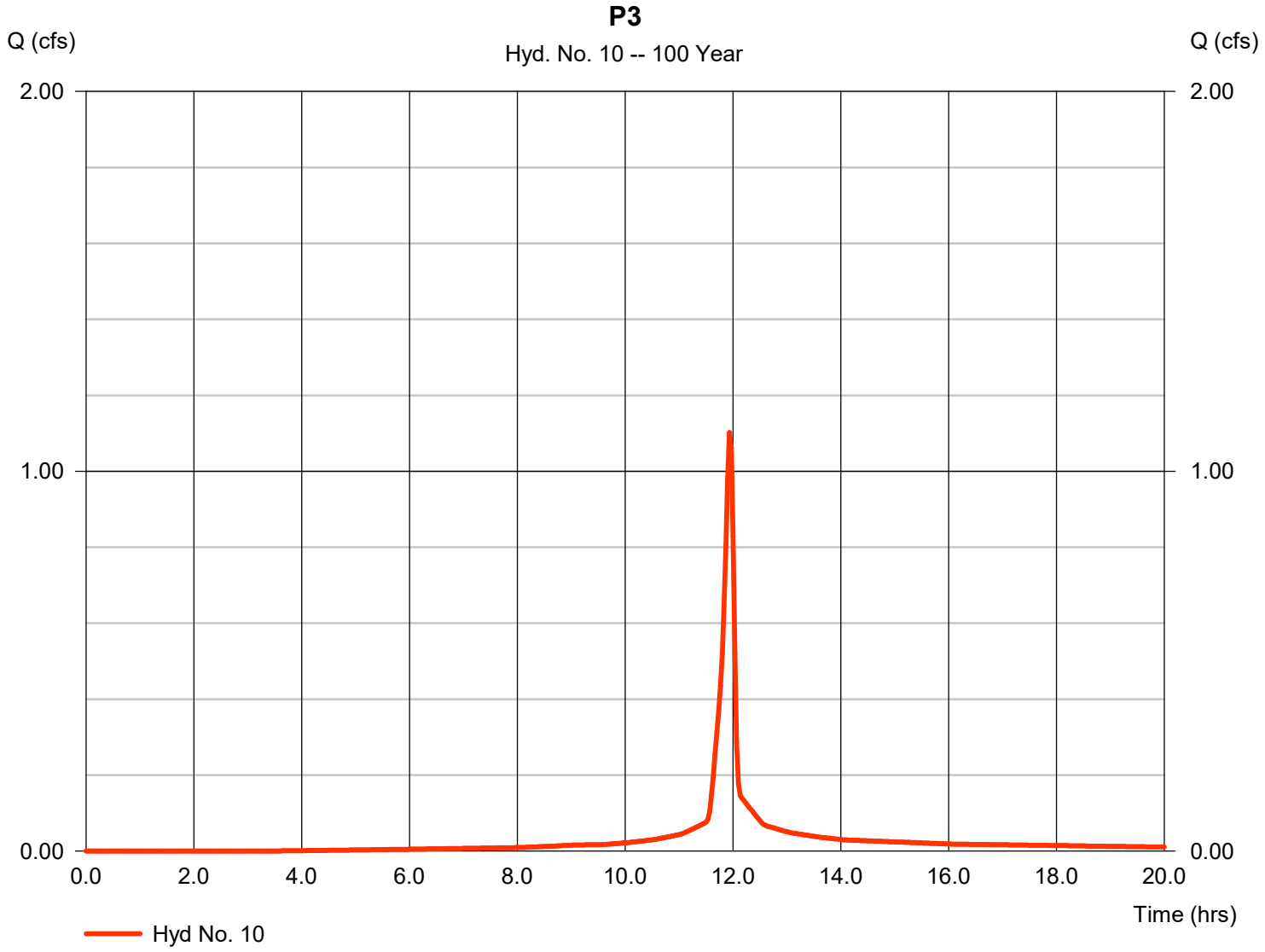
Hydrograph Report

Hyd. No. 10

P3

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.102 cfs
Storm frequency	=	100 yrs	Time to peak	=	11.93 hrs
Time interval	=	2 min	Hyd. volume	=	2,396 cuft
Drainage area	=	0.110 ac	Curve number	=	87*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	7.95 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.050 x 74) + (0.060 x 98)] / 0.110



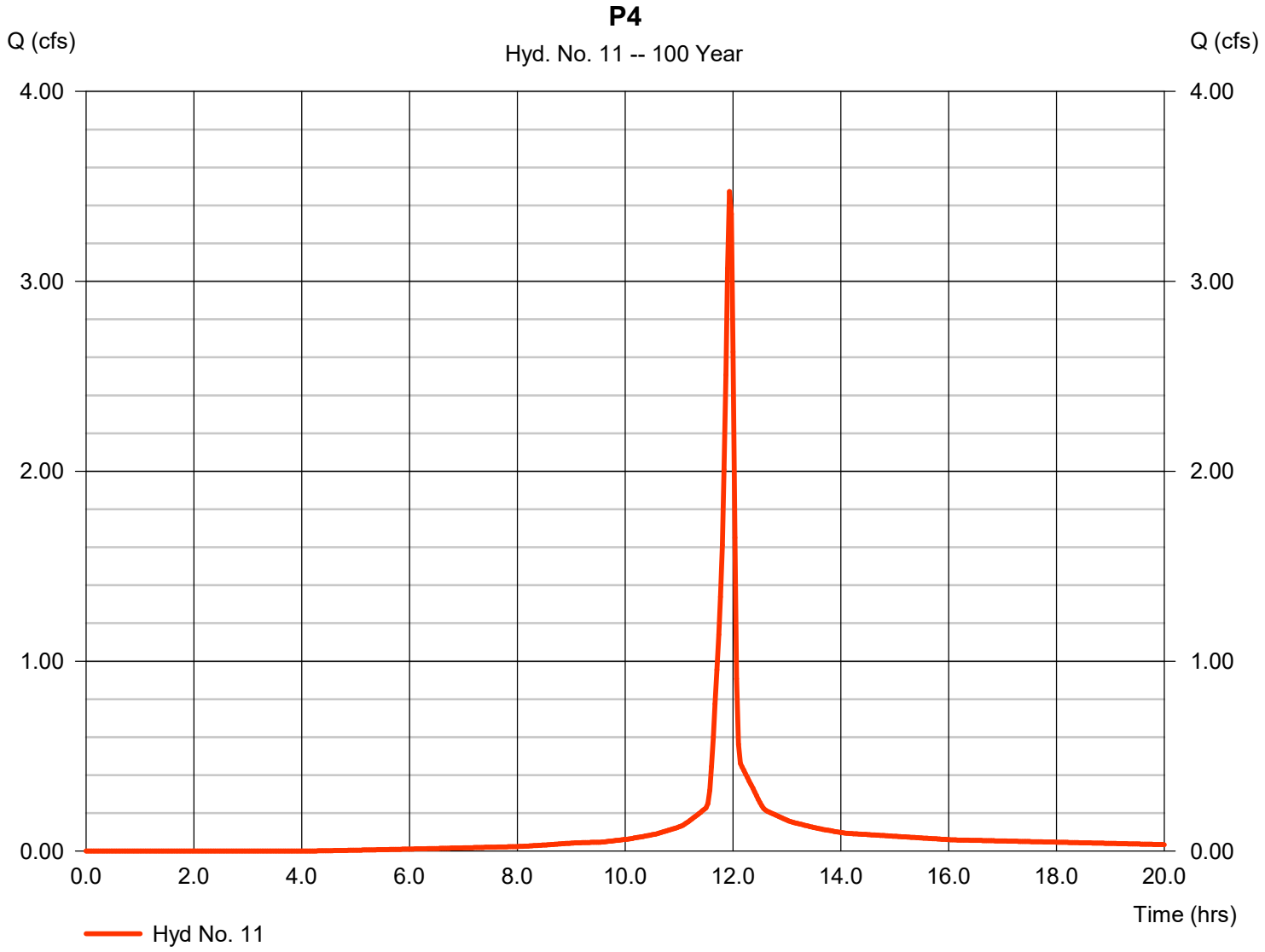
Hydrograph Report

Hyd. No. 11

P4

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.473 cfs
Storm frequency	=	100 yrs	Time to peak	=	11.93 hrs
Time interval	=	2 min	Hyd. volume	=	7,409 cuft
Drainage area	=	0.360 ac	Curve number	=	84*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	7.95 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.210 x 74) + (0.150 x 98)] / 0.360



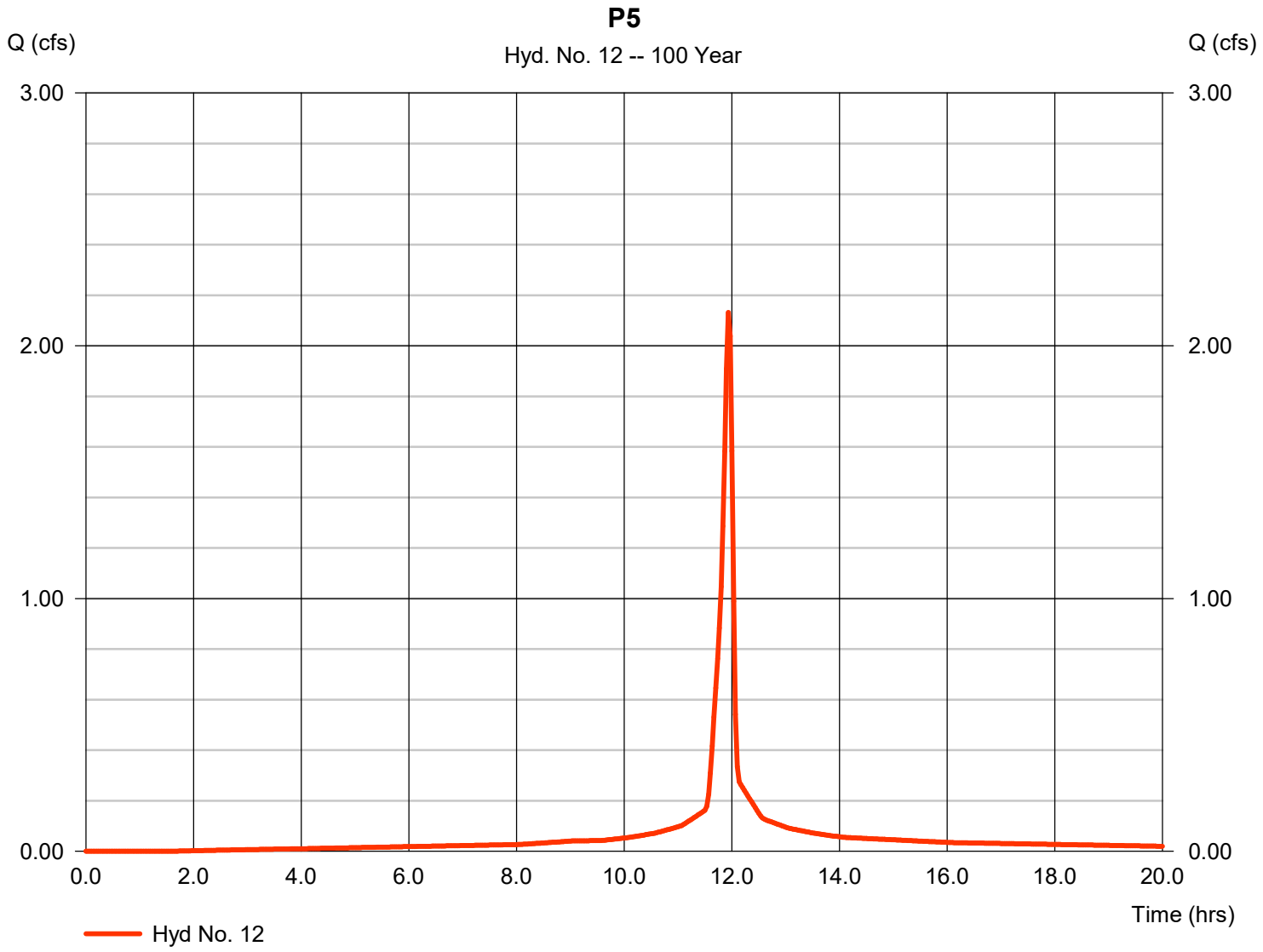
Hydrograph Report

Hyd. No. 12

P5

Hydrograph type	= SCS Runoff	Peak discharge	= 2.132 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 4,922 cuft
Drainage area	= 0.200 ac	Curve number	= 94*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.95 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.030 x 74) + (0.170 x 98)] / 0.200



