# BARRYKNOLL LANE ROADWAY RECONSTRUCTION AND DRAINAGE IMPROVEMENTS
# PRELIMINARY ENGINEERING REPORT
# WBS NO. T-170015-0001-3

Prepared for

TIRZ 17 REDEVELOPMENT AUTHORITY

CITY OF HOUSTON TEXAS

MEMORIAL CITY REDEVELOPMENT AUTHORITY
TAX INCREMENT REINVESTMENT ZONE NO. 17
(TIRZ No. 17)

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DATE: April 10, 2012

Barryknoll RDAI
April 11, 2012
FINAL

**CITY OF HOUSTON**
**DEPARTMENT OF PUBLIC WORKS AND ENGINEERING**
**OFFICE OF CITY ENGINEER**
**TRAFFIC AND TRANSPORTATION SECTION**
**WASTEWATER OPERATIONS SECTION**
**WATER ENGINEERING SECTION**
**FINANCE SECTION**

**SUMMARY OF**
**TECHNICAL REVIEW COMMITTEE MEETING**
**AND RECORD OF DECISIONS AND ACTION ITEMS**

| | |
|---|---|
| DATE: | April 11, 2012 |
| PROJECT TITLE: | TIRZ 17<br>Barryknoll Lane Roadway Reconstruction and Drainage Improvements from Gessner Road to Bunker Hill Road |
| WBS NO.: | WBS No. T-170015-0001-3 |
| DESIGN CONSULTANT: | Lockwood, Andrews & Newnam, Inc. |
| SUPERVISING ENGINEER: | Thomas Artz, PE |
| TRC DATE: | February 23, 2012 |

Attendees:

City of Houston:

| | | | |
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| Tommy Artz | Raymond Ortiz | Braxton R. Coles | Mazen Abdulrazzak |
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| Muhammad Ali | Will Wilshire | Derek St. John | Robert Fiederlein |
| Veda Graves | Abdul El-hout | Brian Whitney | |

## I. Purpose

To review and discuss the recommendations provided by the engineering consultant, make decisions and provide directives. The recommendations are detailed in the Preliminary Engineering Report (PER) titled, "Barryknoll Lane Roadway Reconstruction and Drainage Improvements Preliminary Engineering Report", dated November 2011, prepared by Lockwood, Andrews & Newnam, Inc.

The purpose of the Barryknoll Lane Improvement Project is to improve local and regional drainage with the installation of additional storm sewer which will result in increased conveyance and storage. This drainage solution will require full roadway reconstruction from Gessner Road to Bunker Hill Road. The November 2011 PER study also included evaluation of all existing public and private utilities within the project limits. The age and condition of all public utilities, as well as coordination with the City of Houston's CIP and engineering department is necessary to ensure consideration of the required improvements.

## II. Project Background

### A. Introduction

Lockwood, Andrews, & Newnam, Inc. (LAN) has been retained by the Tax Increment Reinvestment Zone No. 17 (TIRZ 17)/Memorial City Redevelopment Authority to provide professional engineering services to perform a Preliminary Engineering Study for Barryknoll Lane, between Gessner Road and Bunker Hill Road. The project is identified in the City of Houston (City) Comprehensive Drainage Plan (CDP) which identifies existing drainage systems within the City classified with insufficient capacity and/or deficiencies. The CDP is a component of the City's Storm Drainage Facilities Improvement Program which is part of the City of Houston's overall Capital Improvement Program (CIP).The Barryknoll Lane Storm Sewer Project is also identified in the TIRZ 17 Drainage Action Plan as an existing system with capacity deficiencies. The TIRZ 17 Drainage Action Plan summarizes available drainage studies and reports for the TIRZ 17 region and identifies potential drainage improvement projects. Also, LAN completed a TIRZ 17 Regional Drainage Study (RDS) which is a thorough investigation of the TIRZ 17 area using two dimensional (2D) modeling of the storm sewer system. This study was approved by the Public Works and Engineering Department and it served as our basis of design for this project. Proposed drainage improvements along Barryknoll Lane are also referenced in a previous Harris County Flood Control District (HCFCD) study ("W151-00-00 Implementation Study from Buffalo Bayou to IH-10", July 2009) of the W151-00-00 watershed

### B. November 2011 PER Findings & Recommendations

Several improvement alternatives were considered and analyzed. The impacts of each alternative to right-of-way, pedestrian amenities, tree inventories, and underground utilities were considered. The alternative selected is the most optimal solution based on benefit, cost and constructability. It will involve complete reconstruction of the roadway with the addition of inline detention. The recommended proposed improvement will increase storm level protection, reduce overland flow leaving the project area, reduce roadway ponding and improve mobility, improve safety and access along the existing roadway facility.

The following recommendations are based on the results from the preliminary drainage analysis, and the roadway geometric evaluation and condition assessment.

**Roadway:**

Existing Barryknoll Lane is considered a major collector; however, the existing design speed and right-of-way width does not meet the current City of Houston requirements for this street classification. The City of Houston *Infrastructure Design Manual* requires a design speed of 45 mph and a right-of-way width between 80' and 100' for this type of urban roadway. The speed limit on Barryknoll Lane is signed for 30 mph within the project limits. All of the existing horizontal curves along the alignment meet the criteria for a 30 mph design speed. The existing right-of-way width along the alignment is typically 60-feet, but varies in some areas from 54-feet to 82-feet. Also, the existing roadway infrastructure was constructed nearly 50 years ago.

The most reasonable and feasible solution for Barryknoll Lane between Gessner Road and Bettina Court is for complete roadway reconstruction and to increase the design speed to 35 mph and widen the roadway to 11-foot lanes. The speed limit would remain at 30 mph. This alternative will provide improved mobility and safety along Barryknoll Lane while minimizing impacts to adjacent properties. Since right-of-way acquisition is not feasible, a design variance from the City of Houston City Engineer will be required to allow for a non-standard 6-foot border distance between the face of curb and right of way. Due to the presence of large mature trees east of Bettina Court, it is recommended that the pavement transition to its existing geometric condition of 40-feet with 10-foot lanes and continue to the project eastern limit at Bunker Hill Road. The proposed roadway for Barryknoll will be improved with grades that conform to the current City standards, and will generally be at the same level as the current roadway.

The traffic signals at Plantation Road and Memorial City Way will be replaced to meet City of Houston standards as part of the improvements. Also, Barryknoll Lane will be restriped between Gessner Road and Plantation Road to one lane in the eastbound direction with 150-foot left-turn bay at Plantation Road, and two lanes in the westbound direction with 350-foot left-turn bay at Gessner Road.

**Sidewalks:**

Existing sidewalks are continuous along the northern side of Barryknoll Lane from Gessner Road to Bunker Hill. The sidewalks are typically 4-feet in width and are generally located 2-feet behind the existing curb. Typically, no sidewalks exist along the southern side of Barryknoll Lane; however there is an 800-foot section of sidewalk adjacent to the Memorial City Plaza Development which extends from Gessner Road to 100-feet east of Plantation. The sidewalks do not meet current American with Disability Act (ADA) requirements due to the lack of 5-foot passing areas, excessive cross slopes and inadequate wheel chair ramps.

A continuous sidewalk is proposed on the north side of the roadway along the entire project alignment. Along the south side, sidewalks are proposed only along the commercial portion of the project from Gessner Road to Memorial City Way. This minimizes the impacts to trees and residential properties and allows the permanent pavement on Barryknoll to be extended to Bunker Hill Road at its existing location. This was considered the most reasonable and feasible solution. Due to the presence of mature trees within the project right-of-way, the sidewalks will typically be 6-feet in width, situated directly behind the curb.

**Drainage:**

The Barryknoll drainage system is part of the Buffalo Bayou Watershed. It discharges into the W151-00-00 channel. The existing storm sewer facility comprises of two systems, west and east of W151-00-00. It consists of approximately 4,020 linear feet of 24- to 72-inch RCP drained by 11 type B-B inlets, 2 type C inlets and 3 grate inlets. The area has well documented flooding issues. The existing drainage infrastructure was constructed at the time of the original roadway construction and is nearly 50 years old.

The current storm sewer system was found to be deficient and inadequate for the City of Houston criteria:

- 2-year HGL exceeds gutter line for majority of the project limits
- 100-year water surface elevation (WSEL) leaves the City ROW

Other issues include elevated tail water conditions in W151-00-00, capacity deficiencies independent of tail water issues and the existing roadway being graded away from storm sewer outfall (W151-00-00).

As for the improvements, approximately 1,300-feet of 9' x 5' RCB storm sewer is proposed west of W151-00-00; 850 feet of the existing 60-inch RCP will remain in place to serve the commercial areas west of Plantation. Approximately 2,640-feet of 2-10'x6' RCB storm sewer is proposed east of W151-00-00. All inlets will be replaced and some will be enhanced. These improvements will address both the sheetflow and ponding issues on Barryknoll Lane. The drainage improvements can be summarized as follows:

- Short Term
  - Improve 2-year, 10-year and 100-year levels of protection
  - Part of the ultimate regional solution
  - Barryknoll storm improvements function primarily as in-line detention
- Long Term (with other regional project components)
  - Improve tail water condition via W151 Improvements
  - Contribute to regional solution
  - Provide additional level of protection
  - Substantially reduces flow into the W153 watershed
  - Barryknoll storm improvements function as conveyance vs. detention

**Public Utilities**

**A. Water lines:**
The Barryknoll lane project area is currently serviced by an 8/6-inch water line that extends longitudinally along the entire project length. The section between Gessner Road and W151-00-00 is approximately 20 years old and made of PVC pipe. The section from W151-00-00 and Bunker Hill is approximately 50 yrs. old and made of asbestos cement (AC) pipe. Numerous waterlines of various size and material connect laterally to the 8-inch distribution main serving residential and commercial developments, and fire hydrants

As for improvements, the existing 8/6-inch water line between W151 to Bunker Hill Road will be replaced as it has exceeded the typical useful service life of 40-years. It was also recommended to install parallel 8-inch water lines between W151-00-00 and Memorial City Way, along north and south sides of Barryknoll Lane. A single 8-inch water line will extend along the south side from Memorial City Way to Bunker Hill Rd.

**B. Sanitary Sewer:**
The Barryknoll lane project area is currently serviced by a 21/12-inch collector gravity main that flows west along the entire project length from Bunker Hill Road to Gessner Road. The system was constructed nearly 50 years ago. Numerous lines of various size and material cross Barryknoll Lane laterally and connect to the main.

The 21/12-inch sanitary sewer will be removed and replaced. Bypass pumping will be used to maintain service during construction. In addition, existing sanitary sewer manholes will be removed and replaced

**Private Utilities**

CenterPoint Energy has underground gas lines, underground electric street light cables and overheard electric lines. Also, Southwestern Bell Company (SBC or AT&T) has underground cables and duct banks in the project limits. The current design has minimal to no impact on the existing facilities, nevertheless, coordination with private utility entities will be conducted early in the design process as needed.

**Existing Trees:**

Over 220 existing trees are located within the construction area of Barryknoll Lane. Landscaping plans and tree protection plans will be necessary in Phase II to comply with the City Tree Ordinance. In addition to traditional tree protection (pruning, fencing, root stimulation, etc.) it is anticipated that isolated retaining walls behind the curb may be necessary to protect the adjacent existing trees. The limits of the retaining walls will be further defined in Phase II.

**Right-of-way/Easement Acquisition:**

Although the proposed roadway is recommended to be reconstructed within the existing 60-ft right-of-way, two corner clips are required at Barryknoll Lane and Plantation Road to accommodate the traffic controller cabinet along with its related hardware and sidewalk ramps to meet ADA requirements.

**Project Coordination:**

Project coordination will continue throughout the final design with the City of Houston, TIRZ 17, HCFCD, adjacent property owners, and several private utility entities. Coordination meetings will be scheduled with the City of Houston as needed throughout the design phase to coordinate design. Upon completion of 70% and 90% design, drawings will be submitted to the City Engineer's Office for review and approval. Early coordination with private utility entities will also be conducted in design.

**Traffic Control:**

The traffic control plan and construction sequencing will require multiple phases during construction to reduce impacts to the traveling public, pedestrians, and adjacent properties. Consideration to the busy shopping months of November and December and the METRO bus route that travels west on Barryknoll Lane were considered in the preliminary construction schedule and sequence. The multi-phase traffic control plan includes a combination of one-way traffic operations and temporary partial roadway closure detours to minimize impacts, maximize safety, and accelerate construction time.

The main concept behind the multiple phase traffic control plan is that one 12-foot minimum lane will remain open for westbound traffic. Meanwhile, eastbound traffic on Barryknoll will be temporarily detoured north.

**C. TRC Decisions and Directives**

**1. City of Houston requested that LAN investigates having sidewalks on the south side of Barryknoll lane along the entire project.**

- After recently visiting the site, it appears that there have been some recent improvements. A 5′ sidewalk has been constructed east of Dolphin Street. This sidewalk is approximately 100-feet long. Therefore, after further investigation it is recommended to propose a 5′ sidewalk directly behind the curb on the south side of Barryknoll from Memorial City Way to Dolphin Street, i.e. tie into new 5′ sidewalk.

- The remaining short segment east of the new 5′ sidewalk will remain untouched. This section will be improved as part of the potential TIRZ 17 CIP project to improve Bunker Hill Road from IH-10 to Barryknoll Lane

- West of Barracuda Court there is a pinch point area where the distance from back of curb to existing right-of-way goes down to approximately 3.5′. Therefore, to avoid ROW acquisition it is recommended that the sidewalks narrow down to approximately 3.5′ in that area.

- In areas where a 5′ sidewalk may still be in conflict with existing trees, it is recommended that the sidewalk narrow around the tree in an effort to preserve the trees.

- The narrower sidewalk will still meet current ADA requirements; however it will require a design variance from the City Engineer to allow for a nonstandard sidewalk width directly behind the curb.

**2. LAN was asked to reinvestigate having a corner clip in the southeast corner of the intersection of Barryknoll Lane at Plantation Drive. The intention is to minimize the amount of right-of-way acquired from the homeowner.**

Currently the plans show the typical City of Houston 15′x15′ corner clip to accommodate the traffic components. After further investigation, it is recommended to relocate the existing traffic controller cabinet along with its related hardware to the southwest side corner clip. Therefore, the southeast corner clip can be reduced to a minimum, i.e. enough to accommodate wheelchair ramps and a pedestrian pole. There are several benefits to this option:

1. This will significantly reduce the corner clip, almost eliminating it. Therefore, the amount of right-of-way acquired from the home owner is at a minimum.
2. Traffic controller cabinet will be relocated away from being in front of the home owner's property to the southwest corner clip, removing a potential view obstruction.

Based on the above directives and conclusions, the engineering consultant on behalf of TIRZ 17, will proceed with final design of the Barryknoll Lane Project. Please notify Robert Fiederlein or Muhammad Ali at 713-266-6900, should this summary be inconsistent with the TRC findings and decisions.

**Distribution:**

CITY OF HOUSTON:

| | | | |
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| Tommy Artz | Raymond Ortiz | Braxton R. Coles | Mazen Abdulrazzak |
| Patricia Campbell | Ralph Deleom | Raghavender Nednur | Venus Nahid |
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| Muhammad Ali | Will Wilshire | Derek St. John | Robert Fiederlein |
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# 1.0 EXECUTIVE SUMMARY

## 1.1 Project Authorization

Lockwood, Andrews, & Newnam, Inc. (LAN) has been retained by the Tax Increment Reinvestment Zone No. 17 (TIRZ 17) to provide professional engineering services to perform a Preliminary Engineering Study for Barryknoll Lane, between Gessner Road and Bunker Hill Road. The project is identified in the City of Houston (The City) Comprehensive Drainage Plan which identifies existing drainage systems within the City classified with insufficient capacity and/or deficiencies. The Comprehensive Drainage Plan (CDP) is a component of the City's Storm Drainage Facilities Improvement Program which is part of the City of Houston's overall Capital Improvement Program (CIP).

## 1.2 Statement of the Problem

The purpose of the Barryknoll Lane Improvement Project is to improve local and regional drainage with the installation of additional storm sewer which will result in increased conveyance and storage. The Barryknoll Lane Storm Sewer Project is identified in the TIRZ 17 Drainage Action Plan as an existing system with capacity deficiencies. The TIRZ 17 Drainage Action Plan summarized available drainage studies and reports for the region and identified potential drainage improvement projects. A thorough investigation of the TIRZ 17 area using two dimensional (2D) modeling of the storm sewer system is currently underway as part of the TIRZ 17 Regional Drainage Study (RDS), interim results of the study are available, however the study will not be finalized until early 2012. This project has been prepared in parallel with the RDS and will also reference a previous Harris County Flood Control District (HCFCD) study (W151-00-00 Implementation Study from Buffalo Bayou to IH-10, July 2009) of the W151-00-00 watershed that also proposed drainage improvements along Barryknoll.

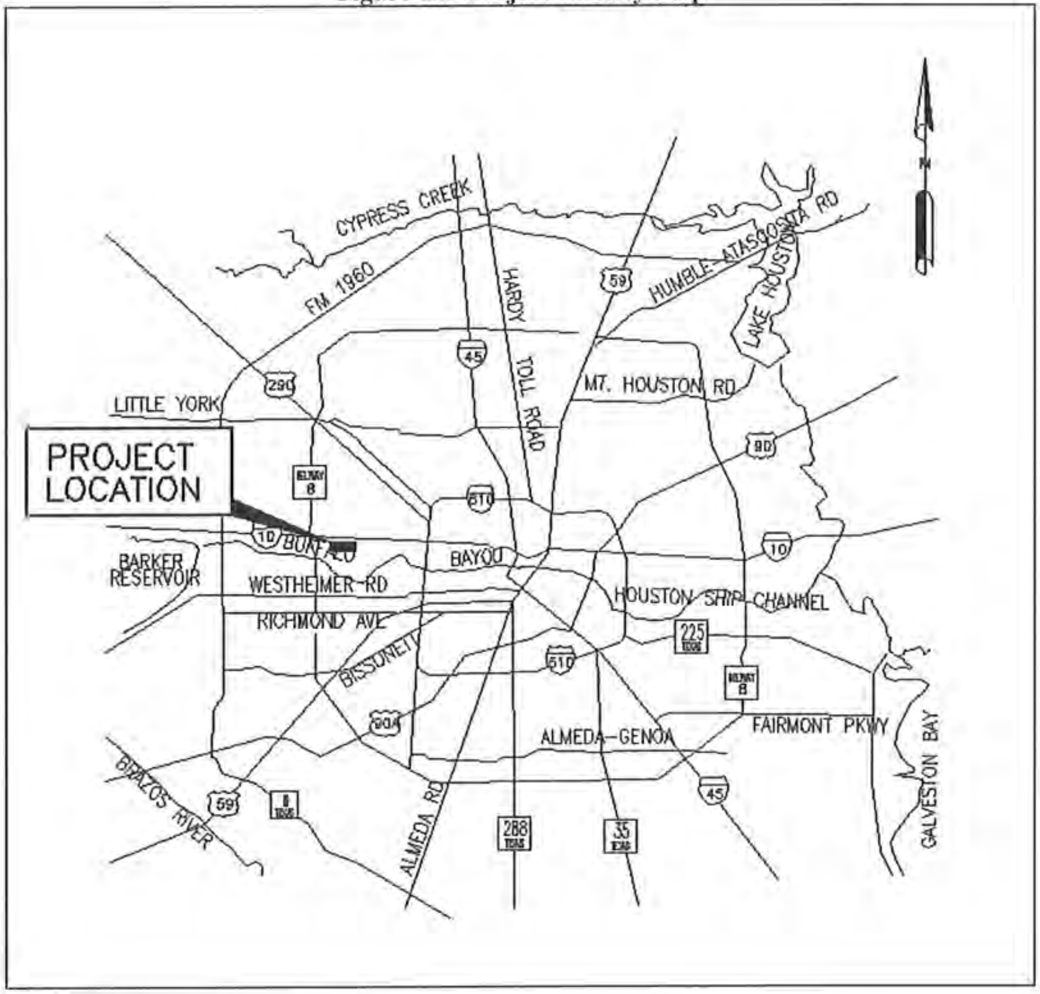
## 1.3 Project Location

Barryknoll Drive is generally located in West Houston approximately 2,000 feet south of Interstate Highway 10, along the south-eastern TIRZ 17 boundary. The limits of this study include approximately 4,000-feet of Barryknoll Lane, between Gessner Road and Bunker Hill Road.

The project is located within a high traffic commercial development with dense existing adjacent businesses with potential existing right-of-way encroachments. The existing adjacent development along Barryknoll Lane is classified mixed-use and is comprised of both commercial and residential developments. Barryknoll Lane is a major local roadway, providing access to and from Memorial City Mall, Memorial Hermann Hospital, Memorial City Plaza, Riedel Estates, Bunker Hill Plaza, Memorial Village Town Homes, and Memorial Hollow, Memorial Forest and Memorial Woods

Subdivisions. The project area can be found on Key Map pages 490A and 490B. See **Figure 1.1**, Project Vicinity Map.

**Figure 1.1- Project Vicinity Map**




## 1.4 Scope of Work

The project scope includes the following tasks: address the engineering components associated with the drainage and roadway reconstruction, perform an initial existing conditions assessment, evaluate and develop recommended solutions for improving the drainage and roadway conditions of Barryknoll Lane between Gessner Road and Bunker Hill Road.

Upon completion of this Phase I PER Study, and approval of the recommended project by both the City and TIRZ 17, the Phase II detailed design project may commence. Phase II of the project will provide engineering services required to provide the necessary construction documents for the proposed improvements of Barryknoll Lane based on recommendations in the PER.

### 1.5 Existing Conditions

Existing conditions pertaining to the project have been reviewed and are further described in Section 2.5 of this report. Existing roadway and drainage conditions, public and private utilities, environmental impacts, geotechnical studies, existing right-of-way, and a tree inventory are the major areas covered in detail within the report.

Barryknoll Lane is an existing concrete curb and gutter roadway located approximately 2,000 feet south of Interstate Highway 10, along the south-eastern TIRZ 17 boundary. Barryknoll Lane serves east-west traffic between Gessner Road and Bunker Hill Road and is an undivided roadway typically striped for two 10-foot lanes in each direction.

Originally constructed in phases from 1962 to 1965, the existing concrete pavement ranges in thickness from 7- to 9-inches and has exceeded the typical useful service life of 40-years. According to the City's Major Thoroughfare and Freeway Plan (MTFP), Barryknoll Lane is considered a major collector. The speed limit on Barryknoll Lane is signed for 30 mph within the project limits. The existing right-of-way width along the alignment is typically 60-feet, but varies in some areas from 54-feet to 82-feet.

Existing sidewalks are continuous along the northern side of Barryknoll Lane from Gessner to Bunker Hill. The sidewalks are typically 4-feet in width and are generally located 2-feet behind the existing curb. Typically, no sidewalks exist along the southern side of Barryknoll Lane; however there is an 800-foot section of sidewalk adjacent to the Memorial City Plaza Development which extends from Gessner Road to 100-feet east of Plantation. The sidewalks do not meet current American with Disability Act (ADA) requirements due to the lack of 5-foot passing areas, excessive cross slopes and inadequate wheel chair ramps. Careful consideration will be given to sidewalk alignment during final design to minimize impacts to existing trees.

Numerous cross streets intersect Barryknoll at various locations along the alignment. Signalized intersections include Gessner Road, Plantation Road, Memorial City Way and Bunker Hill Road. Other intersections, controlled by stop signs on the minor street, are Bettina Court, Strey Lane, Holly Ridge Drive, Riedel Drive, Barracuda Court and Dolphin Court.

The Barryknoll Lane Project is located within the Buffalo Bayou Watershed. The existing storm sewer along Barryknoll Lane consists of approximately 4,020 linear feet of 24- to 72-inch reinforced concrete pipe (RCP). The portion of Barryknoll Lane within the project limits is drained by 11 type B-B inlets, 2 type C inlets, and 3 grate inlets. The existing drainage infrastructure was constructed at the time of the original roadway construction and is nearly 50 years old.

Other public utilities are located within the Barryknoll Lane right-of-way limits. The Barryknoll Lane project area is currently serviced by an 8-inch waterline that runs longitudinally along the entire project length of Barryknoll Lane from Gessner to Bunker Hill Road. The majority of this line was constructed in 1965 of asbestos cement (AC). It is recommended to replace the existing waterlines due to the age of the facility. Numerous waterlines, of various size and material, connect to the 8-inch distribution main along Barryknoll Lane. These lines typically cross Barryknoll Lane laterally, serving residential and commercial developments, as well as fire hydrants. Several sanitary sewer lines exist within the Barryknoll Lane Project study limits. A sanitary sewer, which varies in size from 12- to 21-inches, services the Barryknoll Lane project area. This collector gravity main, constructed in 1962, flows west along the entire project length of Barryknoll Lane from Bunker Hill Road to Gessner Road. Many sanitary sewer lines, of various size and material, cross Barryknoll Lane laterally, and connect to the main. It is recommended to replace the sanitary sewer within the project limits.

CenterPoint Energy (CPE) and Southwestern Bell Company (SBC, also known as AT&T) have existing private utilities located within the Barryknoll Lane project right-of-way. Utility information was requested and obtained from both companies. CPE has underground gas lines, underground electric street light cable and overhead electric lines running within the Barryknoll ROW. SBC facilities include both underground cables and duct banks. Texas One Call should be contacted at least 48 hours prior to excavation to locate all underground utilities.

## 1.6 Findings from Phase I Preliminary Engineering and Analysis

### 1.6.1 Existing Tree Impacts

Over 220 existing trees are located within the construction area of Barryknoll Lane. Landscaping plans and tree protection plans will be necessary in Phase II to comply with the City Tree Ordinance. Per the preliminary tree inventory findings, it is anticipated that additional retaining walls behind the curb may be necessary to protect the adjacent existing trees. The limits of the retaining walls will be further defined in Phase II. For additional information, a detailed tree inventory was performed by C.N. Koehl Urban Forestry and can be found in **Appendix G**.

### 1.6.2 Geotechnical Study

Geotech Engineering and Testing (GET) performed the geotechnical investigation for the project. The findings and recommendations are presented in the report entitled Geotechnical Exploration Study Proposed Barryknoll Drainage Improvements. A copy of this report can be found in **Appendix H**. GET drilled 9 soil core borings at the project site, each 20-feet in depth. Groundwater was encountered at depths ranging from 11- to 19-feet during drilling, rising to depths ranging from 6- to 14-feet after 24 hours. The report recommends a reinforced concrete pavement thickness of 10-inches with an 8-inch lime stabilized subgrade consisting of 4% lime by dry weight.

#### 1.6.3 Environmental Site Assessment

Lockwood, Andrews & Newnam, Inc. conducted a Phase I Environmental Site Assessment (ESA) for the project area. The findings are presented in the report entitled Phase I Environmental Site Assessment Barryknoll Lane Roadway Reconstruction and Drainage Improvements from Gessner to Bunker Hill Road. A copy of the report is available under separate cover. Based on the Phase I ESA for the proposed roadway improvements along Barryknoll Lane, there are three (3) potential Recognized Environmental Conditions (RECs) present in the surrounding area; however the RECs are not located directly on the subject alignment. Therefore, no further investigation is recommended.

#### 1.6.4 Geologic Fault Study

Geotech Engineering and Testing (GET) performed a limited phase I geologic fault study for the project to evaluate the possibility of surface faulting along the project alignment. The findings and recommendations are presented in the report entitled Limited Phase I Geologic Fault Study Proposed Barryknoll Drainage Improvements. A copy of this report can be found in **Appendix I**. Based on the review of existing fault maps, aerial photos and on-site reconnaissance, the report concluded that surface faulting is not evident along the project alignment.

#### 1.6.5 Evaluation of Drainage Improvement Alternatives

The existing storm sewer system along Barryknoll from Gessner to Bunker Hill was found to be inadequate for a City of Houston 2-year storm event. Currently LAN is conducting a separate investigation of storm sewer and overland drainage issues as part of a TIRZ 17 Regional Drainage Study (RDS). This study is evaluating a number of alternatives to alleviate existing flooding and ponding issues within the area bounded by Buffalo Bayou to the south, Bunker Hill to the east, Beltway 8 to the west and Nuens to the north. The final results of this study are not yet finalized. Preliminary results from this study generally confirm the recommendations from a prior HCFCD Study titled "W151-00-00 Implementation Study from Buffalo Bayou to IH10" (HCFCD Study). A primary goal of storm sewer drainage improvements to Barryknoll is to limit the amount of overland flow that leaves the Barryknoll study area and flows south into the adjacent neighborhoods. The TIRZ RDS adds 2D surface/overland hydraulic modeling and builds on the results of the HCFCD Study that was completed by HCFCD in July of 2009. Storm sewer alternatives for Barryknoll were investigated within the RDS and these preliminary results are included in this study as described below. The size of the proposed storm sewer improvements consider impacts to utilities and provide sufficient space for maintaining on lane of through traffic during construction.

- 2-9'x5' RCB to replace the existing 60-inch RCP from Gessner to the existing north/south 8' x 5' RCB at W151-00-00, approximately 850-ft of the existing 60-inch RCP will remain in place to serve the commercial areas west of Plantation.

- 2-8'x6' RCB to replace the 72-inch to 48-inch storm sewer from W151-00-00 east to Bunker Hill.

- Future – Minimum 9'x6' RCB outfall at Bettina that diverts storm water east of W151-00-00 south away from W151-00-00 and drains it south to the lower reaches of W151-00-00 that are just north of Buffalo Bayou. Flow from east side of W151 at Barryknoll would be blocked after this is completed.

As recommended in the HCFCD Study, the storm sewer improvements are intended to function primarily as additional storm sewer conveyance. This is a practical solution when constructed in conjunction with the other proposed storm sewer improvements from the HCFCD Study, and the RDS. The proposed storm sewer improvements will initially function primarily as additional detention storage until the recommended downstream improvements to W151, or other alternative downstream improvements, such as Strey Lane, are implemented that would improve conveyance downstream (south) of Barryknoll.

The HCFCD Study recommended additional detention of approximately 50 ac-ft in the area of W151-00-00 and Barryknoll, however there is limited ROW and open land available with only a small portion of open land along Gaylord Dr. north of Barryknoll. The RDS looked at this option as well, but a feasible option was not found to be cost effective.

The proposed improvements west and east of W151-00-00 as discussed above improve conveyance of these proposed storm sewers along Barryknoll, but the improvements will not meet City of Houston's 2-year criteria at Bunker Hill and low areas near Gessner, until proposed conveyance downstream to Buffalo Bayou is implemented. In the interim, storm sewer connections to the existing 10'x8' RCB north/south culvert from Memorial City Mall will be restricted until the downstream channel improvements are made.

This existing 10'x8' RCB outfall to the W151-00-00 channel from Memorial City Mall is undersized for the flows in this area. In anticipation of possible improvements to W151, as proposed by HCFCD, that may occur if the Bettina outfall option is restricted, LAN has proposed the placement of a 5′ wide by 8′ tall box culvert on both sides of the existing 10′x8′ RCB within the Barryknoll right-of-way. This additional capacity could be utilized in the future if W151 channel improvements are implemented. In the interim, these culverts are used to buffer inflows into the existing 10′x8′ RCB by using wall openings that act as restrictors. The proposed box dimensions were chosen to allow improvements to fit within the limited 50′ drainage easement available for these improvements.

The TIRZ 17 Board approved recommendation includes the complete reconstruction of Barryknoll Lane to improve roadway grading, reduce ponding and provide additional storm sewer trunkline capacity. The HCFCD "W151-00-00 Implementation Study from Buffalo Bayou to IH-10" can be obtained from the HCFCD, and the RDS will be available from TIRZ17 when completed.

#### 1.6.6 Evaluation of Traffic Improvement Alternatives

Due to limited right-of-way, neither the existing conditions nor the study alternatives provide acceptable eastbound approach delay and level of service (LOS) at Barryknoll Lane and Gessner Road. Delays on eastbound Barryknoll Lane at Gessner Road are primarily caused by the operation of the traffic signal that allocates more green time to the major North-South movement along Gessner Road. Alternative 3 provides a solution for the excessive queue lengths caused by the large volume of vehicles making a left-turn movement from westbound Barryknoll Lane to southbound Gessner Road by providing more storage length. LAN recommends:

- Maintain traffic signal operations at all signalized intersections similar to existing conditions.
- Reconstruct Barryknoll Lane with minimal widening to provide four 11-foot lanes between Gessner Road and Bettina Court.
- Stripe Barryknoll Lane between Gessner Road and Plantation Road to one lane in the eastbound direction with 150-foot left-turn bay at Plantation Road, and two lanes in the westbound direction with 350-foot left-turn bay at Gessner Road.

#### 1.6.7 Evaluation of Roadway Improvement Alternatives

##### 1.6.7.1 Roadway Alignment and Right-of-Way Acquisition

The existing roadway alignment currently meets the criteria for a design speed of 30 mph. The City of Houston *Infrastructure Design Manual* requires a design speed of 45 mph for major collectors. Several alternatives were evaluated for the proposed Barryknoll Lane alignment. The impacts to right-of-way and trees were considered for each option. The most reasonable and feasible alternative for Barryknoll Lane between Gessner Road and Bettina Court is to increase the design speed to 35 mph and widen the roadway to 11-foot lanes. The speed limit would remain at 30 mph. This alternative will provide improved mobility and safety along Barryknoll Lane while minimizing impacts to adjacent properties. Since right-of-way acquisition is not feasible, a design variance from the City of Houston City Engineer will be required to allow for a non-standard 6-foot border distance between the face of curb and right of way. Due to the presence of large mature trees east of Bettina Court, it is recommended that the pavement transition to 10-foot lanes at the intersection. The 40-foot pavement section is proposed to continue east to match the existing pavement section on Barryknoll Lane at Bunker Hill Road.

#### 1.6.7.2 Sidewalks

A continuous sidewalk is proposed on the north side of the roadway along the entire project alignment. Along the south side, sidewalks are proposed only along the commercial portion of the project from Gessner Road to Memorial City Way. This minimizes the impacts to trees and residential properties and allows the permanent pavement on Barryknoll to be extended to Bunker Hill Road at its existing location. Since there are bus stops only on the north side of Barryknoll, and there are no connecting sidewalks on intersecting streets to the south, this was considered the most reasonable and feasible alternative.

Due to the presence of mature trees within the project right-of-way, the sidewalks will typically be 6-feet in width, situated directly behind the curb. Additional right-of-way or roadway easements will be required for the construction of sidewalks at two property parcels.

#### 1.6.7.3 Traffic Control Plans

The traffic control plan and construction sequencing will require multiple phases during construction to reduce impacts to adjacent properties. The conceptual construction phasing and detour plans can be found in **Appendix D.6.** Throughout construction, one 12-foot minimum lane will remain open for westbound traffic, while all eastbound traffic will be detoured. Coordination with adjacent property owners, Memorial City Mall, and METRO will be conducted to minimize impacts during construction.

### 1.6.8 Evaluation of Public Utility Improvements

#### 1.6.8.1 Water lines

The existing AC water line, located along Barryknoll Lane between W150-00-00 and Bunker Hill Road, was built in 1965, exceeding the typical useful service life of 40-years. Due to the age and material, the portion of 8-inch water line between Holly Ridge and Bunker Hill Road was scheduled to be replaced by the City of Houston. In order to avoid conflicts with proposed improvements, and to minimize impact to local residences and businesses, the 8-inch water line between W150-00-00 and Bunker Hill Road will be replaced as part of this project. The active waterlines that cross Barryknoll Lane are also anticipated to require replacement for conflict resolution.

In addition, it is recommended that a new 8-inch water line be installed parallel to the existing line, along the opposite side of the street (north) between W150-00-00 and Memorial City Way. Installing a parallel water line will provide two benefits: (1) to minimize the number of permanent service lines crossing the proposed box sewer, and (2) to allow the new water line on the north side to be used as a temporary water line while the existing 8-inch on the south side is being replaced. The proposed 8-inch water line along the north side will not extend past Memorial City Way to Bunker Hill Road due to utility conflicts and space constraints. A temporary above-grade water line will be necessary for the section between Memorial City Way and Bunker Hill Road, to maintain service to customers.

Based on the new roadway alignment, an existing 6-inch water meter at the southwest corner of the intersection of Barryknoll Lane at Plantation Dr. will need to be relocated to the north side of Barryknoll Lane. This will eliminate unnecessary service lines crossing the proposed box culvert, as the existing 8-inch water distribution line extends along the north side of Barryknoll Lane in this section.

#### 1.6.8.2 Sanitary Sewer

The existing 21/12-inch sanitary sewer pipe, located within the eastbound lane of Barryknoll Lane, was installed in 1962. This line also exceeds the typical 40-year useful service life. The City of Houston has slated the entire length of the sanitary sewer along Barryknoll Lane to be removed and replaced. In addition, existing sanitary sewer manholes will be removed and replaced. Active sanitary sewer lines crossing Barryknoll Lane will also be replaced or relocated on an as-needed basis for conflict resolution.

### 1.6.9 Agency Coordination

Contact with different entities will be required throughout the final design phase prior to the final design submittal. Coordination meetings will be scheduled with the City of Houston as needed throughout the design phase to coordinate design. Upon 90% completion, drawings will be submitted to the City Engineer's Office for review and approval. Early coordination with private utility entities will also be conducted in design.

## 1.7 Recommended Project

The following recommendations are based on the results from the preliminary drainage analysis, and the roadway geometric evaluation and condition assessment. The impacts of each alternative to right-of-way, pedestrian amenities, tree inventories, and underground utilities have been considered.

Complete roadway reconstruction is recommended for Barryknoll Lane based on the study findings. The roadway will be widened to 44-feet between the between Gessner Road and Bettina Court with an increased design speed of 35 mph. The speed limit will remain at 30 mph. The roadway will then transition to its existing geometric condition of 40-feet and continue east to the project limit at Bunker Hill Road. The traffic signals at Plantation Road and Memorial City Way will be replaced as part of the improvements. Sidewalks will be constructed on both sides of the roadway from Gessner to Memorial City Way and on the north side of the roadway from Memorial City Way to Bunker Hill.

Per the RDS evaluation and this study approximately 1,300-feet of 2-9'x5' RCB storm sewer is proposed west of W151-00-00, and approximately 2,640-feet of 2-8'x6' RCB storm sewer is proposed east of W151-00-00. The total volume of storm sewer is estimated at 7.5 ac-ft. These improvements will significantly decrease the frequency of overland flow from Barryknoll to the adjacent neighborhood to the south and increase the capacity of the Barryknoll Lane storm sewer system. Approximately 850-feet of the existing storm sewer along Barryknoll Lane will remain in place west of W151-00-00 and interconnect to the proposed additional storage box culverts via lateral pipes. East of W151-00-00 the existing storm sewer will be replaced by the proposed dual box culverts. A condition assessment is recommended to be conducted in Phase II to confirm the existing storm sewer condition. The proposed improvements will improve the system but will not fully meet the 2-year City of Houston minimum criteria until future storm sewer improvements are made to provide additional conveyance south to Buffalo Bayou.

Due to the age of the underground utilities, all existing water lines will be replaced as part of the reconstruction and sanitary sewers will be replaced or rehabilitated as required.

### 1.8 Estimated Construction Costs

The total estimated construction cost for the recommended improvements is estimated $9 Million (cost excludes any right of way acquisition, private utility relocation and landscape/hardscape improvement costs). The recommended proposed improvements will increase storm level protection, reduce overland flow leaving the project area, reduce roadway ponding and improve mobility, improve safety and access along the existing roadway facility. This recommendation is the most optimal solution based on benefit, cost and constructability. Adding the proposed box culverts address both the sheetflow and ponding issues on Barryknoll Lane as well as Barryknoll Lane's need for pavement and infrastructure improvements as the facility has exceeded its useful service life of 40-years. Future drainage improvement options are currently under study with the concurrent TIRZ 17 RDS. This project anticipates these future improvements to eliminate the need to reconstruct portions of Barryknoll after this phase is complete. When the future projects are implemented these would provide a significant benefit to the area. All proposed improvements are reviewed within this project's study limits to identify potential impacts. Due to the other concurrent drainage studies and improvement projects proposed by others within this project's study limits, minor modifications in Phase II due to this coordination may be necessary that would impact the current cost estimates.

# 2.0 INTRODUCTION

## 2.1 Project Authorization

Lockwood, Andrews, & Newnam, Inc. has been retained by the Tax Increment Reinvestment Zone No. 17 (TIRZ 17) to provide professional engineering services to perform a Preliminary Engineering Study for Barryknoll Lane, between Gessner Road and Bunker Hill Road. The project is identified in the City of Houston (The City) Comprehensive Drainage Plan which identifies existing drainage systems within the City classified with insufficient capacity and/or deficiencies. The Comprehensive Drainage Plan (CDP) is a component of the City's Storm Drainage Facilities Improvement Program which is part of the City of Houston's overall Capital Improvement Program (CIP).

## 2.2 Statement of the Problem

The purpose of the Barryknoll Lane Improvement Project is to improve local and regional drainage with the installation of additional storm sewer which will result in increased conveyance and storage. The Barryknoll Lane Storm Sewer Project is identified in the TIRZ 17 Drainage Action Plan as an existing system with capacity deficiencies. The TIRZ 17 Drainage Action Plan summarized available drainage studies and reports for the region and identified potential drainage improvement projects. A thorough investigation of the TIRZ 17 area using two dimensional (2D) modeling of the storm sewer system is currently underway as part of the TIRZ 17 Regional Drainage Study (RDS), interim results of the study are available, however the study will not be finalized until early 2012. This project has been prepared in parallel with the RDS and will also reference a previous Harris County Flood Control District (HCFCD) study (W151-00-00 Implementation Study from Buffalo Bayou to IH-10, July 2009) of the W151-00-00 watershed that also proposed drainage improvements along Barryknoll.

## 2.3 Project Location

Barryknoll Drive is generally located in West Houston approximately 2,000 feet south of Interstate Highway 10, along the south-eastern TIRZ 17 boundary. The limits of this study include approximately 4,000-feet of Barryknoll Lane, between Gessner Road and Bunker Hill Road.

The project is located within a high traffic commercial development with dense existing adjacent businesses with potential existing right-of-way encroachments. The existing adjacent development along Barryknoll Lane is classified mixed-use and is comprised of both commercial and residential developments. Barryknoll Lane is a major local roadway, providing access to and from Memorial City Mall, Memorial Hermann Hospital, Memorial City Plaza, Riedel Estates, Bunker Hill Plaza, Memorial Village Town Homes, and Memorial Hollow, Memorial Forest and Memorial Woods

Subdivisions. The project area can be found on Key Map pages 490A and 490B. See **Exhibit 2.1**, Project Location Map, for additional information.

### 2.4 Scope of Work

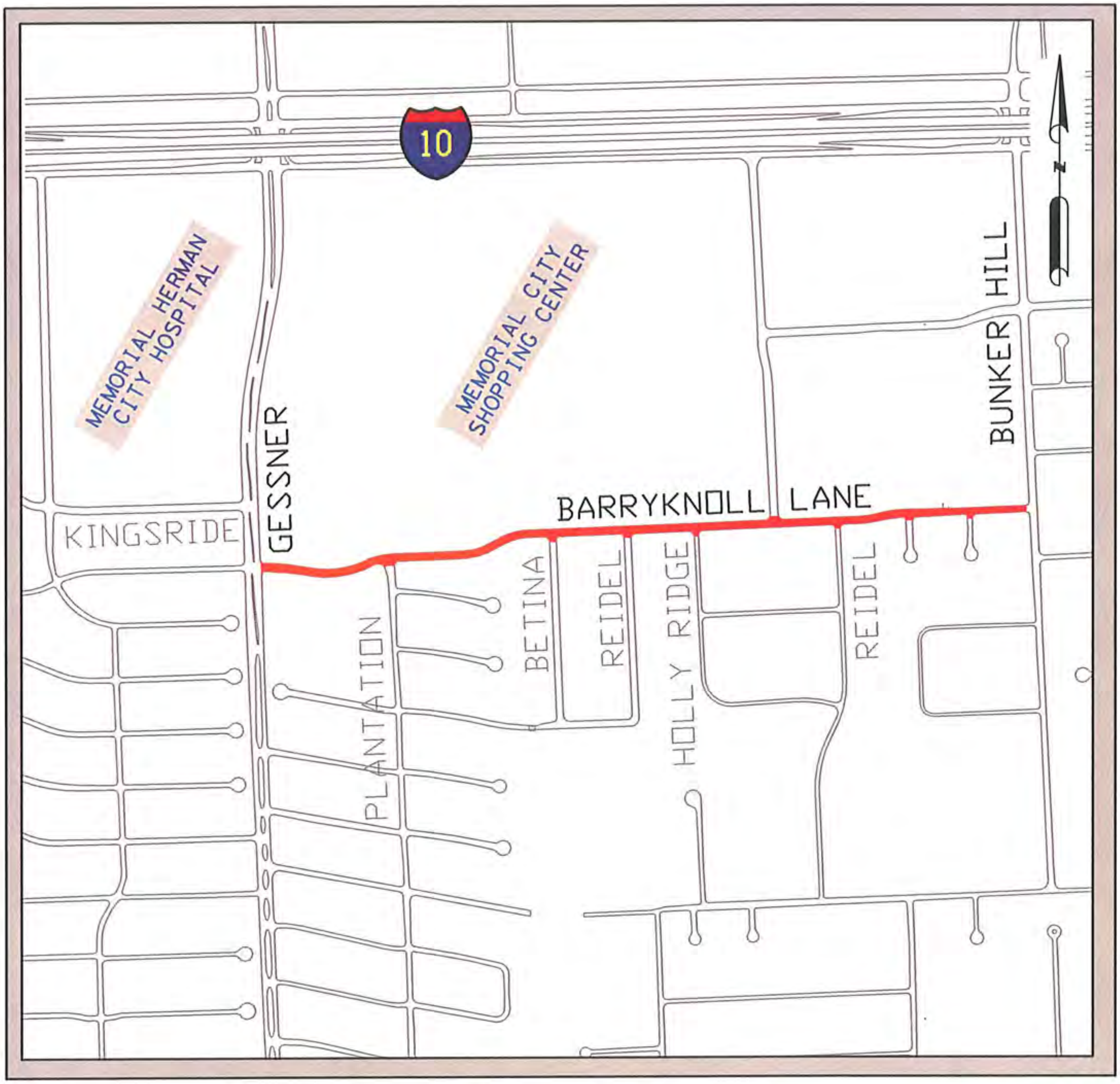
The project scope includes the following tasks: address the engineering components associated with the drainage and roadway reconstruction, perform an initial existing conditions assessment, evaluate and develop recommended solutions for improving the drainage and roadway conditions of Barryknoll Lane between Gessner Road and Bunker Hill Road.

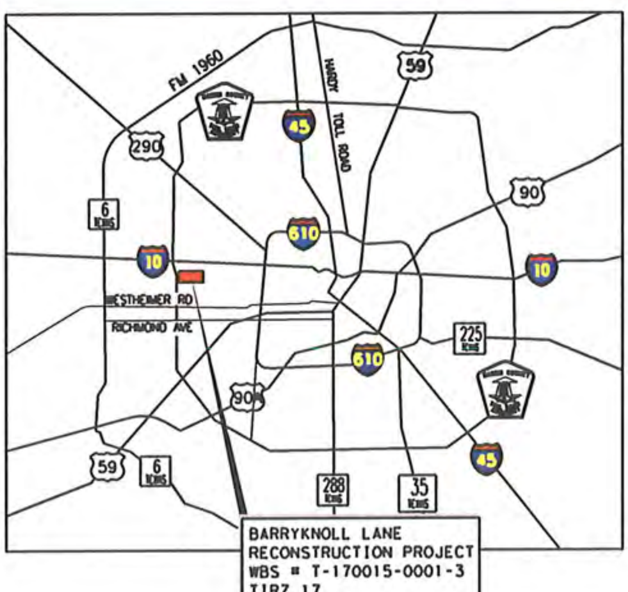
The purpose of this study is to address the engineering components associated with the drainage and roadway reconstruction, perform an initial existing conditions assessment, evaluate and develop recommended solutions for improving the drainage and roadway conditions of Barryknoll Lane between Gessner Road and Bunker Hill Road. A summary of the major tasks performed for the study are listed below:

- Site Visit & Data Collection
- Topographic Survey
- Geotechnical Investigation
- Environmental Assessment
- Tree Inventory
- Investigation of Existing Public and Private Utilities
- Establish Roadway Baseline/Project Control
- Develop Existing and Proposed Roadway Sections
- Develop 30% Plan and Profile Sheets
- Roadway Impact Assessment & Develop Right-of-Way Exhibit
- Develop Conceptual Traffic Control Plan
- Develop Storm Water Pollution Prevention (SWPPP) Plan Concept
- Cost Estimates

Upon completion of this Phase I PER Study, and approval of the recommended project by both the City of Houston and TIRZ 17, the Phase II detail design project development may commence. Phase II of the project will provide engineering services required to provide the necessary construction documents for the proposed improvements of Barryknoll Lane based on recommendations in the PER. The scope of services for the Phase II detailed design includes the following tasks:

- Prepare plans, specifications and estimates construction documents
- Obtain approval from government agencies
- Coordinate with public and private utility owners
- Provide cost estimates
- Assist the Memorial City Redevelopment Authority (MCRA) in the bidding process




MEMORIAL CITY
REDEVELOPMENT AUTHORITY
TIRZ #17

Lockwood, Andrews & Newnam, Inc.
A LEO A DALY COMPANY

BARRYKNOLL LANE
PER

PROJECT LOCATION MAP
HARRIS COUNTY, TEXAS

EXHIBIT 2.1

## 2.5 Existing Conditions

### 2.5.1 Roadway

Barryknoll Lane is an existing concrete curb and gutter roadway located approximately 2,000 feet south of Interstate Highway 10, along the south-eastern TIRZ 17 boundary. Barryknoll Lane serves east-west traffic between Gessner Road and Bunker Hill Road and is an undivided roadway striped for two 10-foot lanes in each direction, with the exception of the Gessner Road intersection. See **Appendix E.2.a** - Existing Typical Sections for additional information.

Originally constructed in 1962, the existing concrete pavement ranges in thickness from 7- to 9-inches and has exceeded the typical useful service life of 40-years. From Gessner Road, the Barryknoll Lane alignment travels east until its termination at Bunker Hill Road. The alignment includes a series of reversing curves that meet the minimum radius criteria for a 30 mph design speed facility. At several locations along the alignment, privately owned walls and fences encroach into the existing right-of-way. See **Appendix E.2.b** – Existing Layout for additional information

According to the City's Major Thoroughfare and Freeway Plan (MTFP), Barryknoll Lane is considered a major collector; however, the existing design speed and right-of-way width does not meet the current City requirements for this street classification. The City of Houston *Infrastructure Design Manual* requires a design speed of 45 mph for major collectors and a right-of-way width between 80′ and 100′ for this type of urban roadway. The speed limit on Barryknoll Lane is signed for 30 mph within the project limits. All of the existing horizontal curves along the alignment meet the criteria for a 30 mph design speed. The existing right-of-way width along the alignment is typically 60-feet, but varies in some areas from 54-feet to 82-feet. The existing roadway is generally centered in the right-of-way; however, east of Dolphin Court the roadway begins to shift to the south allowing only 5 ½ -feet between the south face of curb and right-of-way near Bunker Hill Road.

Existing sidewalks are continuous along the northern side of Barryknoll Lane from Gessner to Bunker Hill. The sidewalks are usually 4-feet in width and are generally located 2-feet behind the existing curb. Typically, no sidewalks exist along the southern side of Barryknoll Lane; however there is 800-feet of sidewalk adjacent to the Memorial City Plaza Development which extends from Gessner Road to 100-feet east of Plantation. The sidewalks do not meet current American with Disability Act (ADA) requirements due to the lack of 5-foot passing areas, excessive cross slopes and inadequate wheel chair ramps.

Numerous cross streets intersect Barryknoll at various locations along the alignment. **Table 2.1** provides detailed information for the existing intersections. The signalized intersections are described in more detail below.

Gessner Road is a four leg intersection which crosses Barryknoll Lane at the western project limit. The intersection was recently reconstructed by TxDOT in 2009, as part of the Gessner Road Widening Project. Gessner Road provides two northbound thru lanes and three southbound thru lanes. Left turn lanes exist for both northbound and southbound movements with a dedicated right turn lane in the northbound direction. On the west side of Gessner Road, Barryknoll Lane provides an entrance to the Memorial Hollow Subdivision. The pavement width is 27-feet face-to-face, with one lane in each direction. East of Gessner Road the pavement section is 40-feet wide with four 10-foot lanes. The lanes are striped for one eastbound thru lane, one westbound thru lane, one westbound right turn lane and one westbound left turn lane.

Plantation Road intersects Barryknoll Lane approximately 750-feet east of Gessner Road. The intersection is signalized with four legs; the east and west legs are Barryknoll Lane, the south leg is Plantation Road and the north leg is a driveway to Memorial City Mall. The existing span wire signal does not meet the current criteria set forth in the City of Houston *Infrastructure Design Manual,* dated July 2009. Plantation Road is a two-lane undivided concrete curb and gutter roadway which provides access to Memorial City Plaza parking garage and Memorial Hollow, Memorial Forest and Memorial Woods Subdivisions. The existing right-of-way width for Plantation Road is typically 67-feet, but widens to 87-feet at Barryknoll Lane to accommodate turn lanes. At the Barryknoll intersection, Plantation Road has one southbound thru lane, one northbound thru lane, one northbound left turn lane and one northbound free flow right turn lane controlled by a yield sign. The Memorial City Mall Driveway is divided with one entrance lane and two exit lanes. Barryknoll Lane has two thru lanes in each direction, with no left turn lanes. Sidewalk ramps exist on all four corners of the intersection, connecting to the existing sidewalks on Barryknoll Lane and Plantation Road. There are no sidewalks leading north to Memorial City Mall.

Memorial City Way is a signalized T-intersection that connects on the north side of Barryknoll Lane, approximately 1,300-feet west of Bunker Hill Road. The existing span wire signal does not meet the current criteria set forth in the City of Houston *Infrastructure Design Manual,* dated July 2009. The existing right-of-way width on Memorial City Way is 60-feet and consists of a four-lane undivided concrete curb and gutter roadway with two 10-foot concrete lanes in each direction. Barryknoll Lane has two thru lanes in each direction, with no left turn lanes. Memorial City Way provides access to Memorial City Mall and the IH-10 Eastbound Frontage Road. Sidewalk ramps exist on the north side of the intersection, connecting to the existing sidewalks on Barryknoll Lane and Memorial City Way. There are no sidewalks on the south side of the roadway.

Barryknoll Lane dead ends at Bunker Hill Road with a signalized "T" intersection at the eastern project limit. The existing span wire signal does not meet the current criteria set forth in the City of Houston *Infrastructure Design Manual,* dated July 2009. Bunker Hill Road has an existing right-of-way width of 60-feet and consists of a four-lane undivided concrete curb and gutter roadway with sidewalks on both sides of the street. The pavement is striped for two 11-foot concrete lanes in each direction with no turn lanes. The pavement is striped for two westbound lanes, one eastbound right turn lane and one eastbound left turn lane. Sidewalk ramps exist on all corners of the intersection, connecting to the sidewalks on the north side of Barryknoll and sidewalks on both sides of the Bunker Hill right-of-way. There are no sidewalks on the south side of the Barryknoll right-of-way. The Bunker Hill intersection is part of a TIRZ 17 CIP project to reconstruct Bunker Hill Road from IH-10 to Barryknoll Lane. Construction is tentatively scheduled to begin in 2012.

**Table 2.1 - Existing Intersections**

| | Approximate Station | Roadway Classification | ROW Width | Intersection Type | Intersection Control | Sidewalk Ramps |
|---|---|---|---|---|---|---|
| Gessner Road | Begin Project | Major Thoroughfare | Varies (100′ – 120′) | Four Leg | Signal | All Corners |
| Plantation Road | 8+33 | Residential | Varies (67′ – 84′) | Four Leg<br>Plantation - South<br>Mall Drive- North | Signal | All Corners |
| Bettina Court | 16+88 | Residential | 55′ | T-intersection South Side | Stop on Minor | None |
| Strey Lane | 20+79 | Residential | 55′ | Four Leg<br>Strey - South<br>Mall Drive - North | Stop on Minor | None |
| Holly Ridge Drive | 24+35 | Residential | 60′ | Four Leg<br>Holly Ridge - South<br>Mall Drive - North | Stop on Minor | None |
| Memorial City Way | 28+51 | Minor Collector | 60′ | T-intersection North Side | Signal | NE, NW |
| Riedel Drive | 31+70 | Residential | 60′ | T-intersection South Side | Stop on Minor | None |
| Barracuda Court | 35+47 | Residential | 60′ | T-intersection South Side | Stop on Minor | None |
| Dolphin Court | 38+61 | Residential | 60′ | T-intersection South Side | Stop on Minor | None |
| Bunker Hill | End Project | Major Thoroughfare | 60′ | T-intersection<br>Bunker Hill – N & S<br>Barryknoll - West | Signal | All Corners |

### 2.5.2 Drainage

The Barryknoll Lane Project is located within the Buffalo Bayou Watershed. The existing storm sewer along Barryknoll Lane consists of approximately 4,020 linear feet of 24- to 72-inch reinforced concrete pipe (RCP). The portion of Barryknoll Lane within the project limits is drained by 11 type B-B inlets, 2 type C inlets, and 3 grate inlets. The existing drainage infrastructure was constructed at the time of the original roadway construction and is nearly 50 years old.

The existing storm sewer enters Barryknoll Lane from Gessner Road and connects to a newly constructed storm sewer junction box near the intersection. At this location, a 60-inch reinforced concrete pipe (RCP), constructed in 1963, exits the box. The 60-inch storm sewer travels on the north side of the roadway for approximately 300 feet, before crossing the street to a location behind the south curb. After crossing Plantation Road, the storm sewer turns in a southeasterly direction through a utility easement and connects to the west side of an 10'x8' box culvert that encloses HCFCD W151-000-00. Another 24-inch storm sewer pipe, constructed in 1974, also connects to the west side of the 10'x8' box culvert. This pipe connects two inlets located approximately 200' west of the existing 10'x8' box culvert.

At the intersection of Barryknoll Lane and Bunker Hill Road, another storm sewer system enters the project limits. This 4'x4' RCB, connects to a manhole on the east side of Bunker Hill. After crossing Bunker Hill, the storm sewer transitions into a 54-inch RCP which travels along the north side of Barryknoll Lane, under the westbound travel lanes. Just west of Dolphin Court, a 36-inch storm sewer, entering from the north, connects to the 54-inch pipe at a manhole, and the pipe diameter increases to a 60-inch. At Memorial City Way, a 4'x3' box storm sewer, entering from the north, connects to the 60-inch pipe at a manhole, and the pipe diameter increases to a 72-inch. The storm sewer continues west, under the westbound travel lanes until it connects to the 10'x8' box culvert that encloses HCFCD W151-000-00. **Table 2.2** - Existing Longitudinal Storm Sewer Lines provides a summary of the existing longitudinal storm sewer lines along Barryknoll.

**Table 2.2 - Existing Longitudinal Storm Sewer Lines**

| Size | Material | Station From | Station To | Year Constructed |
|---|---|---|---|---|
| 60" | RCP | 1+80 | 15+40 | 1963 |
| 24" | RCP | 13+00 | 15+40 | 1974 |
| 72" | RCP | 15+40 | 24+40 | 1965 |
| 66" | RCP | 24+40 | 25+40 | 1965 |
| 60" | RCP | 25+40 | 37+60 | 1973 |
| 54" | RCP | 37+60 | 41+70 | 1973 |
| 4'X4' | RCB | 41+70 | 42+20 | 1991 |

Numerous storm sewer inlets connect to the storm sewer main along Barryknoll Lane. These inlets are typically connected to the storm sewer system with 18- to 24-inch lateral pipes that cross Barryknoll Lane, serving both residential and commercial developments. **Table 2.3** provides a summary of existing lateral storm sewer lines located within the project right-of-way.

**Table 2.3 - Existing Storm Sewer Laterals**

| Size | Material | Station | Inlet Type | Year Constructed |
|---|---|---|---|---|
| 24″ | Concrete | 1+75 | 2-Ty C | 2008 |
| 21″ | Concrete | 4+95 | 2-Ty BB | 1963 |
| 18″ | Concrete | 6+85 | MH/Drop Inlets - Commercial | unknown |
| 24″ | Concrete | 8+00 | Plantation Rd Inlets | 1963 |
| 24″ | Concrete | 8+85 | 2-Ty BB | 1963 |
| 24″ | Concrete | 13+00 | 2-Ty BB | 1974 |
| 18″ | Concrete | 16+90 | Ty B | 1965 |
| 18″ | Concrete | 16+90 | Bettina – 2-Ty B | 1965 |
| 18″ | Concrete | 20+70 | Strey – 2-Ty B | 1965 |
| 36″ | Concrete | 20+70 | Mall – 36″ Lead | unknown |
| 18″ | Concrete | 21+90 | Alley | 1965 |
| 24″ | Concrete | 22+50 | Mall Area Drain | unknown |
| 24″ | Concrete | 24+30 | Holly Ridge – 2-Ty BB | 1973 |
| 12″ | Concrete | 24+30 | Mall – Area Drain | unknown |
| 4′x3′ | Concrete | 28+40 | Memorial City Way | 1991 |
| 24″ | Concrete | 31+70 | Riedel – 2-Ty BB | 1973 |
| On 60″ | Concrete | 31+70 | Drop Inlet Mall Driveway | 1973 |
| 24″ | Concrete | 32+10 | Apartment Drop Inlet | unknown |
| 24″ | Concrete | 34+20 | Apartment Drop Inlet | unknown |
| 24″ | Concrete | 35+45 | Barracuda – 2-Ty BB | 1973 |
| On 60″ | Concrete | 35+45 | Ty BB | 1973 |
| 36″ | Concrete | 37+60 | Apartment | unknown |
| 24″ | Concrete | 38+65 | Dolphin – 2-Ty BB | 1973 |
| 24″ | Concrete | 39+65 | 2-Ty BB | 1973 |

### 2.5.3 Existing Water Lines

Existing water lines are within the Barryknoll Lane Project study limits. Information on these utilities was obtained from survey data, record drawings from the City of Houston, and the City of Houston Geographic Information & Management System (GIMS). See **Appendix E.1** Existing Public Utilities for additional information.

The Barryknoll Lane project area is currently serviced by an 8-inch waterline that runs longitudinally along the entire project length of Barryknoll Lane from Gessner to Bunker Hill. The 8-inch waterline originates at a 12-inch water line located on the west side of Gessner. This portion of the 8-inch waterline was constructed of Polyvinyl Chloride (PVC) in 1990.

From here, the waterline travels east across Gessner and behind the south curb line on Barryknoll Lane. Approximately 550 feet east of the Gessner interconnect, the line crosses Barryknoll Lane with two 45 degree bends and travels along the north right-of-way for approximately 850 feet. At this location, the waterline terminates into an 8-inch asbestos cement (AC) waterline which was constructed in 1965. This 8-inch AC waterline travels north, to Memorial City Mall, and south, across Barryknoll Lane. After crossing Barryknoll, the southern portion of the waterline turns, with a 90 degree bend, and continues east along the south right-of-way of Barryknoll until its termination at Bunker Hill Road. The waterline connects to an 8-inch AC waterline running north-south along the west side of Bunker Hill Road. **Table 2.4** provides a summary of the existing longitudinal water lines along Barryknoll.

**Table 2.4 - Existing Longitudinal Water Lines**

| Size | Material | Station From | Station To | Year Constructed |
|---|---|---|---|---|
| 8" | PVC | Begin Project | 12+95 | 1990 |
| 8" | Steel | 12+95 | 15+65 | 1990 |
| 8" | AC | 15+65 | 41+69 | 1965 |
| 8" (aband.) | unknown | Begin Project | 8+68 | unknown |

Numerous waterlines, of various size and material, connect to the 8-inch distribution main along Barryknoll Lane. These lines typically cross Barryknoll Lane laterally, serving residential and commercial developments, as well as fire hydrants. **Table 2.5** provides a summary of existing lateral water lines located within the project right-of-way.

**Table 2.5 - Existing Lateral Water Lines**

| Size | Material | Station | Year Constructed |
|---|---|---|---|
| 12" | PVC | 0+56 | 1990 |
| 8" | PVC | 6+99 | 1990 |
| 8" | unknown | 7+50 | unknown |
| 6" | unknown | 7+77 | unknown |
| 8" | Steel | 8+54 | 1990 |
| 6" (aband.) | unknown | 14+93 | unknown |
| 8" | AC | 15+65 | 1965 |
| 12" (aband.) | AC | 25+50 | 1972 |
| 12" | unknown | 28+85 | 1991 |
| 8" | unknown | 33+82 | 1991 |
| 8" | AC | 37+67 | 1976 |
| 8" | AC | 41+68 | 1969 |

### 2.5.4 Existing Sanitary Sewer Lines

Several sanitary sewer lines exist within the Barryknoll Lane Project study limits. Information on these utilities was obtained from survey data, record drawings from the City of Houston, and the City of Houston Geographic Information & Management System (GIMS). See **Appendix E.1** Existing Public Utilities for additional information.

The Barryknoll Lane project area is currently serviced by a sanitary sewer that varies in size from 12- to 21-inches. This collector gravity main, constructed in 1962, flows west along the entire project length of Barryknoll Lane from Bunker Hill to Gessner. The line begins as a 12-inch diameter pipe of unknown material, connecting to an 8-inch sanitary sewer on the west side of Bunker Hill. The sanitary line is located under the eastbound travel lanes of Barryknoll Lane for approximately 1000-feet to a manhole at Riedel Drive. At this manhole, the line connects to a 10-inch sanitary sewer line flowing north on Riedel Drive and 12-inch sanitary sewer that crosses Barryknoll from the north. The three pipes flow into a 21-inch collector pipe that continues west under the eastbound lanes until it crosses HCFCD W-151-000-0. At this location, the sanitary sewer turns south and travels parallel to the culvert which encloses the ditch for approximately 220-feet. The line then turns northwest, parallel to the 60-inch storm sewer in a utility easement until it reaches the eastbound lanes on Barryknoll and turns to the west near Plantation Road. The line remains beneath the eastbound lanes for approximately 200-feet before crossing to the north side. At this point, the sanitary sewer travels along the north right-of-way line until it turns north in the southbound lanes on Gessner Road.

There are two additional sanitary sewer lines that run longitudinally for short distances in easements adjacent to the Barryknoll Lane project limits. One of the lines is 8-inch in diameter and serves as a collector to houses on the north side of Queensbury Lane in the Memorial Hollow Subdivision. This sanitary sewer line begins at the drainage ditch and runs parallel to the 60-inch storm sewer in a utility easement before connecting to the 21-inch sanitary sewer on Barryknoll. The second line is 12-inch in diameter and serves the Memorial Village Townhomes on the north side of Barryknoll Lane. This line is located in an easement that runs parallel to Barryknoll Lane on the north side between Riedel Drive and Dolphin Court.

**Table 2.6** provides a summary of the existing longitudinal sanitary sewer lines located within the project right-of-way.

**Table 2.6 - Existing Longitudinal Sanitary Sewer Lines**

| Size | Material | Station From | Station To | Year Constructed |
|---|---|---|---|---|
| 21" | concrete | 0+90 | 31+60 | 1962 |
| 12" | Extra Strength Concrete Pipe* | 31+60 | 41+85 | 1962 |
| 8" | unknown | 7+79 | 10+00 | unknown |

*rehabilitated by pipe bursting; pipe bursting material unknown.

Numerous sanitary sewer lines, of various size and material, connect to the longitudinal sanitary sewers along Barryknoll Lane. These lines typically cross Barryknoll Lane laterally, serving residential and commercial developments. **Table 2.7** provides a summary of existing lateral sanitary sewer lines located within the project right-of-way.

**Table 2.7 - Existing Lateral Sanitary Sewer Lines**

| Size | Material | Station | Year Constructed |
|---|---|---|---|
| 6" | unknown | 2+78 | unknown |
| 6" | Ductile iron | 4+79 | 1982 |
| 21" | unknown | 6+77 | 1962 |
| 8" | Extra Strength Concrete Pipe | 15+75 | unknown |
| 15" | PVC | 28+37 | 1991 |
| 12" | concrete | 28+76 | unknown |
| 12" | Extra Strength Concrete Pipe | 31+59 | unknown |
| 8" | unknown | 41+84 | 1962 |

### 2.5.5 Existing Private Utilities

CenterPoint Energy (CPE) and Southwestern Bell Company (SBC, also known as AT&T) have existing private utilities located within the Barryknoll Lane project right-of-way. Utility information was requested and obtained from both companies. CPE has underground gas lines, underground electric street light cable and overhead electric lines running within the Barryknoll ROW. SBC facilities include both underground cables and duct backs. Texas One Call should be contacted at least 48 hours prior to excavation to locate all underground utilities. See **Appendix F.2** Existing Private Utilities for additional information.

#### 2.5.5.1 Existing CenterPoint Energy Gas Facilities

A 2-inch steel gas line, located on the east side of Gessner Road, turns east on Barryknoll Lane and travels along the north ROW approximately 7-feet behind the curb. At Plantation Road, the gas line crosses Barryknoll Lane and increases in size to a 3-inch line. The line crosses Plantation Road and parallels the existing 60-inch storm sewer, traveling in a southeasterly direction through a utility easement adjacent to Barryknoll Lane. Presumably, the line connects to a 6-inch gas line that runs parallel to HCFCD W-151-000-00. This 6-inch gas line travels north and crosses Barryknoll Lane, where another 6-inch gas line connects to it and travels east, approximately 13-feet behind the north curb. At Memorial City Way, this 6-inch gas line turns north and travels outside of the project limits. A 4-inch gas line also connects to the 6-inch gas line that parallels the drainage ditch. This 4-inch gas line is situated approximately 4 feet behind the south curb and travels east to Holly Ridge Drive, where it decreases in size to a 2-inch gas line. The gas line shifts to the north and travels east under the south curb. 100-feet west of Barracuda, the 2-inch steel gas line splits into three 2-inch steel gas lines. One 2-inch steel gas lines turns south and continues outside the project limits, the other two lines cross Barryknoll Lane. One of these 2-inch steel gas lines continues north and outside the project limits, the other turns east and runs along the north side of Barryknoll Lane near the ROW. This 2-inch gas line continues east along the north side of Barryknoll Lane until it crosses Bunker Hill Road and intersects a 2-inch gas line running north-south along the east side of Bunker Hill Road. **Table 2.8** provides a summary of existing gas lines located within the project right-of-way.

**Table 2.8 - Existing CPE Gas Lines**

| Size | Material | Alignment | Crossing | Longitudinal | |
|---|---|---|---|---|---|
| | | | Station | Station From | Station To |
| 2" | Steel | Longitudinal | - | 1+69 | 7+73 |
| 3" | Steel | Longitudinal | - | 7+73 | 13+88 |
| 6" | Steel | Longitudinal | - | 15+13 | 28+09 |
| 4" | Steel | Longitudinal | - | 15+05 | 24+40 |
| 2" | Steel | Longitudinal | - | 24+40 | 33+95 |
| 2" | Steel | Longitudinal | - | 34+02 | 42+00 |
| 2" | Steel | Crossing | 0+53 | - | - |
| 2" | Steel | Crossing | 7+69 | - | - |
| 6" | Steel | Crossing | 15+08 | - | - |
| unknown | Steel | Crossing | 21+55 | - | - |
| 2" | Steel | Crossing | 34+07 | - | - |
| 2" | Steel | Crossing | 34+16 | - | - |

2.5.5.2 Existing CenterPoint Energy Electric Facilities

Record drawings were obtained from CenterPoint Energy indicating underground electric street light cable and overhead electric lines within the Barryknoll Lane project limits. It is probable that other utility companies also have facilities hanging on the electric poles; however, no information has been provided to document this. The overhead lines run longitudinally along Barryknoll Lane beginning at the east side Plantation Drive. The overhead lines parallel the existing 60-inch storm sewer, traveling in a southeasterly direction through a utility easement adjacent to Barryknoll

Lane. At HCFCD W-151-000-00 the lines turn north and cross Barryknoll Lane. A second line connects to a pole near the south ROW line and travels east until it crosses Bettina Court. Just east of Bettina Court, the lines cross Barryknoll and travel along the north ROW line to Bunker Hill. Overhead lines also cross Barryknoll at several locations along the project alignment. The crossing locations include the west side of Gessner Road, 300-feet east of Plantation Road, east and west of the 3rd Mall Entrance near Bettina Court, 100-feet east of Strey Lane and the west side of Bunker Hill. Underground electric cable is intermittent within the project limits, connecting street lights to each other and to the overhead electric lines. **Table 2.9** provides a summary of existing electric facilities located within the project ROW.

**Table 2.9 - Existing CPE Electric Facilities**

| Type | Alignment | Crossing | Longitudinal | |
|---|---|---|---|---|
| | | Station | Station From | Station To |
| Street light cable | Longitudinal | - | 4+06 | 5+76 |
| Street light cable | Longitudinal | - | 7+57 | 7+95 |
| Street light cable | Longitudinal | - | 8+67 | 9+27 |
| Street light cable | Longitudinal | - | 21+04 | 21+89 |
| Street light cable | Crossing | 1+65 | - | - |
| Overhead Electric | Longitudinal | - | 9+27 | 13+87 |
| Overhead Electric | Longitudinal | - | 15+00 | End Project |
| Overhead Electric | Longitudinal | - | 27+60 | End Project |
| Overhead Electric | Crossing | 11+71 | - | - |
| Overhead Electric | Crossing | 14+93 | - | - |
| Overhead Electric | Crossing | 15+04 | - | - |
| Overhead Electric | Crossing | 16+22 | - | - |
| Overhead Electric | Crossing | 17+22 | - | - |
| Overhead Electric | Crossing | 17+71 | - | - |
| Overhead Electric | Crossing | 22+14 | - | - |
| Overhead Electric | Crossing | 33+95 | - | - |
| Overhead Electric | Crossing | 41+66 | - | - |

2.5.5.3 Existing SBC Facilities

Multiple SBC conduits are located within the Barryknoll Lane project area. SBC cables begin at Gessner Road with four separate groups of cables, a group of 8-4" PVC ducts, a second group of 8-4" PVC ducts, a group of 6-4" PVC ducts, and a group of 2-4" PVC ducts. The ducts meet at the southeastern corner of the Barryknoll Lane and Gessner Road intersection, and follow Barryknoll Lane near the ROW for approximately 150-feet, where they connect to a SBC manhole.

The ducts exit the manhole on the eastern side as two sets of SBC cables, a group of 4-4" PVC cables, and group of 4 cables of unknown size or material. These two cables continue following Barryknoll Lane behind the curb, near the ROW, until they connect to a SBC manhole on private property, approximately 100-feet west of Plantation Road.

Three SBC cables come out the east side of this SBC manhole, one group of 4-4" SBC cables which goes south outside the area of construction, one group of 4-4" SBC cables which follows the west side of Plantation Road south, just inside the ROW, and one group of 8-4" SBC cables which cross Barryknoll Lane at the SBC manhole, and follows Barryknoll Lane along the north side, between the face of curb and ROW. This SBC cable continues until it connects to a SBC manhole about 300-feet west of Bettina Court.

A second set of 8-4" SBC cables connect to the west side of this manhole. This group of cables cross Barryknoll Lane and connect to a one story concrete building just outside the south ROW about 350-feet east of Plantation Road. Two sets of SBC cables exit the manhole on the east side. One of these ducts consists of 2-4" cables and immediately crosses Barryknoll Lane and follows the south ROW until it connects to a SBC box about 50-feet west of Bettina Court. The second duct consists of 8-4" cables and follows the north side of Barryknoll Lane just behind the curb. This duct continues until it connects to a SBC manhole approximately 100-feet east of Strey Lane.

An 8-4" SBC duct exits on the east side of the manhole and continues east along Barryknoll Lane behind the north curb. This duct follows Barryknoll Lane until the intersection of Memorial City Way where turns and runs north along the west side of Memorial City Way, connecting to a manhole outside the project limits.

8-4" PVC cables also connect to this manhole on the south side and cross diagonally to the east side of Memorial City Way. The cables continue east along Barryknoll Lane behind the north curb. This duct intersects a SBC manhole approximately 50-feet west of Barracuda Court. A group of 2-4" cables which enter the project limits from the north, approximately 40 feet west of the manhole, also connect to the west side.

A group of 8-4" SBC cables exit on the east side of the SBC manhole and continue east along the north side of Barryknoll Lane just outside the curb until it intersects a SBC manhole approximately 100-feet west of Bunker Hill.

10-4" SBC cables exist the manhole on the east side before splitting into two groups 25-feet west of Bunker Hill. One, with 4 ducts, crosses Barryknoll Lane and continues south along the west ROW of Bunker Hill Road. The second set of cables turns north and follows the west side of Bunker Hill just inside the ROW. **Table 2.10** provides a summary of existing SBC facilities located within the project right-of-way.

**Table 2.10 - Existing SBC Facilities**

| Owner | Size | Material | Alignment | Crossing | Longitudinal | |
|---|---|---|---|---|---|---|
| | | | | Station | Station From | Station To |
| SBC | 6-4" Duct | PVC | Longitudinal | - | 0+61 | 2+15 |
| SBC | 8-4" Duct | PVC | Longitudinal | - | 0+54 | 2+15 |
| SBC | 8-4" Duct | PVC | Longitudinal | - | 1+22 | 2+15 |
| SBC | 2-4" Duct | PVC | Longitudinal | - | 1+45 | 2+15 |
| SBC | 14-4" Duct | PVC | Longitudinal | - | 2+15 | 3+04 |
| SBC | 4-4" Duct | PVC | Longitudinal | - | 3+04 | 6+91 |
| SBC | 4-4" Duct | PVC | Longitudinal | - | 3+04 | 6+91 |
| SBC | 8-4" Duct | PVC | Longitudinal | - | 6+91 | 13+74 |
| SBC | 8-4" Duct | PVC | Longitudinal | - | 12+32 | 13+74 |
| SBC | 2-4" Duct | PVC | Longitudinal | - | 13+74 | 16+04 |
| SBC | 8-4" Duct | PVC | Longitudinal | - | 13+74 | 21+82 |
| SBC | 8-4" Duct | PVC | Longitudinal | - | 21+82 | 28+30 |
| SBC | 8-4" Duct | PVC | Longitudinal | - | 28+30 | 34+74 |
| SBC | 8-4" Duct | PVC | Longitudinal | - | 34+74 | 40+72 |
| SBC | 10-4" Duct | PVC | Longitudinal | - | 40+72 | 41+32 |
| SBC | 4 Ducts | PVC | Longitudinal | - | 41+32 | 41+69 |
| SBC | 2-4" Duct | PVC | Longitudinal | - | 41+32 | 41+69 |
| SBC | 2-4" Duct | PVC | Crossing | 0+54 | - | - |
| SBC | 6-4" Duct | PVC | Crossing | 1+18 | - | - |
| SBC | 8-4" Duct | PVC | Crossing | 7+36 | - | - |
| SBC | 8-4" Duct | PVC | Crossing | 13+28 | - | - |
| SBC | 2-4" Duct | PVC | Crossing | 14+23 | - | - |
| SBC | 4 Ducts | PVC | Crossing | 41+55 | - | - |

2.5.5.4 Fiber Optic Communications

There is no evidence of Level 3 Communications or other private fiber optic lines within the project limits. It is recommended that Texas One Call be contacted prior to detailed design and construction to further confirm and document this finding.

### 2.5.6 Existing Tree Impacts

Approximately 220 existing trees are located within the Barryknoll Lane project limits and, in order to comply with the City Tree Ordinance, landscaping plans and tree protection plans will be necessary in Phase II. For additional information, a detailed tree inventory was performed by C.N. Koehl Urban Forestry and can be found in **Appendix G**.

### 2.5.7 Geotechnical Study

Geotech Engineering and Testing (GET) performed the geotechnical investigation for the project. The findings and recommendations are presented in the report entitled *Geotechnical Exploration Study Proposed Barryknoll Drainage Improvements*. A copy of this report can be found in **Appendix H**. GET drilled 9 soil core borings at the project site, each 20-feet in depth. Groundwater was encountered at depths of 11-feet during drilling, and depths of 6-feet after 24 hours. The report recommends a reinforced concrete pavement thickness of 10-inches with an 8-inch lime stabilized subgrade consisting of 4% lime by dry weight.

After the Geotechnical Investigation was performed in February 2010, the City provided their recommendations to remove and replace the 21/12-inch sanitary sewer and manholes. The existing manholes to be removed and replaced reach up to 17-ft. in depth. According to the City of Houston Infrastructure Design Manual, soil borings must be taken to the trench depth plus 10-ft. for excavations between 10 and 25 ft. deep. The soil borings taken for this project were only 20-ft. in depth; therefore, City of Houston criteria wasn't met.

Although the soil borings were not at the depth required by City of Houston criteria, based on a review of the Geotechnical Investigation, it appears that there is adequate soil information to design and construct the sanitary sewer and manholes. To avoid unnecessary disruption to local businesses and residents in the area, we may proceed with the sanitary sewer design using existing geotechnical information. At the discretion of TIRZ 17, please advise if we should pursue otherwise.

### 2.5.8 Environmental Site Assessment

Lockwood, Andrews & Newnam, Inc. conducted a Phase I Environmental Site Assessment (ESA) for the project area. The findings are presented in the report entitled *Phase I Environmental Site Assessment Barryknoll Lane Roadway Reconstruction and Drainage Improvements from Gessner to Bunker Hill*. A copy of the report is available under separate cover. Based on the Phase I ESA for the proposed roadway improvements along Barryknoll Lane, there are three (3) potential Recognized Environmental Conditions (RECs) present in the surrounding area; however the RECs are not located directly on or adjacent to the subject alignment. Therefore, no further investigation is recommended.

#### 2.5.9 Geologic Fault Study

Geotech Engineering and Testing (GET) performed a limited phase I geologic fault study for the project to evaluate the possibility of surface faulting along the project alignment. The findings and recommendations are presented in the report entitled *Limited Phase I Geologic Fault Study Proposed Barryknoll Drainage Improvements*. A copy of this report can be found in **Appendix I**. Based on the review of existing fault maps, aerial photos and on-site reconnaissance, the report concluded that surface faulting is not evident along the project alignment.

#### 2.5.10 Agency Coordination

Contact with different entities will be required throughout the final design phase prior to the final design submittal. Coordination meetings will be scheduled with the City of Houston as needed throughout the design phase. Upon 90% completion, drawings will be submitted to the City Engineer's Office for review and approval. Coordination with adjacent businesses will be conducted throughout the project development to minimize access impacts to the existing adjacent development.

2.5.11 Existing Roadway Condition Photos

**Figure 2.1 - Barryknoll Lane near Gessner Road (Looking West)**

**Figure 2.2 - Barryknoll near Plantation (Looking East)**

**Figure 2.3 - Barryknoll Lane near Plantation Drive (Looking East)**

**Figure 2.4 - Barryknoll Lane near Bettina Court (Looking West)**

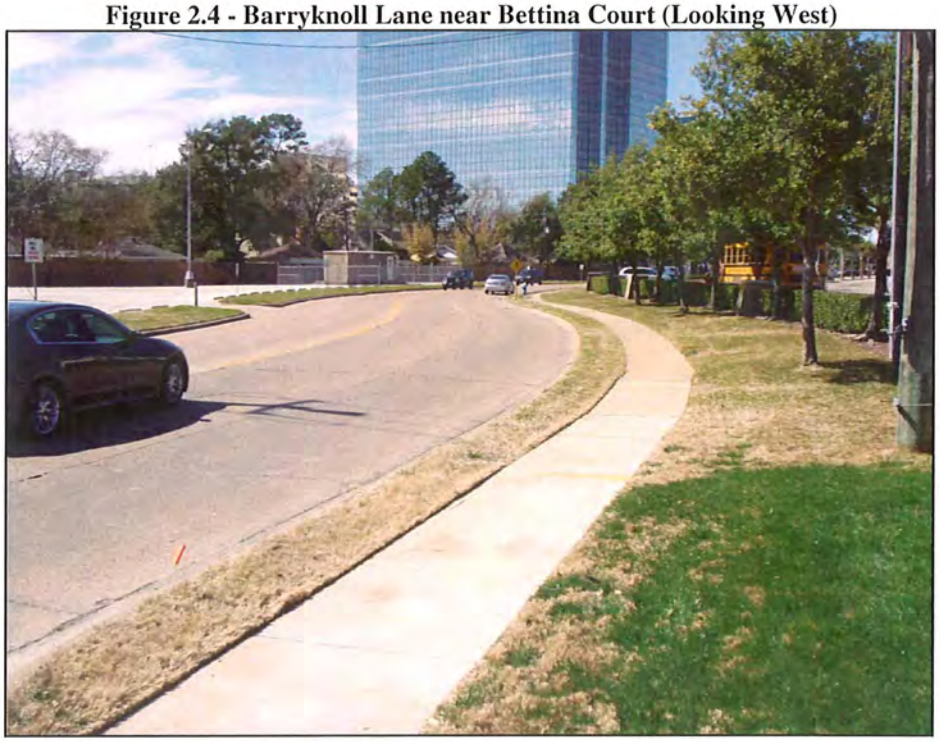


**Figure 2.5 - Barryknoll Lane near Memorial City Way (Looking West)**

**Figure 2.6 - Barryknoll Lane @ Memorial City Way (Looking North)**

**Figure 2.7 - Barryknoll Lane near Barracuda Court (Looking East)**

**Figure 2.8 - Barryknoll Lane at Bunker Hill (Looking East)**

# 3.0 DRAINAGE ANALYSIS AND RECOMMENDATIONS

## 3.1 Design Criteria

The design criteria for this project is based on City of Houston (COH) standards which can be found in the *COH Infrastructure Design Manual*, dated July 2009. Storm Sewer design criteria can be found in Section 9.05 C of the *COH Infrastructure Design Manual.*

In accordance with City design standards, the first objective in the analysis of the existing Barryknoll Lane storm sewer system is to determine the location of the hydraulic grade line (HGL) in relation to the gutter line for the 2 year storm event.

The second objective is to ensure that flow from an extreme event (100-year storm) can be conveyed in the storm sewer and through street sheet flow. The following criterion was used to establish roadway cross-sections and then calculate the flow conveyed by the existing and proposed roadway cross-section:

- Streets shall be designed so that consecutive high points in the street will provide for a gravity flow of drainage to the ultimate outlet.
- The maximum depth of ponding at high points shall be 6" above top of curb.
- The maximum depth of ponding at low points shall be 18" above top of curb.
- The maximum ponding elevation for the 100-year event at any point along the street shall not be higher than the natural ground elevation at the right-of-way line.

Method 4 from Section 9.05D of the *COH Infrastructure Design Manual* was used as guidance for analyzing the extreme event. Output data from the RDS InfoWorks SD model, which is a dynamic flow routing model of the project region, was used to evaluate the extreme event.

A third objective is to meet the regional drainage improvement needs as determined by the June 2004 HCFCD Implementation Study and the ongoing TIRZ 17 Regional Drainage Study. It is anticipated that this criteria will supersede the minimum City of Houston storm sewer design criterion.

The City of Houston's version of TxDOT WinStorm software, HouStorm, was used to model the existing and proposed storm sewer networks. HouStorm utilizes the rational method to estimate peak run-off rates. The run-off coefficients were determined from the COH criteria shown in **Table 3.1**. The HouStorm output for this project can be found in **Appendix C.2**.

**Table 3.1 - COH Run-off Coefficients**

| Land Use Type | Run-off Coefficient (C) |
|---|---|
| Residential Districts | |
| Lots more than 1/2 acre | 0.35 |
| Lots 1/4 - 1/2 acre | 0.45 |
| Lots less than 1/4 acre | 0.55 |
| Multi-Family area | |
| Less than 20 Service Units/Acre | 0.65 |
| 20 Service Units/Acre or Greater | 0.80 |
| Business Districts | 0.80 |
| Industrial Districts | |
| Light Areas | 0.65 |
| Heavy Areas | 0.75 |
| Railroad Yard Areas | 0.30 |
| Parks/Open Areas | 0.30 |

Time of concentration was computed using the following equation:

$$TC = 10A^{0.1761}+15$$

Where: TC = time of concentration (minutes)
A = subarea (acres)

The design criteria used for storm sewers in the Barryknoll Lane Storm Sewer Project can be found in Section 9.05.C of the *COH Infrastructure Design Manual*.

### 3.2 Land Use and Development

The contributing drainage area for the Barryknoll Lane storm sewer consists of commercial and private developments. The Memorial City Mall comprises approximately thirty-five percent of the area that contributes to the Barryknoll Lane storm sewer. The remainder of the contributing drainage area comes from Gessner Road, Bunker Hill, and a large portion of the W151-00-00 watershed that extends north of IH-10 and drains beneath the Memorial City Mall via a 10'x8' RCB culvert. Areas to the south of Barryknoll are generally single family residential with the exception of commercial areas at Gessner Road and apartments at the intersection of Bettina Court and Strey Lane. North of Barryknoll Lane is predominately the mall property with areas east of Memorial City Way apartments. All storm sewer drainage along Barryknoll collects at the north/south 10'x8' RCB culvert that extends south to HCFCD Unit#W151-00-00 and is located just west of Bettina Court. See **Exhibits 3.1 through 3.3** for maps of the existing drainage areas.

The Barryknoll Lane storm sewer within the project limits begins at Gessner Road and drains east to W151-00-00. The storm sewer under Gessner Road was recently reconstructed from Barryknoll north to IH-10. This project included 2-8'x5' RCB's that provide additional storm water storage. The Barryknoll Lane storm sewer system begins at a junction box constructed for the Gessner Road project that connects the newer 9'x5' RCB to the existing 60" RCP pipe that continues along Barryknoll east to W151-00-00. Areas north of this portion of Barryknoll are mall parking areas that generally drain south towards Barryknoll and flow over the curbed areas. South of Barryknoll there are area inlets in parking lots for the commercial properties between Gessner Road and Plantation Road that drain into the Barryknoll storm sewers, and another parking area to the east of Plantation Road. However the residential areas drain south of Barryknoll via separate storm sewer systems. Mall parking areas north of Barryknoll are generally drained by storm sewer systems that connect directly to Barryknoll or the existing 10'x8' box culvert, however the area between Plantation and W151-00-00 drains to concrete flumes that discharge to the existing sidewalk areas on the north side of Barryknoll.

East of W151-00-00 there are a number of roadways and developments that contribute to the Barryknoll storm sewer. This includes 2-18-inch RCP from the apartments at Bettina Court and Strey Lane, and a 24-inch RCP from Holly Ridge and Riedel Drive. The mall parking areas just east of W151-00-00 generally drain to internal inlets and are then piped to Barryknoll Lane. Other connections include a 4'x3' RCB from Memorial City Way, 2-24-inch RCP's from the apartments just east of Memorial City Way, and 2-24-inch RCP's from both Barracuda Court and Dolphin Court. The storm sewer for Bunker Hill was replaced in conjunction with roadway improvements in 1991 that included a 4'x4' RCB connection to the Barryknoll storm sewer system.

## 3.3 Existing Drainage System Analysis

### 3.3.1 Existing Storm Sewer – 2-Year Event Analysis

In accordance with City of Houston design criteria, the performance of the existing Barryknoll Lane storm sewer system was evaluated under the 2-year event through the use of HouStorm. As required by City of Houston design criteria, the location of the hydraulic grade line (HGL) in relation to the gutter line was determined. **Appendix C.1** shows the profile plots of the main trunkline. It was ultimately determined that the HGL in all portions of the Barryknoll Lane storm sewer system are not located below the gutter line or critical elevation thus does not meet the City of Houston requirements. Generally this is due to the high tailwater elevations in W151-00-00 and relatively low roadway elevations at Bunker Hill and areas east of Gessner, and less on actual pipe capacity as the high tailwater limits the hydraulic head available to the storm sewer system.

**Table 3.2 – Existing Hydraulic Data for 2-yr Event Analysis**

| Location | | Gutter | Existing HGL (ft)* | | | Difference (ft) | | |
|---|---|---|---|---|---|---|---|---|
| Description | Station | Elev | 2-YR | 10-YR | 100-YR | 2-YR | 10-YR | 100-YR |
| Gessner Road | 1+50 | 77.39 | 89.75 | 106.19 | 135.75 | 12.36 | 28.80 | 58.36 |
| Near Office Complex | 5+00 | 77.11 | 86.62 | 99.45 | 122.55 | 9.51 | 22.34 | 45.44 |
| Plantation Road | 8+00 | 78.00 | 81.86 | 89.14 | 102.27 | 3.86 | 11.14 | 24.27 |
| W151 | 15+35 | 78.22 | 76.20 | 76.78 | 77.89 | -2.02 | -1.44 | -0.33 |
| Holly Ridge Drive | 24+35 | 77.12 | 77.78 | 81.01 | 86.63 | 0.66 | 3.89 | 9.51 |
| Memorial City Way | 28+50 | 77.55 | 79.10 | 84.07 | 92.92 | 1.55 | 6.52 | 15.37 |
| Riedel Drive | 31+75 | 77.87 | 79.73 | 85.54 | 95.92 | 1.86 | 7.67 | 18.05 |
| Barracuda Court | 35+50 | 76.75 | 80.02 | 86.22 | 97.89 | 3.27 | 9.47 | 21.14 |
| Dolphin Court | 38+65 | 76.47 | 80.34 | 86.95 | 99.36 | 3.87 | 10.48 | 22.89 |
| Bunker Hill Road | 41+75 | 76.58 | 80.61 | 87.54 | 99.89 | 4.03 | 10.96 | 23.31 |

*From HouStorm model

The existing conditions of the Barryknoll Lane storm sewer system does not satisfy the drainage criteria defined in the *City of Houston Infrastructure Design Manual* Criteria Section 9.05.C.1.b. Criteria Section 9.05.C.1.b which states the hydraulic grade line must be at or below the gutter line at all points in the storm sewer. See **Appendix C.2** for the detailed HouStorm calculations and output for the 2-year event analysis.

### 3.3.2 Existing Storm Sewer – Extreme Event Analysis

Refer to **Exhibit 3.7** for the Sheet Flow and Ponding Map. Based on the ArcHydro analysis of the 2008 LiDAR data a number of existing low areas exist along Barryknoll Lane. These locations include an area just east of Gessner Road and south of the Sears Auto Center, a low area at the Holly Ridge Drive and Riedel Drive intersections, and just west of the Bunker Hill intersection. Existing overland flow paths are located between Gessner and Plantation, a crossing at Bettina Court. The overland flow is generally east starting at Strey Ln and continuing to Bunker Hill then south to Joan of Arc Drive.

Extreme event analysis (100-YR) was performed using the TIRZ 17 Regional Drainage Study (RDS) InfoWorks SD model. Technical Paper No. 101, "Guidelines for Consideration of Overland Flow for the Extreme Event for Improvement Projects in the City of Houston" allows the use of a dynamic flow routing model (method 4) for extreme event analysis. Because this model offers more accurate results than the HouStorm Analysis the RDS InfoWorks SD model output data will be used to evaluate the extreme event as well as evaluate the expected benefits of the recommended drainage improvements analysis.

The RDS analysis shows that the storm sewers along Barryknoll Lane are limited in capacity due to relatively high tail water conditions within the W151-00-00 Channel. Problem areas include:

- Once the Barryknoll storm sewer capacity is exceeded east of W151, storm water from the easterly portion of the area travels overland in an easterly direction from Barryknoll Lane into Hedwig Village.
- Overland flow from areas west of W151 travels south along Gessner Road and Plantation Road entering the W153-00-00 watershed. This causes the Gessner Road storm sewer to surcharge and backflow south.
- During the 2-year storm event, localized ponding is above the curb within the area and exceeds the design criteria along Bunker Hill Road.
- During the 10-year, 24-hour storm event significant localized ponding and potential for structural flooding within the Riedel Estates neighborhood is present.
- The model indicates that no overland flow path exist along Barryknoll Lane to direct storm water to W151-00-00 as this channel's banks are elevated higher than the surrounding areas. The most significant street ponding is just east of Gessner where the roadway gutter elevations are approximately 2-ft below the top of bank at the W151 channel.

The maximum ponding elevation for the 100-year event was found to exceed maximum ponding elevation at multiple locations. **Therefore, the existing system does not satisfy the 100-year COH criteria.**

**Table 3.3 – Existing Hydraulic Data for Extreme Event Analysis**

| Location | | MPE | Existing HGL (ft)* | | | Difference (ft) | | |
|---|---|---|---|---|---|---|---|---|
| Description | Station | Elev | 2-YR | 10-YR | 100-YR | 2-YR | 10-YR | 100-YR |
| Gessner Road | 1+50 | 78.32 | 78.24 | 78.28 | 79.20 | -0.08 | -0.04 | 0.88 |
| Near Office Complex | 5+00 | 77.53 | 77.94 | 78.44 | 78.87 | 0.41 | 0.91 | 1.34 |
| Plantation Road | 8+00 | 78.21 | 77.29 | 77.87 | 78.30 | -0.92 | -0.34 | 0.09 |
| W151 | 15+35 | 79.14 | 76.61 | 77.33 | 78.01 | -2.53 | -1.81 | -1.13 |
| Holly Ridge Drive | 24+35 | 78.62 | 76.98 | 77.55 | 78.06 | -1.64 | -1.07 | -0.56 |
| Memorial City Way | 28+50 | 79.05 | 77.03 | 77.60 | 78.12 | -2.02 | -1.45 | -0.93 |
| Riedel Drive | 31+75 | 79.37 | 77.02 | 77.60 | 78.15 | -2.35 | -1.77 | -1.22 |
| Barracuda Court | 35+50 | 78.25 | 76.91 | 77.30 | 77.73 | -1.34 | -0.95 | -0.52 |
| Dolphin Court | 38+65 | 77.62 | 76.91 | 77.29 | 77.73 | -0.71 | -0.33 | 0.11 |
| Bunker Hill Road | 41+75 | 77.42 | 76.90 | 77.27 | 77.71 | -0.52 | -0.15 | 0.29 |

*From RDS InfoWorks SD model

The failure to meet the minimum COH criteria along with the roll that Barryknoll plays in a regional drainage improvement solution, were considered the critical factors that warranted an improvement project for the Barryknoll Lane storm sewer. **Appendix C.3** includes the 100-year analysis for Barryknoll Lane in greater detail.

### 3.4 Recommended Drainage Improvements

The proposed roadway for Barryknoll will be improved with grades that conform to the current City standards, and will generally be at the same level as the current roadway. The existing ROW on the north side is higher than the south side therefore to provide a consistent roadway cross-section with consistent cross-slopes, the curb will generally be lowered on the north side of Barryknoll, and raised on the south side of Barryknoll. The roadway pavement cross-section will still be below ROW elevations to allow positive drainage into the roadway. This modification to the roadway section is intended to maintain existing overland flow patterns leaving the project area. The lowest existing roadway elevations are located at Bunker Hill and an area just east of Gessner. The Bunker Hill area is at an intersection, therefore these grades cannot be adjusted, however there are options of reducing the ponding depths just east of Gessner that are discussed in the Roadway section. Refer to **Exhibits 3.4 through 3.6** for the Proposed Drainage Areas Maps.

Initially the proposed HCFCD improvements were added to the storm sewer system and analyzed using HouStorm, and evaluated within the RDS. With the existing 60-inch RCP and proposed 9'x5' RCB west of W151-00-00 a composite box size of 13'x5' RCB was used to represent this combined system. East of W151-00-00 the proposed 2-10'x6' RCB's replace the existing storm sewer trunk line. Based on a review of the available space within the ROW these proposed improvements were found to create construction problems where 1-lane of traffic could not be maintained. Therefore, to maximize the available space for drainage and leave just enough room for the proposed and existing utilities along with traffic control the following improvements are recommended.

- 2-9'x5' RCB to replace the existing 60-inch RCP from Gessner to the existing north/south 8' x 5' RCB at W151-00-00, approximately 850-ft of the existing 60-inch RCP will remain in place to serve the commercial areas west of Plantation..

- 2-8'x6' RCB to replace the 72-inch to 48-inch storm sewer from W151-00-00 east to Bunker Hill.

- Future – Minimum 9'x6' RCB outfall at Bettina that diverts storm water east of W151-00-00 south away from W151-00-00 and drains it south to the lower reaches of W151-00-00 that are just north of Buffalo Bayou. Flow to the existing 10'x8' box culvert from east side of W151 at Barryknoll would be blocked after completion of this diversion.

**Table 3.4 – Proposed Hydraulic Data**

| Location | | Gutter | MPE | Proposed HGL (ft)* | | | Difference (ft)** | | |
|---|---|---|---|---|---|---|---|---|---|
| Description | Station | Elev | Elev | 2-YR | 10-YR | 100-YR | 2-YR | 10-YR | 100-YR |
| Gessner Road | 1+50 | 77.39 | 78.32 | 77.61 | 78.31 | 78.80 | 0.22 | -0.01 | 0.48 |
| Near Office Complex | 5+00 | 77.40 | 77.53 | 77.53 | 78.22 | 78.70 | 0.13 | 0.69 | 1.17 |
| Plantation Road | 8+00 | 78.00 | 78.21 | 77.42 | 78.06 | 78.50 | -0.58 | -0.15 | 0.29 |
| W151 | 15+35 | 78.22 | 79.14 | 76.81 | 77.49 | 78.09 | -1.41 | -1.65 | -1.05 |
| Holly Ridge Drive | 24+35 | 77.12 | 78.62 | 76.96 | 77.53 | 78.08 | -0.16 | -1.09 | -0.54 |
| Memorial City Way | 28+50 | 77.55 | 79.05 | 76.96 | 77.53 | 78.08 | -0.59 | -1.52 | -0.97 |
| Riedel Drive | 31+75 | 77.87 | 79.37 | 76.95 | 77.53 | 78.07 | -0.92 | -1.84 | -1.30 |
| Barracuda Court | 35+50 | 76.75 | 78.25 | 76.94 | 77.50 | 78.03 | 0.19 | -0.75 | -0.22 |
| Dolphin Court | 38+65 | 76.47 | 77.62 | 76.94 | 77.50 | 78.03 | 0.47 | -0.12 | 0.41 |
| Bunker Hill Road | 41+75 | 76.58 | 77.42 | 76.94 | 77.49 | 78.03 | 0.36 | 0.07 | 0.61 |

*From RDS InfoWorks SD model
** 2-yr Difference based on Gutter, and 10- and 100-yr based on MPE

An analysis of the proposed improvements with HouStorm shows that the proposed system will improve the 2-year HGL by 0.6-ft at Gessner Road. Based on the estimated combined 2-year flows of 608 cfs into W151-00-00, the tailwater in W151-00-00 is estimated based on normal depth to be at an elevation of approximately 76.21-ft. This tailwater elevation is only 0.4-ft below the lowest gutter elevations located at the intersection of Bunker Hill and Barryknoll, thus there is only 0.4-ft of hydraulic head loss available for the storm sewer system between Bunker Hill west to W151-00-00. This results in the need for 2-8'x6'RCB's that limit head losses. LAN looked at 2-10'x6' RCB's as recommended, however there is insufficient room to construct this size and maintain traffic, and adjust utilities. With the proposed 2-8'x6' RCB's in place the 2-year HGL will still exceed the lowest gutter elevations at Bunker Hill by 0.50-ft. A 9'x6' stub out is proposed at Betina that will facilitate a future storm sewer south to Buffalo Bayou that will ultimately provide significant relief and bring the area in compliance with 2-year criteria. At W151-00-00 parallel north/south 5' wide by 8' tall box culverts are proposed within the Barryknoll right-of-way to facilitate a secondary option to upgrade the W151 channel by HCFCD if proposed Strey Lane improvements are not implemented (Betina Outfall). The drainage easement south is 50-ft wide with the existing 10'x8' box culvert is at the center of this ROW. Adding an additional parallel box culvert on each side allows the existing 10'x8' RCB that drains Memorial City Mall to stay in place. Utilizing these culverts would be a secondary option if the Bettina outfall does not get implemented due to partnering issues, and these culverts could be extended south to the improved W151 channel sometime in the future. In the interim, these culverts will provide storage, and will be means to regulate flows into the existing 10'x8' RCB.

Results from the RDS study show the following results based on the Barryknoll improvements only, and with additional future downstream improvements as shown below.

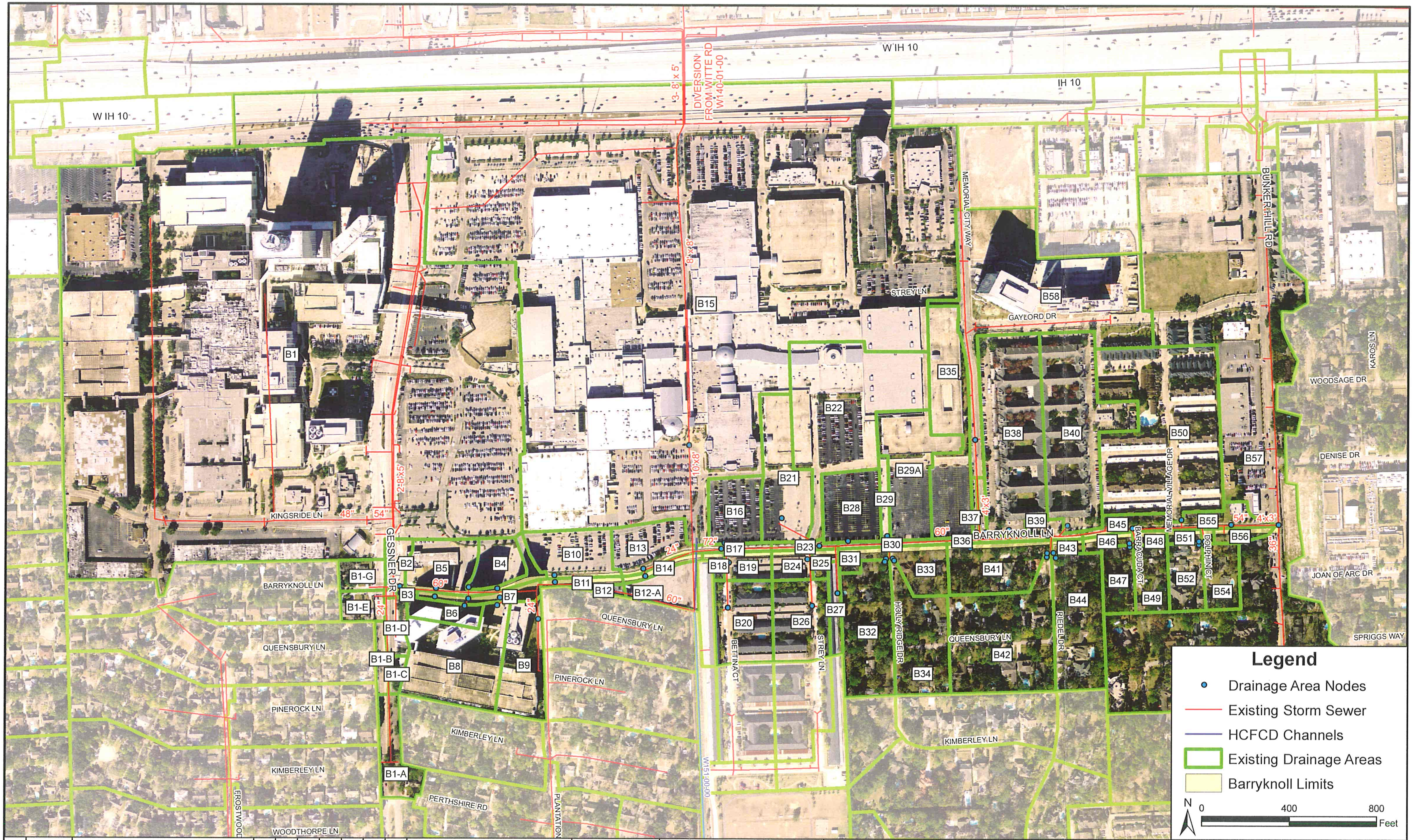
Other storm sewer improvements identified in the storm sewer analysis of Barryknoll Lane include:

- Replace existing 18-inch storm sewer lateral at Memorial City Mall parking area near STA 5+00 with a 24-inch inlet lead
- Replace existing 12-inch storm sewer lateral at Memorial City Mall parking area at Bettina Ct with a 24-inch inlet lead.
- Replace existing 36-inch storm sewer lateral at Memorial City Mall driveway at Strey Lane with a 36-inch storm sewer lowered to match proposed box.
- Replace existing 12-inch storm sewer at Memorial City Mall driveway at Holly Ridge Dr. with a 30-inch RCP
- Replace the existing 4'x3' RCB at Memorial City Way with a lowered 4'x3' RCB to match the proposed box.
- Replace existing pipe leads to existing roadside ditches at Riedel Dr., Barracuda, and Dolphin Ct. with 24-inch pipe leads and adjust existing roadside ditch and adjacent driveway culverts as necessary to accommodate the additional ditch depth required.
- Upgrade the current 24-inch RCP lateral at Riedel Dr. to a 30-inch RCP.

The 100-yr analysis also shows a significant improvement. However, as required for the interim conditions, the proposed main trunk line storm sewer improvements will be restricted to maintain flows to W151-00-00 (existing 10'x8' RCB) until additional channel conveyance capacity is added downstream of the project south to Buffalo Bayou. Therefore; with the restrictions (interim brick plugs) there is no excess capacity for a 100-yr event based on the HouStorm analysis. The RDS 2D surface flow modeling shows that 100-yr sheet flows are not changed significantly in the area with this project alone as the restrictors force the HGL and ponding levels almost as high as current conditions in some locations, however the HGL's are relatively flat due to the larger box culverts within the Barryknoll ROW.

In regards to available storm water storage within the proposed drainage system, approximately 1,300-feet of 2-9' x 5' box culvert is proposed to provide additional 1.7 ac-ft of storage (in-line detention) west of W151-00-00, and approximately 2,640-feet of 2-8'x6' box culvert is proposed west of W151-00-00 for an estimate 5.8 ac-ft of storage, as proposed in the HCFCD study. The total inline storage volume is estimated at 7.5 ac-ft. These improvements will decrease the frequency of Barryknoll Lane flooding and increase the capacity of the Barryknoll Lane storm sewer system. The existing storm sewer along Barryknoll Lane will remain in place west of W151-00-00 to serve the commercial areas west of Plantation, and interconnect to the proposed additional box culverts via lateral pipes just east of Plantation. East of W151-00-00 the existing storm sewer will be replaced by the proposed dual box culverts. A condition assessment is recommended to be conducted in Phase II to confirm the existing storm sewer condition where it will remain in place. The proposed improvements will improve the storm sewer system to a 2-year level of service.

This recommendation is considered optimal based on benefit, cost and constructability. Adding the proposed box culverts addresses both the sheetflow and ponding issues on Barryknoll Lane as well as Barryknoll Lane's need for pavement and infrastructure improvements. With these improvements in place, there are two options available for future relief downstream of the project by either Betina/Strey Lane, or at W151 depending on future projects outside the TIRZ 17 boundaries. Additional detention has been looked at within parking areas within the project area. It has been found that detention alone produces minimal drainage improvement in the area. Future relief south of the project to provide additional conveyance to Buffalo Bayou is the most cost effective. As the RDS is ongoing, the proposed drainage improvements may change during subsequent phases of the project. For example; if one of the bypass routes is approved before bidding and construction of the Barryknoll project then it is possible to reduce the proposed storm sewer planned for Barryknoll from 2-8'x6' RCB's to a minimum of 1-9'x6' RCB and ultimately save money on this portion of the project. Therefore, these recommendations may need some modification in subsequent design phases based on any changes to partnering agreements, or other considerations. Any of these potential changes can be accommodated within the design phase of the project.

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Engineer: Brian R. Whitney, P.E.
P.E. Serial No.: 81591
Firm: Lockwood, Andrews, and Newnam, Inc.
Firm No.: F-2614
Date: 7/21/2011

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|---|---|
| C.P.F. DRN BY | 07/21/2011 DATE |
| B.R.W. DRN CKD BY | 07/21/2011 DATE |
| M.J.M. DES BY | 07/21/2011 DATE |
| B.R.W. DES CKD BY | 07/21/2011 DATE |
| APPROVED BY | DATE |

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# EXHIBIT 3.1 - OVERALL EXISTING DRAINAGE AREA MAP BARRYKNOLL

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Firm No.: F-2614
Date: 7/21/2011

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| B.R.W. (DRN CKD BY) | 07/21/2011 (DATE) |
| M.J.M. (DES BY) | 07/21/2011 (DATE) |
| B.R.W. (DES CKD BY) | 07/21/2011 (DATE) |
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# EXHIBIT 3.2 - EXISTING DRAINAGE AREA MAP (WEST) BARRYKNOLL

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Firm No.: F-2614
Date: 7/21/2011

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# EXHIBIT 3.3 - EXISTING DRAINAGE AREA MAP (EAST) BARRYKNOLL

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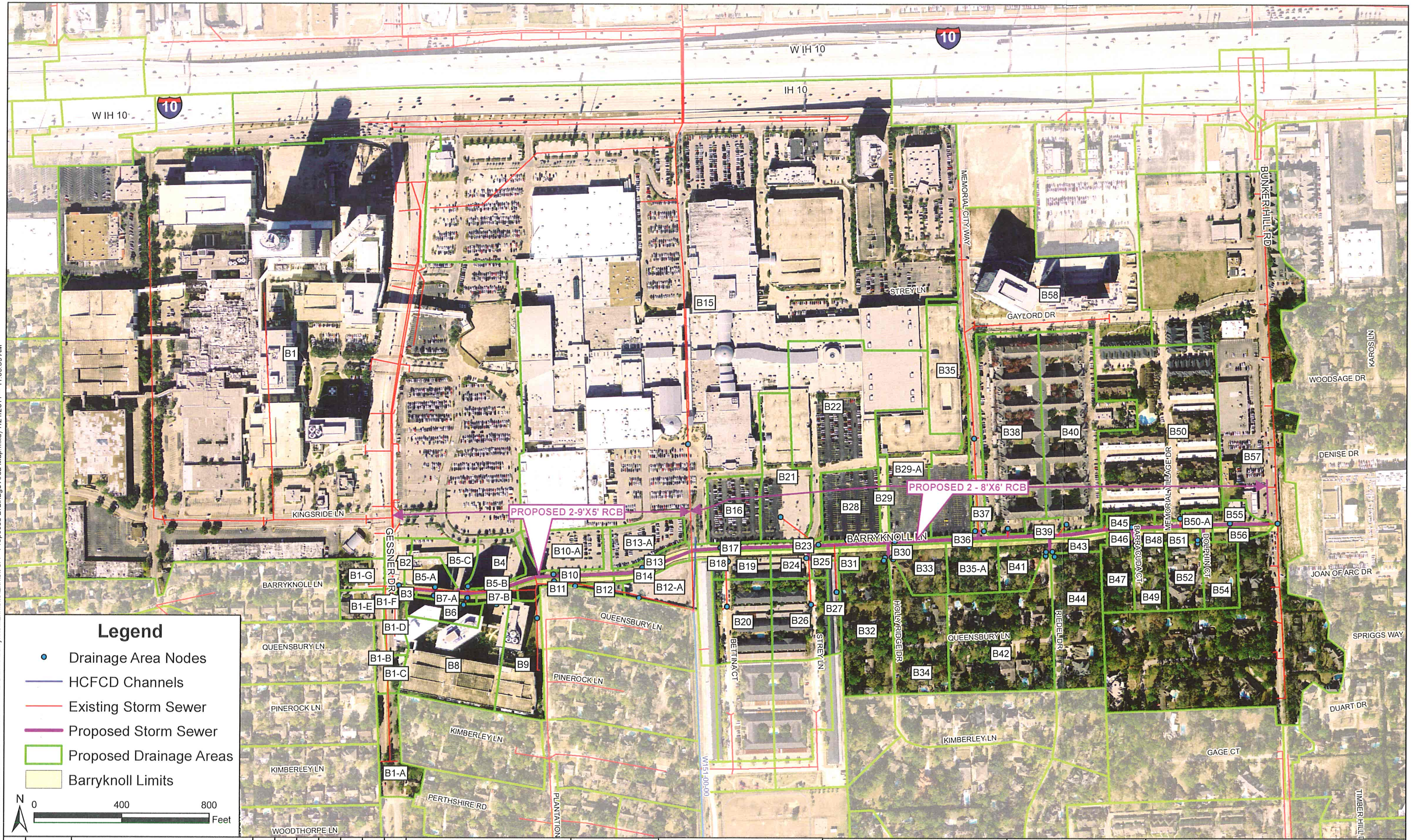


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# EXHIBIT 3.4 - PROPOSED DRAINAGE AREA MAP (OVERALL) BARRYKNOLL

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| M.J.M. DES BY | 07/21/2011 DATE |
| B.R.W. DES CKD BY | 07/21/2011 DATE |
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# EXHIBIT 3.5 - PROPOSED DRAINAGE AREA MAP (WEST) BARRYKNOLL

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# EXHIBIT 3.6 - PROPOSED DRAINAGE AREA MAP (EAST) BARRYKNOLL

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Date: 7/21/2011

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| APPROVED BY | DATE |

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# EXHIBIT 3.7 - SHEET FLOW AND PONDING MAP BARRYKNOLL

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# 4.0 TRAFFIC ANALYSIS

## 4.1 Area Conditions

LAN conducted a field visit on April 28, 2011 to collect signalized intersections data, roadway geometry, signing and striping, traffic operations data, and traffic control features. Figure 1 provides a summary of existing area conditions.

### 4.1.1 Existing Traffic Volumes

24-hour traffic volume data was collected on May 4, 2011 and May 7, 2011. Traffic volume data was collected over a continuous 24-hour period using Automated Traffic Recorders (ATRs) at the following locations:

- NB Gessner Rd South of Barryknoll Ln
- SB Gessner Rd North of Barryknoll Ln
- EB Barryknoll Ln West of Gessner Rd
- WB Barryknoll Ln East of Gessner Rd
- NB Plantation Rd South of Barryknoll Ln
- SB Plantation Rd North of Barryknoll Ln
- EB Barryknoll Ln West of Plantation Road
- WB Barryknoll Ln East of Plantation Rd
- SB Memorial City Way North of Barryknoll Ln
- EB Barryknoll Ln Between Plantation Rd and Memorial City Way
- EB Barryknoll Ln West of Memorial City Way
- WB Barryknoll Ln East of Memorial City Way
- NB Bunker Hill Rd South of Barryknoll Ln
- SB Bunker Hill Rd North of Barryknoll Ln
- EB Barryknoll Ln West of Bunker Hill Rd

24-hour traffic volume data was used in determining the weekday AM, weekday PM and weekend peak hour periods. The weekday AM peak hour period was determined to occur between 7:30 AM and 8:30 AM. The weekday PM peak hour period was determined to occur between 5:00 PM and 6:00 PM. The weekend peak hour period was determined to occur between 12:45 PM and 1:45 PM. A summary of this calculation can be found in Appendix D.

TMC's were collected on May 4, 2011 and May 14, 2011. TMC's were used to determine peak hour volumes and quantify existing conditions. TMC's were collected during the weekday AM, weekday PM and weekend peak hour periods at the following signalized intersections and are presented in **Exhibit 4.2** of this report:

- Barryknoll Lane and Gessner Road
- Barryknoll Lane and Plantation Road
- Barryknoll Lane and Memorial City Way
- Barryknoll Lane and Bunker Hill Road

### 4.1.2 Existing Pedestrian Volumes

Existing pedestrian volumes were also collected on May 4, 2011 and May 14, 2011. Existing pedestrian volumes were collected during the weekday AM, weekday PM and weekend peak hour periods at major intersections along the study corridor. Pedestrian volumes were considered in this traffic study and were used in the evaluation of different corridor alternatives.

### 4.1.3 Existing Traffic Signal Timings

Timings for signalized intersections were provided by City of Houston (COH). **Table 4.1** and **Table 4.2** present a summary of signal operations for signalized intersections within the study corridor.

**Table 4.1 - Traffic Signals Operations Summary during the AM and PM Peak Periods**

| Intersection | Type | Cycle Length (Seconds) | Offset (Seconds) | Reference |
|---|---|---|---|---|
| Barryknoll Lane and Gessner Road | Actuated Coordinated | 120 | 7 | Barrier b |
| Barryknoll Lane and Plantation Road | Semi-Actuated Coordinated | 60 | 25 | Barrier a |
| Barryknoll Lane and Memorial City Way | Actuated Coordinated | 60 | 55 | Barrier a |
| Barryknoll Lane and Bunker Hill Road | Actuated Coordinated | 60 | 55 | Barrier b |

**Table 4.2 - Traffic Signals Operations Summary During the Weekend Peak Period**

| Intersection | Type | Cycle Length (Seconds) | Offset (Seconds) | Reference |
|---|---|---|---|---|
| Barryknoll Lane and Gessner Road | Actuated Coordinated | 120 | 7 | Barrier b |
| Barryknoll Lane and Plantation Road | Semi-Actuated Coordinated | 45 | 12 | Barrier a |
| Barryknoll Lane and Memorial City Way | Actuated Coordinated | 45 | 10 | Barrier a |
| Barryknoll Lane and Bunker Hill Road | Actuated Coordinated | 45 | 15 | Barrier b |

All signalized intersections along the study corridor are actuated coordinated. Barryknoll Lane at Gessner Road and Barryknoll Lane at Bunker Hill Road are coordinated in the North-South direction. Barryknoll Lane at Plantation Road and Barryknoll Lane at Memorial City Way are coordinated in the East-West direction.

### 4.1.4 Transit Service

METRO Bus Route 70 provides service between Downtown Houston, Memorial City Hospital, Memorial City Shopping Center and Memorial Park. METRO Bus Route 70 enters the study corridor at Barryknoll Lane and Bunker Hill Road and exits at Barryknoll Lane and Gessner

Road. Bus stops along the study corridor include one major bus stop with scheduled layovers located on southbound Barryknoll Lane North of Bunker Hill Road, and four bus stops with unscheduled layovers, located at:

1. Barryknoll Lane and Dolphin Court
2. Barryknoll Lane and Memorial City Way
3. Barryknoll Lane and Bettina Court
4. Barryknoll Lane and Plantation Road

METRO bus service on Route 70 operates on weekdays only. Bus Route 70 operates on an average headway of 40 minutes. As a result, it was determined that METRO bus service does not impact the performance of the study corridor to a degree that merits consideration in this traffic analysis.


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Engineer: THOMAS D. DUNCAN, P.E.
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Firm No.: F-2614
Date: 7/13/2011

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| AH DES BY | 07/14/2011 DATE |
| TD DES CKD BY | 07/14/2011 DATE |
| APPROVED BY | DATE |

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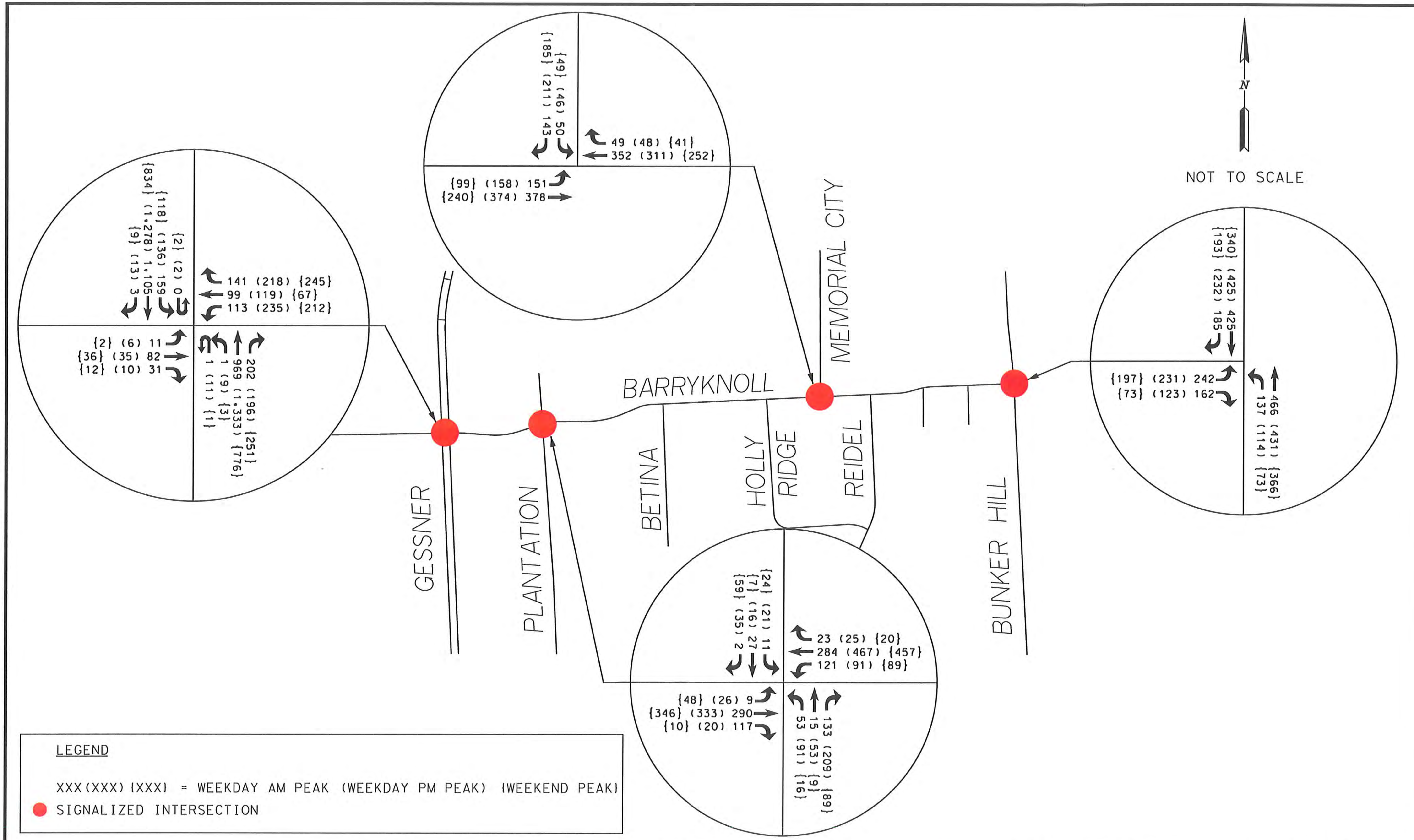
# EXHIBIT 4.1
## BARRYKNOLL LANE PRELIMINARY ENGINEERING STUDY TRAFFIC ANALYSIS EXISTING AREA CONDITIONS

CONTRACT NO. DRAWING NO. REV.

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Engineer: Thomas D. Duncan, P.E.
P.E. Serial No.: 98353
Firm: Lockwood, Andrews & Newnam Inc.
Firm No.: F-2614
Date: 11/2/2011

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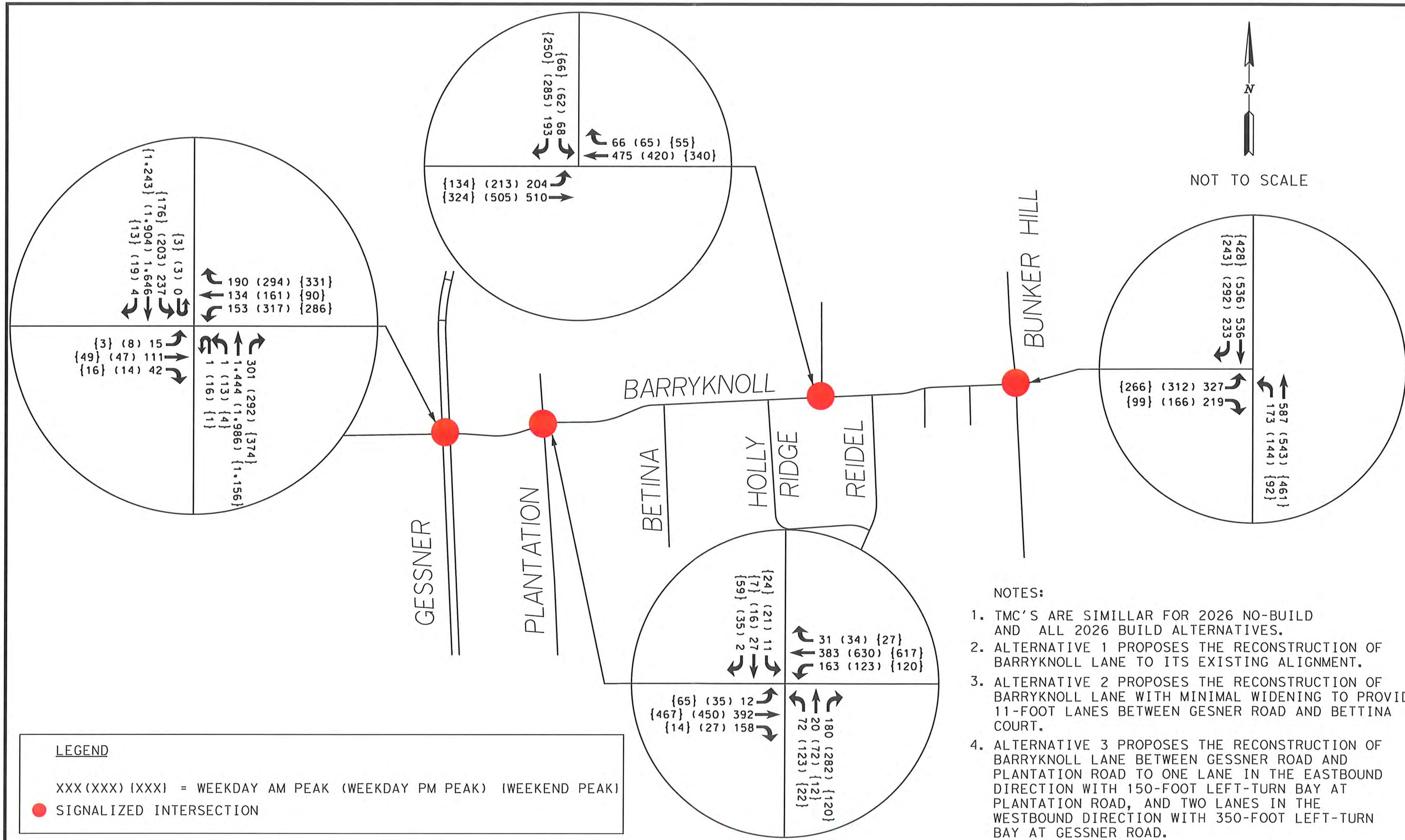
| A.E.H. DRN CKD BY | 11/2/2011 DATE |
| A.E.H. DES BY | 11/2/2011 DATE |
| T.D. DES CKD BY | 11/2/2011 DATE |
| APPROVED BY | DATE |
| SCALE: AS SHOWN | |

BARRYKNOLL LANE

EXHIBIT 4.2
BARRYKNOLL TMCs
EXISTING (YEAR 2011) COUNTS

CONTRACT NO. | DRAWING NO. | REV.

11/2/2011 10:06:21 AM L:\12021\4\120-10308-000\545\4-0-Production\4-06-Ref-Studies-Reports\by\LAN\TRAFFIC\Exhibits\TMC's\Barryknoll TMCs Existing.dgn




LEGEND

XXX (XXX) {XXX} = WEEKDAY AM PEAK (WEEKDAY PM PEAK) {WEEKEND PEAK}

● SIGNALIZED INTERSECTION

NOTES:

1. TMC'S ARE SIMILLAR FOR 2026 NO-BUILD AND ALL 2026 BUILD ALTERNATIVES.
2. ALTERNATIVE 1 PROPOSES THE RECONSTRUCTION OF BARRYKNOLL LANE TO ITS EXISTING ALIGNMENT.
3. ALTERNATIVE 2 PROPOSES THE RECONSTRUCTION OF BARRYKNOLL LANE WITH MINIMAL WIDENING TO PROVIDE 11-FOOT LANES BETWEEN GESSNER ROAD AND BETTINA COURT.
4. ALTERNATIVE 3 PROPOSES THE RECONSTRUCTION OF BARRYKNOLL LANE BETWEEN GESSNER ROAD AND PLANTATION ROAD TO ONE LANE IN THE EASTBOUND DIRECTION WITH 150-FOOT LEFT-TURN BAY AT PLANTATION ROAD, AND TWO LANES IN THE WESTBOUND DIRECTION WITH 350-FOOT LEFT-TURN BAY AT GESSNER ROAD.

| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
|---|---|---|---|---|---|---|---|---|---|

Lockwood, Andrews & Newnam, Inc.
A LEO A DALY COMPANY

TIRZ 17 REDEVELOPMENT AUTHORITY

DRAFT

INTERIM REVIEW ONLY
Document incomplete: not intended for permit, bidding or construction.
Engineer: Thomas D. Duncan, P.E.
P.E. Serial No.: 98353
Firm: Lockwood, Andrews & Newnam Inc.
Firm No.: F-2614
Date: 11/2/2011

| | |
|---|---|
| A.E.H. DRN BY | 11/2/2011 DATE |
| A.E.H. DRN CKD BY | 11/2/2011 DATE |
| A.E.H. DES BY | 11/2/2011 DATE |
| T.D. DES CKD BY | 11/2/2011 DATE |
| APPROVED BY | DATE |
| SCALE: AS SHOWN | |

BARRYKNOLL LANE

EXHIBIT 4.3
BARRYKNOLL TMCs
2026 NO BUILD / BUILD
ALTERNATIVES 1, 2 AND 3

CONTRACT NO. | DRAWING NO. | REV.

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## 4.2 Area Conditions

In order to examine future traffic conditions, existing traffic was collected for year 2011 and projected to build year 2026. Traffic growth was determined by analyzing forecasted daily traffic volumes obtained from the Houston-Galveston Area Council's Regional Traffic Models for years 2009 and 2035. The annualized growth rates were determined for the northbound and southbound direction of Gessner Road and Bunker Hill Road. The greater value of the northbound and the southbound annualized growth rates were then applied to the corresponding traffic volumes in both directions. Traffic growth rates along Barryknoll Lane, Plantation Road and Memorial City Way were determined by computing the average of growth rates determined for Gessner Road and Bunker Hill Road. **Table 4.3** summarizes the growth rates used in this study. **Exhibit 4.3** summarizes the study year 2026 traffic volumes used in this analysis.

**Table 4.3 - Growth Rates**

| Road Direction | Calculated Annualized Growth Rate (%) | Proposed Annualized Growth Rates (%) |
|---|---|---|
| Eastbound Barryknoll Lane | - | 2.0 |
| Westbound Barryknoll Lane | - | 2.0 |
| Northbound Gessner Road | 2.4 | 2.7 |
| Southbound Gessner Road | 2.7 | 2.7 |
| Northbound Bunker Hill Road | 1.4 | 1.5 |
| Southbound Bunker Hill Road | 1.5 | 1.5 |
| Barryknoll Lane | - | 2.0 |
| Plantation Road | - | 2.0 |
| Memorial City Way | - | 2.0 |

Measures of Effectiveness (MOEs) were calculated for all signalized intersections for each scenario. MOEs included: approach delay, approach LOS, intersection delay and intersection level of service (LOS). Since it was necessary to look at the performance of individual intersections, MOEs were calculated that represent standard indices for gauging the performance of intersections. Traditionally, this is accomplished through the evaluation of Level of Service (LOS). The *Highway Capacity Manual 2000 (HCM 2000)* contains analysis procedures that provide meaningful measures of effectiveness concerning capacity, average control delay and LOS.

Intersection LOS is defined in terms of delay, which is a direct and/or indirect measure of driver discomfort, frustration, fuel consumption, and increased travel time. The LOS standards have been established based on driver acceptability of various delays at signalized and unsignalized intersections; delay for each approach lane group is calculated based on a number of factors including lane geometrics, percentage of trucks, peak hour factor, number of lanes, volume, roadway grades, parking conditions and pedestrian flows.

This analysis was performed using the procedures set forth in the HCM 2000 edition. The HCM 2000 uses the criteria of average control delay which includes initial deceleration, delay in queue, queue move-up time, stopped delay and final acceleration delay. The City of Houston Infrastructure Design Manual states that, "The need for mitigation is determined by using the qualitative measure Level of Service (LOS). The threshold for significance for transportation facilities on the area street system is LOS D." **LOS D is considered acceptable for this study.** **Table 4.4** summarizes the LOS for different levels of average control delay and a qualitative description.

**Table 4.4 - LOS Criteria for Signalized and Unsignalized Intersections**

| LOS | Control Delay - Signalized Intersections | LOS Description |
|---|---|---|
| **A** | ≤10 | Few or no delays |
| **B** | > 10 and < 20 | Short traffic delays |
| **C** | > 20 and < 35 | Average traffic delays |
| **D** | > 35 and < 55 | Long traffic delays |
| **E** | > 55 and < 80 | Very long traffic delays |
| **F** | > 80 | Extreme traffic delays with intersection capacity exceeded |

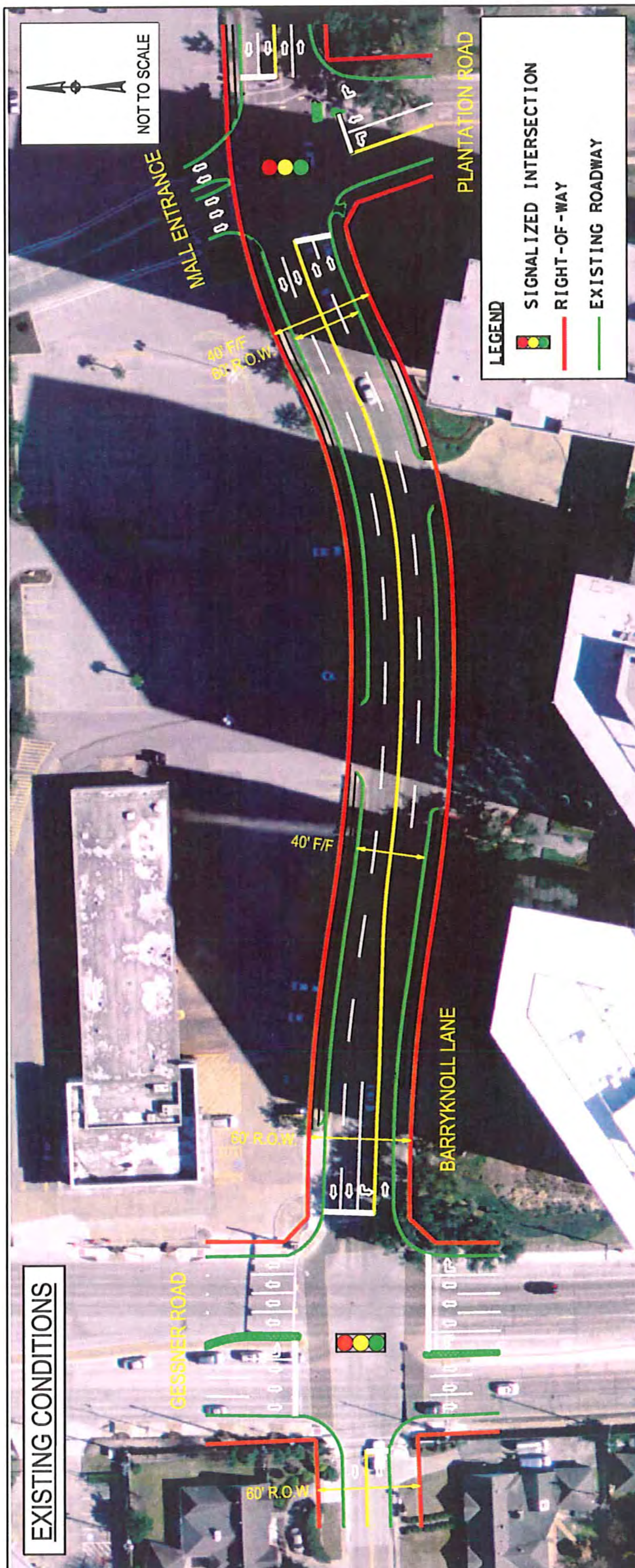
### 4.3 Results and Analysis

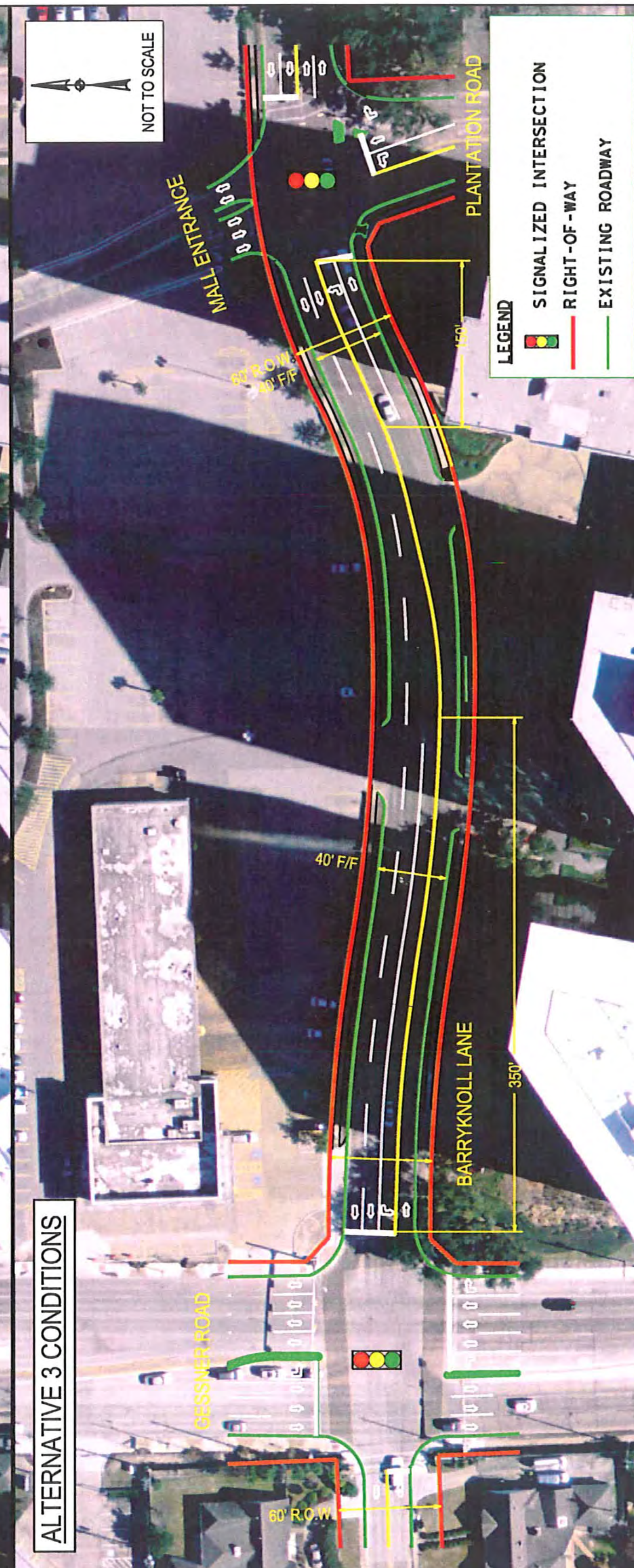
Three alternatives were evaluated as part of this study. Alternative 1 proposes the reconstruction of Barryknoll Lane between Gessner Road and Bunker Hill Road to its existing alignment. Alternative 1 also proposes the extension of the sidewalk on the South side of Barryknoll Lane from the southeast corner of Barryknoll Lane and Plantation Road to the southeast corner of Barryknoll Lane and Bunker Hill Road. Alternative 1 does not affect the traffic operations along Barryknoll Lane; therefore the results and analysis for Alternative 1 are identical to the results and analysis for the No-Build conditions. Alternative 2 proposes the reconstruction of Barryknoll Lane with minimal widening to provide four 11-foot lanes between Gessner Road and Bettina Court. Alternative 3 is a modified alignment of Alternative 2 based on the recommendations provided in this analysis. Exhibit 4.4 presents the lanes rearrangement of Barryknoll Lane between Gessner Road and Plantation Road as proposed by Alternative 3. Overall, fifteen scenarios were analyzed for this study:

1. Existing AM Peak Hour Period
2. Existing PM Peak Hour Period
3. Existing Weekend Peak Hour Period
4. No-Build AM Peak Hour Period
5. No-Build PM Peak Hour Period
6. No-Build Weekend Peak Hour Period
7. Build Alt 1 AM Peak Hour Period
8. Build Alt 1 PM Peak Hour Period
9. Build Alt 1 Weekend Peak Hour Period
10. Build Alt 2 AM Peak Hour Period
11. Build Alt 2 PM Peak Hour Period
12. Build Alt 2 Weekend Peak Hour Period
13. Build Alt 3 AM Peak Hour Period
14. Build Alt 3 PM Peak Hour Period
15. Build Alt 3 Weekend Peak Hour Period

### 4.3.1 Delay and LOS Analysis

Approach delay, approach LOS, intersection delay and intersection LOS were calculated for all major intersections along the study corridor for Existing year 2011, No-Build year 2026, Alternative 1 Build year 2026, Alternative 2 Build year 2026 and Alternative 3 Build year 2026. **Tables 4.5** through **4.8** present a summary of measures of effectiveness for the study intersections.

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# BARRYKNOLL LANE PER

TRAFFIC ANALYSIS

EXISTING CONDITIONS / ALTERNATIVE 3 CONDITIONS
BETWEEN GESSNER ROAD AND PLANTATION ROAD

EXHIBIT

4.4

#### 4.3.1.1 Existing (Year 2011) Conditions

All intersections operate at acceptable LOS during the weekday AM, weekday PM and weekend peak hour periods. Intersection approaches also operate at acceptable LOS during the weekday AM, weekday PM and weekend peak hour periods with the exception of the eastbound approach of Barryknoll Lane at Gessner Road. This approach LOS is E during the weekday AM, weekday PM and weekend peak hour periods with approach delays of 55.9, 62.5 and 65.5 seconds, respectively. Traffic queues during the weekday AM and the weekday PM peak hour periods were observed on the eastbound and westbound approaches of Barryknoll Lane at Gessner Road. These traffic queues are primarily caused by the operation of the traffic signal providing more green time to the major North-South movement along Gessner Road. Traffic queues on westbound Barryknoll Lane at Gessner road extend beyond Plantation road during the weekday PM and the weekend peak hour periods. This excessive queuing is caused by the heavy volume of westbound-left movement vehicles (235 vehicles during the weekday PM peak hour period and 212 vehicles during the weekend peak hour period) and the undersized corresponding left-turn storage bay. Vehicles making a left-turn from westbound Barryknoll Lane to southbound Gessner Road were observed to extend beyond the 100-foot left-turn bay and interrupt the flow of vehicles in the westbound-through direction.

**Table 4.5 - Existing Year 2011 Conditions MOE's**

| Intersection | Intersection Control | Approach | Existing 2011 Weekday AM Peak | | | | Existing 2011 Weekday PM Peak | | | | Existing 2011 Weekend Peak | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | HCM Approach Delay | HCM Approach LOS | HCM Intersection Average Control Delay | HCM Intersection LOS | HCM Approach Delay | HCM Approach LOS | HCM Intersection Average Control Delay | HCM Intersection LOS | HCM Approach Delay | HCM Approach LOS | HCM Intersection Average Control Delay | HCM Intersection LOS |
| Barryknoll Lane @ Gessner Road | Signalized | EB | 55.9 | E | 22.3 | C | 62.5 | E | 24.7 | C | 56.5 | E | 22.7 | C |
| | | WB | 46.9 | D | | | 48.6 | D | | | 47.4 | D | | |
| | | NB | 19.9 | B | | | 21.4 | C | | | 17.2 | B | | |
| | | SB | 14.4 | B | | | 17.4 | B | | | 13.4 | B | | |
| Barryknoll Lane @ Plantation Road | Signalized | EB | 1.9 | A | 6.7 | A | 2.9 | A | 8.9 | A | 2.6 | A | 5.8 | A |
| | | WB | 1.5 | A | | | 3.3 | A | | | 3.4 | A | | |
| | | NB | 24.4 | C | | | 22.1 | C | | | 18.6 | B | | |
| | | SB | 24.5 | C | | | 21.2 | C | | | 18.9 | B | | |
| Barryknoll Lane @ Memorial City Way | Signalized | EB | 3.9 | A | 7.1 | A | 3.3 | A | 8.1 | A | 2.9 | A | 6.1 | A |
| | | WB | 2.8 | A | | | 4.0 | A | | | 0.8 | A | | |
| | | NB | - | - | | | - | - | | | - | - | | |
| | | SB | 24.6 | C | | | 23.5 | C | | | 17.4 | B | | |
| Barryknoll Lane @ Bunker Hill Road | Signalized | EB | 32.2 | C | 13.7 | B | 22.9 | C | 10.6 | B | 15.0 | B | 7.5 | A |
| | | WB | - | - | | | - | - | | | - | - | | |
| | | NB | 8.3 | A | | | 7.4 | A | | | 5.6 | A | | |
| | | SB | 6.8 | A | | | 6.6 | A | | | 5.3 | A | | |

#### 4.3.1.2 No-Build (year 2026) / Alternative 1 (Year 2026) Conditions

Alternative 1 proposes the reconstruction of Barryknoll Lane between Gessner Road and Bunker Hill Road to its existing alignment of 40-foot width (face-of-curb to face-of-curb), striped for two 10-foot lanes in each direction. Alternative 1 also proposes the extension of the sidewalk on the South side of Barryknoll Lane from the southeast corner of Barryknoll Lane and Plantation Road to the southeast corner of Barryknoll Lane and Bunker Hill Road. During year 2026 No-Build and year 2026 Alternative 1 conditions, all intersections continue to operate at acceptable LOS during the weekday AM, weekday PM and weekend peak hour periods. Intersection approaches also operate at acceptable LOS during the weekday AM, weekday PM and weekend peak hour periods with the exception of the eastbound approach of Barryknoll Lane at Gessner Road. The eastbound approach LOS of Barryknoll Lane at Gessner Road remains E during the weekday AM and the weekend peak hour periods with approach delays of 60.2 and 56.8 seconds, respectively, and is reduced to F during the weekday PM peak hour period with an approach delay of 140.2 seconds. Traffic queues on both directions of Barryknoll Lane at Gessner Road increase during the weekday AM and the weekend PM peak hour periods. Westbound left-turn vehicle queues at Barryknoll Lane and Gessner Road continue to extend beyond the left-turn bay during the weekday PM and the weekend peak hour periods causing excessive traffic queues that extend beyond Plantation Road.

**Table 4.6 - No-Build Year 2026 / Alternative 1 Year 2026 MOE's**

| Intersection | Intersection Control | Approach | No-Build 2026 / Build 2026 Alt 1 – Weekday AM Peak: HCM Approach Delay | HCM Approach LOS | HCM Intersection Average Control Delay | HCM Intersection LOS | No-Build 2026 / Build 2026 Alt 1 – Weekday PM Peak: HCM Approach Delay | HCM Approach LOS | HCM Intersection Average Control Delay | HCM Intersection LOS | No-Build 2026 / Build 2026 Alt 1 – Weekend Peak: HCM Approach Delay | HCM Approach LOS | HCM Intersection Average Control Delay | HCM Intersection LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Barryknoll Lane @ Gessner Road | Signalized | EB | 60.2 | **E** | 28.3 | C | 140.2 | **F** | 38.2 | D | 56.8 | **E** | 27.5 | C |
| | | WB | 52.9 | D | | | 43.7 | D | | | 49.2 | D | | |
| | | NB | 29.3 | C | | | 41.4 | D | | | 25.6 | C | | |
| | | SB | 18.5 | B | | | 29.4 | C | | | 17.6 | B | | |
| Barryknoll Lane @ Plantation Road | Signalized | EB | 2.8 | A | 6.9 | A | 2.1 | A | 8.6 | A | 3.6 | A | 6.3 | A |
| | | WB | 2.3 | A | | | 4.1 | A | | | 4.6 | A | | |
| | | NB | 22.8 | C | | | 21.3 | C | | | 17.5 | B | | |
| | | SB | 22.5 | C | | | 19.9 | B | | | 17.6 | B | | |
| Barryknoll Lane @ Memorial City Way | Signalized | EB | 7.3 | A | 9.3 | A | 5.0 | A | 9.4 | A | 3.7 | A | 6.3 | A |
| | | WB | 5.2 | A | | | 6.1 | A | | | 1.5 | A | | |
| | | NB | - | - | | | - | - | | | - | - | | |
| | | SB | 23.3 | C | | | 23.2 | C | | | 16.2 | A | | |
| Barryknoll Lane @ Bunker Hill Road | Signalized | EB | 23.7 | C | 15.4 | B | 20.3 | C | 12.4 | B | 11.3 | B | 9.0 | A |
| | | WB | - | - | | | - | - | | | - | - | | |
| | | NB | 15.5 | B | | | 12.4 | B | | | 8.9 | A | | |
| | | SB | 9.4 | A | | | 9.1 | A | | | 7.8 | A | | |

4.3.1.3 Alternative 2 (Year 2026) Conditions

Alternative 2 proposes the reconstruction of Barryknoll Lane with minimal widening to provide four 11-foot lanes between Gessner Road and Bettina Court. During Alternative 2, the delay at all signalized intersection is either slightly reduced or identical to year 2026 No-Build conditions. All intersections continue to operate at acceptable LOS during the weekday AM, weekday PM and weekend peak hour periods. Intersection approaches also operate at acceptable LOS during the weekday AM, weekday PM and weekend peak hour periods with the exception of the eastbound approach of Barryknoll Lane at Gessner Road. The eastbound approach

LOS of Barryknoll Lane at Gessner Road remains E during the weekday AM and the weekend peak hour periods with approach delays of 60.2 and 56.8 seconds, respectively, and is reduced to F during the weekday PM peak hour period with an approach delay of 140.2 seconds. Other intersection approaches in Alternative 2 operate at either similar or slightly reduced delays. Traffic queues on both directions of Barryknoll Lane at Gessner Road, during the weekday PM and the weekend peak hour periods remain similar to the traffic queues in the No-Build condition. Westbound left-turn vehicle queues at Barryknoll Lane and Gessner Road continue to extend beyond the left-turn bay during the weekday PM and the weekend peak hour periods causing excessive traffic queues that extend beyond Plantation Road.

**Table 4.7 - Alternative 2 Year 2026 MOE's**

| Intersection | Intersection Control | Approach | Build (Alt-2) 2026 Weekday AM Peak | | | | Build (Alt-2) 2026 Weekday PM Peak | | | | Build (Alt-2) 2026 Weekend Peak | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | HCM Approach Delay | HCM Approach LOS | HCM Intersection Average Control Delay | HCM Intersection LOS | HCM Approach Delay | HCM Approach LOS | HCM Intersection Average Control Delay | HCM Intersection LOS | HCM Approach Delay | HCM Approach LOS | HCM Intersection Average Control Delay | HCM Intersection LOS |
| Barryknoll Lane @ Gessner Road | Signalized | EB | 60.2 | E | 28.2 | C | 140.2 | F | 37.1 | D | 56.8 | E | 27.2 | C |
| | | WB | 52.5 | D | | | 43.4 | D | | | 48.1 | D | | |
| | | NB | 29.3 | C | | | 39.6 | D | | | 25.3 | C | | |
| | | SB | 18.4 | B | | | 28.9 | C | | | 17.3 | B | | |
| Barryknoll Lane @ Plantation Road | Signalized | EB | 2.8 | A | 6.8 | A | 2.1 | A | 8.5 | A | 3.5 | A | 6.1 | A |
| | | WB | 2.2 | A | | | 3.9 | A | | | 4.4 | A | | |
| | | NB | 22.8 | C | | | 21.3 | C | | | 17.5 | B | | |
| | | SB | 22.5 | C | | | 19.9 | B | | | 17.6 | B | | |
| Barryknoll Lane @ Memorial City Way | Signalized | EB | 7.3 | A | 9.3 | A | 5.0 | A | 9.4 | A | 3.7 | A | 6.3 | A |
| | | WB | 5.2 | A | | | 6.1 | A | | | 1.5 | A | | |
| | | NB | - | - | | | - | - | | | - | - | | |
| | | SB | 23.3 | C | | | 23.2 | C | | | 16.2 | B | | |
| Barryknoll Lane @ Bunker Hill Road | Signalized | EB | 23.7 | C | 15.4 | B | 20.4 | C | 13.0 | B | 11.3 | B | 9.0 | A |
| | | WB | - | - | | | - | - | | | - | - | | |
| | | NB | 15.5 | B | | | 12.4 | B | | | 8.9 | A | | |
| | | SB | 9.4 | A | | | 9.1 | A | | | 7.8 | A | | |

4.3.1.4 Alternative 3 (Year 2026) Conditions

Alternative 3 is a modified alignment of Alternative 2 based on the recommendations provided in this analysis. Alternative 3 proposes the reconstruction of Barryknoll Lane with minimal widening to provide four 11-foot lanes between Gessner Road and Bettina Court. Alternative 3 also proposes the reconstruction of Barryknoll Lane, between Gessner Road and Plantation Road, to one lane in the eastbound direction with 150-foot left-turn bay at Plantation Road and two lanes in the westbound direction with 350-foot left-turn bay at Gessner Road. During Alternative 3, all intersections continue to operate at acceptable LOS during the weekday AM, weekday PM and weekend peak hour periods. Intersection approaches also operate at acceptable LOS during the weekday AM, weekday PM and weekend peak hour periods with the exception of the eastbound approach of Barryknoll Lane at Gessner Road. The eastbound approach LOS of Barryknoll Lane at Gessner Road remains E during the weekday AM and the weekend peak hour periods with approach delays of 60.2 and 56.8 seconds, respectively, and is reduced to F during the weekday PM peak hour period with an approach delay of 140.2 seconds. The delay on the eastbound approach of Barryknoll Lane at Plantation Road is slightly increased from 2.8 to 4.7 seconds; however, the LOS remains A. This increase in approach delay is due to changing the lane configuration of eastbound Barryknoll Lane at Plantation Road from one through lane and one shared through and left lane to one through lane and one 150-foot left turn bay.

**Table 4.8 - Alternative 3 Year 2026 MOE's**

| Intersection | Intersection Control | Approach | Build (Alt-3) 2026 Weekday AM Peak | | | | Build (Alt-3) 2026 Weekday PM Peak | | | | Build (Alt-3) 2026 Weekend Peak | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | HCM Approach Delay | HCM Approach LOS | HCM Intersection Average Control Delay | HCM Intersection LOS | HCM Approach Delay | HCM Approach LOS | HCM Intersection Average Control Delay | HCM Intersection LOS | HCM Approach Delay | HCM Approach LOS | HCM Intersection Average Control Delay | HCM Intersection LOS |
| Barryknoll Lane @ Gessner Road | Signalized | EB | 60.2 | E | 28.3 | C | 140.2 | F | 37.1 | D | 56.8 | E | 27.2 | C |
| | | WB | 52.5 | D | | | 43.3 | D | | | 48.1 | D | | |
| | | NB | 29.3 | C | | | 39.6 | D | | | 25.3 | C | | |
| | | SB | 18.4 | B | | | 28.9 | C | | | 17.3 | B | | |
| Barryknoll Lane @ Plantation Road | Signalized | EB | 4.7 | A | 7.6 | A | 3.6 | A | 8.9 | A | 4.4 | A | 6.4 | A |
| | | WB | 2.2 | A | | | 3.8 | A | | | 4.3 | A | | |
| | | NB | 22.8 | C | | | 21.3 | C | | | 17.5 | B | | |
| | | SB | 22.5 | C | | | 19.9 | B | | | 17.6 | B | | |
| Barryknoll Lane @ Memorial City Way | Signalized | EB | 6.8 | A | 9.1 | A | 5.7 | A | 9.7 | A | 3.5 | A | 6.3 | A |
| | | WB | 5.2 | A | | | 6.1 | A | | | 1.5 | A | | |
| | | NB | - | - | | | - | - | | | - | - | | |
| | | SB | 23.3 | C | | | 23.2 | C | | | 16.2 | B | | |
| Barryknoll Lane @ Bunker Hill Road | Signalized | EB | 23.0 | C | 15.2 | B | 20.8 | C | 13.1 | B | 11.0 | B | 8.9 | A |
| | | WB | - | - | | | - | - | | | - | - | | |
| | | NB | 15.5 | B | | | 12.4 | B | | | 8.9 | A | | |
| | | SB | 9.4 | A | | | 9.1 | A | | | 7.8 | A | | |

The proposed 350-foot left turn bay on the westbound approach of Barryknoll Lane at Gessner Road allows enough storage length to accommodate for the heavy volumes of vehicles making the westbound left-turn movement, and eliminates the queuing on westbound Barryknoll Lane at Gessner Road.

## 4.4 Recommendations

Due to limited right-of-way, neither the existing conditions nor the study alternatives provide acceptable eastbound approach delay and LOS at Barryknoll Lane and Gessner Road. Delays on eastbound Barryknoll Lane at Gessner Road are primarily caused by the operation of the traffic signal that allocates more green time to the major North-South movement along Gessner Road. Alternative 3 provides a solution for the excessive queue lengths caused by the large volume of vehicles making a left-turn movement from westbound Barryknoll Lane to southbound Gessner Road by providing more storage length. LAN recommends:

1. Maintain traffic signal operations at all signalized intersections similar to existing conditions.
2. Install Alternative 3.
3. Reconstruct Barryknoll Lane with minimal widening to provide four 11-foot lanes between Gessner Road and Bettina Court.
4. Stripe Barryknoll Lane between Gessner Road and Plantation Road to one lane in the eastbound direction with 150-foot left-turn bay at Plantation Road, and two lanes in the westbound direction with 350-foot left-turn bay at Gessner Road.

# 5.0 ROADWAY ASSESSMENT AND RECOMMENDATIONS

## 5.1 Design Criteria

The following publications were referenced for determining key design criteria in developing improvement alternatives to Barryknoll Lane.

- City of Houston Department of Public Works and Engineering *Infrastructure Design Manual*, July 2009.
- City of Houston department of Public Works and Engineering *Standard Construction Details for Wastewater Collections Systems, Water Lines, Storm Drainage and Street Paving*.
- City of Houston Department of Public Works and Engineering *Standard Construction Specifications for Wastewater Collections Systems, Water Lines, Storm Drainage and Street Paving*, dated 2009.
- American Association of State Highway and Transportation Officials (AASHTO*): AASHTO Guide for Design of Pavement Structures*.
- American Association of State Highway and Transportation Officials (AASHTO): *A Policy on Geometric Design of Highways and Streets*, 2004 (Green Book).
- *Texas Manual on Uniform Traffic Control Devices*, 2006.

Geometric design criteria was established based upon the City *Infrastructure Design Manual*. The following is a summary of the geometric design parameters that will be incorporated in this project:

- Design Speed – 35 mph; Posted Speed – 30 mph
- Vertical curves will be used when the algebraic difference in grades exceeds 1 percent
- Crest and sag vertical curves will be designed according to the guidelines in A Policy on Geometric Design of Highways and Streets by AASHTO
- Minimum grades will be 0.30 percent.
- Minimum gradient around intersection turnouts will be 1 percent.
- Pavement headers will be used at the end of all concrete pavements.
- Horizontal dowel bars shall be used when meeting existing concrete pavement that has no exposed steel.
- Minimum cross slope of pavement will be ¼ inch per foot.
- Sidewalks will conform to the latest requirements of the American with Disabilities Act.
- Expansion joints will be placed at a maximum of 80-feet.
- Construction joints will be used when pavement is wider than 24-feet in accordance with City requirements.

## 5.2 Potential Improvement Alternatives

Various roadway alternatives for Barryknoll Lane have been developed based on the findings determined in this study. The drainage analysis recommends large box culverts along the entire Barryknoll alignment, thus, requiring complete pavement reconstruction to improve existing drainage conditions. The City of Houston *Infrastructure Design Manual* requires a design speed of 45 mph for major collectors. The following provides a description of the alternatives considered for roadway design. The impacts to right-of-way, trees, and adjacent development were considered for each option. **Table 5.1** provides a summary of each roadway alignment evaluated.

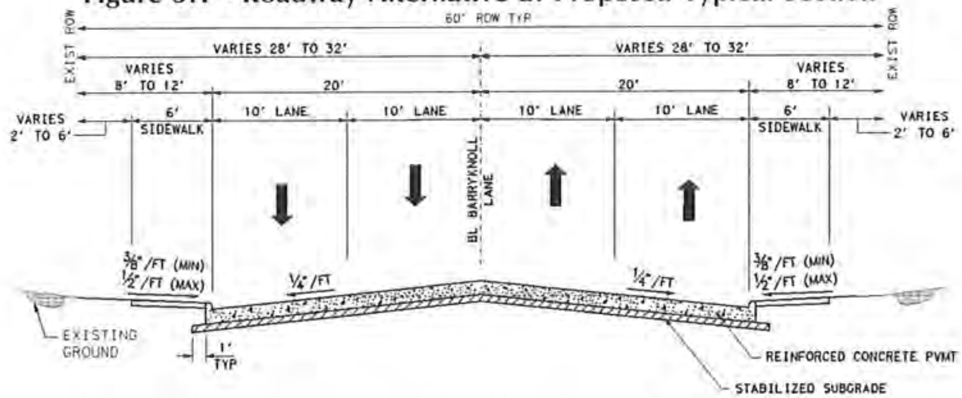
### 5.2.1 Roadway Alternative 1 – 45 mph Design Speed

The first alignment alternative considered was for a 45 mph design speed. This is the only alternative considered which meets the current City of Houston criteria for a major collector. This alternative has the greatest impact on right-of-way, requiring 6,807 square feet (sf) of acquisition. Due to the severe impacts to Memorial City Mall and other adjacent properties, any right-of-way acquisition, other than corner clips, would prove to be cost prohibitive; therefore, this is not considered a reasonable, feasible alternative. See **Appendix E.3.a** - Horizontal Alignment Alternative - 45 mph Design Speed.

### 5.2.2 Roadway Alternative 2 – 35 mph Design Speed with 10-foot Lanes

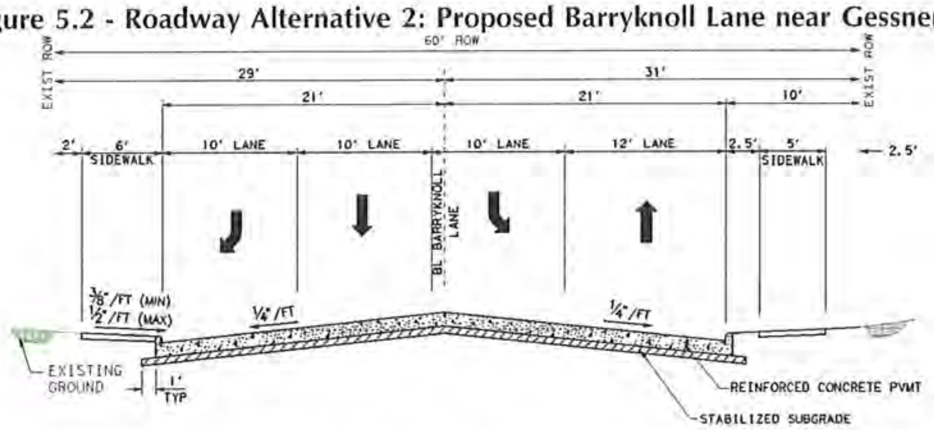
After eliminating the 45 mph design speed alternative, a 35 mph design speed was evaluated. Two alternatives were considered for a 35 mph design speed, both of which would require a design variance from the City of Houston City Engineer for a nonstandard border distance between the curb and right-of-way line. The variance request was prepared and submitted to the City Engineer's Office for approval, see **Appendix E.6**. The first alternative considered would replace the roadway to its existing width of 40-foot, striped for two 10-foot lanes in each direction. Since right-of-way acquisition is not feasible, the border width between the curb and right-of-way line would be decreased to 8-feet in some areas to accommodate the larger radius for horizontal curves. **Figure 5.1** shows the proposed typical section on Barryknoll Lane for Alternative 2. See **Appendix E.3.b** - Horizontal Alignment Alternative - 35 mph Design Speed w/ 8-foot Border.

**Figure 5.1 - Roadway Alternative 2: Proposed Typical Section**




The existing lane configuration on Barryknoll Lane near Gessner Road will remain striped for one eastbound thru lane, one westbound thru lane, one westbound right turn lane and one westbound left turn lane. The eastbound thru lane is proposed to be 12-feet in width to improve the right turning movement for northbound traffic on Gessner Road. The westbound lanes will remain at their existing 10-foot width. The existing brick paver sidewalk will be extended 2-feet to the north, and with minimal curb relocation, the existing sidewalks and ramps will remain in place. The signal, which was constructed as part of the Gessner Road widening in 2009, will not be impacted by the construction. 200-feet east of the Gessner intersection, the lane configuration will transition back to four 10-foot lanes. **Figure 5.2** shows the proposed section for Barryknoll Lane near Gessner Road.

**Figure 5.2 - Roadway Alternative 2: Proposed Barryknoll Lane near Gessner Road**



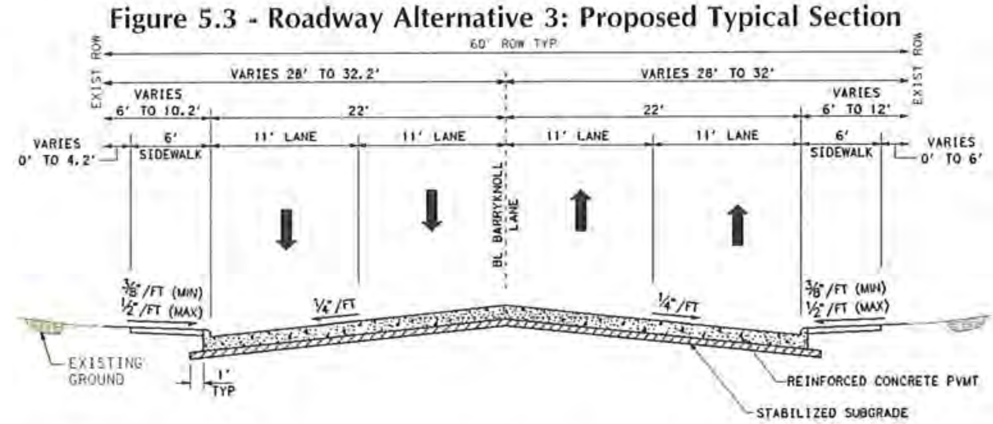

Barryknoll Lane will tie into the remaining intersections matching their existing geometric conditions. The traffic signals at Plantation Road and Memorial City Way will be replaced as part of the proposed improvements. Driveways along the project alignment will be removed and replaced at their existing locations with standard City of Houston driveway radii. In some locations, the existing driveways may need to be replaced past the right-of-way limits to provide a smooth transition resulting from the change in grade.

5.2.3 Roadway Alternative 3 – 35 mph Design Speed with 11-foot Lanes

Alternative 3 also proposes a 35-mph design speed in addition to minimal widening to provide four 11-foot lanes. The roadway will be widened 2-feet in each direction, for a total of 4-feet. See **Appendix E.3.c** - Horizontal Alignment Alternative - 35 mph Design Speed w/ 6-foot Border for additional information. Since right-of-way acquisition is not feasible, a design variance from the City of Houston City Engineer to allow for a nonstandard 6-foot border distance between the curb and right-of-way line is required at some locations. Due to the impacts to residential properties, this alternative was only considered from Gessner Road to Bettina Court. Sight distance triangles for each driveway and cross street within this area were developed to confirm that the proposed limited border width did not create additional sight obstructions for motorists. In most cases, the sight distance is improved due to the need to remove existing trees for the construction. These exhibits can be found in **Appendix E.4**.