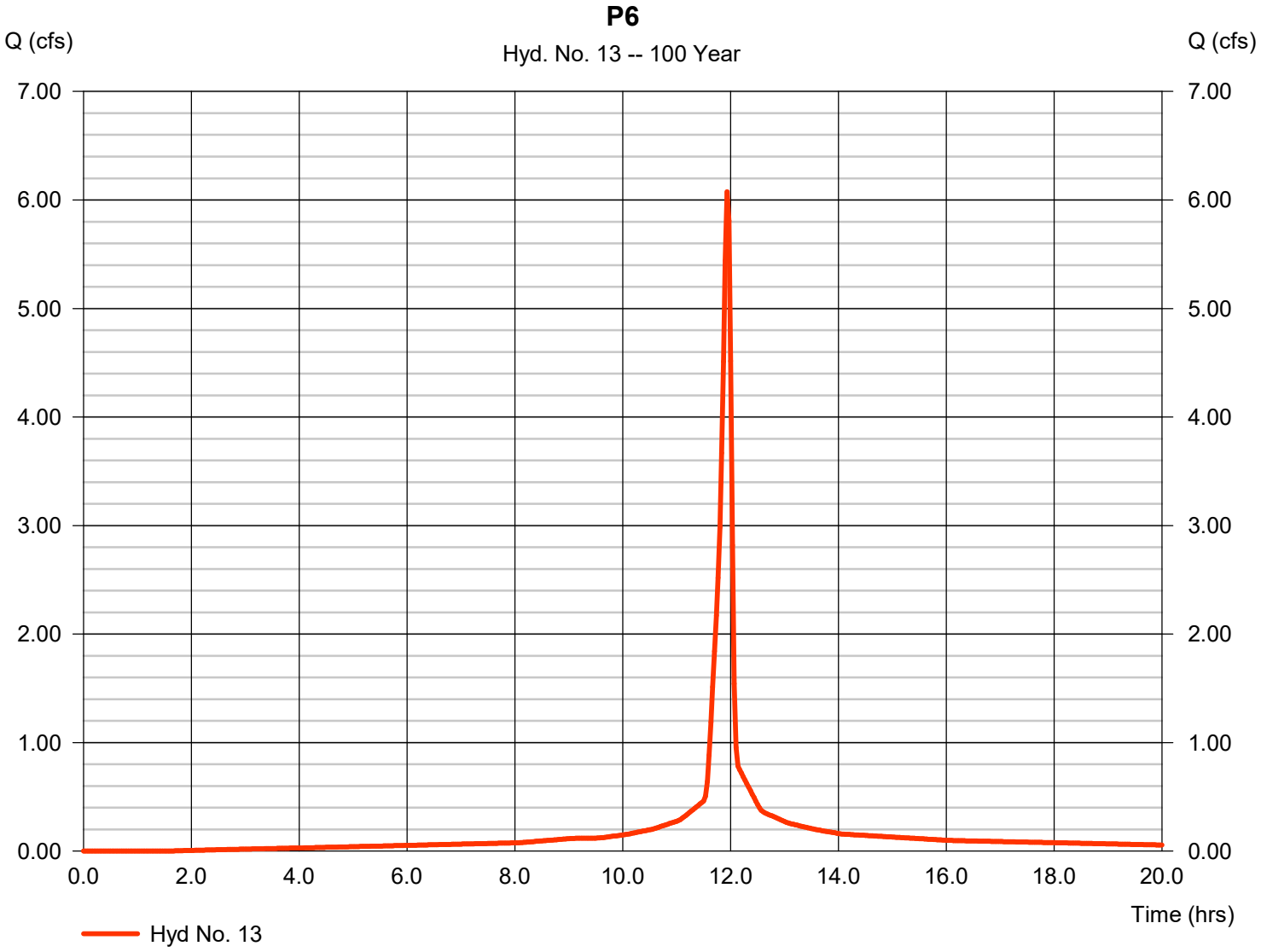
Hydrograph Report

Hyd. No. 13

P6

Hydrograph type	=	SCS Runoff	Peak discharge	=	6.076 cfs
Storm frequency	=	100 yrs	Time to peak	=	11.93 hrs
Time interval	=	2 min	Hyd. volume	=	14,029 cuft
Drainage area	=	0.570 ac	Curve number	=	94*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	7.95 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.100 x 75) + (0.470 x 98)] / 0.570



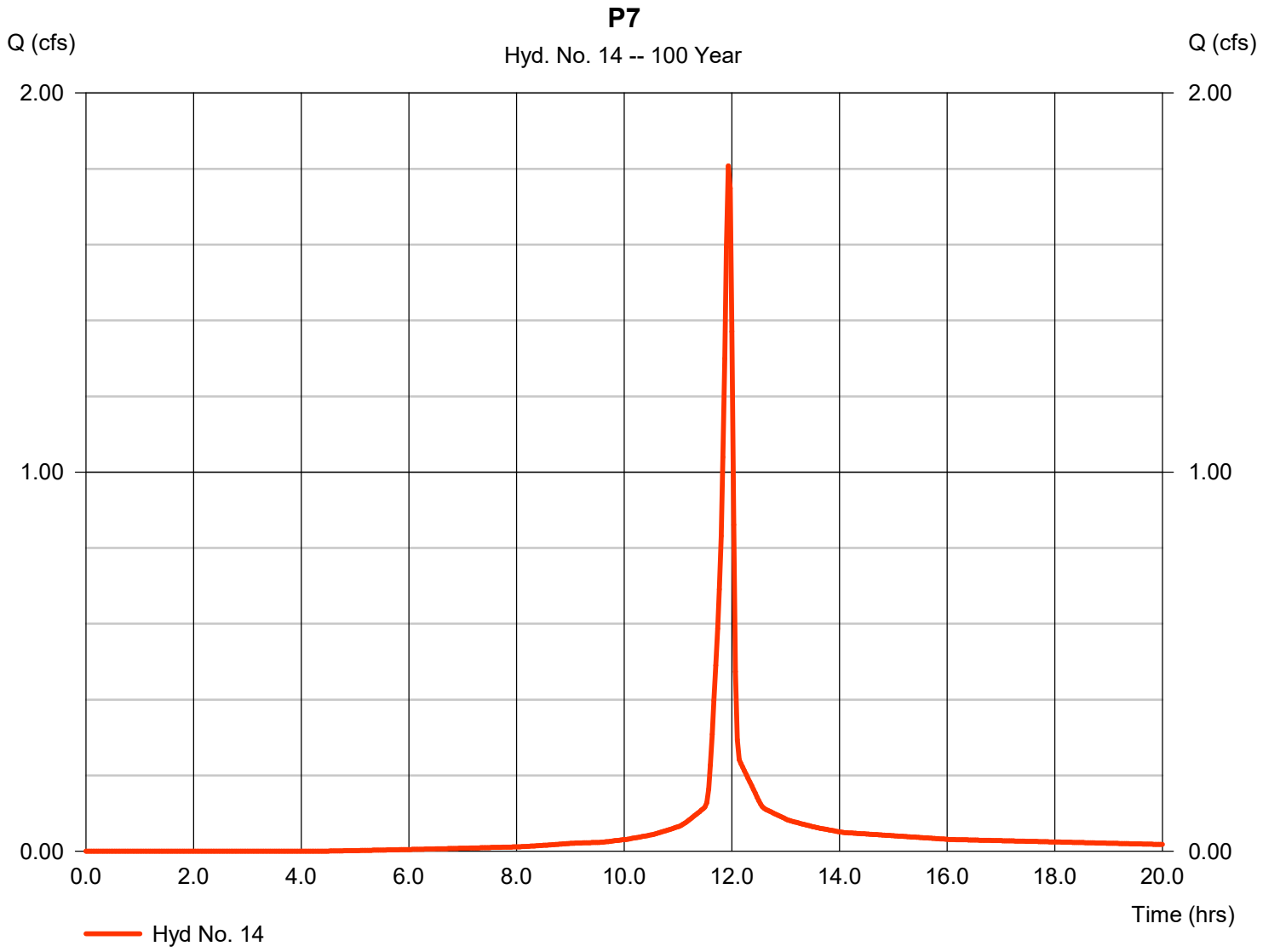
Hydrograph Report

Hyd. No. 14

P7

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.808 cfs
Storm frequency	=	100 yrs	Time to peak	=	11.93 hrs
Time interval	=	2 min	Hyd. volume	=	3,834 cuft
Drainage area	=	0.190 ac	Curve number	=	83*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	7.95 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.120 x 74) + (0.070 x 98)] / 0.190