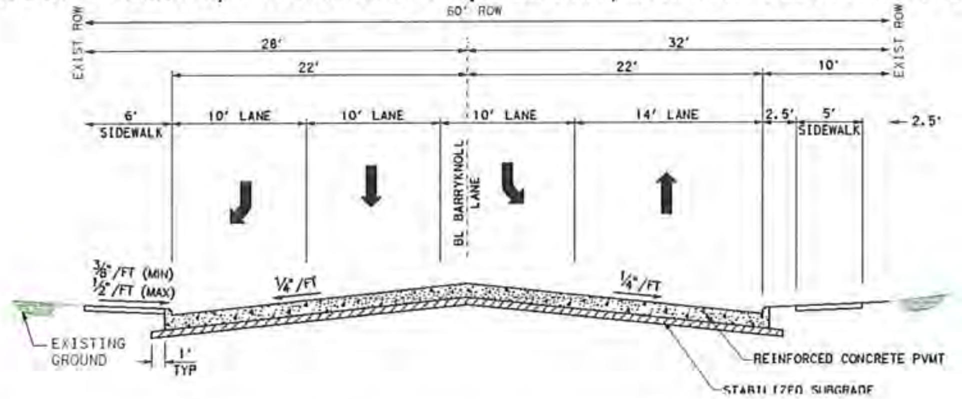
This alternative does impact some additional trees due to the widening. **Appendix G** provides a more detailed inventory of the existing trees and the potential impacts associated with each proposed alternative. Driveways will be designed as described in Alternative 2. **Figure 5.3** shows the proposed typical section on Barryknoll Lane for Alternative 3.

**Figure 5.3 - Roadway Alternative 3: Proposed Typical Section**




Barryknoll Lane will tie into the existing intersections as described in Alternative 2, with the exception of Gessner Road. Near Gessner Road, there is a large mature oak tree that would be greatly impacted by widening the roadway to the south. To preserve the tree, the roadway will be widened 4-feet to the northern side. The eastbound thru lane will be 14-feet in width, leaving the remaining lanes at their existing 10-foot width. The 14-foot lane will provide an even greater improved right turning movement for northbound traffic on Gessner Road. **Figure 5.4** shows the proposed section for Barryknoll Lane near Gessner Road.

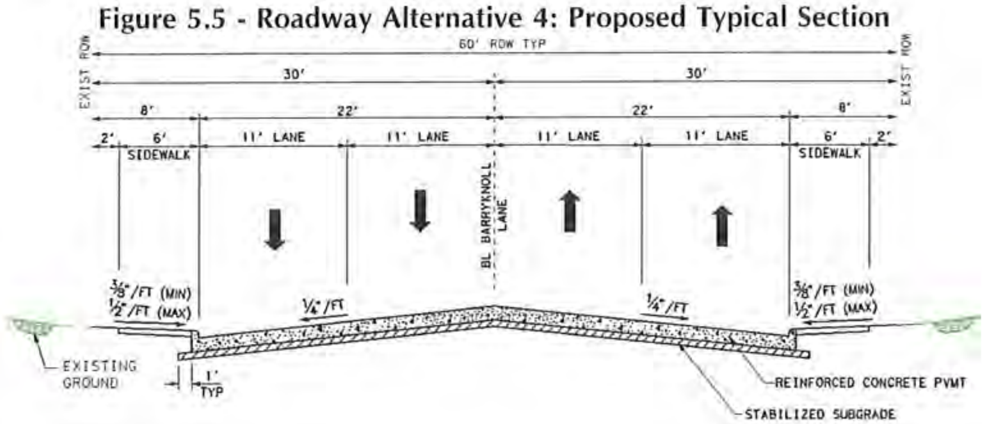
**Figure 5.4 - Roadway Alternative 3: Proposed Barryknoll Lane near Gessner Road**




### 5.2.4 Roadway Alternative 4 – 30 mph Design Speed with 11-foot Lanes

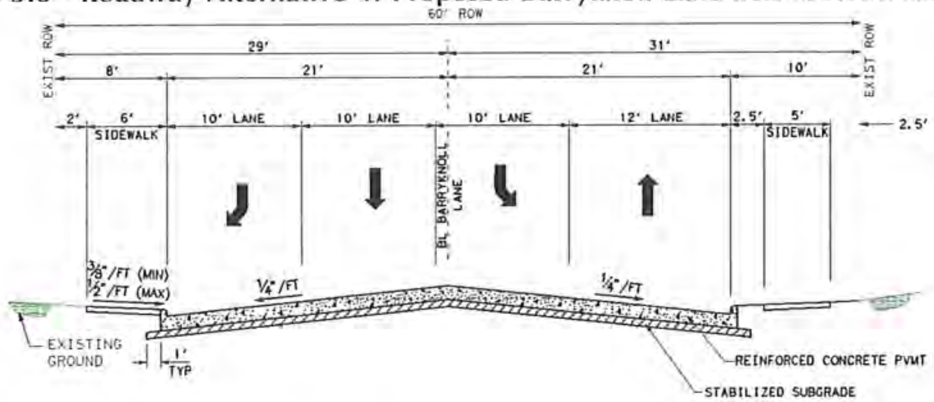
The fourth and final alternative evaluated was for a 30 mph design speed with minimal widening to provide four 11-foot lanes. The roadway will be widened 2-feet in each direction, for a total of 4-feet. As with the other alternatives, a design variance from the City of Houston City Engineer to allow for a nonstandard 8-foot border distance between the curb and right-of-way line is required at some locations. See **Appendix E.3.d** - Horizontal Alignment Alternative - 30 mph Design Speed w/ 8-foot Border for additional information. **Figure 5.5** shows the proposed typical section on Barryknoll Lane for Alternative 4.

**Figure 5.5 - Roadway Alternative 4: Proposed Typical Section**




Barryknoll Lane will tie into the existing intersections and driveways as described in Alternative 2. Error! Reference source not found. **Figure 5.6** shows the proposed section for Barryknoll Lane near Gessner Road.

**Figure 5.6 - Roadway Alternative 4: Proposed Barryknoll Lane near Gessner Road**




### 5.2.5 Roadway Alternative Comparison

**Table 5.1- Roadway Alignment Evaluation**

| Alternative | Design Speed | Lane Width | Number of Impacted ROW Parcels | Approximate ROW Required | Approximate Number of Impacted Trees |
|---|---|---|---|---|---|
| 1 | 45 mph | 10 ft | 5 | 6,807 sf | |
| 2 | 35 mph | 10 ft | 2 | 211 sf | 31 |
| 3 | 35 mph | 11 ft | 2 | 211 sf | 37 |
| 4 | 30 mph | 11 ft | 2 | 211 sf | 37 |

## 5.3 Sidewalks

Two options were considered for sidewalks within the project limits. In both options, a continuous sidewalk is proposed on the north side of Barryknoll Lane from Gessner Road to Bunker Hill. Due to the presence of mature trees within the project right-of-way, the sidewalks will be 6-feet in width, situated directly behind the curb. Widening the existing sidewalks to meet current ADA requirements and City of Houston criteria will create grading issues behind the curb. This will require the construction of small retaining walls in some areas to meet existing elevations along the right-of-way to minimize impacts to existing trees. In areas where a 6-foot sidewalk is still in conflict with existing trees, it is recommended that the sidewalk narrow around the tree in effort to preserve them. The narrow sidewalk will still meet current ADA requirements; however it will require a design variance from the City of Houston City Engineer to allow for a nonstandard sidewalk width directly behind the curb.

On the south side, two sidewalk options were considered. This first option proposes a continuous sidewalk on the south side of the roadway for the entire project alignment. Since there are currently no sidewalks on the south side of the road past Plantation Drive, numerous trees will be removed to accommodate this construction. In addition, At Bunker Hill, the pavement begins to shift to the south, leaving only 5 ½-feet between the curb and right-of-way line with no corner clip. Continuing the sidewalk on the south to Bunker Hill will require the entire intersection of Barryknoll and Bunker Hill to be reconstructed. Since the Bunker Hill intersection will be improved as part of the TIRZ 17 CIP project to improve Bunker Hill Road from IH-10 to Barryknoll Lane, this option proposes that the pavement end approximately 300-feet west of the intersection. An asphalt pavement section, with monolithic curb and gutter, will be used to temporarily transition the roadway back its existing location. The sidewalk will temporarily end at Dolphin Court. The remaining sidewalks and pavement will then be constructed and centered in the right-of way as part of the Bunker Hill Project scheduled for 2014, without impacting the intersection twice, during two separate construction projects.

The second option considered proposes sidewalk on the south side of the roadway only along the commercial portion of the project from Gessner Road to Memorial City Way. This option minimizes the impacts to trees and residential properties. Without the addition of sidewalks on the south side near Bunker Hill, the permanent pavement on Barryknoll can be extended to Bunker Hill Road at its existing location. Since there are bus stops only on the north side of Barryknoll, and there are no connecting sidewalks on intersecting streets to the south, this was considered the most reasonable and feasible alternative.

Several existing hardscape improvements have recently been constructed, including brick paver sidewalks and concrete retaining walls at the intersection of Gessner Road and Barryknoll Lane. Every effort will be made to preserve and minimize reconstruction of these improvements during Phase II Design.

Additional right-of-way or roadway easements will be required for the construction of sidewalks at two property parcels. Preliminary proposed right-of-way/roadway easements are identified in **Appendix E.3.c** – Recommended Horizontal Alignment Alternative.

### 5.4 Traffic Control Plans

The traffic control plan and construction sequencing will require multiple phases during construction to reduce impacts to adjacent properties. There is a METRO bus route that travels west on Barryknoll Lane. Every effort will be made to minimize impacts to this route; however, provisions must be made to relocate existing bus stops to accommodate the lane closures. The conceptual construction phasing and detour plans can be found in **Appendix E.6.**

Phase I and II will begin at Memorial City Way and end at Bunker Hill. One 12-foot minimum lane will remain open for westbound traffic. Eastbound traffic on Barryknoll will be detoured north on Memorial City Way, east on Gaylord Street and north on Bunker Hill Road to Barryknoll Lane.

Phases III and IV will continue west from Memorial City Way to HCFCD W151-000-00. Again, one westbound lane will remain open. Eastbound traffic on Barryknoll will be temporarily detoured north on Gessner Road to the IH-10 Eastbound Frontage Road and south on Bunker Hill Road to Barryknoll Lane. Upon completion of Phases III and IV, all travel lanes between HCFCD W151-000-00 and Memorial City Way will be opened.

Phases V and VI will construct Barryknoll Lane between Gessner Road and HCFCD W151-000-00. One 12-foot minimum lane on Barryknoll Lane will remain open for westbound traffic. Eastbound traffic on Barryknoll will be temporarily detoured north on Gessner Road to the IH-10 Eastbound Frontage Road and south on Memorial City Way to Barryknoll Lane. During Phases V and VI, no construction will be permitted during the busy shopping months of November and December. Coordination with adjacent property owners, Memorial City Mall, and METRO will be conducted to minimize impacts during construction.

### 5.5 Recommended Roadway Improvements

Roadway recommendations are based on roadway geometrics, pedestrian facilities and construction cost, as well as the recommendation from the drainage and traffic portions of this report. The impacts to right-of-way, trees, and underground utilities have all been considered for each option. Roadway Alternative 3 is the most reasonable and feasible alternative for Barryknoll Lane between Gessner Road and Bettina Court. This alternative will provide improved mobility and safety along Barryknoll Lane while minimizing impacts to adjacent properties. Due to the impacts to residential properties, it is recommended that the pavement transition to Roadway Alternative 2 at the intersection. The 40-foot pavement section is proposed to continue east to match the existing pavement section on Barryknoll Lane at Bunker Hill Road. The traffic signals at Plantation Road and Memorial City Way will be replaced as part of the improvements. Sidewalks will be constructed on both sides of the roadway from Gessner to Memorial City Way and on the north side of the roadway from Memorial City Way to Bunker Hill.

# 6.0 UTILITY ASSESSMENT AND RECOMMENDATIONS

## 6.1 Design Criteria

The design of the water lines along Barryknoll Lane between Gessner Road and Bunker Hill Road is based upon the following criteria:

- City of Houston Department of Public Works and Engineering Infrastructure Design Manual, latest edition.
- City of Houston department of Public Works and Engineering Standard Construction Details for Wastewater Collections Systems, Water Lines, Storm Drainage and Street Paving, latest edition.
- City of Houston Department of Public Works and Engineering Standard Construction Specifications for Wastewater Collections Systems, Water Lines, Storm Drainage and Street Paving, latest edition.

## 6.2 Regulatory Agencies

The design of the proposed water lines will comply with the Texas Commission on Environmental Quality criteria. In all cases where the water lines parallel or cross sanitary sewer lines, appropriate separation will be maintained in accordance with City of Houston standards. Pertinent correspondences regarding any required variance obtained after submittal of this report will be submitted to City of Houston for approval.

## 6.3 Recommended Public Utility Improvements

Information on existing water and sanitary sewer lines within the Barryknoll Lane Project study limits was obtained from survey data, record drawings from the City of Houston, and the City of Houston Geographic Information & Management System (GIMS). See **Appendix F.1** Existing Public Utilities for additional information.

### 6.3.1 Recommended Water Line Improvements

The existing AC water line, located along Barryknoll Lane between W151-00-00 and Bunker Hill, was built in 1965, exceeding the typical useful service life of 40-years. Due to the age and material, the portion of 8-inch water line between Holly Ridge and Bunker Hill Road was scheduled to be replaced by the City of Houston. In order to avoid conflicts with proposed improvements, and to minimize impact to local residences and businesses, the 8-inch water line between W151-00-00 and Bunker Hill Road will be replaced as part of this project. The active waterlines that cross Barryknoll Lane are also anticipated to require replacement for conflict resolution.

To maintain water service during construction, a parallel 8-inch water line will be installed along the eastbound lanes (south side of the street), and services will be transferred after completion. In addition, it is recommended that a second 8-inch water line be installed along the opposite side of the street (north) between W151-00-00 and Memorial City Way. Installing a second, parallel water line will minimize the number of permanent service lines crossing the proposed box sewer. The proposed 8-inch water line along the north side will not extend past Memorial City Way to Bunker Hill Road due to utility conflicts and space constraints.

The method of construction for the 8-inch water line along the south side will be primarily auger boring, a trenchless construction method with pits spaced approximately 100 – 200 ft. Open-cut sections will be required at fittings, valves and interconnections. According to City of Houston Standards, the pipe material may be ductile iron or PVC pipe.

Due to space constraints, the proposed 8-inch water line along the eastbound lanes (south side of the street), will be closer than 9-ft. from the proposed 21/12-inch sanitary sewer. Based on TCEQ standards, a minimum 9-ft. horizontal separation must be maintained between outside wall of sanitary sewer, and outside wall of water line. If the sanitary sewer is constructed of pressure-rated material, a minimum 4-ft. separation distance must be maintained. Because the 9-ft. separation distance cannot be achieved along Barryknoll Lane between W151-00-00 and Bunker Hill Road, the sanitary sewer will be constructed of pressure-rated material. Furthermore, at sanitary sewer manhole locations, TCEQ standards require a minimum 9-ft. separation from water lines. Where a minimum 9-ft. separation distance cannot be achieved, the water line must be placed in a casing of minimum two nominal sizes larger than the carrier pipe, supported at 5-ft. intervals, and filled to the springline with washed sand. For the proposed water line along the eastbound lanes of Barryknoll Lane (south side), a 16-in. casing is shown at all sanitary sewer manhole locations.

Based on the new roadway alignment, an existing 6-inch water meter at the southwest corner of the intersection of Barryknoll Lane at Plantation Dr. will need to be relocated to the north side of Barryknoll Lane. This will eliminate unnecessary service lines crossing the proposed box culvert, as the existing 8-inch water distribution line extends along the north side of Barryknoll Lane in this section. The PER drawings show the proposed location of a 15' x 25' meter easement that will be required for the 6-inch water meter relocation. In addition to the permanent meter easement, a temporary easement is shown to allow the 6-inch service line to be re-connected to the new meter.

### 6.3.2 Recommended Sanitary Sewer Improvements

The existing 21/12-inch sanitary sewer pipe was installed in 1962. It is located along the north right-of-way at Gessner Road to approximately 500 feet east, where it crosses Barryknoll Lane and continues along an easement on the south side of the road to Plantation Drive, where the sanitary sewer returns to Barryknoll Lane and extends to Bunker Hill Road within the eastbound lane. The 21/12-inch sanitary sewer exceeds the typical 40-year useful service life. The City of Houston has recommended the entire length of the sanitary sewer along Barryknoll Lane to be removed and replaced. See **Appendix F.5** for the City of Houston's recommendations. To minimize impact to local residences and businesses, the sanitary sewer replacement will be included as part of this project. In addition, existing sanitary sewer manholes will be removed and replaced.

Between Gessner Rd. and W151-00-00, it is recommended to remove and replace the existing 21/12-inch sanitary sewer in the same location, due to space constraints. Between W151-00-00 and Bunker Hill, a new 21/12-inch sanitary sewer will be installed approximately 5-7 ft. from the proposed box culvert. The old 21/12-inch sanitary sewer will be removed. This will allow space for the proposed 8-inch water line within the eastbound lanes.

The method of construction for the proposed sanitary sewers may be a combination of open-cut and trenchless methods. For the section between Gessner Road and W151-00-00, gravity sewer pipe materials include ductile iron (DIP), fiberglass (FRP), high-density polyethylene (HDPE), polyvinyl chloride (PVC), extra strength clay, and reinforced concrete. For the section between W151-00-00 and Bunker Hill Road, the proposed sanitary sewer will be constructed of pressure-rated pipe, because the TCEQ minimum 9-ft. separation requirement cannot be achieved from the water line. The pipe material options allowed by the City of Houston for pressure-rated sanitary sewers include DIP, PVC, HDPE, and FRP. Active sanitary sewer lines crossing Barryknoll Lane will also be replaced or relocated on an as-needed basis for conflict resolution.

Bypass pumping will be necessary, and will be accomplished in segments, possibly requiring additional manholes to be installed on the pipe. Detailed bypass pumping requirements will be evaluated in more depth during the final design phase.

A television inspection of the 21-inch portion of the sanitary sewer was performed by the City of Houston in November 2010. Additional television inspection will be required for the 12-inch sanitary line, along with connecting laterals, to locate existing service connections. Furthermore, additional topographic surveying will be necessary for an existing easement located west of Plantation Dr., which contains a section of the 21-inch sanitary sewer scheduled to be replaced.

Plans include the existing sanitary sewer manhole within the Bunker Hill Road intersection to be removed and replaced. The replacement of this manhole may require bypassing of the existing 8-inch sanitary sewer along Bunker Hill Road. It may be more beneficial to include the Bunker Hill Road manhole removal and replacement to a future project. Both options will be further evaluated during the design phase.

# 7.0 CONCLUSION

The following recommendations are based on the results from the preliminary drainage analysis, and the roadway geometric evaluation and condition assessment. The impacts of each alternative to right-of-way, pedestrian amenities, tree inventories, and underground utilities have been considered.

Complete roadway reconstruction is recommended for Barryknoll Lane based on the study findings. The roadway will be widened to 44-feet between the between Gessner Road and Bettina Court. The roadway will then transition to its existing geometric condition of 40-feet and continue to the project eastern limit at Bunker Hill Road. The traffic signals at Plantation Road and Memorial City Way will be replaced as part of the improvements. Sidewalks will be constructed on both sides of the roadway from Gessner to Memorial City Way and on the north side of the roadway from Memorial City Way to Bunker Hill.

The proposed horizontal alignment will meet the requirements for a design speed of 35 mph. To accommodate the increased design speed, a design variance from the City of Houston City Engineer to allow for a nonstandard 6-foot border distance between the curb and right-of-way line is required at some locations. The proposed roadway for Barryknoll will be improved with grades that conform to the current City standards, and will generally be at the same level as the current roadway. The existing ROW on the north side is higher than the south side therefore to provide a consistent roadway cross-section with consistent cross-slopes, the curb will generally be lowered on the north side of Barryknoll, and raised on the south side of Barryknoll. The roadway pavement cross-section will still be below ROW elevations to allow positive drainage into the roadway.

Per the June 2009 HCFCD Implementation Study, approximately 1,300-feet of 9' x 5' RCB storm sewer is proposed west of W151-00-00, and approximately 2,640-feet of 2-10'x6' RCB storm sewer is proposed east of W151-00-00. The total volume of storm sewer is estimated at 9.2 ac-ft. These improvements will significantly decrease the frequency of overland flow from Barryknoll to the adjacent neighborhood to the south and increase the capacity of the Barryknoll Lane storm sewer system. The existing storm sewer along Barryknoll Lane will remain in place west of W151-00-00 and interconnect to the proposed additional storage box culverts via lateral pipes. East of W151-00-00 the existing storm sewer will be replaced by the proposed dual box culverts. A condition assessment is recommended to be conducted in Phase II to confirm the existing storm sewer condition. The proposed improvements will improve the system to exceed the 2-year level of service City of Houston minimum criteria.

Due to the age of the underground utilities, all existing water lines and sanitary sewers will be replaced as part of the reconstruction.

The total estimated construction cost for the recommended improvements is estimated $9 Million (cost excludes any right of way acquisition, private utility relocation and landscape/hardscape improvement costs). The recommended proposed improvements will increase storm level protection, reduce overland flow leaving the project area, reduce roadway ponding and improve mobility, improve safety and access along the existing roadway facility. This recommendation is the most optimal solution based on benefit, cost and constructability. Adding the proposed box culverts addresses both the sheetflow and ponding issues on Barryknoll Lane as well as Barryknoll Lane's need for pavement and infrastructure improvements as the facility has exceeded its useful service life of 40-years. Other drainage improvement options are currently under study with the concurrent TIRZ 17 Regional Drainage Study; however the results of this study are not complete at this time. Preliminary results from the TIRZ 17 Regional Drainage Study indicate that the proposed improvements will not deviate greatly from those of the June 2009 HCFCD W151-00-00 Improvement Study. All proposed improvements are reviewed within this project's study limits to identify potential impacts. In addition, all other concurrent studies and improvement projects proposed by others within this project's study limits will be coordinated, including the storm water detention proposed by HCFCD along with other options within the Memorial City Mall area. Therefore, recommendations from this study may result in minor modifications in Phase II due to further study and coordination with concurrent drainage studies within the region.

# APPENDIX A

# CONSTRUCTION COST ESTIMATES

**Barryknoll Drive**
**Recommended Alternative Preliminary Cost Estimate**

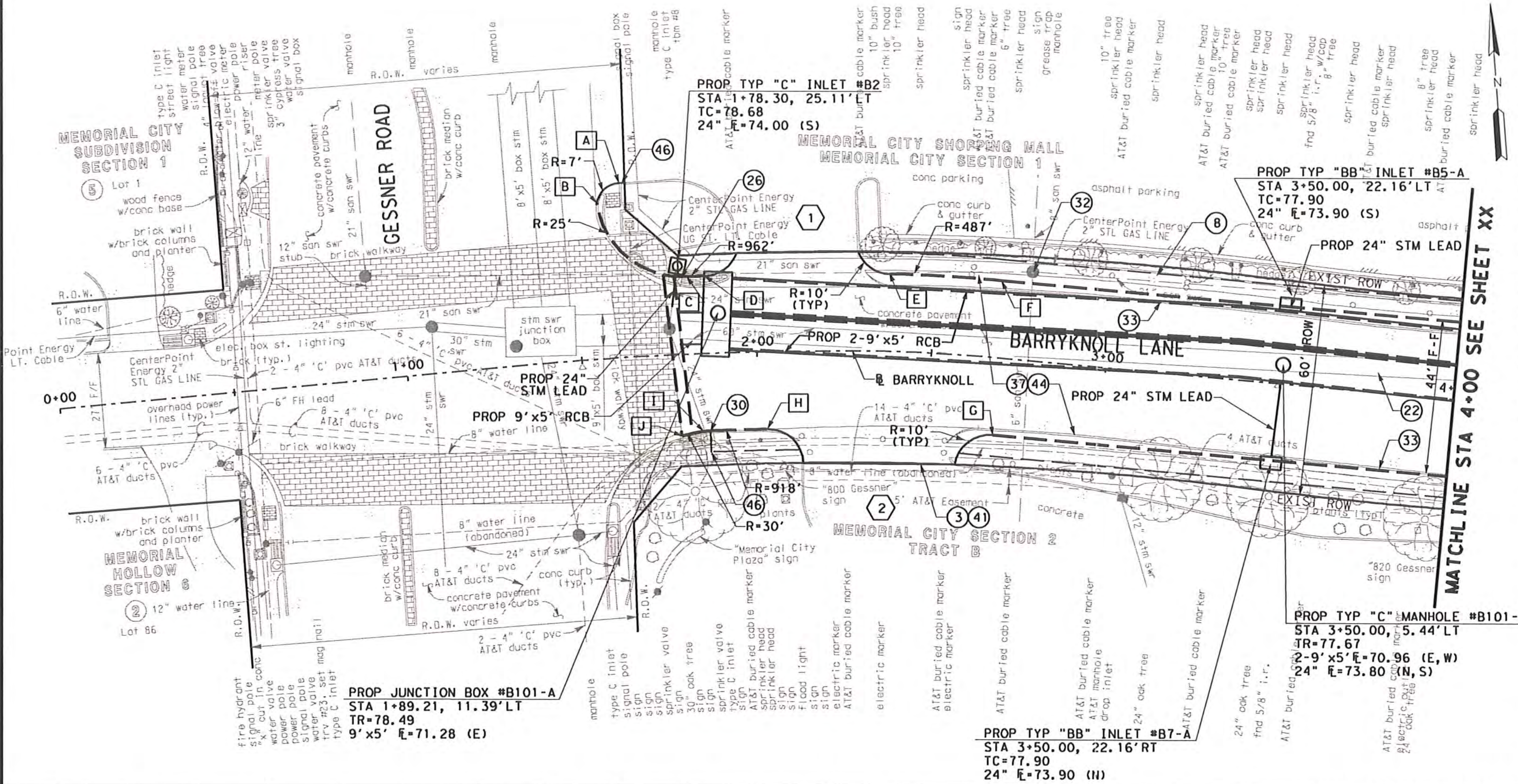
| Item No. | Item Description | Unit | Quantity | Engineering Estimate Unit Price | Engineering Estimate Total Price |
|---|---|---|---|---|---|
| | **Drainage** | | | | |
| 1 | Type A Inlet | EA | 3 | $ 2,500.00 | $ 7,500.00 |
| 2 | Type B-B Inlet | EA | 23 | $ 2,750.00 | $ 63,250.00 |
| 3 | Type C1 Inlet - Complete in Place | EA | 12 | $ 2,900.00 | $ 34,800.00 |
| 4 | Type "C" Manhole | EA | 16 | $ 3,250.00 | $ 52,000.00 |
| 5 | Junction Box | EA | 7 | $ 20,000.00 | $ 140,000.00 |
| 6 | 18" RCP | LF | 25 | $ 44.00 | $ 1,100.00 |
| 7 | 24-inch Diameter Storm Sewer by Open-Cut | LF | 780 | $ 63.00 | $ 49,140.00 |
| 8 | 30-inch Diameter Storm Sewer by Open Cut | LF | 80 | $ 70.00 | $ 5,600.00 |
| 9 | 36-inch Diameter Storm Sewer by Open-Cut | LF | 40 | $ 80.00 | $ 3,200.00 |
| 10 | 60" RCP | LF | 18 | $ 155.00 | $ 2,790.00 |
| 11 | 9' x 5' RCB | LF | 2,654 | $ 300.00 | $ 796,200.00 |
| 12 | 8' x 6' RCB | LF | 5,256 | $ 340.00 | $ 1,787,040.00 |
| 13 | 8' x 5' RCB | LF | 52 | $ 340.00 | $ 17,680.00 |
| 14 | 9' x 6' RCB | LF | 47 | $ 350.00 | $ 16,450.00 |
| 15 | Trench Safety System | LF | 5,002 | $ 1.00 | $ 5,002.00 |
| 16 | Ground Water Control for Open Cut Construction | LF | 2,000 | $ 30.00 | $ 60,000.00 |
| 17 | CSB for Culvert | CF | 7,531 | $ 30.00 | $ 225,930.00 |
| 18 | SWPPP | LS | 1 | $ 15,000.00 | $ 15,000.00 |
| | **Roadway** | | | | |
| 18 | 10-inch Reinforced Concrete Pavement | SY | 19,646 | $ 50.00 | $ 982,300.00 |
| 19 | 7-inch High Early Strength Concrete Driveway, including excavation and base | SF | 11,097 | $ 6.00 | $ 66,582.00 |
| 20 | Lime/Fly-Ash Stabilized Subgrade, 6-inch | SY | 20,879 | $ 3.00 | $ 62,637.00 |
| 21 | Lime for Lime/Fly-Ash Stabilized Subgrade | TON | 574 | $ 149.00 | $ 85,551.70 |
| 22 | Concrete Curb, All Heights | LF | 6,371 | $ 3.00 | $ 19,113.00 |
| 23 | 4 ½-inch Concrete Sidewalk | SF | 35,952 | $ 7.00 | $ 251,664.00 |
| 24 | Remove and Dispose of Reinforced Concrete Pavement, with or without Asphalt Overlay (12-inches or less) | SY | 19,205 | $ 4.00 | $ 76,820.00 |
| 25 | Remove and Dispose of Driveways, (all materials, all Thicknesses) | SY | 1,265 | $ 5.00 | $ 6,325.00 |
| 26 | Roadway Excavation | CY | 849 | $ 15.00 | $ 12,733.52 |
| | **Public Utilities** | | | | |
| **Water Line Items** | | | | | |
| 27 | Trench Safety System for Water Line | LF | 386 | $ 1.00 | $ 386.00 |
| 28 | 12-inch water Line in 20-inch Casing | LF | 36 | $ 125.00 | $ 4,500.00 |
| 29 | Proposed 8-inch Water Line by Auger | LF | 4,222 | $ 79.00 | $ 333,538.00 |
| 30 | Proposed 8-inch Water Line in 16-inch Casing | LF | 220 | $ 110.00 | $ 24,200.00 |
| 31 | Proposed 6-inch Water Line by Open Cut | LF | 20 | $ 30.00 | $ 600.00 |
| 32 | Proposed 2-inch Water Line by Open Cut | LF | 63 | $ 20.00 | $ 1,260.00 |
| 33 | 12-inch cut, plug and abandon | EA | 1 | $ 905.00 | $ 905.00 |
| 34 | 8-inch cut, plug and abandon | EA | 2 | $ 894.00 | $ 1,788.00 |
| 35 | Remove & Dispose Existing 8-inch Water Line | LF | 60 | $ 75.00 | $ 4,500.00 |
| 36 | 6-inch cut, plug and abandon | EA | 2 | $ 827.00 | $ 1,654.00 |
| 37 | Remove & Dispose Existing 6-inch Water Line | LF | 25 | $ 75.00 | $ 1,875.00 |
| 38 | 6-inch water meter assembly, concrete vault & cover, complete in place | EA | 1 | $ 28,500.00 | $ 28,500.00 |
| 39 | Remove and Replace 12-inch Water Line by Open Cut | LF | 79 | $ 113.00 | $ 8,927.00 |
| 40 | Remove and Replace 8-inch Water Line by Open Cut | LF | 202 | $ 40.00 | $ 8,080.00 |
| 41 | Fire Hydrant Assembly, all depths, Including w/ 6-inch gate valve and box | EA | 6 | $ 3,967.00 | $ 23,802.00 |
| 42 | 12-inch Wet Connection | EA | 1 | $ 2,900.00 | $ 2,900.00 |
| 43 | 8-inch Wet Connection | EA | 9 | $ 1,900.00 | $ 17,100.00 |
| 44 | 6-inch Wet Connection | EA | 3 | $ 966.00 | $ 2,898.00 |
| 45 | 2-inch Wet Connection | EA | 4 | $ 540.00 | $ 2,160.00 |
| 46 | Water Line Service Connections (Permanent) | EA | 4 | $ 2,500.00 | $ 10,000.00 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Sanitary Sewer Items** | | | | | | | | |
| 47 | Trench Safety for Sanitary Sewers | LF | 3,976 | $ | 2.00 | $ | 7,952.00 |
| 48 | Remove and Replace Sanitary Sewer Manhole | EA | 7 | $ | 5,500.00 | $ | 38,500.00 |
| 49 | Sanitary Sewer Manhole (new) | EA | 14 | $ | 4,800.00 | $ | 67,200.00 |
| 50 | 21-inch Sanitary Sewer, Pressure Class 150 psi | LF | 1,600 | $ | 130.00 | $ | 208,000.00 |
| 51 | Remove and Replace 21-inch Sanitary Sewer with 24-inch Sanitary Sewer | LF | 210 | $ | 219.00 | $ | 45,990.00 |
| 52 | Remove and Replace 21-inch Sanitary Sewer | LF | 973 | $ | 192.00 | $ | 186,816.00 |
| 53 | 12-inch Sanitary Sewer, Pressure Class 150 psi | LF | 1,045 | $ | 95.00 | $ | 99,275.00 |
| 54 | Remove and Replace 12-inch Sanitary Sewer | LF | 48 | $ | 110.00 | $ | 5,280.00 |
| 55 | Remove and Replace 8-inch Sanitary Sewer | LF | 40 | $ | 73.00 | $ | 2,920.00 |
| 56 | Remove and Replace 6-inch Sanitary Sewer | LF | 60 | $ | 90.00 | $ | 5,400.00 |
| 57 | Service stubs or reconnections without stack on sanitary sewer | EA | 5 | $ | 2,079.00 | $ | 10,395.00 |
| 58 | Bypass Pumping | LS | 1 | $ | 68,400.00 | $ | 68,400.00 |
| **General** | | | | | | | |
| 59 | Traffic Signal | EA | 2 | $ | 150,000.00 | $ | 300,000.00 |
| 60 | Illumination | LS | 1 | $ | 100,000.00 | $ | 100,000.00 |
| 61 | Temporary Signal | LS | 1 | $ | 75,000.00 | $ | 75,000.00 |
| 62 | Remove Traffic Signal | EA | 2 | $ | 3,000.00 | $ | 6,000.00 |
| 63 | Fiber Optic Interconnect | LF | 1,400 | $ | 55.00 | $ | 77,000.00 |
| 64 | Remove Existing Structures | EA | 48 | $ | 500.00 | $ | 24,000.00 |
| 65 | Landscaping | LS | 1 | $ | 54,000.00 | $ | 54,000.00 |
| 66 | Uniformed Peace Officers | LS | 1 | $ | 324,000.00 | $ | 324,000.00 |
| 67 | Irrigation | LS | 1 | $ | 54,000.00 | $ | 54,000.00 |
| 68 | Tree and Plant Protection | LS | 1 | $ | 108,000.00 | $ | 108,000.00 |
| 69 | Traffic Control | LS | 1 | $ | 360,000.00 | $ | 360,000.00 |

| | | | |
|---|---|---|---|
| | **Sub-Total** | $ | **7,554,109.22** |
| | **Total** | $ | **7,554,109.22** |
| | **Contingency (10%)** | $ | **755,410.92** |
| | **Mobilization (10%)** | $ | **755,410.92** |
| | **Grand Total** | $ | **9,064,931.07** |

# APPENDIX B

# 30% PLAN AND PROFILE SHEETS

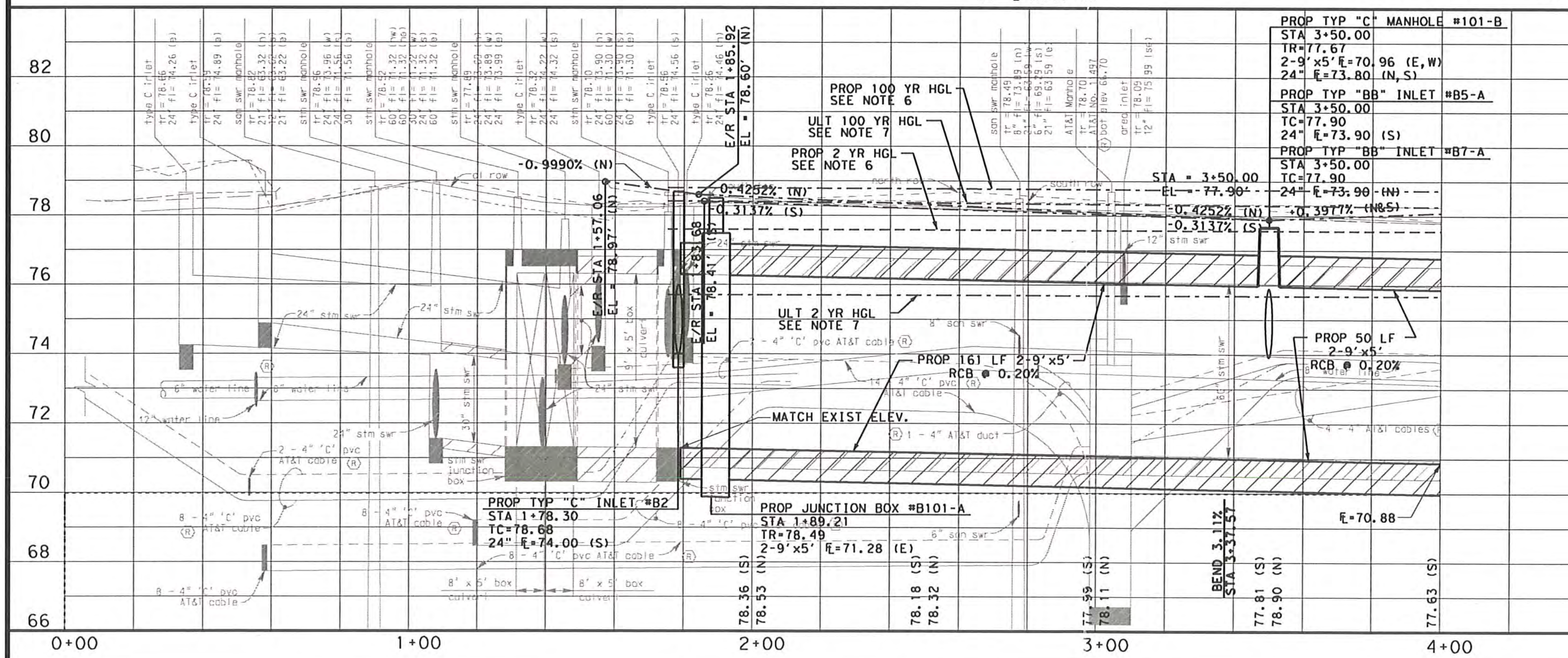



## KEYED NOTES

3. PROPOSED SAWED JOINT AND EXPOSE 15-INCHES OF REINFORCING STEEL. IF NO REINFORCING STEEL EXISTS, USE HORIZONTAL DOWELS. SEE NOTE 11.
8. REMOVE EXISTING SIDEWALK.
22. EXISTING STRUCTURE TO BE REMOVED.
26. REMOVE EXISTING INLET AND LEAD. PLUG AS SHOWN.
30. MEET EXISTING CURB OR CURB AND GUTTER FOR GRADE AND ALIGNMENT.
32. ADJUST EXISTING MANHOLE FRAME AND COVER TO FIT NEW GRADE.
33. REMOVE CURB OR CURB AND GUTTER FOR GRADE AND ALIGNMENT.
37. PROPOSED PAVEMENT MARKINGS AS SHOWN ON STANDARD DETAIL 02763-01 - PAVEMENT MARKING DETAILS.
41. REMOVE AND REPLACE DRIVEWAY TO ROW, EXCEPT WHERE NOTED OTHERWISE ON PLANS, AT EXISTING WIDTH AS SHOWN ON DETAILS.
44. REMOVE EXISTING PAVEMENT (ALL TYPES AND THICKNESSES).
46. TRANSITION PROPOSED SIDEWALK TO EXISTING SIDEWALK LEVEL WITH A MINIMUM SLOPE OF 20:1.

**NOTES:**

1. ALL RCP ARE CLASS III UNLESS OTHERWISE NOTED.
2. SEE STORM SEWER LATERALS SHEETS XX TO XX FOR MORE INFORMATION.
3. ADJUST EXIST WATER VALVE/METER BOXES TO NEW GRADE. REPLACE ALL MISSING OR DAMAGED WATER VALVE/METER BOXES AND COVERS.
4. REFER TO TYPICAL SECTION (X) FOR STATION X+00 TO X+00
5. CUT AND REMOVE PORTION OF EXISTING RCP INSIDE PROPOSED INLET OR MANHOLE; RCP TO BE FLUSH WITH INSIDE WALL FACE. (NOT SEPARATE PAY ITEM, INCIDENTAL TO UNIT PRICE OF MANHOLE OR INLET.)
6. PROPOSED HGL CALCULATED FOR POST-PROJECT CONDITIONS USING INFOWORKS SD.
7. ULTIMATE CONDITION INCLUDE ADDITIONAL INTERCONNECTED STORM SEWER IMPROVEMENTS HGL CALCULATED USING INFOWORKS SD




**HORIZONTAL GEOMETRY DATA**

| NO. | DESCRIP | STATION | OFFSET |
|---|---|---|---|
| A | PC | 1+63.54 | 49.61 LT |
| B | PI | 1+57.06 | 44.20 LT |
| C | PCC | 1+80.76 | 22.00 LT |
| D | PCC | 1+85.92 | 22.00 LT |
| E | PCC | 2+37.54 | 22.00 LT |
| F | PT | 2+68.03 | 22.00 LT |
| G | PC | 2+69.39 | 22.00 RT |
| H | PC | 2+02.87 | 22.00 RT |
| I | PT | 1+83.68 | 22.15 RT |
| J | PCC | 1+77.55 | 23.18 RT |

PRIVATE UTILITY LINES SHOWN

CENTERPOINT ENERGY, GAS FACILITIES

SBC UTILITY LINES SHOWN DATE
APPROVED FOR SBC UNDERGROUND CONDUIT FACILITIES ONLY. SIGNATURE VALID FOR ONE YEAR

CENTERPOINT ENERGY, ELECTRIC FACILITIES
APPROVED ONLY FOR CROSSING UNDERGROUND DUCTLINES UNLESS NOTED. VALID AT TIME OF REVIEW ONLY.

CABLE COMPANY

INTERIM REVIEW ONLY

Document incomplete: not intended for permit, bidding or construction.

Engineer: TARA G BURRER
P.E. Serial No. 99997
Firm: LOCKWOOD, ANDREWS & NEWNAM, INC.
Firm No.: 2614
Date: 11/4/2011

MEMORIAL CITY REDEVELOPMENT AUTHORITY

Lockwood, Andrews & Newnam, Inc.
A LEO A DALY COMPANY

BARRYKNOLL LANE
T-170015-0001-3
PLAN & PROFILE
PVMT & STM SWR IMPROVEMENTS
STA 0+00 TO 4+00

SHEET 1 OF 11

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

| WATER | WASTEWATER | TRAFFIC |
|---|---|---|
| ST. & BRIDGE | STORMWATER | SWD |

FILE NO.: | FACILITY

DRAWING SCALE: | CITY DWG NO.

VERT: 1"=2'
HORZ: 1"=20'

SHEET: OF XX

11/4/2011 10:12:42 AM

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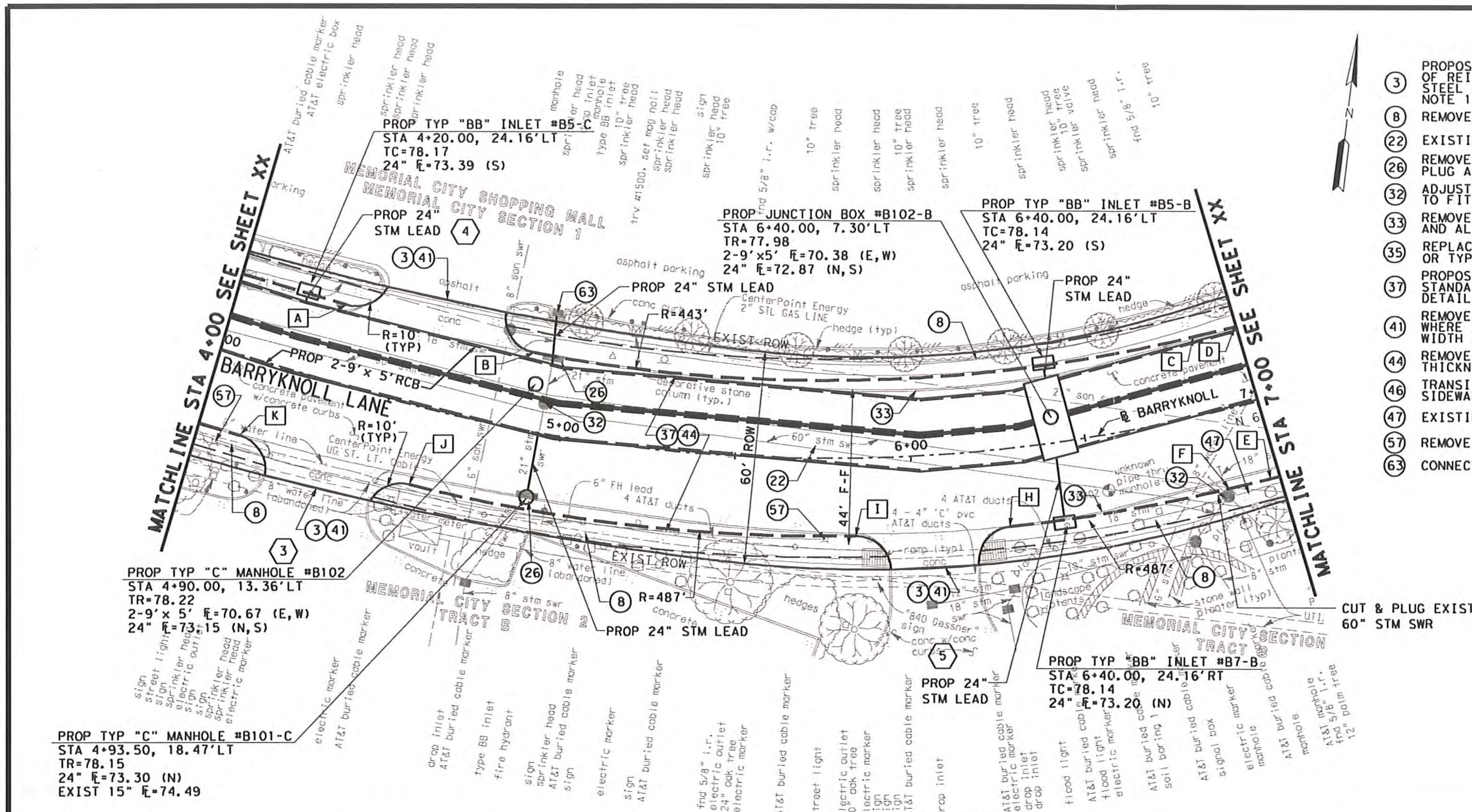
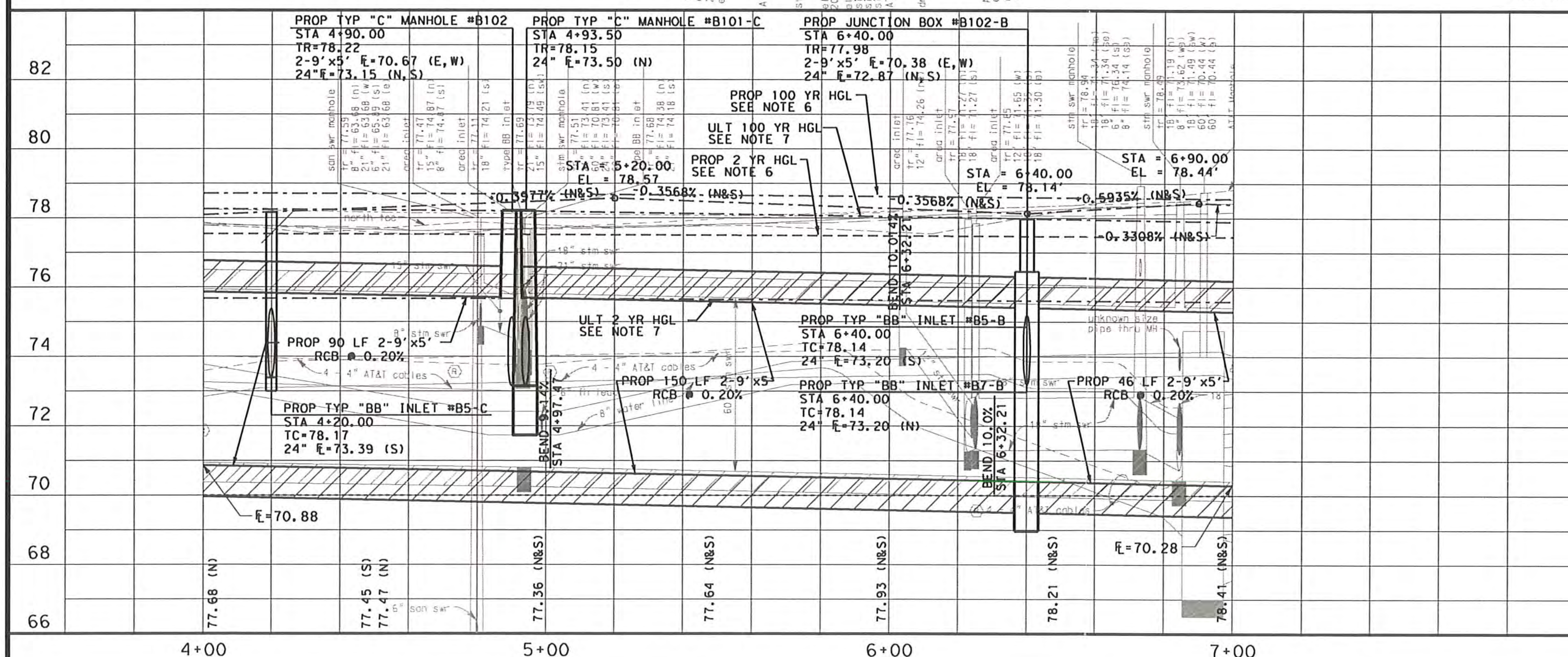



## KEYED NOTES

- (3) PROPOSED SAWED JOINT AND EXPOSE 15-INCHES OF REINFORCING STEEL. IF NO REINFORCING STEEL EXISTS, USE HORIZONTAL DOWELS. SEE NOTE 11.
- (8) REMOVE EXISTING SIDEWALK.
- (22) EXISTING STRUCTURE TO BE REMOVED.
- (26) REMOVE EXISTING INLET AND LEAD. PLUG AS SHOWN.
- (32) ADJUST EXISTING MANHOLE FRAME AND COVER TO FIT NEW GRADE.
- (33) REMOVE CURB OR CURB AND GUTTER FOR GRADE AND ALIGNMENT.
- (35) REPLACE TYPE B INLET WITH TYPE BB INLET OR TYPE C-1 INLET.
- (37) PROPOSED PAVEMENT MARKINGS AS SHOWN ON STANDARD DETAIL 02763-01 - PAVEMENT MARKING DETAILS.
- (41) REMOVE AND REPLACE DRIVEWAY TO ROW, EXCEPT WHERE NOTED OTHERWISE ON PLANS, AT EXISTING WIDTH AS SHOWN ON DETAILS.
- (44) REMOVE EXISTING PAVEMENT (ALL TYPES AND THICKNESSES).
- (46) TRANSITION PROPOSED SIDEWALK TO EXISTING SIDEWALK LEVEL WITH A MINIMUM SLOPE OF 20:1.
- (47) EXISTING STRUCTURE/UTILITY TO REMAIN.
- (57) REMOVE & RELOCATE EXISTING LIGHT STANDARD.
- (63) CONNECT PROP 24" LEAD TO EXIST INLET

## NOTES:

1. ALL RCP ARE CLASS III UNLESS OTHERWISE NOTED.
2. SEE STORM SEWER LATERALS SHEETS XX TO XX FOR MORE INFORMATION.
3. ADJUST EXIST WATER VALVE/METER BOXES TO NEW GRADE. REPLACE ALL MISSING OR DAMAGED WATER VALVE/METER BOXES AND COVERS.
4. REFER TO TYPICAL SECTION (X) FOR STATION X+00 TO X+00
5. CUT AND REMOVE PORTION OF EXISTING RCP INSIDE PROPOSED INLET OR MANHOLE; RCP TO BE FLUSH WITH INSIDE WALL FACE. (NOT SEPARATE PAY ITEM, INCIDENTAL TO UNIT PRICE OF MANHOLE OR INLET.)
6. PROPOSED HGL CALCULATED FOR POST-PROJECT CONDITIONS USING INFOWORKS SD.
7. ULTIMATE CONDITION INCLUDE ADDITIONAL INTERCONNECTED STORM SEWER IMPROVEMENTS HGL CALCULATED USING INFOWORKS SD




| HORIZONTAL GEOMETRY DATA | | | |
|---|---|---|---|
| NO. | DESCRIP | STATION | OFFSET |
| A | PCC | 4+30.90 | 22.75 LT |
| B | PCC | 4+88.30 | 22.00 LT |
| C | PT | 6+86.59 | 22.00 LT |
| D | PC | 6+98.59 | 22.00 LT |
| E | PT | 6+86.59 | 22.00 RT |
| F | PC | 6+96.62 | 22.00 LT |
| G | PC | 6+96.62 | 22.00 RT |
| H | PT | 6+26.12 | 22.00 RT |
| I | PCC | 5+83.97 | 22.00 RT |
| J | PCC | 4+61.47 | 22.00 RT |
| K | PC | 4+12.33 | 22.00 RT |

PRIVATE UTILITY LINES SHOWN

CENTERPOINT ENERGY, GAS FACILITIES

SBC UTILITY LINES SHOWN DATE
APPROVED FOR SBC UNDERGROUND CONDUIT FACILITIES ONLY. SIGNATURE VALID FOR ONE YEAR

CENTERPOINT ENERGY, ELECTRIC FACILITIES
APPROVED ONLY FOR CROSSING UNDERGROUND DUCTLINES UNLESS NOTED. VALID AT TIME OF REVIEW ONLY.

CABLE COMPANY

INTERIM REVIEW ONLY

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Engineer: TARA G BURRER
P.E. Serial No. 99997
Firm: LOCKWOOD, ANDREWS & NEWNAM, INC.
Firm No.: 2614
Date: 11/4/2011

MEMORIAL CITY REDEVELOPMENT AUTHORITY

Lockwood, Andrews & Newnam, Inc.
A LEO A DALY COMPANY

BARRYKNOLL LANE
T-170015-0001-3
PLAN & PROFILE
PVMT & STM SWR IMPROVEMENTS
STA 4+00 TO 7+00
SHEET 2 OF 11

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

| WATER | WASTEWATER | TRAFFIC |
|---|---|---|
| ST. & BRIDGE | STORMWATER | SWD |

FILE NO.: FACILITY
DRAWING SCALE: CITY DWG NO.
VERT: 1"=2'
HORZ: 1"=20'
SHEET: OF XX

| No. | Date | Revisions | App. |
|---|---|---|---|

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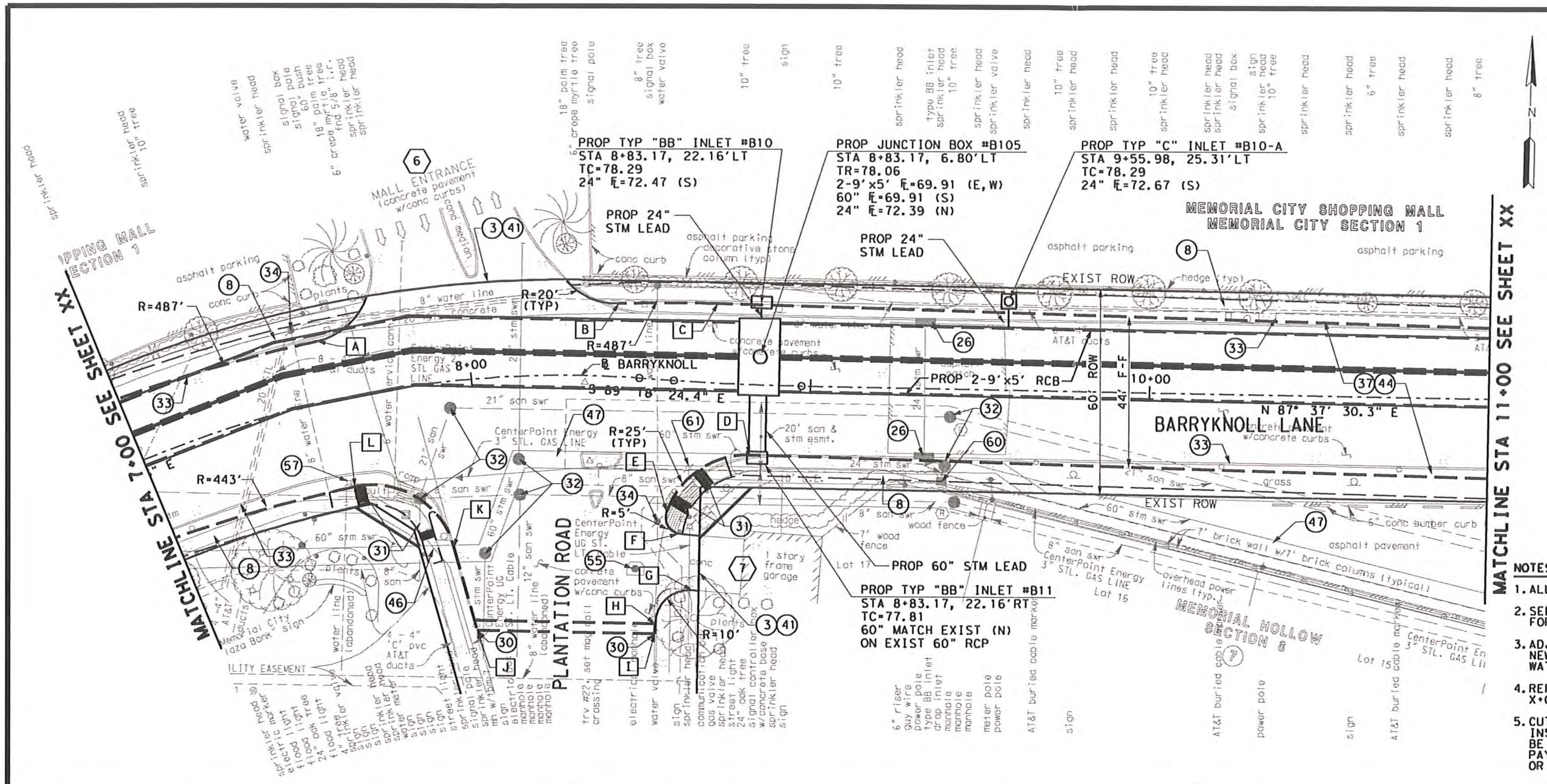
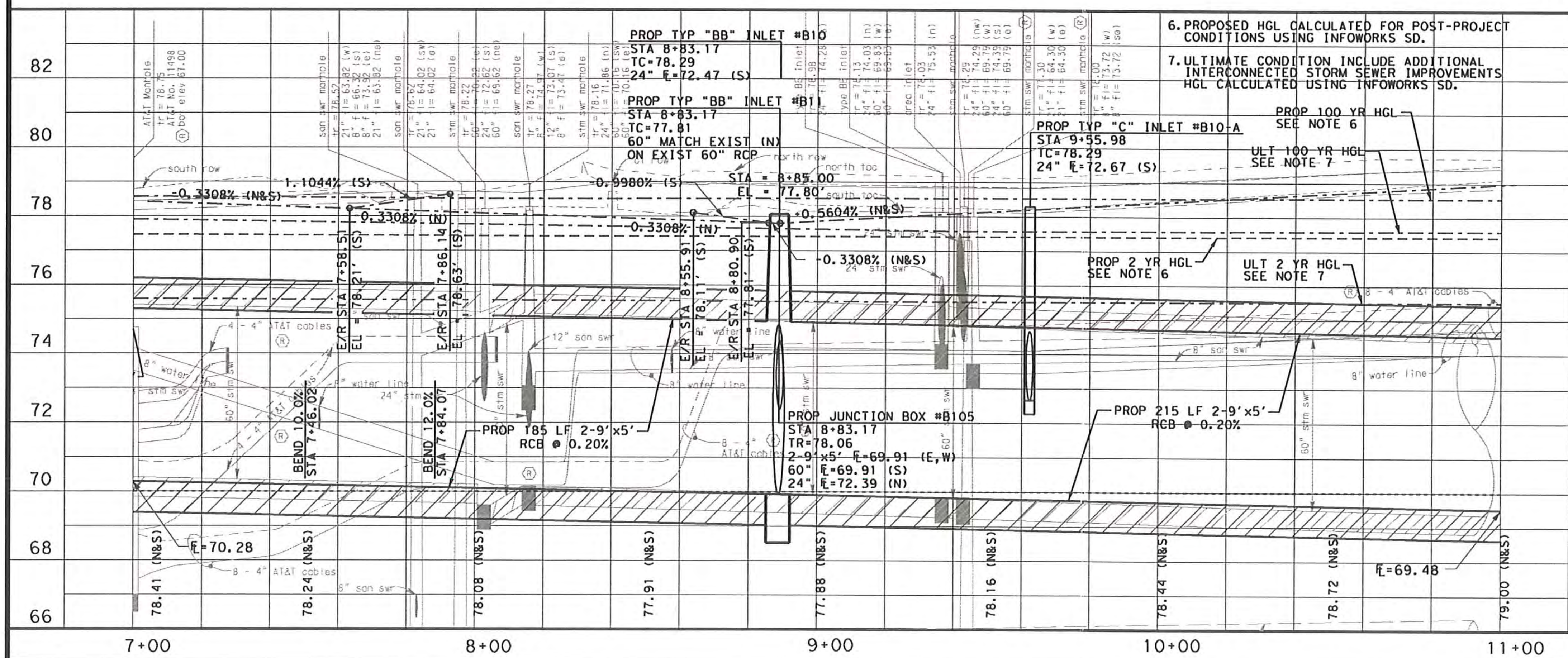



KEYED NOTES

- (3) PROPOSED SAWED JOINT AND EXPOSE 15-INCHES OF REINFORCING STEEL. IF NO REINFORCING STEEL EXISTS, USE HORIZONTAL DOWELS. SEE NOTE 11.
- (8) REMOVE EXISTING SIDEWALK.
- (26) REMOVE EXISTING INLET AND LEAD. PLUG AS SHOWN.
- (30) MEET EXISTING CURB OR CURB AND GUTTER FOR GRADE AND ALIGNMENT.
- (31) PROPOSED WHEELCHAIR RAMP, AS SHOWN ON STANDARD DETAIL 02775-02 WHEELCHAIR RAMP DETAILS.
- (32) ADJUST EXISTING MANHOLE FRAME AND COVER TO FIT NEW GRADE.
- (33) REMOVE CURB OR CURB AND GUTTER FOR GRADE AND ALIGNMENT.
- (34) ADJUST EXISTING WATER VALVE BOXES TO NEW PAVING GRADE. REPLACE MISSING OR DAMAGED VALVE BOXES AND COVERS.
- (37) PROPOSED PAVEMENT MARKINGS AS SHOWN ON STANDARD DETAIL 02763-01 - PAVEMENT MARKING DETAILS.
- (41) REMOVE AND REPLACE DRIVEWAY TO ROW, EXCEPT WHERE NOTED OTHERWISE ON PLANS, AT EXISTING WIDTH AS SHOWN ON DETAILS.
- (44) REMOVE EXISTING PAVEMENT (ALL TYPES AND THICKNESSES).
- (46) TRANSITION PROPOSED SIDEWALK TO EXISTING SIDEWALK LEVEL WITH A MINIMUM SLOPE OF 20:1.
- (47) EXISTING STRUCTURE/UTILITY TO REMAIN.
- (55) ADJUST EXISTING MANHOLE FRAME AND COVER TO FIT NEW GRADE AND ALIGNMENT (BY PRIVATE UTILITY COMPANY)
- (57) REMOVE & RELOCATE EXISTING LIGHT STANDARD.
- (60) ADJUST EXISTING GRATE FRAME AND COVER TO FIT NEW GRADE.
- (61) EXISTING GAS VALVE TO BE ADJUSTED TO FIT NEW GRADE. (BY OTHERS; CENTERPOINT ENERGY)

NOTES:

1. ALL RCP ARE CLASS III UNLESS OTHERWISE NOTED.
2. SEE STORM SEWER LATERALS SHEETS XX TO XX FOR MORE INFORMATION.
3. ADJUST EXIST WATER VALVE/METER BOXES TO NEW GRADE. REPLACE ALL MISSING OR DAMAGED WATER VALVE/METER BOXES AND COVERS.
4. REFER TO TYPICAL SECTION (X) FOR STATION X+00 TO X+00
5. CUT AND REMOVE PORTION OF EXISTING RCP INSIDE PROPOSED INLET OR MANHOLE; RCP TO BE FLUSH WITH INSIDE WALL FACE. (NOT SEPARATE PAY ITEM, INCIDENTAL TO UNIT PRICE OF MANHOLE OR INLET.)
6. PROPOSED HGL CALCULATED FOR POST-PROJECT CONDITIONS USING INFOWORKS SD.
7. ULTIMATE CONDITION INCLUDE ADDITIONAL INTERCONNECTED STORM SEWER IMPROVEMENTS HGL CALCULATED USING INFOWORKS SD.




HORIZONTAL GEOMETRY DATA

| NO. | DESCRIP | STATION | OFFSET |
|---|---|---|---|
| A | PCC | 7+56.61 | 22.00 LT |
| B | PCC | 8+42.45 | 22.00 LT |
| C | PT | 8+70.19 | 22.00 LT |
| D | PC | 8+80.90 | 22.00 RT |
| E | PT | 8+55.91 | 39.11 RT |
| F | PT | 8+60.68 | 45.75 RT |
| G | PCC | 8+64.42 | 62.12 RT |
| H | PCC | 8+51.76 | 71.92 RT |
| I | PC | 8+51.65 | 74.92 RT |
| J | PT | 7+89.69 | 69.83 RT |
| K | PC | 7+86.14 | 44.75 RT |
| L | PI | 7+58.51 | 22.00 RT |

PRIVATE UTILITY LINES SHOWN

CENTERPOINT ENERGY, GAS FACILITIES

SBC UTILITY LINES SHOWN DATE
APPROVED FOR SBC UNDERGROUND CONDUIT FACILITIES ONLY. SIGNATURE VALID FOR ONE YEAR

CENTERPOINT ENERGY, ELECTRIC FACILITIES
APPROVED ONLY FOR CROSSING UNDERGROUND DUCTLINES UNLESS NOTED. VALID AT TIME OF REVIEW ONLY.

CABLE COMPANY

INTERIM REVIEW ONLY
Document incomplete: not intended for permit, bidding or construction.
Engineer: TARA G BURRER
P.E. Serial No. 99997
Firm: LOCKWOOD, ANDREWS & NEWNAM, INC.
Firm No.: 2614
Date: 11/4/2011

MEMORIAL CITY REDEVELOPMENT AUTHORITY

Lockwood, Andrews & Newnam, Inc.
A LEO A DALY COMPANY

BARRYKNOLL LANE
T-170015-0001-3
PLAN & PROFILE
PVMT & STM SWR IMPROVEMENTS
STA 7+00 TO 11+00
SHEET 3 OF 11

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

| WATER | WASTEWATER | TRAFFIC |
|---|---|---|
| ST. & BRIDGE | STORMWATER | SWD |

FILE NO.: FACILITY
DRAWING SCALE: CITY DWG NO.
VERT: 1"=2'
HORZ: 1"=20'
SHEET: OF XX

No. | Date | Revisions | App.

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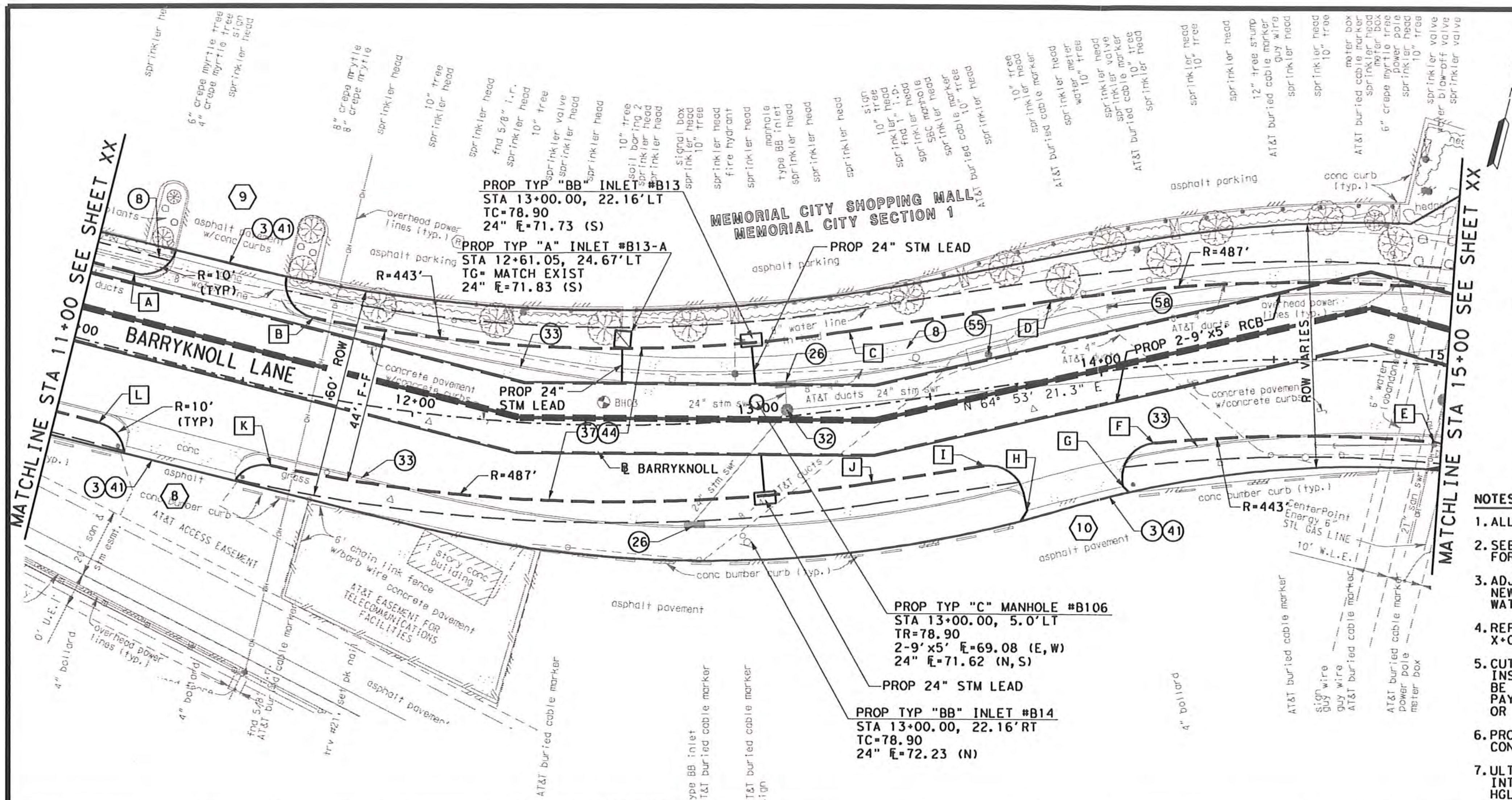
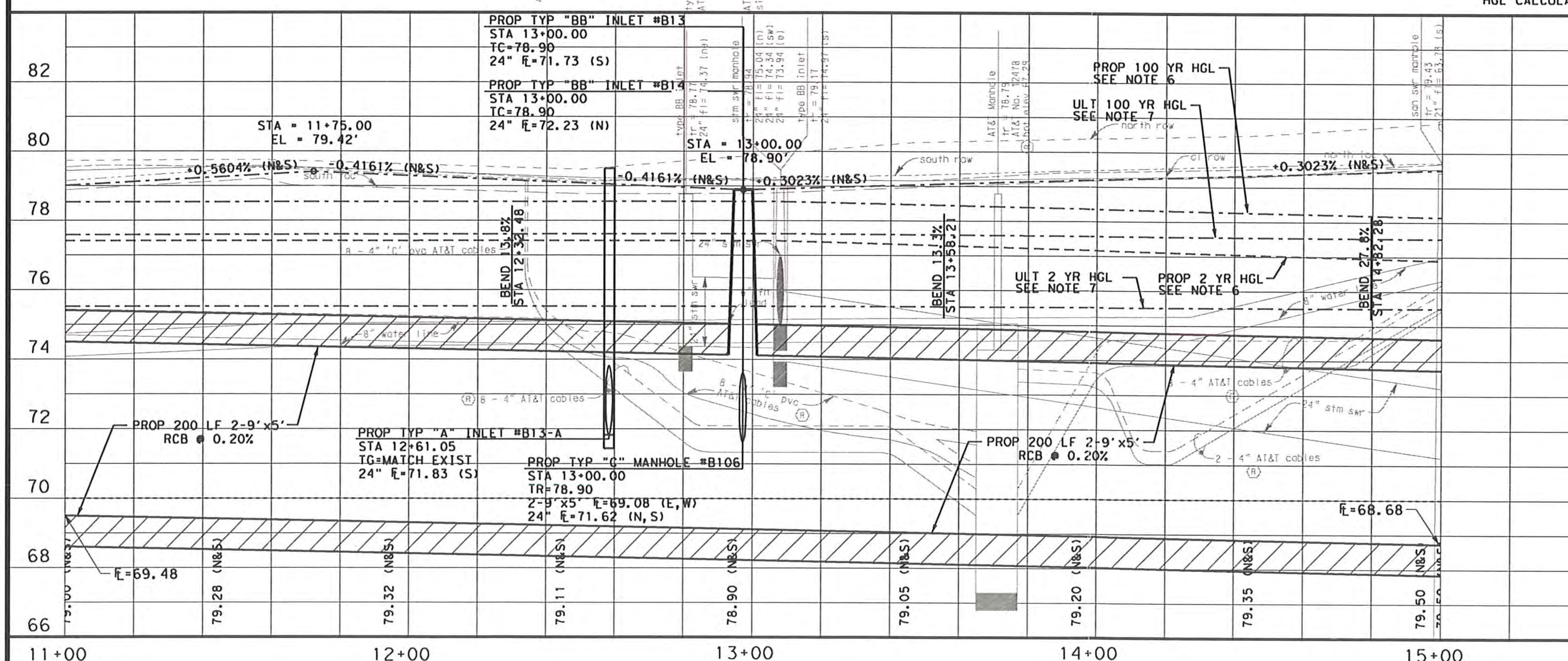



## KEYED NOTES

3. PROPOSED SAWED JOINT AND EXPOSE 15-INCHES OF REINFORCING STEEL. IF NO REINFORCING STEEL EXISTS, USE HORIZONTAL DOWELS. SEE NOTE 11.
8. REMOVE EXISTING SIDEWALK.
13. ADJUST EXISTING INLET TO FIT NEW GRADE AND ALIGNMENT.
26. REMOVE EXISTING INLET AND LEAD. PLUG AS SHOWN.
32. ADJUST EXISTING MANHOLE FRAME AND COVER TO FIT NEW GRADE.
33. REMOVE CURB OR CURB AND GUTTER FOR GRADE AND ALIGNMENT.
37. PROPOSED PAVEMENT MARKINGS AS SHOWN ON STANDARD DETAIL 02763-01 - PAVEMENT MARKING DETAILS.
41. REMOVE AND REPLACE DRIVEWAY TO ROW, EXCEPT WHERE NOTED OTHERWISE ON PLANS, AT EXISTING WIDTH AS SHOWN ON DETAILS.
44. REMOVE EXISTING PAVEMENT (ALL TYPES AND THICKNESSES).
52. EXISTING POWER POLE TO BE REMOVED. (BY OTHERS; CENTERPOINT ENERGY HL&P)
55. ADJUST EXISTING MANHOLE FRAME AND COVER TO FIT NEW GRADE AND ALIGNMENT (BY PRIVATE UTILITY COMPANY)
58. RELOCATE AND RECONNECT EXISTING WATER METER

## NOTES:

1. ALL RCP ARE CLASS III UNLESS OTHERWISE NOTED.
2. SEE STORM SEWER LATERALS SHEETS XX TO XX FOR MORE INFORMATION.
3. ADJUST EXIST WATER VALVE/METER BOXES TO NEW GRADE. REPLACE ALL MISSING OR DAMAGED WATER VALVE/METER BOXES AND COVERS.
4. REFER TO TYPICAL SECTION (X) FOR STATION X+00 TO X+00
5. CUT AND REMOVE PORTION OF EXISTING RCP INSIDE PROPOSED INLET OR MANHOLE; RCP TO BE FLUSH WITH INSIDE WALL FACE. (NOT SEPARATE PAY ITEM, INCIDENTAL TO UNIT PRICE OF MANHOLE OR INLET.)
6. PROPOSED HGL CALCULATED FOR POST-PROJECT CONDITIONS USING INFOWORKS SD.
7. ULTIMATE CONDITION INCLUDE ADDITIONAL INTERCONNECTED STORM SEWER IMPROVEMENTS HGL CALCULATED USING INFOWORKS SD.




| HORIZONTAL GEOMETRY DATA | | | |
|---|---|---|---|
| NO. | DESCRIP | STATION | OFFSET |
| A | PC | 11+12.04 | 22.00 LT |
| B | PT | 11+66.57 | 22.00 LT |
| C | PC | 13+29.73 | 22.00 LT |
| D | PT | 13+88.58 | 22.00 LT |
| E | PC | 14+97.96 | 22.00 RT |
| F | PCC | 14+13.11 | 22.00 RT |
| G | PI | 14+02.37 | 33.51 RT |
| H | PI | 13+72.97 | 36.43 RT |
| I | PCC | 13+62.62 | 22.00 RT |
| J | PC | 12+08.89 | 22.00 RT |
| K | PT | 11+62.98 | 22.00 RT |
| L | PC | 11+12.93 | 22.00 RT |

PRIVATE UTILITY LINES SHOWN

CENTERPOINT ENERGY, GAS FACILITIES

SBC UTILITY LINES SHOWN DATE
APPROVED FOR SBC UNDERGROUND CONDUIT FACILITIES ONLY. SIGNATURE VALID FOR ONE YEAR

CENTERPOINT ENERGY, ELECTRIC FACILITIES
APPROVED ONLY FOR CROSSING UNDERGROUND DUCTLINES UNLESS NOTED. VALID AT TIME OF REVIEW ONLY.

CABLE COMPANY

INTERIM REVIEW ONLY

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Engineer: TARA G BURRER
P.E. Serial No. 99997
Firm: LOCKWOOD, ANDREWS & NEWNAM, INC.
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Date: 11/4/2011

MEMORIAL CITY REDEVELOPMENT AUTHORITY

Lockwood, Andrews & Newnam, Inc.
A LEO A DALY COMPANY

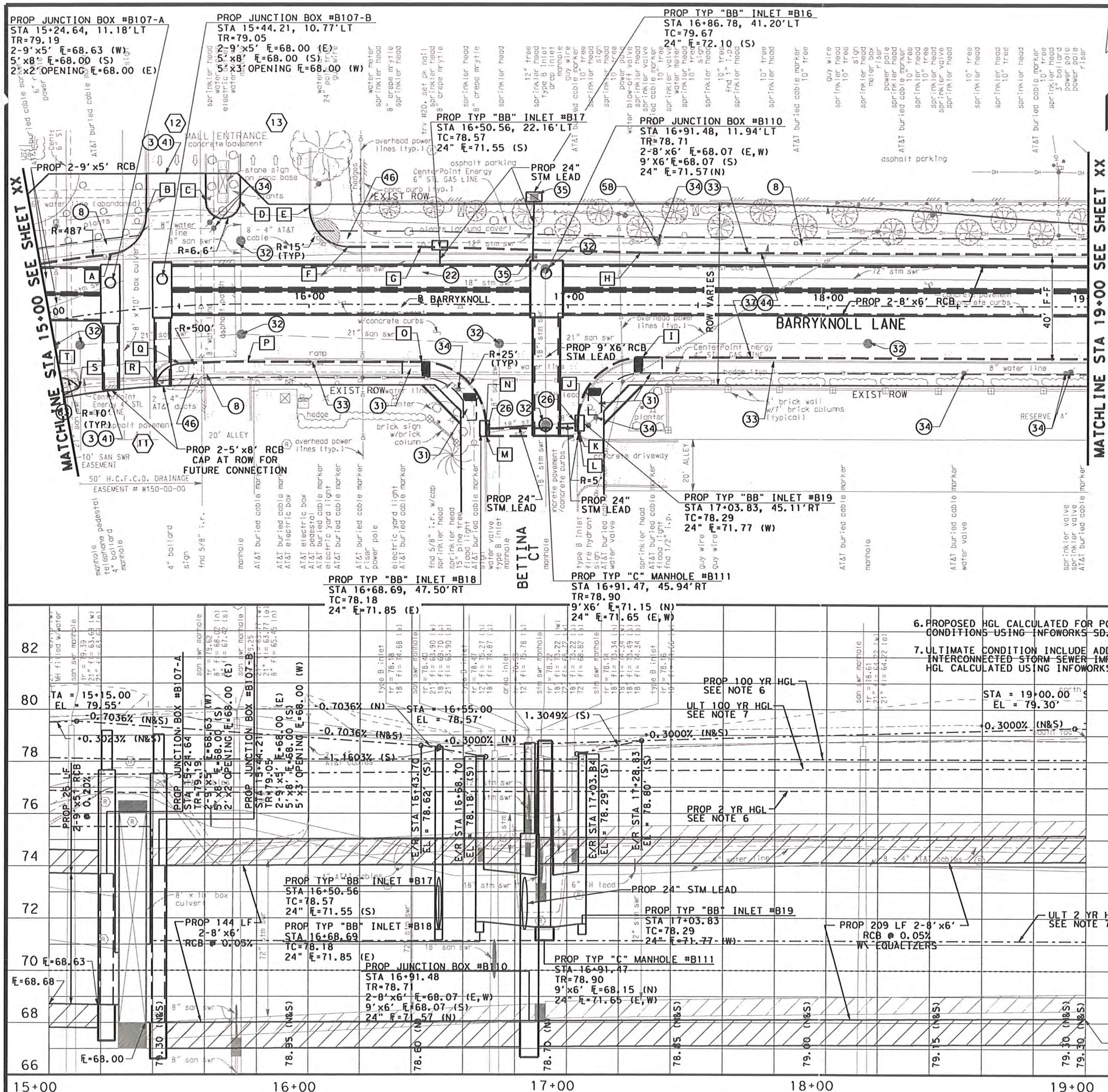
BARRYKNOLL LANE
T-170015-0001-3
PLAN & PROFILE
PVMT & STM SWR IMPROVEMENTS
STA 11+00 TO 15+00
SHEET 4 OF 11

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

| WATER | WASTEWATER | TRAFFIC |
|---|---|---|
| ST. & BRIDGE | STORMWATER | SWD |

FILE NO.:
FACILITY
DRAWING SCALE:
CITY DWG NO.
VERT: 1"=2'
HORZ: 1"=20'
SHEET: OF XX

11/4/2011 10:12:45 AM




## KEYED NOTES

- (3) PROPOSED SAWED JOINT AND EXPOSE 15-INCHES OF REINFORCING STEEL. IF NO REINFORCING STEEL EXISTS, USE HORIZONTAL DOWELS. SEE NOTE 11.
- (8) REMOVE EXISTING SIDEWALK.
- (13) ADJUST EXISTING INLET TO FIT NEW GRADE AND ALIGNMENT.
- (22) EXISTING STRUCTURE TO BE REMOVED.
- (26) REMOVE EXISTING INLET AND LEAD. PLUG AS SHOWN.
- (30) MEET EXISTING CURB OR CURB AND GUTTER FOR GRADE AND ALIGNMENT.
- (31) PROPOSED WHEELCHAIR RAMP, AS SHOWN ON STANDARD DETAIL 02775-02 WHEELCHAIR RAMP DETAILS.
- (32) ADJUST EXISTING MANHOLE FRAME AND COVER TO FIT NEW GRADE.
- (33) REMOVE CURB OR CURB AND GUTTER FOR GRADE AND ALIGNMENT.
- (34) ADJUST EXISTING WATER VALVE BOXES TO NEW PAVING GRADE. REPLACE MISSING OR DAMAGED VALVE BOXES AND COVERS.
- (35) REPLACE TYPE B INLET WITH TYPE BB INLET OR TYPE C-1 INLET.
- (37) PROPOSED PAVEMENT MARKINGS AS SHOWN ON STANDARD DETAIL 02763-01 - PAVEMENT MARKING DETAILS.
- (41) REMOVE AND REPLACE DRIVEWAY TO ROW, EXCEPT WHERE NOTED OTHERWISE ON PLANS, AT EXISTING WIDTH AS SHOWN ON DETAILS.
- (44) REMOVE EXISTING PAVEMENT (ALL TYPES AND THICKNESSES).
- (46) TRANSITION PROPOSED SIDEWALK TO EXISTING SIDEWALK LEVEL WITH A MINIMUM SLOPE OF 20:1.
- (57) REMOVE & RELOCATE EXISTING LIGHT STANDARD.
- (61) EXISTING GAS VALVE TO BE ADJUSTED TO FIT NEW GRADE. (BY OTHERS; CENTERPOINT ENERGY)
- (63) EXISTING SBC PEDESTAL TO BE RELOCATED. (BY OTHERS; SBC)

NOTES:

1. ALL RCP ARE CLASS III UNLESS OTHERWISE NOTED.
2. SEE STORM SEWER LATERALS SHEETS XX TO XX FOR MORE INFORMATION.
3. ADJUST EXIST WATER VALVE/METER BOXES TO NEW GRADE. REPLACE ALL MISSING OR DAMAGED WATER VALVE/METER BOXES AND COVERS.
4. REFER TO TYPICAL SECTION (X) FOR STATION X+00 TO X+00
5. CUT AND REMOVE PORTION OF EXISTING RCP INSIDE PROPOSED INLET OR MANHOLE; RCP TO BE FLUSH WITH INSIDE WALL FACE. (NOT SEPARATE PAY ITEM, INCIDENTAL TO UNIT PRICE OF MANHOLE OR INLET.)
6. PROPOSED HGL CALCULATED FOR POST-PROJECT CONDITIONS USING INFOWORKS SD.
7. ULTIMATE CONDITION INCLUDE ADDITIONAL INTERCONNECTED STORM SEWER IMPROVEMENTS HGL CALCULATED USING INFOWORKS SD.

HORIZONTAL GEOMETRY DATA

| NO. | DESCRIP | STATION | OFFSET |
|---|---|---|---|
| A | PCC | 15+26.21 | 22.00 LT |
| B | PT | 15+40.09 | 35.92 LT |
| C | PC | 15+61.48 | 39.71 LT |
| D | PT | 15+73.69 | 39.52 LT |
| E | PC | 16+00.18 | 36.96 LT |
| F | PCC | 16+15.18 | 22.00 LT |
| G | PT | 16+43.38 | 22.00 LT |
| H | PT | 17+27.92 | 20.00 RT |
| I | PC | 17+28.83 | 20.00 RT |
| J | PT | 17+03.84 | 44.53 RT |
| K | PI | 17+03.79 | 47.28 RT |
| L | PI | 17+04.64 | 50.16 RT |
| M | PT | 16+68.73 | 50.45 RT |
| N | PC | 16+68.70 | 46.80 RT |
| O | PT | 16+43.70 | 22.00 RT |
| P | PC | 15+76.45 | 22.00 RT |
| Q | PT | 15+48.98 | 22.00 RT |
| R | PCC | 15+38.96 | 28.51 RT |
| S | PI | 15+07.31 | 27.16 RT |
| T | PI | 14+97.96 | 22.00 RT |

PRIVATE UTILITY LINES SHOWN

CENTERPOINT ENERGY, GAS FACILITIES

SBC UTILITY LINES SHOWN DATE
APPROVED FOR SBC UNDERGROUND CONDUIT FACILITIES ONLY. SIGNATURE VALID FOR ONE YEAR

CENTERPOINT ENERGY, ELECTRIC FACILITIES
APPROVED ONLY FOR CROSSING UNDERGROUND DUCTLINES UNLESS NOTED. VALID AT TIME OF REVIEW ONLY.

CABLE COMPANY

INTERIM REVIEW ONLY
Document incomplete: not intended for permit, bidding or construction.
Engineer: TARA G BURRER
P.E. Serial No. 99997
Firm: LOCKWOOD, ANDREWS & NEWNAM, INC.
Firm No.: 2614
Date: 11/4/2011

MEMORIAL CITY REDEVELOPMENT AUTHORITY

Lockwood, Andrews & Newnam, Inc.
A LEO A DALY COMPANY

BARRYKNOLL LANE
T-170015-0001-3
PLAN & PROFILE
PVMT & STM SWR IMPROVEMENTS
STA 15+00 TO 19+00
SHEET 5 OF 11

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

| WATER | WASTEWATER | TRAFFIC |
|---|---|---|
| ST. & BRIDGE | STORMWATER | SWD |

FILE NO.: FACILITY
DRAWING SCALE: CITY DWG NO.
VERT: 1"=2'
HORZ: 1"=20'
SHEET: OF XX

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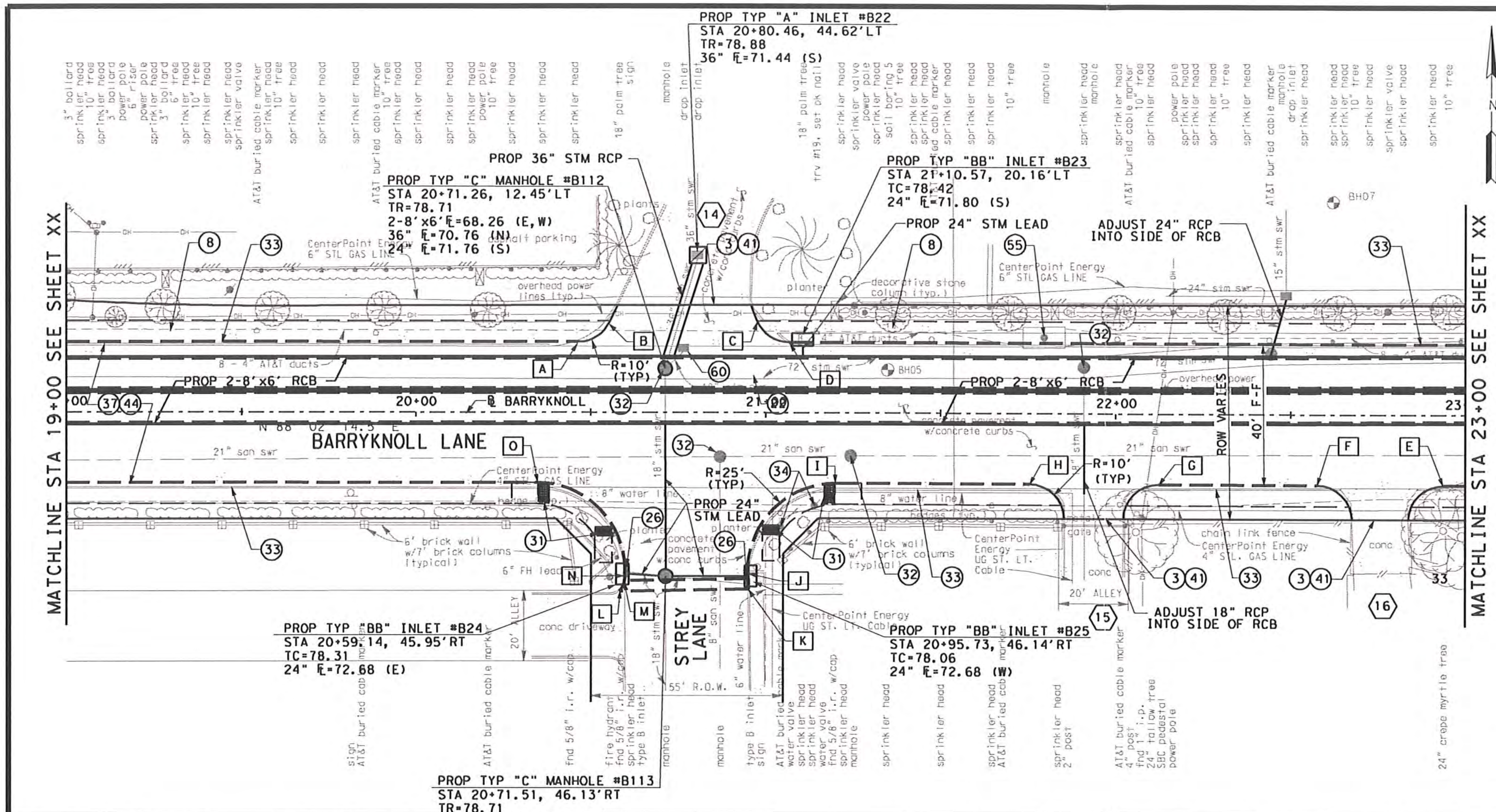
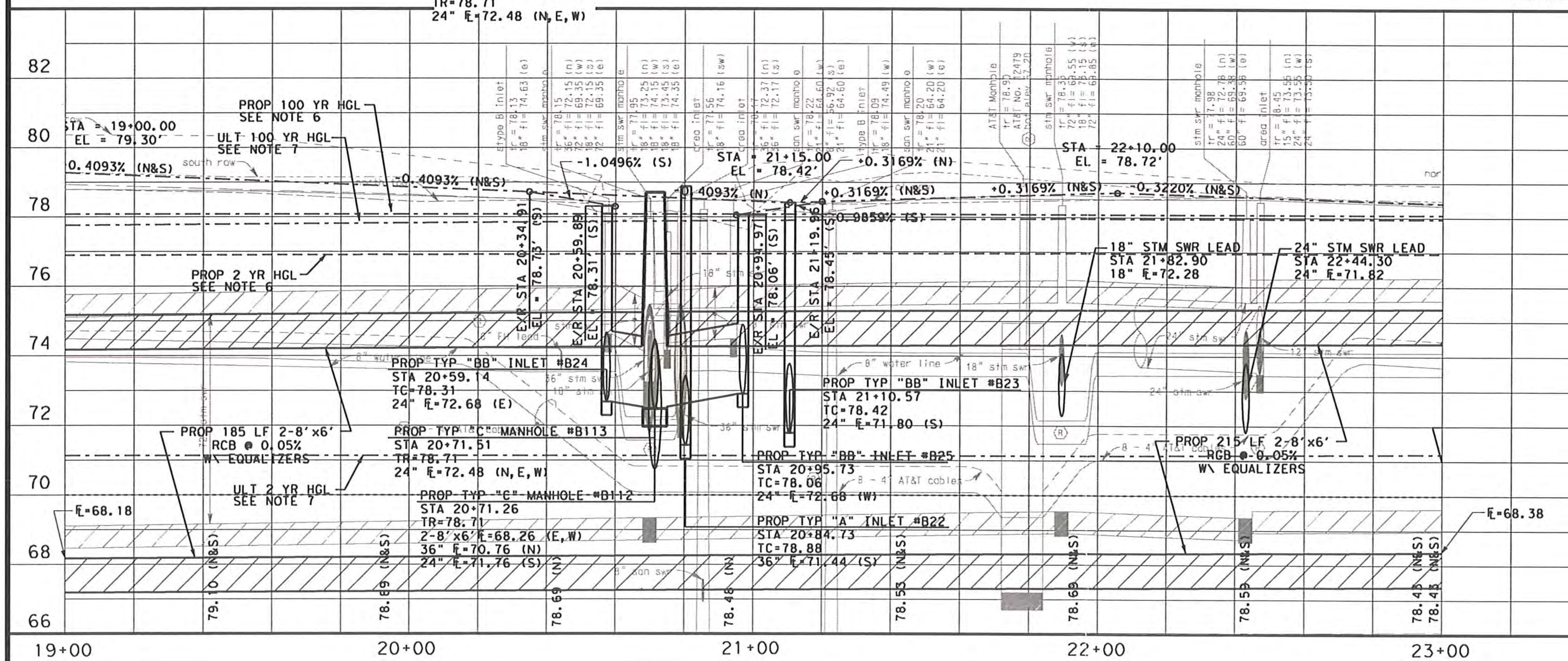



# KEYED NOTES

- (3) PROPOSED SAWED JOINT AND EXPOSE 15-INCHES OF REINFORCING STEEL. IF NO REINFORCING STEEL EXISTS, USE HORIZONTAL DOWELS. SEE NOTE 11.
- (8) REMOVE EXISTING SIDEWALK.
- (13) ADJUST EXISTING INLET TO FIT NEW GRADE AND ALIGNMENT.
- (22) EXISTING STRUCTURE TO BE REMOVED.
- (26) REMOVE EXISTING INLET AND LEAD. PLUG AS SHOWN.
- (31) PROPOSED WHEELCHAIR RAMP, AS SHOWN ON STANDARD DETAIL 02775-02 WHEELCHAIR RAMP DETAILS.
- (32) ADJUST EXISTING MANHOLE FRAME AND COVER TO FIT NEW GRADE.
- (33) REMOVE CURB OR CURB AND GUTTER FOR GRADE AND ALIGNMENT.
- (34) ADJUST EXISTING WATER VALVE BOXES TO NEW PAVING GRADE. REPLACE MISSING OR DAMAGED VALVE BOXES AND COVERS.
- (37) PROPOSED PAVEMENT MARKINGS AS SHOWN ON STANDARD DETAIL 02763-01 - PAVEMENT MARKING DETAILS.
- (41) REMOVE AND REPLACE DRIVEWAY TO ROW, EXCEPT WHERE NOTED OTHERWISE ON PLANS, AT EXISTING WIDTH AS SHOWN ON DETAILS.
- (44) REMOVE EXISTING PAVEMENT (ALL TYPES AND THICKNESSES).
- (55) ADJUST EXISTING MANHOLE FRAME AND COVER TO FIT NEW GRADE AND ALIGNMENT (BY PRIVATE UTILITY COMPANY)

## NOTES:

1. ALL RCP ARE CLASS III UNLESS OTHERWISE NOTED.
2. SEE STORM SEWER LATERALS SHEETS XX TO XX FOR MORE INFORMATION.
3. ADJUST EXIST WATER VALVE/METER BOXES TO NEW GRADE. REPLACE ALL MISSING OR DAMAGED WATER VALVE/METER BOXES AND COVERS.
4. REFER TO TYPICAL SECTION (X) FOR STATION X+00 TO X+00
5. CUT AND REMOVE PORTION OF EXISTING RCP INSIDE PROPOSED INLET OR MANHOLE; RCP TO BE FLUSH WITH INSIDE WALL FACE. (NOT SEPARATE PAY ITEM, INCIDENTAL TO UNIT PRICE OF MANHOLE OR INLET.)
6. PROPOSED HGL CALCULATED FOR POST-PROJECT CONDITIONS USING INFOWORKS SD.
7. ULTIMATE CONDITION INCLUDE ADDITIONAL INTERCONNECTED STORM SEWER IMPROVEMENTS HGL CALCULATED USING INFOWORKS SD.




## HORIZONTAL GEOMETRY DATA

| NO. | DESCRIP | STATION | OFFSET |
|---|---|---|---|
| A | PC | 20+46.34 | 20.00 LT |
| B | PT | 20+55.34 | 25.64 LT |
| C | PC | 20+97.44 | 26.13 LT |
| D | PT | 21+06.66 | 20.00 LT |
| E | PT | 22+93.80 | 20.00 RT |
| F | PC | 22+57.64 | 20.00 RT |
| G | PT | 22+12.27 | 20.00 RT |
| H | PC | 21+75.34 | 20.00 RT |
| I | PT | 21+19.96 | 20.00 RT |
| J | PC | 20+94.97 | 45.41 RT |
| K | PI | 20+95.04 | 50.21 RT |
| L | PI | 20+58.35 | 50.81 RT |
| M | PC | 20+59.83 | 47.47 RT |
| N | PT | 20+59.89 | 46.07 RT |
| O | PC | 20+34.91 | 20.00 RT |

PRIVATE UTILITY LINES SHOWN

CENTERPOINT ENERGY, GAS FACILITIES

SBC UTILITY LINES SHOWN DATE
APPROVED FOR SBC UNDERGROUND CONDUIT FACILITIES ONLY. SIGNATURE VALID FOR ONE YEAR

CENTERPOINT ENERGY, ELECTRIC FACILITIES
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CABLE COMPANY

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Firm No.: 2614
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MEMORIAL CITY REDEVELOPMENT AUTHORITY

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A LEO A DALY COMPANY

BARRYKNOLL LANE
T-170015-0001-3
PLAN & PROFILE
PVMT & STM SWR IMPROVEMENTS
STA 19+00 TO 23+00
SHEET 6 OF 11

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

| WATER | WASTEWATER | TRAFFIC |
|---|---|---|
| ST. & BRIDGE | STORMWATER | SWD |

FILE NO.: FACILITY
DRAWING SCALE: CITY DWG NO.
VERT: 1"=2'
HORZ: 1"=20'
SHEET: OF XX

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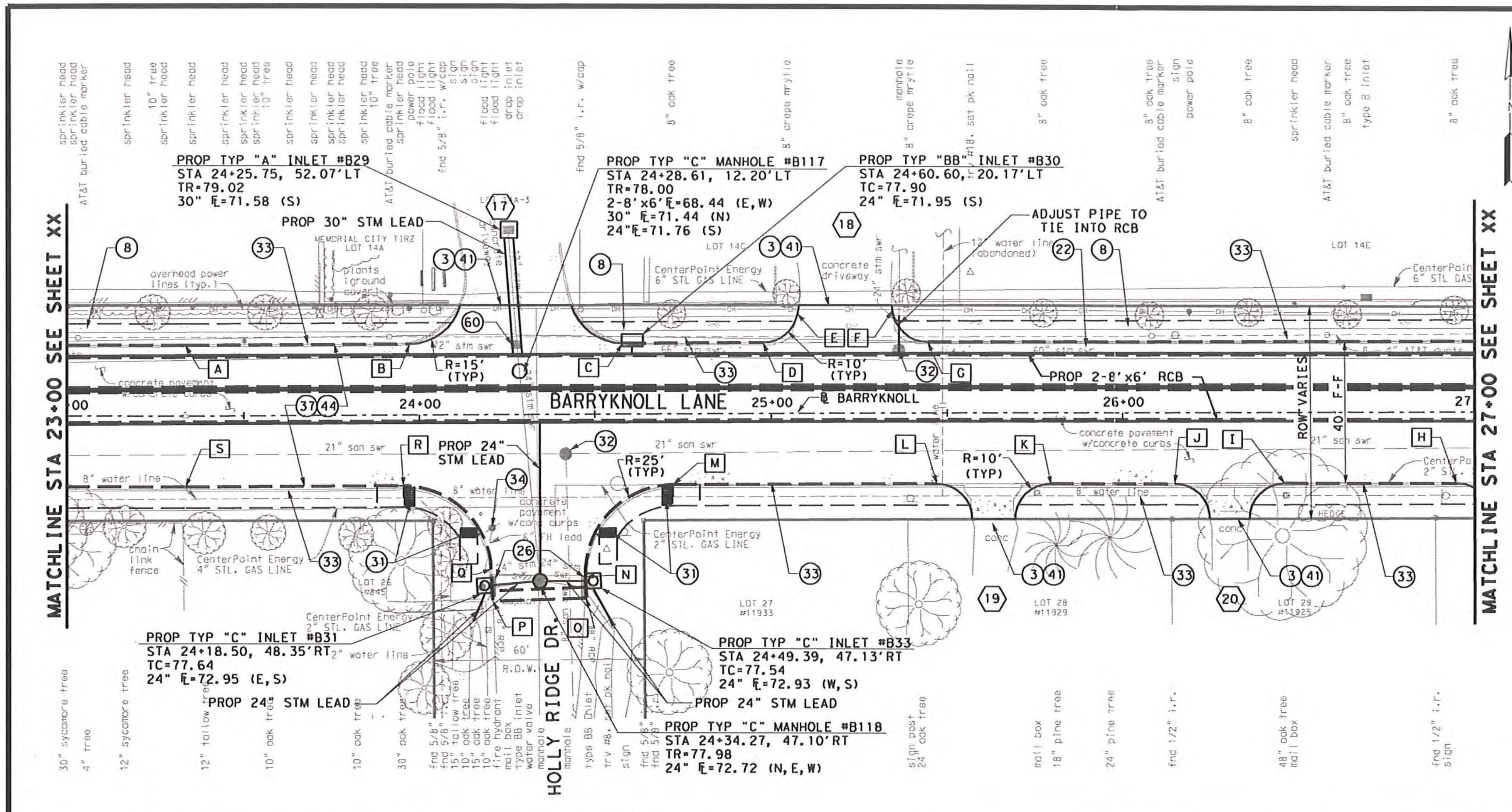


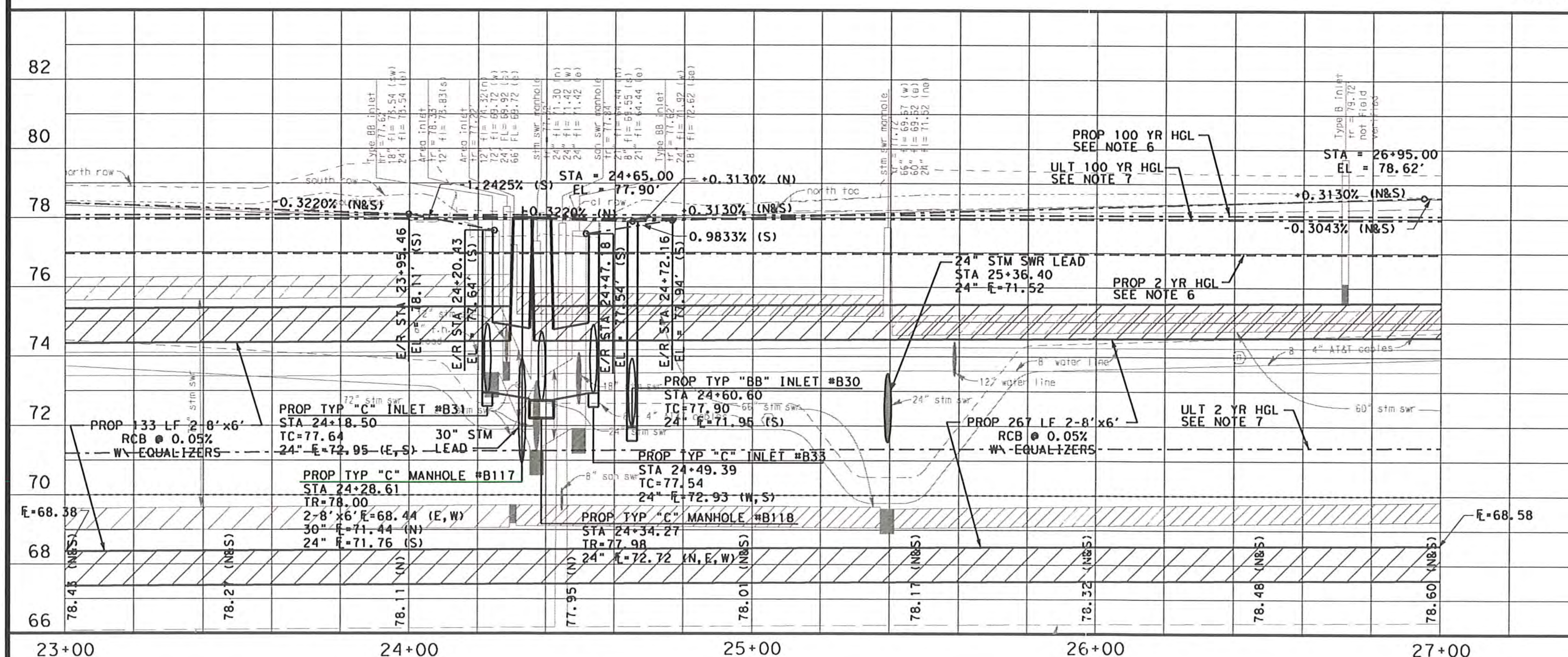


## KEYED NOTES

- (3) PROPOSED SAWED JOINT AND EXPOSE 15-INCHES OF REINFORCING STEEL. IF NO REINFORCING STEEL EXISTS, USE HORIZONTAL DOWELS. SEE NOTE 11.
- (8) REMOVE EXISTING SIDEWALK.
- (22) EXISTING STRUCTURE TO BE REMOVED.
- (26) REMOVE EXISTING INLET AND LEAD. PLUG AS SHOWN.
- (31) PROPOSED WHEELCHAIR RAMP, AS SHOWN ON STANDARD DETAIL 02775-02 WHEELCHAIR RAMP DETAILS.
- (32) ADJUST EXISTING MANHOLE FRAME AND COVER TO FIT NEW GRADE.
- (33) REMOVE CURB OR CURB AND GUTTER FOR GRADE AND ALIGNMENT.
- (34) ADJUST EXISTING WATER VALVE BOXES TO NEW PAVING GRADE. REPLACE MISSING OR DAMAGED VALVE BOXES AND COVERS.
- (37) PROPOSED PAVEMENT MARKINGS AS SHOWN ON STANDARD DETAIL 02763-01 - PAVEMENT MARKING DETAILS.
- (41) REMOVE AND REPLACE DRIVEWAY TO ROW, EXCEPT WHERE NOTED OTHERWISE ON PLANS, AT EXISTING WIDTH AS SHOWN ON DETAILS.
- (44) REMOVE EXISTING PAVEMENT (ALL TYPES AND THICKNESSES).
- (60) ADJUST EXISTING GRATE FRAME AND COVER TO FIT NEW GRADE.

## NOTES:

1. ALL RCP ARE CLASS III UNLESS OTHERWISE NOTED.
2. SEE STORM SEWER LATERALS SHEETS XX TO XX FOR MORE INFORMATION.
3. ADJUST EXIST WATER VALVE/METER BOXES TO NEW GRADE. REPLACE ALL MISSING OR DAMAGED WATER VALVE/METER BOXES AND COVERS.
4. REFER TO TYPICAL SECTION (X) FOR STATION X+00 TO X+00
5. CUT AND REMOVE PORTION OF EXISTING RCP INSIDE PROPOSED INLET OR MANHOLE; RCP TO BE FLUSH WITH INSIDE WALL FACE. (NOT SEPARATE PAY ITEM, INCIDENTAL TO UNIT PRICE OF MANHOLE OR INLET.)
6. PROPOSED HGL CALCULATED FOR POST-PROJECT CONDITIONS USING INFOWORKS SD.
7. ULTIMATE CONDITION INCLUDE ADDITIONAL INTERCONNECTED STORM SEWER IMPROVEMENTS HGL CALCULATED USING INFOWORKS SD.

HORIZONTAL GEOMETRY DATA

| NO. | DESCRIP | STATION | OFFSET |
|---|---|---|---|
| A | PI | 23+33.43 | 20.00 LT |
| B | PC | 23+97.37 | 20.00 LT |
| C | PT | 24+57.88 | 20.00 LT |
| D | PC | 24+97.70 | 20.00 LT |
| E | PT | 25+07.41 | 27.46 LT |
| F | PC | 25+34.58 | 28.98 LT |
| G | PT | 25+44.52 | 20.00 LT |
| H | PC | 26+94.79 | 20.00 RT |
| I | PT | 26+45.98 | 20.00 RT |
| J | PC | 26+14.78 | 20.00 RT |
| K | PT | 25+79.26 | 20.00 RT |
| L | PC | 25+47.07 | 20.00 RT |
| M | PT | 24+72.16 | 20.00 RT |
| N | PC | 24+47.18 | 45.92 RT |
| O | PI | 24+47.40 | 51.93 RT |
| P | PI | 24+20.90 | 52.78 RT |
| Q | PT | 24+20.43 | 43.70 RT |
| R | PC | 23+95.46 | 20.00 RT |
| S | PI | 23+33.57 | 20.00 RT |

PRIVATE UTILITY LINES SHOWN

CENTERPOINT ENERGY, GAS FACILITIES

SBC UTILITY LINES SHOWN DATE
APPROVED FOR SBC UNDERGROUND CONDUIT FACILITIES ONLY. SIGNATURE VALID FOR ONE YEAR

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CABLE COMPANY

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Engineer: TARA G BURRER
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Firm: LOCKWOOD, ANDREWS & NEWNAM, INC.
Firm No.: 2614
Date: 11/4/2011

MEMORIAL CITY REDEVELOPMENT AUTHORITY

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A LEO A DALY COMPANY

BARRYKNOLL LANE
T-170015-0001-3
PLAN & PROFILE
PVMT & STM SWR IMPROVEMENTS
STA 23+00 TO 27+00
SHEET 7 OF 11

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

| WATER | WASTEWATER | TRAFFIC |
|---|---|---|
| ST. & BRIDGE | STORMWATER | SWQ |

FILE NO.: FACILITY
DRAWING SCALE: CITY DWG NO.
VERT: 1"=2'
HORZ: 1"=20'
SHEET: OF XX

No. Date Revisions App

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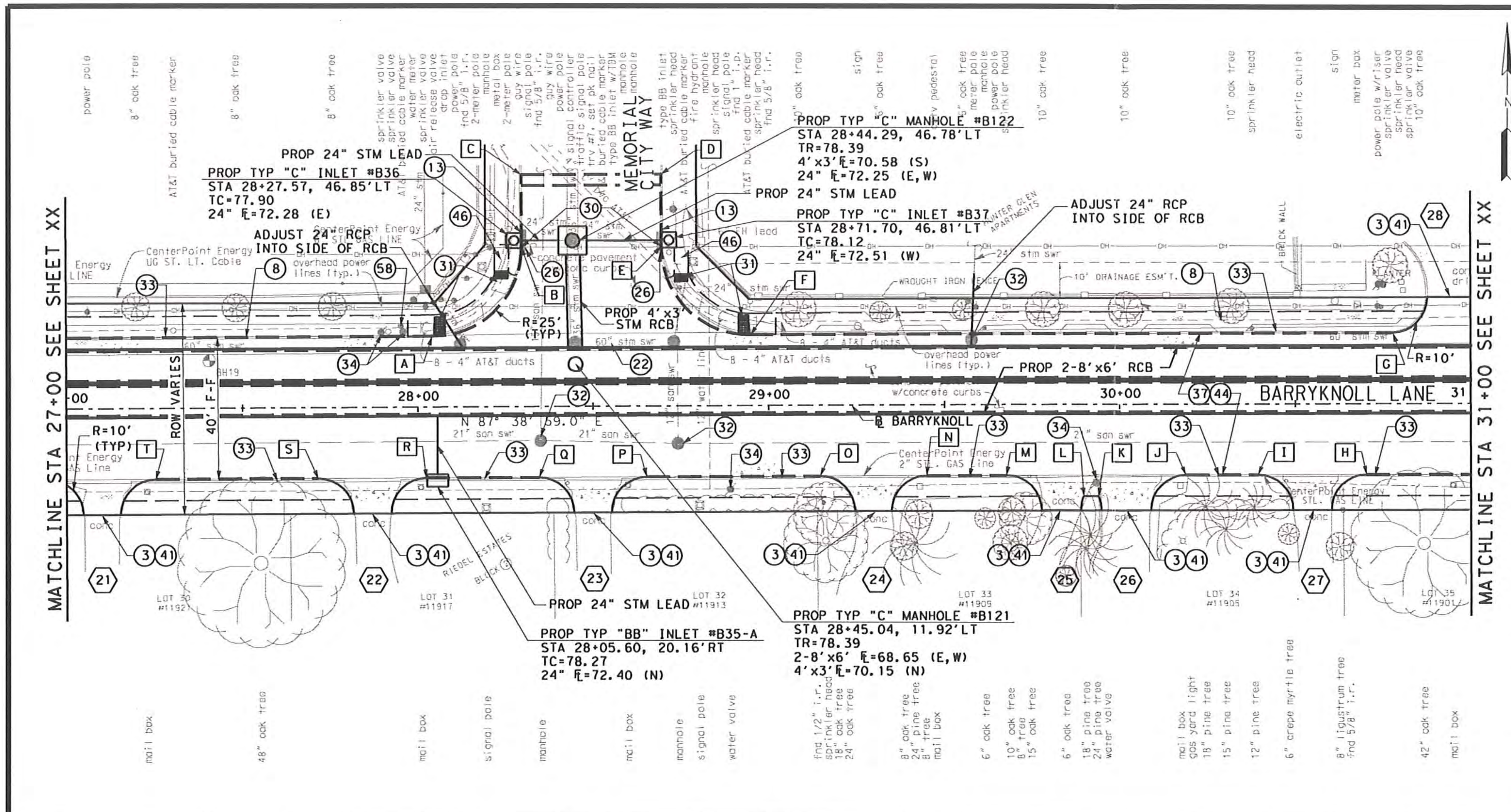


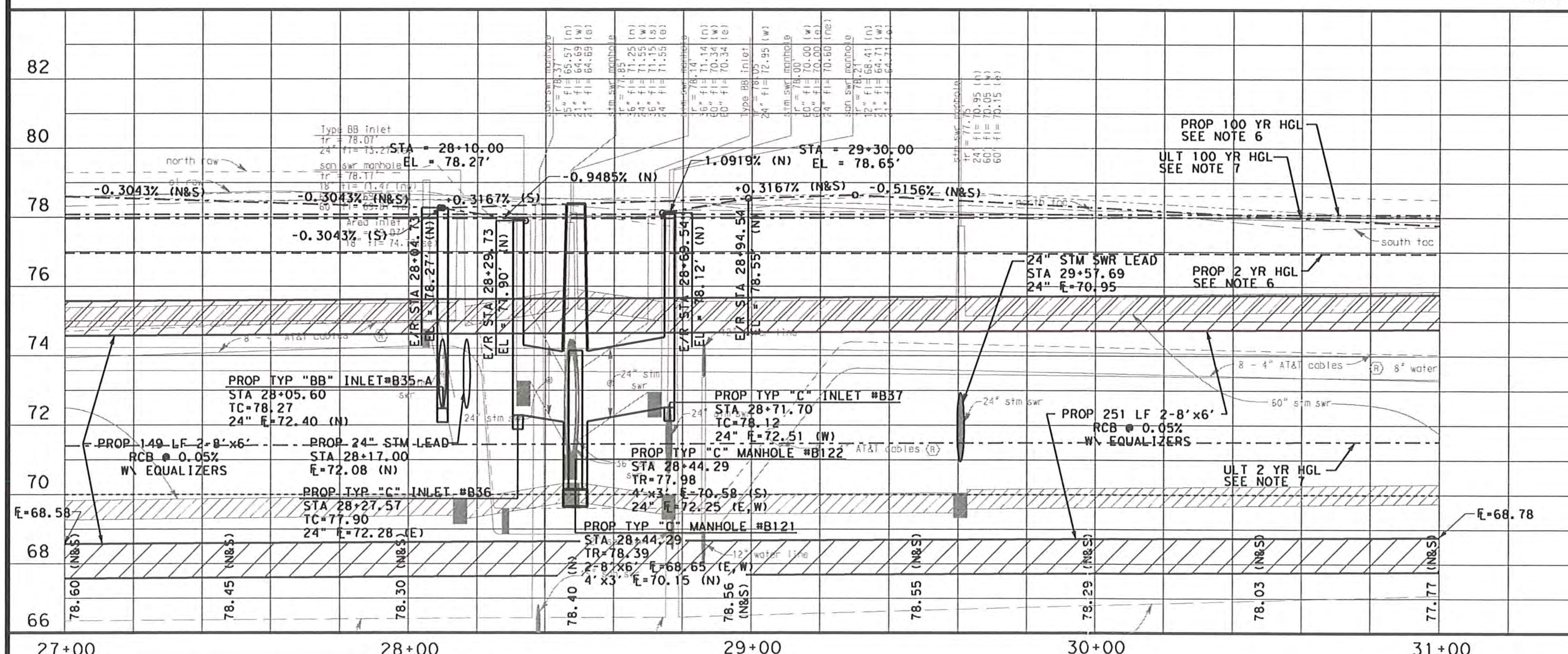


## KEYED NOTES

3. PROPOSED SAWED JOINT AND EXPOSE 15-INCHES OF REINFORCING STEEL. IF NO REINFORCING STEEL EXISTS, USE HORIZONTAL DOWELS. SEE NOTE 11.
8. REMOVE EXISTING SIDEWALK.
13. ADJUST EXISTING INLET TO FIT NEW GRADE AND ALIGNMENT.
22. EXISTING STRUCTURE TO BE REMOVED.
26. REMOVE EXISTING INLET AND LEAD. PLUG AS SHOWN.
30. MEET EXISTING CURB OR CURB AND GUTTER FOR GRADE AND ALIGNMENT.
31. PROPOSED WHEELCHAIR RAMP, AS SHOWN ON STANDARD DETAIL 02775-02 WHEELCHAIR RAMP DETAILS.
32. ADJUST EXISTING MANHOLE FRAME AND COVER TO FIT NEW GRADE.
33. REMOVE CURB OR CURB AND GUTTER FOR GRADE AND ALIGNMENT.
34. ADJUST EXISTING WATER VALVE BOXES TO NEW PAVING GRADE. REPLACE MISSING OR DAMAGED VALVE BOXES AND COVERS.
37. PROPOSED PAVEMENT MARKINGS AS SHOWN ON STANDARD DETAIL 02763-01 - PAVEMENT MARKING DETAILS.
41. REMOVE AND REPLACE DRIVEWAY TO ROW, EXCEPT WHERE NOTED OTHERWISE ON PLANS, AT EXISTING WIDTH AS SHOWN ON DETAILS.
44. REMOVE EXISTING PAVEMENT (ALL TYPES AND THICKNESSES).
58. RELOCATE AND RECONNECT EXISTING WATER METER.

## NOTES:

1. ALL RCP ARE CLASS III UNLESS OTHERWISE NOTED.
2. SEE STORM SEWER LATERALS SHEETS XX TO XX FOR MORE INFORMATION.
3. ADJUST EXIST WATER VALVE/METER BOXES TO NEW GRADE. REPLACE ALL MISSING OR DAMAGED WATER VALVE/METER BOXES AND COVERS.
4. REFER TO TYPICAL SECTION (X) FOR STATION X+00 TO X+00
5. CUT AND REMOVE PORTION OF EXISTING RCP INSIDE PROPOSED INLET OR MANHOLE; RCP TO BE FLUSH WITH INSIDE WALL FACE. (NOT SEPARATE PAY ITEM, INCIDENTAL TO UNIT PRICE OF MANHOLE OR INLET.)
6. PROPOSED HGL CALCULATED FOR POST-PROJECT CONDITIONS USING INFOWORKS SD.
7. ULTIMATE CONDITION INCLUDE ADDITIONAL INTERCONNECTED STORM SEWER IMPROVEMENTS HGL CALCULATED USING INFOWORKS SD.

HORIZONTAL GEOMETRY DATA

| NO. | DESCRIP | STATION | OFFSET |
|---|---|---|---|
| A | PC | 28+04.73 | 20.00 LT |
| B | PT | 28+29.73 | 44.98 LT |
| C | PI | 28+29.75 | 65.48 LT |
| D | PI | 28+69.46 | 65.44 LT |
| E | PC | 28+69.54 | 44.91 LT |
| F | PT | 28+94.54 | 20.00 LT |
| G | PC | 30+77.78 | 20.00 LT |
| H | PT | 30+70.34 | 20.00 RT |
| I | PC | 30+39.39 | 20.00 RT |
| J | PT | 30+18.90 | 20.00 RT |
| K | PI | 29+93.85 | 26.00 RT |
| L | PI | 29+89.72 | 26.00 RT |
| M | PC | 29+67.68 | 20.00 RT |
| N | PT | 29+44.95 | 20.00 RT |
| O | PC | 29+14.61 | 20.00 RT |
| P | PT | 28+65.21 | 20.00 RT |
| Q | PC | 28+34.57 | 20.00 RT |
| R | PT | 28+02.40 | 20.00 RT |
| S | PC | 27+71.74 | 20.00 RT |
| T | PT | 27+25.23 | 20.00 RT |

PRIVATE UTILITY LINES SHOWN

CENTERPOINT ENERGY, GAS FACILITIES

SBC UTILITY LINES SHOWN DATE
APPROVED FOR SBC UNDERGROUND CONDUIT FACILITIES ONLY. SIGNATURE VALID FOR ONE YEAR

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CABLE COMPANY

INTERIM REVIEW ONLY

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Engineer: TARA G BURRER
P.E. Serial No. 99997
Firm: LOCKWOOD, ANDREWS & NEWNAM, INC.
Firm No.: 2614
Date: 11/4/2011

MEMORIAL CITY REDEVELOPMENT AUTHORITY

Lockwood, Andrews & Newnam, Inc.
A LEO A DALY COMPANY

BARRYKNOLL LANE
T-170015-0001-3
PLAN & PROFILE
PVMT & STM SWR IMPROVEMENTS
STA 27+00 TO 31+00

SHEET 8 OF 11

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

WATER | WASTEWATER | TRAFFIC
ST. & BRIDGE | STORMWATER | SWD

FILE NO.:
FACILITY
DRAWING SCALE:
CITY DWG NO.
VERT: 1"=2'
HORZ: 1"=20'
SHEET: OF XX

No. | Date | Revisions | App.

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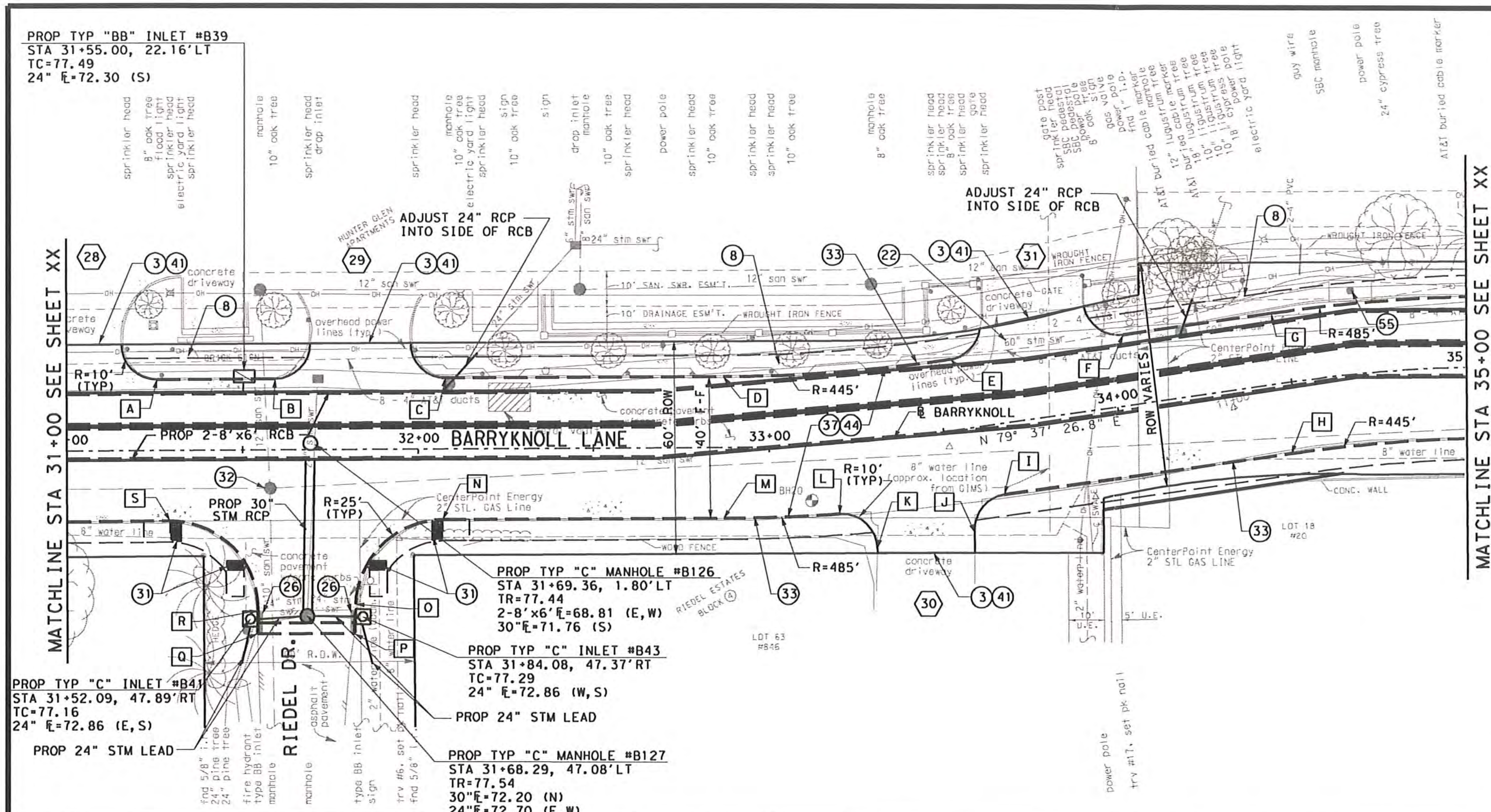
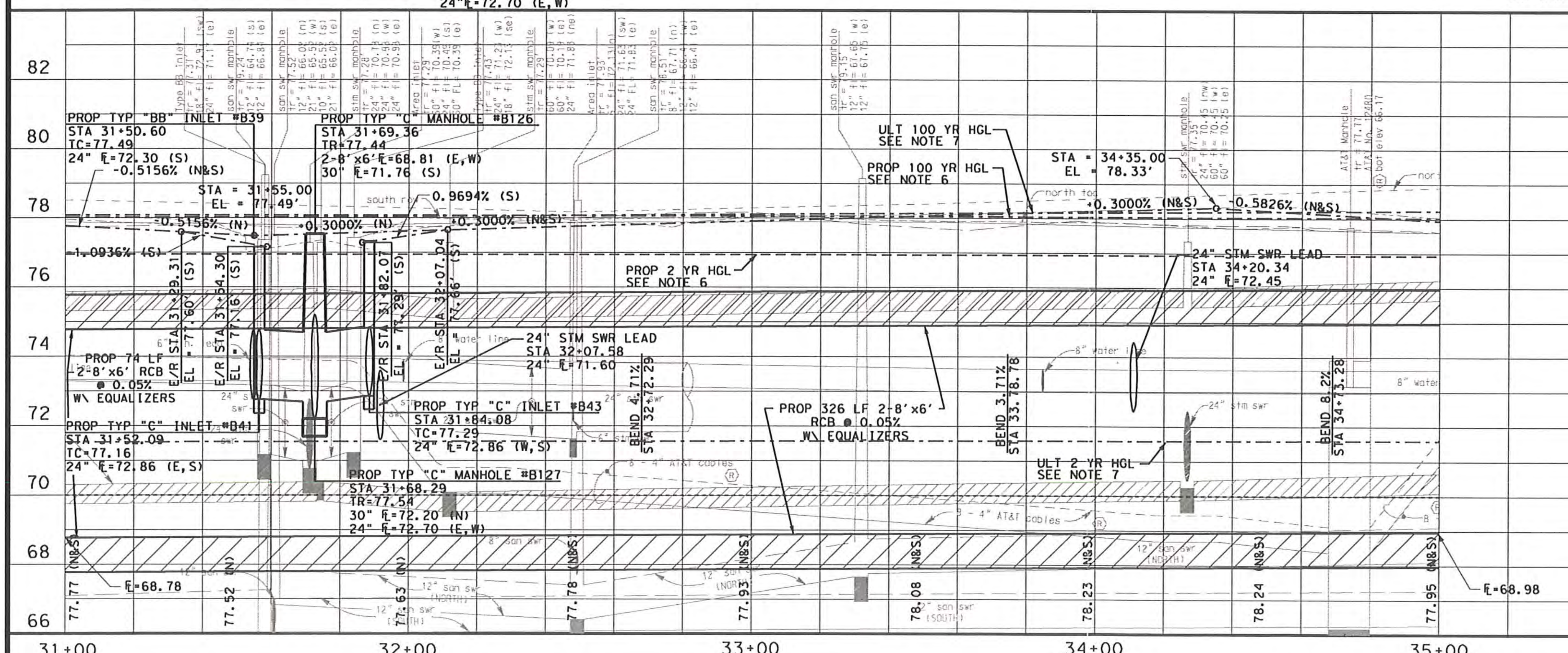



## KEYED NOTES

- (3) PROPOSED SAWED JOINT AND EXPOSE 15-INCHES OF REINFORCING STEEL. IF NO REINFORCING STEEL EXISTS, USE HORIZONTAL DOWELS. SEE NOTE 11.
- (8) REMOVE EXISTING SIDEWALK.
- (22) EXISTING STRUCTURE TO BE REMOVED.
- (26) REMOVE EXISTING INLET AND LEAD. PLUG AS SHOWN.
- (31) PROPOSED WHEELCHAIR RAMP, AS SHOWN ON STANDARD DETAIL 02775-02 WHEELCHAIR RAMP DETAILS.
- (32) ADJUST EXISTING MANHOLE FRAME AND COVER TO FIT NEW GRADE.
- (33) REMOVE CURB OR CURB AND GUTTER FOR GRADE AND ALIGNMENT.
- (37) PROPOSED PAVEMENT MARKINGS AS SHOWN ON STANDARD DETAIL 02763-01 - PAVEMENT MARKING DETAILS.
- (41) REMOVE AND REPLACE DRIVEWAY TO ROW, EXCEPT WHERE NOTED OTHERWISE ON PLANS, AT EXISTING WIDTH AS SHOWN ON DETAILS.
- (44) REMOVE EXISTING PAVEMENT (ALL TYPES AND THICKNESSES).
- (55) ADJUST EXISTING MANHOLE FRAME AND COVER TO FIT NEW GRADE AND ALIGNMENT (BY PRIVATE UTILITY COMPANY)

## NOTES:

1. ALL RCP ARE CLASS III UNLESS OTHERWISE NOTED.
2. SEE STORM SEWER LATERALS SHEETS XX TO XX FOR MORE INFORMATION.
3. ADJUST EXIST WATER VALVE/METER BOXES TO NEW GRADE. REPLACE ALL MISSING OR DAMAGED WATER VALVE/METER BOXES AND COVERS.
4. REFER TO TYPICAL SECTION (X) FOR STATION X+00 TO X+00
5. CUT AND REMOVE PORTION OF EXISTING RCP INSIDE PROPOSED INLET OR MANHOLE; RCP TO BE FLUSH WITH INSIDE WALL FACE. (NOT SEPARATE PAY ITEM, INCIDENTAL TO UNIT PRICE OF MANHOLE OR INLET.)
6. PROPOSED HGL CALCULATED FOR POST-PROJECT CONDITIONS USING INFOWORKS SD.
7. ULTIMATE CONDITION INCLUDE ADDITIONAL INTERCONNECTED STORM SEWER IMPROVEMENTS HGL CALCULATED USING INFOWORKS SD.




| HORIZONTAL GEOMETRY DATA | | | |
|---|---|---|---|
| NO. | DESCRIP | STATION | OFFSET |
| A | PT | 31+25.66 | 20.00 LT |
| B | PC | 31+59.41 | 20.00 LT |
| C | PT | 32+06.89 | 20.00 LT |
| D | PC | 32+86.99 | 20.00 LT |
| E | PCC | 33+54.76 | 20.00 LT |
| F | PCC | 34+04.43 | 20.00 LT |
| G | PT | 34+46.97 | 20.00 LT |
| H | PC | 34+46.97 | 20.00 RT |
| I | PC | 33+64.71 | 20.00 RT |
| J | PT | 33+54.81 | 28.65 RT |
| K | PCC | 33+27.97 | 30.87 RT |
| L | PC | 33+18.71 | 20.00 RT |
| M | PT | 32+86.99 | 20.00 RT |
| N | PCC | 32+07.04 | 20.00 RT |
| O | PC | 31+82.07 | 43.88 RT |
| P | PT | 31+81.70 | 52.04 RT |
| Q | PC | 31+54.17 | 52.06 RT |
| R | PI | 31+54.30 | 45.52 RT |
| S | PI | 31+29.31 | 20.00 RT |

PRIVATE UTILITY LINES SHOWN

CENTERPOINT ENERGY, GAS FACILITIES

SBC UTILITY LINES SHOWN DATE
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PLAN & PROFILE
PVMT & STM SWR IMPROVEMENTS
STA 31+00 TO 35+00
SHEET 9 OF 11

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

| WATER | WASTEWATER | TRAFFIC |
|---|---|---|
| ST. & BRIDGE | STORMWATER | SWQ |

FILE NO.: FACILITY
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VERT: 1"=2'
HORZ: 1"=20'
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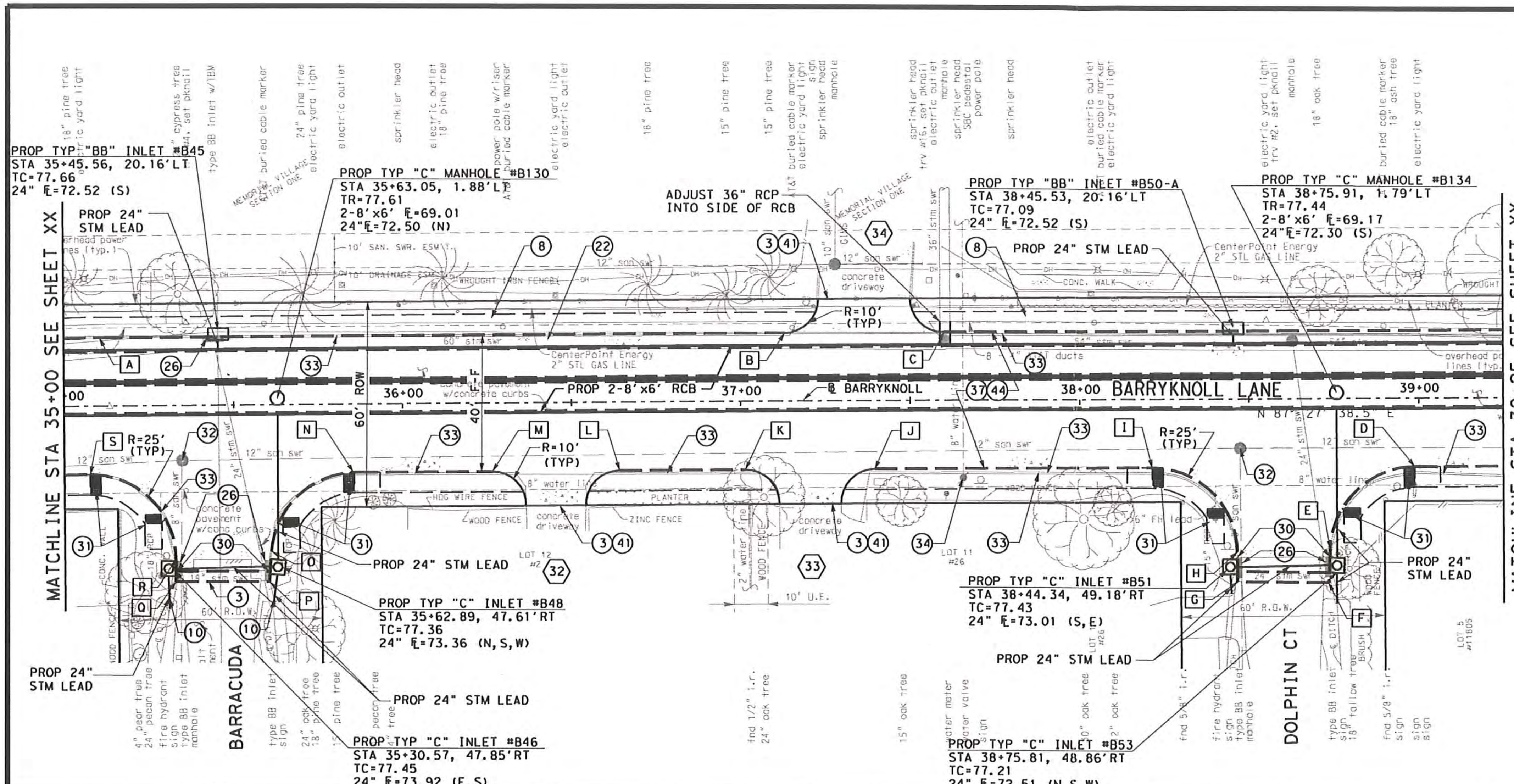


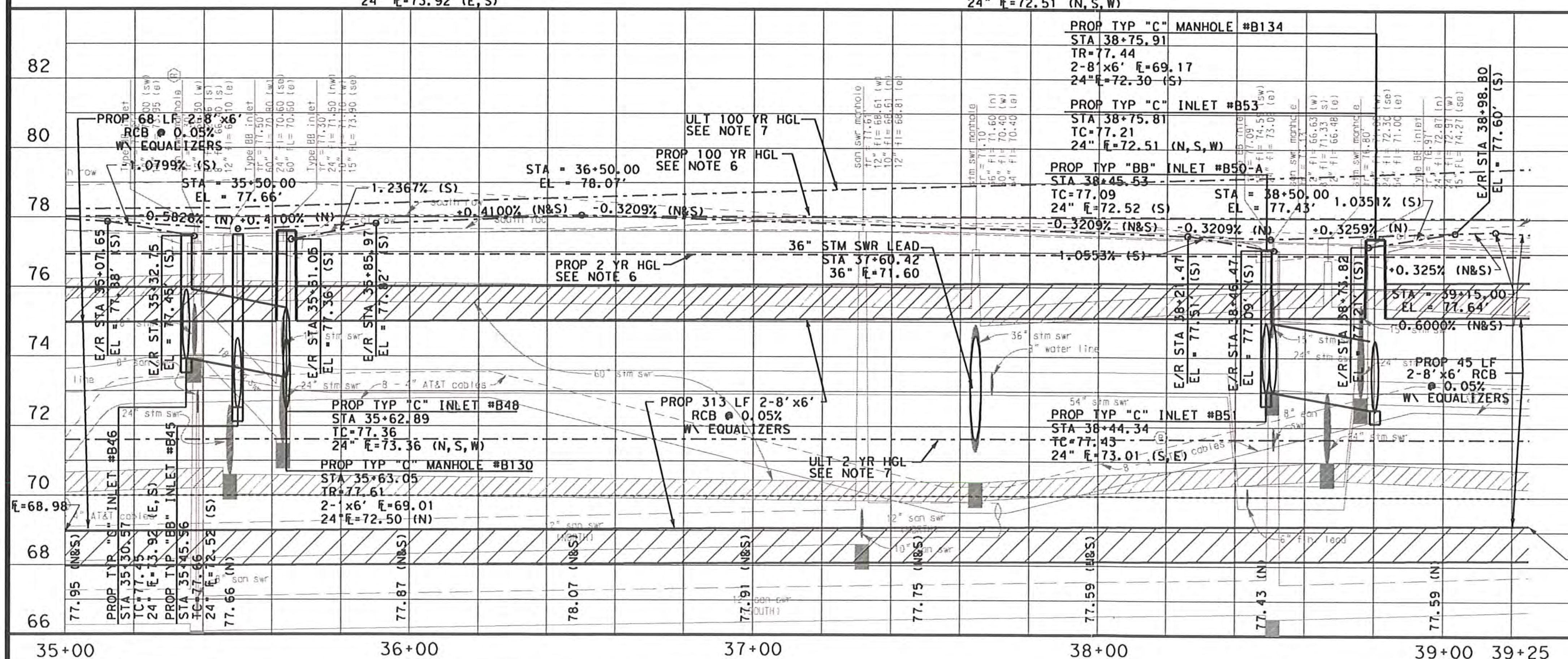


## KEYED NOTES

3. PROPOSED SAWED JOINT AND EXPOSE 15-INCHES OF REINFORCING STEEL. IF NO REINFORCING STEEL EXISTS, USE HORIZONTAL DOWELS. SEE NOTE 11.
8. REMOVE EXISTING SIDEWALK.
10. REMOVE A SUFFICIENT LENGTH OF CONCRETE PIPE, AS DETERMINED BY THE ENGINEER, AND CONNECT TO PROPOSED INLET WITH REINFORCED CONCRETE PIPE OF LIKE DIAMETER.
13. ADJUST EXISTING INLET TO FIT NEW GRADE AND ALIGNMENT.
26. REMOVE EXISTING INLET AND LEAD. PLUG AS SHOWN.
30. MEET EXISTING CURB OR CURB AND GUTTER FOR GRADE AND ALIGNMENT.
31. PROPOSED WHEELCHAIR RAMP, AS SHOWN ON STANDARD DETAIL 02775-02 WHEELCHAIR RAMP DETAILS.
32. ADJUST EXISTING MANHOLE FRAME AND COVER TO FIT NEW GRADE.
33. REMOVE CURB OR CURB AND GUTTER FOR GRADE AND ALIGNMENT.
34. ADJUST EXISTING WATER VALVE BOXES TO NEW PAVING GRADE. REPLACE MISSING OR DAMAGED VALVE BOXES AND COVERS.
37. PROPOSED PAVEMENT MARKINGS AS SHOWN ON STANDARD DETAIL 02763-01 - PAVEMENT MARKING DETAILS.
41. REMOVE AND REPLACE DRIVEWAY TO ROW, EXCEPT WHERE NOTED OTHERWISE ON PLANS, AT EXISTING WIDTH AS SHOWN ON DETAILS.
44. REMOVE EXISTING PAVEMENT (ALL TYPES AND THICKNESSES).

## NOTES:

1. ALL RCP ARE CLASS III UNLESS OTHERWISE NOTED.
2. SEE STORM SEWER LATERALS SHEETS XX TO XX FOR MORE INFORMATION.
3. ADJUST EXIST WATER VALVE/METER BOXES TO NEW GRADE. REPLACE ALL MISSING OR DAMAGED WATER VALVE/METER BOXES AND COVERS.
4. REFER TO TYPICAL SECTION (X) FOR STATION X+00 TO X+00
5. CUT AND REMOVE PORTION OF EXISTING RCP INSIDE PROPOSED INLET OR MANHOLE; RCP TO BE FLUSH WITH INSIDE WALL FACE. (NOT SEPARATE PAY ITEM, INCIDENTAL TO UNIT PRICE OF MANHOLE OR INLET.)
6. PROPOSED HGL CALCULATED FOR POST-PROJECT CONDITIONS USING INFOWORKS SD.
7. ULTIMATE CONDITION INCLUDE ADDITIONAL INTERCONNECTED STORM SEWER IMPROVEMENTS HGL CALCULATED USING INFOWORKS SD.

### HORIZONTAL GEOMETRY DATA

| NO. | DESCRIP | STATION | OFFSET |
|---|---|---|---|
| A | PT | 35+10.59 | 20.00 LT |
| B | PC | 37+13.02 | 20.00 LT |
| C | PT | 37+60.03 | 20.00 LT |
| D | PT | 38+98.80 | 20.00 RT |
| E | PC | 38+73.82 | 44.02 RT |
| F | PI | 38+73.43 | 53.95 RT |
| G | PI | 38+46.54 | 53.55 RT |
| H | PT | 38+46.47 | 44.79 RT |
| I | PC | 38+21.47 | 20.00 RT |
| J | PT | 37+39.46 | 20.00 RT |
| K | PC | 37+01.27 | 20.00 RT |
| L | PT | 36+64.11 | 20.00 RT |
| M | PC | 36+26.38 | 20.00 RT |
| N | PT | 35+85.97 | 20.00 RT |
| O | PC | 35+61.05 | 42.98 RT |
| P | PI | 35+64.81 | 51.89 RT |
| Q | PI | 35+32.71 | 51.67 RT |
| R | PT | 35+32.75 | 45.15 RT |
| S | PC | 35+07.65 | 20.00 RT |

PRIVATE UTILITY LINES SHOWN

CENTERPOINT ENERGY, GAS FACILITIES

SBC UTILITY LINES SHOWN DATE
APPROVED FOR SBC UNDERGROUND CONDUIT FACILITIES ONLY. SIGNATURE VALID FOR ONE YEAR

CENTERPOINT ENERGY, ELECTRIC FACILITIES
APPROVED ONLY FOR CROSSING UNDERGROUND DUCTLINES UNLESS NOTED. VALID AT TIME OF REVIEW ONLY.

CABLE COMPANY

INTERIM REVIEW ONLY
Document incomplete: not intended for permit, bidding or construction.
Engineer: TARA G BURRER
P.E. Serial No. 99997
Firm: LOCKWOOD, ANDREWS & NEWNAM, INC.
Firm No.: 2614
Date: 11/4/2011

MEMORIAL CITY REDEVELOPMENT AUTHORITY

Lockwood, Andrews & Newnam, Inc.
A LEO A DALY COMPANY

BARRYKNOLL LANE
T-170015-0001-3
PLAN & PROFILE
PVMT & STM SWR IMPROVEMENTS
STA 35+00 TO STA 39+25
SHEET 10 OF 11

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

| WATER | WASTEWATER | TRAFFIC |
|---|---|---|
| ST. & BRIDGE | STORMWATER | SWQ |

FILE NO.: FACILITY
DRAWING SCALE: CITY DWG NO.
VERT: 1"=2'
HORZ: 1"=20'
SHEET: OF XX

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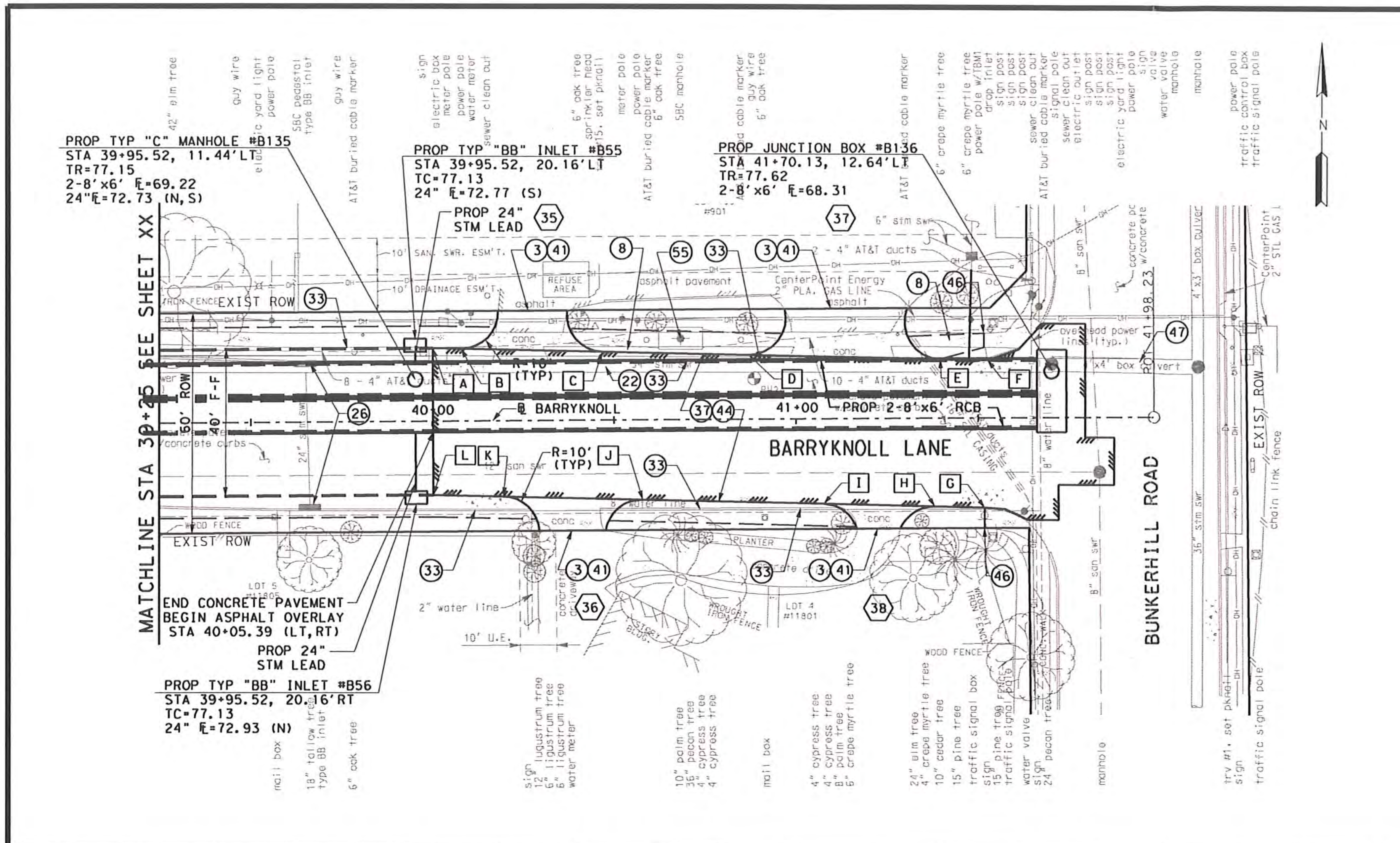


KEYED NOTES

3. PROPOSED SAWED JOINT AND EXPOSE 15-INCHES OF REINFORCING STEEL. IF NO REINFORCING STEEL EXISTS, USE HORIZONTAL DOWELS. SEE NOTE 11.
8. REMOVE EXISTING SIDEWALK.
22. EXISTING STRUCTURE TO BE REMOVED.
26. REMOVE EXISTING INLET AND LEAD. PLUG AS SHOWN.
30. MEET EXISTING CURB OR CURB AND GUTTER FOR GRADE AND ALIGNMENT.
31. PROPOSED WHEELCHAIR RAMP, AS SHOWN ON STANDARD DETAIL 02775-02 WHEELCHAIR RAMP DETAILS.
32. ADJUST EXISTING MANHOLE FRAME AND COVER TO FIT NEW GRADE.
33. REMOVE CURB OR CURB AND GUTTER FOR GRADE AND ALIGNMENT.
34. ADJUST EXISTING WATER VALVE BOXES TO NEW PAVING GRADE. REPLACE MISSING OR DAMAGED VALVE BOXES AND COVERS.
37. PROPOSED PAVEMENT MARKINGS AS SHOWN ON STANDARD DETAIL 02763-01 - PAVEMENT MARKING DETAILS.
41. REMOVE AND REPLACE DRIVEWAY TO ROW, EXCEPT WHERE NOTED OTHERWISE ON PLANS, AT EXISTING WIDTH AS SHOWN ON DETAILS.
44. REMOVE EXISTING PAVEMENT (ALL TYPES AND THICKNESSES).
46. TRANSITION PROPOSED SIDEWALK TO EXISTING SIDEWALK LEVEL WITH A MINIMUM SLOPE OF 20:1.
47. EXISTING STRUCTURE/UTILITY TO REMAIN.
52. EXISTING POWER POLE TO BE REMOVED. (BY OTHERS; CENTERPOINT ENERGY HL&P)
55. ADJUST EXISTING MANHOLE FRAME AND COVER TO FIT NEW GRADE AND ALIGNMENT (BY PRIVATE UTILITY COMPANY)
62. REMOVE EXISTING TRAFFIC SIGNAL/CONTROL BOX

NOTES:

1. ALL RCP ARE CLASS III UNLESS OTHERWISE NOTED.
2. SEE STORM SEWER LATERALS SHEETS XX TO XX FOR MORE INFORMATION.
3. ADJUST EXIST WATER VALVE/METER BOXES TO NEW GRADE. REPLACE ALL MISSING OR DAMAGED WATER VALVE/METER BOXES AND COVERS.
4. REFER TO TYPICAL SECTION (X) FOR STATION X+00 TO X+00
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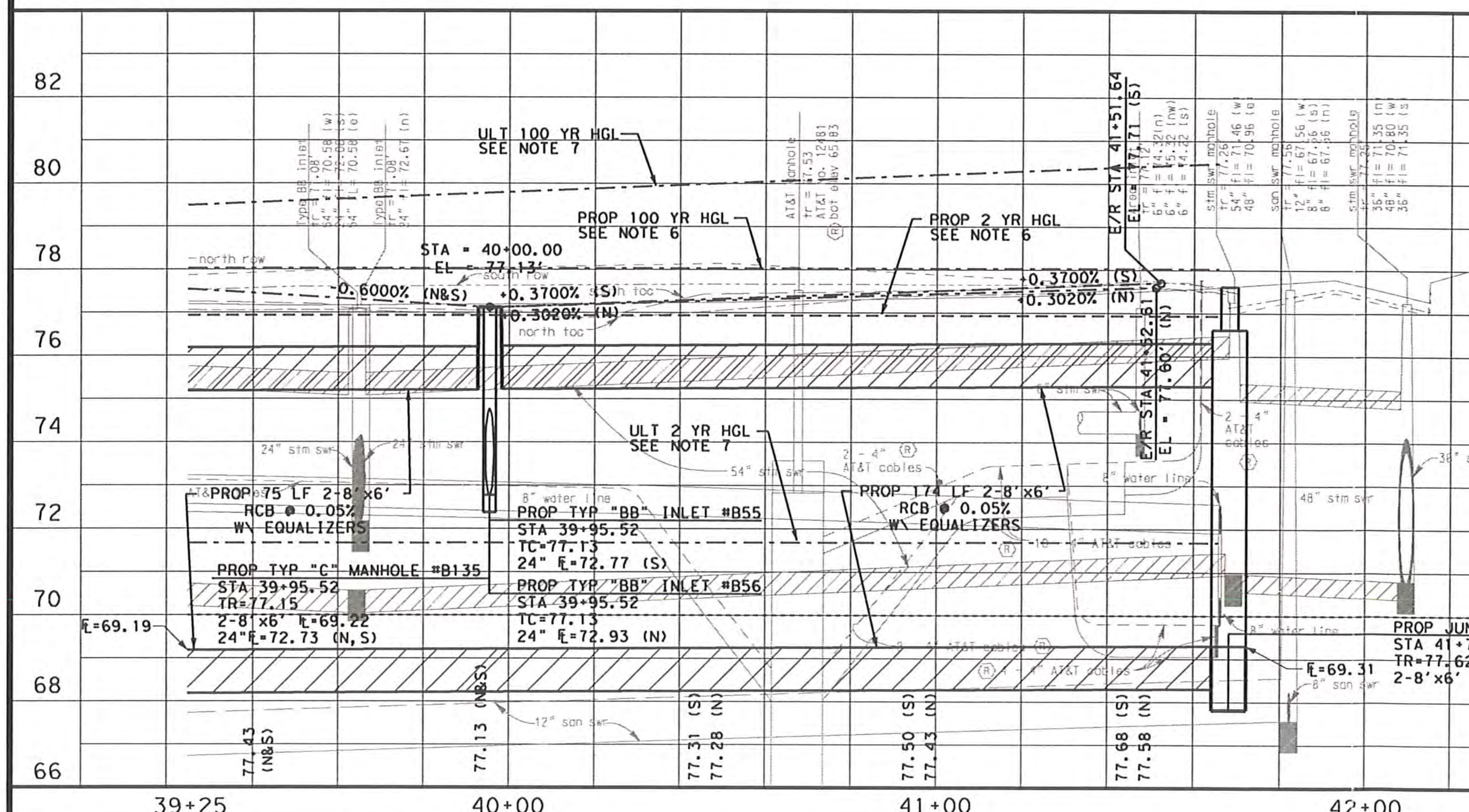
7. ULTIMATE CONDITION INCLUDE ADDITIONAL INTERCONNECTED STORM SEWER IMPROVEMENTS HGL CALCULATED USING INFOWORKS SD.




HORIZONTAL GEOMETRY DATA

| NO. | DESCRIP | STATION | OFFSET |
|---|---|---|---|
| A | PI | 40+00.34 | 20.00 LT |
| B | PC | 40+08.09 | 19.78 LT |
| C | PT | 40+46.89 | 18.67 LT |
| D | PC | 40+87.03 | 17.53 LT |
| E | PT | 41+39.72 | 16.04 LT |
| F | PI | 41+52.61 | 15.71 LT |
| G | PI | 41+51.64 | 24.47 RT |
| H | PT | 41+37.98 | 24.07 RT |
| I | PC | 41+07.45 | 23.17 RT |
| J | PT | 40+57.69 | 21.70 RT |
| K | PC | 40+19.55 | 20.57 RT |
| L | PI | 40+00.34 | 20.00 RT |

PRIVATE UTILITY LINES SHOWN

CENTERPOINT ENERGY, GAS FACILITIES

SBC UTILITY LINES SHOWN DATE
APPROVED FOR SBC UNDERGROUND CONDUIT FACILITIES ONLY. SIGNATURE VALID FOR ONE YEAR

CENTERPOINT ENERGY, ELECTRIC FACILITIES
APPROVED ONLY FOR CROSSING UNDERGROUND DUCTLINES UNLESS NOTED. VALID AT TIME OF REVIEW ONLY.

CABLE COMPANY

INTERIM REVIEW ONLY
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A LEO A DALY COMPANY

BARRYKNOLL LANE
T-170015-0001-3
PLAN & PROFILE
PVMT & STM SWR IMPROVEMENTS
STA 39+25 TO STA END
SHEET 11 OF 11

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

| WATER | WASTEWATER | TRAFFIC |
|---|---|---|
| ST. & BRIDGE | STORMWATER | SWQ |

FILE NO.: | FACILITY
DRAWING SCALE: | CITY DWG NO.
VERT: 1"=2'
HORZ: 1"=20'
SHEET: OF XX

| No. | Date | Revisions | App. |
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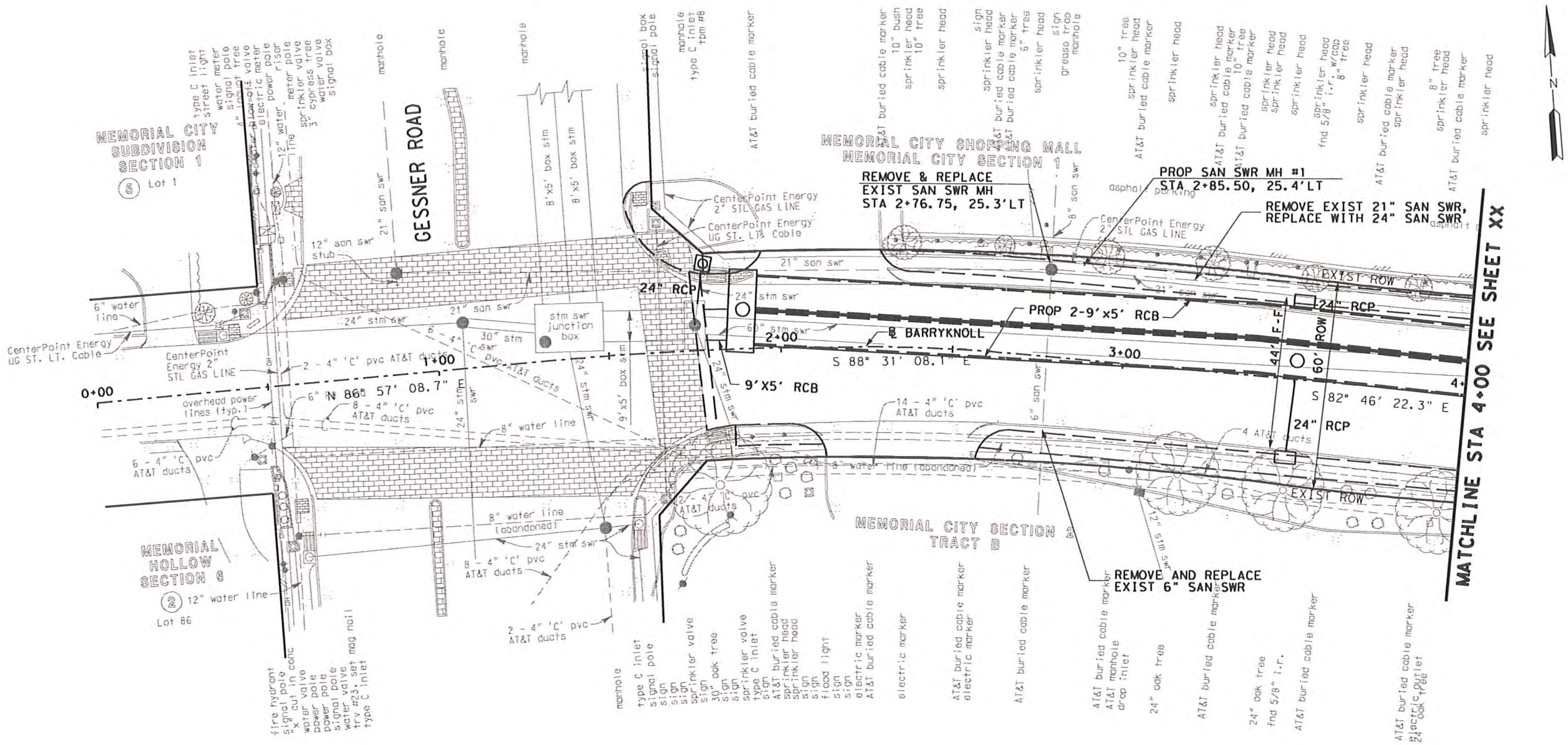


SEE SHEET XX FOR PROFILE VIEW

NOTE:

1. MAINTAIN WATER SERVICES TO ALL CUSTOMERS, FIRE HYDRANTS, AND INTERCONNECTIONS. PROVIDE TEMPORARY CONNECTION AS NECESSARY FOR CONSTRUCTION.
2. SEE PAVEMENT & STORM SEWER SHEETS XX TO XX FOR MORE INFORMATION.

PRIVATE UTILITY LINES SHOWN

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CABLE COMPANY

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Engineer: CHRISTINE H. KIRBY
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Firm No.: 2614
Date: 11/4/2011

MEMORIAL CITY REDEVELOPMENT AUTHORITY

Lockwood, Andrews & Newnam, Inc.
A LEO A DALY COMPANY

BARRYKNOLL LANE
T-170015-0001-3
PLAN VIEW
WATER & SAN SWR IMPROVEMENTS
STA 0+00 TO 4+00

SHEET 1 OF 18

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

| WATER | WASTEWATER | TRAFFIC |
|---|---|---|
| ST. & BRIDGE | STORMWATER | SWD |

FILE NO.: FACILITY

DRAWING SCALE: CITY DWG NO.

VERT: 1"=2'
HORZ: 1"=20'

SHEET: OF XX

| No. | Date | Revisions | App. |
|---|---|---|---|

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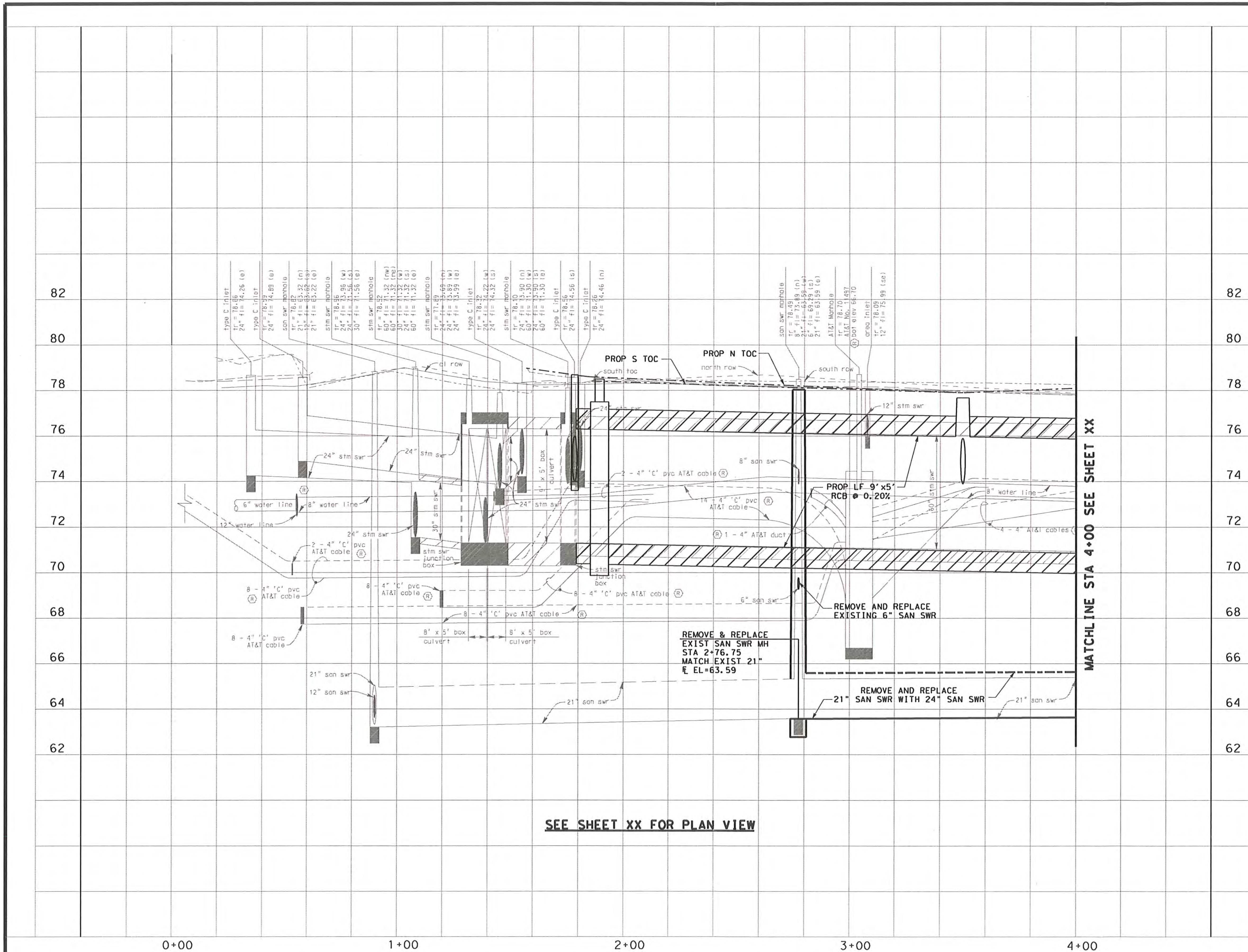


PRIVATE UTILITY LINES SHOWN

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MEMORIAL CITY REDEVELOPMENT AUTHORITY

Lockwood, Andrews & Newnam, Inc.
A LEO A DALY COMPANY

BARRYKNOLL LANE
T-170015-0001-3
PROFILE VIEW
WATER & SAN SWR IMPROVEMENTS
STA 0+00 TO 4+00
SHEET 2 OF 18

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

| WATER | WASTEWATER | TRAFFIC |
|---|---|---|
| ST. & BRIDGE | STORMWATER | SWQ |

FILE NO.: FACILITY
DRAWING SCALE: CITY DWG NO.
VERT: 1"=2'
HORZ: 1"=20'
SHEET: OF XX

No. Date Revisions App

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| No. | Date | Revisions | App |
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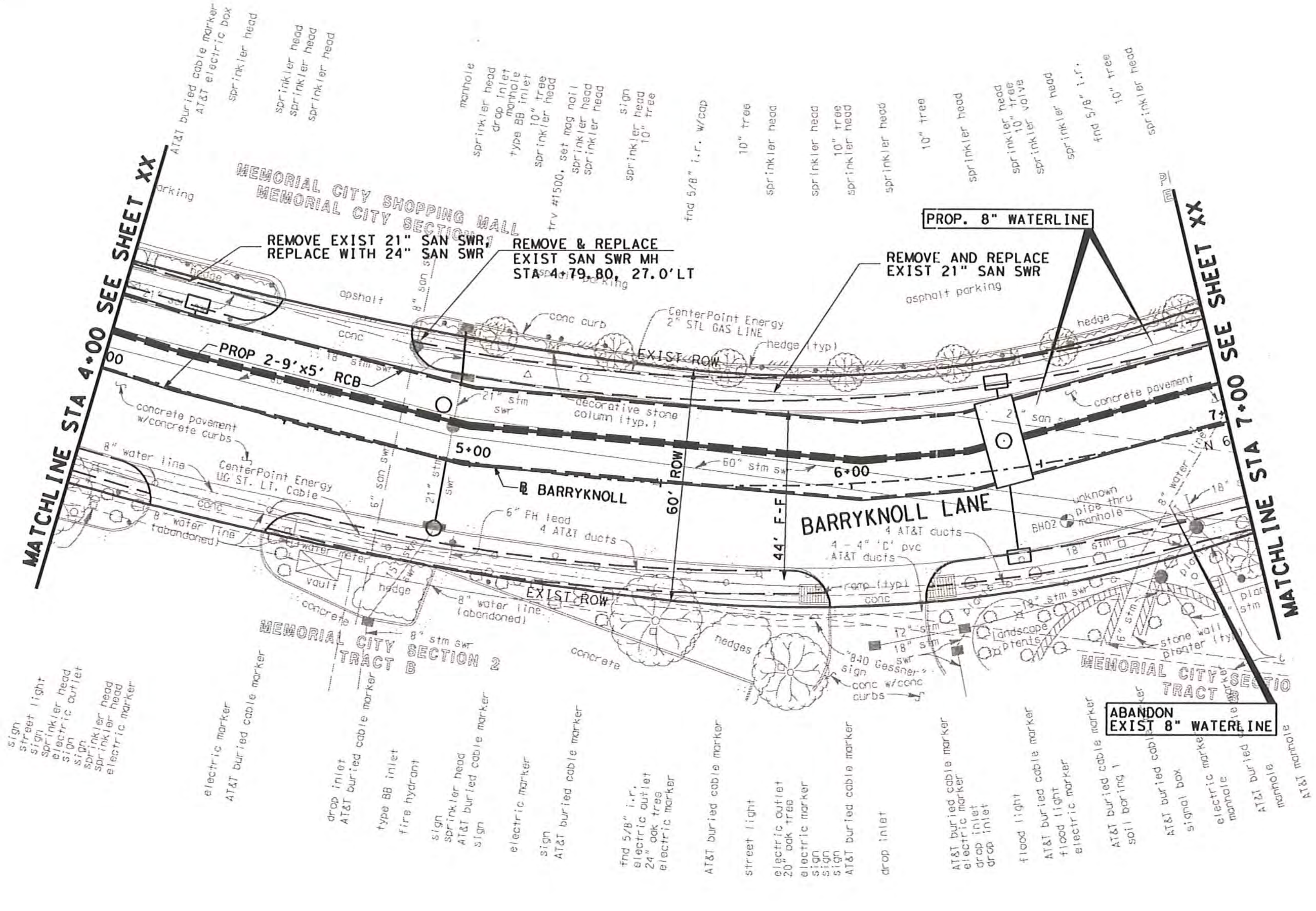


SEE SHEET XX FOR PROFILE VIEW

NOTE:

1. MAINTAIN WATER SERVICES TO ALL CUSTOMERS, FIRE HYDRANTS, AND INTERCONNECTIONS. PROVIDE TEMPORARY CONNECTION AS NECESSARY FOR CONSTRUCTION.
2. SEE PAVEMENT & STORM SEWER SHEETS XX TO XX FOR MORE INFORMATION.