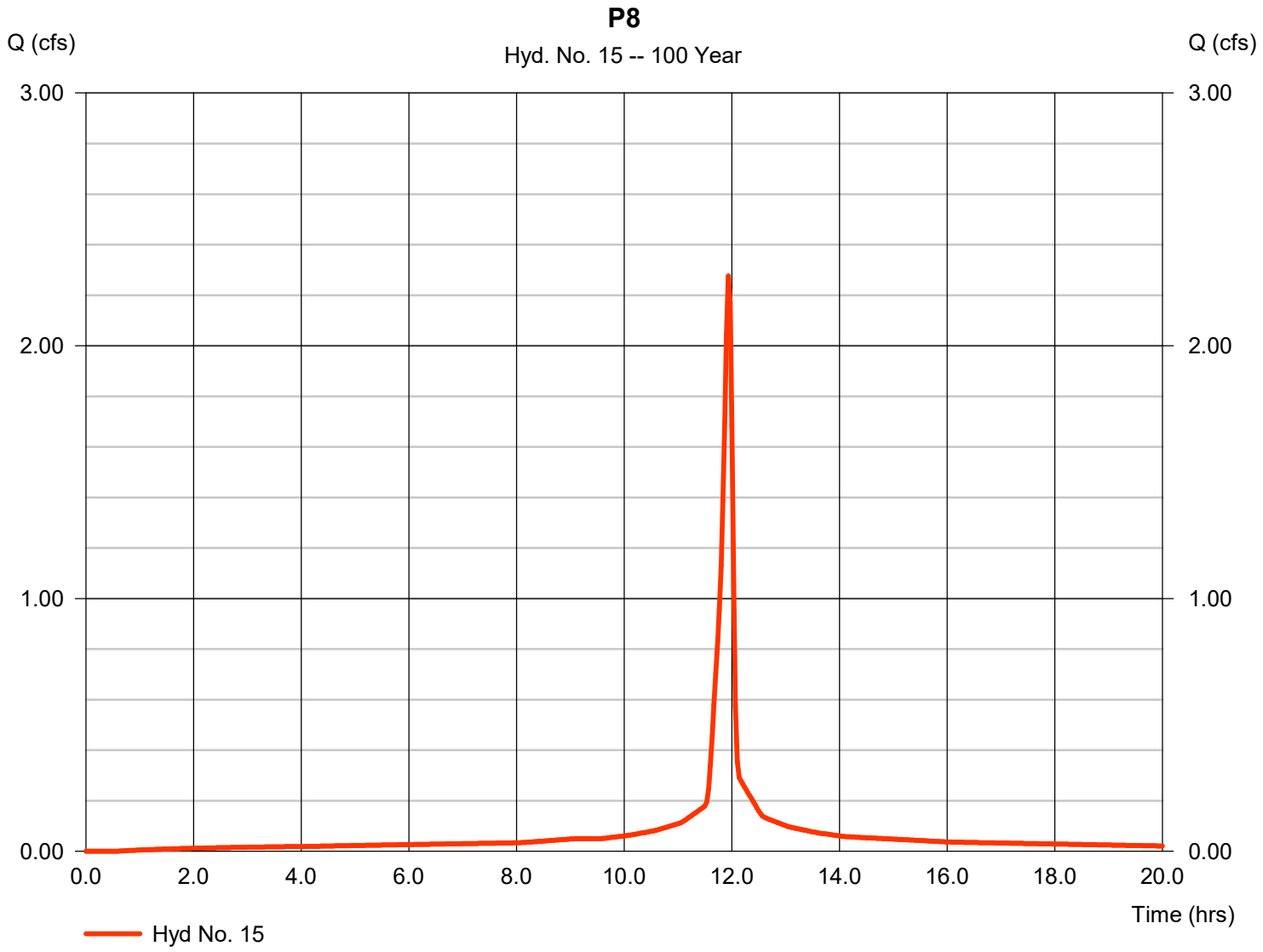
Hydrograph Report

Hyd. No. 15

P8

Hydrograph type	= SCS Runoff	Peak discharge	= 2.276 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 5,510 cuft
Drainage area	= 0.210 ac	Curve number	= 98*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.95 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.210 x 98)] / 0.210



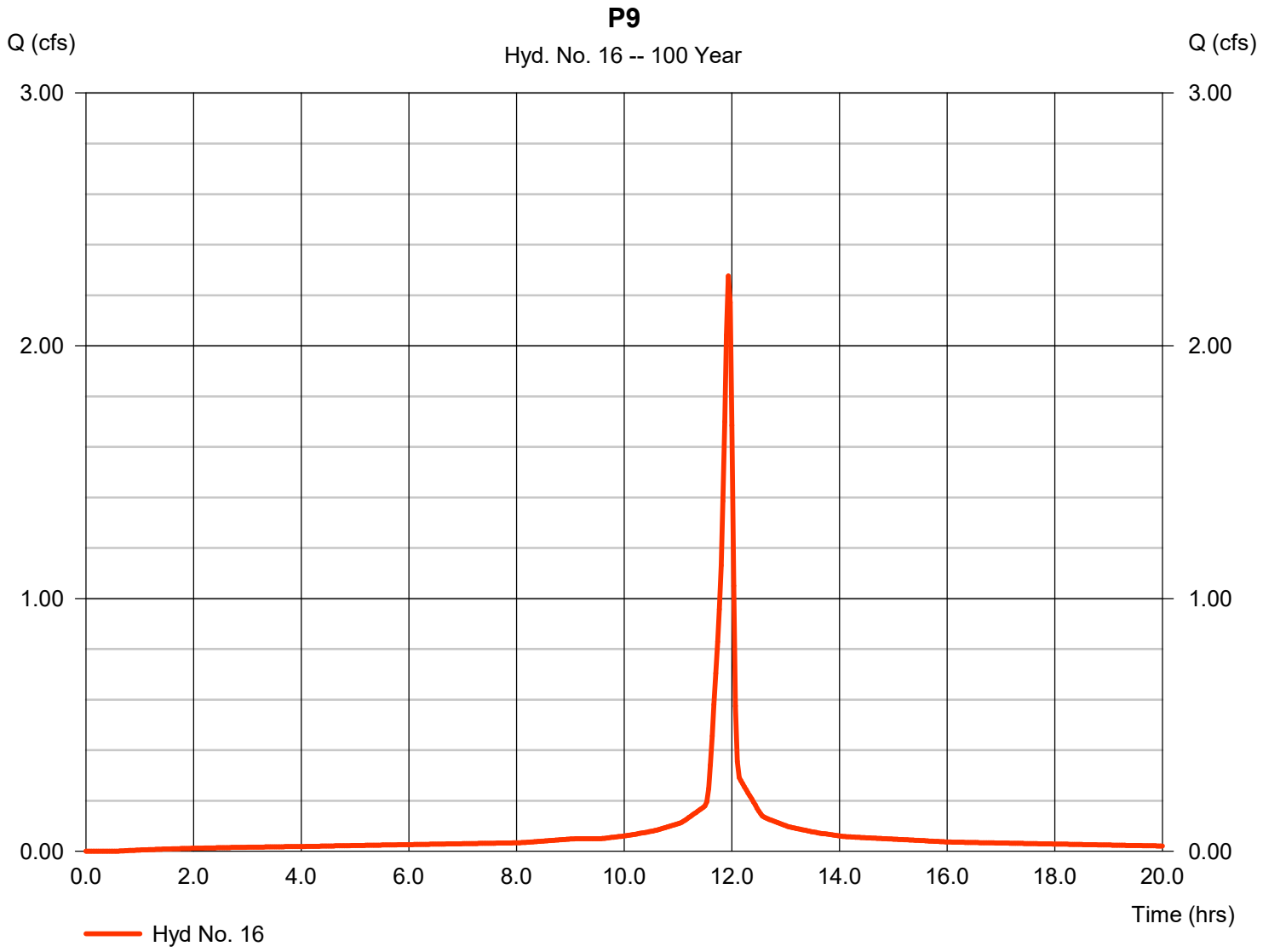
Hydrograph Report

Hyd. No. 16

P9

Hydrograph type	= SCS Runoff	Peak discharge	= 2.276 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 5,510 cuft
Drainage area	= 0.210 ac	Curve number	= 98*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.95 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.210 x 98)] / 0.210



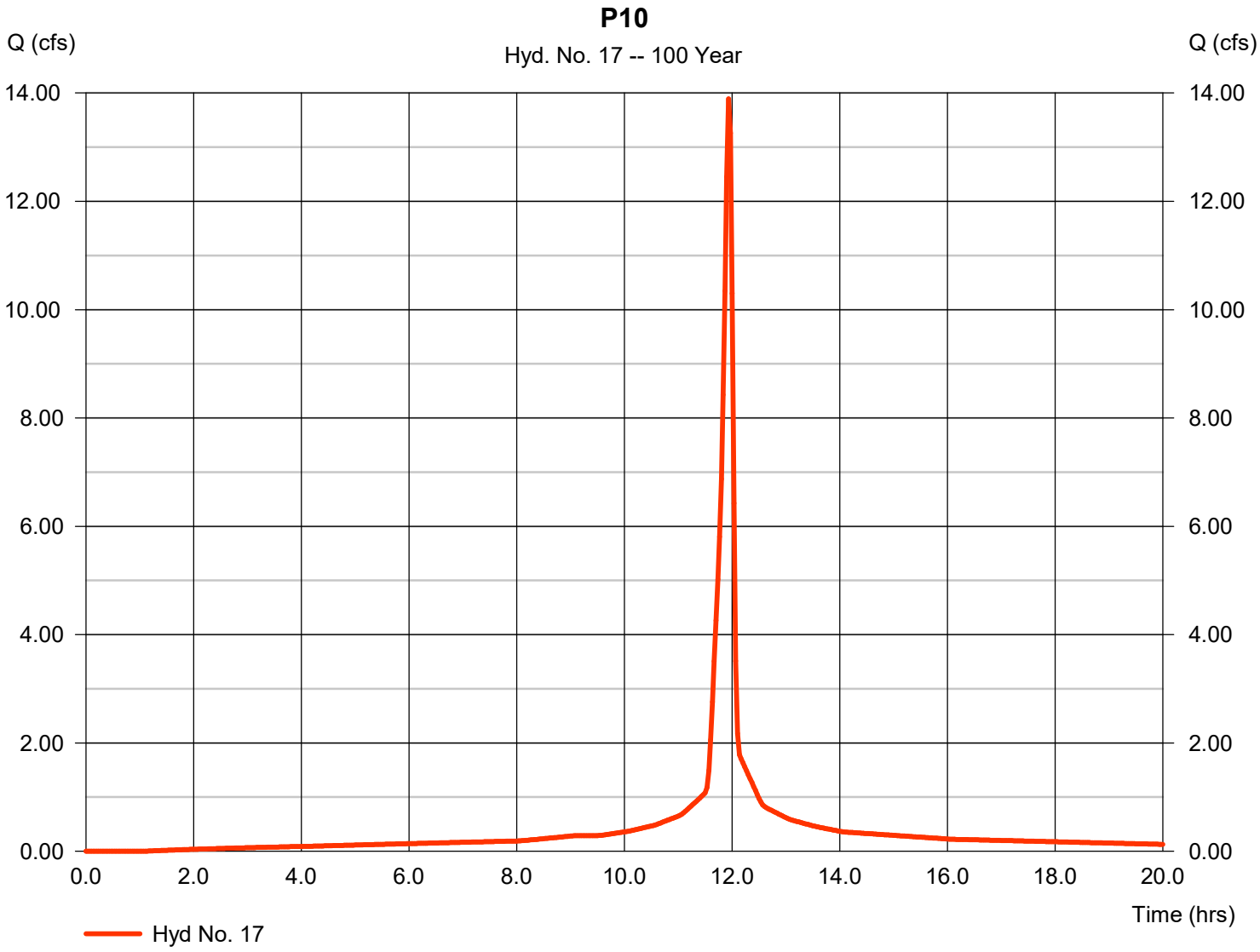
Hydrograph Report

Hyd. No. 17

P10

Hydrograph type	=	SCS Runoff	Peak discharge	=	13.89 cfs
Storm frequency	=	100 yrs	Time to peak	=	11.93 hrs
Time interval	=	2 min	Hyd. volume	=	32,798 cuft
Drainage area	=	1.290 ac	Curve number	=	96*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	7.95 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.090 x 74) + (1.200 x 98)] / 1.290