PRIVATE UTILITY LINES SHOWN

CENTERPOINT ENERGY, GAS FACILITIES

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Firm: LOCKWOOD, ANDREWS & NEWNAM, INC.
Firm No.: 2614
Date: 11/4/2011

MEMORIAL CITY REDEVELOPMENT AUTHORITY

Lockwood, Andrews & Newnam, Inc.
A LEO A DALY COMPANY

BARRYKNOLL LANE
T-170015-0001-3
PLAN VIEW
WATER & SAN SWR IMPROVEMENTS
STA 4+00 TO 7+00
SHEET 3 OF 18

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

| WATER | WASTEWATER | TRAFFIC |
|---|---|---|
| ST. & BRIDGE | STORMWATER | SWD |

FILE NO.: | FACILITY
DRAWING SCALE: | CITY DWG NO.
VERT: 1"=2'
HORZ: 1"=20'
SHEET: OF XX

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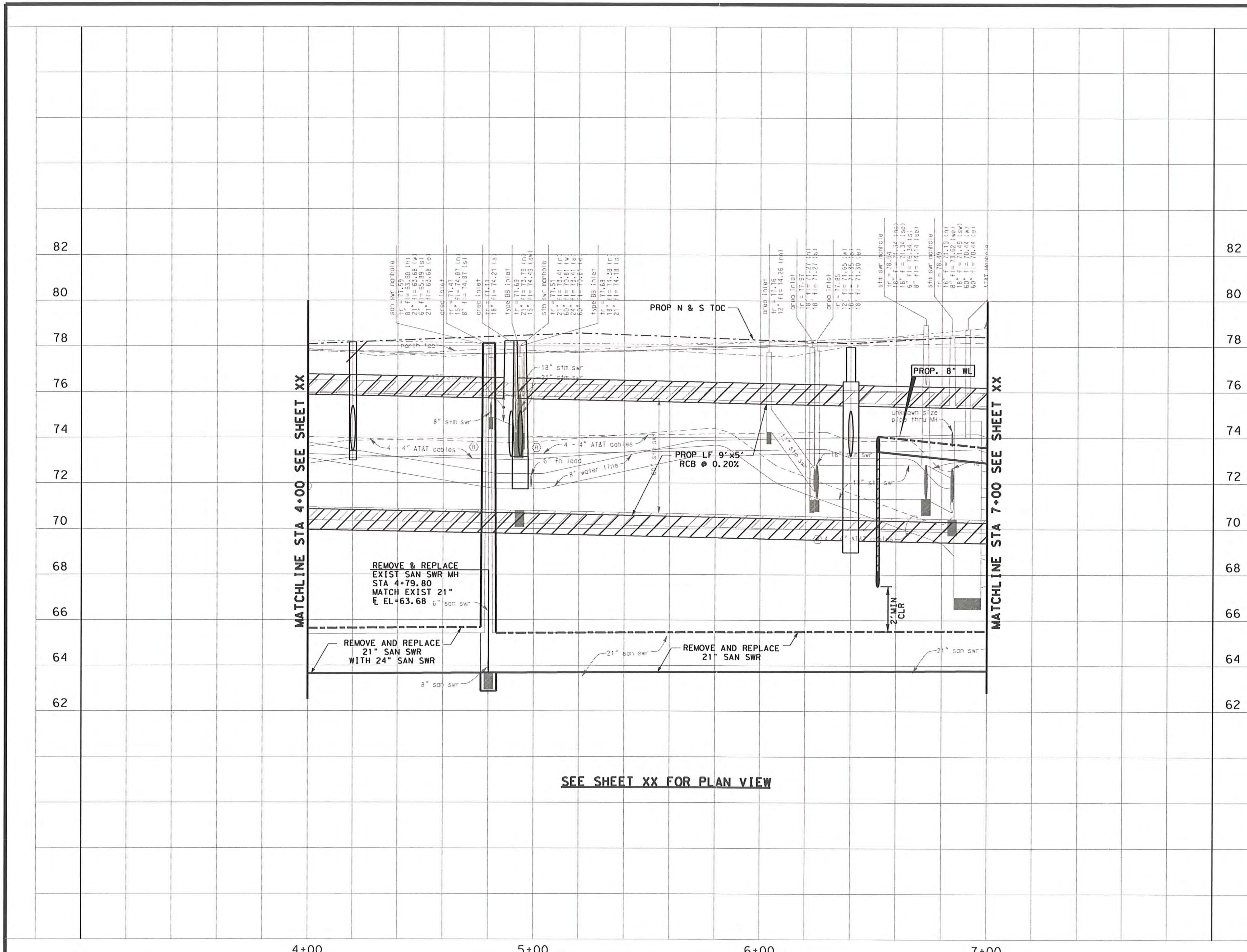


No. Date Revisions App

PRIVATE UTILITY LINES SHOWN

CENTERPOINT ENERGY, GAS FACILITIES

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Date: 11/4/2011

MEMORIAL CITY REDEVELOPMENT AUTHORITY

Lockwood, Andrews & Newnam, Inc.
A LEO A DALY COMPANY

BARRYKNOLL LANE
T-170015-0001-3
PROFILE VIEW
WATER & SAN SWR IMPROVEMENTS
STA 4+00 TO 7+00
SHEET 4 OF 18

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

| WATER | WASTEWATER | TRAFFIC |
|---|---|---|
| ST. & BRIDGE | STORMWATER | SWQ |

FILE NO.: FACILITY
DRAWING SCALE: CITY DWG NO.
VERT: 1"=2'
HORZ: 1"=20'
SHEET: OF XX

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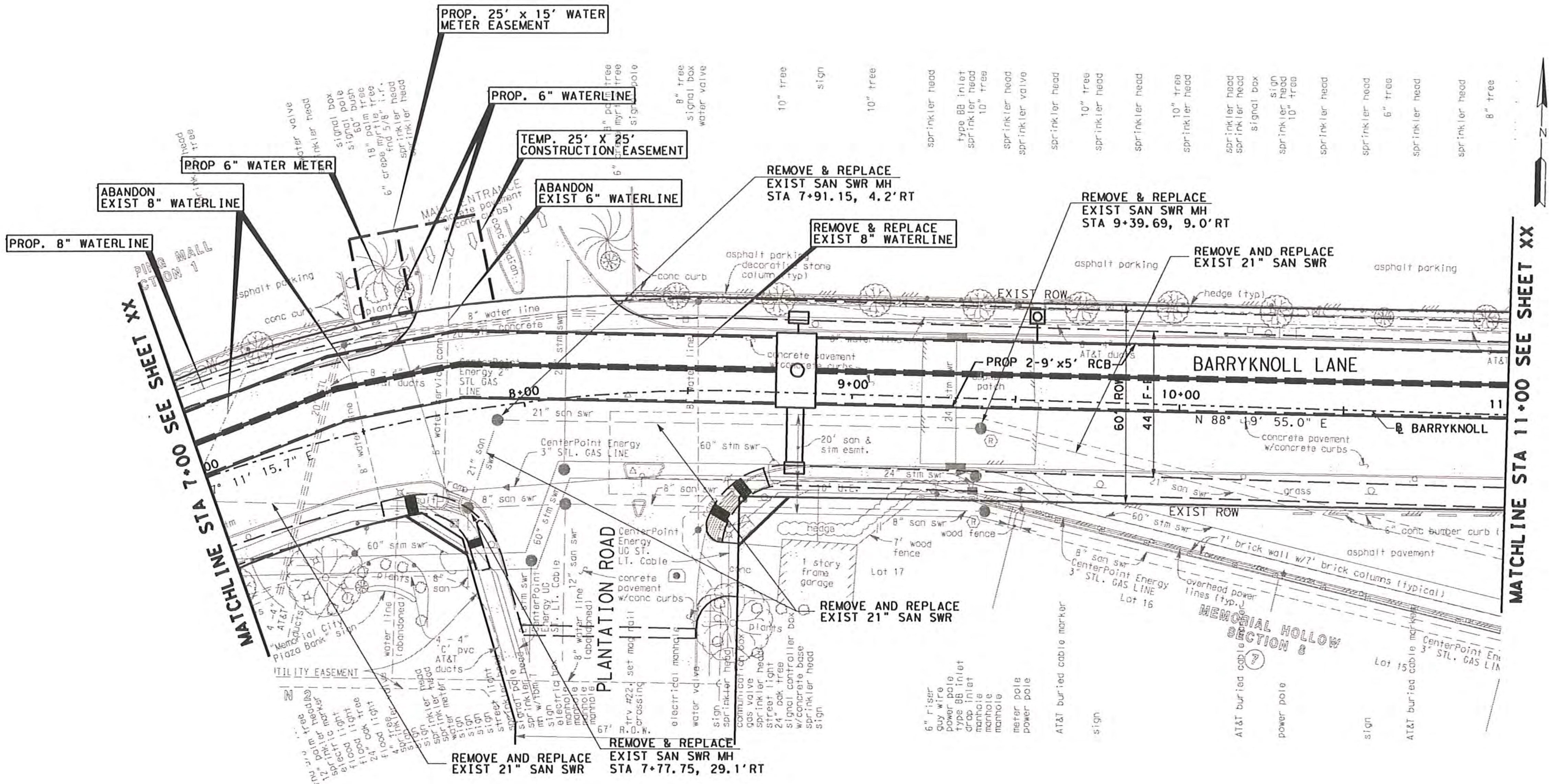


SEE SHEET XX FOR PROFILE VIEW

NOTE:

1. MAINTAIN WATER SERVICES TO ALL CUSTOMERS, FIRE HYDRANTS, AND INTERCONNECTIONS. PROVIDE TEMPORARY CONNECTION AS NECESSARY FOR CONSTRUCTION.
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PRIVATE UTILITY LINES SHOWN

CENTERPOINT ENERGY, GAS FACILITIES

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Engineer: CHRISTINE H. KIRBY
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Firm No.: 2614
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MEMORIAL CITY REDEVELOPMENT AUTHORITY

Lockwood, Andrews & Newnam, Inc.
A LEO A DALY COMPANY

BARRYKNOLL LANE
T-170015-0001-3
PLAN VIEW
WATER & SAN SWR IMPROVEMENTS
STA 7+00 TO 11+00
SHEET 5 OF 18

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

| WATER | WASTEWATER | TRAFFIC |
|---|---|---|
| ST. & BRIDGE | STORMWATER | SWD |

FILE NO.:
FACILITY
DRAWING SCALE:
CITY DWG NO.
VERT: 1"=2'
HORZ: 1"=20'
SHEET: OF XX

No. | Date | Revisions | App.

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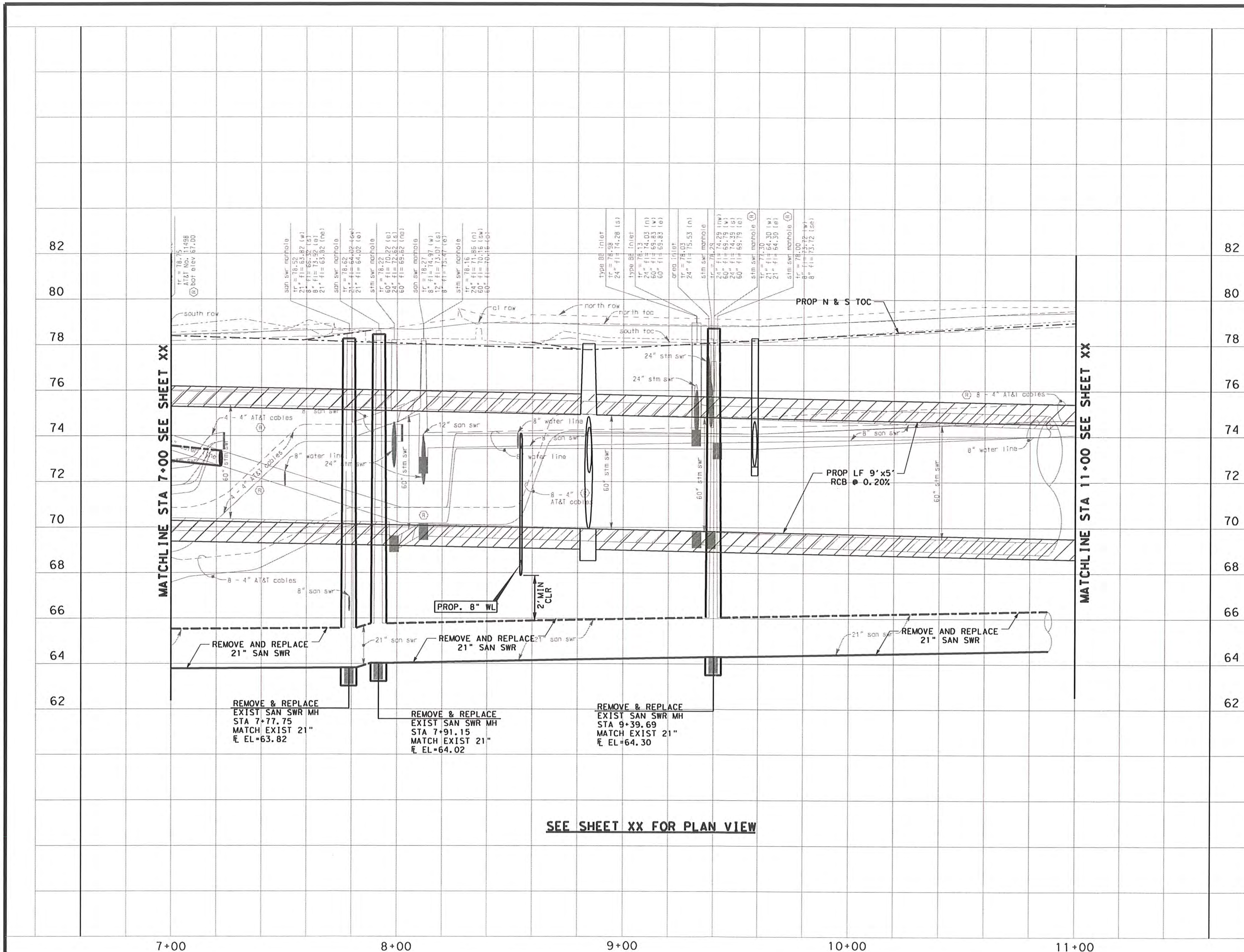


SEE SHEET XX FOR PLAN VIEW

PRIVATE UTILITY LINES SHOWN

CENTERPOINT ENERGY, GAS FACILITIES

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Date: 11/4/2011

MEMORIAL CITY REDEVELOPMENT AUTHORITY

Lockwood, Andrews & Newnam, Inc.
A LEO A DALY COMPANY

BARRYKNOLL LANE
T-170015-0001-3
PROFILE VIEW
WATER & SAN SWR IMPROVEMENTS
STA 7+00 TO 11+00
SHEET 6 OF 18

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

| WATER | WASTEWATER | TRAFFIC |
|---|---|---|
| ST. & BRIDGE | STORMWATER | SWD |

FILE NO.:
FACILITY
DRAWING SCALE:
CITY DWG NO.
VERT: 1"=2'
HORZ: 1"=20'
SHEET: OF XX

No. Date Revisions App

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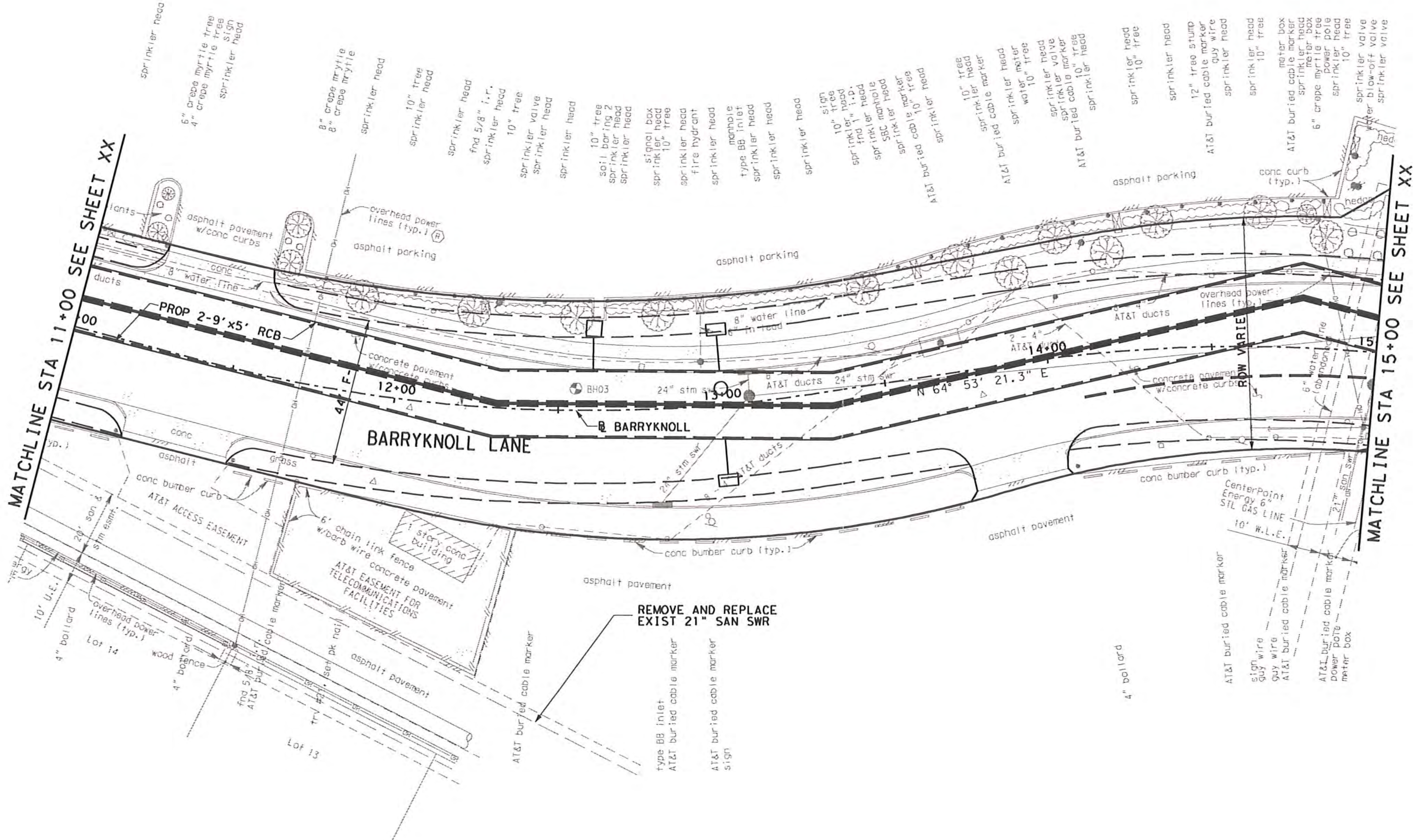


NOTE:

1. MAINTAIN WATER SERVICES TO ALL CUSTOMERS, FIRE HYDRANTS, AND INTERCONNECTIONS. PROVIDE TEMPORARY CONNECTION AS NECESSARY FOR CONSTRUCTION.
2. SEE PAVEMENT & STORM SEWER SHEETS XX TO XX FOR MORE INFORMATION.

SEE SHEET XX FOR PROFILE VIEW

PRIVATE UTILITY LINES SHOWN

CENTERPOINT ENERGY, GAS FACILITIES

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MEMORIAL CITY REDEVELOPMENT AUTHORITY

Lockwood, Andrews & Newnam, Inc.
A LEO A DALY COMPANY

BARRYKNOLL LANE
T-170015-0001-3

PLAN VIEW
WATER & SAN SWR IMPROVEMENTS
STA 11+00 TO 15+00

SHEET 7 OF 18

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

| WATER | WASTEWATER | TRAFFIC |
|---|---|---|
| ST. & BRIDGE | STORMWATER | SWQ |

FILE NO.: | FACILITY
DRAWING SCALE: | CITY DWG NO.
VERT: 1"=2'
HORZ: 1"=20'
SHEET: OF XX

No. | Date | Revisions | App

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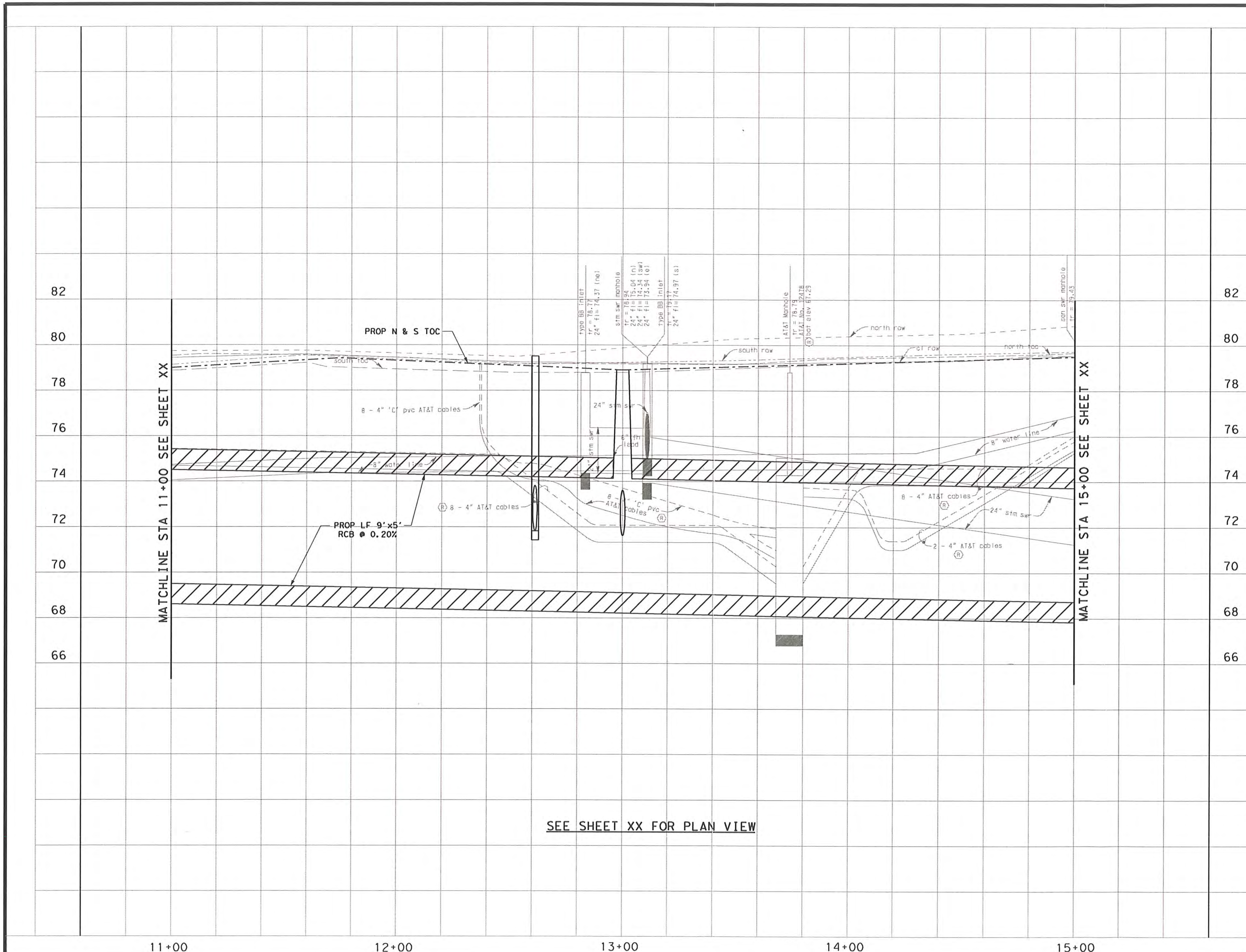


PRIVATE UTILITY LINES SHOWN

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BARRYKNOLL LANE
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PROFILE VIEW
WATER & SAN SWR IMPROVEMENTS
STA 11+00 TO 15+00
SHEET 8 OF 18

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

| WATER | WASTEWATER | TRAFFIC |
|---|---|---|
| ST. & BRIDGE | STORMWATER | SWQ |

FILE NO.:
FACILITY
DRAWING SCALE:
CITY DWG NO.
VERT: 1"=2'
HORZ: 1"=20'
SHEET:
OF XX

No. Date Revisions App

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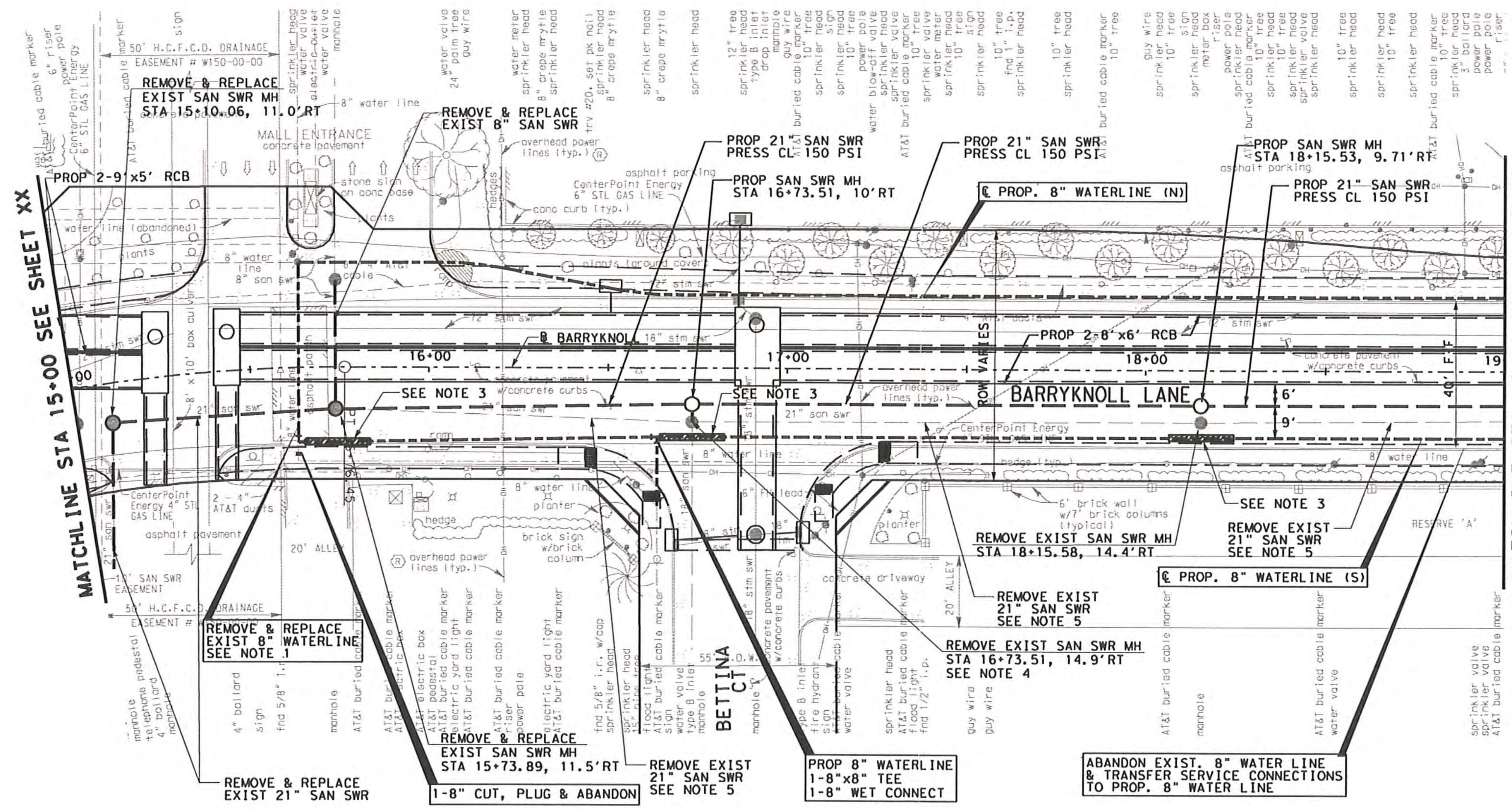


SEE SHEET XX FOR PROFILE VIEW

NOTE:

1. MAINTAIN WATER SERVICES TO ALL CUSTOMERS, FIRE HYDRANTS, AND INTERCONNECTIONS. PROVIDE TEMPORARY CONNECTION AS NECESSARY FOR CONSTRUCTION.
2. SEE PAVEMENT & STORM SEWER SHEETS XX TO XX FOR MORE INFORMATION.
3. INSTALL PROP 8" WATERLINE IN 16" DIA CASING, MIN 18' LENGTH, CENTERED AT SAN SWR MANHOLE CROSSING. SUPPORT CARRIER PIPE AT 5' INTERVALS AND FILL TO SPRINGLINE W/ WASHED SAND.
4. RECONNECT ALL EXIST SERVICES TO PROP SAN SWR MH.
5. RECONNECT ALL EXIST LATERALS TO PROP SAN SWR.

PRIVATE UTILITY LINES SHOWN

CENTERPOINT ENERGY, GAS FACILITIES

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Lockwood, Andrews & Newnam, Inc.
A LEO A DALY COMPANY

BARRYKNOLL LANE
T-170015-0001-3
PLAN VIEW
WATER & SAN SWR IMPROVEMENTS
STA 15+00 TO 19+00
SHEET 9 OF 18

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

| WATER | WASTEWATER | TRAFFIC |
|---|---|---|
| ST. & BRIDGE | STORMWATER | SWQ |

FILE NO.: FACILITY
DRAWING SCALE: CITY DWG NO.
VERT: 1"=2'
HORZ: 1"=20'
SHEET: OF XX

No. Date Revisions App

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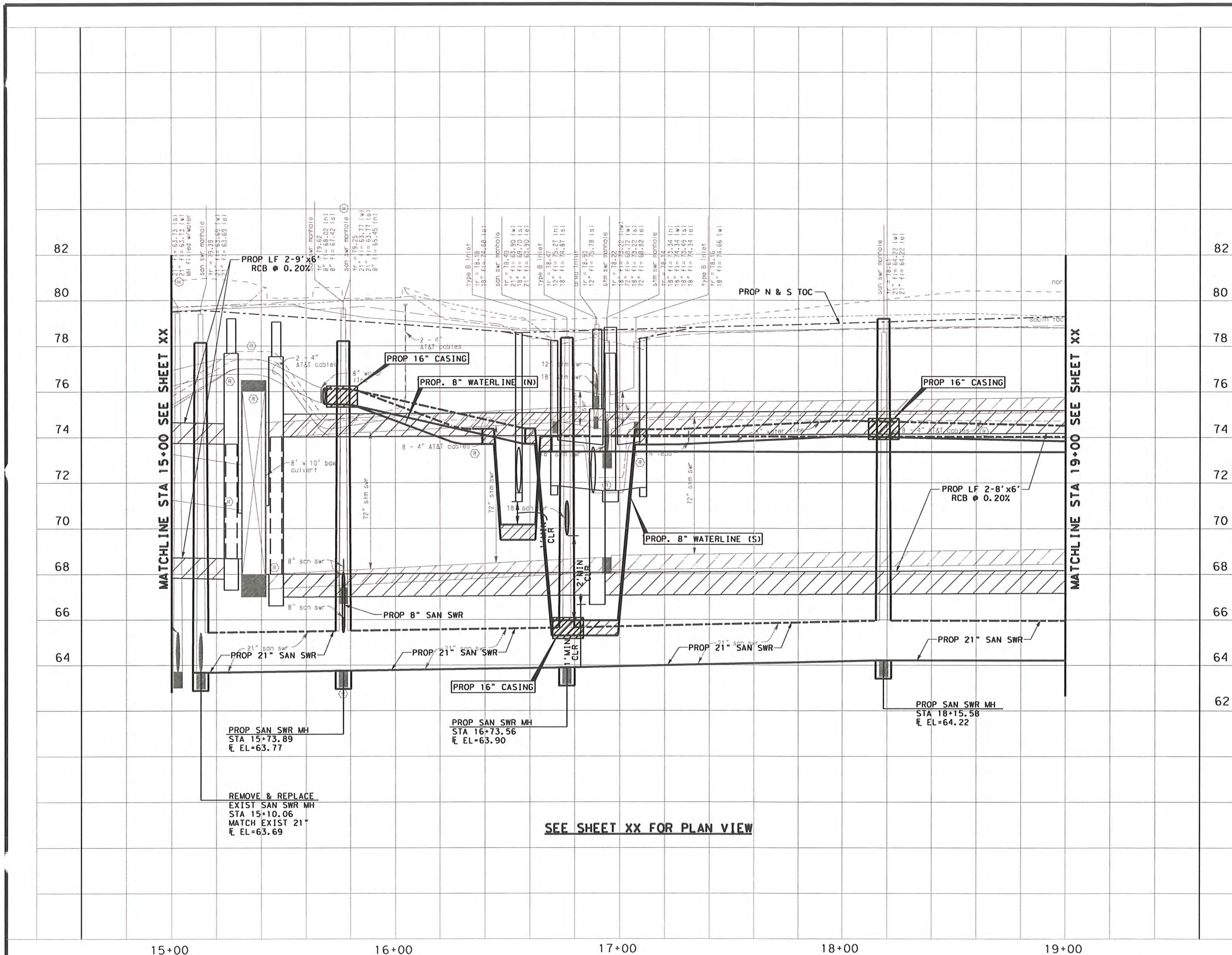


SEE SHEET XX FOR PLAN VIEW

| PRIVATE UTILITY LINES SHOWN |
|---|
| CENTERPOINT ENERGY, GAS FACILITIES |
| SBC UTILITY LINES SHOWN DATE<br>APPROVED FOR SBC UNDERGROUND CONDUIT FACILITIES ONLY. SIGNATURE VALID FOR ONE YEAR |
| CENTERPOINT ENERGY, ELECTRIC FACILITIES<br>APPROVED ONLY FOR CROSSING UNDERGROUND DUCTLINES UNLESS NOTED. VALID AT TIME OF REVIEW ONLY. |
| CABLE COMPANY |

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Engineer: CHRISTINE H. KIRBY
P.E. Serial No. 94776
Firm: LOCKWOOD, ANDREWS & NEWNAM, INC.
Firm No.: 2614
Date: 11/4/2011

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Lockwood, Andrews & Newnam, Inc.
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WATER & SAN SWR IMPROVEMENTS
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SHEET 10 OF 18

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

| WATER | WASTEWATER | TRAFFIC |
|---|---|---|
| ST. & BRIDGE | STORMWATER | SWD |

FILE NO.: | FACILITY
DRAWING SCALE: | CITY DWG NO.
VERT: 1"=2'
HORZ: 1"=20'
SHEET: OF XX

No. | Date | Revisions | App

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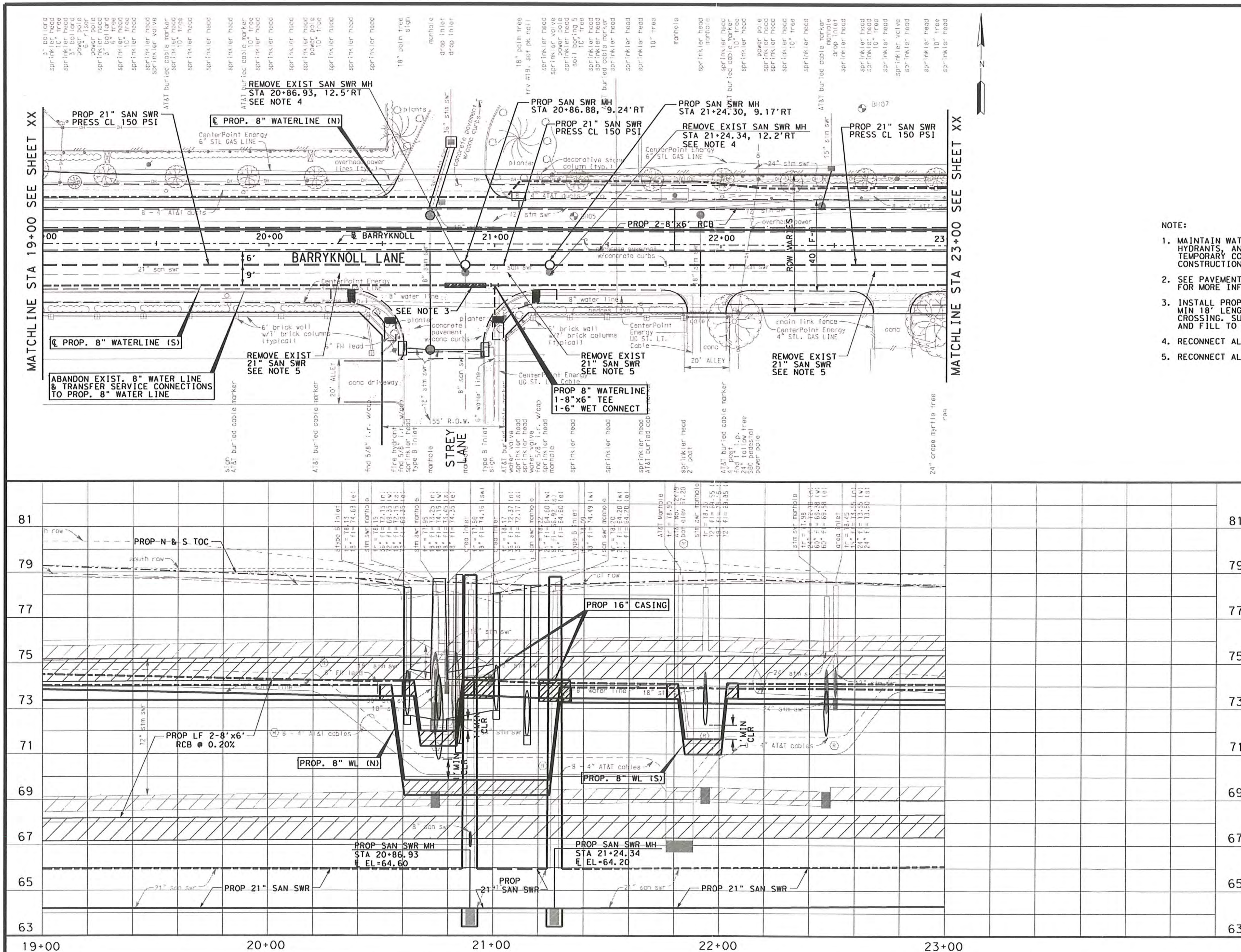


NOTE:

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5. RECONNECT ALL EXIST LATERALS TO PROP SAN SWR.

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CENTERPOINT ENERGY, GAS FACILITIES

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MEMORIAL CITY REDEVELOPMENT AUTHORITY

Lockwood, Andrews & Newnam, Inc.
A LEO A DALY COMPANY

BARRYKNOLL LANE
T-170015-0001-3
PLAN & PROFILE
WATER & SAN SWR IMPROVEMENTS
STA 19+00 TO 23+00

SHEET 11 OF 18

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

| | | |
|---|---|---|
| WATER | WASTEWATER | TRAFFIC |
| ST. & BRIDGE | STORMWATER | SWQ |

FILE NO.: FACILITY

DRAWING SCALE: CITY DWG NO.

VERT: 1"=2'
HORZ: 1"=20'

SHEET: OF XX

No. Date Revisions App

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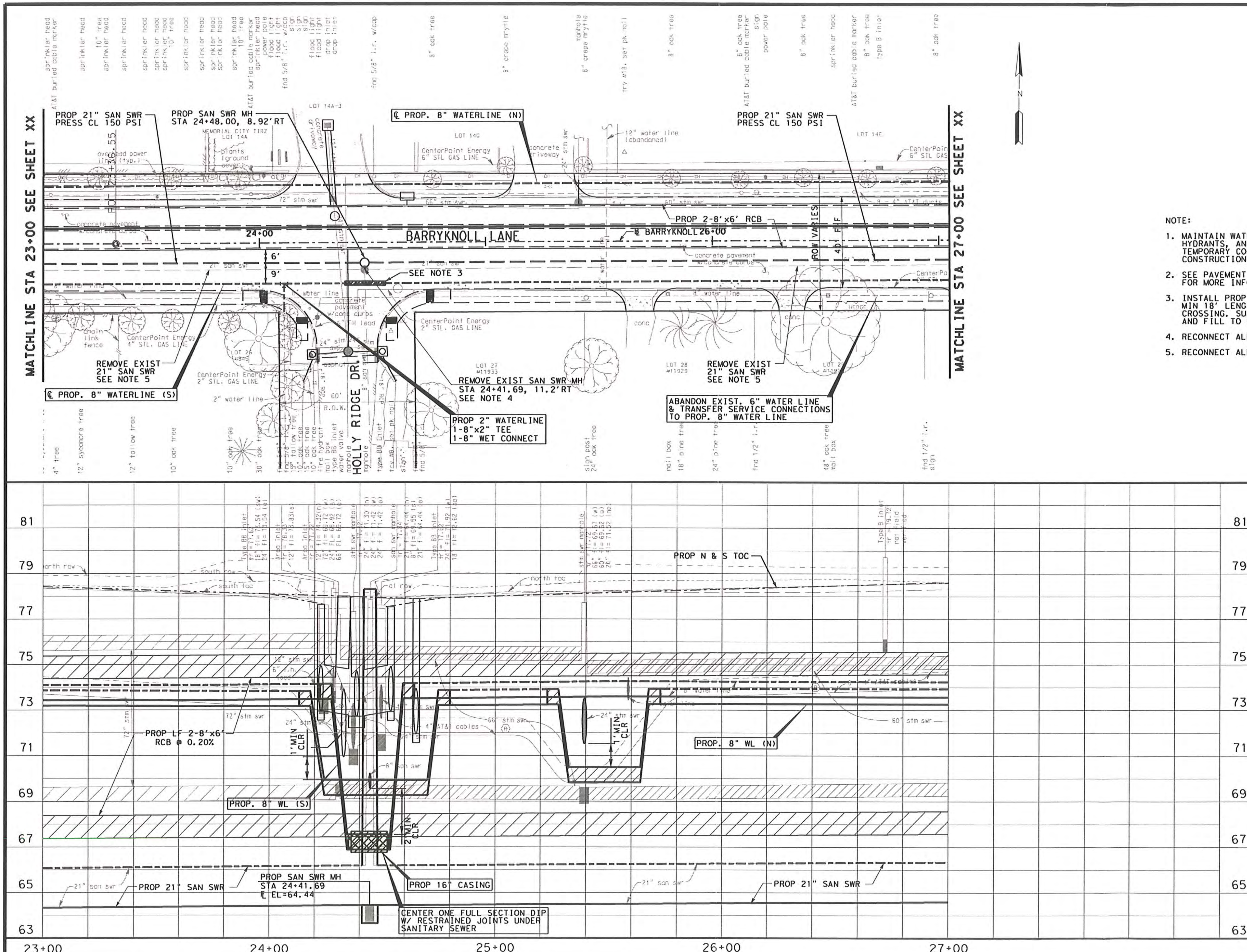


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Firm No.: 2614
Date: 11/4/2011

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Lockwood, Andrews & Newnam, Inc.
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BARRYKNOLL LANE
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PLAN & PROFILE
WATER & SAN SWR IMPROVEMENTS
STA 23+00 TO 27+00
SHEET 12 OF 18

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

| WATER | WASTEWATER | TRAFFIC |
|---|---|---|
| ST. & BRIDGE | STORMWATER | SWQ |

FILE NO.:
FACILITY
DRAWING SCALE:
CITY DWG NO.
VERT: 1"=2'
HORZ: 1"=20'
SHEET: OF XX

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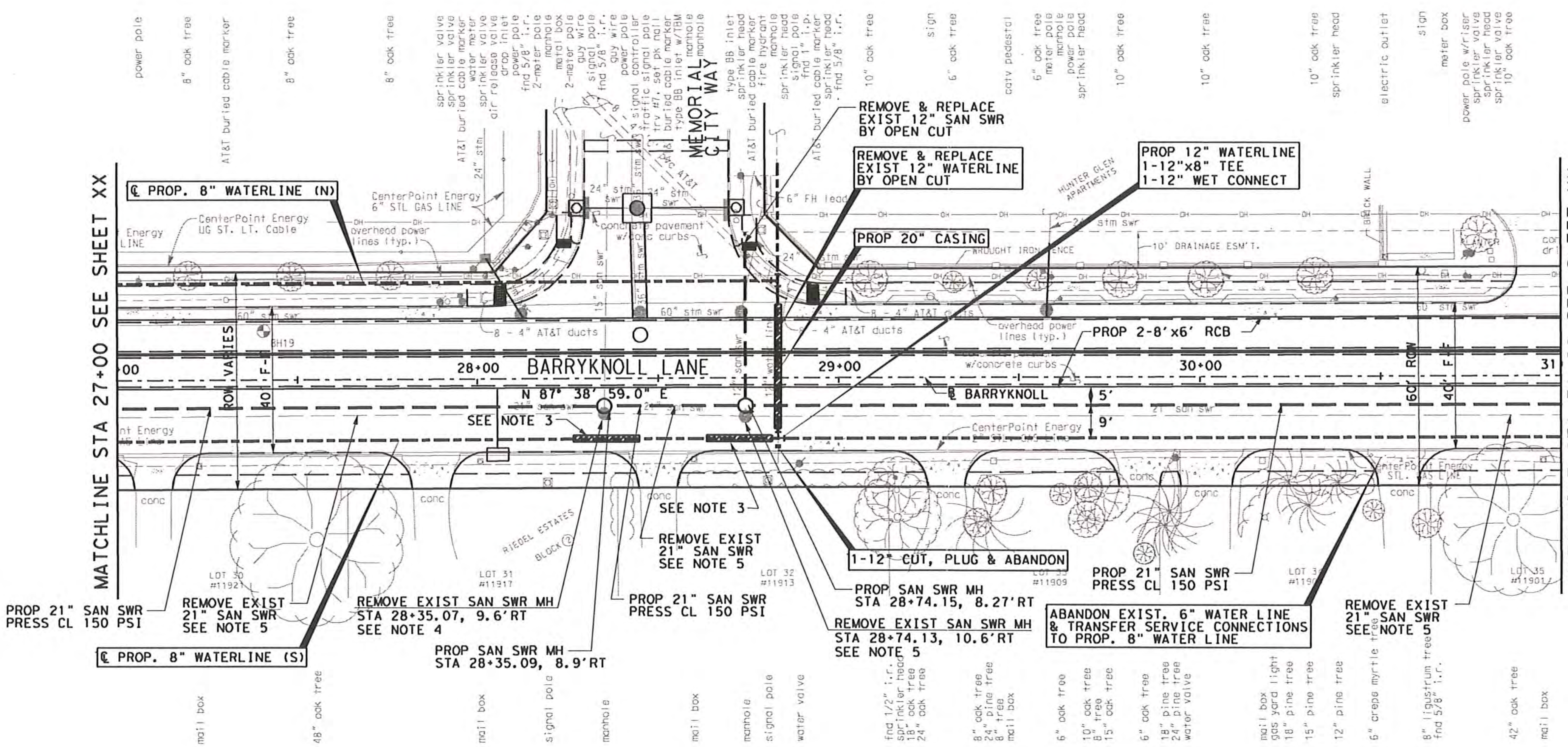
Revisions | No. | Date | App




SEE SHEET XX FOR PROFILE VIEW

NOTE:

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PRIVATE UTILITY LINES SHOWN

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Firm No.: 2614
Date: 11/4/2011

MEMORIAL CITY REDEVELOPMENT AUTHORITY

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PLAN VIEW
WATER & SAN SWR IMPROVEMENTS
STA 27+00 TO 31+00

SHEET 13 OF 18

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

| WATER | WASTEWATER | TRAFFIC |
|---|---|---|
| ST. & BRIDGE | STORMWATER | SWQ |

FILE NO.:
FACILITY
DRAWING SCALE:
CITY DWG NO.
VERT: 1"=2'
HORZ: 1"=20'
SHEET: OF XX

No. Date Revisions App

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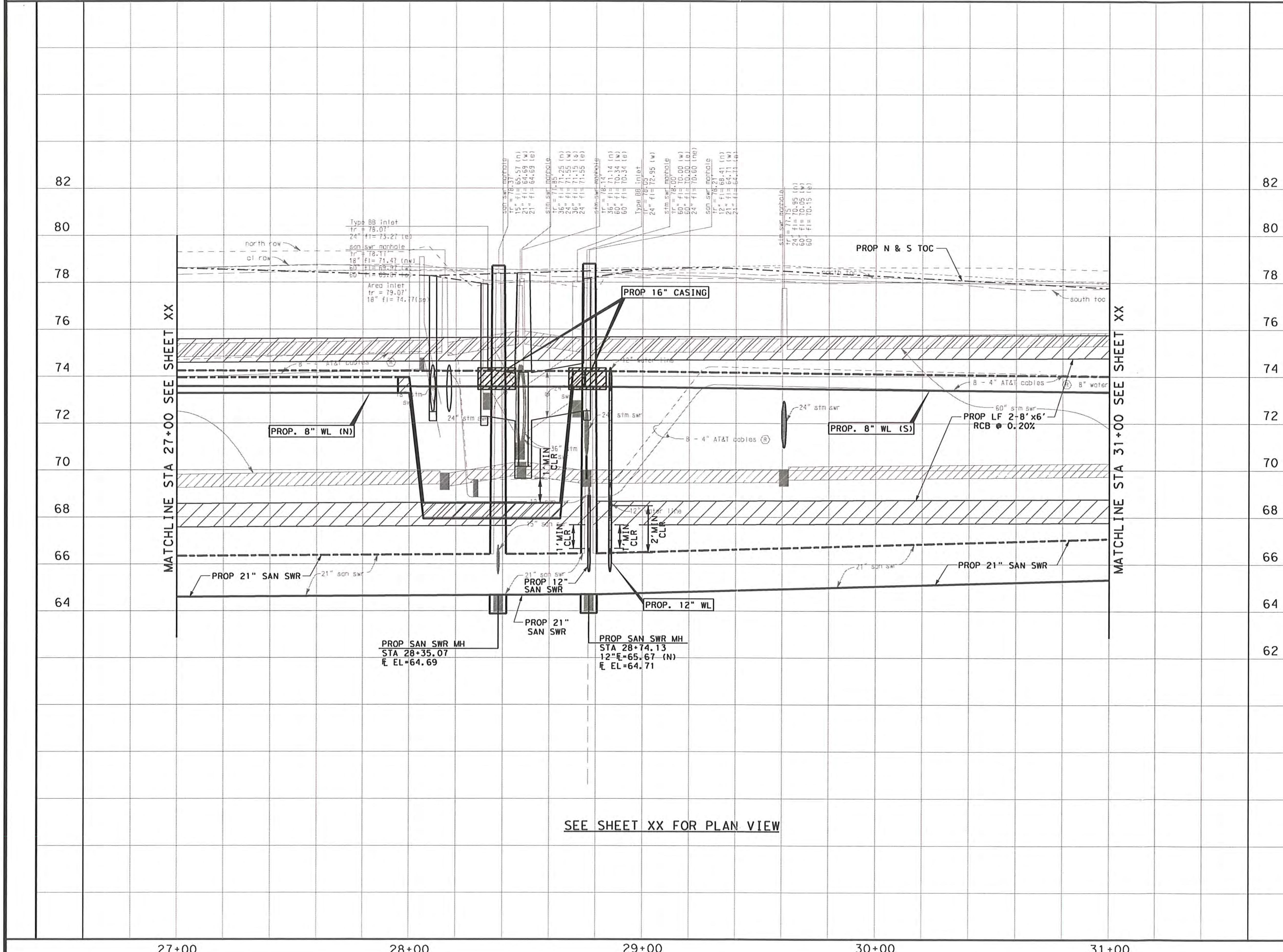


SEE SHEET XX FOR PLAN VIEW

PRIVATE UTILITY LINES SHOWN

CENTERPOINT ENERGY, GAS FACILITIES

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Lockwood, Andrews & Newnam, Inc.
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T-170015-0001-3
PROFILE VIEW
WATER & SAN SWR IMPROVEMENTS
STA 27+00 TO 31+00
SHEET 14 OF 18

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

| WATER | WASTEWATER | TRAFFIC |
|---|---|---|
| ST. & BRIDGE | STORMWATER | SWQ |

FILE NO.:
FACILITY
DRAWING SCALE:
CITY DWG NO.
VERT: 1"=2'
HORZ: 1"=20'
SHEET: OF XX

No. Date Revisions App

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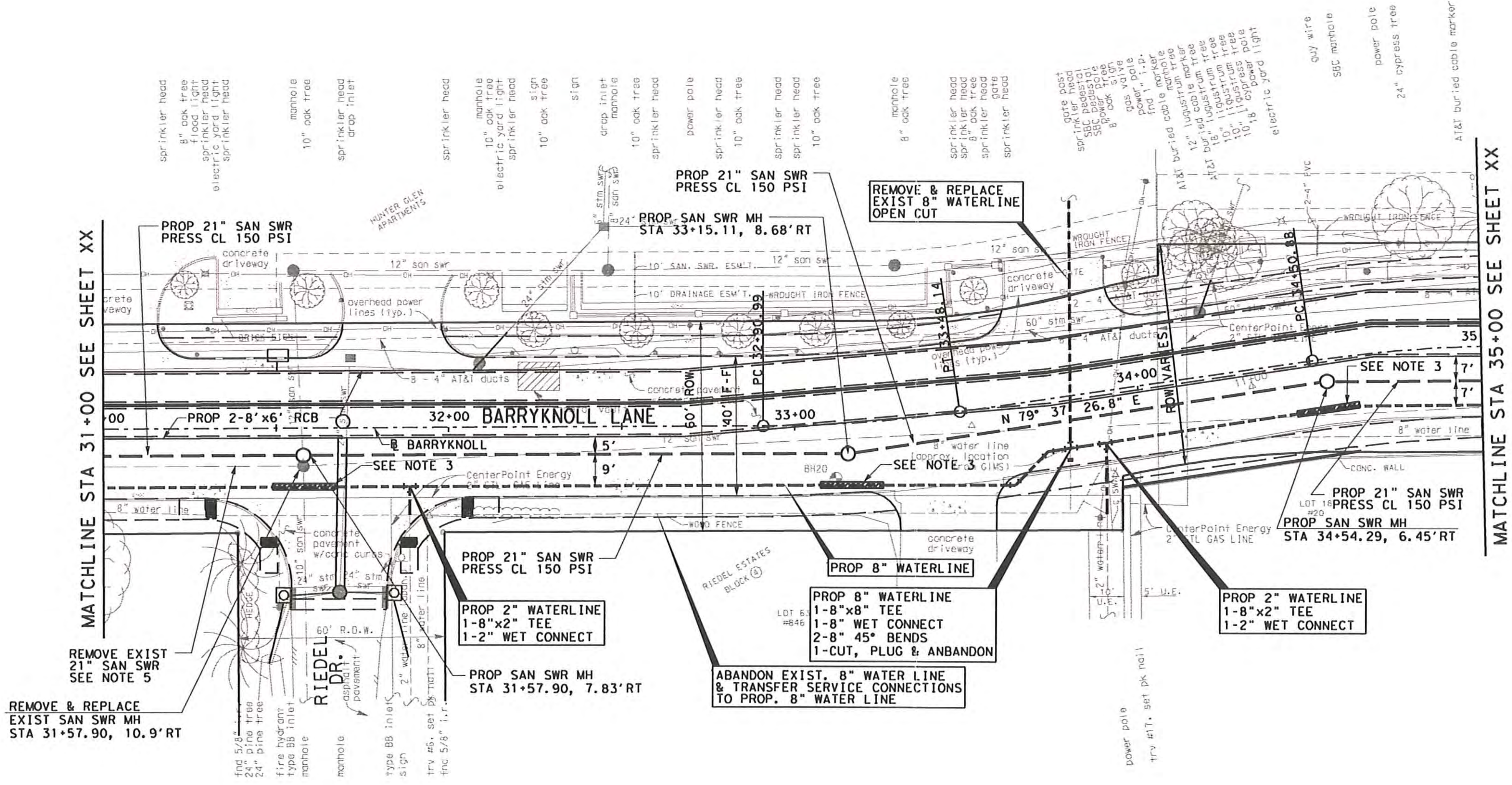


SEE SHEET XX FOR PROFILE VIEW

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Firm No.: 2614
Date: 11/4/2011

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PLAN VIEW
WATER & SAN SWR IMPROVEMENTS
STA 31+00 TO 35+00
SHEET 15 OF 18

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

| WATER | WASTEWATER | TRAFFIC |
|---|---|---|
| ST. & BRIDGE | STORMWATER | SWQ |

FILE NO.: | FACILITY
DRAWING SCALE: | CITY DWG NO.
VERT: 1"=2'
HORZ: 1"=20'
SHEET: OF XX

No. | Date | Revisions | App

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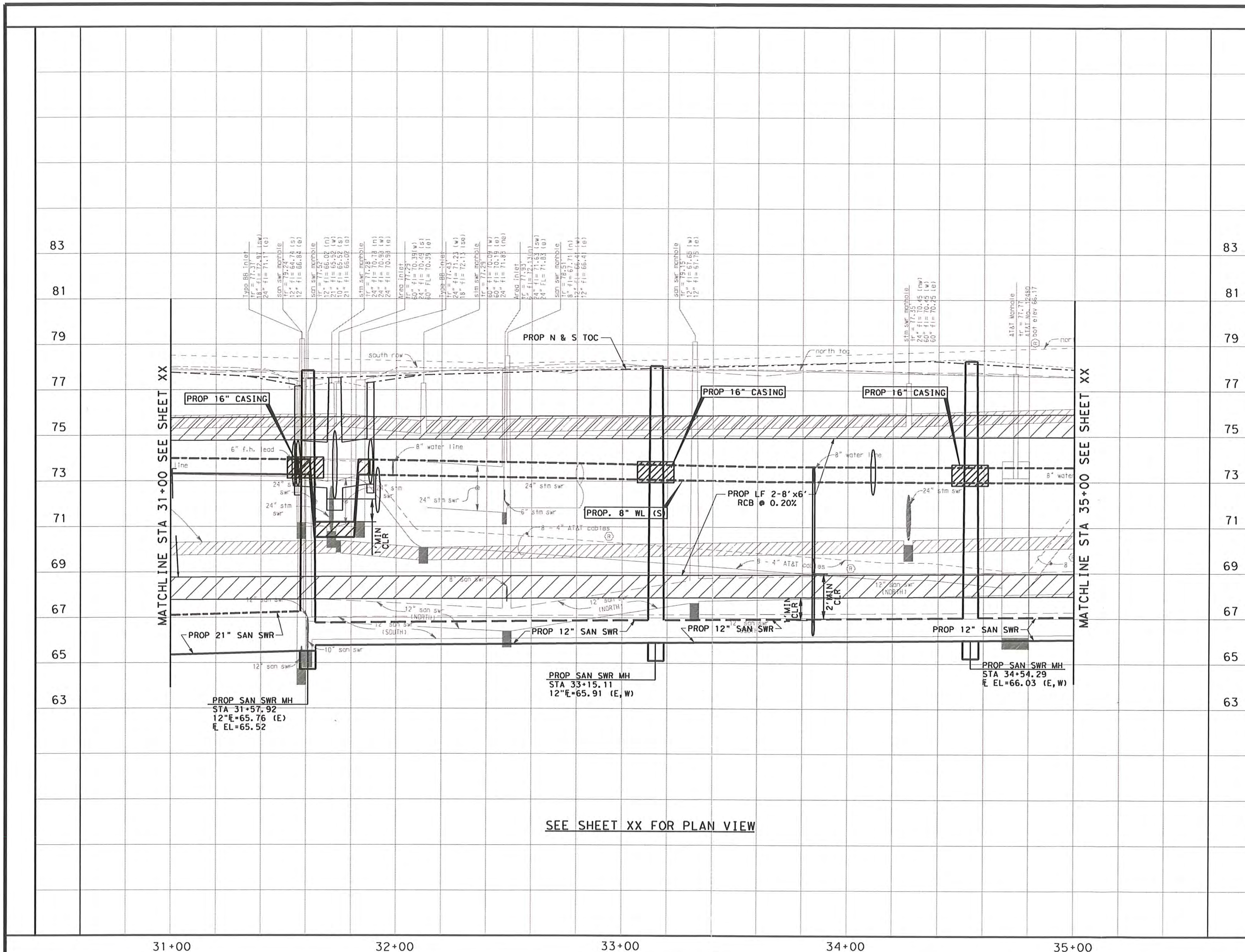


SEE SHEET XX FOR PLAN VIEW

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PRIVATE UTILITY LINES SHOWN

CENTERPOINT ENERGY, GAS FACILITIES

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Firm No.: 2614
Date: 11/4/2011

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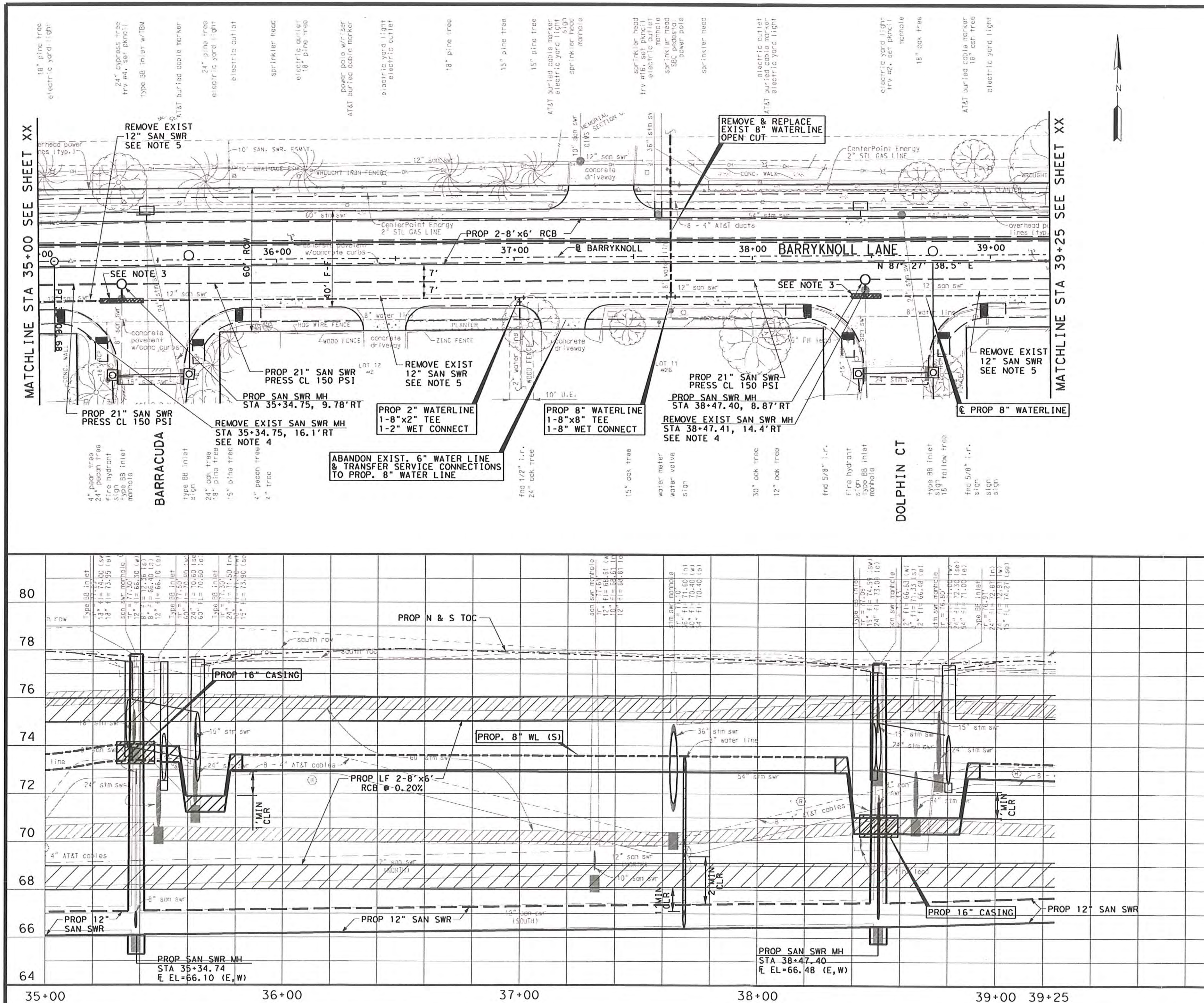
PROFILE VIEW
WATER & SAN SWR IMPROVEMENTS
STA 31+00 TO 35+00
SHEET 16 OF 18

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

| WATER | WASTEWATER | TRAFFIC |
|---|---|---|
| ST. & BRIDGE | STORMWATER | SWQ |

FILE NO.:
FACILITY
DRAWING SCALE:
CITY DWG NO.
VERT: 1"=2'
HORZ: 1"=20'
SHEET:
OF XX

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BARRYKNOLL LANE
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STA 35+00 TO STA 39+25
SHEET 17 OF 18

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

| WATER | WASTEWATER | TRAFFIC |
|---|---|---|
| ST. & BRIDGE | STORMWATER | SWD |

FILE NO.: | FACILITY
DRAWING SCALE: | CITY DWG NO.
VERT: 1"=2'
HORZ: 1"=20'
SHEET: OF XX

No. | Date | Revisions | App

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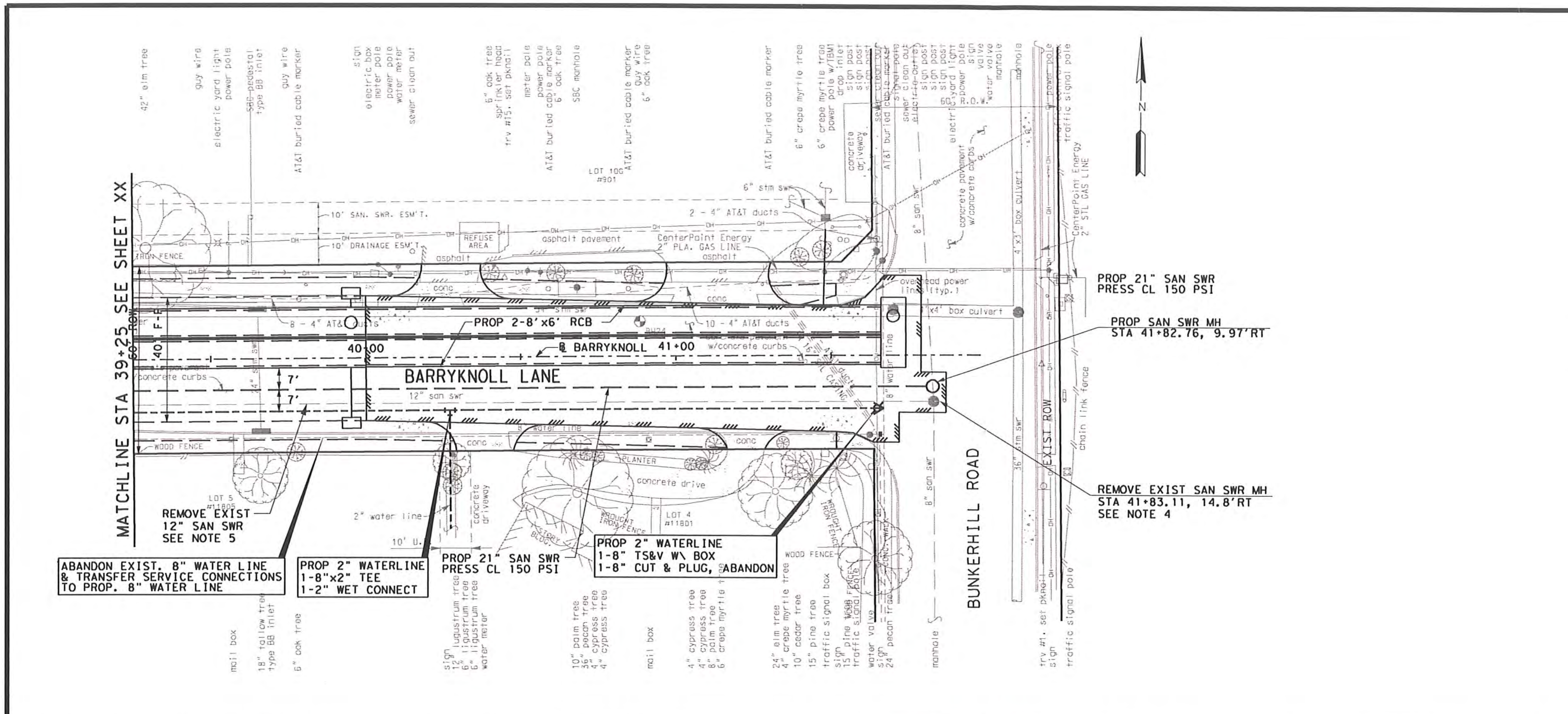


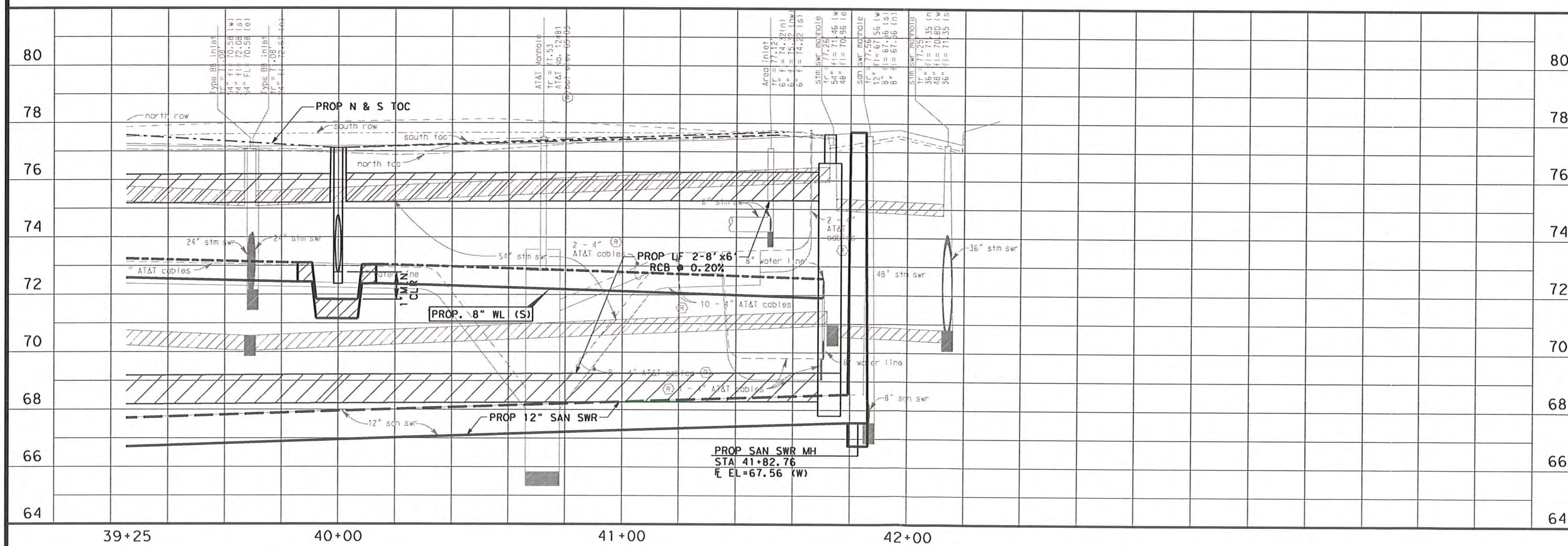


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WATER & SAN SWR IMPROVEMENTS
STA 39+25 TO STA END
SHEET 18 OF 18

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

| WATER | WASTEWATER | TRAFFIC |
|---|---|---|
| ST. & BRIDGE | STORMWATER | SWQ |

FILE NO.:
FACILITY
DRAWING SCALE:
CITY DWG NO.
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HORZ: 1"=20'
SHEET: OF XX

No. Date Revisions

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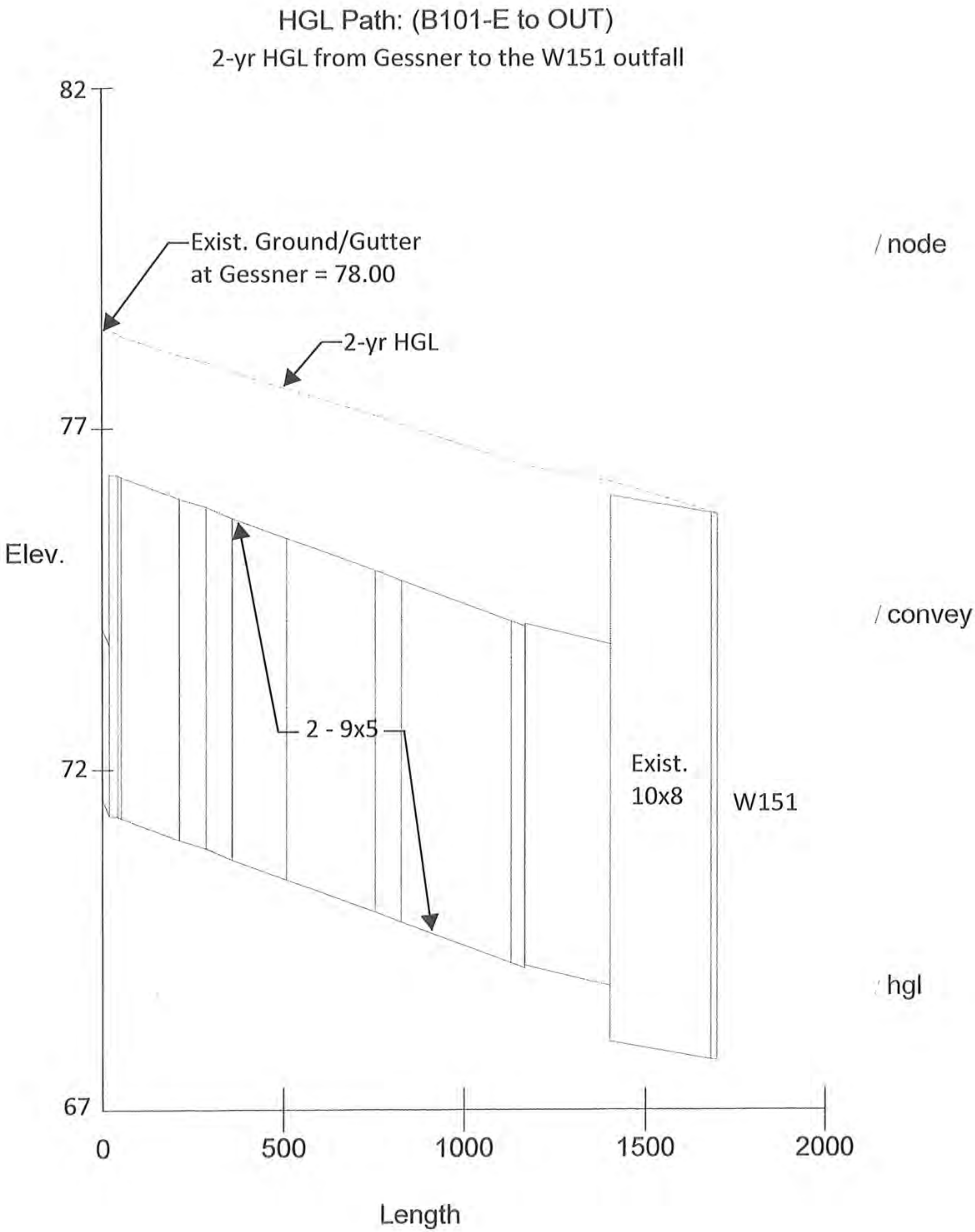
# APPENDIX C

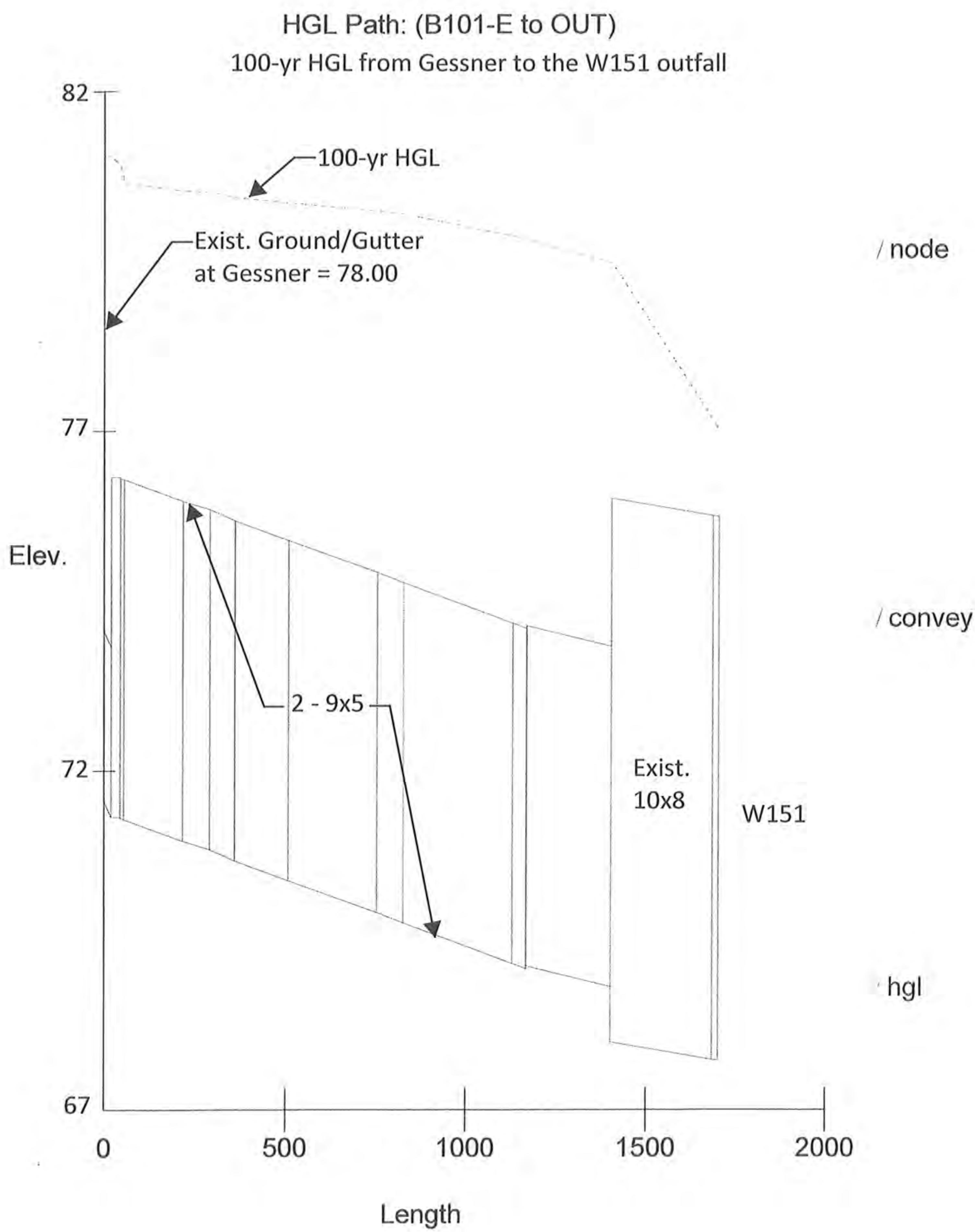
# DRAINAGE

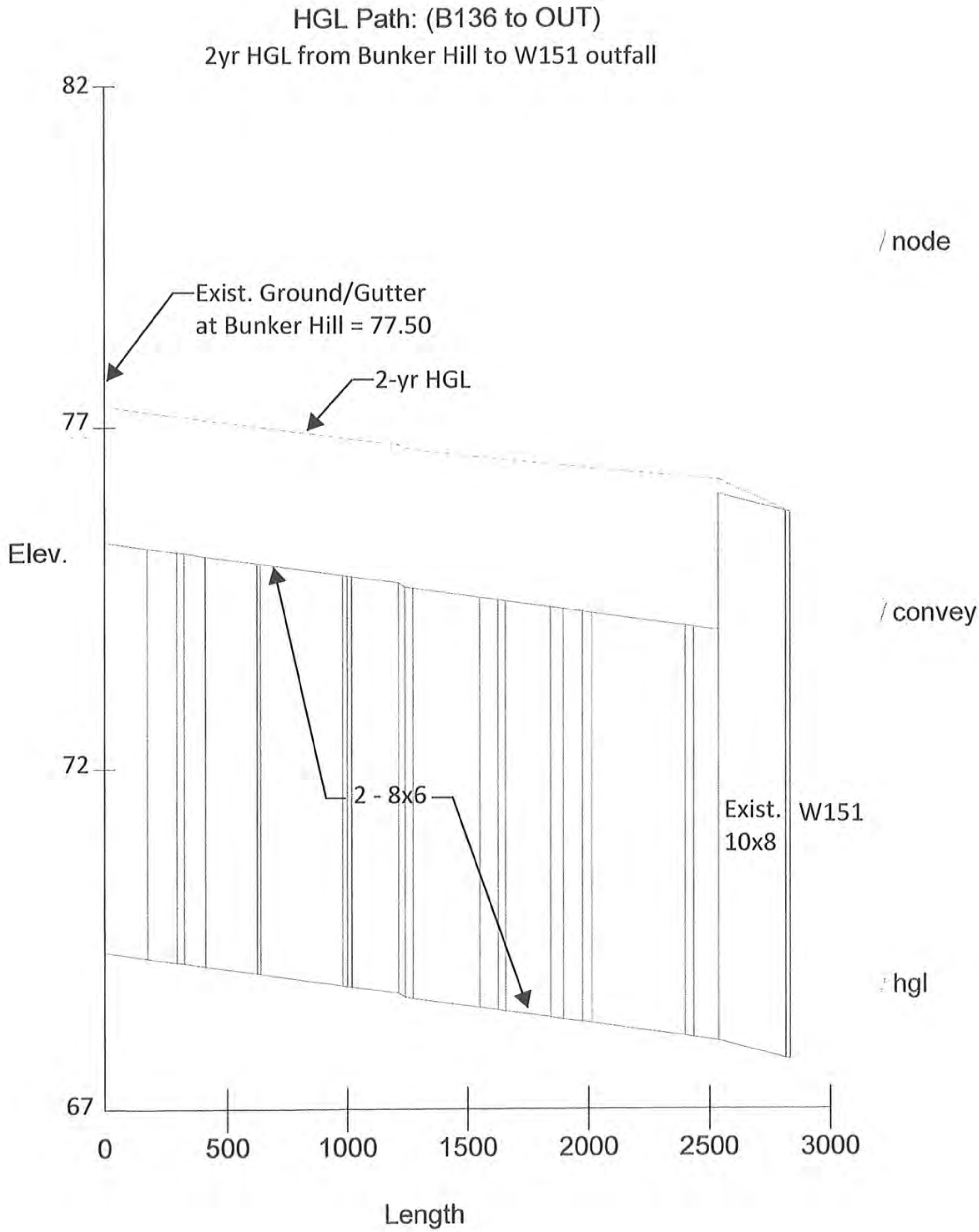
TIRZ 17 REDEVELOPMENT AUTHORITY

## Appendix C.1
## Barryknoll Lane Storm Sewer HGL Profile

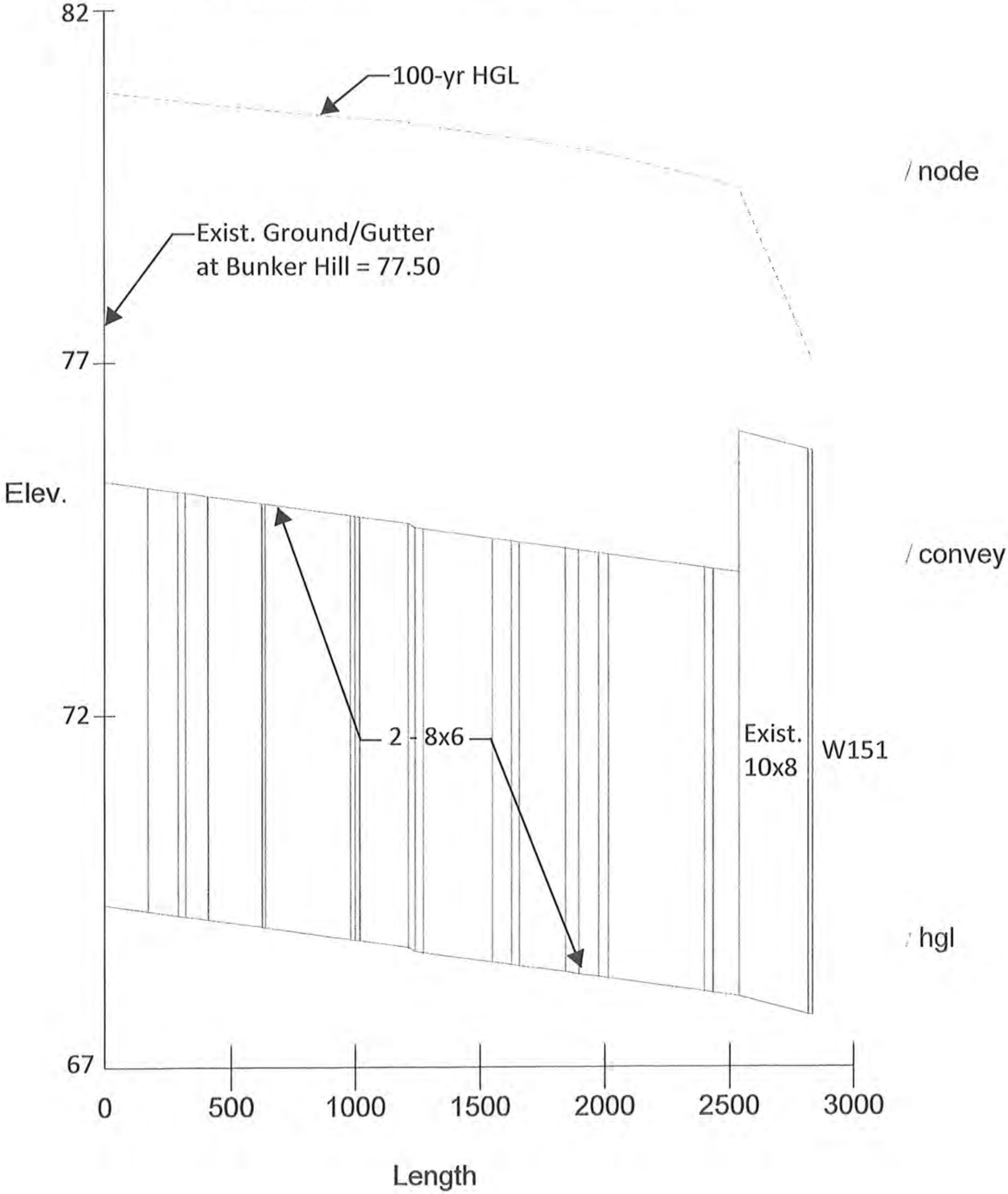


HGL Path: (B101-E to OUT)
2-yr HGL from Gessner to the W151 outfall
82
77
72
67
Elev.
Exist. Ground/Gutter
at Gessner = 78.00
2-yr HGL
2 - 9x5
Exist.
10x8
W151
node
convey
hgl
0
500
1000
1500
2000
Length


HGL Path: (B101-E to OUT)
100-yr HGL from Gessner to the W151 outfall
82
77
72
67
Elev.
100-yr HGL
Exist. Ground/Gutter
at Gessner = 78.00
2 - 9x5
Exist.
10x8
W151
/ node
/ convey
hgl
0
500
1000
1500
2000
Length


HGL Path: (B136 to OUT)
2yr HGL from Bunker Hill to W151 outfall
82
77
72
67
Elev.
Exist. Ground/Gutter
at Bunker Hill = 77.50
2-yr HGL
2 - 8x6
Exist.
10x8
W151
node
convey
hgl
0
500
1000
1500
2000
2500
3000
Length

HGL Path: (B136 to OUT)
100-yr HGL from Bunker Hill to W151 outfall



# Appendix C.2
# Hydraulic Calculations- HouStorm Output

# Appendix C.2.a
# Existing Conditions – 2 year and 100 year

BARRYKNOLL PRELIMINARY ENGINEERING REPORT
APPENDIX C.2.A - EXISTING CONDITIONS 2YR AND 100YR

HouStorm (City Of Houston STORM DRAIN DESIGN) Version 2.1, Update: Nov/01/2007
Run @ 8/5/2011 2:59:13 PM

PROJECT NAME : Barryknoll
JOB NUMBER :
PROJECT DESCRIPTION :
PROJECT File: P:\BARRYKNOLL\Barryknoll-exist.stm

DESIGN FREQUENCY : 2 Years
ANALYSYS FREQUENCY : 100 Years
MEASUREMENT UNITS: ENGLISH

OUTPUT FOR DESIGN FREQUENCY of: 2 Years

Runoff Computation for Design Frequency.

| ID | C Value | Area (acre) | Tc (min) | Tc Used (min) | Intensity (in/hr) | Supply Q (cfs) | Total Q (cfs) |
|---|---|---|---|---|---|---|---|
| B32 | 0.45 | 3.33 | 27.36 | 27.36 | 3.25 | 0.000 | 4.873 |
| | 0.45 | 3.33 | Res Lot betwen 1/4 and 1/2 acre | | | | |
| B33 | 0.534 | 1.11 | 25.18 | 25.18 | 3.39 | 0.000 | 2.007 |
| | 0.9 | 0.21 | Roadway | | | | |
| | 0.45 | 0.90 | Res Lot betwen 1/4 and 1/2 acre | | | | |
| B34 | 0.442 | 3.35 | 27.00 | 27.00 | 3.28 | 0.000 | 4.850 |
| | 0.35 | 0.49 | Grassy area or median | | | | |
| | 0.9 | 0.05 | Roadway | | | | |
| | 0.45 | 2.81 | Res Lot betwen 1/4 and 1/2 acre | | | | |
| B35 | 0.8 | 2.73 | 26.93 | 26.93 | 3.28 | 0.000 | 7.154 |
| | 0.8 | 2.73 | Business District | | | | |
| B36 | 0.782 | 0.29 | 23.05 | 23.05 | 3.55 | 0.000 | 0.812 |
| | 0.35 | 0.06 | Grassy area or median | | | | |
| | 0.9 | 0.23 | Roadway | | | | |
| B37 | 0.772 | 0.39 | 23.48 | 23.48 | 3.52 | 0.000 | 1.061 |
| | 0.35 | 0.09 | Grassy area or median | | | | |
| | 0.9 | 0.30 | Roadway | | | | |
| B38 | 0.65 | 5.70 | 28.59 | 28.59 | 3.18 | 0.000 | 11.781 |
| | 0.65 | 5.70 | Multi Family < 20 units/acre | | | | |
| B39 | 0.788 | 0.57 | 24.04 | 24.04 | 3.47 | 0.000 | 1.547 |
| | 0.35 | 0.12 | Grassy area or median | | | | |
| | 0.9 | 0.45 | Roadway | | | | |
| B50 | 0.65 | 10.75 | 30.19 | 30.19 | 3.09 | 0.000 | 21.567 |
| | 0.65 | 10.75 | Multi Family < 20 units/acre | | | | |
| B51 | 0.731 | 0.23 | 22.73 | 22.73 | 3.57 | 0.000 | 0.606 |
| | 0.55 | 0.11 | Residential Lots < 1/4 acre | | | | |
| | 0.9 | 0.12 | Roadway | | | | |
| B52 | 0.55 | 1.14 | 25.24 | 25.24 | 3.39 | 0.000 | 2.128 |
| | 0.55 | 1.14 | Residential Lots < 1/4 acre | | | | |
| B53 | 0.55 | 0.04 | 20.65 | 20.65 | 3.74 | 0.000 | 0.080 |
| | 0.55 | 0.04 | Residential Lots < 1/4 acre | | | | |
| B54 | 0.55 | 1.13 | 25.21 | 25.21 | 3.39 | 0.000 | 2.099 |
| | 0.55 | 1.13 | Residential Lots < 1/4 acre | | | | |
| B55 | 0.767 | 0.77 | 24.55 | 24.55 | 3.44 | 0.000 | 2.029 |
| | 0.65 | 0.30 | Multi Family < 20 units/acre | | | | |
| | 0.9 | 0.20 | Roadway | | | | |
| | 0.8 | 0.27 | Business Distrct | | | | |
| B56 | 0.681 | 0.40 | 23.51 | 23.51 | 3.51 | 0.000 | 0.957 |
| | 0.55 | 0.25 | Residential Lots < 1/4 acre | | | | |
| | 0.9 | 0.15 | Roadway | | | | |
| B57 | 0.659 | 29.76 | 33.18 | 33.18 | 2.93 | 0.000 | 57.466 |
| | 0.8 | 17.76 | Business District | | | | |
| | 0.45 | 12.00 | Res Lot betwen 1/4 and 1/2 acre | | | | |
| B20 | 0.65 | 1.98 | 26.28 | 26.28 | 3.32 | 0.000 | 4.268 |
| | 0.65 | 1.98 | Multi Family < 20 units/acre | | | | |
| B21 | 0.8 | 2.87 | 27.04 | 27.04 | 3.27 | 0.000 | 7.514 |
| | 0.8 | 2.87 | Business District | | | | |
| B22 | 0.8 | 7.15 | 29.14 | 29.14 | 3.15 | 0.000 | 18.005 |
| | 0.8 | 7.15 | Business District | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| B23 | 0.9 | 0.23 | 22.71 | 22.71 | 3.57 | 0.000 | 0.733 |
| | 0.9 | 0.23 | Roadway | | | | |
| B24 | 0.449 | 0.67 | 24.31 | 24.31 | 3.46 | 0.000 | 1.032 |
| | 0.35 | 0.55 | Grassy area or median | | | | |
| | 0.9 | 0.12 | Roadway | | | | |
| B25 | 0.771 | 0.23 | 22.70 | 22.70 | 3.57 | 0.000 | 0.626 |
| | 0.65 | 0.12 | Multi Family < 20 units/acre | | | | |
| | 0.9 | 0.11 | Roadway | | | | |
| B26 | 0.65 | 2.03 | 26.32 | 26.32 | 3.32 | 0.000 | 4.370 |
| | 0.65 | 2.03 | Multi Family < 20 units/acre | | | | |
| B27 | 0.65 | 0.87 | 24.01 | 24.01 | 3.48 | 0.000 | 1.959 |
| | 0.65 | 0.87 | Multi Family < 20 units/acre | | | | |
| B28 | 0.8 | 1.89 | 26.19 | 26.19 | 3.33 | 0.000 | 5.038 |
| | 0.8 | 1.89 | Business District | | | | |
| B29 | 0.8 | 1.91 | 26.21 | 26.21 | 3.33 | 0.000 | 5.079 |
| | 0.8 | 1.91 | Business District | | | | |
| B40 | 0.65 | 5.49 | 28.50 | 28.50 | 3.18 | 0.000 | 11.357 |
| | 0.65 | 5.49 | Multi Family < 20 units/acre | | | | |
| B41 | 0.479 | 2.33 | 26.60 | 26.60 | 3.30 | 0.000 | 3.679 |
| | 0.9 | 0.15 | Roadway | | | | |
| | 0.45 | 2.18 | Res Lot betwen 1/4 and 1/2 acre | | | | |
| B42 | 0.45 | 5.26 | 28.40 | 28.40 | 3.19 | 0.000 | 7.553 |
| | 0.45 | 5.26 | Res Lot betwen 1/4 and 1/2 acre | | | | |
| B44 | 0.45 | 3.30 | 27.34 | 27.34 | 3.25 | 0.000 | 4.833 |
| | 0.45 | 3.30 | Res Lot betwen 1/4 and 1/2 acre | | | | |
| B43 | 0.706 | 0.35 | 23.32 | 23.32 | 3.53 | 0.000 | 0.876 |
| | 0.9 | 0.20 | Roadway | | | | |
| | 0.45 | 0.15 | Res Lot betwen 1/4 and 1/2 acre | | | | |
| B45 | 0.713 | 0.60 | 24.14 | 24.14 | 3.47 | 0.000 | 1.482 |
| | 0.65 | 0.45 | Multi Family < 20 units/acre | | | | |
| | 0.9 | 0.15 | Roadway | | | | |
| B46 | 0.775 | 0.19 | 22.44 | 22.44 | 3.59 | 0.000 | 0.520 |
| | 0.55 | 0.07 | Residential Lots < 1/4 acre | | | | |
| | 0.9 | 0.12 | Roadway | | | | |
| B47 | 0.55 | 1.04 | 25.06 | 25.06 | 3.40 | 0.000 | 1.939 |
| | 0.55 | 1.04 | Residential Lots < 1/4 acre | | | | |
| B48 | 0.738 | 0.22 | 22.68 | 22.68 | 3.57 | 0.000 | 0.589 |
| | 0.55 | 0.10 | Residential Lots < 1/4 acre | | | | |
| | 0.9 | 0.12 | Roadway | | | | |
| B1 | 0.8 | 93.35 | 20.00 | 20.00 | 3.79 | 0.000 | 283.292 |
| | 0.8 | 93.35 | Business District | | | | |
| B2 | 0.8 | 0.81 | 24.65 | 24.65 | 3.43 | 0.000 | 2.234 |
| | 0.8 | 0.81 | Business District | | | | |
| B3 | 0.694 | 0.08 | 21.41 | 21.41 | 3.68 | 0.000 | 0.204 |
| | 0.35 | 0.03 | Grassy median | | | | |
| | 0.9 | 0.05 | Roadway | | | | |
| B4 | 0.8 | 1.04 | 25.07 | 25.07 | 3.40 | 0.000 | 2.836 |
| | 0.8 | 1.04 | Business District | | | | |
| B5 | 0.8 | 1.83 | 23.77 | 23.77 | 3.49 | 0.000 | 5.112 |
| | 0.8 | 1.83 | Business district | | | | |
| B6 | 0.8 | 0.32 | 23.20 | 23.20 | 3.54 | 0.000 | 0.914 |
| | 0.8 | 0.32 | Business District | | | | |
| B7 | 0.778 | 0.64 | 24.25 | 24.25 | 3.46 | 0.000 | 1.730 |
| | 0.35 | 0.14 | Grassy area or median | | | | |
| | 0.9 | 0.50 | Roadway | | | | |
| B49 | 0.55 | 1.09 | 25.15 | 25.15 | 3.40 | 0.000 | 2.031 |
| | 0.55 | 1.09 | Residential Lots < 1/4 acre | | | | |
| B58 | 0.8 | 12.30 | 30.56 | 30.56 | 3.07 | 0.000 | 30.177 |
| | 0.8 | 12.30 | Business District | | | | |
| B12-A | 0.852 | 1.15 | 1.15 | 10.00 | 4.96 | 0.000 | 4.847 |
| | 0.35 | 0.10 | Grassy area or median | | | | |
| | 0.9 | 1.05 | Parking Lot | | | | |
| B8 | 0.8 | 0.38 | 23.45 | 23.45 | 3.52 | 0.000 | 1.078 |
| | 0.8 | 0.38 | Business District | | | | |
| B9 | 0.8 | 2.29 | 26.57 | 26.57 | 3.30 | 0.000 | 6.052 |
| | 0.8 | 2.29 | Business District | | | | |
| B10 | 0.8 | 1.67 | 25.95 | 25.95 | 3.34 | 0.000 | 4.466 |
| | 0.8 | 1.67 | Business District | | | | |
| B11 | 0.694 | 0.32 | 23.18 | 23.18 | 3.54 | 0.000 | 0.785 |
| | 0.35 | 0.12 | Grassy area or median | | | | |
| | 0.9 | 0.20 | Roadway | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| B12 | 0.7 | 0.19 | 22.45 | 22.45 | 3.59 | 0.000 | 0.470 |
| B13 | 0.794 | 1.42 | 25.64 | 25.64 | 3.36 | 0.000 | 3.803 |
| | 0.35 | 0.27 | Grassy area or median | | | | |
| | 0.9 | 0.90 | Parking Lot | | | | |
| | 0.9 | 0.25 | Roadway | | | | |
| B14 | 0.789 | 0.29 | 23.03 | 23.03 | 3.55 | 0.000 | 0.806 |
| | 0.35 | 0.06 | Grassy area or median | | | | |
| | 0.9 | 0.23 | Roadway | | | | |
| B15 | 0.8 | 86.05 | 36.91 | 36.91 | 2.76 | 0.000 | 189.859 |
| | 0.8 | 86.05 | Business District | | | | |
| B16 | 0.8 | 1.72 | 26.00 | 26.00 | 3.34 | 0.000 | 4.582 |
| | 0.8 | 1.72 | Business District | | | | |
| B17 | 0.852 | 0.22 | 23.15 | 23.15 | 3.54 | 0.000 | 0.661 |
| | 0.35 | 0.02 | Grassy area or median | | | | |
| | 0.9 | 0.20 | Roadway | | | | |
| B18 | 0.719 | 0.33 | 23.21 | 23.21 | 3.54 | 0.000 | 0.826 |
| | 0.65 | 0.24 | Multi Family < 20 units/acre | | | | |
| | 0.9 | 0.09 | Roadway | | | | |
| B19 | 0.688 | 0.53 | 23.95 | 23.95 | 3.48 | 0.000 | 1.272 |
| | 0.65 | 0.45 | Multi Family < 20 units/acre | | | | |
| | 0.9 | 0.08 | Roadway | | | | |
| B30 | 0.9 | 0.25 | 22.84 | 22.84 | 3.56 | 0.000 | 0.806 |
| | 0.9 | 0.25 | Roadway | | | | |
| B31 | 0.608 | 0.31 | 23.13 | 23.13 | 3.54 | 0.000 | 0.663 |
| | 0.9 | 0.11 | Roadway | | | | |
| | 0.45 | 0.20 | Res Lot betwen 1/4 and 1/2 acre | | | | |

Sag Inlets Configuration Data.

| Inlet ID | Inlet Type | Length/ Perim (ft) | Grate Area (sf) | Left-Slope Longi (%) | Left-Slope Transv (%) | Right-Slope Longi (%) | Right-Slope Transv (%) | Gutter n | Gutter DeprW (ft) | Head Allowed (ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| B19 | Curb | 2.50 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B35 | Grate | 10.00 | 3.28 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | n/a | 1.50 |
| B36 | Curb | 5.00 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B37 | Curb | 5.00 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B39 | Grate | 10.00 | 3.28 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | n/a | 1.50 |
| B41 | Curb | 5.00 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B43 | Curb | 5.00 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B2 | Curb | 5.00 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B3 | Curb | 5.00 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B10 | Curb | 5.00 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B11 | Curb | 5.00 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B12 | Grate | 10.00 | 3.28 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | n/a | 1.50 |
| B13 | Curb | 5.00 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B14 | Curb | 5.00 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B16 | Grate | 10.00 | 3.28 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | n/a | 1.50 |
| B17 | Curb | 5.00 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B18 | Curb | 2.50 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B4 | Grate | 10.00 | 3.28 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | n/a | 1.50 |
| B5 | Curb | 5.00 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B6 | Grate | 10.00 | 3.28 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | n/a | 1.50 |
| B7 | Curb | 5.00 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B8 | Grate | 10.00 | 3.28 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | n/a | 1.50 |
| B21 | Grate | 10.00 | 3.28 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | n/a | 1.50 |
| B23 | Curb | 2.50 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B24 | Curb | 2.50 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B25 | Curb | 2.50 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B27 | Grate | 10.00 | 6.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | n/a | 1.50 |
| B28 | Grate | 10.00 | 6.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | n/a | 1.50 |
| B29 | Grate | 10.00 | 3.28 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | n/a | 1.50 |
| B30 | Grate | 10.00 | 3.28 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | n/a | 1.50 |
| B31 | Curb | 5.00 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B33 | Curb | 5.00 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B45 | Curb | 5.00 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B46 | Curb | 5.00 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B48 | Curb | 5.00 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B51 | Curb | 5.00 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| B53 | Curb | 5.00 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B55 | Curb | 5.00 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B56 | Curb | 5.00 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |

Sag Inlets Computation Data.

| Inlet ID | Inlet Type | Length (ft) | Grate Perim (ft) | Grate Area (sf) | Total Q (cfs) | Inlet Capacity (cfs) | Actual Head (ft) | Ponded Width Left (ft) | Ponded Width Right (ft) |
|---|---|---|---|---|---|---|---|---|---|
| B19 | Curb | 2.50 | n/a | n/a | 1.272 | 7.511 | 0.286 | 6.60 | 6.60 |
| B35 | Grate | n/a | 10.00 | 3.28 | 7.154 | 21.590 | 0.377 | 12.60 | 12.60 |
| B36 | Curb | 5.00 | n/a | n/a | 0.812 | 15.022 | 0.254 | 5.55 | 5.55 |
| B37 | Curb | 5.00 | n/a | n/a | 1.061 | 15.022 | 0.256 | 6.15 | 6.15 |
| B39 | Grate | n/a | 10.00 | 3.28 | 1.547 | 21.590 | 0.136 | 7.10 | 7.10 |
| B41 | Curb | 5.00 | n/a | n/a | 3.679 | 15.022 | 0.325 | 9.80 | 9.80 |
| B43 | Curb | 5.00 | n/a | n/a | 0.876 | 15.022 | 0.254 | 5.70 | 5.70 |
| B2 | Curb | 5.00 | n/a | n/a | 2.234 | 15.022 | 0.278 | 8.15 | 8.15 |
| B3 | Curb | 5.00 | n/a | n/a | 0.204 | 15.022 | 0.250 | 3.30 | 3.30 |
| B10 | Curb | 5.00 | n/a | n/a | 4.466 | 15.022 | 0.360 | 10.55 | 10.55 |
| B11 | Curb | 5.00 | n/a | n/a | 0.785 | 15.022 | 0.253 | 5.50 | 5.50 |
| B12 | Grate | n/a | 10.00 | 3.28 | 0.470 | 21.590 | 0.061 | 4.55 | 4.55 |
| B13 | Curb | 5.00 | n/a | n/a | 3.803 | 15.022 | 0.330 | 9.95 | 9.95 |
| B14 | Curb | 5.00 | n/a | n/a | 0.806 | 15.022 | 0.254 | 5.55 | 5.55 |
| B16 | Grate | n/a | 10.00 | 3.28 | 4.582 | 21.590 | 0.280 | 10.65 | 10.65 |
| B17 | Curb | 5.00 | n/a | n/a | 0.661 | 15.022 | 0.252 | 5.15 | 5.15 |
| B18 | Curb | 2.50 | n/a | n/a | 0.826 | 7.511 | 0.265 | 5.60 | 5.60 |
| B4 | Grate | n/a | 10.00 | 3.28 | 2.836 | 21.590 | 0.204 | 8.90 | 8.90 |
| B5 | Curb | 5.00 | n/a | n/a | 5.112 | 15.022 | 0.395 | 11.10 | 11.10 |
| B6 | Grate | n/a | 10.00 | 3.28 | 0.914 | 21.590 | 0.096 | 5.80 | 5.80 |
| B7 | Curb | 5.00 | n/a | n/a | 1.730 | 15.022 | 0.267 | 7.40 | 7.40 |
| B8 | Grate | n/a | 10.00 | 3.28 | 1.078 | 21.590 | 0.107 | 6.20 | 6.20 |
| B21 | Grate | n/a | 10.00 | 3.28 | 7.514 | 21.590 | 0.390 | 12.80 | 12.80 |
| B23 | Curb | 2.50 | n/a | n/a | 0.733 | 7.511 | 0.262 | 5.35 | 5.35 |
| B24 | Curb | 2.50 | n/a | n/a | 1.032 | 7.511 | 0.274 | 6.10 | 6.10 |
| B25 | Curb | 2.50 | n/a | n/a | 0.626 | 7.511 | 0.259 | 5.05 | 5.05 |
| B27 | Grate | n/a | 10.00 | 6.00 | 1.959 | 39.495 | 0.159 | 7.75 | 7.75 |
| B28 | Grate | n/a | 10.00 | 6.00 | 5.038 | 39.495 | 0.299 | 11.05 | 11.05 |
| B29 | Grate | n/a | 10.00 | 3.28 | 5.079 | 21.590 | 0.300 | 11.05 | 11.05 |
| B30 | Grate | n/a | 10.00 | 3.28 | 0.806 | 21.590 | 0.088 | 5.55 | 5.55 |
| B31 | Curb | 5.00 | n/a | n/a | 0.663 | 15.022 | 0.252 | 5.15 | 5.15 |
| B33 | Curb | 5.00 | n/a | n/a | 2.007 | 15.022 | 0.272 | 7.80 | 7.80 |
| B45 | Curb | 5.00 | n/a | n/a | 1.482 | 15.022 | 0.262 | 6.95 | 6.95 |
| B46 | Curb | 5.00 | n/a | n/a | 0.520 | 15.022 | 0.252 | 4.70 | 4.70 |
| B48 | Curb | 5.00 | n/a | n/a | 0.589 | 15.022 | 0.252 | 4.95 | 4.95 |
| B51 | Curb | 5.00 | n/a | n/a | 0.606 | 15.022 | 0.252 | 5.00 | 5.00 |
| B53 | Curb | 5.00 | n/a | n/a | 0.080 | 15.022 | 0.250 | 2.35 | 2.35 |
| B55 | Curb | 5.00 | n/a | n/a | 2.029 | 15.022 | 0.273 | 7.85 | 7.85 |
| B56 | Curb | 5.00 | n/a | n/a | 0.957 | 15.022 | 0.255 | 5.90 | 5.90 |

Cumulative Junction Discharge Computations

| Node I.D. | Node Type | Weighted C-Value | Cumulat. Dr.Area (acres) | Cumulat. Tc (min) | Intens. (in/hr) | User Supply Q cfs) | Additional Q in Node (cfs) | Total Disch. (cfs) |
|---|---|---|---|---|---|---|---|---|
| B19 | Curb | 0.688 | 0.53 | 23.95 | 3.48 | | 0.00 | 1.272 |
| B20 | CrcMh | 0.650 | 1.98 | 26.28 | 3.32 | | 0.00 | 4.268 |
| B32 | CrcMh | 0.450 | 3.33 | 27.36 | 3.25 | | 0.00 | 4.873 |
| B34 | CrcMh | 0.442 | 3.35 | 27.00 | 3.28 | | 0.00 | 4.850 |
| B35 | Grate | 0.800 | 2.73 | 26.93 | 3.28 | | 0.00 | 7.154 |
| B36 | Curb | 0.782 | 0.29 | 23.05 | 3.55 | | 0.00 | 0.812 |
| B37 | Curb | 0.772 | 0.39 | 23.48 | 3.52 | | 0.00 | 1.061 |
| B38 | CrcMh | 0.650 | 5.70 | 28.59 | 3.18 | | 0.00 | 11.781 |
| B39 | Grate | 0.619 | 64.65 | 36.08 | 2.79 | | 0.00 | 111.870 |
| B40 | CrcMh | 0.650 | 5.49 | 28.50 | 3.18 | | 0.00 | 11.357 |
| B41 | Curb | 0.459 | 7.59 | 28.42 | 3.19 | | 0.00 | 11.103 |
| B43 | Curb | 0.475 | 3.65 | 27.38 | 3.25 | | 0.00 | 5.637 |
| B42 | CrcMh | 0.450 | 5.26 | 28.40 | 3.19 | | 0.00 | 7.553 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| B44 | CrcMh | 0.450 | 3.30 | 27.34 | 3.25 | 0.00 | 4.833 |
| B57 | CrcMh | 0.659 | 29.76 | 33.18 | 2.93 | 0.00 | 57.466 |
| B1 | JctBx | 0.800 | 93.35 | 20.00 | 3.79 | 0.00 | 283.292 |
| B101 | CrcMh | 0.800 | 94.24 | 24.68 | 3.43 | 0.00 | 258.490 |
| B2 | Curb | 0.800 | 0.81 | 24.65 | 3.43 | 0.00 | 2.234 |
| B3 | Curb | 0.694 | 0.08 | 21.41 | 3.68 | 0.00 | 0.204 |
| B102 | CrcMh | 0.800 | 98.08 | 25.20 | 3.39 | 0.00 | 266.140 |
| B9 | CrcMh | 0.800 | 100.75 | 26.57 | 3.30 | 0.00 | 266.086 |
| B10 | Curb | 0.800 | 1.67 | 25.95 | 3.34 | 0.00 | 4.466 |
| B11 | Curb | 0.783 | 1.99 | 26.08 | 3.33 | 0.00 | 5.195 |
| B12 | Grate | 0.700 | 0.19 | 22.45 | 3.59 | 0.00 | 0.470 |
| B13 | Curb | 0.794 | 1.42 | 25.64 | 3.36 | 0.00 | 3.803 |
| B14 | Curb | 0.789 | 0.29 | 23.03 | 3.55 | 0.00 | 0.806 |
| B15 | CrcMh | 0.800 | 86.05 | 36.91 | 2.76 | 0.00 | 189.859 |
| B16 | Grate | 0.800 | 1.72 | 26.00 | 3.34 | 0.00 | 4.582 |
| B17 | Curb | 0.806 | 1.93 | 26.04 | 3.34 | 0.00 | 5.201 |
| B18 | Curb | 0.719 | 0.33 | 23.21 | 3.54 | 0.00 | 0.826 |
| B4 | Grate | 0.800 | 1.04 | 25.07 | 3.40 | 0.00 | 2.836 |
| B5 | Curb | 0.800 | 2.87 | 25.18 | 3.39 | 0.00 | 7.796 |
| B6 | Grate | 0.800 | 0.32 | 23.20 | 3.54 | 0.00 | 0.914 |
| B7 | Curb | 0.785 | 0.97 | 24.25 | 3.46 | 0.00 | 2.623 |
| B8 | Grate | 0.800 | 0.38 | 23.45 | 3.52 | 0.00 | 1.078 |
| B103 | CrcMh | 0.800 | 98.46 | 25.44 | 3.38 | 0.00 | 265.891 |
| B104 | CrcMh | 0.800 | 100.75 | 26.57 | 3.30 | 0.00 | 266.086 |
| B21 | Grate | 0.800 | 2.87 | 27.04 | 3.27 | 0.00 | 7.514 |
| B22 | CrcMh | 0.800 | 10.02 | 29.14 | 3.15 | 0.00 | 25.228 |
| B23 | Curb | 0.900 | 0.23 | 22.71 | 3.57 | 0.00 | 0.733 |
| B24 | Curb | 0.449 | 0.67 | 24.31 | 3.46 | 0.00 | 1.032 |
| B25 | Curb | 0.771 | 0.23 | 22.70 | 3.57 | 0.00 | 0.626 |
| B26 | CrcMh | 0.650 | 2.03 | 26.32 | 3.32 | 0.00 | 4.370 |
| B27 | Grate | 0.650 | 0.87 | 24.01 | 3.48 | 0.00 | 1.959 |
| B28 | Grate | 0.800 | 1.89 | 26.19 | 3.33 | 0.00 | 5.038 |
| B29 | Grate | 0.800 | 1.91 | 26.21 | 3.33 | 0.00 | 5.079 |
| B30 | Grate | 0.642 | 96.31 | 37.09 | 2.75 | 0.00 | 169.982 |
| B31 | Curb | 0.463 | 3.64 | 27.38 | 3.25 | 0.00 | 5.480 |
| B33 | Curb | 0.465 | 4.46 | 27.01 | 3.27 | 0.00 | 6.785 |
| B45 | Curb | 0.650 | 47.35 | 35.30 | 2.83 | 0.00 | 87.165 |
| B46 | Curb | 0.584 | 1.22 | 25.08 | 3.40 | 0.00 | 2.431 |
| B48 | Curb | 0.583 | 2.53 | 25.17 | 3.40 | 0.00 | 5.015 |
| B47 | CrcMh | 0.550 | 1.04 | 25.06 | 3.40 | 0.00 | 1.939 |
| B49 | CrcMh | 0.550 | 1.09 | 25.15 | 3.40 | 0.00 | 2.031 |
| B50 | CrcMh | 0.650 | 10.75 | 30.19 | 3.09 | 0.00 | 21.567 |
| B51 | Curb | 0.581 | 1.37 | 25.25 | 3.39 | 0.00 | 2.702 |
| B53 | Curb | 0.567 | 2.54 | 25.36 | 3.38 | 0.00 | 4.861 |
| B52 | CrcMh | 0.550 | 1.14 | 25.24 | 3.39 | 0.00 | 2.128 |
| B54 | CrcMh | 0.550 | 1.13 | 25.21 | 3.39 | 0.00 | 2.099 |
| B55 | Curb | 0.662 | 30.93 | 33.80 | 2.90 | 0.00 | 59.375 |
| B56 | Curb | 0.681 | 0.40 | 23.51 | 3.51 | 0.00 | 0.957 |
| B105 | CrcMh | 0.799 | 102.93 | 26.73 | 3.29 | 0.00 | 270.836 |
| B110 | CrcMh | 0.747 | 308.84 | 39.91 | 2.63 | 0.00 | 608.071 |
| B108 | CrcMh | 0.793 | 1.71 | 25.69 | 3.36 | 0.00 | 4.563 |
| B109 | CrcMh | 0.720 | 204.77 | 39.15 | 2.67 | 0.00 | 393.177 |
| B111 | CrcMh | 0.661 | 117.01 | 38.92 | 2.67 | 0.00 | 206.815 |
| B122 | CrcMh | 0.622 | 70.35 | 36.70 | 2.77 | 0.00 | 121.028 |
| B113 | CrcMh | 0.658 | 112.24 | 38.03 | 2.71 | 0.00 | 200.313 |
| B115 | CrcMh | 0.645 | 99.07 | 37.74 | 2.72 | 0.00 | 173.925 |
| B116 | CrcMh | 0.645 | 98.21 | 37.60 | 2.73 | 0.00 | 172.781 |
| B117 | CrcMh | 0.464 | 8.09 | 27.39 | 3.25 | 0.00 | 12.215 |
| B118 | CrcMh | 0.654 | 86.06 | 36.81 | 2.76 | 0.00 | 155.495 |
| B119 | CrcMh | 0.654 | 86.06 | 36.81 | 2.76 | 0.00 | 155.495 |
| B120 | CrcMh | 0.649 | 83.33 | 36.78 | 2.76 | 0.00 | 149.551 |
| B121 | CrcMh | 0.799 | 12.99 | 32.20 | 2.98 | 0.00 | 30.905 |
| B123 | CrcMh | 0.622 | 70.35 | 36.70 | 2.77 | 0.00 | 121.028 |
| B124 | CrcMh | 0.464 | 11.24 | 28.45 | 3.19 | 0.00 | 16.623 |
| B125 | CrcMh | 0.650 | 52.84 | 35.95 | 2.80 | 0.00 | 96.244 |
| B126 | CrcMh | 0.650 | 47.35 | 35.30 | 2.83 | 0.00 | 87.165 |
| B127 | CrcMh | 0.000 | 0.00 | 0.00 | 0.00 | 0.00 | 0.000 |
| B128 | CrcMh | 0.654 | 44.22 | 34.44 | 2.87 | 0.00 | 82.919 |
| B129 | CrcMh | 0.655 | 33.47 | 34.26 | 2.88 | 0.00 | 63.062 |
| B130 | CrcMh | 0.659 | 29.76 | 33.36 | 2.92 | 0.00 | 57.466 |
| B112 | CrcMh | 0.665 | 2.83 | 27.26 | 3.26 | 0.00 | 6.140 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| OUT | CrcMh | 0.747 | 308.84 | 39.91 | 2.63 | 0.00 | 608.071 |
| B114 | CrcMh | 0.614 | 2.92 | 27.33 | 3.25 | 0.00 | 5.827 |
| B58 | CrcMh | 0.800 | 12.30 | 30.56 | 3.07 | 0.00 | 30.177 |
| B12-A | CrcMh | 0.800 | 104.07 | 27.05 | 3.27 | 0.00 | 272.382 |

Conveyance Configuration Data

| Run # | Node US | I.D. DS | FlowLine Elev. US (ft) | DS (ft) | Shape # | Span (ft) | Rise (ft) | Length (ft) | Slope (%) | n_value |
|---|---|---|---|---|---|---|---|---|---|---|
| 48 | B34 | B33 | 75.49 | 72.62 | Cir 1 | 0.00 | 1.50 | 15.0 | 19.493 | 0.013 |
| 49 | B33 | B117 | 71.92 | 71.42 | Cir 1 | 0.00 | 2.00 | 12.5 | 4.003 | 0.013 |
| 50 | B118 | B30 | 69.73 | 69.72 | Cir 1 | 0.00 | 5.50 | 108.5 | 0.009 | 0.013 |
| 77 | B50 | B128 | 72.00 | 71.60 | Cir 1 | 0.00 | 3.00 | 34.4 | 1.163 | 0.013 |
| 78 | B129 | B128 | 71.00 | 70.40 | Cir 1 | 0.00 | 4.50 | 102.0 | 0.588 | 0.013 |
| 79 | B52 | B51 | 75.49 | 74.59 | Cir 1 | 0.00 | 1.25 | 9.0 | 10.050 | 0.013 |
| 80 | B51 | B53 | 73.09 | 72.97 | Cir 1 | 0.00 | 2.00 | 25.0 | 0.480 | 0.013 |
| 81 | B54 | B53 | 75.28 | 74.27 | Cir 1 | 0.00 | 1.25 | 12.0 | 8.447 | 0.013 |
| 82 | B53 | B129 | 72.87 | 72.30 | Cir 1 | 0.00 | 2.00 | 64.2 | 0.888 | 0.013 |
| 83 | B55 | B129 | 71.01 | 71.00 | Cir 1 | 0.00 | 4.50 | 103.0 | 0.010 | 0.013 |
| 84 | B56 | B55 | 73.67 | 72.08 | Cir 1 | 0.00 | 2.00 | 37.0 | 4.301 | 0.013 |
| 85 | B130 | B55 | 71.46 | 70.58 | Cir 1 | 0.00 | 4.50 | 205.0 | 0.429 | 0.013 |
| 86 | B57 | B130 | 70.97 | 70.96 | Box 1 | 4.00 | 4.00 | 40.0 | 0.025 | 0.015 |
| 87 | B110 | OUT | 67.97 | 67.95 | Box 1 | 10.0 | 8.00 | 17.0 | 0.118 | 0.015 |
| 1 | B1 | B101 | 71.32 | 71.30 | Box 1 | 9.00 | 5.00 | 32.3 | 0.062 | 0.013 |
| 2 | B2 | B101 | 74.56 | 73.90 | Cir 1 | 0.00 | 2.00 | 15.0 | 4.404 | 0.013 |
| 3 | B3 | B101 | 74.46 | 73.90 | Cir 1 | 0.00 | 2.00 | 33.4 | 1.677 | 0.013 |
| 4 | B101 | B102 | 71.30 | 70.81 | Cir 1 | 0.00 | 5.00 | 315.0 | 0.156 | 0.013 |
| 5 | B4 | B5 | 74.38 | 74.38 | Cir 1 | 0.00 | 1.50 | 10.7 | 0.009 | 0.013 |
| 6 | B5 | B102 | 74.18 | 73.41 | Cir 1 | 0.00 | 1.75 | 12.2 | 6.324 | 0.013 |
| 7 | B6 | B7 | 74.87 | 74.49 | Cir 1 | 0.00 | 1.25 | 28.4 | 1.338 | 0.013 |
| 8 | B7 | B102 | 73.79 | 73.41 | Cir 1 | 0.00 | 1.75 | 25.6 | 1.485 | 0.013 |
| 9 | B102 | B103 | 70.81 | 70.44 | Cir 1 | 0.00 | 5.00 | 196.4 | 0.188 | 0.013 |
| 10 | B8 | B103 | 71.30 | 70.80 | Cir 1 | 0.00 | 1.50 | 97.0 | 0.515 | 0.013 |
| 11 | B103 | B9 | 70.44 | 70.22 | Cir 1 | 0.00 | 5.00 | 106.0 | 0.208 | 0.013 |
| 12 | B9 | B104 | 70.17 | 70.16 | Cir 1 | 0.00 | 5.00 | 29.4 | 0.034 | 0.013 |
| 13 | B104 | B105 | 70.16 | 69.79 | Cir 1 | 0.00 | 5.00 | 127.7 | 0.290 | 0.013 |
| 14 | B10 | B11 | 74.28 | 74.03 | Cir 1 | 0.00 | 2.00 | 39.0 | 0.641 | 0.013 |
| 15 | B11 | B105 | 74.04 | 74.03 | Cir 1 | 0.00 | 2.00 | 7.0 | 0.143 | 0.013 |
| 16 | B12 | B105 | 75.53 | 74.39 | Cir 1 | 0.00 | 2.00 | 4.5 | 26.188 | 0.013 |
| 17 | B105 | B12-A | 69.79 | 69.32 | Cir 1 | 0.00 | 5.00 | 262.0 | 0.179 | 0.013 |
| 18 | B12-A | B110 | 69.32 | 68.90 | Cir 1 | 0.00 | 5.00 | 283.0 | 0.148 | 0.013 |
| 19 | B13 | B108 | 75.05 | 75.04 | Cir 1 | 0.00 | 2.00 | 7.5 | 0.133 | 0.013 |
| 20 | B14 | B108 | 74.37 | 74.34 | Cir 1 | 0.00 | 2.00 | 42.5 | 0.071 | 0.013 |
| 21 | B108 | B109 | 73.94 | 70.80 | Cir 1 | 0.00 | 2.00 | 222.6 | 1.411 | 0.013 |
| 22 | B109 | B110 | 68.15 | 67.97 | Box 1 | 10.0 | 8.00 | 250.0 | 0.072 | 0.015 |
| 23 | B15 | B109 | 68.64 | 68.15 | Box 1 | 10.0 | 8.00 | 487.0 | 0.101 | 0.015 |
| 24 | B111 | B109 | 68.72 | 68.00 | Cir 1 | 0.00 | 6.00 | 152.7 | 0.472 | 0.013 |
| 51 | B119 | B118 | 69.97 | 69.62 | Cir 1 | 0.00 | 5.00 | 275.8 | 0.127 | 0.013 |
| 52 | B35 | B119 | 74.77 | 71.47 | Cir 1 | 0.00 | 2.00 | 18.5 | 18.129 | 0.013 |
| 53 | B120 | B119 | 70.34 | 69.87 | Cir 1 | 0.00 | 5.00 | 32.9 | 1.429 | 0.013 |
| 55 | B36 | B121 | 73.27 | 71.55 | Cir 1 | 0.00 | 2.00 | 14.0 | 12.379 | 0.013 |
| 56 | B37 | B121 | 72.95 | 71.55 | Cir 1 | 0.00 | 2.00 | 24.0 | 5.843 | 0.013 |
| 57 | B121 | B120 | 71.15 | 71.14 | Box 1 | 4.00 | 3.00 | 28.0 | 0.036 | 0.015 |
| 58 | B122 | B120 | 70.35 | 70.34 | Cir 1 | 0.00 | 5.00 | 28.0 | 0.036 | 0.013 |
| 59 | B123 | B122 | 70.05 | 70.00 | Cir 1 | 0.00 | 5.00 | 84.7 | 0.059 | 0.013 |
| 60 | B38 | B123 | 72.00 | 70.95 | Cir 1 | 0.00 | 2.00 | 38.3 | 2.743 | 0.013 |
| 61 | B39 | B123 | 70.39 | 70.15 | Cir 1 | 0.00 | 5.00 | 213.7 | 0.112 | 0.013 |
| 62 | B42 | B41 | 75.85 | 72.97 | Cir 1 | 0.00 | 1.50 | 22.0 | 13.205 | 0.013 |
| 63 | B41 | B124 | 71.17 | 70.98 | Cir 1 | 0.00 | 2.00 | 13.4 | 1.418 | 0.013 |
| 64 | B44 | B43 | 75.85 | 75.00 | Cir 1 | 0.00 | 1.50 | 24.3 | 3.500 | 0.013 |
| 65 | B43 | B124 | 71.23 | 70.98 | Cir 1 | 0.00 | 2.00 | 13.0 | 1.923 | 0.013 |
| 66 | B124 | B39 | 70.78 | 70.49 | Cir 1 | 0.00 | 2.00 | 66.0 | 0.439 | 0.013 |
| 67 | B125 | B39 | 70.40 | 70.39 | Cir 1 | 0.00 | 5.00 | 37.7 | 0.027 | 0.013 |
| 68 | B40 | B125 | 71.84 | 71.83 | Cir 1 | 0.00 | 2.00 | 53.1 | 0.019 | 0.013 |
| 69 | B126 | B125 | 70.45 | 70.19 | Cir 1 | 0.00 | 5.00 | 208.9 | 0.124 | 0.013 |
| 71 | B45 | B126 | 70.80 | 70.45 | Cir 1 | 0.00 | 5.00 | 125.6 | 0.279 | 0.013 |
| 72 | B47 | B46 | 75.19 | 74.00 | Cir 1 | 0.00 | 1.50 | 12.0 | 9.966 | 0.013 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 73 | B46 | B48 | 73.95 | 70.80 | Cir 1 | 0.00 | 2.00 | 24.6 | 12.911 | 0.013 |
| 74 | B49 | B48 | 74.93 | 73.90 | Cir 1 | 0.00 | 1.50 | 11.0 | 9.405 | 0.013 |
| 75 | B48 | B45 | 71.50 | 70.60 | Cir 1 | 0.00 | 2.00 | 66.6 | 1.351 | 0.013 |
| 76 | B128 | B45 | 70.61 | 70.60 | Cir 1 | 0.00 | 5.00 | 216.2 | 0.005 | 0.013 |
| 88 | B58 | B121 | 71.60 | 71.25 | Cir 1 | 0.00 | 3.00 | 420.7 | 0.083 | 0.013 |
| 25 | B16 | B17 | 75.78 | 75.27 | Cir 1 | 0.00 | 1.00 | 22.0 | 2.319 | 0.013 |
| 26 | B17 | B111 | 74.87 | 73.22 | Cir 1 | 0.00 | 1.50 | 7.0 | 24.255 | 0.013 |
| 27 | B20 | B112 | 73.91 | 73.34 | Cir 1 | 0.00 | 1.50 | 205.0 | 0.278 | 0.013 |
| 28 | B112 | B111 | 73.34 | 73.22 | Cir 1 | 0.00 | 1.50 | 60.0 | 0.200 | 0.013 |
| 29 | B18 | B112 | 74.68 | 74.34 | Cir 1 | 0.00 | 1.50 | 22.5 | 1.511 | 0.013 |
| 30 | B19 | B112 | 74.66 | 74.34 | Cir 1 | 0.00 | 1.50 | 12.0 | 2.668 | 0.013 |
| 31 | B113 | B111 | 69.35 | 68.82 | Cir 1 | 0.00 | 6.00 | 380.0 | 0.139 | 0.013 |
| 32 | B21 | B22 | 73.00 | 72.17 | Cir 1 | 0.00 | 2.00 | 172.0 | 0.483 | 0.013 |
| 33 | B22 | B113 | 72.17 | 72.15 | Cir 1 | 0.00 | 3.00 | 33.0 | 0.061 | 0.013 |
| 34 | B23 | B113 | 74.16 | 72.15 | Cir 1 | 0.00 | 1.50 | 8.0 | 25.958 | 0.013 |
| 35 | B26 | B114 | 84.80 | 84.23 | Cir 1 | 0.00 | 1.50 | 208.6 | 0.273 | 0.013 |
| 36 | B24 | B114 | 74.63 | 74.15 | Cir 1 | 0.00 | 1.50 | 11.0 | 4.368 | 0.013 |
| 37 | B25 | B114 | 74.49 | 74.35 | Cir 1 | 0.00 | 1.50 | 23.0 | 0.609 | 0.013 |
| 38 | B114 | B113 | 73.25 | 72.15 | Cir 1 | 0.00 | 1.50 | 59.0 | 1.865 | 0.013 |
| 39 | B115 | B113 | 69.55 | 69.35 | Cir 1 | 0.00 | 6.00 | 119.5 | 0.167 | 0.013 |
| 40 | B27 | B115 | 85.11 | 84.47 | Cir 1 | 0.00 | 1.50 | 215.0 | 0.298 | 0.013 |
| 41 | B116 | B115 | 69.56 | 69.55 | Cir 1 | 0.00 | 6.00 | 53.7 | 0.019 | 0.013 |
| 42 | B28 | B116 | 73.50 | 72.78 | Cir 1 | 0.00 | 2.00 | 17.0 | 4.239 | 0.013 |
| 43 | B30 | B116 | 69.72 | 69.58 | Cir 1 | 0.00 | 6.00 | 183.0 | 0.077 | 0.013 |
| 44 | B29 | B30 | 74.33 | 74.32 | Cir 1 | 0.00 | 1.00 | 32.5 | 0.031 | 0.013 |
| 45 | B117 | B30 | 71.30 | 69.92 | Cir 1 | 0.00 | 2.00 | 67.0 | 2.060 | 0.013 |
| 46 | B32 | B31 | 75.27 | 73.54 | Cir 1 | 0.00 | 1.50 | 14.0 | 12.453 | 0.013 |
| 47 | B31 | B117 | 73.54 | 71.42 | Cir 1 | 0.00 | 2.00 | 13.0 | 16.529 | 0.013 |

Conveyance Hydraulic Computations. Tailwater = 76.708 (ft)

| Run # | Hyd. Gr.line US (ft) | DS (ft) | Crit.Elev US (ft) | Fr.Slope (%) | Depth Unif. (ft) | Actual (ft) | Velocity Unif. (f/s) | Actual (f/s) | Q (cfs) | Cap (cfs) | Junc Loss (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 48* | 78.78 | 78.75 | 75.49 | 0.211 | 0.33 | 1.50 | 17.00 | 4.72 | 4.9 | 46.6 | 0.000 |
| 49* | 78.75 | 78.73 | 77.12 | 0.089 | 0.52 | 2.00 | 10.36 | 4.78 | 6.8 | 45.5 | 0.000 |
| 50 | 78.77 | 78.54 | 77.72 | 0.213 | 5.50 | 5.50 | 6.54 | 6.54 | 155.5 | 32.4 | 0.000 |
| 77* | 81.03 | 80.99 | 2.00 | 0.104 | 1.13 | 3.00 | 8.89 | 6.14 | 21.6 | 72.2 | 0.000 |
| 78* | 81.10 | 80.99 | 76.80 | 0.102 | 2.03 | 4.50 | 9.05 | 7.67 | 63.1 | 151.5 | 0.000 |
| 79* | 81.14 | 81.13 | 75.49 | 0.108 | 0.27 | 1.25 | 10.79 | 3.79 | 2.1 | 20.6 | 0.000 |
| 80* | 81.13 | 81.13 | 76.59 | 0.014 | 0.56 | 2.00 | 3.73 | 3.63 | 2.7 | 15.7 | 0.000 |
| 81* | 81.14 | 81.13 | 75.28 | 0.105 | 0.28 | 1.25 | 10.11 | 3.79 | 2.1 | 18.9 | 0.000 |
| 82* | 81.13 | 81.10 | 76.47 | 0.046 | 0.65 | 2.00 | 5.50 | 4.31 | 4.9 | 21.4 | 0.000 |
| 83 | 81.19 | 81.10 | 76.58 | 0.090 | 4.50 | 4.50 | 3.73 | 3.73 | 59.4 | 19.5 | 0.000 |
| 84* | 81.19 | 81.19 | 76.58 | 0.002 | 0.20 | 2.00 | 5.95 | 2.70 | 1.0 | 47.1 | 0.000 |
| 85* | 81.36 | 81.19 | 77.26 | 0.085 | 2.10 | 4.50 | 7.87 | 7.43 | 57.5 | 129.4 | 0.000 |
| 86 | 81.42 | 81.36 | 77.25 | 0.131 | 4.00 | 4.00 | 3.59 | 3.59 | 57.5 | 25.1 | 0.000 |
| 87 | 76.74 | 76.71 | 2.00 | 0.203 | 8.00 | 8.00 | 7.60 | 7.60 | 608.1 | 462.9 | 0.000 |
| 1 | 90.50 | 90.45 | 78.52 | 0.161 | 5.00 | 5.00 | 6.30 | 6.30 | 283.3 | 175.6 | 0.000 |
| 2* | 90.45 | 90.45 | 78.06 | 0.010 | 0.30 | 2.00 | 7.73 | 3.45 | 2.2 | 47.7 | 0.000 |
| 3* | 90.45 | 90.45 | 77.76 | 0.000 | 0.12 | 2.00 | 2.68 | 1.37 | 0.2 | 29.4 | 0.000 |
| 4 | 90.45 | 87.38 | 78.10 | 0.977 | 5.00 | 5.00 | 13.16 | 13.16 | 258.5 | 103.2 | 0.000 |
| 5 | 87.41 | 87.41 | 77.11 | 0.072 | 1.50 | 1.50 | 1.60 | 1.60 | 2.8 | 1.0 | 0.000 |
| 6* | 87.41 | 87.38 | 77.18 | 0.240 | 0.52 | 1.75 | 12.85 | 5.26 | 7.8 | 40.0 | 0.000 |
| 7* | 87.39 | 87.38 | 77.47 | 0.020 | 0.30 | 1.25 | 4.13 | 2.97 | 0.9 | 7.5 | 0.000 |
| 8* | 87.38 | 87.38 | 77.19 | 0.027 | 0.44 | 1.75 | 5.61 | 3.71 | 2.6 | 19.4 | 0.000 |
| 9 | 87.38 | 85.34 | 77.51 | 1.035 | 5.00 | 5.00 | 13.55 | 13.55 | 266.1 | 113.5 | 0.000 |
| 10* | 85.35 | 85.34 | 77.85 | 0.010 | 0.38 | 1.50 | 3.03 | 2.92 | 1.1 | 7.6 | 0.000 |
| 11 | 85.34 | 84.25 | 78.49 | 1.033 | 5.00 | 5.00 | 13.54 | 13.54 | 265.9 | 119.2 | 0.000 |
| 12 | 84.25 | 83.94 | 78.16 | 1.035 | 5.00 | 5.00 | 13.55 | 13.55 | 266.1 | 48.2 | 0.000 |
| 13 | 83.94 | 82.62 | 78.22 | 1.035 | 5.00 | 5.00 | 13.55 | 13.55 | 266.1 | 140.8 | 0.000 |
| 14* | 82.64 | 82.63 | 78.48 | 0.039 | 0.68 | 2.00 | 4.77 | 4.21 | 4.5 | 18.2 | 0.000 |
| 15 | 82.63 | 82.62 | 77.63 | 0.052 | 1.13 | 2.00 | 2.85 | 1.65 | 5.2 | 8.6 | 0.000 |
| 16* | 82.62 | 82.62 | 78.03 | 0.000 | 0.09 | 2.00 | 9.00 | 2.17 | 0.5 | 116.3 | 0.000 |
| 17 | 82.62 | 79.81 | 78.29 | 1.072 | 5.00 | 5.00 | 13.79 | 13.79 | 270.8 | 110.8 | 0.000 |
| 18 | 79.81 | 76.74 | 2.00 | 1.085 | 5.00 | 5.00 | 13.87 | 13.87 | 272.4 | 100.8 | 0.000 |
| 19 | 77.05 | 77.04 | 78.67 | 0.028 | 0.95 | 2.00 | 2.57 | 1.21 | 3.8 | 8.3 | 0.000 |
| 20 | 77.07 | 77.04 | 78.27 | 0.001 | 0.50 | 2.00 | 1.33 | 0.26 | 0.8 | 6.0 | 0.000 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 21* | 77.04 | 76.95 | 78.94 | 0.040 | 0.56 | 2.00 | 6.38 | 4.23 | 4.6 | 27.0 | 0.000 |
| 22 | 76.95 | 76.74 | 78.50 | 0.085 | 7.19 | 8.00 | 5.47 | 4.91 | 393.2 | 362.1 | 0.000 |
| 23 | 77.35 | 76.95 | 2.00 | 0.020 | 3.66 | 8.00 | 5.19 | 2.37 | 189.9 | 428.1 | 0.000 |
| 24* | 77.32 | 76.95 | 78.22 | 0.236 | 3.74 | 6.00 | 11.17 | 10.53 | 206.8 | 292.1 | 0.000 |
| 51 | 79.75 | 78.77 | 78.17 | 0.353 | 5.00 | 5.00 | 7.92 | 7.92 | 155.5 | 93.2 | 0.000 |
| 52* | 79.76 | 79.75 | 79.07 | 0.099 | 0.37 | 2.00 | 17.97 | 4.87 | 7.2 | 96.7 | 0.000 |
| 53* | 79.85 | 79.75 | 78.14 | 0.327 | 2.44 | 5.00 | 15.70 | 10.17 | 149.6 | 312.6 | 0.000 |
| 55* | 79.88 | 79.88 | 77.57 | 0.001 | 0.14 | 2.00 | 8.18 | 3.02 | 0.8 | 79.9 | 0.000 |
| 56* | 79.88 | 79.88 | 77.55 | 0.002 | 0.19 | 2.00 | 6.83 | 2.83 | 1.1 | 54.9 | 0.000 |
| 57 | 79.88 | 79.85 | 77.85 | 0.083 | 3.00 | 3.00 | 2.58 | 2.58 | 30.9 | 20.3 | 0.000 |
| 58 | 79.91 | 79.85 | 78.14 | 0.214 | 5.00 | 5.00 | 6.16 | 6.16 | 121.0 | 49.4 | 0.000 |
| 59 | 80.09 | 79.91 | 77.75 | 0.214 | 5.00 | 5.00 | 6.16 | 6.16 | 121.0 | 63.5 | 0.000 |
| 60* | 80.20 | 80.09 | 79.00 | 0.269 | 0.77 | 2.00 | 10.56 | 5.80 | 11.8 | 37.6 | 0.000 |
| 61 | 80.49 | 80.09 | 77.29 | 0.183 | 5.00 | 5.00 | 5.70 | 5.70 | 111.9 | 87.7 | 0.000 |
| 62* | 80.98 | 80.87 | 75.85 | 0.513 | 0.45 | 1.50 | 16.82 | 5.63 | 7.6 | 38.3 | 0.000 |
| 63* | 80.87 | 80.84 | 76.87 | 0.239 | 0.89 | 2.00 | 8.16 | 5.67 | 11.1 | 27.1 | 0.000 |
| 64* | 80.90 | 80.85 | 73.00 | 0.210 | 0.51 | 1.50 | 9.20 | 4.71 | 4.8 | 19.7 | 0.000 |
| 65* | 80.85 | 80.84 | 76.93 | 0.062 | 0.57 | 2.00 | 7.56 | 4.51 | 5.6 | 31.5 | 0.000 |
| 66 | 80.84 | 80.49 | 77.28 | 0.535 | 2.00 | 2.00 | 5.29 | 5.29 | 16.6 | 15.1 | 0.000 |
| 67 | 80.54 | 80.49 | 77.29 | 0.135 | 5.00 | 5.00 | 4.90 | 4.90 | 96.2 | 42.6 | 0.000 |
| 68 | 80.67 | 80.54 | 77.93 | 0.250 | 2.00 | 2.00 | 3.61 | 3.61 | 11.4 | 3.1 | 0.000 |
| 69 | 80.56 | 80.54 | 77.35 | 0.111 | 3.89 | 5.00 | 5.32 | 4.44 | 87.2 | 92.3 | 0.000 |
| 71 | 80.78 | 80.56 | 77.00 | 0.111 | 2.89 | 5.00 | 7.41 | 4.44 | 87.2 | 138.1 | 0.000 |
| 72* | 80.82 | 80.81 | 75.19 | 0.034 | 0.25 | 1.50 | 10.24 | 3.51 | 1.9 | 33.3 | 0.000 |
| 73* | 80.81 | 80.81 | 76.75 | 0.011 | 0.24 | 2.00 | 11.57 | 3.54 | 2.4 | 81.6 | 0.000 |
| 74* | 80.81 | 80.81 | 74.93 | 0.037 | 0.26 | 1.50 | 10.17 | 3.57 | 2.0 | 32.4 | 0.000 |
| 75* | 80.81 | 80.78 | 76.80 | 0.049 | 0.59 | 2.00 | 6.45 | 4.35 | 5.0 | 26.4 | 0.000 |
| 76 | 80.99 | 80.78 | 77.10 | 0.101 | 5.00 | 5.00 | 4.22 | 4.22 | 82.9 | 17.8 | 0.000 |
| 88 | 80.73 | 79.88 | 78.19 | 0.203 | 3.00 | 3.00 | 4.27 | 4.27 | 30.2 | 19.3 | 0.000 |
| 25* | 77.69 | 77.33 | 78.93 | 1.640 | 0.70 | 1.00 | 7.75 | 6.19 | 4.6 | 5.4 | 0.000 |
| 26* | 77.33 | 77.32 | 77.97 | 0.243 | 0.32 | 1.50 | 18.74 | 4.84 | 5.2 | 52.0 | 0.000 |
| 27 | 77.75 | 77.52 | 2.00 | 0.164 | 0.99 | 1.50 | 3.46 | 2.42 | 4.3 | 5.6 | 0.000 |
| 28 | 77.52 | 77.32 | 78.14 | 0.339 | 1.50 | 1.50 | 3.47 | 3.47 | 6.1 | 4.7 | 0.000 |
| 29* | 77.52 | 77.52 | 77.68 | 0.006 | 0.26 | 1.50 | 4.10 | 2.82 | 0.8 | 13.0 | 0.000 |
| 30* | 77.52 | 77.52 | 77.66 | 0.015 | 0.28 | 1.50 | 5.69 | 2.89 | 1.3 | 17.2 | 0.000 |
| 31 | 78.16 | 77.32 | 78.15 | 0.222 | 6.00 | 6.00 | 7.08 | 7.08 | 200.3 | 158.8 | 0.000 |
| 32 | 78.85 | 78.21 | 2.00 | 0.109 | 0.97 | 2.00 | 4.94 | 2.39 | 7.5 | 15.8 | 0.000 |
| 33 | 78.21 | 78.16 | 78.17 | 0.142 | 3.00 | 3.00 | 3.57 | 3.57 | 25.2 | 16.5 | 0.000 |
| 34* | 78.16 | 78.16 | 77.06 | 0.005 | 0.12 | 1.50 | 10.70 | 2.63 | 0.7 | 53.7 | 0.000 |
| 35 | 85.89 | 85.73 | 2.00 | 0.172 | 1.01 | 1.50 | 3.45 | 2.47 | 4.4 | 5.5 | 0.000 |
| 36* | 78.34 | 78.34 | 77.63 | 0.010 | 0.22 | 1.50 | 6.35 | 2.96 | 1.0 | 22.0 | 0.000 |
| 37* | 78.34 | 78.34 | 77.59 | 0.004 | 0.28 | 1.50 | 2.74 | 2.50 | 0.6 | 8.2 | 0.000 |
| 38* | 78.34 | 78.16 | 77.95 | 0.305 | 0.67 | 1.50 | 7.70 | 5.05 | 5.8 | 14.4 | 0.000 |
| 39 | 78.16 | 78.16 | 77.98 | 0.167 | 4.95 | 6.00 | 6.98 | 6.15 | 173.9 | 174.0 | 0.000 |
| 40 | 86.54 | 85.97 | 2.00 | 0.034 | 0.60 | 1.50 | 2.94 | 1.11 | 2.0 | 5.8 | 0.000 |
| 41 | 78.25 | 78.16 | 77.98 | 0.165 | 6.00 | 6.00 | 6.11 | 6.11 | 172.8 | 58.0 | 0.000 |
| 42* | 78.26 | 78.25 | 78.45 | 0.049 | 0.44 | 2.00 | 9.70 | 4.36 | 5.0 | 46.8 | 0.000 |
| 43 | 78.54 | 78.25 | 77.22 | 0.160 | 6.00 | 6.00 | 6.01 | 6.01 | 170.0 | 117.6 | 0.000 |
| 44 | 79.20 | 78.54 | 78.33 | 2.015 | 1.00 | 1.00 | 6.47 | 6.47 | 5.1 | 0.6 | 0.000 |
| 45* | 78.73 | 78.54 | 77.32 | 0.289 | 0.85 | 2.00 | 9.60 | 5.88 | 12.2 | 32.6 | 0.000 |
| 46* | 78.77 | 78.74 | 75.27 | 0.213 | 0.37 | 1.50 | 14.53 | 4.72 | 4.9 | 37.2 | 0.000 |
| 47* | 78.74 | 78.73 | 77.12 | 0.058 | 0.33 | 2.00 | 16.08 | 4.47 | 5.5 | 92.4 | 0.000 |

* Supercritical flow.

SUMMARY OF STORM DRAIN STRUCTURE QUANTITIES

NOTE:
The convey length should be from upstream to downstream inside box.
This length may also be used as Pay Item.
Using hydraulic length, from node center to node center, may result in profile error, and this length should not be used as Pay Item.

LINKS:

| Type of Convey Structure | Material | Rise (ft) | Span (ft) | Number of Links of this type | Quantity (ft) |
|---|---|---|---|---|---|
| Circular | Concrete | 1.5 | 0.0 | 19 | 1037.1 |
| Circular | Concrete | 2.0 | 0.0 | 26 | 1110.7 |

| | | | | | |
|---|---|---|---|---|---|
| Circular | Concrete | 5.5 | 0.0 | 1 | 108.5 |
| Circular | Concrete | 3.0 | 0.0 | 3 | 488.1 |
| Circular | Concrete | 4.5 | 0.0 | 3 | 410.0 |
| Circular | Concrete | 1.25 | 0.0 | 3 | 49.4 |
| Box | Concrete | 4.0 | 4.0 | 1 | 40.0 |
| Box | Concrete | 8.0 | 10.0 | 3 | 754.0 |
| Box | Concrete | 5.0 | 9.0 | 1 | 32.3 |
| Circular | Concrete | 5.0 | 0.0 | 16 | 2543.0 |
| Circular | Concrete | 1.75 | 0.0 | 2 | 37.8 |
| Circular | Concrete | 6.0 | 0.0 | 5 | 888.9 |
| Box | Concrete | 3.0 | 4.0 | 1 | 28.0 |
| Circular | Concrete | 1.0 | 0.0 | 2 | 54.5 |

NODES:

| Type of Inlet Structure | Type of Grate | Inlet Length (ft) | Grate Width (ft) | Grate Length (ft) | Grate Area (ft) | Grate Perimeter (ft) | Quantity (each) |
|---|---|---|---|---|---|---|---|
| Curb In Sag | | 2.5 | 0.0 | 0.0 | 0.0 | 0.0 | 5 |
| Circular Manhole | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 48 |
| Grate In Sag | Parallel | 0.0 | 0.0 | 0.0 | 3.28 | 10.0 | 10 |
| Curb In Sag | | 5.0 | 0.0 | 0.0 | 0.0 | 0.0 | 22 |
| Junction Box | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1 |
| Grate In Sag | Parallel | 0.0 | 0.0 | 0.0 | 6.0 | 10.0 | 2 |

OUTPUT FOR ANALYSYS FREQUENCY of: 100 Years

Runoff Computation for Analysis Frequency.

| ID | C Value | Area (acre) | Tc (min) | Tc Used (min) | Intensity (in/hr) | Supply Q (cfs) | Total Q (cfs) |
|---|---|---|---|---|---|---|---|
| B32 | 0.45 | 3.33 | 27.36 | 27.36 | 6.75 | 0.000 | 10.119 |
| | 0.45 | 3.33 | Res Lot betwen 1/4 and 1/2 acre | | | | |
| B33 | 0.534 | 1.11 | 25.18 | 25.18 | 6.99 | 0.000 | 4.132 |
| | 0.9 | 0.21 | Roadway | | | | |
| | 0.45 | 0.90 | Res Lot betwen 1/4 and 1/2 acre | | | | |
| B34 | 0.442 | 3.35 | 27.00 | 27.00 | 6.79 | 0.000 | 10.059 |
| | 0.35 | 0.49 | Grassy area or median | | | | |
| | 0.9 | 0.05 | Roadway | | | | |
| | 0.45 | 2.81 | Res Lot betwen 1/4 and 1/2 acre | | | | |
| B35 | 0.8 | 2.73 | 26.93 | 26.93 | 6.80 | 0.000 | 14.832 |
| | 0.8 | 2.73 | Business District | | | | |
| B36 | 0.782 | 0.29 | 23.05 | 23.05 | 7.24 | 0.000 | 1.657 |
| | 0.35 | 0.06 | Grassy area or median | | | | |
| | 0.9 | 0.23 | Roadway | | | | |
| B37 | 0.772 | 0.39 | 23.48 | 23.48 | 7.18 | 0.000 | 2.169 |
| | 0.35 | 0.09 | Grassy area or median | | | | |
| | 0.9 | 0.30 | Roadway | | | | |
| B38 | 0.65 | 5.70 | 28.59 | 28.59 | 6.63 | 0.000 | 24.579 |
| | 0.65 | 5.70 | Multi Family < 20 units/acre | | | | |
| B39 | 0.788 | 0.57 | 24.04 | 24.04 | 7.12 | 0.000 | 3.169 |
| | 0.35 | 0.12 | Grassy area or median | | | | |
| | 0.9 | 0.45 | Roadway | | | | |
| B50 | 0.65 | 10.75 | 30.19 | 30.19 | 6.48 | 0.000 | 45.254 |
| | 0.65 | 10.75 | Multi Family < 20 units/acre | | | | |
| B51 | 0.731 | 0.23 | 22.73 | 22.73 | 7.27 | 0.000 | 1.234 |
| | 0.55 | 0.11 | Residential Lots < 1/4 acre | | | | |
| | 0.9 | 0.12 | Roadway | | | | |
| B52 | 0.55 | 1.14 | 25.24 | 25.24 | 6.98 | 0.000 | 4.382 |
| | 0.55 | 1.14 | Residential Lots < 1/4 acre | | | | |
| B53 | 0.55 | 0.04 | 20.65 | 20.65 | 7.54 | 0.000 | 0.162 |
| | 0.55 | 0.04 | Residential Lots < 1/4 acre | | | | |
| B54 | 0.55 | 1.13 | 25.21 | 25.21 | 6.98 | 0.000 | 4.322 |
| | 0.55 | 1.13 | Residential Lots < 1/4 acre | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| B55 | 0.767 | 0.77 | 24.55 | 24.55 | 7.06 | 0.000 | 4.167 |
| | 0.65 | 0.30 | Multi Family < 20 units/acre | | | | |
| | 0.9 | 0.20 | Roadway | | | | |
| | 0.8 | 0.27 | Business Distrct | | | | |
| B56 | 0.681 | 0.40 | 23.51 | 23.51 | 7.18 | 0.000 | 1.957 |
| | 0.55 | 0.25 | Residential Lots < 1/4 acre | | | | |
| | 0.9 | 0.15 | Roadway | | | | |
| B57 | 0.659 | 29.76 | 33.18 | 33.18 | 6.21 | 0.000 | 121.792 |
| | 0.8 | 17.76 | Business District | | | | |
| | 0.45 | 12.00 | Res Lot betwen 1/4 and 1/2 acre | | | | |
| B20 | 0.65 | 1.98 | 26.28 | 26.28 | 6.87 | 0.000 | 8.826 |
| | 0.65 | 1.98 | Multi Family < 20 units/acre | | | | |
| B21 | 0.8 | 2.87 | 27.04 | 27.04 | 6.79 | 0.000 | 15.584 |
| | 0.8 | 2.87 | Business District | | | | |
| B22 | 0.8 | 7.15 | 29.14 | 29.14 | 6.58 | 0.000 | 37.639 |
| | 0.8 | 7.15 | Business District | | | | |
| B23 | 0.9 | 0.23 | 22.71 | 22.71 | 7.28 | 0.000 | 1.493 |
| | 0.9 | 0.23 | Roadway | | | | |
| B24 | 0.449 | 0.67 | 24.31 | 24.31 | 7.09 | 0.000 | 2.117 |
| | 0.35 | 0.55 | Grassy area or median | | | | |
| | 0.9 | 0.12 | Roadway | | | | |
| B25 | 0.771 | 0.23 | 22.70 | 22.70 | 7.28 | 0.000 | 1.274 |
| | 0.65 | 0.12 | Multi Family < 20 units/acre | | | | |
| | 0.9 | 0.11 | Roadway | | | | |
| B26 | 0.65 | 2.03 | 26.32 | 26.32 | 6.86 | 0.000 | 9.038 |
| | 0.65 | 2.03 | Multi Family < 20 units/acre | | | | |
| B27 | 0.65 | 0.87 | 24.01 | 24.01 | 7.12 | 0.000 | 4.013 |
| | 0.65 | 0.87 | Multi Family < 20 units/acre | | | | |
| B28 | 0.8 | 1.89 | 26.19 | 26.19 | 6.88 | 0.000 | 10.416 |
| | 0.8 | 1.89 | Business District | | | | |
| B29 | 0.8 | 1.91 | 26.21 | 26.21 | 6.88 | 0.000 | 10.501 |
| | 0.8 | 1.91 | Business District | | | | |
| B40 | 0.65 | 5.49 | 28.50 | 28.50 | 6.64 | 0.000 | 23.685 |
| | 0.65 | 5.49 | Multi Family < 20 units/acre | | | | |
| B41 | 0.479 | 2.33 | 26.60 | 26.60 | 6.83 | 0.000 | 7.617 |
| | 0.9 | 0.15 | Roadway | | | | |
| | 0.45 | 2.18 | Res Lot betwen 1/4 and 1/2 acre | | | | |
| B42 | 0.45 | 5.26 | 28.40 | 28.40 | 6.65 | 0.000 | 15.746 |
| | 0.45 | 5.26 | Res Lot betwen 1/4 and 1/2 acre | | | | |
| B44 | 0.45 | 3.30 | 27.34 | 27.34 | 6.76 | 0.000 | 10.036 |
| | 0.45 | 3.30 | Res Lot betwen 1/4 and 1/2 acre | | | | |
| B43 | 0.706 | 0.35 | 23.32 | 23.32 | 7.20 | 0.000 | 1.789 |
| | 0.9 | 0.20 | Roadway | | | | |
| | 0.45 | 0.15 | Res Lot betwen 1/4 and 1/2 acre | | | | |
| B45 | 0.713 | 0.60 | 24.14 | 24.14 | 7.11 | 0.000 | 3.038 |
| | 0.65 | 0.45 | Multi Family < 20 units/acre | | | | |
| | 0.9 | 0.15 | Roadway | | | | |
| B46 | 0.775 | 0.19 | 22.44 | 22.44 | 7.31 | 0.000 | 1.059 |
| | 0.55 | 0.07 | Residential Lots < 1/4 acre | | | | |
| | 0.9 | 0.12 | Roadway | | | | |
| B47 | 0.55 | 1.04 | 25.06 | 25.06 | 7.00 | 0.000 | 3.989 |
| | 0.55 | 1.04 | Residential Lots < 1/4 acre | | | | |
| B48 | 0.738 | 0.22 | 22.68 | 22.68 | 7.28 | 0.000 | 1.199 |
| | 0.55 | 0.10 | Residential Lots < 1/4 acre | | | | |
| | 0.9 | 0.12 | Roadway | | | | |
| B1 | 0.8 | 93.35 | 20.00 | 20.00 | 7.63 | 0.000 | 569.635 |
| | 0.8 | 93.35 | Business District | | | | |
| B2 | 0.8 | 0.81 | 24.65 | 24.65 | 7.05 | 0.000 | 4.590 |
| | 0.8 | 0.81 | Business District | | | | |
| B3 | 0.694 | 0.08 | 21.41 | 21.41 | 7.44 | 0.000 | 0.413 |
| | 0.35 | 0.03 | Grassy median | | | | |
| | 0.9 | 0.05 | Roadway | | | | |
| B4 | 0.8 | 1.04 | 25.07 | 25.07 | 7.00 | 0.000 | 5.835 |
| | 0.8 | 1.04 | Business District | | | | |
| B5 | 0.8 | 1.83 | 23.77 | 23.77 | 7.15 | 0.000 | 10.462 |
| | 0.8 | 1.83 | Business district | | | | |
| B6 | 0.8 | 0.32 | 23.20 | 23.20 | 7.22 | 0.000 | 1.865 |
| | 0.8 | 0.32 | Business District | | | | |
| B7 | 0.778 | 0.64 | 24.25 | 24.25 | 7.09 | 0.000 | 3.547 |
| | 0.35 | 0.14 | Grassy area or median | | | | |
| | 0.9 | 0.50 | Roadway | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| B49 | 0.55 | 1.09 | 25.15 | 25.15 | 6.99 | 0.000 | 4.180 |
| | 0.55 | 1.09 | Residential Lots < 1/4 acre | | | | |
| B58 | 0.8 | 12.30 | 30.56 | 30.56 | 6.44 | 0.000 | 63.401 |
| | 0.8 | 12.30 | Business District | | | | |
| B12-A | 0.852 | 1.15 | 1.15 | 10.00 | 9.36 | 0.000 | 9.143 |
| | 0.35 | 0.10 | Grassy area or median | | | | |
| | 0.9 | 1.05 | Parking Lot | | | | |
| B8 | 0.8 | 0.38 | 23.45 | 23.45 | 7.19 | 0.000 | 2.202 |
| | 0.8 | 0.38 | Business District | | | | |
| B9 | 0.8 | 2.29 | 26.57 | 26.57 | 6.84 | 0.000 | 12.530 |
| | 0.8 | 2.29 | Business District | | | | |
| B10 | 0.8 | 1.67 | 25.95 | 25.95 | 6.90 | 0.000 | 9.224 |
| | 0.8 | 1.67 | Business District | | | | |
| B11 | 0.694 | 0.32 | 23.18 | 23.18 | 7.22 | 0.000 | 1.603 |
| | 0.35 | 0.12 | Grassy area or median | | | | |
| | 0.9 | 0.20 | Roadway | | | | |
| B12 | 0.7 | 0.19 | 22.45 | 22.45 | 7.31 | 0.000 | 0.957 |
| B13 | 0.794 | 1.42 | 25.64 | 25.64 | 6.94 | 0.000 | 7.845 |
| | 0.35 | 0.27 | Grassy area or median | | | | |
| | 0.9 | 0.90 | Parking Lot | | | | |
| | 0.9 | 0.25 | Roadway | | | | |
| B14 | 0.789 | 0.29 | 23.03 | 23.03 | 7.24 | 0.000 | 1.645 |
| | 0.35 | 0.06 | Grassy area or median | | | | |
| | 0.9 | 0.23 | Roadway | | | | |
| B15 | 0.8 | 86.05 | 36.91 | 36.91 | 5.91 | 0.000 | 406.970 |
| | 0.8 | 86.05 | Business District | | | | |
| B16 | 0.8 | 1.72 | 26.00 | 26.00 | 6.90 | 0.000 | 9.465 |
| | 0.8 | 1.72 | Business District | | | | |
| B17 | 0.852 | 0.22 | 23.15 | 23.15 | 7.22 | 0.000 | 1.348 |
| | 0.35 | 0.02 | Grassy area or median | | | | |
| | 0.9 | 0.20 | Roadway | | | | |
| B18 | 0.719 | 0.33 | 23.21 | 23.21 | 7.22 | 0.000 | 1.687 |
| | 0.65 | 0.24 | Multi Family < 20 units/acre | | | | |
| | 0.9 | 0.09 | Roadway | | | | |
| B19 | 0.688 | 0.53 | 23.95 | 23.95 | 7.13 | 0.000 | 2.605 |
| | 0.65 | 0.45 | Multi Family < 20 units/acre | | | | |
| | 0.9 | 0.08 | Roadway | | | | |
| B30 | 0.9 | 0.25 | 22.84 | 22.84 | 7.26 | 0.000 | 1.644 |
| | 0.9 | 0.25 | Roadway | | | | |
| B31 | 0.608 | 0.31 | 23.13 | 23.13 | 7.23 | 0.000 | 1.353 |
| | 0.9 | 0.11 | Roadway | | | | |
| | 0.45 | 0.20 | Res Lot betwen 1/4 and 1/2 acre | | | | |

Sag Inlets Configuration Data.

| Inlet ID | Inlet Type | Length/ Perim (ft) | Grate Area (sf) | Left-Slope Longi (%) | Left-Slope Transv (%) | Right-Slope Longi (%) | Right-Slope Transv (%) | n | Gutter DeprW (ft) | Head Allowed (ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| B19 | Curb | 2.50 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B35 | Grate | 10.00 | 3.28 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | n/a | 1.50 |
| B36 | Curb | 5.00 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B37 | Curb | 5.00 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B39 | Grate | 10.00 | 3.28 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | n/a | 1.50 |
| B41 | Curb | 5.00 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B43 | Curb | 5.00 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B2 | Curb | 5.00 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B3 | Curb | 5.00 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B10 | Curb | 5.00 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B11 | Curb | 5.00 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B12 | Grate | 10.00 | 3.28 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | n/a | 1.50 |
| B13 | Curb | 5.00 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B14 | Curb | 5.00 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B16 | Grate | 10.00 | 3.28 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | n/a | 1.50 |
| B17 | Curb | 5.00 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B18 | Curb | 2.50 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B4 | Grate | 10.00 | 3.28 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | n/a | 1.50 |
| B5 | Curb | 5.00 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B6 | Grate | 10.00 | 3.28 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | n/a | 1.50 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| B7 | Curb | 5.00 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B8 | Grate | 10.00 | 3.28 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | n/a | 1.50 |
| B21 | Grate | 10.00 | 3.28 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | n/a | 1.50 |
| B23 | Curb | 2.50 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B24 | Curb | 2.50 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B25 | Curb | 2.50 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B27 | Grate | 10.00 | 6.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | n/a | 1.50 |
| B28 | Grate | 10.00 | 6.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | n/a | 1.50 |
| B29 | Grate | 10.00 | 3.28 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | n/a | 1.50 |
| B30 | Grate | 10.00 | 3.28 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | n/a | 1.50 |
| B31 | Curb | 5.00 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B33 | Curb | 5.00 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B45 | Curb | 5.00 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B46 | Curb | 5.00 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B48 | Curb | 5.00 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B51 | Curb | 5.00 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B53 | Curb | 5.00 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B55 | Curb | 5.00 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |
| B56 | Curb | 5.00 | 0.00 | 0.50 | 2.00 | 0.50 | 2.00 | 0.014 | 1.50 | 1.50 |

Sag Inlets Computation Data.

| Inlet ID | Inlet Type | Length (ft) | Grate Perim (ft) | Grate Area (sf) | Total Q (cfs) | Inlet Capacity (cfs) | Actual Head (ft) | Ponded Left (ft) | Width Right (ft) |
|---|---|---|---|---|---|---|---|---|---|
| B19 | Curb | 2.50 | n/a | n/a | 2.605 | 7.511 | 0.400 | 8.60 | 8.60 |
| B35 | Grate | n/a | 10.00 | 3.28 | 14.832 | 21.590 | 0.707 | 16.55 | 16.55 |
| B36 | Curb | 5.00 | n/a | n/a | 1.657 | 15.022 | 0.265 | 7.25 | 7.25 |
| B37 | Curb | 5.00 | n/a | n/a | 2.169 | 15.022 | 0.276 | 8.05 | 8.05 |
| B39 | Grate | n/a | 10.00 | 3.28 | 3.169 | 21.590 | 0.219 | 9.30 | 9.30 |
| B41 | Curb | 5.00 | n/a | n/a | 7.617 | 15.022 | 0.571 | 12.90 | 12.90 |
| B43 | Curb | 5.00 | n/a | n/a | 1.789 | 15.022 | 0.268 | 7.50 | 7.50 |
| B2 | Curb | 5.00 | n/a | n/a | 4.590 | 15.022 | 0.367 | 10.65 | 10.65 |
| B3 | Curb | 5.00 | n/a | n/a | 0.413 | 15.022 | 0.251 | 4.30 | 4.30 |
| B10 | Curb | 5.00 | n/a | n/a | 9.224 | 15.022 | 0.721 | 13.85 | 13.85 |
| B11 | Curb | 5.00 | n/a | n/a | 1.603 | 15.022 | 0.264 | 7.20 | 7.20 |
| B12 | Grate | n/a | 10.00 | 3.28 | 0.957 | 21.590 | 0.099 | 5.90 | 5.90 |
| B13 | Curb | 5.00 | n/a | n/a | 7.845 | 15.022 | 0.591 | 13.05 | 13.05 |
| B14 | Curb | 5.00 | n/a | n/a | 1.645 | 15.022 | 0.265 | 7.25 | 7.25 |
| B16 | Grate | n/a | 10.00 | 3.28 | 9.465 | 21.590 | 0.455 | 14.00 | 14.00 |
| B17 | Curb | 5.00 | n/a | n/a | 1.348 | 15.022 | 0.260 | 6.75 | 6.75 |
| B18 | Curb | 2.50 | n/a | n/a | 1.687 | 7.511 | 0.313 | 7.30 | 7.30 |
| B4 | Grate | n/a | 10.00 | 3.28 | 5.835 | 21.590 | 0.329 | 11.65 | 11.65 |
| B5 | Curb | 5.00 | n/a | n/a | 10.462 | 15.022 | 0.856 | 14.50 | 14.50 |
| B6 | Grate | n/a | 10.00 | 3.28 | 1.865 | 21.590 | 0.154 | 7.60 | 7.60 |
| B7 | Curb | 5.00 | n/a | n/a | 3.547 | 15.022 | 0.320 | 9.70 | 9.70 |
| B8 | Grate | n/a | 10.00 | 3.28 | 2.202 | 21.590 | 0.172 | 8.10 | 8.10 |
| B21 | Grate | n/a | 10.00 | 3.28 | 15.584 | 21.590 | 0.781 | 16.85 | 16.85 |
| B23 | Curb | 2.50 | n/a | n/a | 1.493 | 7.511 | 0.299 | 7.00 | 7.00 |
| B24 | Curb | 2.50 | n/a | n/a | 2.117 | 7.511 | 0.349 | 7.95 | 7.95 |
| B25 | Curb | 2.50 | n/a | n/a | 1.274 | 7.511 | 0.286 | 6.60 | 6.60 |
| B27 | Grate | n/a | 10.00 | 6.00 | 4.013 | 39.495 | 0.257 | 10.15 | 10.15 |
| B28 | Grate | n/a | 10.00 | 6.00 | 10.416 | 39.495 | 0.485 | 14.50 | 14.50 |
| B29 | Grate | n/a | 10.00 | 3.28 | 10.501 | 21.590 | 0.487 | 14.55 | 14.55 |
| B30 | Grate | n/a | 10.00 | 3.28 | 1.644 | 21.590 | 0.142 | 7.25 | 7.25 |
| B31 | Curb | 5.00 | n/a | n/a | 1.353 | 15.022 | 0.260 | 6.75 | 6.75 |
| B33 | Curb | 5.00 | n/a | n/a | 4.132 | 15.022 | 0.345 | 10.25 | 10.25 |
| B45 | Curb | 5.00 | n/a | n/a | 3.038 | 15.022 | 0.301 | 9.15 | 9.15 |
| B46 | Curb | 5.00 | n/a | n/a | 1.059 | 15.022 | 0.256 | 6.15 | 6.15 |
| B48 | Curb | 5.00 | n/a | n/a | 1.199 | 15.022 | 0.258 | 6.45 | 6.45 |
| B51 | Curb | 5.00 | n/a | n/a | 1.234 | 15.022 | 0.258 | 6.50 | 6.50 |
| B53 | Curb | 5.00 | n/a | n/a | 0.162 | 15.022 | 0.250 | 3.05 | 3.05 |
| B55 | Curb | 5.00 | n/a | n/a | 4.167 | 15.022 | 0.346 | 10.30 | 10.30 |
| B56 | Curb | 5.00 | n/a | n/a | 1.957 | 15.022 | 0.271 | 7.75 | 7.75 |