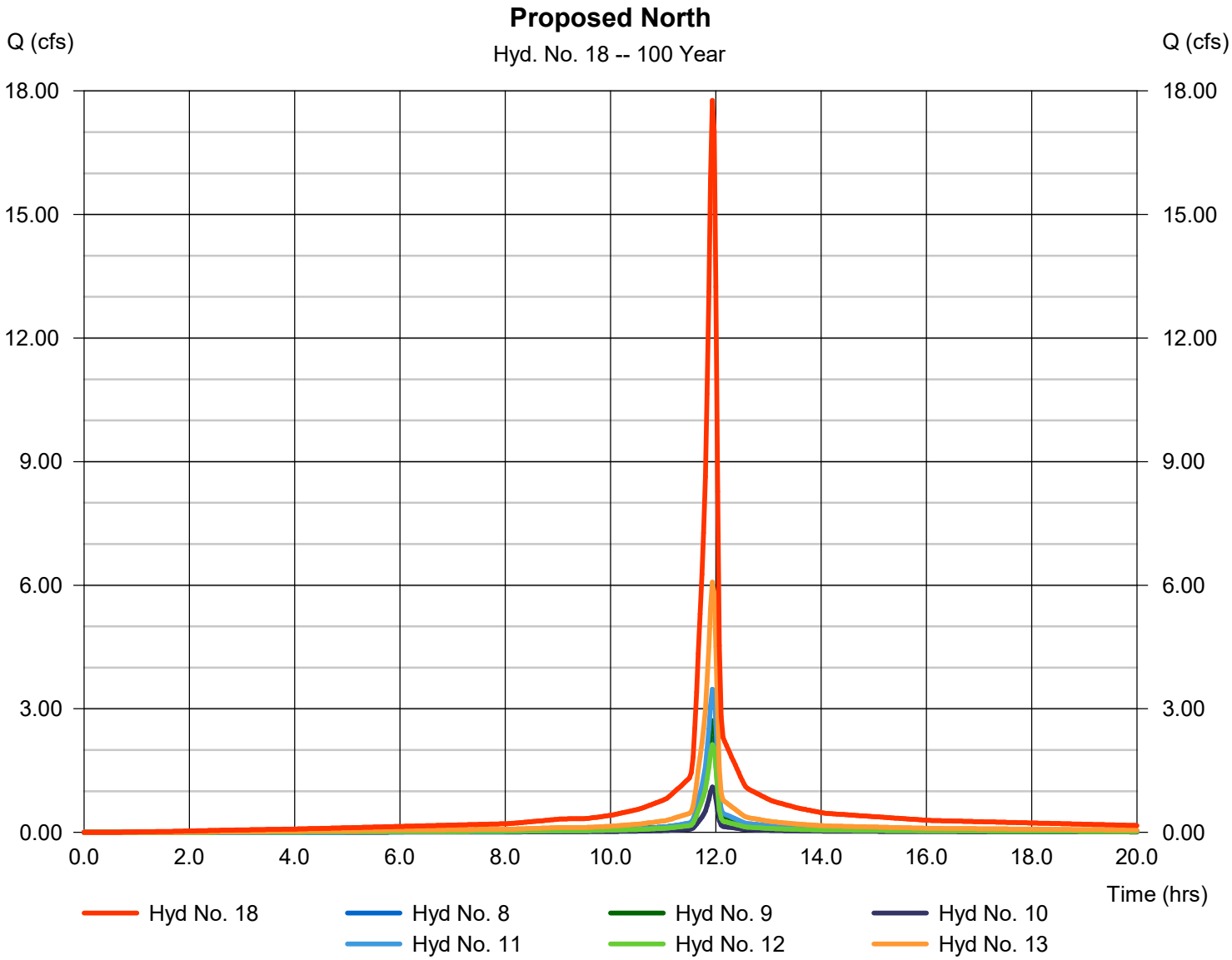


Hydrograph Report

Hyd. No. 18

Proposed North

Hydrograph type	= Combine	Peak discharge	= 17.77 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 40,826 cuft
Inflow hyds.	= 8, 9, 10, 11, 12, 13	Contrib. drain. area	= 1.700 ac

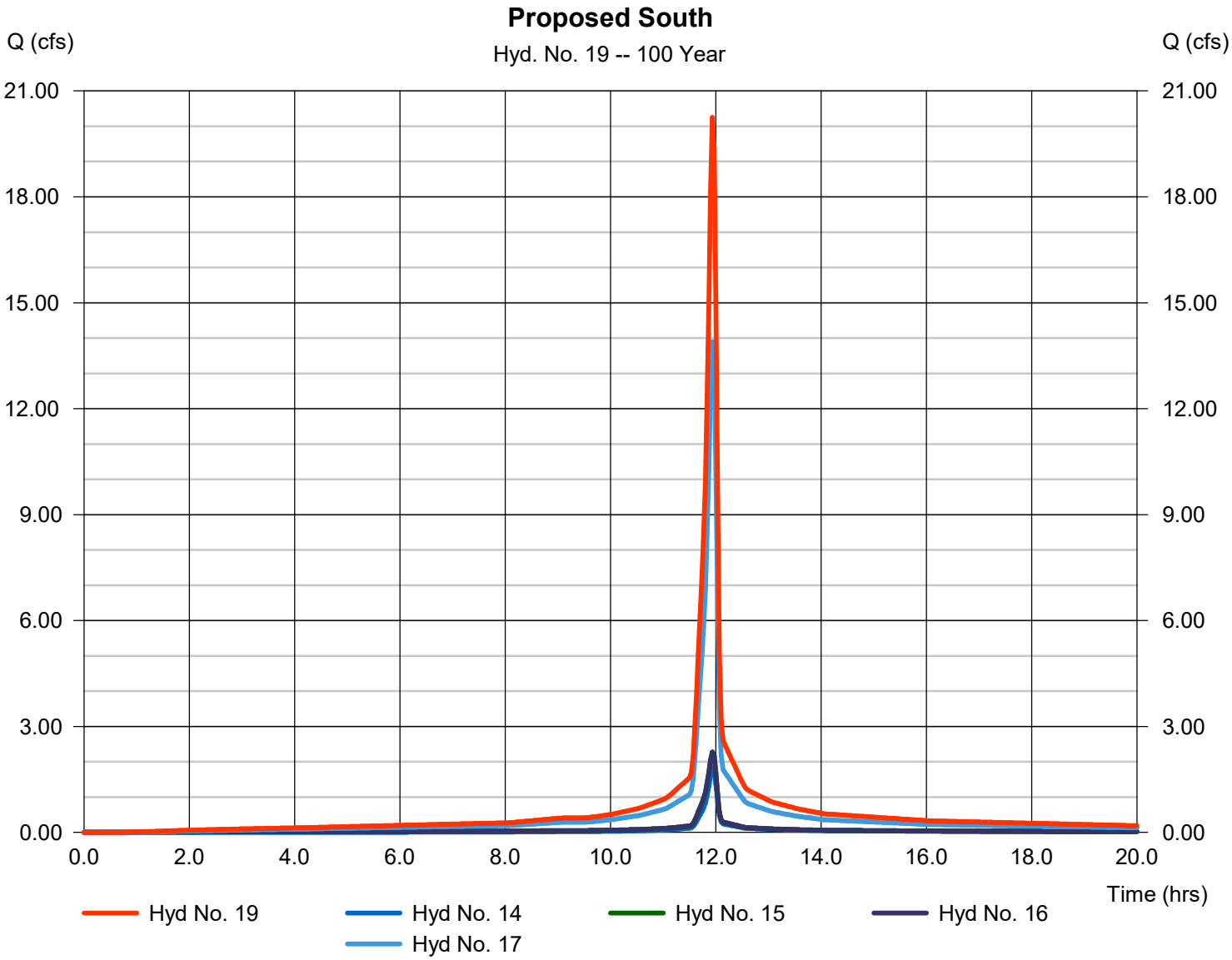


Hydrograph Report

Hyd. No. 19

Proposed South

Hydrograph type	= Combine	Peak discharge	= 20.25 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 47,652 cuft
Inflow hyds.	= 14, 15, 16, 17	Contrib. drain. area	= 1.900 ac

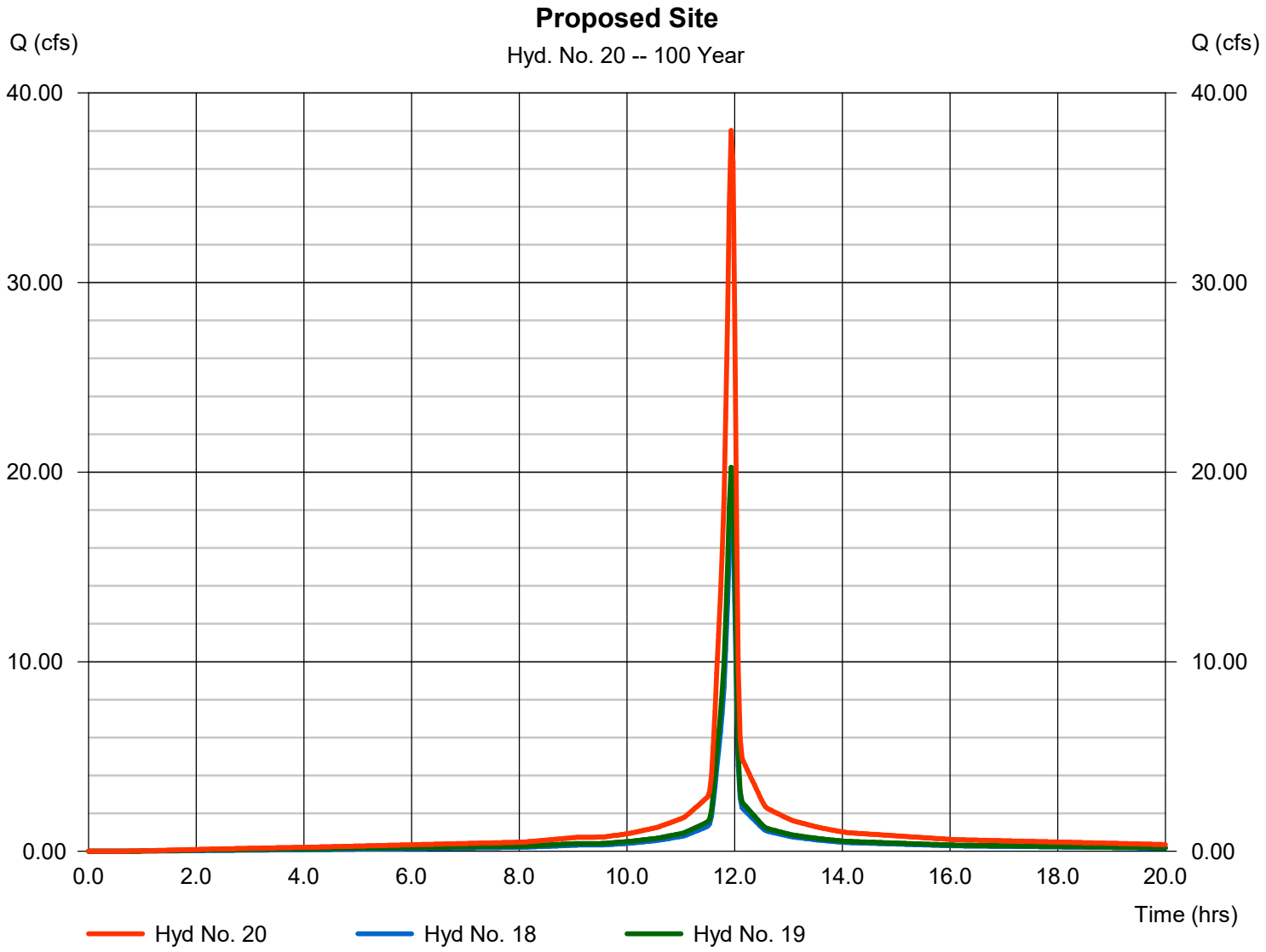


Hydrograph Report

Hyd. No. 20

Proposed Site

Hydrograph type	= Combine	Peak discharge	= 38.02 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 88,478 cuft
Inflow hyds.	= 18, 19	Contrib. drain. area	= 0.000 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	0.0000	0.0000	0.0000	--------
2	69.8703	13.1000	0.8658	--------
3	0.0000	0.0000	0.0000	--------
5	79.2597	14.6000	0.8369	--------
10	88.2351	15.5000	0.8279	--------
25	102.6072	16.5000	0.8217	--------
50	114.8193	17.2000	0.8199	--------
100	127.1596	17.8000	0.8186	--------

File name: SampleFHA.idf

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	5.69	4.61	3.89	3.38	2.99	2.69	2.44	2.24	2.07	1.93	1.81	1.70
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	6.57	5.43	4.65	4.08	3.65	3.30	3.02	2.79	2.59	2.42	2.27	2.15
10	7.24	6.04	5.21	4.59	4.12	3.74	3.43	3.17	2.95	2.77	2.60	2.46
25	8.25	6.95	6.03	5.34	4.80	4.38	4.02	3.73	3.48	3.26	3.07	2.91
50	9.04	7.65	6.66	5.92	5.34	4.87	4.49	4.16	3.88	3.65	3.44	3.25
100	9.83	8.36	7.30	6.50	5.87	5.36	4.94	4.59	4.29	4.03	3.80	3.60

Tc = time in minutes. Values may exceed 60.