Cumulative Junction Discharge Computations

| Node | Node | Weighted | Cumulat. | Cumulat. | Intens. | User | Additional | Total |
|---|---|---|---|---|---|---|---|---|

| I.D. | Type | C-Value | Dr.Area (acres) | Tc (min) | (in/hr) | Supply Q cfs) | Q in Node (cfs) | Disch. (cfs) |
|---|---|---|---|---|---|---|---|---|
| B19 | Curb | 0.688 | 0.53 | 23.95 | 7.13 | | 0.00 | 2.605 |
| B20 | CrcMh | 0.650 | 1.98 | 26.28 | 6.87 | | 0.00 | 8.826 |
| B32 | CrcMh | 0.450 | 3.33 | 27.36 | 6.75 | | 0.00 | 10.119 |
| B34 | CrcMh | 0.442 | 3.35 | 27.00 | 6.79 | | 0.00 | 10.059 |
| B35 | Grate | 0.800 | 2.73 | 26.93 | 6.80 | | 0.00 | 14.832 |
| B36 | Curb | 0.782 | 0.29 | 23.05 | 7.24 | | 0.00 | 1.657 |
| B37 | Curb | 0.772 | 0.39 | 23.48 | 7.18 | | 0.00 | 2.169 |
| B38 | CrcMh | 0.650 | 5.70 | 28.59 | 6.63 | | 0.00 | 24.579 |
| B39 | Grate | 0.619 | 64.65 | 34.83 | 6.07 | | 0.00 | 243.163 |
| B40 | CrcMh | 0.650 | 5.49 | 28.50 | 6.64 | | 0.00 | 23.685 |
| B41 | Curb | 0.459 | 7.59 | 28.41 | 6.65 | | 0.00 | 23.151 |
| B43 | Curb | 0.475 | 3.65 | 27.38 | 6.75 | | 0.00 | 11.708 |
| B42 | CrcMh | 0.450 | 5.26 | 28.40 | 6.65 | | 0.00 | 15.746 |
| B44 | CrcMh | 0.450 | 3.30 | 27.34 | 6.76 | | 0.00 | 10.036 |
| B57 | CrcMh | 0.659 | 29.76 | 33.18 | 6.21 | | 0.00 | 121.792 |
| B1 | JctBx | 0.800 | 93.35 | 20.00 | 7.63 | | 0.00 | 569.635 |
| B101 | CrcMh | 0.800 | 94.24 | 24.67 | 7.05 | | 0.00 | 531.107 |
| B2 | Curb | 0.800 | 0.81 | 24.65 | 7.05 | | 0.00 | 4.590 |
| B3 | Curb | 0.694 | 0.08 | 21.41 | 7.44 | | 0.00 | 0.413 |
| B102 | CrcMh | 0.800 | 98.08 | 25.14 | 6.99 | | 0.00 | 548.487 |
| B9 | CrcMh | 0.800 | 100.75 | 26.57 | 6.84 | | 0.00 | 550.889 |
| B10 | Curb | 0.800 | 1.67 | 25.95 | 6.90 | | 0.00 | 9.224 |
| B11 | Curb | 0.783 | 1.99 | 26.06 | 6.89 | | 0.00 | 10.738 |
| B12 | Grate | 0.700 | 0.19 | 22.45 | 7.31 | | 0.00 | 0.957 |
| B13 | Curb | 0.794 | 1.42 | 25.64 | 6.94 | | 0.00 | 7.845 |
| B14 | Curb | 0.789 | 0.29 | 23.03 | 7.24 | | 0.00 | 1.645 |
| B15 | CrcMh | 0.800 | 86.05 | 36.91 | 5.91 | | 0.00 | 406.970 |
| B16 | Grate | 0.800 | 1.72 | 26.00 | 6.90 | | 0.00 | 9.465 |
| B17 | Curb | 0.806 | 1.93 | 26.03 | 6.90 | | 0.00 | 10.747 |
| B18 | Curb | 0.719 | 0.33 | 23.21 | 7.22 | | 0.00 | 1.687 |
| B4 | Grate | 0.800 | 1.04 | 25.07 | 7.00 | | 0.00 | 5.835 |
| B5 | Curb | 0.800 | 2.87 | 25.13 | 6.99 | | 0.00 | 16.064 |
| B6 | Grate | 0.800 | 0.32 | 23.20 | 7.22 | | 0.00 | 1.865 |
| B7 | Curb | 0.785 | 0.97 | 24.25 | 7.09 | | 0.00 | 5.380 |
| B8 | Grate | 0.800 | 0.38 | 23.45 | 7.19 | | 0.00 | 2.202 |
| B103 | CrcMh | 0.800 | 98.46 | 25.26 | 6.98 | | 0.00 | 549.601 |
| B104 | CrcMh | 0.800 | 100.75 | 26.57 | 6.84 | | 0.00 | 550.889 |
| B21 | Grate | 0.800 | 2.87 | 27.04 | 6.79 | | 0.00 | 15.584 |
| B22 | CrcMh | 0.800 | 10.02 | 29.14 | 6.58 | | 0.00 | 52.739 |
| B23 | Curb | 0.900 | 0.23 | 22.71 | 7.28 | | 0.00 | 1.493 |
| B24 | Curb | 0.449 | 0.67 | 24.31 | 7.09 | | 0.00 | 2.117 |
| B25 | Curb | 0.771 | 0.23 | 22.70 | 7.28 | | 0.00 | 1.274 |
| B26 | CrcMh | 0.650 | 2.03 | 26.32 | 6.86 | | 0.00 | 9.038 |
| B27 | Grate | 0.650 | 0.87 | 24.01 | 7.12 | | 0.00 | 4.013 |
| B28 | Grate | 0.800 | 1.89 | 26.19 | 6.88 | | 0.00 | 10.416 |
| B29 | Grate | 0.800 | 1.91 | 26.21 | 6.88 | | 0.00 | 10.501 |
| B30 | Grate | 0.642 | 96.31 | 35.31 | 6.04 | | 0.00 | 373.049 |
| B31 | Curb | 0.463 | 3.64 | 27.37 | 6.75 | | 0.00 | 11.381 |
| B33 | Curb | 0.465 | 4.46 | 27.01 | 6.79 | | 0.00 | 14.072 |
| B45 | Curb | 0.650 | 47.35 | 34.41 | 6.11 | | 0.00 | 188.155 |
| B46 | Curb | 0.584 | 1.22 | 25.08 | 7.00 | | 0.00 | 5.002 |
| B48 | Curb | 0.583 | 2.53 | 25.16 | 6.99 | | 0.00 | 10.326 |
| B47 | CrcMh | 0.550 | 1.04 | 25.06 | 7.00 | | 0.00 | 3.989 |
| B49 | CrcMh | 0.550 | 1.09 | 25.15 | 6.99 | | 0.00 | 4.180 |
| B50 | CrcMh | 0.650 | 10.75 | 30.19 | 6.48 | | 0.00 | 45.254 |
| B51 | Curb | 0.581 | 1.37 | 25.25 | 6.98 | | 0.00 | 5.565 |
| B53 | Curb | 0.567 | 2.54 | 25.34 | 6.97 | | 0.00 | 10.019 |
| B52 | CrcMh | 0.550 | 1.14 | 25.24 | 6.98 | | 0.00 | 4.382 |
| B54 | CrcMh | 0.550 | 1.13 | 25.21 | 6.98 | | 0.00 | 4.322 |
| B55 | Curb | 0.662 | 30.93 | 33.63 | 6.17 | | 0.00 | 126.361 |
| B56 | Curb | 0.681 | 0.40 | 23.51 | 7.18 | | 0.00 | 1.957 |
| B105 | CrcMh | 0.799 | 102.93 | 26.65 | 6.83 | | 0.00 | 561.775 |
| B110 | CrcMh | 0.747 | 308.84 | 38.60 | 5.79 | | 0.00 | 1335.727 |
| B108 | CrcMh | 0.793 | 1.71 | 25.68 | 6.93 | | 0.00 | 9.416 |
| B109 | CrcMh | 0.720 | 204.77 | 38.21 | 5.82 | | 0.00 | 858.059 |
| B111 | CrcMh | 0.661 | 117.01 | 36.16 | 5.97 | | 0.00 | 461.696 |
| B122 | CrcMh | 0.622 | 70.35 | 35.12 | 6.05 | | 0.00 | 264.673 |
| B113 | CrcMh | 0.658 | 112.24 | 35.75 | 6.00 | | 0.00 | 443.462 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| B115 | CrcMh | 0.645 | 99.07 | 35.61 | 6.01 | 0.00 | 384.092 |
| B116 | CrcMh | 0.645 | 98.21 | 35.54 | 6.02 | 0.00 | 381.034 |
| B117 | CrcMh | 0.464 | 8.09 | 27.38 | 6.75 | 0.00 | 25.371 |
| B118 | CrcMh | 0.654 | 86.06 | 35.18 | 6.05 | 0.00 | 340.347 |
| B119 | CrcMh | 0.654 | 86.06 | 35.18 | 6.05 | 0.00 | 340.347 |
| B120 | CrcMh | 0.649 | 83.33 | 35.15 | 6.05 | 0.00 | 327.288 |
| B121 | CrcMh | 0.799 | 12.99 | 31.34 | 6.37 | 0.00 | 66.083 |
| B123 | CrcMh | 0.622 | 70.35 | 35.12 | 6.05 | 0.00 | 264.673 |
| B124 | CrcMh | 0.464 | 11.24 | 28.44 | 6.65 | 0.00 | 34.666 |
| B125 | CrcMh | 0.650 | 52.84 | 34.77 | 6.08 | 0.00 | 208.934 |
| B126 | CrcMh | 0.650 | 47.35 | 34.41 | 6.11 | 0.00 | 188.155 |
| B127 | CrcMh | 0.000 | 0.00 | 0.00 | 0.00 | 0.00 | 0.000 |
| B128 | CrcMh | 0.654 | 44.22 | 34.01 | 6.14 | 0.00 | 177.465 |
| B129 | CrcMh | 0.655 | 33.47 | 33.85 | 6.15 | 0.00 | 134.839 |
| B130 | CrcMh | 0.659 | 29.76 | 33.26 | 6.20 | 0.00 | 121.792 |
| B112 | CrcMh | 0.665 | 2.83 | 26.96 | 6.80 | 0.00 | 12.805 |
| OUT | CrcMh | 0.747 | 308.84 | 38.60 | 5.79 | 0.00 | 1335.727 |
| B114 | CrcMh | 0.614 | 2.92 | 27.00 | 6.79 | 0.00 | 12.161 |
| B58 | CrcMh | 0.800 | 12.30 | 30.56 | 6.44 | 0.00 | 63.401 |
| B12-A | CrcMh | 0.800 | 104.07 | 26.80 | 6.81 | 0.00 | 567.103 |

Conveyance Configuration Data

| Run # | Node I.D. US | DS | FlowLine Elev. US (ft) | DS (ft) | Shape # | Span (ft) | Rise (ft) | Length (ft) | Slope (%) | n_value |
|---|---|---|---|---|---|---|---|---|---|---|
| 48 | B34 | B33 | 75.49 | 72.62 | Cir 1 | 0.00 | 1.50 | 15.0 | 19.493 | 0.013 |
| 49 | B33 | B117 | 71.92 | 71.42 | Cir 1 | 0.00 | 2.00 | 12.5 | 4.003 | 0.013 |
| 50 | B118 | B30 | 69.73 | 69.72 | Cir 1 | 0.00 | 5.50 | 108.5 | 0.009 | 0.013 |
| 77 | B50 | B128 | 72.00 | 71.60 | Cir 1 | 0.00 | 3.00 | 34.4 | 1.163 | 0.013 |
| 78 | B129 | B128 | 71.00 | 70.40 | Cir 1 | 0.00 | 4.50 | 102.0 | 0.588 | 0.013 |
| 79 | B52 | B51 | 75.49 | 74.59 | Cir 1 | 0.00 | 1.25 | 9.0 | 10.050 | 0.013 |
| 80 | B51 | B53 | 73.09 | 72.97 | Cir 1 | 0.00 | 2.00 | 25.0 | 0.480 | 0.013 |
| 81 | B54 | B53 | 75.28 | 74.27 | Cir 1 | 0.00 | 1.25 | 12.0 | 8.447 | 0.013 |
| 82 | B53 | B129 | 72.87 | 72.30 | Cir 1 | 0.00 | 2.00 | 64.2 | 0.888 | 0.013 |
| 83 | B55 | B129 | 71.01 | 71.00 | Cir 1 | 0.00 | 4.50 | 103.0 | 0.010 | 0.013 |
| 84 | B56 | B55 | 73.67 | 72.08 | Cir 1 | 0.00 | 2.00 | 37.0 | 4.301 | 0.013 |
| 85 | B130 | B55 | 71.46 | 70.58 | Cir 1 | 0.00 | 4.50 | 205.0 | 0.429 | 0.013 |
| 86 | B57 | B130 | 70.97 | 70.96 | Box 1 | 4.00 | 4.00 | 40.0 | 0.025 | 0.015 |
| 87 | B110 | OUT | 67.97 | 67.95 | Box 1 | 10.0 | 8.00 | 17.0 | 0.118 | 0.015 |
| 1 | B1 | B101 | 71.32 | 71.30 | Box 1 | 9.00 | 5.00 | 32.3 | 0.062 | 0.013 |
| 2 | B2 | B101 | 74.56 | 73.90 | Cir 1 | 0.00 | 2.00 | 15.0 | 4.404 | 0.013 |
| 3 | B3 | B101 | 74.46 | 73.90 | Cir 1 | 0.00 | 2.00 | 33.4 | 1.677 | 0.013 |
| 4 | B101 | B102 | 71.30 | 70.81 | Cir 1 | 0.00 | 5.00 | 315.0 | 0.156 | 0.013 |
| 5 | B4 | B5 | 74.38 | 74.38 | Cir 1 | 0.00 | 1.50 | 10.7 | 0.009 | 0.013 |
| 6 | B5 | B102 | 74.18 | 73.41 | Cir 1 | 0.00 | 1.75 | 12.2 | 6.324 | 0.013 |
| 7 | B6 | B7 | 74.87 | 74.49 | Cir 1 | 0.00 | 1.25 | 28.4 | 1.338 | 0.013 |
| 8 | B7 | B102 | 73.79 | 73.41 | Cir 1 | 0.00 | 1.75 | 25.6 | 1.485 | 0.013 |
| 9 | B102 | B103 | 70.81 | 70.44 | Cir 1 | 0.00 | 5.00 | 196.4 | 0.188 | 0.013 |
| 10 | B8 | B103 | 71.30 | 70.80 | Cir 1 | 0.00 | 1.50 | 97.0 | 0.515 | 0.013 |
| 11 | B103 | B9 | 70.44 | 70.22 | Cir 1 | 0.00 | 5.00 | 106.0 | 0.208 | 0.013 |
| 12 | B9 | B104 | 70.17 | 70.16 | Cir 1 | 0.00 | 5.00 | 29.4 | 0.034 | 0.013 |
| 13 | B104 | B105 | 70.16 | 69.79 | Cir 1 | 0.00 | 5.00 | 127.7 | 0.290 | 0.013 |
| 14 | B10 | B11 | 74.28 | 74.03 | Cir 1 | 0.00 | 2.00 | 39.0 | 0.641 | 0.013 |
| 15 | B11 | B105 | 74.04 | 74.03 | Cir 1 | 0.00 | 2.00 | 7.0 | 0.143 | 0.013 |
| 16 | B12 | B105 | 75.53 | 74.39 | Cir 1 | 0.00 | 2.00 | 4.5 | 26.188 | 0.013 |
| 17 | B105 | B12-A | 69.79 | 69.32 | Cir 1 | 0.00 | 5.00 | 262.0 | 0.179 | 0.013 |
| 18 | B12-A | B110 | 69.32 | 68.90 | Cir 1 | 0.00 | 5.00 | 283.0 | 0.148 | 0.013 |
| 19 | B13 | B108 | 75.05 | 75.04 | Cir 1 | 0.00 | 2.00 | 7.5 | 0.133 | 0.013 |
| 20 | B14 | B108 | 74.37 | 74.34 | Cir 1 | 0.00 | 2.00 | 42.5 | 0.071 | 0.013 |
| 21 | B108 | B109 | 73.94 | 70.80 | Cir 1 | 0.00 | 2.00 | 222.6 | 1.411 | 0.013 |
| 22 | B109 | B110 | 68.15 | 67.97 | Box 1 | 10.0 | 8.00 | 250.0 | 0.072 | 0.015 |
| 23 | B15 | B109 | 68.64 | 68.15 | Box 1 | 10.0 | 8.00 | 487.0 | 0.101 | 0.015 |
| 24 | B111 | B109 | 68.72 | 68.00 | Cir 1 | 0.00 | 6.00 | 152.7 | 0.472 | 0.013 |
| 51 | B119 | B118 | 69.97 | 69.62 | Cir 1 | 0.00 | 5.00 | 275.8 | 0.127 | 0.013 |
| 52 | B35 | B119 | 74.77 | 71.47 | Cir 1 | 0.00 | 2.00 | 18.5 | 18.129 | 0.013 |
| 53 | B120 | B119 | 70.34 | 69.87 | Cir 1 | 0.00 | 5.00 | 32.9 | 1.429 | 0.013 |
| 55 | B36 | B121 | 73.27 | 71.55 | Cir 1 | 0.00 | 2.00 | 14.0 | 12.379 | 0.013 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 56 | B37 | B121 | 72.95 | 71.55 | Cir 1 | 0.00 | 2.00 | 24.0 | 5.843 | 0.013 |
| 57 | B121 | B120 | 71.15 | 71.14 | Box 1 | 4.00 | 3.00 | 28.0 | 0.036 | 0.015 |
| 58 | B122 | B120 | 70.35 | 70.34 | Cir 1 | 0.00 | 5.00 | 28.0 | 0.036 | 0.013 |
| 59 | B123 | B122 | 70.05 | 70.00 | Cir 1 | 0.00 | 5.00 | 84.7 | 0.059 | 0.013 |
| 60 | B38 | B123 | 72.00 | 70.95 | Cir 1 | 0.00 | 2.00 | 38.3 | 2.743 | 0.013 |
| 61 | B39 | B123 | 70.39 | 70.15 | Cir 1 | 0.00 | 5.00 | 213.7 | 0.112 | 0.013 |
| 62 | B42 | B41 | 75.85 | 72.97 | Cir 1 | 0.00 | 1.50 | 22.0 | 13.205 | 0.013 |
| 63 | B41 | B124 | 71.17 | 70.98 | Cir 1 | 0.00 | 2.00 | 13.4 | 1.418 | 0.013 |
| 64 | B44 | B43 | 75.85 | 75.00 | Cir 1 | 0.00 | 1.50 | 24.3 | 3.500 | 0.013 |
| 65 | B43 | B124 | 71.23 | 70.98 | Cir 1 | 0.00 | 2.00 | 13.0 | 1.923 | 0.013 |
| 66 | B124 | B39 | 70.78 | 70.49 | Cir 1 | 0.00 | 2.00 | 66.0 | 0.439 | 0.013 |
| 67 | B125 | B39 | 70.40 | 70.39 | Cir 1 | 0.00 | 5.00 | 37.7 | 0.027 | 0.013 |
| 68 | B40 | B125 | 71.84 | 71.83 | Cir 1 | 0.00 | 2.00 | 53.1 | 0.019 | 0.013 |
| 69 | B126 | B125 | 70.45 | 70.19 | Cir 1 | 0.00 | 5.00 | 208.9 | 0.124 | 0.013 |
| 71 | B45 | B126 | 70.80 | 70.45 | Cir 1 | 0.00 | 5.00 | 125.6 | 0.279 | 0.013 |
| 72 | B47 | B46 | 75.19 | 74.00 | Cir 1 | 0.00 | 1.50 | 12.0 | 9.966 | 0.013 |
| 73 | B46 | B48 | 73.95 | 70.80 | Cir 1 | 0.00 | 2.00 | 24.6 | 12.911 | 0.013 |
| 74 | B49 | B48 | 74.93 | 73.90 | Cir 1 | 0.00 | 1.50 | 11.0 | 9.405 | 0.013 |
| 75 | B48 | B45 | 71.50 | 70.60 | Cir 1 | 0.00 | 2.00 | 66.6 | 1.351 | 0.013 |
| 76 | B128 | B45 | 70.61 | 70.60 | Cir 1 | 0.00 | 5.00 | 216.2 | 0.005 | 0.013 |
| 88 | B58 | B121 | 71.60 | 71.25 | Cir 1 | 0.00 | 3.00 | 420.7 | 0.083 | 0.013 |
| 25 | B16 | B17 | 75.78 | 75.27 | Cir 1 | 0.00 | 1.00 | 22.0 | 2.319 | 0.013 |
| 26 | B17 | B111 | 74.87 | 73.22 | Cir 1 | 0.00 | 1.50 | 7.0 | 24.255 | 0.013 |
| 27 | B20 | B112 | 73.91 | 73.34 | Cir 1 | 0.00 | 1.50 | 205.0 | 0.278 | 0.013 |
| 28 | B112 | B111 | 73.34 | 73.22 | Cir 1 | 0.00 | 1.50 | 60.0 | 0.200 | 0.013 |
| 29 | B18 | B112 | 74.68 | 74.34 | Cir 1 | 0.00 | 1.50 | 22.5 | 1.511 | 0.013 |
| 30 | B19 | B112 | 74.66 | 74.34 | Cir 1 | 0.00 | 1.50 | 12.0 | 2.668 | 0.013 |
| 31 | B113 | B111 | 69.35 | 68.82 | Cir 1 | 0.00 | 6.00 | 380.0 | 0.139 | 0.013 |
| 32 | B21 | B22 | 73.00 | 72.17 | Cir 1 | 0.00 | 2.00 | 172.0 | 0.483 | 0.013 |
| 33 | B22 | B113 | 72.17 | 72.15 | Cir 1 | 0.00 | 3.00 | 33.0 | 0.061 | 0.013 |
| 34 | B23 | B113 | 74.16 | 72.15 | Cir 1 | 0.00 | 1.50 | 8.0 | 25.958 | 0.013 |
| 35 | B26 | B114 | 84.80 | 84.23 | Cir 1 | 0.00 | 1.50 | 208.6 | 0.273 | 0.013 |
| 36 | B24 | B114 | 74.63 | 74.15 | Cir 1 | 0.00 | 1.50 | 11.0 | 4.368 | 0.013 |
| 37 | B25 | B114 | 74.49 | 74.35 | Cir 1 | 0.00 | 1.50 | 23.0 | 0.609 | 0.013 |
| 38 | B114 | B113 | 73.25 | 72.15 | Cir 1 | 0.00 | 1.50 | 59.0 | 1.865 | 0.013 |
| 39 | B115 | B113 | 69.55 | 69.35 | Cir 1 | 0.00 | 6.00 | 119.5 | 0.167 | 0.013 |
| 40 | B27 | B115 | 85.11 | 84.47 | Cir 1 | 0.00 | 1.50 | 215.0 | 0.298 | 0.013 |
| 41 | B116 | B115 | 69.56 | 69.55 | Cir 1 | 0.00 | 6.00 | 53.7 | 0.019 | 0.013 |
| 42 | B28 | B116 | 73.50 | 72.78 | Cir 1 | 0.00 | 2.00 | 17.0 | 4.239 | 0.013 |
| 43 | B30 | B116 | 69.72 | 69.58 | Cir 1 | 0.00 | 6.00 | 183.0 | 0.077 | 0.013 |
| 44 | B29 | B30 | 74.33 | 74.32 | Cir 1 | 0.00 | 1.00 | 32.5 | 0.031 | 0.013 |
| 45 | B117 | B30 | 71.30 | 69.92 | Cir 1 | 0.00 | 2.00 | 67.0 | 2.060 | 0.013 |
| 46 | B32 | B31 | 75.27 | 73.54 | Cir 1 | 0.00 | 1.50 | 14.0 | 12.453 | 0.013 |
| 47 | B31 | B117 | 73.54 | 71.42 | Cir 1 | 0.00 | 2.00 | 13.0 | 16.529 | 0.013 |

Conveyance Hydraulic Computations. Tailwater = 76.206 (ft)

| Run # | Hyd. Gr.line US (ft) | DS (ft) | Crit.Elev US (ft) | Fr.Slope (%) | Depth Unif. (ft) | Actual (ft) | Velocity Unif. (f/s) | Actual (f/s) | Q (cfs) | Cap (cfs) | Junc Loss (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 48* | 87.15 | 87.01 | 75.49 | 0.909 | 0.47 | 1.50 | 20.96 | 6.52 | 10.1 | 46.6 | 0.000 |
| 49* | 87.01 | 86.96 | 77.12 | 0.384 | 0.77 | 2.00 | 12.72 | 6.23 | 14.1 | 45.5 | 0.000 |
| 50 | 87.23 | 86.13 | 77.72 | 1.019 | 5.50 | 5.50 | 14.33 | 14.33 | 340.3 | 32.4 | 0.000 |
| 77* | 98.54 | 98.39 | 78.00 | 0.456 | 1.73 | 3.00 | 10.75 | 8.18 | 45.3 | 72.2 | 0.000 |
| 78* | 98.86 | 98.39 | 76.80 | 0.466 | 3.32 | 4.50 | 10.73 | 10.41 | 134.8 | 151.5 | 0.000 |
| 79* | 99.04 | 99.00 | 75.49 | 0.456 | 0.39 | 1.25 | 13.28 | 4.95 | 4.4 | 20.6 | 0.000 |
| 80* | 99.00 | 98.99 | 76.59 | 0.060 | 0.82 | 2.00 | 4.56 | 4.49 | 5.6 | 15.7 | 0.000 |
| 81* | 99.04 | 98.99 | 75.28 | 0.444 | 0.41 | 1.25 | 12.43 | 4.91 | 4.3 | 18.9 | 0.000 |
| 82* | 98.99 | 98.86 | 76.47 | 0.194 | 0.96 | 2.00 | 6.68 | 5.46 | 10.0 | 21.4 | 0.000 |
| 83 | 99.28 | 98.86 | 76.58 | 0.409 | 4.50 | 4.50 | 7.95 | 7.95 | 126.4 | 19.5 | 0.000 |
| 84* | 99.29 | 99.28 | 76.58 | 0.007 | 0.28 | 2.00 | 7.37 | 3.26 | 2.0 | 47.1 | 0.000 |
| 85 | 99.38 | 99.28 | 77.26 | 0.380 | 3.48 | 4.50 | 9.22 | 7.66 | 121.8 | 129.4 | 0.000 |
| 86 | 99.62 | 99.38 | 77.25 | 0.590 | 4.00 | 4.00 | 7.61 | 7.61 | 121.8 | 25.1 | 0.000 |
| 87* | 76.37 | 76.21 | 78.00 | 0.980 | 8.00 | 8.00 | 16.70 | 16.70 | 1335.7 | 462.9 | 0.000 |
| 1 | 135.25 | 135.04 | 78.52 | 0.651 | 5.00 | 5.00 | 12.66 | 12.66 | 569.6 | 175.6 | 0.000 |
| 2* | 135.04 | 135.04 | 78.06 | 0.041 | 0.42 | 2.00 | 9.57 | 4.24 | 4.6 | 47.7 | 0.000 |
| 3* | 135.04 | 135.04 | 77.76 | 0.000 | 0.17 | 2.00 | 3.32 | 2.00 | 0.4 | 29.4 | 0.000 |
| 4 | 135.04 | 122.05 | 78.10 | 4.123 | 5.00 | 5.00 | 27.05 | 27.05 | 531.1 | 103.2 | 0.000 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | 122.21 | 122.17 | 77.11 | 0.306 | 1.50 | 1.50 | 3.30 | 3.30 | 5.8 | 1.0 | 0.000 |
| 6* | 122.17 | 122.05 | 77.18 | 1.019 | 0.77 | 1.75 | 15.68 | 7.41 | 16.1 | 40.0 | 0.000 |
| 7* | 122.10 | 122.08 | 77.47 | 0.083 | 0.43 | 1.25 | 5.06 | 3.63 | 1.9 | 7.5 | 0.000 |
| 8* | 122.08 | 122.05 | 77.19 | 0.114 | 0.63 | 1.75 | 6.88 | 4.63 | 5.4 | 19.4 | 0.000 |
| 9 | 122.05 | 113.41 | 77.51 | 4.398 | 5.00 | 5.00 | 27.93 | 27.93 | 548.5 | 113.5 | 0.000 |
| 10* | 113.46 | 113.41 | 77.85 | 0.044 | 0.56 | 1.50 | 3.70 | 3.66 | 2.2 | 7.6 | 0.000 |
| 11 | 113.41 | 108.73 | 78.49 | 4.415 | 5.00 | 5.00 | 27.99 | 27.99 | 549.6 | 119.2 | 0.000 |
| 12 | 108.73 | 107.43 | 78.22 | 4.436 | 5.00 | 5.00 | 28.06 | 28.06 | 550.9 | 48.2 | 0.000 |
| 13 | 107.43 | 101.76 | 78.16 | 4.436 | 5.00 | 5.00 | 28.06 | 28.06 | 550.9 | 140.8 | 0.000 |
| 14* | 101.84 | 101.78 | 78.48 | 0.165 | 1.01 | 2.00 | 5.79 | 5.30 | 9.2 | 18.2 | 0.000 |
| 15 | 101.78 | 101.76 | 77.63 | 0.223 | 2.00 | 2.00 | 3.42 | 3.42 | 10.7 | 8.6 | 0.000 |
| 16* | 101.76 | 101.76 | 78.03 | 0.002 | 0.13 | 2.00 | 11.16 | 2.70 | 1.0 | 116.3 | 0.000 |
| 17 | 101.76 | 89.68 | 78.29 | 4.613 | 5.00 | 5.00 | 28.61 | 28.61 | 561.8 | 110.8 | 0.000 |
| 18 | 89.68 | 76.37 | 78.00 | 4.701 | 5.00 | 5.00 | 28.88 | 28.88 | 567.1 | 100.8 | 0.000 |
| 19 | 77.77 | 77.77 | 78.67 | 0.119 | 1.55 | 2.00 | 2.99 | 2.50 | 7.8 | 8.3 | 0.000 |
| 20 | 77.79 | 77.77 | 78.27 | 0.005 | 0.71 | 2.00 | 1.63 | 0.52 | 1.6 | 6.0 | 0.000 |
| 21* | 77.77 | 77.38 | 78.94 | 0.172 | 0.82 | 2.00 | 7.80 | 5.34 | 9.4 | 27.0 | 0.000 |
| 22 | 77.38 | 76.37 | 78.50 | 0.404 | 8.00 | 8.00 | 10.73 | 10.73 | 858.1 | 362.1 | 0.000 |
| 23 | 77.43 | 77.38 | 78.50 | 0.091 | 6.50 | 8.00 | 6.26 | 5.09 | 407.0 | 428.1 | 0.000 |
| 24 | 79.18 | 77.38 | 78.22 | 1.178 | 6.00 | 6.00 | 16.33 | 16.33 | 461.7 | 292.1 | 0.000 |
| 51 | 91.90 | 87.23 | 78.17 | 1.693 | 5.00 | 5.00 | 17.33 | 17.33 | 340.3 | 93.2 | 0.000 |
| 52* | 91.98 | 91.90 | 79.07 | 0.426 | 0.53 | 2.00 | 22.22 | 6.37 | 14.8 | 96.7 | 0.000 |
| 53* | 92.42 | 91.90 | 78.14 | 1.566 | 4.38 | 5.00 | 17.95 | 16.67 | 327.3 | 312.6 | 0.000 |
| 55* | 92.52 | 92.52 | 77.57 | 0.005 | 0.20 | 2.00 | 10.15 | 3.14 | 1.7 | 79.9 | 0.000 |
| 56* | 92.53 | 92.52 | 77.55 | 0.009 | 0.27 | 2.00 | 8.47 | 3.44 | 2.2 | 54.9 | 0.000 |
| 57 | 92.52 | 92.42 | 77.85 | 0.380 | 3.00 | 3.00 | 5.51 | 5.51 | 66.1 | 20.3 | 0.000 |
| 58 | 92.70 | 92.42 | 78.14 | 1.024 | 5.00 | 5.00 | 13.48 | 13.48 | 264.7 | 49.4 | 0.000 |
| 59 | 93.57 | 92.70 | 77.75 | 1.024 | 5.00 | 5.00 | 13.48 | 13.48 | 264.7 | 63.5 | 0.000 |
| 60* | 94.02 | 93.57 | 79.00 | 1.170 | 1.18 | 2.00 | 12.72 | 8.43 | 24.6 | 37.6 | 0.000 |
| 61 | 95.42 | 93.57 | 77.29 | 0.864 | 5.00 | 5.00 | 12.38 | 12.38 | 243.2 | 87.7 | 0.000 |
| 62* | 97.58 | 97.09 | 75.85 | 2.228 | 0.67 | 1.50 | 20.56 | 9.10 | 15.7 | 38.3 | 0.000 |
| 63* | 97.09 | 96.96 | 76.87 | 1.038 | 1.43 | 2.00 | 9.64 | 8.09 | 23.2 | 27.1 | 0.000 |
| 64* | 97.21 | 96.99 | 75.85 | 0.905 | 0.76 | 1.50 | 11.18 | 6.52 | 10.0 | 19.7 | 0.000 |
| 65* | 96.99 | 96.96 | 76.93 | 0.266 | 0.85 | 2.00 | 9.26 | 5.79 | 11.7 | 31.5 | 0.000 |
| 66 | 96.96 | 95.42 | 77.28 | 2.328 | 2.00 | 2.00 | 11.03 | 11.03 | 34.7 | 15.1 | 0.000 |
| 67 | 95.66 | 95.42 | 77.29 | 0.638 | 5.00 | 5.00 | 10.64 | 10.64 | 208.9 | 42.6 | 0.000 |
| 68 | 96.24 | 95.66 | 77.93 | 1.087 | 2.00 | 2.00 | 7.54 | 7.54 | 23.7 | 3.1 | 0.000 |
| 69 | 96.74 | 95.66 | 77.35 | 0.518 | 5.00 | 5.00 | 9.58 | 9.58 | 188.2 | 92.3 | 0.000 |
| 71 | 97.39 | 96.74 | 77.00 | 0.518 | 5.00 | 5.00 | 9.58 | 9.58 | 188.2 | 138.1 | 0.000 |
| 72* | 97.56 | 97.54 | 75.19 | 0.143 | 0.35 | 1.50 | 12.66 | 4.41 | 4.0 | 33.3 | 0.000 |
| 73* | 97.54 | 97.53 | 76.75 | 0.048 | 0.34 | 2.00 | 14.34 | 4.35 | 5.0 | 81.6 | 0.000 |
| 74* | 97.54 | 97.53 | 74.93 | 0.157 | 0.36 | 1.50 | 12.58 | 4.48 | 4.2 | 32.4 | 0.000 |
| 75* | 97.53 | 97.39 | 76.80 | 0.207 | 0.87 | 2.00 | 7.87 | 5.52 | 10.3 | 26.4 | 0.000 |
| 76 | 98.39 | 97.39 | 77.10 | 0.460 | 5.00 | 5.00 | 9.04 | 9.04 | 177.5 | 17.8 | 0.000 |
| 88 | 96.29 | 92.52 | 78.19 | 0.896 | 3.00 | 3.00 | 8.97 | 8.97 | 63.4 | 19.3 | 0.000 |
| 25 | 80.79 | 79.26 | 78.93 | 6.997 | 1.00 | 1.00 | 12.05 | 12.05 | 9.5 | 5.4 | 0.000 |
| 26* | 79.26 | 79.18 | 77.97 | 1.038 | 0.46 | 1.50 | 23.11 | 6.79 | 10.7 | 52.0 | 0.000 |
| 27 | 81.50 | 80.07 | 78.14 | 0.700 | 1.50 | 1.50 | 4.99 | 4.99 | 8.8 | 5.6 | 0.000 |
| 28 | 80.07 | 79.18 | 78.14 | 1.473 | 1.50 | 1.50 | 7.25 | 7.25 | 12.8 | 4.7 | 0.000 |
| 29* | 80.07 | 80.07 | 77.68 | 0.026 | 0.37 | 1.50 | 5.05 | 3.38 | 1.7 | 13.0 | 0.000 |
| 30* | 80.07 | 80.07 | 77.66 | 0.061 | 0.40 | 1.50 | 7.01 | 3.85 | 2.6 | 17.2 | 0.000 |
| 31 | 83.31 | 79.18 | 78.15 | 1.087 | 6.00 | 6.00 | 15.68 | 15.68 | 443.5 | 158.8 | 0.000 |
| 32 | 83.54 | 83.52 | 78.17 | 0.471 | 1.63 | 2.00 | 5.70 | 4.96 | 15.6 | 15.8 | 0.000 |
| 33 | 83.52 | 83.31 | 78.17 | 0.620 | 3.00 | 3.00 | 7.46 | 7.46 | 52.7 | 16.5 | 0.000 |
| 34* | 83.32 | 83.31 | 77.06 | 0.020 | 0.17 | 1.50 | 13.26 | 3.22 | 1.5 | 53.7 | 0.000 |
| 35 | 87.26 | 85.73 | 77.95 | 0.734 | 1.50 | 1.50 | 5.11 | 5.11 | 9.0 | 5.5 | 0.000 |
| 36* | 84.10 | 84.10 | 77.63 | 0.040 | 0.31 | 1.50 | 7.86 | 3.61 | 2.1 | 22.0 | 0.000 |
| 37* | 84.10 | 84.10 | 77.59 | 0.015 | 0.40 | 1.50 | 3.37 | 2.90 | 1.3 | 8.2 | 0.000 |
| 38* | 84.10 | 83.31 | 77.95 | 1.329 | 1.06 | 1.50 | 9.11 | 7.38 | 12.2 | 14.4 | 0.000 |
| 39 | 84.29 | 83.31 | 77.98 | 0.816 | 6.00 | 6.00 | 13.58 | 13.58 | 384.1 | 174.0 | 0.000 |
| 40 | 86.29 | 85.97 | 78.35 | 0.145 | 0.93 | 1.50 | 3.51 | 2.27 | 4.0 | 5.8 | 0.000 |
| 41 | 84.72 | 84.29 | 77.98 | 0.803 | 6.00 | 6.00 | 13.48 | 13.48 | 381.0 | 58.0 | 0.000 |
| 42* | 84.75 | 84.72 | 78.45 | 0.210 | 0.64 | 2.00 | 11.95 | 5.53 | 10.4 | 46.8 | 0.000 |
| 43 | 86.13 | 84.72 | 77.22 | 0.769 | 6.00 | 6.00 | 13.19 | 13.19 | 373.0 | 117.6 | 0.000 |
| 44 | 88.93 | 86.13 | 78.33 | 8.613 | 1.00 | 1.00 | 13.37 | 13.37 | 10.5 | 0.6 | 0.000 |
| 45* | 86.96 | 86.13 | 77.32 | 1.247 | 1.33 | 2.00 | 11.43 | 8.62 | 25.4 | 32.6 | 0.000 |
| 46* | 87.12 | 87.00 | 75.27 | 0.920 | 0.54 | 1.50 | 17.87 | 6.55 | 10.1 | 37.2 | 0.000 |
| 47* | 87.00 | 86.96 | 77.12 | 0.251 | 0.48 | 2.00 | 19.92 | 5.72 | 11.4 | 92.4 | 0.000 |

* Supercritical flow.

SUMMARY OF STORM DRAIN STRUCTURE QUANTITIES

NOTE:
The convey length should be from upstream to downstream inside box.
This length may also be used as Pay Item.
Using hydraulic length, from node center to node center, may result in profile error, and this length should not be used as Pay Item.

LINKS:

| Type of Convey Structure | Material | Rise (ft) | Span (ft) | Number of Links of this type | Quantity (ft) |
|---|---|---|---|---|---|
| Circular | Concrete | 1.5 | 0.0 | 19 | 1037.1 |
| Circular | Concrete | 2.0 | 0.0 | 26 | 1110.7 |
| Circular | Concrete | 5.5 | 0.0 | 1 | 108.5 |
| Circular | Concrete | 3.0 | 0.0 | 3 | 488.1 |
| Circular | Concrete | 4.5 | 0.0 | 3 | 410.0 |
| Circular | Concrete | 1.25 | 0.0 | 3 | 49.4 |
| Box | Concrete | 4.0 | 4.0 | 1 | 40.0 |
| Box | Concrete | 8.0 | 10.0 | 3 | 754.0 |
| Box | Concrete | 5.0 | 9.0 | 1 | 32.3 |
| Circular | Concrete | 5.0 | 0.0 | 16 | 2543.0 |
| Circular | Concrete | 1.75 | 0.0 | 2 | 37.8 |
| Circular | Concrete | 6.0 | 0.0 | 5 | 888.9 |
| Box | Concrete | 3.0 | 4.0 | 1 | 28.0 |
| Circular | Concrete | 1.0 | 0.0 | 2 | 54.5 |

NODES:

| Type of Inlet Structure | Type of Grate | Inlet Length (ft) | Grate Width (ft) | Grate Length (ft) | Grate Area (ft) | Grate Perimeter (ft) | Quantity (each) |
|---|---|---|---|---|---|---|---|
| Curb In Sag | | 2.5 | 0.0 | 0.0 | 0.0 | 0.0 | 5 |
| Circular Manhole | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 48 |
| Grate In Sag | Parallel | 0.0 | 0.0 | 0.0 | 3.28 | 10.0 | 10 |
| Curb In Sag | | 5.0 | 0.0 | 0.0 | 0.0 | 0.0 | 22 |
| Junction Box | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1 |
| Grate In Sag | Parallel | 0.0 | 0.0 | 0.0 | 6.0 | 10.0 | 2 |

END

NORMAL TERMINATION OF HOUSTORM.

Warning Messages for current project:

Runoff Frequency of: 2 Years
Discharge decreased downstream node Id= B104 Previous intensity used.
Discharge decreased downstream node Id= B130 Previous intensity used.
Discharge decreased downstream node Id= B126 Previous intensity used.
Discharge decreased downstream node Id= B122 Previous intensity used.
Discharge decreased downstream node Id= B118 Previous intensity used.
Computed right ponded width exceeds allowable width at inlet Id= B35
Computed left ponded width exceeds allowable width at inlet Id= B35
Computed right ponded width exceeds allowable width at inlet Id= B21
Computed left ponded width exceeds allowable width at inlet Id= B21
Run# 87 Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B110 Run # 87
Run# 18 Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B12-A Run # 18
Upstream HGL exceeds critical elevation (Analysis)at node Id= B12-A Run # 18
Run# 22 Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B15 Run # 23
Run# 28 Insufficient capacity.
Run# 31 Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B113 Run # 31
Upstream HGL exceeds critical elevation (Analysis)at node Id= B113 Run # 31
Run# 33 Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B22 Run # 33
Upstream HGL exceeds critical elevation (Analysis)at node Id= B22 Run # 33

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Upstream HGL exceeds critical elevation (Design) at node Id= B23 Run # 34
Upstream HGL exceeds critical elevation (Analysis)at node Id= B23 Run # 34
Upstream HGL exceeds critical elevation (Design) at node Id= B114 Run # 38
Upstream HGL exceeds critical elevation (Analysis)at node Id= B114 Run # 38
HGL elevation below invert. Downstream HGL set to soffit elevation at Run# 35
Upstream HGL exceeds critical elevation (Design) at node Id= B115 Run # 39
Upstream HGL exceeds critical elevation (Analysis)at node Id= B115 Run # 39
HGL elevation below invert. Downstream HGL set to soffit elevation at Run# 40
Upstream HGL exceeds critical elevation (Design) at node Id= B27 Run # 40
Upstream HGL exceeds critical elevation (Analysis)at node Id= B27 Run # 40
Run# 41  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B116 Run # 41
Upstream HGL exceeds critical elevation (Analysis)at node Id= B116 Run # 41
Run# 43  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B30 Run # 43
Upstream HGL exceeds critical elevation (Analysis)at node Id= B30 Run # 43
Run# 44  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B29 Run # 44
Upstream HGL exceeds critical elevation (Analysis)at node Id= B29 Run # 44
Upstream HGL exceeds critical elevation (Design) at node Id= B117 Run # 45
Upstream HGL exceeds critical elevation (Analysis)at node Id= B117 Run # 45
Upstream HGL exceeds critical elevation (Design) at node Id= B31 Run # 47
Upstream HGL exceeds critical elevation (Analysis)at node Id= B31 Run # 47
Upstream HGL exceeds critical elevation (Design) at node Id= B33 Run # 49
Upstream HGL exceeds critical elevation (Analysis)at node Id= B33 Run # 49
Run# 50  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B118 Run # 50
Upstream HGL exceeds critical elevation (Analysis)at node Id= B118 Run # 50
Run# 17  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B105 Run # 17
Upstream HGL exceeds critical elevation (Analysis)at node Id= B105 Run # 17
Run# 51  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B119 Run # 51
Upstream HGL exceeds critical elevation (Analysis)at node Id= B119 Run # 51
Upstream HGL exceeds critical elevation (Design) at node Id= B35 Run # 52
Upstream HGL exceeds critical elevation (Analysis)at node Id= B35 Run # 52
Upstream HGL exceeds critical elevation (Design) at node Id= B120 Run # 53
Upstream HGL exceeds critical elevation (Analysis)at node Id= B120 Run # 53
Run# 57  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B121 Run # 57
Upstream HGL exceeds critical elevation (Analysis)at node Id= B121 Run # 57
Run# 58  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B122 Run # 58
Upstream HGL exceeds critical elevation (Analysis)at node Id= B122 Run # 58
Run# 59  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B123 Run # 59
Upstream HGL exceeds critical elevation (Analysis)at node Id= B123 Run # 59
Upstream HGL exceeds critical elevation (Design) at node Id= B38 Run # 60
Upstream HGL exceeds critical elevation (Analysis)at node Id= B38 Run # 60
Run# 61  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B39 Run # 61
Upstream HGL exceeds critical elevation (Analysis)at node Id= B39 Run # 61
Run# 66  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B124 Run # 66
Upstream HGL exceeds critical elevation (Analysis)at node Id= B124 Run # 66
Run# 67  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B125 Run # 67
Upstream HGL exceeds critical elevation (Analysis)at node Id= B125 Run # 67
Run# 68  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B40 Run # 68
Upstream HGL exceeds critical elevation (Analysis)at node Id= B40 Run # 68
Upstream HGL exceeds critical elevation (Design) at node Id= B126 Run # 69
Upstream HGL exceeds critical elevation (Analysis)at node Id= B126 Run # 69
Upstream HGL exceeds critical elevation (Design) at node Id= B45 Run # 71
Upstream HGL exceeds critical elevation (Analysis)at node Id= B45 Run # 71
Upstream HGL exceeds critical elevation (Design) at node Id= B48 Run # 75
Upstream HGL exceeds critical elevation (Analysis)at node Id= B48 Run # 75
Run# 76  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B128 Run # 76
Upstream HGL exceeds critical elevation (Analysis)at node Id= B128 Run # 76
Run# 88  Insufficient capacity.
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Upstream HGL exceeds critical elevation (Design) at node Id= B58 Run # 88
Upstream HGL exceeds critical elevation (Analysis)at node Id= B58 Run # 88
Upstream HGL exceeds critical elevation (Design) at node Id= B20 Run # 27
Upstream HGL exceeds critical elevation (Design) at node Id= B21 Run # 32
Upstream HGL exceeds critical elevation (Analysis)at node Id= B21 Run # 32
Upstream HGL exceeds critical elevation (Design) at node Id= B26 Run # 35
Upstream HGL exceeds critical elevation (Analysis)at node Id= B26 Run # 35
Upstream HGL exceeds critical elevation (Design) at node Id= B24 Run # 36
Upstream HGL exceeds critical elevation (Analysis)at node Id= B24 Run # 36
Upstream HGL exceeds critical elevation (Design) at node Id= B25 Run # 37
Upstream HGL exceeds critical elevation (Analysis)at node Id= B25 Run # 37
Upstream HGL exceeds critical elevation (Design) at node Id= B32 Run # 46
Upstream HGL exceeds critical elevation (Analysis)at node Id= B32 Run # 46
Upstream HGL exceeds critical elevation (Design) at node Id= B34 Run # 48
Upstream HGL exceeds critical elevation (Analysis)at node Id= B34 Run # 48
Upstream HGL exceeds critical elevation (Design) at node Id= B50 Run # 77
Upstream HGL exceeds critical elevation (Analysis)at node Id= B50 Run # 77
Upstream HGL exceeds critical elevation (Design) at node Id= B129 Run # 78
Upstream HGL exceeds critical elevation (Analysis)at node Id= B129 Run # 78
Upstream HGL exceeds critical elevation (Design) at node Id= B53 Run # 82
Upstream HGL exceeds critical elevation (Analysis)at node Id= B53 Run # 82
Run# 83  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B55 Run # 83
Upstream HGL exceeds critical elevation (Analysis)at node Id= B55 Run # 83
Upstream HGL exceeds critical elevation (Design) at node Id= B56 Run # 84
Upstream HGL exceeds critical elevation (Analysis)at node Id= B56 Run # 84
Upstream HGL exceeds critical elevation (Design) at node Id= B130 Run # 85
Upstream HGL exceeds critical elevation (Analysis)at node Id= B130 Run # 85
Run# 86  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B57 Run # 86
Upstream HGL exceeds critical elevation (Analysis)at node Id= B57 Run # 86
Run# 13  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B104 Run # 13
Upstream HGL exceeds critical elevation (Analysis)at node Id= B104 Run # 13
Upstream HGL exceeds critical elevation (Design) at node Id= B11 Run # 15
Upstream HGL exceeds critical elevation (Analysis)at node Id= B11 Run # 15
Upstream HGL exceeds critical elevation (Design) at node Id= B12 Run # 16
Upstream HGL exceeds critical elevation (Analysis)at node Id= B12 Run # 16
Upstream HGL exceeds critical elevation (Design) at node Id= B36 Run # 55
Upstream HGL exceeds critical elevation (Analysis)at node Id= B36 Run # 55
Upstream HGL exceeds critical elevation (Design) at node Id= B37 Run # 56
Upstream HGL exceeds critical elevation (Analysis)at node Id= B37 Run # 56
Upstream HGL exceeds critical elevation (Design) at node Id= B41 Run # 63
Upstream HGL exceeds critical elevation (Analysis)at node Id= B41 Run # 63
Upstream HGL exceeds critical elevation (Design) at node Id= B43 Run # 65
Upstream HGL exceeds critical elevation (Analysis)at node Id= B43 Run # 65
Upstream HGL exceeds critical elevation (Design) at node Id= B46 Run # 73
Upstream HGL exceeds critical elevation (Analysis)at node Id= B46 Run # 73
Upstream HGL exceeds critical elevation (Design) at node Id= B49 Run # 74
Upstream HGL exceeds critical elevation (Analysis)at node Id= B49 Run # 74
Upstream HGL exceeds critical elevation (Design) at node Id= B51 Run # 80
Upstream HGL exceeds critical elevation (Analysis)at node Id= B51 Run # 80
Upstream HGL exceeds critical elevation (Design) at node Id= B54 Run # 81
Upstream HGL exceeds critical elevation (Analysis)at node Id= B54 Run # 81
Run# 12  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B9 Run # 12
Upstream HGL exceeds critical elevation (Analysis)at node Id= B9 Run # 12
Upstream HGL exceeds critical elevation (Design) at node Id= B10 Run # 14
Upstream HGL exceeds critical elevation (Analysis)at node Id= B10 Run # 14
Upstream HGL exceeds critical elevation (Design) at node Id= B42 Run # 62
Upstream HGL exceeds critical elevation (Analysis)at node Id= B42 Run # 62
Upstream HGL exceeds critical elevation (Design) at node Id= B44 Run # 64
Upstream HGL exceeds critical elevation (Analysis)at node Id= B44 Run # 64
Upstream HGL exceeds critical elevation (Design) at node Id= B47 Run # 72
Upstream HGL exceeds critical elevation (Analysis)at node Id= B47 Run # 72
Upstream HGL exceeds critical elevation (Design) at node Id= B52 Run # 79
Upstream HGL exceeds critical elevation (Analysis)at node Id= B52 Run # 79
Run# 11  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B103 Run # 11
Upstream HGL exceeds critical elevation (Analysis)at node Id= B103 Run # 11
Run# 9  Insufficient capacity.
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Upstream HGL exceeds critical elevation (Design) at node Id= B102 Run # 9
Upstream HGL exceeds critical elevation (Analysis)at node Id= B102 Run # 9
Upstream HGL exceeds critical elevation (Design) at node Id= B8 Run # 10
Upstream HGL exceeds critical elevation (Analysis)at node Id= B8 Run # 10
Run# 4  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B101 Run # 4
Upstream HGL exceeds critical elevation (Analysis)at node Id= B101 Run # 4
Upstream HGL exceeds critical elevation (Design) at node Id= B5 Run # 6
Upstream HGL exceeds critical elevation (Analysis)at node Id= B5 Run # 6
Upstream HGL exceeds critical elevation (Design) at node Id= B7 Run # 8
Upstream HGL exceeds critical elevation (Analysis)at node Id= B7 Run # 8
Run# 1  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B1 Run # 1
Upstream HGL exceeds critical elevation (Analysis)at node Id= B1 Run # 1
Upstream HGL exceeds critical elevation (Design) at node Id= B2 Run # 2
Upstream HGL exceeds critical elevation (Analysis)at node Id= B2 Run # 2
Upstream HGL exceeds critical elevation (Design) at node Id= B3 Run # 3
Upstream HGL exceeds critical elevation (Analysis)at node Id= B3 Run # 3
Run# 5  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B4 Run # 5
Upstream HGL exceeds critical elevation (Analysis)at node Id= B4 Run # 5
Upstream HGL exceeds critical elevation (Design) at node Id= B6 Run # 7
Upstream HGL exceeds critical elevation (Analysis)at node Id= B6 Run # 7