Precip. file name: Sample.pcp

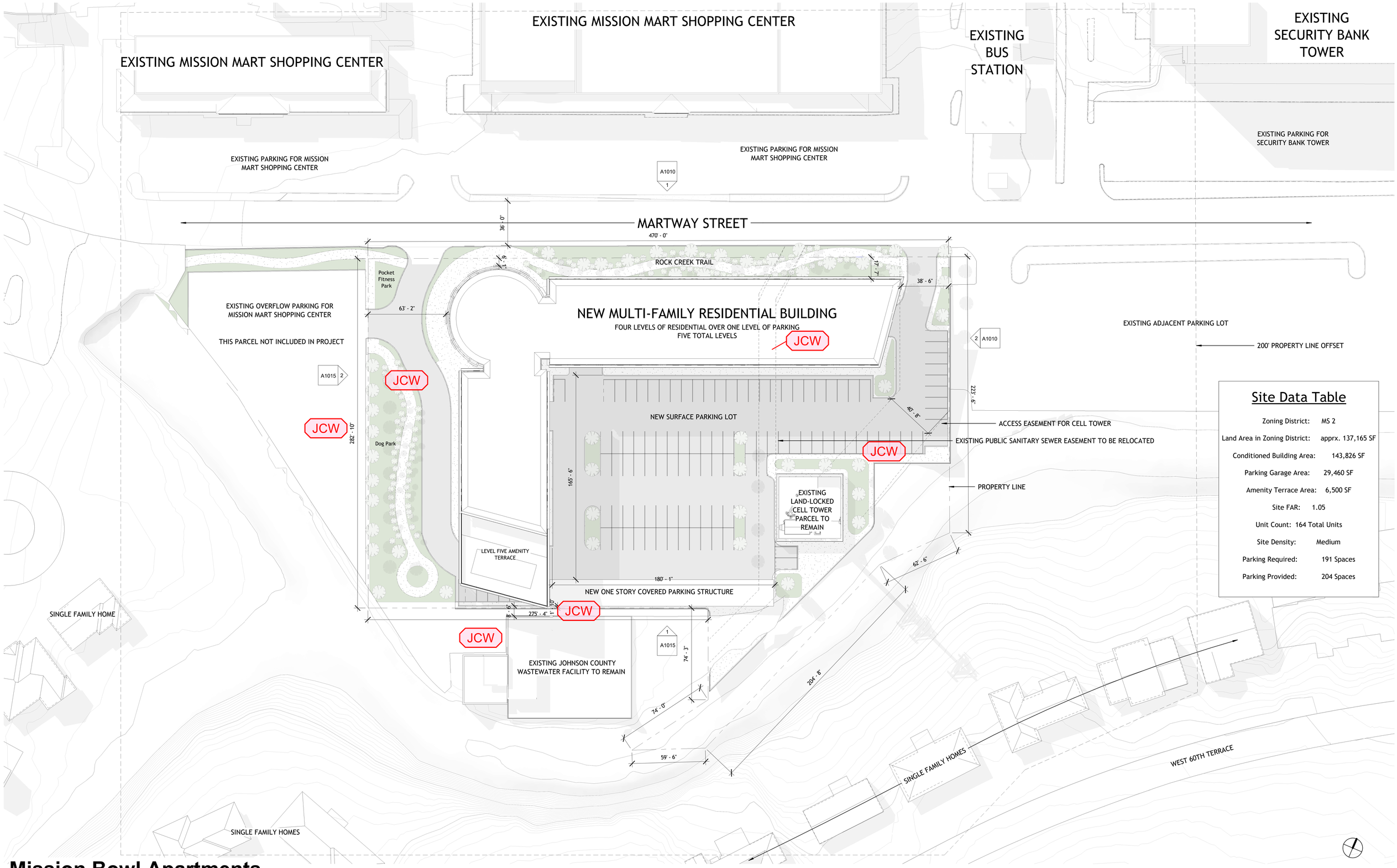
Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	0.00	2.20	0.00	3.30	4.25	5.77	6.80	7.95
SCS 6-Hr	0.00	1.80	0.00	0.00	2.60	0.00	0.00	4.00
Huff-1st	0.00	1.55	0.00	2.75	4.00	5.38	6.50	8.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	1.75	0.00	2.80	3.90	5.25	6.00	7.10

Hydraflow Table of Contents

Mission Bowl.gpw

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12

Monday, 07 / 6 / 2020



Site Data Table

Zoning District:	MS 2
Land Area in Zoning District:	apprx. 137,165 SF
Conditioned Building Area:	143,826 SF
Parking Garage Area:	29,460 SF
Amenity Terrace Area:	6,500 SF
Site FAR:	1.05
Unit Count:	164 Total Units
Site Density:	Medium
Parking Required:	191 Spaces
Parking Provided:	204 Spaces

Mission Bowl Apartments

PDP Site Plan

1/32" = 1'-0"

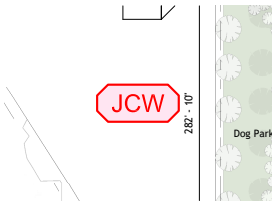
07/10/20

SUNFLOWER Development Group

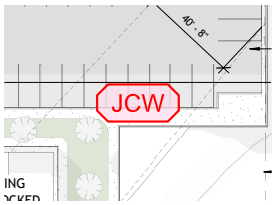
TREANORHL

Preliminary Comments.pdf Markup Summary

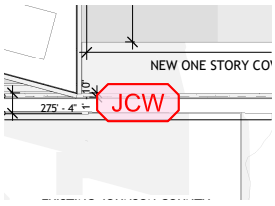
JCW Comment (6)



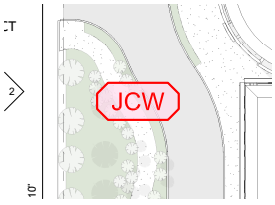
Item: JCW Comment
Page Index: 1
JCW Comment: Provide anticipated sanitary flows from the proposed development. JCW will need to analyze the hydraulic impact based on the flows from the development to our system. Note: Flows cannot be based of DFUs and must be actual flow.
Reviewer Note: N/A



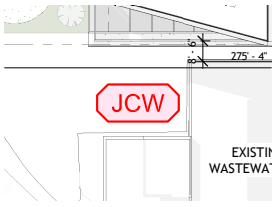
Item: JCW Comment
Page Index: 1
JCW Comment: A large diameter abandoned main is located in this area. Depending on the relocation of the active main portions of the abandoned main may have to be partially removed to allow for active main to be relocated.
Reviewer Note: N/A



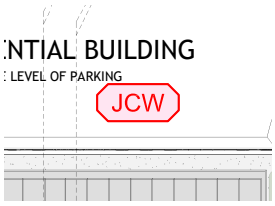
Item: JCW Comment
Page Index: 1
JCW Comment: There is an existing sanitary main North of the pump station. Structures (including overhangs) and their footings cannot be within the sanitary easement.
Reviewer Note: N/A



Item: JCW Comment
Page Index: 1
JCW Comment: A larger sanitary easement width will be required on the existing mains with the re-plat. Minimum sewer easements are twice the depth of the sanitary main with a minimum easement of 15 LF.
Reviewer Note: N/A



Item: JCW Comment
Page Index: 1
JCW Comment: Access to pump station must be provided.
Reviewer Note: N/A



Item: JCW Comment
Page Index: 1
JCW Comment: A large active diameter sanitary main shown under the multi-family residential building will need to be relocated such that structures and their footings are located outside of the sanitary easement.
Reviewer Note: N/A

(1)

Item:
Page Index: 1
JCW Comment:
Reviewer Note: N/A

Letters and Emails Received
Regarding Proposed Mission Bowl
Redevelopment Project

Commercial Ventures, Inc.

Real Estate Investments • Brokerage • Leasing • Management

August 14, 2020

Planning Commission Members
City of Mission
6090 Woodson
Mission, KS 66202

Re: Redevelopment – Former Mission Bowl

Dear Planning Commission Members,

Please allow me this opportunity to introduce myself to you. My name is Steve Choikhit, and I own the Mission Mart Shopping Center located on the southeast corner of Johnson Drive and Nall. Our property includes the 128,500 square foot retail shopping center in addition to the land on which the former Mission Bowl is situated. As you know, Sunflower Development Group is proposing to build a new apartment development on this site, and they will be bringing their plans to you at the Planning Commission meeting on Monday, August 24. Although I would normally attend a meeting of this importance, I am scheduled to undergo open heart surgery on August 17 and will be unable to attend. It is my hope that this letter will give you some insight on my feelings regarding this proposed development.

Some of you may already know me or know of me as I have been involved in the ownership of Mission Mart Shopping Center for the past thirty five (35) years. Last December, my wife and I bought out our partners, and we plan to own the property for many more years to come. We have a very substantial investment of time and money in Mission Mart, and along those lines, we continue to be committed to the continued overall growth and well being of the City of Mission. As one of the biggest tax payers in the city over these years, we would like to think that our efforts in making our center continue to grow and thrive have made a very positive impact on the city.

We have seen many changes along Johnson Drive over the years. Mission Shopping Center, anchored by Macy's, was built in 1956 at the corner of Johnson Drive and Roe. In 1989, that center was demolished and rebuilt as the 350,000 square foot Mission Center Mall that was anchored on each end by Dillards. That mall was then demolished in 2006 in favor of another development that was slated to be Mission Gateway. Shortly thereafter, a study was done for the City of Mission that included traffic patterns along Johnson Drive. It was decided that our city needed to be more pedestrian friendly. This resulted in walking trails being built throughout various parts of the city for residents to enjoy. Johnson Drive was also redesigned from a four (4) lane major thoroughfare to a two lane street that would see traffic speeds reduced from thirty five (35) miles per hour to twenty five (25) miles per hour in order to enhance the pedestrian friendly part of the overall plan.

5426 Martway • Mission, Kansas 66205 • (913) 262-7799 • Fax (913) 262-9299

Approximately one (1) year ago, I met with Mayor Ron Appletoft and Laura Smith to discuss our vision and future plans for the former Mission Bowl, which at that time, had been tied up in bankruptcy court and a lawsuit for over three (3) years by the owners of the bowling alley. I told them at our meeting that once we were able to get the property back under our control, I envisioned the highest and best use for this tract of land would be apartments rather than more retail. Their reaction to my suggestion was favorable. The reason for this vision was that apartments would act as a nice compliment to the existing retail base that we already have in place in the City of Mission, rather than adding more retail development that would compete with the ample retail space that is already in place. The new apartments would also help create a "lifestyle development" for the new residents as they would be able to live on one side of the street and meet their shopping and restaurant needs on the other side.

A few months ago, we entered into a contract with Sunflower Development Group to sell them approximately three (3) acres of land which includes the former Mission Bowl. Although we had several other apartment developers who were also interested in buying the property, we chose to go with Sunflower for a variety of reasons. First of all, they have a good track record as they have successfully developed, redeveloped or are in the construction process of over $180,000,000 of apartments in the Kansas City area alone since 2015. Some of their properties are as follows:

The Grand – 1125 Grand - 202 units - $69,000,000
Pershing Lofts – 215 Pershing Road - 55units - $20,000,000
Uptown Lofts – Corner of Valentine Road & Broadway - 213 units - $45,000,000
Brookside Commons – 65th & Rockhill Road - 210 units - $40,000,000

Another reason we liked Sunflower Development Group was the fact that they are **local developers** who have offices in downtown Kansas City, Missouri. Their partners on this project have offices in Lawrence, Kansas. They currently manage a couple of Sunflower's developments outlined above, and they will manage this property as well. Furthermore, Sunflower indicated that they would be willing to work with us, the City and the neighbors regarding their development plans so they could try to come up with a plan that would work well for all who would be affected by the development. As you may know, they already had a Zoom meeting with the neighborhood group directly south of the property, and that meeting seemed to go very well.

Their plans for approximately 166 units seem to be a good fit for the area. The project is not too large, yet it is large enough to make a positive impact on the City of Mission. Construction on The Locale was recently completed at the corner of Johnson Drive and Lamar, and it is my understanding that leasing on this 200 unit apartment complex is going very well for them as they are already fifty percent (50%) leased. As you know,

the Mission Gateway project has stalled once again, so the apartments that were supposed to be built at that location will most likely not be coming on line any time soon, if at all. Along those lines, that project which is commonly referred to as the "gateway" to our city, will unfortunately and most likely be an eye sore for quite some time.

The proposed development by Sunflower Development Group will enable us to move our eyes off of that stalled project and onto one which will help all of us in a number of ways. The 166 units will most likely bring in at least 200 to 250 new residents into our city. These are people that we need in order to help our existing retail stores and restaurants grow and thrive over the years, which in turn, will increase our chances that they remain long-term tenants in our city. These additional people in our community will also make it more attractive for other retail and office users to locate their businesses in the City of Mission as they will have that many more people that will make up their built-in audience. These additional residents and businesses will translate into more money being spent in Mission, and that will result in more sales tax revenue for the city. The apartments at this development will help us create a "lifestyle environment" with the 128,500 square feet of shopping and dining establishments that are already conveniently located directly across the street for the new residents to enjoy. This fits in very nicely with the City's vision of pedestrian friendly streets and trails that are also already in place.

During the past ten (10) years, one of the biggest obstacles that I have had to overcome as I leased vacant spaces at our Mission Mart Shopping Center was the perception that the east side of Johnson Drive was not nearly as strong as the west side. That comment that I seemed to hear over and over again was the direct result of three (3) different projects, Mission Gateway, the former Wild Oats building located directly across the street and the Mission Bowl. Since the demolition of Mission Center Mall in 2006, the Mission Gateway project has been one disappointment after another. For years, it was nothing more than an unsightly tract of land that was filled with weeds and piles of dirt. After years of broken promises, the developer finally broke ground which got a lot of people in our city very excited, and I was one of those people. Unfortunately, construction on that project has stalled twice, and now we are left with a half-way completed, lien-riddled project without financing, with not much hope of if or when it will ever be completed. The result is an eyesore for the City of Mission and all of the neighboring tenants and property owners. The Wild Oats building directly across the street from Mission Gateway has been vacant for approximately thirteen (13) years. Although the out-of-town owner has had opportunities to sell the building to multiple buyers, he has instead chosen to leave it vacant, and in a less-than-desirable physical condition. Finally, after a fire in 2015 partially destroyed the Mission Bowl, it was tied up in bankruptcy court with a lien and a lawsuit against it, and that prevented our ownership entity from doing anything with the property during that period of time. It was not until December 2019 that we were finally able to re-gain control of the property. Taking all of the problems

associated with these three (3) properties into consideration, it is easy to see why the east side of Johnson Drive has had the perception of being the "weaker side" of this major thoroughfare.

Now we have an opportunity to change this negative connotation regarding the east end of Johnson Drive and the eye sore that we are left with at Mission Gateway and the former Wild Oats building. We have a local developer with a good track record who is willing to make an investment in excess of $28,000,000 in our community. They will own and operate the new development with their successful team that is already in place and is a proven commodity. Their proposed development has good support from the residential neighbors to the south and the existing businesses in the immediate area. The City of Mission will not have the responsibility to sell any bonds to make this project happen, they will have no responsibility to make any improvements to the site or surrounding street, and they will have a lot of upside potential as it relates to increased sales tax revenue that they are sure to receive. Residents of this new apartment development could also turn out to be permanent residents in the City of Mission, either living in the apartments or buying a home in Mission at some time in the future.

We have an excellent opportunity to bring something good to the City of Mission, and we have a good, reputable and financially able local development group who has proven over and over again that they can and will finish what they start. I ask you to embrace this opportunity, work with Sunflower Development Group to approve their development plans and welcome what they have to offer to our city. You will not regret your decision as it will give all of us who have a commitment to the City of Mission, the boost that we all need right now as we face so much uncertainty in our lives. This is a win/win proposition for everyone, something that we do not see often enough, and I ask for your help and support so we can take advantage of this opportunity. Thank you for your time and consideration, and I look forward to working together to make this proposed development a reality.

Kindest Regards,

COMMERCIAL VENTURES, LLC

Steve Choikhit

5426 Martway • Mission, Kansas 66205 • (913) 262-7799 • Fax (913) 262-9299

CITY OF MISSION
KANSAS

Brian Scott <bscott@missionks.org>

Mission Bowl Redevelopment - Letter in Support (For Planning Commission)

1 message

Ben Chociej <bchociej@gmail.com> Tue, Aug 18, 2020 at 7:03 PM
To: Brian Scott <bscott@missionks.org>
Cc: Kaitlyn Service <kservice@missionks.org>, Banks Floodman <bfloodman@sunflowerkc.com>, Sollie Flora <sflora@missionks.org>, Ken Davis <kdavis@missionks.org>

The following message is addressed to the Planning Commission in support of the Mission Bowl redevelopment proposal. Please forward/share as you see fit.

--

Commissioners:

My name is Ben Chociej. My wife, Betsy, and I live at 5136 W 60th Terrace, directly behind the old Mission Bowl site. Our home overlooks the old bowling alley and wastewater facility very directly, just across the Rock Creek Channel from our backyard. Tonight I write to ask you to approve the proposed apartment development on this site presented by Mr. Floodman from Sunflower Development.

Like others who have written on behalf of previous similar projects, my wife and I moved to Mission three years ago, in large part because we were excited by its potential growth and development. Close-in suburbs like Mission are exciting because they can provide the best of both urban and suburban living, and that is precisely what attracted us to the area. Projects like the Locale, the Gateway, and the previously proposed Martway Mixed-Use project are projects we are or would have been thrilled to see in Mission and believe will bring great new life and energy to the community. We view the Mission Bowl apartment proposal in a similar way.

Density and walkability are obvious key factors to the success of our close-in community. Our main street fares better than many, but to continue thriving and acting as the hub of our community, we need residents dining, shopping, walking, and biking in the area. And there can be no doubt that the proposed development would help build a larger, more resilient tax base for our city. Multifamily residential developments such as this one are therefore vital to the success of our beloved Johnson Drive "main street" and our city as a whole.

I understand that this project, like its predecessors, will face an obstacle in the height restrictions related to its zoning. While I believe the continued struggle to meet this restriction in a fiscally feasible way is a strong suggestion that the council revisit this restriction altogether, I ask you to approve a deviation in this specific case, among my other reasons, because of the unique topography of the site.

Unlike the Martway Mixed-Use proposal, the site of this proposal sits at a much lower elevation compared to the surrounding single family homes. Our house, for reference, is perhaps the one most directly impacted by the proposed development due to its proximity, the surrounding landscape, and the tree cover in the area. About 80 feet out our back door, the lot slopes sharply down to the creek bed directly behind the wastewater facility abutting the Mission Bowl site, and we can see very clearly over the top of both buildings to the Mission Mart.

Using the GIS tools on the Johnson County AIMS website, I can see that the Mission Bowl site sits at least 40 feet lower than our lot (950' versus 998'; while I suspect the precision of these numbers, the drop is indeed substantial as I view it from my backyard). In short, the proposed development is not likely to loom over our neighborhood. In fact, based on the application materials we have seen, the proposed building wouldn't even best our own home in its most extreme elevation. To me, this is an abundantly reasonable height, and I believe this topography should weigh strongly into the decision to allow the height deviation.

If this weren't enough, I have already witnessed the developer's abundant willingness to react positively to our concerns about the development by amending the proposal to include significant screening of the rear features of the proposal. And in general, I find the proposed design to be very pleasant and attractive, welcome additions to our backyard view of Mission. (Much more attractive, incidentally, than the larger and more imposing office building not far away at 5201 Johnson Drive.) Based on what I have seen proposed and amended over the past couple of months, I have no doubt this development would make for a "good neighbor" to us in its very design.

I could continue possibly forever explaining why I think multifamily residential is right for Mission, for this site, and even for (nearly) my backyard, but I will conclude my written message tonight by simply repeating my sincere request that the proposed development be approved with necessary deviations, as I think it represents a very positive step forward for the area. I do plan on attending the hearing on 8/24 by Zoom and will present any additional commentary there as appropriate.

Thank you very kindly for your consideration.

Yours truly,
Ben Chociej
5136 W 60th Terrace

P.S. Please note, in the interest of full disclosure, that I sit on the city's Parks, Recreation, and Trees Commission. My comments in this letter and in next week's hearing are purely the personal views of myself and my wife. I have no other potential conflicts of interest.

CC: Kaitlyn Service, City Planner
CC: Banks Floodman, applicant of record for the proposed development
CC: Sollie Flora & Ken Davis, Ward 4 Councilmembers

5214 W. 60th Terrace
Mission, KS 66205
August 17, 2020

Members of the Planning Commission
Mission, Kansas

Re: Application of Sunflower Development for
160 residential units at former Mission Bowl Site

Dear Members of the Commission:

I am writing with my objections to this proposed development for both safety and aesthetic reasons. I reside on the neighboring 60th Terrace.

Safety Concerns

As I understand it from the prior presentation by the developer, this project will encourage dog-owners to reside because the developer will be providing some kind of dog park on the premises. However, this area lacks the necessary infrastructure to safely support the reasonably anticipated increase in pedestrian traffic that such a project will likely produce.

The project will be located on the Rock Creek Trail, and if pedestrians stay on this trail, there would not be a significant safety issue. However, people do get bored walking the same route and it is anticipated that they will soon investigate the intersecting sidewalk that takes walkers to the adjacent Birch Park.

Again it is foreseeable that the dog-walkers will not be content with walking in Birch Park. They will continue their walks as many pedestrians now do, south on Birch Street, and then west to Nall or easterly to Roeland Drive and back north to the Rock Creek Trail at Wendy's.

The problem is that there are no sidewalks on Birch Street nor 60th Terrace. We already have numerous walkers on these streets. Those walking dogs can be distracted by their animals from oncoming traffic, so this is already a potential problem.

However, the City has approved the Gateway project, and we all must assume that one day this will be completed. 60th Terrace dead-ends on the east at the entry number one to the Gateway. To my knowledge the City did not require a traffic study for 60th Terrace for either project, but again we can reasonably anticipate that traffic on 60th Terrace will substantially increase from drivers looking for a shortcut from Nall to the Gateway.

Thus, we have a foreseeable and unnecessary increased perilous situation from the increased vehicle traffic coupled with an increased pedestrian traffic without the safety of sidewalks. *Over time, serious injury, if not death, can be reasonably anticipated unless planning requires more study and one or more of the following steps:*

1. Construction of sidewalks on Birch and 60th Terrace. This may not be welcomed by all affected neighbors.

2. Removal of the dog park from the Project to discourage pedestrian traffic on Birch and 60th Terrace.

3. Closure of the sidewalk entrance from Rock Creek Trail to Birch Park. This alternative will also reduce the existing pedestrian traffic on these affected streets, but be a disadvantage to current neighbors who use this sidewalk as their entry way to the Rock Creek Trail and Mission shops.

Any costs associated with this important safety remediation must be borne by the project and not current residents who will see no benefit from this project.

Aesthetic Objections

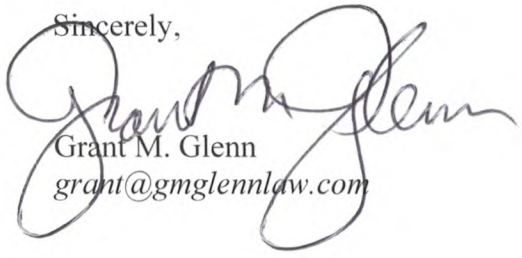
This five story behemoth is out of place in this residential neighborhood. The Developers indicate that it is not such a bad problem because it sits lower than the houses in our neighborhood and further, it is shorter than the neighboring tornado siren.

The tornado siren performs a safety function, the residential building does not. In fact it increases traffic and the developers want to use TIF funding to divert increased tax income for twenty years so the rest of us must pay the taxes for the increased city and other governmental services that must be provided to the increased project residents who do not pay taxes.

The fourth and fifth floor residents of this project will be able to anonymously stare down into our windows and back yards. It invades our privacy unlike an office building where most tenants do not occupy their space during weekends and evenings when our current residents expect our privacy. This is a substantial and unnecessary requested use change from that of the former occupant.

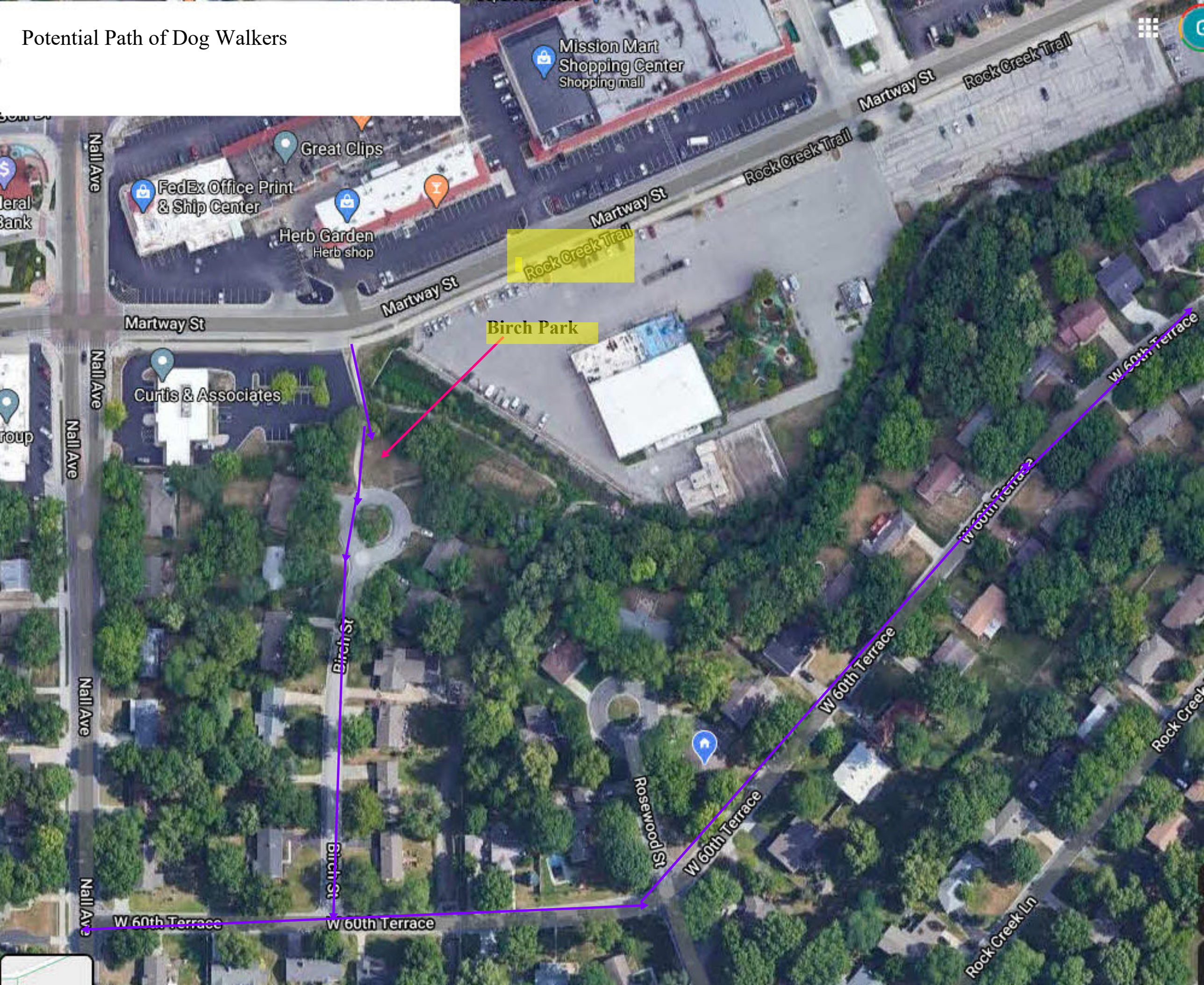
I dare say that none of you would want this edifice with those peering eyes in your backyard. Please do not permit the use changes that will permit this in ours!

Sincerely,



Grant M. Glenn
grant@gmglennlaw.com

Potential Path of Dog Walkers



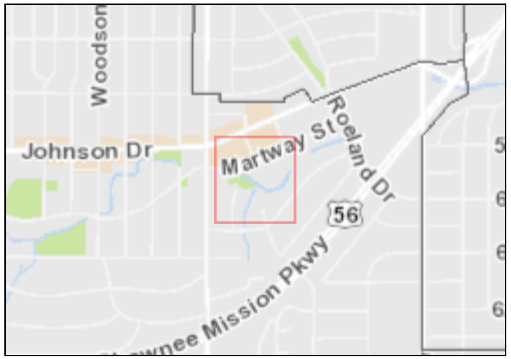
BIRCH PARK

Johnson Co AIMS Map

LEGEND

AIMS Imagery: Current Imagery (2019)

Property



JOHNSON COUNTY KANSAS
AIMS GIS & Mapping

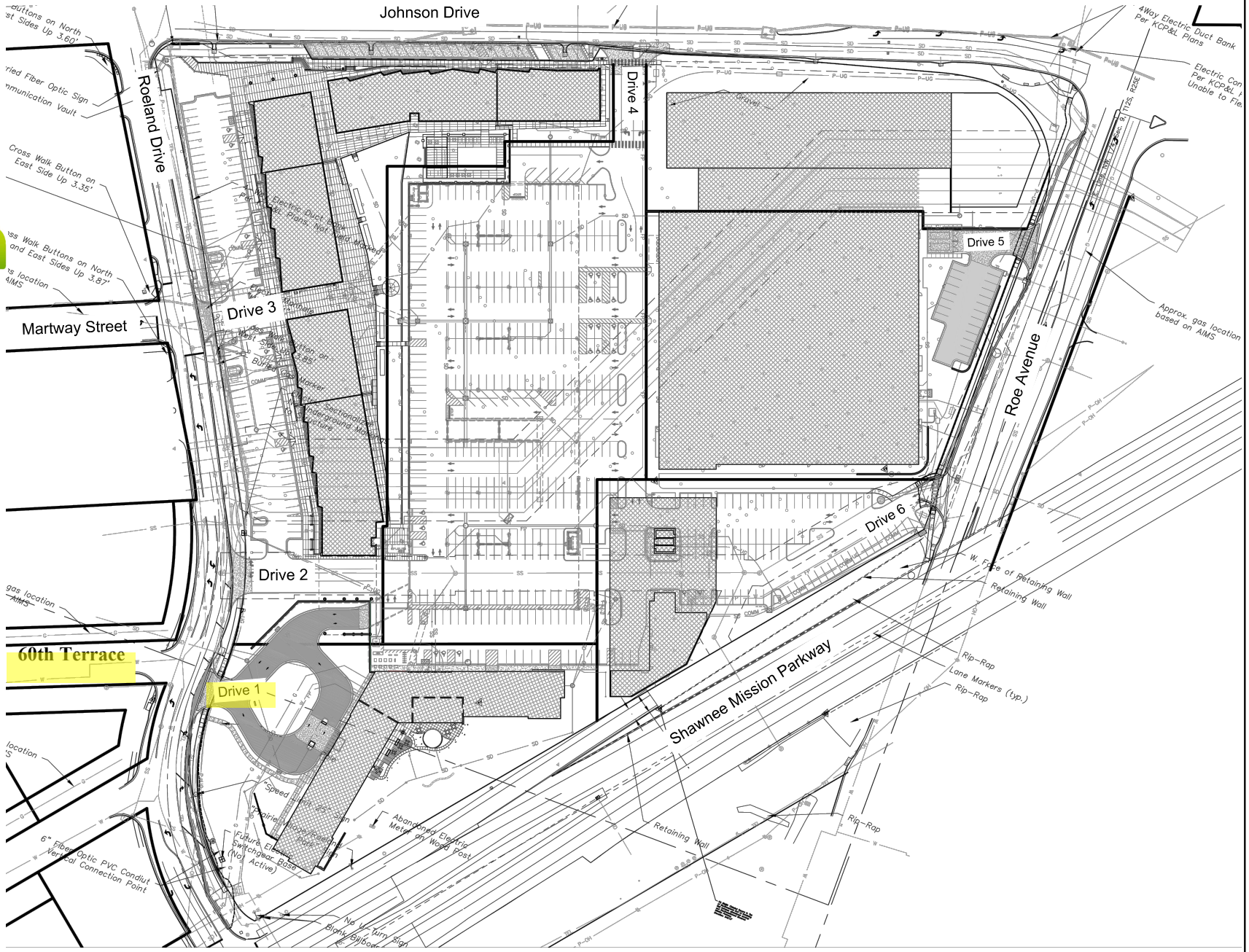
8/12/2020

FIGURE 7

Site Plan

Gateway Development
Mission, KS

olsson



E-mails

From: **Ben Chociej**
Date: Mon, Aug 10, 2020 at 11:29 AM
Subject: Re: Mission Bowl Redevelopment E-mail Distribution List
To: Kaitlyn Service <kservice@missionks.org>

Kaitlyn,

Thank you for the updated information. I am quite happy with the revisions to the plan so far, and as a homeowner and resident immediately behind the proposed development, I hope my support weighs deeply with city staff and the Planning Commission.

Would it be preferable to give comments in support of this project to the Planning Commission on Zoom during the 8/24 meeting, or should I instead send a letter of support ahead of time? I am happy to do whichever is more impactful.

Yours,
Ben Chociej

From: **Grant Glenn**
Date: Mon, Aug 10, 2020 at 10:10 AM
Subject: Re: FW: Mission Bowl Redevelopment E-mail Distribution List
To: Kaitlyn Service <kservice@missionks.org>

Kaitlyn,

Thank you. Has there been a pedestrian traffic study done regarding safety? My concern is that with a building built to encourage owners to have dogs, that many will walk their dogs through the neighboring park and onto 60th Terrace, as many residents do now. Unfortunately, there are no sidewalks and this pedestrian traffic is in potential danger and is a foreseeable danger that needs to be addressed in advance to either build the sidewalks or block off access from the park to this neighborhood. Vehicle traffic will only increase with the construction of this apartment building and the completion of the development at the end of the street.

I would like to address these concerns to the planning commissioners. Is there a way for me to write them a letter in advance of the meeting? Is there a way that I can address the meeting?

Would you please provide me the traffic study completed for the entertainment project at the east end of this area. Why did the traffic study for this project not include 60th Terrace, the nearest parallel street to this project?

Thank you.

Grant

From: **Grant Glenn**
Date: Mon, Aug 10, 2020 at 2:56 PM
Subject: Re: FW: Mission Bowl Redevelopment E-mail Distribution List
To: Kaitlyn Service <kservice@missionks.org>

Thank you Kaitlyn,

In looking at the Gateway traffic study, it appears that Drive "1" is opposite of 60th Terrace. Am I reading the map correctly? If that is the case, can you explain why 60th Terrace was not the subject of the traffic study. It appears that if Gateway will ever open that there is likely to be a huge increase in traffic on 60th Terrace from those people going from Nall to the Gateway down 60th. Even if it is only 5% of the potential number of people who would otherwise use Johnson Drive or SM PArkway, it could be a huge influx of traffic for this residential street.

I take it from your previous response that there has been no potential study done for increase of pedestrian traffic for these streets that do not have sidewalks. It appears we have a very foreseeable hazard that will develop - substantial increase in vehicle traffic coupled with a significant increase in pedestrian traffic. Before I write to the Commissioners about addressing this potential foreseeable hazard, has staff made any recommendations that would address these concerns?

When will the staff recommendations report for the Mission Bowl project be available?

Thank you.

Grant

From: **Jim Alexander**
Date: Tue, Jun 16, 2020 at 7:17 PM
Subject: Hi
To: <kservice@missionks.org>

Jim Alexander here, I think Brooks Floodman and C Treanor should contact jack stack or Stroud's and see if they might be interested in putting a place here in mission across from the Peanut

From: Ben Chociej
Date: Mon, Jun 15, 2020 at 8:15 PM
Subject: Mission Bowl Redevelopment

To: <kservice@missionks.org>

Thanks for hosting the meeting tonight. My wife and I would like to keep informed on the Mission Bowl redevelopment project so we are sharing our contact information as requested

I quickly want to say that we are right behind the proposed development and really are in favor of the density. We think it is vital to Mission's success. We hope to retain some of the nice woodsy privacy we have now despite the Rock Creek Construction and hope the developer can be respectful of that. But it's a great proposal so far in our opinion.

Anyway, thanks again and let us know how we can help or keep informed!

Ben & Ellen Chociej, 60th Terrace, Mission, KS 66205

From: **Mike Patterson**
Date: Mon, Jun 15, 2020 at 7:06 PM
Subject: Proposed 5399 Martway project.
To: <kservice@missionks.org>

Good Evening Kaitlyn,

My name is Michael Patterson and I reside at Rosewood Street, Mission, KS.
I will be attending the virtual meeting this evening on the proposed 5399 Martway project. My inquiry is to receive any proposed drawings and/or information for this project.
As I live almost directly behind this, at first pass, I am concerned as to height and density of this proposal.

I appreciate your assistance. I am happy to stop and pick up any available information.

Sincerely,
Mike Patterson

From: <longboardswb@gmail.com>
Date: Mon, Jun 15, 2020 at 3:20 PM
Subject: Mission Bowl Apartments
To: <kservice@missionks.org>
Cc: <lsmith@missionks.org>, Commercial Ventures, LLC

Hello Kaitlyn. My name is John Bailey. I'm one of the owners of Longboards Wraps & Bowls. We have a location on Johnson drive in Mission. I understand there is a proposal for an apartment complex at the site of the old Mission Bowl. What a great addition this would be! We've missed the Mission Bowl, and are unsure what is happening at Mission Gateway, but I see all the activity over by Target and just wish we had that over on our end of Johnson Drive. We're certainly ready for it, and I think this apartment would go a long way with that. I very much look forward to having the residents walk over for a wrap, hopefully sometime soon.

Let

John

From: The Blind Broker
Date: Mon, Jun 15, 2020 at 3:16 PM
Subject: Development Proposal at Former Mission Bowl Site
To: <kservice@missionks.org>
Cc: <lsmith@misionks.org>, Commercial Ventures, LLC

We at The Blind Broker are excited for the possibility of a nice apartment complex at the site of the former Mission Bowl. There are so many advantages. First is having ANYTHING on this site that has been vacant for so long. Second, affordable housing in a convenient location within an outstanding school district is difficult to find and highly sought after. Third, the additional dollars generated for local businesses by those 140-150 households would be much appreciated!

We look forward to having new neighbors and increased traffic flow, which will lead to greater exposure for our business and more tax dollars for our community. We currently have a nice mix of retail in the area with restaurants, boutiques, goods, and services. An apartment complex will complement our current diversity and add to the neighborhood-feel of this area.

The project has our whole-hearted support.

--
Rick and Joey Ford
The BlindBroker, LLC
Showroom:
5440 Martway St.
Mission KS 66205
9-5 M-F; 10-5 Sat

Web: www.blindbroker.com

From: **Scott Hinz**
Date: Mon, Jun 15, 2020 at 2:41 PM
Subject: PROPOSED APARTMENT DEVELOPMENT AT THE FORMER MISSION BOWL
To: kservice@missionks.org <kservice@missionks.org>
Cc: lsmith@missionks.org <lsmith@missionks.org>, Commercial Ventures, LLC

I just wanted to take a moment to voice my support of the proposed apartment development at the former Mission Bowl. I believe this project would be beneficial to the city in additional revenues, revitalization of the area and drawing more people and businesses to the area. I know it would certainly help our business (Jimmy John's) to have additional people living in the area. More people = more sales, more sales = more taxes paid. A win/win for us all I believe.

I hope you all will help get behind this project and help move it forward.

Scott Hinz | Chief Operating Officer
HINZJJ LLC, DBA JIMMY JOHNS GOURMET SANDWICHES
www.jimmyjohns.com

On Tue, Jun 9, 2020 at 3:52 PM Susan Speck wrote:

> I saw plans for the the old Mission Bowl. I am seriously opposed to this plan of a five story building on this site. This area does not need 160 more families in this area..a flood of people and traffic in an area that has been calm for the 26 years I have lived here. How about a few units of condos in this FLOOD PLANE area or a retirement/assisted living structure?
>
> **SIZE: 5 Stories...160 new families:** the 2 schools in this neighborhood will not be able to handle the surge of students (might I say from Wyandotte county) to the newly refurbished Highlands Elementary and the older Rushton School. Is the school district willing to increase class size for already stressed teachers of add structures to the school sites? Even if there were only 160 new students to Highlands, that would overwhelm that school. As a retired Elementary Art teacher in Wyandotte county schools, I can attest that, assuming many of these students are elementary age, that would be 160 new students. That is like adding 6 new classrooms of students! If there are 20 classrooms at Highlands, that is 6 new students per class.

AND please, 5 stories? There are no apartment buildings in Mission that are above 2 stories. OH! I forgot the hideous new MONOLITH on Johnson Drive near Lamar. THAT building blights Mission. It is too big and ruins the charm of our area. WE are not downtown KCMO...keep structures small. I MIGHT not have problems with some single family condos like the ones on the next street south of the M.Bowl. how about 2 or 3 single family homes?

This is a single-family-owned area. THAT is why I moved here. I lived in an area with an over abundance of apartments. I saw and EXPERIENCED loitering, kids in streets, trash, vandalism, poor landlord-ship and CRIME! I moved to Mission for its affordable housing, ease of shopping, calm small town atmosphere and good schools. I'm 66 and do not ever want to move from a house that was paid for in 2009.

TRAFFIC: I live within site of the Mission bowl site. I walk to the Peanut, Fed Ex, Dollar General, and the Bank. I also ride my bike through there. 160 families will likely add at least 160 cars creating traffic issues on Martway and Nall.

OTHER ISSUES: the Mission Bowl is set on *a flood plane* that is still having problems. I saw flood damage subsidence near the big sidewalk behind Fluffy Fresh Donuts last week...walls and fencing collapsing. I walk my dogs and ride my bike through the Mission Bowl parking lot and I see new subsidence all the time.
As stated before, how about a few condos or some single family homes? OH yeah, mega apartments create continuous revenue. Privately owned home or condos do not.

Is the city going to disrupt traffic and water draining on Nall and housing close to Martway to fix issues downstream near the M. Bowl? Is there a guarantee that the city will not create water issues for my home with whatever has to be done?

How about a park? a fenced dog park? small retail? stream channel widening? farmer's market? MAINTAINED tennis courts, bocci ball, basket ball or pickle ball courts? Another place for children to play is always great! That miniature golf course could be revived.

Why not see if the BEHEMOTH on Johnson Drive fills up before allowing this new build? Why not chat with Overland Park about ALL the new apartment buildings built in their downtown area? **Have THEY filled up after being there a year?**

Please have someone read this during the virtual Zoom meeting if I can't get that working.
I opposed the Walmart being built in the Gateway and will oppose this 5 story apartment building.

Susan Speck
Nall Avenue
Mission, KS 66202

cheers,

Susan Speck
hand built, funk-tional porcelain
website: www.susanspeck.com
TBN: kcclayguild.org/Teabowl-National
KCClayGuild: http://www.kcclayguild.org

From: **Susan Speck**
Date: Wed, Jun 10, 2020 at 12:38 PM
Subject: Re: Mission Bowl plans
To: Kaitlyn Service <kservice@missionks.org>

Would the plans for this new building at the Mission Bowl site be like The Locale on Johnson Drive...'luxury apartments'? That kind of a plan would be more agreeable to me...but still NOT 5 stories. Five stories, to me, equal GREED. The bottom line here is making lots of money, not the safety of residents and keeping Mission a 'small' town'.

My fear is that all these apartments are un-rented. I fear that un-rented apartments become HUD housing in the future. HUD housing equals CRIME in my opinion. I lived near MANY HUD apartments in my pre-divorce life in KCMO. I lived with drug sales on the corner, creepy people on the sidewalk, bullets through cars and condoms in my yard. NO HUD housing. Mission needs to remain a safe, place for families...FAMILIES, not single people.

Part of choosing to BUY a home in Mission what that I DID NOT needing a home security system...feeling safe when I my daughter was small, or now, when I walk or ride my bike...even at dusk.

I still prefer no buildings taller than 2-3 stories tall anywhere in Mission...or the influx of 160+ (probably at least 300+) people in one SMALL area. Small equals cozy, small town, SAFE. The Pro-Script and The Locale ruin Mission for me. I also hate that The Locale doesn't have much of a setback from the street. I feel like I 'm in a canyon. It's like being in downtown KCMO.

KEEP MISSION SMALL! That is the lure and charm of Mission!

cheers,

Susan Speck
hand built, funk-tional porcelain
website: www.susanspeck.com
TBN: kcclayguild.org/Teabowl-National
KCClayGuild: http://www.kcclayguild.org

Phone calls:

1. MD Management, who owns the parking lot to the east of the Mission Bowl site was concerned residents/ visitors were going to use their parking lot
2. Grant Glenn of W 60th Ter, Mission said that a five story building would be imposing and would not fit with the environment. He was concerned that people in the apartment building would be able to look down onto his property. He asked what protections the city has in place to ensure that financing doesn't fall through mid-project like the Gateway. He also asked if the city was considering any incentives for the project. He said many neighbors are "reasonably concerned and upset".
3. Ann Chesnut, representing the Baskin Robins in the Mission Mart, said apartments would be “wonderful”.
4. Carol Hein of W 56th St, Roeland Park: “The area is getting too dense. There is already an apartment building on Johnson Drive. Roeland Park wants to replace the CVS with apartments and relocate the CVS to the Price Chopper. We have already seen a bank robbery and a shoot out at Highlands Elementary. It doesn't feel like I am living in the suburbs anymore. It feels like I’m living in Kansas City, Missouri. The apartments will be nothing but trouble and we have already had trouble.”