        Runoff Frequency of: 100 Years
Discharge decreased downstream node Id= B104 Previous intensity used.
Discharge decreased downstream node Id= B130 Previous intensity used.
Discharge decreased downstream node Id= B126 Previous intensity used.
Discharge decreased downstream node Id= B122 Previous intensity used.
Discharge decreased downstream node Id= B118 Previous intensity used.
Computed right ponded width exceeds allowable width at inlet Id= B35
Computed left ponded width exceeds allowable width at inlet Id= B35
Computed right ponded width exceeds allowable width at inlet Id= B41
Computed left ponded width exceeds allowable width at inlet Id= B41
Computed right ponded width exceeds allowable width at inlet Id= B10
Computed left ponded width exceeds allowable width at inlet Id= B10
Computed right ponded width exceeds allowable width at inlet Id= B13
Computed left ponded width exceeds allowable width at inlet Id= B13
Computed right ponded width exceeds allowable width at inlet Id= B16
Computed left ponded width exceeds allowable width at inlet Id= B16
Computed right ponded width exceeds allowable width at inlet Id= B5
Computed left ponded width exceeds allowable width at inlet Id= B5
Computed right ponded width exceeds allowable width at inlet Id= B21
Computed left ponded width exceeds allowable width at inlet Id= B21
Computed right ponded width exceeds allowable width at inlet Id= B28
Computed left ponded width exceeds allowable width at inlet Id= B28
Computed right ponded width exceeds allowable width at inlet Id= B29
Computed left ponded width exceeds allowable width at inlet Id= B29
Run# 87  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B110 Run # 87
Run# 18  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B12-A Run # 18
Upstream HGL exceeds critical elevation (Analysis)at node Id= B12-A Run # 18
Run# 22  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B15 Run # 23
Run# 24  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B111 Run # 24
Upstream HGL exceeds critical elevation (Analysis)at node Id= B111 Run # 24
Upstream HGL exceeds critical elevation (Design) at node Id= B17 Run # 26
Upstream HGL exceeds critical elevation (Analysis)at node Id= B17 Run # 26
Run# 28  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B112 Run # 28
Upstream HGL exceeds critical elevation (Analysis)at node Id= B112 Run # 28
Upstream HGL exceeds critical elevation (Design) at node Id= B18 Run # 29
Upstream HGL exceeds critical elevation (Analysis)at node Id= B18 Run # 29
Upstream HGL exceeds critical elevation (Design) at node Id= B19 Run # 30
Upstream HGL exceeds critical elevation (Analysis)at node Id= B19 Run # 30
Run# 31  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B113 Run # 31
Upstream HGL exceeds critical elevation (Analysis)at node Id= B113 Run # 31
Run# 33  Insufficient capacity.
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Upstream HGL exceeds critical elevation (Design) at node Id= B22 Run # 33
Upstream HGL exceeds critical elevation (Analysis)at node Id= B22 Run # 33
Upstream HGL exceeds critical elevation (Design) at node Id= B23 Run # 34
Upstream HGL exceeds critical elevation (Analysis)at node Id= B23 Run # 34
Upstream HGL exceeds critical elevation (Design) at node Id= B114 Run # 38
Upstream HGL exceeds critical elevation (Analysis)at node Id= B114 Run # 38
HGL elevation below invert. Downstream HGL set to soffit elevation at Run# 35
Run# 39  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B115 Run # 39
Upstream HGL exceeds critical elevation (Analysis)at node Id= B115 Run # 39
HGL elevation below invert. Downstream HGL set to soffit elevation at Run# 40
Upstream HGL exceeds critical elevation (Design) at node Id= B27 Run # 40
Upstream HGL exceeds critical elevation (Analysis)at node Id= B27 Run # 40
Run# 41  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B116 Run # 41
Upstream HGL exceeds critical elevation (Analysis)at node Id= B116 Run # 41
Upstream HGL exceeds critical elevation (Design) at node Id= B28 Run # 42
Upstream HGL exceeds critical elevation (Analysis)at node Id= B28 Run # 42
Run# 43  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B30 Run # 43
Upstream HGL exceeds critical elevation (Analysis)at node Id= B30 Run # 43
Run# 44  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B29 Run # 44
Upstream HGL exceeds critical elevation (Analysis)at node Id= B29 Run # 44
Upstream HGL exceeds critical elevation (Design) at node Id= B117 Run # 45
Upstream HGL exceeds critical elevation (Analysis)at node Id= B117 Run # 45
Upstream HGL exceeds critical elevation (Design) at node Id= B31 Run # 47
Upstream HGL exceeds critical elevation (Analysis)at node Id= B31 Run # 47
Upstream HGL exceeds critical elevation (Design) at node Id= B33 Run # 49
Upstream HGL exceeds critical elevation (Analysis)at node Id= B33 Run # 49
Run# 50  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B118 Run # 50
Upstream HGL exceeds critical elevation (Analysis)at node Id= B118 Run # 50
Run# 17  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B105 Run # 17
Upstream HGL exceeds critical elevation (Analysis)at node Id= B105 Run # 17
Run# 51  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B119 Run # 51
Upstream HGL exceeds critical elevation (Analysis)at node Id= B119 Run # 51
Upstream HGL exceeds critical elevation (Design) at node Id= B35 Run # 52
Upstream HGL exceeds critical elevation (Analysis)at node Id= B35 Run # 52
Run# 53  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B120 Run # 53
Upstream HGL exceeds critical elevation (Analysis)at node Id= B120 Run # 53
Run# 57  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B121 Run # 57
Upstream HGL exceeds critical elevation (Analysis)at node Id= B121 Run # 57
Run# 58  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B122 Run # 58
Upstream HGL exceeds critical elevation (Analysis)at node Id= B122 Run # 58
Run# 59  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B123 Run # 59
Upstream HGL exceeds critical elevation (Analysis)at node Id= B123 Run # 59
Upstream HGL exceeds critical elevation (Design) at node Id= B38 Run # 60
Upstream HGL exceeds critical elevation (Analysis)at node Id= B38 Run # 60
Run# 61  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B39 Run # 61
Upstream HGL exceeds critical elevation (Analysis)at node Id= B39 Run # 61
Run# 66  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B124 Run # 66
Upstream HGL exceeds critical elevation (Analysis)at node Id= B124 Run # 66
Run# 67  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B125 Run # 67
Upstream HGL exceeds critical elevation (Analysis)at node Id= B125 Run # 67
Run# 68  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B40 Run # 68
Upstream HGL exceeds critical elevation (Analysis)at node Id= B40 Run # 68
Run# 69  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B126 Run # 69
Upstream HGL exceeds critical elevation (Analysis)at node Id= B126 Run # 69
Run# 71  Insufficient capacity.
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Upstream HGL exceeds critical elevation (Design) at node Id= B45 Run # 71
Upstream HGL exceeds critical elevation (Analysis)at node Id= B45 Run # 71
Upstream HGL exceeds critical elevation (Design) at node Id= B48 Run # 75
Upstream HGL exceeds critical elevation (Analysis)at node Id= B48 Run # 75
Run# 76  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B128 Run # 76
Upstream HGL exceeds critical elevation (Analysis)at node Id= B128 Run # 76
Run# 88  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B58 Run # 88
Upstream HGL exceeds critical elevation (Analysis)at node Id= B58 Run # 88
Run# 25  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B16 Run # 25
Upstream HGL exceeds critical elevation (Analysis)at node Id= B16 Run # 25
Run# 27  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B20 Run # 27
Upstream HGL exceeds critical elevation (Analysis)at node Id= B20 Run # 27
Upstream HGL exceeds critical elevation (Design) at node Id= B21 Run # 32
Upstream HGL exceeds critical elevation (Analysis)at node Id= B21 Run # 32
Run# 35  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B26 Run # 35
Upstream HGL exceeds critical elevation (Analysis)at node Id= B26 Run # 35
Upstream HGL exceeds critical elevation (Design) at node Id= B24 Run # 36
Upstream HGL exceeds critical elevation (Analysis)at node Id= B24 Run # 36
Upstream HGL exceeds critical elevation (Design) at node Id= B25 Run # 37
Upstream HGL exceeds critical elevation (Analysis)at node Id= B25 Run # 37
Upstream HGL exceeds critical elevation (Design) at node Id= B32 Run # 46
Upstream HGL exceeds critical elevation (Analysis)at node Id= B32 Run # 46
Upstream HGL exceeds critical elevation (Design) at node Id= B34 Run # 48
Upstream HGL exceeds critical elevation (Analysis)at node Id= B34 Run # 48
Upstream HGL exceeds critical elevation (Design) at node Id= B50 Run # 77
Upstream HGL exceeds critical elevation (Analysis)at node Id= B50 Run # 77
Upstream HGL exceeds critical elevation (Design) at node Id= B129 Run # 78
Upstream HGL exceeds critical elevation (Analysis)at node Id= B129 Run # 78
Upstream HGL exceeds critical elevation (Design) at node Id= B53 Run # 82
Upstream HGL exceeds critical elevation (Analysis)at node Id= B53 Run # 82
Run# 83  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B55 Run # 83
Upstream HGL exceeds critical elevation (Analysis)at node Id= B55 Run # 83
Upstream HGL exceeds critical elevation (Design) at node Id= B56 Run # 84
Upstream HGL exceeds critical elevation (Analysis)at node Id= B56 Run # 84
Upstream HGL exceeds critical elevation (Design) at node Id= B130 Run # 85
Upstream HGL exceeds critical elevation (Analysis)at node Id= B130 Run # 85
Run# 86  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B57 Run # 86
Upstream HGL exceeds critical elevation (Analysis)at node Id= B57 Run # 86
Run# 13  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B104 Run # 13
Upstream HGL exceeds critical elevation (Analysis)at node Id= B104 Run # 13
Run# 15  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B11 Run # 15
Upstream HGL exceeds critical elevation (Analysis)at node Id= B11 Run # 15
Upstream HGL exceeds critical elevation (Design) at node Id= B12 Run # 16
Upstream HGL exceeds critical elevation (Analysis)at node Id= B12 Run # 16
Upstream HGL exceeds critical elevation (Design) at node Id= B36 Run # 55
Upstream HGL exceeds critical elevation (Analysis)at node Id= B36 Run # 55
Upstream HGL exceeds critical elevation (Design) at node Id= B37 Run # 56
Upstream HGL exceeds critical elevation (Analysis)at node Id= B37 Run # 56
Upstream HGL exceeds critical elevation (Design) at node Id= B41 Run # 63
Upstream HGL exceeds critical elevation (Analysis)at node Id= B41 Run # 63
Upstream HGL exceeds critical elevation (Design) at node Id= B43 Run # 65
Upstream HGL exceeds critical elevation (Analysis)at node Id= B43 Run # 65
Upstream HGL exceeds critical elevation (Design) at node Id= B46 Run # 73
Upstream HGL exceeds critical elevation (Analysis)at node Id= B46 Run # 73
Upstream HGL exceeds critical elevation (Design) at node Id= B49 Run # 74
Upstream HGL exceeds critical elevation (Analysis)at node Id= B49 Run # 74
Upstream HGL exceeds critical elevation (Design) at node Id= B51 Run # 80
Upstream HGL exceeds critical elevation (Analysis)at node Id= B51 Run # 80
Upstream HGL exceeds critical elevation (Design) at node Id= B54 Run # 81
Upstream HGL exceeds critical elevation (Analysis)at node Id= B54 Run # 81
Run# 12  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B9 Run # 12
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Upstream HGL exceeds critical elevation (Analysis)at node Id= B9 Run # 12
Upstream HGL exceeds critical elevation (Design) at node Id= B10 Run # 14
Upstream HGL exceeds critical elevation (Analysis)at node Id= B10 Run # 14
Upstream HGL exceeds critical elevation (Design) at node Id= B42 Run # 62
Upstream HGL exceeds critical elevation (Analysis)at node Id= B42 Run # 62
Upstream HGL exceeds critical elevation (Design) at node Id= B44 Run # 64
Upstream HGL exceeds critical elevation (Analysis)at node Id= B44 Run # 64
Upstream HGL exceeds critical elevation (Design) at node Id= B47 Run # 72
Upstream HGL exceeds critical elevation (Analysis)at node Id= B47 Run # 72
Upstream HGL exceeds critical elevation (Design) at node Id= B52 Run # 79
Upstream HGL exceeds critical elevation (Analysis)at node Id= B52 Run # 79
Run# 11  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B103 Run # 11
Upstream HGL exceeds critical elevation (Analysis)at node Id= B103 Run # 11
Run# 9  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B102 Run # 9
Upstream HGL exceeds critical elevation (Analysis)at node Id= B102 Run # 9
Upstream HGL exceeds critical elevation (Design) at node Id= B8 Run # 10
Upstream HGL exceeds critical elevation (Analysis)at node Id= B8 Run # 10
Run# 4  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B101 Run # 4
Upstream HGL exceeds critical elevation (Analysis)at node Id= B101 Run # 4
Upstream HGL exceeds critical elevation (Design) at node Id= B5 Run # 6
Upstream HGL exceeds critical elevation (Analysis)at node Id= B5 Run # 6
Upstream HGL exceeds critical elevation (Design) at node Id= B7 Run # 8
Upstream HGL exceeds critical elevation (Analysis)at node Id= B7 Run # 8
Run# 1  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B1 Run # 1
Upstream HGL exceeds critical elevation (Analysis)at node Id= B1 Run # 1
Upstream HGL exceeds critical elevation (Design) at node Id= B2 Run # 2
Upstream HGL exceeds critical elevation (Analysis)at node Id= B2 Run # 2
Upstream HGL exceeds critical elevation (Design) at node Id= B3 Run # 3
Upstream HGL exceeds critical elevation (Analysis)at node Id= B3 Run # 3
Run# 5  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B4 Run # 5
Upstream HGL exceeds critical elevation (Analysis)at node Id= B4 Run # 5
Upstream HGL exceeds critical elevation (Design) at node Id= B6 Run # 7
Upstream HGL exceeds critical elevation (Analysis)at node Id= B6 Run # 7
```

# Appendix C.2.b
# Proposed Conditions – 2 year and 100 year

HouStorm (City Of Houston STORM DRAIN DESIGN) Version 2.1, Update: Nov/01/2007
Run @ 8/5/2011 2:55:20 PM

PROJECT NAME : Barryknoll Proposed
JOB NUMBER :
PROJECT DESCRIPTION :
PROJECT File: L:\120214\120-10308-000\545\4-0-Production\4-02-Design_Notes-Cal

DESIGN FREQUENCY : 2 Years
ANALYSYS FREQUENCY : 100 Years
MEASUREMENT UNITS: ENGLISH

OUTPUT FOR DESIGN FREQUENCY of: 2 Years

Runoff Computation for Design Frequency.

| ID | C Value | Area (acre) | Tc (min) | Tc Used (min) | Intensity (in/hr) | Supply Q (cfs) | Total Q (cfs) |
|---|---|---|---|---|---|---|---|
| B53 | 0.725 | 0.08 | 21.48 | 21.48 | 3.67 | 0.000 | 0.213 |
| | 0.9 | 0.04 | Roadway | | | | |
| | 0.55 | 0.04 | Residential Lots < 1/4 acre | | | | |
| B18 | 0.8 | 0.25 | 22.81 | 22.81 | 3.56 | 0.000 | 0.713 |
| | 0.9 | 0.15 | Roadway | | | | |
| | 0.65 | 0.10 | Multi Family < 20 units/acre | | | | |
| B19 | 0.708 | 0.65 | 24.28 | 24.28 | 3.46 | 0.000 | 1.590 |
| | 0.9 | 0.15 | Roadway | | | | |
| | 0.65 | 0.50 | Multi Family < 20 units/acre | | | | |
| B20 | 0.65 | 2.29 | 26.57 | 26.57 | 3.30 | 0.000 | 4.916 |
| | 0.65 | 2.29 | Multi Family < 20 units/acre | | | | |
| B21 | 0.8 | 2.82 | 27.00 | 27.00 | 3.28 | 0.000 | 7.388 |
| | 0.8 | 2.82 | Business District | | | | |
| B22 | 0.8 | 7.07 | 29.11 | 29.11 | 3.15 | 0.000 | 17.803 |
| | 0.8 | 7.07 | Business District | | | | |
| B23 | 0.9 | 0.27 | 22.93 | 22.93 | 3.56 | 0.000 | 0.864 |
| | 0.9 | 0.27 | Roadway | | | | |
| B8 | 0.8 | 4.02 | 27.78 | 27.78 | 3.23 | 0.000 | 10.377 |
| | 0.8 | 4.02 | Business District | | | | |
| B9 | 0.8 | 2.30 | 26.58 | 26.58 | 3.30 | 0.000 | 6.075 |
| | 0.8 | 2.30 | Business District | | | | |
| B10 | 0.8 | 0.69 | 24.31 | 24.31 | 3.45 | 0.000 | 1.907 |
| | 0.8 | 0.69 | Business District | | | | |
| B11 | 0.9 | 0.52 | 23.81 | 23.81 | 3.49 | 0.000 | 1.634 |
| | 0.9 | 0.52 | Roadway | | | | |
| B12 | 0.8 | 0.19 | 22.45 | 22.45 | 3.59 | 0.000 | 0.546 |
| B12-A | 0.8 | 1.15 | 25.24 | 25.24 | 3.39 | 0.000 | 3.119 |
| B13 | 0.8 | 0.36 | 23.37 | 23.37 | 3.52 | 0.000 | 1.015 |
| | 0.8 | 0.36 | Business District | | | | |
| B24 | 0.707 | 0.57 | 24.07 | 24.07 | 3.47 | 0.000 | 1.399 |
| | 0.9 | 0.13 | Roadway | | | | |
| | 0.65 | 0.44 | Multi Family < 20 units/acre | | | | |
| B25 | 0.736 | 0.29 | 23.04 | 23.04 | 3.55 | 0.000 | 0.757 |
| | 0.9 | 0.10 | Roadway | | | | |
| | 0.65 | 0.19 | Multi Family < 20 units/acre | | | | |
| B26 | 0.65 | 2.20 | 26.49 | 26.49 | 3.31 | 0.000 | 4.730 |
| | 0.65 | 2.20 | Multi Family < 20 units/acre | | | | |
| B36 | 0.9 | 0.27 | 22.93 | 22.93 | 3.56 | 0.000 | 0.864 |
| | 0.9 | 0.27 | Roadway | | | | |
| B37 | 0.9 | 0.28 | 22.98 | 22.98 | 3.55 | 0.000 | 0.895 |
| | 0.9 | 0.28 | Roadway | | | | |
| B38 | 0.65 | 5.75 | 28.61 | 28.61 | 3.18 | 0.000 | 11.874 |
| | 0.65 | 5.75 | Multi Family < 20 units/acre | | | | |
| B39 | 0.804 | 0.65 | 24.26 | 24.26 | 3.46 | 0.000 | 1.807 |
| | 0.9 | 0.40 | Roadway | | | | |
| | 0.65 | 0.25 | Multi Family < 20 units/acre | | | | |
| B40 | 0.65 | 5.73 | 28.60 | 28.60 | 3.18 | 0.000 | 11.834 |
| | 0.65 | 5.73 | Multi Family < 20 units/acre | | | | |
| B41 | 0.603 | 1.00 | 25.01 | 25.01 | 3.41 | 0.000 | 2.052 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 0.9 | 0.15 | Roadway | | | | |
| | 0.55 | 0.85 | Residential Lots < 1/4 acre | | | | |
| B42 | 0.55 | 5.26 | 28.40 | 28.40 | 3.19 | 0.000 | 9.227 |
| | 0.55 | 5.26 | Residential Lots < 1/4 acre | | | | |
| B43 | 0.729 | 0.39 | 23.47 | 23.47 | 3.52 | 0.000 | 1.000 |
| | 0.9 | 0.20 | Roadway | | | | |
| | 0.55 | 0.19 | Residential Lots < 1/4 acre | | | | |
| B44 | 0.55 | 3.30 | 27.34 | 27.34 | 3.25 | 0.000 | 5.906 |
| | 0.55 | 3.30 | Residential Lots < 1/4 acre | | | | |
| B52 | 0.45 | 1.14 | 25.23 | 25.23 | 3.39 | 0.000 | 1.740 |
| | 0.45 | 1.14 | Residential Lots 1/4 to 1/2 acre | | | | |
| B54 | 0.45 | 1.12 | 25.21 | 25.21 | 3.39 | 0.000 | 1.710 |
| | 0.45 | 1.12 | Residential Lots 1/4 to 1/2 acre | | | | |
| B14 | 0.9 | 0.27 | 22.94 | 22.94 | 3.56 | 0.000 | 0.864 |
| | 0.9 | 0.27 | Roadway | | | | |
| B15 | 0.8 | 85.67 | 36.90 | 36.90 | 2.76 | 0.000 | 189.070 |
| | 0.8 | 85.67 | Business District | | | | |
| B16 | 0.8 | 1.67 | 25.95 | 25.95 | 3.34 | 0.000 | 4.466 |
| | 0.8 | 1.67 | Business District | | | | |
| B17 | 0.8 | 0.33 | 23.21 | 23.21 | 3.53 | 0.000 | 0.933 |
| | 0.8 | 0.33 | Business District | | | | |
| B27 | 0.65 | 0.53 | 23.94 | 23.94 | 3.48 | 0.000 | 1.199 |
| | 0.65 | 0.53 | Multi Family < 20 units/acre | | | | |
| B28 | 0.8 | 1.95 | 26.25 | 26.25 | 3.32 | 0.000 | 5.184 |
| | 0.8 | 1.95 | Business District | | | | |
| B29 | 0.8 | 0.35 | 23.32 | 23.32 | 3.53 | 0.000 | 0.987 |
| | 0.8 | 0.35 | Business District | | | | |
| B55 | 0.8 | 0.48 | 23.80 | 23.80 | 3.49 | 0.000 | 1.341 |
| | 0.8 | 0.48 | Business District | | | | |
| B56 | 0.664 | 0.35 | 23.33 | 23.33 | 3.53 | 0.000 | 0.820 |
| | 0.9 | 0.20 | Roadway | | | | |
| | 0.35 | 0.15 | Grassy area or median | | | | |
| B57 | 0.609 | 30.59 | 33.26 | 33.26 | 2.93 | 0.000 | 54.497 |
| | 0.35 | 13.00 | Residential Lots > 1/2 acre | | | | |
| | 0.8 | 17.59 | Business District | | | | |
| B58 | 0.8 | 10.14 | 30.04 | 30.04 | 3.09 | 0.000 | 25.106 |
| | 0.8 | 10.14 | Business District | | | | |
| B35-A | 0.415 | 1.27 | 25.43 | 25.43 | 3.38 | 0.000 | 1.780 |
| | 0.35 | 1.12 | Residential Lots > 1/2 acre | | | | |
| | 0.9 | 0.15 | Roadway | | | | |
| B1 | 0.8 | 89.26 | 36.87 | 36.87 | 2.76 | 0.000 | 197.085 |
| | 0.8 | 89.26 | Business District | | | | |
| B2 | 0.8 | 0.53 | 24.01 | 24.01 | 3.48 | 0.000 | 1.474 |
| | 0.8 | 0.53 | Business District | | | | |
| B3 | 0.9 | 0.08 | 21.41 | 21.41 | 3.67 | 0.000 | 0.265 |
| | 0.9 | 0.08 | Roadway | | | | |
| B4 | 0.8 | 1.04 | 25.07 | 25.07 | 3.40 | 0.000 | 2.830 |
| | 0.8 | 1.04 | Business District | | | | |
| B5-A | 0.8 | 0.71 | 24.41 | 24.41 | 3.45 | 0.000 | 1.958 |
| | 0.8 | 0.71 | Business District | | | | |
| B6 | 0.8 | 0.76 | 24.52 | 24.52 | 3.44 | 0.000 | 2.092 |
| | 0.8 | 0.76 | Business District | | | | |
| B7-A | 0.82 | 0.41 | 22.74 | 22.74 | 3.57 | 0.000 | 1.200 |
| | 0.9 | 0.35 | Roadway | | | | |
| | 0.35 | 0.06 | Grassy area or median | | | | |
| B29-A | 0.8 | 3.11 | 27.21 | 27.21 | 3.26 | 0.000 | 8.115 |
| | 0.8 | 3.11 | Business District | | | | |
| B10-A | 0.8 | 1.44 | 25.66 | 25.66 | 3.36 | 0.000 | 3.873 |
| | 0.8 | 1.44 | Business District | | | | |
| B30 | 0.9 | 0.30 | 21.41 | 21.41 | 3.68 | 0.000 | 0.992 |
| | 0.9 | 0.30 | Roadway | | | | |
| B31 | 0.658 | 0.42 | 23.59 | 23.59 | 3.51 | 0.000 | 0.970 |
| | 0.9 | 0.13 | Roadway | | | | |
| | 0.55 | 0.29 | Residential Lots < 1/4 acre | | | | |
| B32 | 0.55 | 3.21 | 27.28 | 27.28 | 3.26 | 0.000 | 5.751 |
| | 0.55 | 3.21 | Residential Lots < 1/4 acre | | | | |
| B33 | 0.595 | 1.16 | 25.26 | 25.26 | 3.39 | 0.000 | 2.340 |
| | 0.9 | 0.15 | Roadway | | | | |
| | 0.55 | 1.01 | Residential Lots < 1/4 acre | | | | |
| B34 | 0.55 | 2.81 | 27.00 | 27.00 | 3.28 | 0.000 | 5.062 |
| | 0.55 | 2.81 | Residential Lots < 1/4 acre | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| B35 | 0.8 | 3.92 | 27.72 | 27.72 | 3.23 | 0.000 | 10.130 |
| | 0.8 | 3.92 | Business District | | | | |
| B45 | 0.9 | 0.40 | 23.53 | 23.53 | 3.51 | 0.000 | 1.264 |
| | 0.9 | 0.40 | Roadway | | | | |
| B46 | 0.783 | 0.15 | 22.15 | 22.15 | 3.62 | 0.000 | 0.425 |
| | 0.9 | 0.10 | Roadway | | | | |
| | 0.55 | 0.05 | Residential Lots < 1/4 acre | | | | |
| B47 | 0.55 | 1.04 | 25.06 | 25.06 | 3.40 | 0.000 | 1.946 |
| | 0.55 | 1.04 | Residential Lots < 1/4 acre | | | | |
| B48 | 0.783 | 0.15 | 22.17 | 22.17 | 3.61 | 0.000 | 0.425 |
| | 0.9 | 0.10 | Roadway | | | | |
| | 0.55 | 0.05 | Residential Lots < 1/4 acre | | | | |
| B49 | 0.55 | 1.09 | 25.15 | 25.15 | 3.40 | 0.000 | 2.036 |
| | 0.55 | 1.09 | Residential Lots < 1/4 acre | | | | |
| B50 | 0.65 | 9.14 | 29.76 | 29.76 | 3.11 | 0.000 | 18.480 |
| | 0.65 | 9.14 | Multi Family < 20 units/acre | | | | |
| B50-A | 0.795 | 0.43 | 23.60 | 23.60 | 3.51 | 0.000 | 1.199 |
| | 0.9 | 0.25 | Roadway | | | | |
| | 0.65 | 0.18 | Multi Family < 20 units/acre | | | | |
| B51 | 0.725 | 0.30 | 23.11 | 23.11 | 3.54 | 0.000 | 0.770 |
| | 0.9 | 0.15 | Roadway | | | | |
| | 0.55 | 0.15 | Residential Lots < 1/4 acre | | | | |
| B13-A | 0.8 | 1.24 | 25.38 | 25.38 | 3.38 | 0.000 | 3.354 |
| | 0.8 | 1.24 | Business District | | | | |
| B5-B | 0.9 | 0.12 | 21.92 | 21.92 | 3.63 | 0.000 | 0.392 |
| B7-B | 0.9 | 0.21 | 22.57 | 22.57 | 3.58 | 0.000 | 0.677 |
| B1-A | 0.8 | 1.42 | 25.63 | 25.63 | 3.36 | 0.000 | 3.821 |
| B1-B | 0.8 | 0.42 | 23.59 | 23.59 | 3.51 | 0.000 | 1.178 |
| B1-C | 0.8 | 0.26 | 22.91 | 22.91 | 3.56 | 0.000 | 0.740 |
| B1-D | 0.8 | 0.61 | 24.16 | 24.16 | 3.47 | 0.000 | 1.691 |
| B1-E | 0.65 | 0.65 | 24.28 | 24.28 | 3.46 | 0.000 | 1.461 |
| B1-F | 0.9 | 0.05 | 20.93 | 20.93 | 3.71 | 0.000 | 0.167 |
| B1-G | 0.65 | 0.69 | 24.37 | 24.37 | 3.45 | 0.000 | 1.548 |
| B5-C | 0.85 | 0.94 | 24.90 | 24.90 | 3.41 | 0.000 | 2.727 |

On Grade Inlet Configuration Data

| Inlet ID | Inlet Type | Inlet Length (ft) | Slopes Long (%) | Slopes Trans (%) | Gutter n | Gutter Depr. (ft) | Grate Width (ft) | Grate Type | Pond Width Allowed (ft) |
|---|---|---|---|---|---|---|---|---|---|
| B3 | Curb | 3.00 | 0.31 | 2.08 | 0.014 | 0.33 | n/a | n/a | 11.00 |
| B5-C | Curb | 8.00 | 0.40 | 2.08 | 0.014 | 0.33 | n/a | n/a | 11.00 |
| B2 | Curb | 3.00 | 0.50 | 2.08 | 0.014 | 0.33 | n/a | n/a | 11.00 |
| B1-C | Curb | 3.00 | 0.14 | 2.08 | 0.014 | 0.33 | n/a | n/a | 11.00 |

On Grade Inlets Computation Data.

| Inlet ID | Inlet Type | Total Q (cfs) | Intercept Capacity (cfs) | Q Bypass Allow (cfs) | Q Bypass Actual (cfs) | To Inlet ID | Required Length (ft) | Actual Length (ft) | Ponded Width (ft) |
|---|---|---|---|---|---|---|---|---|---|
| B3 | Curb | 0.265 | 0.265 | 0.500 | 0.000 | B7-A | 1.96 | 3.00 | 5.05 |
| B5-C | Curb | 2.727 | 2.727 | 1.000 | 0.000 | B5-A | 7.28 | 8.00 | 11.59 |
| B2 | Curb | 1.474 | 1.137 | 0.500 | 0.337 | B5-A | 5.36 | 3.00 | 8.80 |
| B1-C | Curb | 0.740 | 0.740 | 0.500 | 0.000 | B1-D | 2.72 | 3.00 | 8.65 |

Sag Inlets Configuration Data.

| Inlet ID | Inlet Type | Length/ Perim (ft) | Grate Area (sf) | Left-Slope Longi (%) | Left-Slope Transv (%) | Right-Slope Longi (%) | Right-Slope Transv (%) | Gutter n | Gutter DeprW (ft) | Head Allowed (ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| B4 | Grate | 10.00 | 3.28 | 0.50 | 2.08 | 0.50 | 2.08 | 0.014 | n/a | 1.50 |
| B6 | Grate | 10.00 | 3.28 | 0.50 | 2.08 | 0.50 | 2.08 | 0.014 | n/a | 1.50 |
| B7-A | Curb | 5.00 | 0.00 | 0.31 | 2.08 | 0.40 | 2.08 | 0.014 | 1.50 | 1.50 |
| B5-A | Curb | 5.00 | 0.00 | 0.40 | 2.08 | 0.43 | 2.08 | 0.014 | 1.50 | 1.50 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| B35-A | Curb | 5.00 | 0.00 | 0.30 | 2.08 | 0.32 | 2.08 | 0.014 | 1.50 | 1.50 |
| B14 | Curb | 5.00 | 0.00 | 0.42 | 2.08 | 0.30 | 2.08 | 0.014 | 1.50 | 1.50 |
| B17 | Curb | 5.00 | 0.00 | 0.30 | 2.08 | 0.70 | 2.08 | 0.014 | 1.50 | 1.50 |
| B16 | Curb | 5.00 | 0.00 | 0.50 | 2.08 | 0.50 | 2.08 | 0.014 | 1.50 | 1.50 |
| B10 | Curb | 5.00 | 0.00 | 0.56 | 2.08 | 0.33 | 2.08 | 0.014 | 1.50 | 1.50 |
| B11 | Curb | 8.00 | 0.00 | 1.00 | 2.08 | 0.56 | 2.08 | 0.014 | 1.50 | 1.50 |
| B12 | Grate | 10.00 | 3.28 | 0.50 | 2.08 | 0.50 | 2.08 | 0.014 | n/a | 1.50 |
| B13 | Curb | 5.00 | 0.00 | 0.30 | 2.08 | 0.42 | 2.08 | 0.014 | 1.50 | 1.50 |
| B23 | Curb | 5.00 | 0.00 | 0.32 | 2.08 | 0.41 | 2.08 | 0.014 | 1.50 | 1.50 |
| B36 | Curb | 5.00 | 0.00 | 2.08 | 2.08 | 0.95 | 2.08 | 0.014 | 1.50 | 1.50 |
| B37 | Curb | 5.00 | 0.00 | 1.09 | 2.08 | 0.50 | 2.08 | 0.014 | 1.50 | 1.50 |
| B28 | Grate | 10.00 | 3.28 | 0.50 | 2.08 | 0.50 | 2.08 | 0.014 | n/a | 1.50 |
| B29 | Grate | 10.00 | 3.28 | 0.50 | 2.08 | 0.50 | 2.08 | 0.014 | n/a | 1.50 |
| B30 | Curb | 5.00 | 0.00 | 0.31 | 2.08 | 0.32 | 2.08 | 0.014 | 1.50 | 1.50 |
| B39 | Curb | 5.00 | 0.00 | 0.30 | 2.08 | 0.52 | 2.08 | 0.014 | 1.50 | 1.50 |
| B45 | Curb | 5.00 | 0.00 | 0.41 | 2.08 | 0.58 | 2.08 | 0.014 | 1.50 | 1.50 |
| B50-A | Curb | 5.00 | 0.00 | 0.33 | 2.08 | 0.32 | 2.08 | 0.014 | 1.50 | 1.50 |
| B55 | Curb | 5.00 | 0.00 | 0.30 | 2.08 | 0.60 | 2.08 | 0.014 | 1.50 | 1.50 |
| B56 | Curb | 5.00 | 0.00 | 0.60 | 2.08 | 0.37 | 2.08 | 0.014 | 1.50 | 1.50 |
| B18 | Curb | 5.00 | 0.00 | 1.16 | 2.08 | 0.50 | 2.08 | 0.014 | 1.50 | 1.50 |
| B19 | Curb | 5.00 | 0.00 | 0.50 | 2.08 | 1.30 | 2.08 | 0.014 | 1.50 | 1.50 |
| B24 | Curb | 5.00 | 0.00 | 1.05 | 2.08 | 0.50 | 2.08 | 0.014 | 1.50 | 1.50 |
| B25 | Curb | 5.00 | 0.00 | 0.50 | 2.08 | 0.98 | 2.08 | 0.014 | 1.50 | 1.50 |
| B27 | Grate | 10.00 | 3.28 | 0.50 | 2.08 | 0.50 | 2.08 | 0.014 | n/a | 1.50 |
| B31 | Curb | 3.00 | 0.00 | 1.24 | 2.08 | 0.50 | 2.08 | 0.014 | 1.50 | 1.50 |
| B33 | Curb | 3.00 | 0.00 | 0.50 | 2.08 | 0.98 | 2.08 | 0.014 | 1.50 | 1.50 |
| B41 | Curb | 3.00 | 0.00 | 1.09 | 2.08 | 0.50 | 2.08 | 0.014 | 1.50 | 1.50 |
| B43 | Curb | 3.00 | 0.00 | 0.50 | 2.08 | 0.97 | 2.08 | 0.014 | 1.50 | 1.50 |
| B46 | Curb | 3.00 | 0.00 | 1.08 | 2.08 | 0.50 | 2.08 | 0.014 | 1.50 | 1.50 |
| B48 | Curb | 3.00 | 0.00 | 0.50 | 2.08 | 1.24 | 2.08 | 0.014 | 1.50 | 1.50 |
| B51 | Curb | 3.00 | 0.00 | 1.06 | 2.08 | 0.50 | 2.08 | 0.014 | 1.50 | 1.50 |
| B53 | Curb | 3.00 | 0.00 | 0.50 | 2.08 | 1.04 | 2.08 | 0.014 | 1.50 | 1.50 |
| B12-A | Grate | 10.00 | 3.28 | 0.50 | 2.08 | 0.50 | 2.08 | 0.014 | n/a | 1.50 |
| B10-A | Curb | 3.00 | 0.00 | 0.30 | 2.08 | 0.30 | 2.08 | 0.014 | 1.50 | 1.50 |
| B13-A | Grate | 10.00 | 3.28 | 0.42 | 2.08 | 0.42 | 2.08 | 0.014 | n/a | 1.50 |
| B5-B | Curb | 5.00 | 0.00 | 0.59 | 2.08 | 0.36 | 2.08 | 0.014 | 1.50 | 1.50 |
| B7-B | Curb | 5.00 | 0.00 | 0.36 | 2.08 | 0.59 | 2.08 | 0.014 | 1.50 | 1.50 |
| B1-B | Curb | 3.00 | 0.00 | 0.14 | 2.08 | 0.42 | 2.08 | 0.014 | 1.50 | 1.50 |
| B1-D | Curb | 3.00 | 0.00 | 0.14 | 2.08 | 0.42 | 2.08 | 0.014 | 1.50 | 1.50 |
| B1-E | Curb | 3.00 | 0.00 | 0.50 | 2.08 | 0.50 | 2.08 | 0.014 | 1.50 | 1.50 |
| B1-F | Curb | 3.00 | 0.00 | 0.48 | 2.08 | 0.48 | 2.08 | 0.014 | 1.50 | 1.50 |
| B1-G | Curb | 3.00 | 0.00 | 0.50 | 2.08 | 0.50 | 2.08 | 0.014 | 1.50 | 1.50 |

Sag Inlets Computation Data.

| Inlet ID | Inlet Type | Length (ft) | Grate Perim (ft) | Grate Area (sf) | Total Q (cfs) | Inlet Capacity (cfs) | Actual Head (ft) | Ponded Width Left (ft) | Ponded Width Right (ft) |
|---|---|---|---|---|---|---|---|---|---|
| B4 | Grate | n/a | 10.00 | 3.28 | 2.830 | 21.590 | 0.203 | 8.65 | 8.65 |
| B6 | Grate | n/a | 10.00 | 3.28 | 2.092 | 21.590 | 0.166 | 7.74 | 7.74 |
| B7-A | Curb | 5.00 | n/a | n/a | 1.200 | 15.022 | 0.258 | 6.88 | 6.54 |
| B5-A | Curb | 5.00 | n/a | n/a | 2.296 | 15.022 | 0.279 | 8.37 | 8.27 |
| B35-A | Curb | 5.00 | n/a | n/a | 1.780 | 15.022 | 0.268 | 7.98 | 7.93 |
| B14 | Curb | 5.00 | n/a | n/a | 0.864 | 15.022 | 0.254 | 5.77 | 6.11 |
| B17 | Curb | 5.00 | n/a | n/a | 0.933 | 15.022 | 0.255 | 6.30 | 5.38 |
| B16 | Curb | 5.00 | n/a | n/a | 4.466 | 15.022 | 0.360 | 10.29 | 10.29 |
| B10 | Curb | 5.00 | n/a | n/a | 1.907 | 15.022 | 0.270 | 7.31 | 8.08 |
| B11 | Curb | 8.00 | n/a | n/a | 1.634 | 24.036 | 0.256 | 6.20 | 6.92 |
| B12 | Grate | n/a | 10.00 | 3.28 | 0.546 | 21.590 | 0.068 | 4.66 | 4.66 |
| B13 | Curb | 5.00 | n/a | n/a | 1.015 | 15.022 | 0.256 | 6.49 | 6.11 |
| B23 | Curb | 5.00 | n/a | n/a | 0.864 | 15.022 | 0.254 | 6.06 | 5.77 |
| B36 | Curb | 5.00 | n/a | n/a | 0.864 | 15.022 | 0.254 | 4.23 | 4.90 |
| B37 | Curb | 5.00 | n/a | n/a | 0.895 | 15.022 | 0.254 | 4.86 | 5.63 |
| B28 | Grate | n/a | 10.00 | 3.28 | 5.184 | 21.590 | 0.304 | 10.87 | 10.87 |
| B29 | Grate | n/a | 10.00 | 3.28 | 0.987 | 21.590 | 0.101 | 5.87 | 5.87 |
| B30 | Curb | 5.00 | n/a | n/a | 0.992 | 15.022 | 0.255 | 6.39 | 6.35 |
| B39 | Curb | 5.00 | n/a | n/a | 1.807 | 15.022 | 0.268 | 8.08 | 7.31 |
| B45 | Curb | 5.00 | n/a | n/a | 1.264 | 15.022 | 0.259 | 6.63 | 6.25 |
| B50-A | Curb | 5.00 | n/a | n/a | 1.199 | 15.022 | 0.258 | 6.83 | 6.83 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| B55 | Curb | 5.00 | n/a | n/a | 1.341 | 15.022 | 0.260 | 7.21 | 6.35 |
| B56 | Curb | 5.00 | n/a | n/a | 0.820 | 15.022 | 0.254 | 5.29 | 5.77 |
| B18 | Curb | 5.00 | n/a | n/a | 0.713 | 15.022 | 0.253 | 4.42 | 5.19 |
| B19 | Curb | 5.00 | n/a | n/a | 1.590 | 15.022 | 0.264 | 6.97 | 5.82 |
| B24 | Curb | 5.00 | n/a | n/a | 1.399 | 15.022 | 0.261 | 5.77 | 6.68 |
| B25 | Curb | 5.00 | n/a | n/a | 0.757 | 15.022 | 0.253 | 5.29 | 4.66 |
| B27 | Grate | n/a | 10.00 | 3.28 | 1.199 | 21.590 | 0.115 | 6.30 | 6.30 |
| B31 | Curb | 3.00 | n/a | n/a | 0.970 | 9.013 | 0.264 | 4.90 | 5.82 |
| B33 | Curb | 3.00 | n/a | n/a | 2.340 | 9.013 | 0.334 | 8.08 | 7.12 |
| B41 | Curb | 3.00 | n/a | n/a | 2.052 | 9.013 | 0.315 | 6.63 | 7.69 |
| B43 | Curb | 3.00 | n/a | n/a | 1.000 | 9.013 | 0.265 | 5.87 | 5.19 |
| B46 | Curb | 3.00 | n/a | n/a | 0.425 | 9.013 | 0.253 | 3.70 | 4.28 |
| B48 | Curb | 3.00 | n/a | n/a | 0.425 | 9.013 | 0.253 | 4.28 | 3.61 |
| B51 | Curb | 3.00 | n/a | n/a | 0.770 | 9.013 | 0.259 | 4.62 | 5.34 |
| B53 | Curb | 3.00 | n/a | n/a | 0.213 | 9.013 | 0.251 | 3.27 | 2.88 |
| B12-A | Grate | n/a | 10.00 | 3.28 | 3.119 | 21.590 | 0.217 | 8.99 | 8.99 |
| B10-A | Curb | 3.00 | n/a | n/a | 3.873 | 9.013 | 0.481 | 10.72 | 10.72 |
| B13-A | Grate | n/a | 10.00 | 3.28 | 3.354 | 21.590 | 0.228 | 9.57 | 9.57 |
| B5-B | Curb | 5.00 | n/a | n/a | 0.392 | 15.022 | 0.251 | 3.99 | 4.42 |
| B7-B | Curb | 5.00 | n/a | n/a | 0.677 | 15.022 | 0.253 | 5.38 | 4.90 |
| B1-B | Curb | 3.00 | n/a | n/a | 1.178 | 9.013 | 0.271 | 7.93 | 6.44 |
| B1-D | Curb | 3.00 | n/a | n/a | 1.691 | 9.013 | 0.294 | 9.09 | 7.40 |
| B1-E | Curb | 3.00 | n/a | n/a | 1.461 | 9.013 | 0.283 | 6.78 | 6.78 |
| B1-F | Curb | 3.00 | n/a | n/a | 0.167 | 9.013 | 0.250 | 3.03 | 3.03 |
| B1-G | Curb | 3.00 | n/a | n/a | 1.548 | 9.013 | 0.287 | 6.92 | 6.92 |

Cumulative Junction Discharge Computations

| Node I.D. | Node Type | Weighted C-Value | Cumulat. Dr.Area (acres) | Cumulat. Tc (min) | Intens. (in/hr) | User Supply Q cfs) | Additional Q in Node (cfs) | Total Disch. (cfs) |
|---|---|---|---|---|---|---|---|---|
| B3 | Curb | 0.900 | 0.08 | 21.41 | 3.67 | | 0.00 | 0.265 |
| B101-A | JctBx | 0.798 | 93.97 | 37.00 | 2.75 | | 0.00 | 206.557 |
| B102 | CrcMh | 0.799 | 97.83 | 37.91 | 2.72 | | 0.00 | 212.174 |
| B4 | Grate | 0.800 | 1.04 | 25.07 | 3.40 | | 0.00 | 2.830 |
| B6 | Grate | 0.800 | 0.76 | 24.52 | 3.44 | | 0.00 | 2.092 |
| B7-A | Curb | 0.820 | 0.41 | 22.74 | 3.57 | | 0.00 | 1.200 |
| B5-A | Curb | 0.800 | 0.71 | 24.41 | 3.45 | | 0.00 | 1.958 |
| B120 | Junct | 0.645 | 84.42 | 41.74 | 2.57 | | 0.00 | 139.645 |
| B35 | CrcMh | 0.800 | 3.92 | 27.72 | 3.23 | | 0.00 | 10.130 |
| B35-A | Curb | 0.415 | 1.27 | 25.43 | 3.38 | | 0.00 | 1.780 |
| B14 | Curb | 0.900 | 0.27 | 22.94 | 3.56 | | 0.00 | 0.864 |
| B107 | JctBx | 0.748 | 305.02 | 47.44 | 2.37 | | 0.00 | 541.678 |
| B108 | CrcMh | 0.750 | 312.68 | 48.13 | 2.35 | | 0.00 | 551.261 |
| B109 | Junct | 0.665 | 116.67 | 46.92 | 2.39 | | 0.00 | 185.415 |
| B17 | Curb | 0.800 | 0.33 | 23.21 | 3.53 | | 0.00 | 0.933 |
| B110 | CrcMh | 0.665 | 116.34 | 46.75 | 2.39 | | 0.00 | 185.188 |
| B16 | Curb | 0.800 | 1.67 | 25.95 | 3.34 | | 0.00 | 4.466 |
| B112 | CrcMh | 0.662 | 111.48 | 44.82 | 2.46 | | 0.00 | 181.496 |
| B21 | CrcMh | 0.800 | 2.82 | 27.00 | 3.28 | | 0.00 | 7.388 |
| B22 | Junct | 0.800 | 9.89 | 29.11 | 3.15 | | 0.00 | 24.905 |
| B102-B | CrcMh | 0.799 | 98.16 | 37.91 | 2.72 | | 0.00 | 212.981 |
| B8 | CrcMh | 0.800 | 4.02 | 27.78 | 3.23 | | 0.00 | 10.377 |
| B9 | CrcMh | 0.800 | 2.30 | 26.58 | 3.30 | | 0.00 | 6.075 |
| B105 | JctBx | 0.800 | 99.37 | 38.65 | 2.69 | | 0.00 | 213.345 |
| B10 | Curb | 0.800 | 0.69 | 24.31 | 3.45 | | 0.00 | 1.907 |
| B11 | Curb | 0.900 | 0.52 | 23.81 | 3.49 | | 0.00 | 1.634 |
| B12 | Grate | 0.800 | 0.19 | 22.45 | 3.59 | | 0.00 | 0.546 |
| B106 | Junct | 0.800 | 102.68 | 38.98 | 2.67 | | 0.00 | 219.423 |
| B13 | Curb | 0.800 | 0.36 | 23.37 | 3.52 | | 0.00 | 1.015 |
| B5-C | Curb | 0.850 | 0.94 | 24.90 | 3.41 | | 0.00 | 2.727 |
| B102-A | Junct | 0.799 | 96.03 | 37.72 | 2.72 | | 0.00 | 208.889 |
| B114 | Junct | 0.648 | 98.53 | 44.62 | 2.46 | | 0.00 | 157.454 |
| B23 | Curb | 0.900 | 0.27 | 22.93 | 3.56 | | 0.00 | 0.864 |
| B121 | CrcMh | 0.641 | 79.23 | 41.57 | 2.57 | | 0.00 | 130.564 |
| B122 | CrcMh | 0.805 | 10.69 | 32.50 | 2.96 | | 0.00 | 25.514 |
| B36 | Curb | 0.900 | 0.27 | 22.93 | 3.56 | | 0.00 | 0.864 |
| B37 | Curb | 0.900 | 0.28 | 22.98 | 3.55 | | 0.00 | 0.895 |
| B58 | CrcMh | 0.800 | 10.14 | 30.04 | 3.09 | | 0.00 | 25.106 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| B137 | CrcMh | 0.800 | 4.02 | 28.03 | 3.21 | 0.00 | 10.377 |
| B124 | Junct | 0.615 | 68.54 | 41.48 | 2.58 | 0.00 | 108.582 |
| B38 | CrcMh | 0.650 | 5.75 | 28.61 | 3.18 | 0.00 | 11.874 |
| B115 | Junct | 0.648 | 98.26 | 44.62 | 2.46 | 0.00 | 156.855 |
| B116 | Junct | 0.648 | 97.73 | 44.35 | 2.47 | 0.00 | 156.573 |
| B28 | Grate | 0.800 | 1.95 | 26.25 | 3.32 | 0.00 | 5.184 |
| B117 | CrcMh | 0.645 | 95.78 | 43.38 | 2.51 | 0.00 | 154.781 |
| B29 | Grate | 0.800 | 0.35 | 23.32 | 3.53 | 0.00 | 0.987 |
| B119 | Junct | 0.651 | 87.83 | 43.22 | 2.51 | 0.00 | 143.671 |
| B30 | Curb | 0.900 | 0.30 | 21.41 | 3.68 | 0.00 | 0.992 |
| B1 | CrcMh | 0.800 | 89.26 | 36.87 | 2.76 | 0.00 | 197.085 |
| B101 | CrcMh | 0.798 | 93.97 | 37.00 | 2.75 | 0.00 | 206.557 |
| B2 | Curb | 0.800 | 0.53 | 24.01 | 3.48 | 0.00 | 1.474 |
| B125 | Junct | 0.612 | 62.79 | 40.30 | 2.62 | 0.00 | 100.663 |
| B39 | Curb | 0.804 | 0.65 | 24.26 | 3.46 | 0.00 | 1.807 |
| B126 | CrcMh | 0.610 | 62.14 | 40.19 | 2.62 | 0.00 | 99.457 |
| B127 | CrcMh | 0.562 | 9.95 | 28.45 | 3.19 | 0.00 | 17.827 |
| B40 | CrcMh | 0.650 | 5.73 | 28.60 | 3.18 | 0.00 | 11.834 |
| B129 | Junct | 0.615 | 46.46 | 37.87 | 2.72 | 0.00 | 77.664 |
| B130 | CrcMh | 0.613 | 46.06 | 37.79 | 2.72 | 0.00 | 76.780 |
| B45 | Curb | 0.900 | 0.40 | 23.53 | 3.51 | 0.00 | 1.264 |
| B132 | Junct | 0.615 | 43.63 | 36.37 | 2.78 | 0.00 | 74.592 |
| B50 | CrcMh | 0.650 | 9.14 | 29.76 | 3.11 | 0.00 | 18.480 |
| B133 | Junct | 0.605 | 34.49 | 35.81 | 2.81 | 0.00 | 58.587 |
| B50-A | Curb | 0.795 | 0.43 | 23.60 | 3.51 | 0.00 | 1.199 |
| B134 | CrcMh | 0.603 | 34.06 | 35.55 | 2.82 | 0.00 | 57.862 |
| B135 | CrcMh | 0.612 | 31.42 | 34.70 | 2.86 | 0.00 | 54.974 |
| B55 | Curb | 0.800 | 0.48 | 23.80 | 3.49 | 0.00 | 1.341 |
| B56 | Curb | 0.664 | 0.35 | 23.33 | 3.53 | 0.00 | 0.820 |
| B136 | JctBx | 0.609 | 30.59 | 33.46 | 2.92 | 0.00 | 54.497 |
| B57 | CrcMh | 0.609 | 30.59 | 33.26 | 2.93 | 0.00 | 54.497 |
| B18 | Curb | 0.800 | 0.25 | 22.81 | 3.56 | 0.00 | 0.713 |
| B19 | Curb | 0.708 | 0.65 | 24.28 | 3.46 | 0.00 | 1.590 |
| B113 | CrcMh | 0.669 | 3.06 | 27.47 | 3.25 | 0.00 | 6.642 |
| B24 | Curb | 0.707 | 0.57 | 24.07 | 3.47 | 0.00 | 1.399 |
| B25 | Curb | 0.736 | 0.29 | 23.04 | 3.55 | 0.00 | 0.757 |
| B27 | Grate | 0.650 | 0.53 | 23.94 | 3.48 | 0.00 | 1.199 |
| B118 | CrcMh | 0.563 | 7.60 | 27.33 | 3.25 | 0.00 | 13.921 |
| B31 | Curb | 0.563 | 3.63 | 27.30 | 3.26 | 0.00 | 6.650 |
| B33 | Curb | 0.563 | 3.97 | 27.01 | 3.27 | 0.00 | 7.321 |
| B32 | CrcMh | 0.550 | 3.21 | 27.28 | 3.26 | 0.00 | 5.751 |
| B34 | CrcMh | 0.550 | 2.81 | 27.00 | 3.28 | 0.00 | 5.062 |
| B41 | Curb | 0.558 | 6.26 | 28.42 | 3.19 | 0.00 | 11.145 |
| B43 | Curb | 0.569 | 3.69 | 27.36 | 3.25 | 0.00 | 6.829 |
| B42 | CrcMh | 0.550 | 5.26 | 28.40 | 3.19 | 0.00 | 9.227 |
| B44 | CrcMh | 0.550 | 3.30 | 27.34 | 3.25 | 0.00 | 5.906 |
| B46 | Curb | 0.579 | 1.19 | 25.09 | 3.40 | 0.00 | 2.345 |
| B48 | Curb | 0.579 | 2.43 | 25.18 | 3.39 | 0.00 | 4.774 |
| B47 | CrcMh | 0.550 | 1.04 | 25.06 | 3.40 | 0.00 | 1.946 |
| B49 | CrcMh | 0.550 | 1.09 | 25.15 | 3.40 | 0.00 | 2.036 |
| B51 | Curb | 0.507 | 1.44 | 25.26 | 3.39 | 0.00 | 2.475 |
| B53 | Curb | 0.490 | 2.64 | 25.35 | 3.38 | 0.00 | 4.372 |
| B52 | CrcMh | 0.450 | 1.14 | 25.23 | 3.39 | 0.00 | 1.740 |
| B54 | CrcMh | 0.450 | 1.12 | 25.21 | 3.39 | 0.00 | 1.710 |
| B15 | CrcMh | 0.800 | 85.67 | 36.90 | 2.76 | 0.00 | 189.070 |
| B20 | CrcMh | 0.650 | 2.29 | 26.57 | 3.30 | 0.00 | 4.916 |
| B26 | CrcMh | 0.650 | 2.20 | 26.49 | 3.31 | 0.00 | 4.730 |
| B12-A | Grate | 0.800 | 1.15 | 25.24 | 3.39 | 0.00 | 3.119 |
| B111 | JctBx | 0.674 | 3.19 | 27.52 | 3.24 | 0.00 | 6.966 |
| B128 | Junct | 0.619 | 52.19 | 40.07 | 2.63 | 0.00 | 84.920 |
| B29-A | CrcMh | 0.800 | 3.11 | 27.21 | 3.26 | 0.00 | 8.115 |
| B117-A | Junct | 0.650 | 87.53 | 43.22 | 2.51 | 0.00 | 142.993 |
| B10-A | Curb | 0.800 | 1.44 | 25.66 | 3.36 | 0.00 | 3.873 |
| B13-A | Grate | 0.800 | 1.24 | 25.38 | 3.38 | 0.00 | 3.354 |
| B105-A | CrcMh | 0.800 | 100.81 | 38.86 | 2.68 | 0.00 | 215.739 |
| B105-B | CrcMh | 0.800 | 102.05 | 38.86 | 2.68 | 0.00 | 218.394 |
| B107-A | CrcMh | 0.000 | 0.00 | 0.00 | 0.00 | 0.00 | 0.000 |
| B101-B | CrcMh | 0.798 | 95.09 | 37.48 | 2.73 | 0.00 | 207.472 |
| B5-B | Curb | 0.900 | 0.12 | 21.92 | 3.63 | 0.00 | 0.392 |
| B7-B | Curb | 0.900 | 0.21 | 22.57 | 3.58 | 0.00 | 0.677 |
| B101-C | CrcMh | 0.800 | 0.76 | 24.65 | 3.43 | 0.00 | 2.092 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| B138 | CrcMh | 0.800 | 6.32 | 28.50 | 3.18 | 0.00 | 16.095 |
| B139 | CrcMh | 0.800 | 6.51 | 29.95 | 3.10 | 0.00 | 16.144 |
| B140 | CrcMh | 0.800 | 7.66 | 31.41 | 3.02 | 0.00 | 18.513 |
| B1-A | CrcMh | 0.800 | 1.42 | 25.63 | 3.36 | 0.00 | 3.821 |
| B1-B | Curb | 0.800 | 0.42 | 23.59 | 3.51 | 0.00 | 1.178 |
| B1-C | Curb | 0.800 | 0.26 | 22.91 | 3.56 | 0.00 | 0.740 |
| B1-D | Curb | 0.800 | 0.61 | 24.16 | 3.47 | 0.00 | 1.691 |
| B1-E | Curb | 0.650 | 0.65 | 24.28 | 3.46 | 0.00 | 1.461 |
| B1-F | Curb | 0.729 | 1.31 | 50.07 | 2.29 | 0.00 | 2.192 |
| B1-G | Curb | 0.650 | 0.69 | 24.37 | 3.45 | 0.00 | 1.548 |
| B101-E | CrcMh | 0.763 | 2.79 | 29.64 | 3.12 | 0.00 | 6.635 |
| B101-F | CrcMh | 0.798 | 93.36 | 36.91 | 2.76 | 0.00 | 205.472 |
| B101-D | CrcMh | 0.800 | 2.10 | 28.44 | 3.19 | 0.00 | 5.354 |
| OUT | Outlt | 0.750 | 312.68 | 48.13 | 2.35 | 0.00 | 551.261 |

Conveyance Configuration Data

| Run # | Node I.D. US | Node I.D. DS | FlowLine Elev. US (ft) | FlowLine Elev. DS (ft) | Shape # | Span (ft) | Rise (ft) | Length (ft) | Slope (%) | n_value |
|---|---|---|---|---|---|---|---|---|---|---|
| 144 | B42 | B41 | 75.85 | 72.86 | Cir 1 | 0.00 | 1.50 | 18.0 | 16.845 | 0.013 |
| 145 | B41 | B127 | 72.86 | 72.70 | Cir 1 | 0.00 | 2.00 | 16.0 | 1.000 | 0.013 |
| 146 | B44 | B43 | 75.85 | 72.86 | Cir 1 | 0.00 | 1.50 | 18.0 | 16.845 | 0.013 |
| 1 | B1 | B101-F | 71.72 | 71.32 | Box 2 | 8.00 | 5.00 | 26.0 | 1.539 | 0.015 |
| 3 | B101 | B101-A | 71.30 | 71.28 | Cir 1 | 0.00 | 5.00 | 9.0 | 0.222 | 0.013 |
| 30 | B2 | B101 | 74.00 | 73.90 | Cir 1 | 0.00 | 2.00 | 8.0 | 1.250 | 0.013 |
| 31 | B3 | B101 | 74.46 | 73.90 | Cir 1 | 0.00 | 2.00 | 31.4 | 1.782 | 0.013 |
| 4 | B101-A | B101-B | 71.28 | 70.96 | Box 2 | 9.00 | 5.00 | 162.0 | 0.198 | 0.015 |
| 35 | B4 | B102 | 73.50 | 73.15 | Cir 1 | 0.00 | 2.00 | 15.0 | 2.334 | 0.013 |
| 32 | B5-A | B101-B | 73.90 | 73.80 | Cir 1 | 0.00 | 2.00 | 5.0 | 2.000 | 0.013 |
| 36 | B6 | B101-C | 74.87 | 74.49 | Cir 1 | 0.00 | 1.25 | 36.0 | 1.056 | 0.013 |
| 33 | B7-A | B101-B | 73.90 | 73.80 | Cir 1 | 0.00 | 2.00 | 20.0 | 0.500 | 0.013 |
| 7 | B102 | B102-B | 70.67 | 70.38 | Box 2 | 9.00 | 5.00 | 150.0 | 0.193 | 0.015 |
| 8 | B102-B | B105 | 70.38 | 69.91 | Box 2 | 9.00 | 5.00 | 245.0 | 0.192 | 0.015 |
| 60 | B8 | B137 | 71.30 | 70.80 | Cir 1 | 0.00 | 1.50 | 89.0 | 0.562 | 0.013 |
| 62 | B9 | B138 | 72.94 | 72.62 | Cir 1 | 0.00 | 2.00 | 124.0 | 0.258 | 0.013 |
| 64 | B12 | B139 | 72.70 | 72.62 | Cir 1 | 0.00 | 2.00 | 8.0 | 1.000 | 0.013 |
| 40 | B10 | B105 | 72.47 | 72.39 | Cir 1 | 0.00 | 2.00 | 8.0 | 1.000 | 0.013 |
| 41 | B11 | B105 | 70.08 | 69.89 | Cir 1 | 0.00 | 5.00 | 19.0 | 1.000 | 0.013 |
| 9 | B105 | B105-A | 69.91 | 69.76 | Box 2 | 9.00 | 5.00 | 73.0 | 0.205 | 0.015 |
| 12 | B106 | B107 | 69.12 | 68.82 | Box 2 | 9.00 | 5.00 | 235.0 | 0.128 | 0.015 |
| 66 | B12-A | B140 | 69.26 | 69.18 | Cir 1 | 0.00 | 1.50 | 8.0 | 1.000 | 0.013 |
| 114 | B117-A | B119 | 68.49 | 68.46 | Box 2 | 8.00 | 6.00 | 76.0 | 0.039 | 0.015 |
| 63 | B138 | B139 | 69.82 | 69.79 | Cir 1 | 0.00 | 5.00 | 155.0 | 0.019 | 0.013 |
| 65 | B139 | B140 | 69.79 | 69.36 | Cir 1 | 0.00 | 5.00 | 317.0 | 0.136 | 0.013 |
| 67 | B140 | B108 | 69.36 | 68.57 | Cir 1 | 0.00 | 5.00 | 280.0 | 0.282 | 0.013 |
| 148 | B127 | B126 | 72.20 | 71.76 | Cir 1 | 0.00 | 2.50 | 44.0 | 1.000 | 0.013 |
| 109 | B126 | B125 | 68.81 | 68.80 | Box 2 | 8.00 | 6.00 | 19.0 | 0.053 | 0.015 |
| 108 | B128 | B126 | 68.82 | 68.81 | Box 2 | 8.00 | 6.00 | 19.0 | 0.053 | 0.015 |
| 107 | B129 | B128 | 68.99 | 68.82 | Box 2 | 8.00 | 6.00 | 342.0 | 0.050 | 0.015 |
| 106 | B130 | B129 | 69.00 | 68.99 | Box 2 | 8.00 | 6.00 | 14.0 | 0.071 | 0.015 |
| 105 | B132 | B130 | 69.10 | 69.00 | Box 2 | 8.00 | 6.00 | 215.0 | 0.047 | 0.015 |
| 104 | B133 | B132 | 69.15 | 69.10 | Box 2 | 8.00 | 6.00 | 85.0 | 0.059 | 0.015 |
| 103 | B134 | B133 | 69.16 | 69.15 | Box 2 | 8.00 | 6.00 | 31.0 | 0.032 | 0.015 |
| 102 | B135 | B134 | 69.22 | 69.16 | Box 2 | 8.00 | 6.00 | 119.0 | 0.050 | 0.015 |
| 101 | B136 | B135 | 69.31 | 69.22 | Box 2 | 8.00 | 6.00 | 175.0 | 0.051 | 0.015 |
| 100 | B57 | B136 | 70.97 | 70.96 | Box 1 | 4.00 | 4.00 | 40.0 | 0.025 | 0.015 |
| 142 | B45 | B129 | 72.52 | 72.50 | Cir 1 | 0.00 | 2.00 | 4.0 | 0.500 | 0.013 |
| 138 | B47 | B46 | 75.19 | 74.00 | Cir 1 | 0.00 | 1.50 | 16.0 | 7.458 | 0.013 |
| 139 | B46 | B48 | 73.92 | 73.36 | Cir 1 | 0.00 | 2.00 | 32.0 | 1.750 | 0.013 |
| 140 | B49 | B48 | 74.93 | 73.36 | Cir 1 | 0.00 | 1.50 | 16.0 | 9.860 | 0.013 |
| 141 | B48 | B130 | 73.36 | 72.50 | Cir 1 | 0.00 | 2.00 | 44.0 | 1.955 | 0.013 |
| 137 | B50 | B132 | 72.00 | 71.60 | Cir 1 | 0.00 | 3.00 | 50.0 | 0.800 | 0.013 |
| 136 | B50-A | B133 | 72.52 | 72.50 | Cir 1 | 0.00 | 2.00 | 4.0 | 0.500 | 0.013 |
| 132 | B52 | B51 | 75.49 | 74.59 | Cir 1 | 0.00 | 1.25 | 16.0 | 5.634 | 0.013 |
| 134 | B54 | B53 | 75.28 | 74.27 | Cir 1 | 0.00 | 1.25 | 16.0 | 6.325 | 0.013 |
| 133 | B51 | B53 | 73.01 | 72.51 | Cir 1 | 0.00 | 2.00 | 31.0 | 1.613 | 0.013 |
| 135 | B53 | B134 | 72.51 | 72.30 | Cir 1 | 0.00 | 2.00 | 44.0 | 0.477 | 0.013 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 130 | B55 | B135 | 72.77 | 72.73 | Cir 1 | 0.00 | 2.00 | 4.0 | 1.000 | 0.013 |
| 44 | B13 | B106 | 71.73 | 71.62 | Cir 1 | 0.00 | 2.00 | 7.0 | 1.572 | 0.013 |
| 157 | B29-A | B117-A | 71.60 | 71.52 | Cir 1 | 0.00 | 2.00 | 30.0 | 0.267 | 0.013 |
| 10 | B105-A | B105-B | 69.76 | 69.16 | Box 2 | 11.0 | 5.00 | 303.0 | 0.198 | 0.015 |
| 11 | B105-B | B106 | 69.16 | 69.08 | Box 2 | 11.0 | 5.00 | 39.0 | 0.205 | 0.015 |
| 42 | B10-A | B105-A | 72.37 | 72.29 | Cir 1 | 0.00 | 2.00 | 15.0 | 0.533 | 0.015 |
| 43 | B13-A | B105-B | 71.83 | 71.70 | Cir 1 | 0.00 | 2.00 | 14.0 | 0.929 | 0.013 |
| 45 | B14 | B106 | 72.92 | 72.60 | Cir 1 | 0.00 | 2.00 | 32.0 | 1.000 | 0.013 |
| 50 | B15 | B107 | 68.49 | 68.00 | Box 1 | 10.0 | 8.00 | 487.0 | 0.101 | 0.015 |
| 13 | B107 | B108 | 68.00 | 67.74 | Box 1 | 10.0 | 8.00 | 280.0 | 0.093 | 0.015 |
| 14 | B108 | OUT | 67.74 | 67.73 | Box 1 | 10.0 | 8.00 | 17.0 | 0.059 | 0.015 |
| 122 | B109 | B107 | 68.05 | 68.00 | Box 2 | 8.00 | 6.00 | 103.0 | 0.049 | 0.015 |
| 178 | B17 | B109 | 71.55 | 71.50 | Cir 1 | 0.00 | 2.00 | 4.0 | 1.250 | 0.013 |
| 177 | B16 | B110 | 72.10 | 71.57 | Cir 1 | 0.00 | 2.00 | 26.0 | 2.039 | 0.013 |
| 121 | B110 | B109 | 68.07 | 68.05 | Box 2 | 8.00 | 6.00 | 35.0 | 0.057 | 0.015 |
| 120 | B112 | B110 | 68.26 | 68.07 | Box 2 | 8.00 | 6.00 | 385.0 | 0.049 | 0.015 |
| 176 | B20 | B111 | 73.91 | 73.34 | Cir 1 | 0.00 | 1.50 | 203.0 | 0.281 | 0.013 |
| 173 | B18 | B111 | 71.85 | 71.65 | Cir 1 | 0.00 | 2.00 | 20.0 | 1.000 | 0.013 |
| 174 | B19 | B111 | 71.77 | 71.65 | Cir 1 | 0.00 | 2.00 | 12.0 | 1.000 | 0.013 |
| 175 | B111 | B110 | 68.15 | 68.07 | Box 1 | 9.00 | 6.00 | 42.0 | 0.190 | 0.015 |
| 172 | B26 | B113 | 74.02 | 73.45 | Cir 1 | 0.00 | 1.50 | 207.0 | 0.275 | 0.013 |
| 170 | B24 | B113 | 72.68 | 72.48 | Cir 1 | 0.00 | 2.00 | 12.0 | 1.667 | 0.013 |
| 171 | B25 | B113 | 72.68 | 72.48 | Cir 1 | 0.00 | 2.00 | 22.0 | 0.909 | 0.013 |
| 173 | B113 | B112 | 72.48 | 71.76 | Cir 1 | 0.00 | 2.00 | 40.0 | 1.800 | 0.013 |
| 168 | B21 | B22 | 73.00 | 72.17 | Cir 1 | 0.00 | 2.00 | 172.0 | 0.483 | 0.013 |
| 169 | B22 | B112 | 71.44 | 70.76 | Cir 1 | 0.00 | 3.00 | 34.0 | 2.000 | 0.013 |
| 167 | B23 | B114 | 71.80 | 71.78 | Cir 1 | 0.00 | 2.00 | 4.0 | 0.500 | 0.013 |
| 119 | B114 | B112 | 68.28 | 68.26 | Box 2 | 8.00 | 6.00 | 39.0 | 0.051 | 0.015 |
| 118 | B115 | B114 | 68.32 | 68.28 | Box 2 | 8.00 | 6.00 | 80.0 | 0.050 | 0.015 |
| 117 | B116 | B115 | 68.35 | 68.32 | Box 2 | 8.00 | 6.00 | 53.0 | 0.057 | 0.015 |
| 116 | B117 | B116 | 68.44 | 68.35 | Box 2 | 8.00 | 6.00 | 185.0 | 0.049 | 0.015 |
| 166 | B27 | B115 | 72.73 | 72.28 | Cir 1 | 0.00 | 1.50 | 180.0 | 0.250 | 0.013 |
| 5 | B101-B | B102-A | 70.96 | 70.84 | Box 2 | 9.00 | 5.00 | 74.0 | 0.162 | 0.015 |
| 37 | B101-C | B102 | 73.50 | 73.15 | Cir 1 | 0.00 | 2.00 | 20.0 | 1.750 | 0.013 |
| 38 | B5-B | B102-B | 73.20 | 72.87 | Cir 1 | 0.00 | 2.00 | 4.0 | 8.278 | 0.013 |
| 39 | B7-B | B102-B | 73.20 | 72.89 | Cir 1 | 0.00 | 2.00 | 20.0 | 1.550 | 0.013 |
| 20 | B1-A | B101-D | 73.73 | 72.75 | Cir 1 | 0.00 | 1.50 | 497.0 | 0.197 | 0.013 |
| 21 | B1-B | B101-D | 74.43 | 74.20 | Cir 1 | 0.00 | 1.50 | 50.0 | 0.460 | 0.013 |
| 22 | B1-C | B101-D | 73.63 | 73.60 | Cir 1 | 0.00 | 2.00 | 33.0 | 0.091 | 0.013 |
| 27 | B101-D | B101-E | 72.75 | 71.56 | Cir 1 | 0.00 | 2.00 | 303.0 | 0.393 | 0.013 |
| 26 | B1-G | B101-E | 74.26 | 73.96 | Cir 1 | 0.00 | 2.00 | 77.0 | 0.390 | 0.013 |
| 23 | B1-D | B1-F | 74.64 | 74.32 | Cir 1 | 0.00 | 2.00 | 1610.0 | 0.020 | 0.013 |
| 24 | B1-E | B1-F | 74.89 | 74.32 | Cir 1 | 0.00 | 2.00 | 88.0 | 0.648 | 0.013 |
| 28 | B101-E | B101-F | 71.56 | 71.32 | Cir 1 | 0.00 | 2.50 | 19.0 | 1.263 | 0.013 |
| 2 | B101-F | B101 | 71.32 | 71.31 | Box 1 | 9.00 | 5.00 | 24.0 | 0.042 | 0.015 |
| 147 | B43 | B127 | 72.86 | 72.70 | Cir 1 | 0.00 | 2.00 | 16.0 | 1.000 | 0.013 |
| 25 | B1-F | B101-F | 74.32 | 73.69 | Cir 1 | 0.00 | 2.00 | 52.0 | 1.212 | 0.013 |
| 34 | B5-C | B102-A | 73.39 | 73.34 | Cir 1 | 0.00 | 2.00 | 5.0 | 1.000 | 0.013 |
| 6 | B102-A | B102 | 70.84 | 70.67 | Box 2 | 9.00 | 5.00 | 70.0 | 0.243 | 0.015 |
| 131 | B56 | B135 | 72.93 | 72.73 | Cir 1 | 0.00 | 2.00 | 15.0 | 1.333 | 0.013 |
| 165 | B28 | B116 | 72.01 | 71.82 | Cir 1 | 0.00 | 2.00 | 19.0 | 1.000 | 0.013 |
| 164 | B29 | B117 | 71.58 | 71.44 | Cir 1 | 0.00 | 2.00 | 32.0 | 0.438 | 0.013 |
| 158 | B30 | B119 | 71.95 | 71.94 | Cir 1 | 0.00 | 2.00 | 4.0 | 0.250 | 0.013 |
| 159 | B32 | B31 | 75.27 | 73.54 | Cir 1 | 0.00 | 1.50 | 15.0 | 11.611 | 0.013 |
| 160 | B31 | B118 | 72.95 | 72.72 | Cir 1 | 0.00 | 2.00 | 16.0 | 1.438 | 0.013 |
| 161 | B34 | B33 | 75.49 | 72.62 | Cir 1 | 0.00 | 1.50 | 15.0 | 19.493 | 0.013 |
| 162 | B33 | B118 | 72.93 | 72.72 | Cir 1 | 0.00 | 2.00 | 15.0 | 1.400 | 0.013 |
| 163 | B118 | B117 | 72.72 | 71.76 | Cir 1 | 0.00 | 2.00 | 42.0 | 2.286 | 0.013 |
| 115 | B119 | B117 | 68.46 | 68.44 | Box 2 | 8.00 | 6.00 | 32.0 | 0.063 | 0.015 |
| 113 | B120 | B117-A | 68.63 | 68.49 | Box 2 | 8.00 | 6.00 | 276.0 | 0.051 | 0.015 |
| 112 | B121 | B120 | 68.65 | 68.63 | Box 2 | 8.00 | 6.00 | 33.0 | 0.061 | 0.015 |
| 111 | B124 | B121 | 68.71 | 68.65 | Box 2 | 8.00 | 6.00 | 28.0 | 0.214 | 0.015 |
| 110 | B125 | B124 | 68.80 | 68.71 | Box 2 | 8.00 | 6.00 | 193.0 | 0.047 | 0.015 |
| 151 | B58 | B122 | 71.60 | 71.25 | Box 1 | 4.00 | 3.00 | 430.0 | 0.081 | 0.015 |
| 152 | B36 | B122 | 72.28 | 72.25 | Cir 1 | 0.00 | 2.00 | 17.0 | 0.176 | 0.013 |
| 153 | B37 | B122 | 72.51 | 72.25 | Cir 1 | 0.00 | 2.00 | 27.0 | 0.963 | 0.013 |
| 154 | B122 | B121 | 70.40 | 70.15 | Box 1 | 4.00 | 3.00 | 31.0 | 0.806 | 0.015 |
| 156 | B35 | B120 | 74.77 | 72.08 | Cir 1 | 0.00 | 2.00 | 20.0 | 13.573 | 0.013 |
| 155 | B35-A | B120 | 72.40 | 72.08 | Cir 1 | 0.00 | 2.00 | 17.0 | 1.883 | 0.013 |
| 150 | B38 | B124 | 72.00 | 70.95 | Cir 1 | 0.00 | 2.00 | 38.0 | 2.764 | 0.013 |
| 149 | B39 | B125 | 72.30 | 72.26 | Cir 1 | 0.00 | 2.00 | 4.0 | 1.000 | 0.013 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 143 | B40 | B128 | 71.84 | 71.83 | Cir | 1 | 0.00 | 2.00 | 52.0 | 0.019 | 0.013 |
| 61 | B137 | B138 | 70.44 | 70.22 | Cir | 1 | 0.00 | 5.00 | 105.0 | 0.210 | 0.013 |

Conveyance Hydraulic Computations. Tailwater = 75.700 (ft)

| Run # | Hyd. Gr.line US (ft) | Hyd. Gr.line DS (ft) | Crit.Elev US (ft) | Fr.Slope (%) | Depth Unif. (ft) | Depth Actual (ft) | Velocity Unif. (f/s) | Velocity Actual (f/s) | Q (cfs) | Cap (cfs) | Junc Loss (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 144* | 77.04 | 76.95 | 76.66 | 0.765 | 0.47 | 1.50 | 19.41 | 5.22 | 9.2 | 43.3 | 0.000 |
| 145* | 76.95 | 76.91 | 76.66 | 0.241 | 0.99 | 2.00 | 7.18 | 5.68 | 11.1 | 22.7 | 0.000 |
| 146* | 76.98 | 76.92 | 76.79 | 0.313 | 0.38 | 1.50 | 17.09 | 5.08 | 5.9 | 43.3 | 0.000 |
| 1* | 78.43 | 78.43 | 78.78 | 0.035 | 1.10 | 5.00 | 11.16 | 7.35 | 197.1 | 1310.1 | 0.000 |
| 3 | 78.40 | 78.34 | 78.33 | 0.624 | 5.00 | 5.00 | 10.52 | 10.52 | 206.6 | 123.3 | 0.000 |
| 30* | 78.40 | 78.40 | 78.18 | 0.004 | 0.33 | 2.00 | 4.39 | 3.08 | 1.5 | 25.4 | 0.000 |
| 31* | 78.40 | 78.40 | 78.18 | 0.000 | 0.13 | 2.00 | 2.96 | 2.33 | 0.3 | 30.3 | 0.000 |
| 4 | 78.34 | 78.07 | 78.49 | 0.029 | 2.07 | 5.00 | 5.56 | 2.30 | 206.6 | 543.7 | 0.000 |
| 35* | 77.82 | 77.82 | 77.11 | 0.016 | 0.39 | 2.00 | 6.64 | 3.69 | 2.8 | 34.7 | 0.000 |
| 32* | 78.07 | 78.07 | 77.40 | 0.007 | 0.34 | 2.00 | 5.64 | 3.33 | 2.0 | 32.1 | 0.000 |
| 36* | 77.86 | 77.82 | 77.47 | 0.104 | 0.48 | 1.25 | 4.79 | 3.74 | 2.1 | 6.7 | 0.000 |
| 33* | 78.07 | 78.07 | 77.40 | 0.003 | 0.37 | 2.00 | 2.99 | 2.92 | 1.2 | 16.1 | 0.000 |
| 7 | 77.82 | 77.57 | 77.67 | 0.030 | 2.12 | 5.00 | 5.56 | 2.36 | 212.2 | 537.9 | 0.000 |
| 8 | 77.57 | 77.18 | 77.98 | 0.030 | 2.13 | 5.00 | 5.56 | 2.37 | 213.0 | 535.8 | 0.000 |
| 60 | 78.06 | 77.20 | 77.85 | 0.968 | 1.50 | 1.50 | 5.87 | 5.87 | 10.4 | 7.9 | 0.000 |
| 62 | 77.21 | 76.98 | 77.02 | 0.072 | 1.03 | 2.00 | 3.71 | 1.93 | 6.1 | 11.5 | 0.000 |
| 64* | 76.95 | 76.95 | 78.03 | 0.001 | 0.21 | 2.00 | 3.02 | 1.34 | 0.5 | 22.7 | 0.000 |
| 40* | 77.18 | 77.18 | 77.31 | 0.007 | 0.39 | 2.00 | 4.38 | 3.29 | 1.9 | 22.7 | 0.000 |
| 41* | 77.18 | 77.18 | 77.31 | 0.000 | 0.28 | 5.00 | 3.70 | 2.77 | 1.6 | 261.6 | 0.000 |
| 9 | 77.18 | 77.05 | 78.06 | 0.030 | 2.08 | 5.00 | 5.68 | 2.37 | 213.3 | 554.5 | 0.000 |
| 12 | 76.43 | 76.21 | 79.15 | 0.032 | 2.51 | 5.00 | 4.86 | 2.44 | 219.4 | 437.1 | 0.000 |
| 66* | 76.54 | 76.53 | 77.30 | 0.087 | 0.56 | 1.50 | 5.18 | 4.07 | 3.1 | 10.5 | 0.000 |
| 114 | 76.55 | 76.53 | 78.12 | 0.011 | 3.14 | 6.00 | 2.85 | 1.49 | 143.0 | 270.7 | 0.000 |
| 63 | 76.98 | 76.95 | 78.22 | 0.004 | 2.34 | 5.00 | 1.78 | 0.82 | 16.1 | 36.4 | 0.000 |
| 65 | 76.95 | 76.53 | 78.29 | 0.004 | 1.39 | 5.00 | 3.64 | 0.82 | 16.1 | 96.3 | 0.000 |
| 67 | 76.53 | 75.76 | 78.10 | 0.005 | 1.24 | 5.00 | 4.90 | 0.94 | 18.5 | 138.9 | 0.000 |
| 148* | 76.91 | 76.83 | 77.54 | 0.187 | 1.15 | 2.50 | 8.06 | 6.14 | 17.8 | 41.2 | 0.000 |
| 109 | 76.83 | 76.82 | 77.44 | 0.005 | 2.18 | 6.00 | 2.85 | 1.04 | 99.5 | 312.5 | 0.000 |
| 108 | 76.84 | 76.83 | 77.54 | 0.004 | 1.95 | 6.00 | 2.73 | 0.88 | 84.9 | 312.5 | 0.000 |
| 107 | 77.00 | 76.84 | 78.20 | 0.003 | 1.88 | 6.00 | 2.59 | 0.81 | 77.7 | 303.7 | 0.000 |
| 106 | 77.01 | 77.00 | 77.61 | 0.003 | 1.64 | 6.00 | 2.92 | 0.80 | 76.8 | 364.1 | 0.000 |
| 105 | 77.10 | 77.01 | 77.73 | 0.003 | 1.85 | 6.00 | 2.52 | 0.78 | 74.6 | 293.8 | 0.000 |
| 104 | 77.15 | 77.10 | 77.45 | 0.002 | 1.45 | 6.00 | 2.52 | 0.61 | 58.6 | 330.4 | 0.000 |
| 103 | 77.16 | 77.15 | 77.44 | 0.002 | 1.78 | 6.00 | 2.03 | 0.60 | 57.9 | 244.7 | 0.000 |
| 102 | 77.22 | 77.16 | 77.15 | 0.002 | 1.48 | 6.00 | 2.33 | 0.57 | 55.0 | 305.9 | 0.000 |
| 101 | 77.31 | 77.22 | 77.62 | 0.002 | 1.45 | 6.00 | 2.34 | 0.57 | 54.5 | 308.9 | 0.000 |
| 100 | 77.35 | 77.31 | 77.25 | 0.118 | 4.00 | 4.00 | 3.41 | 3.41 | 54.5 | 25.1 | 0.000 |
| 142* | 77.00 | 77.00 | 77.16 | 0.003 | 0.38 | 2.00 | 3.04 | 2.94 | 1.3 | 16.1 | 0.000 |
| 138* | 77.03 | 77.03 | 76.79 | 0.034 | 0.26 | 1.50 | 9.26 | 3.52 | 1.9 | 28.8 | 0.000 |
| 139* | 77.03 | 77.02 | 76.95 | 0.011 | 0.38 | 2.00 | 5.67 | 3.50 | 2.3 | 30.1 | 0.000 |
| 140* | 77.03 | 77.02 | 76.86 | 0.037 | 0.25 | 1.50 | 10.35 | 3.67 | 2.0 | 33.1 | 0.000 |
| 141* | 77.02 | 77.01 | 76.86 | 0.044 | 0.53 | 2.00 | 7.25 | 4.29 | 4.8 | 31.8 | 0.000 |
| 137* | 77.14 | 77.10 | 76.65 | 0.076 | 1.15 | 3.00 | 7.44 | 5.84 | 18.5 | 59.9 | 0.000 |
| 136* | 77.15 | 77.15 | 76.59 | 0.003 | 0.37 | 2.00 | 2.99 | 2.92 | 1.2 | 16.1 | 0.000 |
| 132* | 77.19 | 77.18 | 75.49 | 0.072 | 0.28 | 1.25 | 8.29 | 3.56 | 1.7 | 15.4 | 0.000 |
| 134* | 77.19 | 77.17 | 76.71 | 0.069 | 0.27 | 1.25 | 8.59 | 3.55 | 1.7 | 16.3 | 0.000 |
| 133* | 77.18 | 77.17 | 76.93 | 0.012 | 0.40 | 2.00 | 5.60 | 3.48 | 2.5 | 28.9 | 0.000 |
| 135* | 77.17 | 77.16 | 76.71 | 0.037 | 0.72 | 2.00 | 4.26 | 4.12 | 4.4 | 15.7 | 0.000 |
| 130* | 77.22 | 77.22 | 76.63 | 0.003 | 0.33 | 2.00 | 3.95 | 2.97 | 1.3 | 22.7 | 0.000 |
| 44* | 76.43 | 76.43 | 78.40 | 0.002 | 0.26 | 2.00 | 4.26 | 2.80 | 1.0 | 28.5 | 0.000 |
| 157 | 76.59 | 76.55 | 77.52 | 0.128 | 1.23 | 2.00 | 4.02 | 2.58 | 8.1 | 11.7 | 0.000 |
| 10 | 77.05 | 76.51 | 78.30 | 0.019 | 1.81 | 5.00 | 5.41 | 1.96 | 215.7 | 695.8 | 0.000 |
| 11 | 76.51 | 76.43 | 79.06 | 0.020 | 1.81 | 5.00 | 5.49 | 1.99 | 218.4 | 708.2 | 0.000 |
| 42 | 77.13 | 77.05 | 77.79 | 0.039 | 0.71 | 2.00 | 3.87 | 1.23 | 3.9 | 14.4 | 0.000 |
| 43* | 76.51 | 76.51 | 78.81 | 0.022 | 0.53 | 2.00 | 5.03 | 3.93 | 3.4 | 21.9 | 0.000 |
| 45* | 76.43 | 76.43 | 78.40 | 0.001 | 0.27 | 2.00 | 3.46 | 2.71 | 0.9 | 22.7 | 0.000 |
| 50 | 76.60 | 76.21 | 78.50 | 0.020 | 3.66 | 8.00 | 5.17 | 2.36 | 189.1 | 428.1 | 0.000 |
| 13 | 76.21 | 75.76 | 79.30 | 0.161 | 8.00 | 8.00 | 6.77 | 6.77 | 541.7 | 411.3 | 0.000 |
| 14 | 75.76 | 75.73 | 78.00 | 0.167 | 8.00 | 8.00 | 6.89 | 6.89 | 551.3 | 327.3 | 0.000 |
| 122 | 76.24 | 76.21 | 78.07 | 0.019 | 3.52 | 6.00 | 3.30 | 1.93 | 185.4 | 300.1 | 0.000 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 178* | 76.24 | 76.24 | 78.07 | 0.002 | 0.26 | 2.00 | 3.83 | 2.70 | 0.9 | 25.4 | 0.000 |
| 177* | 76.26 | 76.25 | 79.17 | 0.039 | 0.50 | 2.00 | 7.22 | 4.21 | 4.5 | 32.4 | 0.000 |
| 121 | 76.25 | 76.24 | 78.71 | 0.018 | 3.28 | 6.00 | 3.53 | 1.93 | 185.2 | 325.6 | 0.000 |
| 120 | 76.38 | 76.25 | 78.71 | 0.018 | 3.42 | 6.00 | 3.31 | 1.89 | 181.5 | 302.6 | 0.000 |
| 176 | 76.46 | 76.33 | 77.23 | 0.217 | 1.10 | 1.50 | 3.55 | 2.78 | 4.9 | 5.6 | 0.000 |
| 173* | 76.33 | 76.33 | 77.68 | 0.001 | 0.24 | 2.00 | 3.27 | 2.50 | 0.7 | 22.7 | 0.000 |
| 174* | 76.33 | 76.33 | 77.79 | 0.005 | 0.36 | 2.00 | 4.15 | 3.48 | 1.6 | 22.7 | 0.000 |
| 175 | 76.33 | 76.25 | 78.90 | 0.000 | 0.37 | 6.00 | 2.11 | 0.13 | 7.0 | 345.5 | 0.000 |
| 172 | 76.56 | 76.41 | 76.98 | 0.201 | 1.07 | 1.50 | 3.51 | 2.68 | 4.7 | 5.5 | 0.000 |
| 170* | 76.41 | 76.41 | 77.81 | 0.004 | 0.30 | 2.00 | 4.78 | 3.04 | 1.4 | 29.3 | 0.000 |
| 171* | 76.41 | 76.41 | 77.56 | 0.001 | 0.26 | 2.00 | 3.22 | 2.51 | 0.8 | 21.7 | 0.000 |
| 173* | 76.41 | 76.38 | 78.71 | 0.085 | 0.64 | 2.00 | 7.74 | 4.75 | 6.6 | 30.5 | 0.000 |
| 168* | 76.61 | 76.42 | 78.73 | 0.106 | 0.96 | 2.00 | 4.92 | 4.92 | 7.4 | 15.8 | 0.000 |
| 169* | 76.42 | 76.38 | 78.73 | 0.138 | 1.05 | 3.00 | 11.26 | 6.45 | 24.9 | 94.7 | 0.000 |
| 167* | 76.39 | 76.39 | 77.92 | 0.001 | 0.32 | 2.00 | 2.72 | 2.71 | 0.9 | 16.1 | 0.000 |
| 119 | 76.39 | 76.38 | 78.11 | 0.013 | 3.05 | 6.00 | 3.23 | 1.64 | 157.5 | 308.5 | 0.000 |
| 118 | 76.42 | 76.39 | 78.36 | 0.013 | 3.05 | 6.00 | 3.22 | 1.63 | 156.9 | 304.6 | 0.000 |
| 117 | 76.44 | 76.42 | 78.29 | 0.013 | 2.93 | 6.00 | 3.34 | 1.63 | 156.6 | 324.1 | 0.000 |
| 116 | 76.51 | 76.44 | 78.00 | 0.013 | 3.05 | 6.00 | 3.18 | 1.61 | 154.8 | 300.5 | 0.000 |
| 166 | 76.85 | 76.42 | 77.30 | 0.013 | 0.49 | 1.50 | 2.41 | 0.68 | 1.2 | 5.3 | 0.000 |
| 5 | 78.07 | 77.97 | 77.67 | 0.029 | 2.22 | 5.00 | 5.20 | 2.31 | 207.5 | 492.6 | 0.000 |
| 37* | 77.82 | 77.82 | 78.13 | 0.008 | 0.36 | 2.00 | 5.48 | 3.38 | 2.1 | 30.1 | 0.000 |
| 38* | 77.57 | 77.57 | 77.64 | 0.000 | 0.11 | 2.00 | 5.70 | 2.35 | 0.4 | 65.4 | 0.000 |
| 39* | 77.57 | 77.57 | 77.64 | 0.001 | 0.21 | 2.00 | 3.75 | 2.33 | 0.7 | 28.3 | 0.000 |
| 20 | 79.78 | 79.45 | 76.96 | 0.131 | 1.03 | 1.50 | 2.95 | 2.16 | 3.8 | 4.7 | 0.000 |
| 21 | 79.68 | 79.45 | 77.52 | 0.012 | 0.41 | 1.50 | 2.98 | 0.67 | 1.2 | 7.2 | 0.000 |
| 22 | 79.48 | 79.45 | 77.53 | 0.001 | 0.45 | 2.00 | 1.42 | 0.24 | 0.7 | 6.8 | 0.000 |
| 27 | 79.45 | 78.43 | 77.78 | 0.056 | 0.85 | 2.00 | 4.20 | 1.70 | 5.4 | 14.2 | 0.000 |
| 26 | 78.73 | 78.43 | 77.79 | 0.005 | 0.45 | 2.00 | 2.95 | 0.49 | 1.5 | 14.2 | 0.000 |
| 23 | 78.66 | 78.43 | 77.43 | 0.006 | 1.03 | 2.00 | 1.04 | 0.54 | 1.7 | 3.2 | 0.000 |
| 24* | 78.43 | 78.43 | 77.92 | 0.004 | 0.38 | 2.00 | 3.47 | 3.09 | 1.5 | 18.3 | 0.000 |
| 28* | 78.43 | 78.43 | 78.96 | 0.026 | 0.64 | 2.50 | 6.67 | 4.48 | 6.6 | 46.3 | 0.000 |
| 2 | 78.43 | 78.40 | 78.32 | 0.113 | 5.00 | 5.00 | 4.57 | 4.57 | 205.5 | 124.9 | 0.000 |
| 147* | 76.92 | 76.91 | 76.79 | 0.090 | 0.75 | 2.00 | 6.31 | 4.79 | 6.8 | 22.7 | 0.000 |
| 25* | 78.43 | 78.43 | 77.92 | 0.009 | 0.40 | 2.00 | 4.88 | 3.43 | 2.2 | 25.0 | 0.000 |
| 34* | 77.97 | 77.97 | 77.67 | 0.014 | 0.47 | 2.00 | 4.86 | 3.65 | 2.7 | 22.7 | 0.000 |
| 6 | 77.97 | 77.82 | 78.17 | 0.029 | 1.94 | 5.00 | 5.99 | 2.32 | 208.9 | 602.9 | 0.000 |
| 131* | 77.22 | 77.22 | 76.63 | 0.001 | 0.24 | 2.00 | 3.77 | 3.05 | 0.8 | 26.2 | 0.000 |
| 165* | 76.45 | 76.44 | 78.45 | 0.052 | 0.65 | 2.00 | 5.84 | 4.40 | 5.2 | 22.7 | 0.000 |
| 164 | 76.65 | 76.51 | 77.22 | 0.002 | 0.35 | 2.00 | 2.69 | 0.31 | 1.0 | 15.0 | 0.000 |
| 158 | 76.54 | 76.53 | 77.40 | 0.002 | 0.40 | 2.00 | 2.22 | 0.32 | 1.0 | 11.4 | 0.000 |
| 159* | 76.73 | 76.68 | 77.14 | 0.297 | 0.41 | 1.50 | 14.86 | 5.02 | 5.8 | 35.9 | 0.000 |
| 160* | 76.68 | 76.67 | 77.14 | 0.086 | 0.67 | 2.00 | 7.14 | 4.75 | 6.6 | 27.2 | 0.000 |
| 161* | 76.72 | 76.68 | 77.04 | 0.230 | 0.33 | 1.50 | 17.22 | 4.79 | 5.1 | 46.6 | 0.000 |
| 162* | 76.68 | 76.67 | 77.04 | 0.104 | 0.71 | 2.00 | 7.26 | 4.90 | 7.3 | 26.9 | 0.000 |
| 163* | 76.67 | 76.51 | 77.32 | 0.375 | 0.89 | 2.00 | 10.33 | 6.20 | 13.9 | 34.4 | 0.000 |
| 115 | 76.53 | 76.51 | 77.61 | 0.011 | 2.65 | 6.00 | 3.39 | 1.50 | 143.7 | 340.6 | 0.000 |
| 113 | 76.66 | 76.55 | 78.27 | 0.011 | 2.81 | 6.00 | 3.10 | 1.45 | 139.6 | 306.8 | 0.000 |
| 112 | 76.68 | 76.66 | 78.10 | 0.009 | 2.51 | 6.00 | 3.25 | 1.36 | 130.6 | 335.4 | 0.000 |
| 111 | 76.74 | 76.68 | 78.20 | 0.006 | 1.43 | 6.00 | 4.75 | 1.13 | 108.6 | 630.6 | 0.000 |
| 110 | 76.82 | 76.74 | 77.38 | 0.005 | 2.30 | 6.00 | 2.74 | 1.05 | 100.7 | 294.2 | 0.000 |
| 151 | 76.81 | 76.70 | 77.27 | 0.055 | 2.16 | 3.00 | 2.91 | 2.09 | 25.1 | 30.6 | 0.000 |
| 152 | 76.73 | 76.70 | 77.40 | 0.001 | 0.41 | 2.00 | 1.88 | 0.28 | 0.9 | 9.5 | 0.000 |
| 153* | 76.70 | 76.70 | 77.62 | 0.002 | 0.27 | 2.00 | 3.45 | 2.76 | 0.9 | 22.3 | 0.000 |
| 154* | 76.70 | 76.68 | 77.39 | 0.057 | 0.96 | 3.00 | 6.66 | 5.90 | 25.5 | 96.3 | 0.000 |
| 156* | 76.70 | 76.66 | 79.07 | 0.199 | 0.47 | 2.00 | 17.96 | 5.48 | 10.1 | 83.7 | 0.000 |
| 155* | 76.66 | 76.66 | 77.77 | 0.006 | 0.33 | 2.00 | 5.36 | 3.24 | 1.8 | 31.2 | 0.000 |
| 150* | 76.84 | 76.74 | 78.25 | 0.273 | 0.77 | 2.00 | 10.61 | 5.82 | 11.9 | 37.8 | 0.000 |
| 149* | 76.82 | 76.82 | 76.99 | 0.006 | 0.38 | 2.00 | 4.31 | 3.24 | 1.8 | 22.7 | 0.000 |
| 143 | 76.98 | 76.84 | 77.50 | 0.271 | 2.00 | 2.00 | 3.77 | 3.77 | 11.8 | 3.2 | 0.000 |
| 61 | 77.20 | 76.98 | 78.24 | 0.002 | 1.00 | 5.00 | 3.73 | 0.53 | 10.4 | 119.7 | 0.000 |

* Supercritical flow.

SUMMARY OF STORM DRAIN STRUCTURE QUANTITIES

NOTE:
The convey length should be from upstream to downstream inside box.
This length may also be used as Pay Item.
Using hydraulic length, from node center to node center, may result in profile error,

and this length should not be used as Pay Item.

LINKS:

| Type of Convey Structure | Material | Rise (ft) | Span (ft) | Number of Links of this type | Quantity (ft) |
|---|---|---|---|---|---|
| Circular | Concrete | 1.5 | 0.0 | 13 | 1332.0 |
| Circular | Concrete | 2.0 | 0.0 | 55 | 3354.43 |
| Box | Concrete | 5.0 | 8.0 | 1 | 52.0 |
| Circular | Concrete | 5.0 | 0.0 | 6 | 885.0 |
| Box | Concrete | 5.0 | 9.0 | 8 | 2042.0 |
| Circular | Concrete | 1.25 | 0.0 | 3 | 68.0 |
| Box | Concrete | 6.0 | 8.0 | 22 | 5074.0 |
| Circular | Concrete | 2.5 | 0.0 | 2 | 63.0 |
| Box | Concrete | 4.0 | 4.0 | 1 | 40.0 |
| Circular | Concrete | 3.0 | 0.0 | 2 | 84.0 |
| Box | Concrete | 5.0 | 11.0 | 2 | 684.0 |
| Box | Concrete | 8.0 | 10.0 | 3 | 784.0 |
| Box | Concrete | 6.0 | 9.0 | 1 | 42.0 |
| Box | Concrete | 3.0 | 4.0 | 2 | 461.0 |

NODES:

| Type of Inlet Structure | Type of Grate | Inlet Length (ft) | Grate Width (ft) | Grate Length (ft) | Grate Area (ft) | Grate Perimeter (ft) | Quantity (each) |
|---|---|---|---|---|---|---|---|
| Curb On Grade | | 3.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3 |
| Junction Box | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 5 |
| Circular Manhole | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 51 |
| Grate In Sag | Parallel | 0.0 | 0.0 | 0.0 | 3.28 | 10.0 | 8 |
| Curb In Sag | | 5.0 | 0.0 | 0.0 | 0.0 | 0.0 | 23 |
| Conduit Junction | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 16 |
| Curb In Sag | | 8.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1 |
| Curb On Grade | | 8.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1 |
| Curb In Sag | | 3.0 | 0.0 | 0.0 | 0.0 | 0.0 | 14 |
| Outlet | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1 |

OUTPUT FOR ANALYSYS FREQUENCY of: 100 Years

Runoff Computation for Analysis Frequency.

| ID | C Value | Area (acre) | Tc (min) | Tc Used (min) | Intensity (in/hr) | Supply Q (cfs) | Total Q (cfs) |
|---|---|---|---|---|---|---|---|
| B53 | 0.725 | 0.08 | 21.48 | 21.48 | 7.43 | 0.000 | 0.431 |
| | 0.9 | 0.04 | Roadway | | | | |
| | 0.55 | 0.04 | Residential Lots < 1/4 acre | | | | |
| B18 | 0.8 | 0.25 | 22.81 | 22.81 | 7.26 | 0.000 | 1.453 |
| | 0.9 | 0.15 | Roadway | | | | |
| | 0.65 | 0.10 | Multi Family < 20 units/acre | | | | |
| B19 | 0.708 | 0.65 | 24.28 | 24.28 | 7.09 | 0.000 | 3.262 |
| | 0.9 | 0.15 | Roadway | | | | |
| | 0.65 | 0.50 | Multi Family < 20 units/acre | | | | |
| B20 | 0.65 | 2.29 | 26.57 | 26.57 | 6.84 | 0.000 | 10.177 |
| | 0.65 | 2.29 | Multi Family < 20 units/acre | | | | |
| B21 | 0.8 | 2.82 | 27.00 | 27.00 | 6.79 | 0.000 | 15.322 |
| | 0.8 | 2.82 | Business District | | | | |
| B22 | 0.8 | 7.07 | 29.11 | 29.11 | 6.58 | 0.000 | 37.214 |
| | 0.8 | 7.07 | Business District | | | | |
| B23 | 0.9 | 0.27 | 22.93 | 22.93 | 7.25 | 0.000 | 1.762 |
| | 0.9 | 0.27 | Roadway | | | | |
| B8 | 0.8 | 4.02 | 27.78 | 27.78 | 6.71 | 0.000 | 21.584 |
| | 0.8 | 4.02 | Business District | | | | |
| B9 | 0.8 | 2.30 | 26.58 | 26.58 | 6.84 | 0.000 | 12.578 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 0.8 | 2.30 | Business District | | | | |
| B10 | 0.8 | 0.69 | 24.31 | 24.31 | 7.09 | 0.000 | 3.912 |
| | 0.8 | 0.69 | Business District | | | | |
| B11 | 0.9 | 0.52 | 23.81 | 23.81 | 7.15 | 0.000 | 3.344 |
| | 0.9 | 0.52 | Roadway | | | | |
| B12 | 0.8 | 0.19 | 22.45 | 22.45 | 7.31 | 0.000 | 1.111 |
| B12-A | 0.8 | 1.15 | 25.24 | 25.24 | 6.98 | 0.000 | 6.423 |
| B13 | 0.8 | 0.36 | 23.37 | 23.37 | 7.20 | 0.000 | 2.073 |
| | 0.8 | 0.36 | Business District | | | | |
| B24 | 0.707 | 0.57 | 24.07 | 24.07 | 7.11 | 0.000 | 2.867 |
| | 0.9 | 0.13 | Roadway | | | | |
| | 0.65 | 0.44 | Multi Family < 20 units/acre | | | | |
| B25 | 0.736 | 0.29 | 23.04 | 23.04 | 7.24 | 0.000 | 1.545 |
| | 0.9 | 0.10 | Roadway | | | | |
| | 0.65 | 0.19 | Multi Family < 20 units/acre | | | | |
| B26 | 0.65 | 2.20 | 26.49 | 26.49 | 6.85 | 0.000 | 9.789 |
| | 0.65 | 2.20 | Multi Family < 20 units/acre | | | | |
| B36 | 0.9 | 0.27 | 22.93 | 22.93 | 7.25 | 0.000 | 1.762 |
| | 0.9 | 0.27 | Roadway | | | | |
| B37 | 0.9 | 0.28 | 22.98 | 22.98 | 7.24 | 0.000 | 1.826 |
| | 0.9 | 0.28 | Roadway | | | | |
| B38 | 0.65 | 5.75 | 28.61 | 28.61 | 6.63 | 0.000 | 24.774 |
| | 0.65 | 5.75 | Multi Family < 20 units/acre | | | | |
| B39 | 0.804 | 0.65 | 24.26 | 24.26 | 7.09 | 0.000 | 3.706 |
| | 0.9 | 0.40 | Roadway | | | | |
| | 0.65 | 0.25 | Multi Family < 20 units/acre | | | | |
| B40 | 0.65 | 5.73 | 28.60 | 28.60 | 6.63 | 0.000 | 24.691 |
| | 0.65 | 5.73 | Multi Family < 20 units/acre | | | | |
| B41 | 0.603 | 1.00 | 25.01 | 25.01 | 7.01 | 0.000 | 4.222 |
| | 0.9 | 0.15 | Roadway | | | | |
| | 0.55 | 0.85 | Residential Lots < 1/4 acre | | | | |
| B42 | 0.55 | 5.26 | 28.40 | 28.40 | 6.65 | 0.000 | 19.236 |
| | 0.55 | 5.26 | Residential Lots < 1/4 acre | | | | |
| B43 | 0.729 | 0.39 | 23.47 | 23.47 | 7.19 | 0.000 | 2.044 |
| | 0.9 | 0.20 | Roadway | | | | |
| | 0.55 | 0.19 | Residential Lots < 1/4 acre | | | | |
| B44 | 0.55 | 3.30 | 27.34 | 27.34 | 6.76 | 0.000 | 12.263 |
| | 0.55 | 3.30 | Residential Lots < 1/4 acre | | | | |
| B52 | 0.45 | 1.14 | 25.23 | 25.23 | 6.98 | 0.000 | 3.582 |
| | 0.45 | 1.14 | Residential Lots 1/4 to 1/2 acre | | | | |
| B54 | 0.45 | 1.12 | 25.21 | 25.21 | 6.98 | 0.000 | 3.520 |
| | 0.45 | 1.12 | Residential Lots 1/4 to 1/2 acre | | | | |
| B14 | 0.9 | 0.27 | 22.94 | 22.94 | 7.25 | 0.000 | 1.761 |
| | 0.9 | 0.27 | Roadway | | | | |
| B15 | 0.8 | 85.67 | 36.90 | 36.90 | 5.91 | 0.000 | 405.264 |
| | 0.8 | 85.67 | Business District | | | | |
| B16 | 0.8 | 1.67 | 25.95 | 25.95 | 6.90 | 0.000 | 9.223 |
| | 0.8 | 1.67 | Business District | | | | |
| B17 | 0.8 | 0.33 | 23.21 | 23.21 | 7.22 | 0.000 | 1.905 |
| | 0.8 | 0.33 | Business District | | | | |
| B27 | 0.65 | 0.53 | 23.94 | 23.94 | 7.13 | 0.000 | 2.456 |
| | 0.65 | 0.53 | Multi Family < 20 units/acre | | | | |
| B28 | 0.8 | 1.95 | 26.25 | 26.25 | 6.87 | 0.000 | 10.719 |
| | 0.8 | 1.95 | Business District | | | | |
| B29 | 0.8 | 0.35 | 23.32 | 23.32 | 7.20 | 0.000 | 2.017 |
| | 0.8 | 0.35 | Business District | | | | |
| B55 | 0.8 | 0.48 | 23.80 | 23.80 | 7.15 | 0.000 | 2.744 |
| | 0.8 | 0.48 | Business District | | | | |
| B56 | 0.664 | 0.35 | 23.33 | 23.33 | 7.20 | 0.000 | 1.674 |
| | 0.9 | 0.20 | Roadway | | | | |
| | 0.35 | 0.15 | Grassy area or median | | | | |
| B57 | 0.609 | 30.59 | 33.26 | 33.26 | 6.20 | 0.000 | 115.531 |
| | 0.35 | 13.00 | Residential Lots > 1/2 acre | | | | |
| | 0.8 | 17.59 | Business District | | | | |
| B58 | 0.8 | 10.14 | 30.04 | 30.04 | 6.49 | 0.000 | 52.653 |
| | 0.8 | 10.14 | Business District | | | | |
| B35-A | 0.415 | 1.27 | 25.43 | 25.43 | 6.96 | 0.000 | 3.668 |
| | 0.35 | 1.12 | Residential Lots > 1/2 acre | | | | |
| | 0.9 | 0.15 | Roadway | | | | |
| B1 | 0.8 | 89.26 | 36.87 | 36.87 | 5.92 | 0.000 | 422.408 |
| | 0.8 | 89.26 | Business District | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| B2 | 0.8 | 0.53 | 24.01 | 24.01 | 7.12 | 0.000 | 3.020 |
| | 0.8 | 0.53 | Business District | | | | |
| B3 | 0.9 | 0.08 | 21.41 | 21.41 | 7.44 | 0.000 | 0.536 |
| | 0.9 | 0.08 | Roadway | | | | |
| B4 | 0.8 | 1.04 | 25.07 | 25.07 | 7.00 | 0.000 | 5.824 |
| | 0.8 | 1.04 | Business District | | | | |
| B5-A | 0.8 | 0.71 | 24.41 | 24.41 | 7.08 | 0.000 | 4.019 |
| | 0.8 | 0.71 | Business District | | | | |
| B6 | 0.8 | 0.76 | 24.52 | 24.52 | 7.06 | 0.000 | 4.294 |
| | 0.8 | 0.76 | Business District | | | | |
| B7-A | 0.82 | 0.41 | 22.74 | 22.74 | 7.27 | 0.000 | 2.444 |
| | 0.9 | 0.35 | Roadway | | | | |
| | 0.35 | 0.06 | Grassy area or median | | | | |
| B29-A | 0.8 | 3.11 | 27.21 | 27.21 | 6.77 | 0.000 | 16.844 |
| | 0.8 | 3.11 | Business District | | | | |
| B10-A | 0.8 | 1.44 | 25.66 | 25.66 | 6.94 | 0.000 | 7.989 |
| | 0.8 | 1.44 | Business District | | | | |
| B30 | 0.9 | 0.30 | 21.41 | 21.41 | 7.44 | 0.000 | 2.009 |
| | 0.9 | 0.30 | Roadway | | | | |
| B31 | 0.658 | 0.42 | 23.59 | 23.59 | 7.17 | 0.000 | 1.983 |
| | 0.9 | 0.13 | Roadway | | | | |
| | 0.55 | 0.29 | Residential Lots < 1/4 acre | | | | |
| B32 | 0.55 | 3.21 | 27.28 | 27.28 | 6.76 | 0.000 | 11.940 |
| | 0.55 | 3.21 | Residential Lots < 1/4 acre | | | | |
| B33 | 0.595 | 1.16 | 25.26 | 25.26 | 6.98 | 0.000 | 4.819 |
| | 0.9 | 0.15 | Roadway | | | | |
| | 0.55 | 1.01 | Residential Lots < 1/4 acre | | | | |
| B34 | 0.55 | 2.81 | 27.00 | 27.00 | 6.79 | 0.000 | 10.497 |
| | 0.55 | 2.81 | Residential Lots < 1/4 acre | | | | |
| B35 | 0.8 | 3.92 | 27.72 | 27.72 | 6.72 | 0.000 | 21.066 |
| | 0.8 | 3.92 | Business District | | | | |
| B45 | 0.9 | 0.40 | 23.53 | 23.53 | 7.18 | 0.000 | 2.584 |
| | 0.9 | 0.40 | Roadway | | | | |
| B46 | 0.783 | 0.15 | 22.15 | 22.15 | 7.35 | 0.000 | 0.863 |
| | 0.9 | 0.10 | Roadway | | | | |
| | 0.55 | 0.05 | Residential Lots < 1/4 acre | | | | |
| B47 | 0.55 | 1.04 | 25.06 | 25.06 | 7.00 | 0.000 | 4.005 |
| | 0.55 | 1.04 | Residential Lots < 1/4 acre | | | | |
| B48 | 0.783 | 0.15 | 22.17 | 22.17 | 7.34 | 0.000 | 0.863 |
| | 0.9 | 0.10 | Roadway | | | | |
| | 0.55 | 0.05 | Residential Lots < 1/4 acre | | | | |
| B49 | 0.55 | 1.09 | 25.15 | 25.15 | 6.99 | 0.000 | 4.191 |
| | 0.55 | 1.09 | Residential Lots < 1/4 acre | | | | |
| B50 | 0.65 | 9.14 | 29.76 | 29.76 | 6.52 | 0.000 | 38.719 |
| | 0.65 | 9.14 | Multi Family < 20 units/acre | | | | |
| B50-A | 0.795 | 0.43 | 23.60 | 23.60 | 7.17 | 0.000 | 2.452 |
| | 0.9 | 0.25 | Roadway | | | | |
| | 0.65 | 0.18 | Multi Family < 20 units/acre | | | | |
| B51 | 0.725 | 0.30 | 23.11 | 23.11 | 7.23 | 0.000 | 1.572 |
| | 0.9 | 0.15 | Roadway | | | | |
| | 0.55 | 0.15 | Residential Lots < 1/4 acre | | | | |
| B13-A | 0.8 | 1.24 | 25.38 | 25.38 | 6.97 | 0.000 | 6.910 |
| | 0.8 | 1.24 | Business District | | | | |
| B5-B | 0.9 | 0.12 | 21.92 | 21.92 | 7.38 | 0.000 | 0.797 |
| B7-B | 0.9 | 0.21 | 22.57 | 22.57 | 7.29 | 0.000 | 1.379 |
| B1-A | 0.8 | 1.42 | 25.63 | 25.63 | 6.94 | 0.000 | 7.882 |
| B1-B | 0.8 | 0.42 | 23.59 | 23.59 | 7.17 | 0.000 | 2.409 |
| B1-C | 0.8 | 0.26 | 22.91 | 22.91 | 7.25 | 0.000 | 1.509 |
| B1-D | 0.8 | 0.61 | 24.16 | 24.16 | 7.10 | 0.000 | 3.467 |
| B1-E | 0.65 | 0.65 | 24.28 | 24.28 | 7.09 | 0.000 | 2.996 |
| B1-F | 0.9 | 0.05 | 20.93 | 20.93 | 7.50 | 0.000 | 0.338 |
| B1-G | 0.65 | 0.69 | 24.37 | 24.37 | 7.08 | 0.000 | 3.175 |
| B5-C | 0.85 | 0.94 | 24.90 | 24.90 | 7.02 | 0.000 | 5.609 |

On Grade Inlet Configuration Data

| Inlet ID | Inlet Type | Inlet Length (ft) | Slopes Long (%) | Slopes Trans (%) | Gutter n | Gutter Depr. (ft) | Grate Width (ft) | Grate Type | Pond Width Allowed (ft) |
|---|---|---|---|---|---|---|---|---|---|

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| B3 | Curb | 3.00 | 0.31 | 2.08 | 0.014 | 0.33 | n/a | n/a | 11.00 |
| B5-C | Curb | 8.00 | 0.40 | 2.08 | 0.014 | 0.33 | n/a | n/a | 11.00 |
| B2 | Curb | 3.00 | 0.50 | 2.08 | 0.014 | 0.33 | n/a | n/a | 11.00 |
| B1-C | Curb | 3.00 | 0.14 | 2.08 | 0.014 | 0.33 | n/a | n/a | 11.00 |

On Grade Inlets Computation Data.

| Inlet ID | Inlet Type | Total Q (cfs) | Intercept Capacity (cfs) | Q Bypass Allow (cfs) | Q Bypass Actual (cfs) | To Inlet ID | Required Length (ft) | Actual Length (ft) | Ponded Width (ft) |
|---|---|---|---|---|---|---|---|---|---|
| B3 | Curb | 0.536 | 0.536 | 0.500 | 0.000 | B7-A | 2.78 | 3.00 | 6.59 |
| B5-C | Curb | 5.609 | 5.012 | 1.000 | 0.596 | B5-A | 11.23 | 8.00 | 15.19 |
| B2 | Curb | 3.020 | 1.703 | 0.500 | 1.316 | B5-A | 8.12 | 3.00 | 11.54 |
| B1-C | Curb | 1.509 | 1.367 | 0.500 | 0.141 | B1-D | 4.10 | 3.00 | 11.30 |

Sag Inlets Configuration Data.

| Inlet ID | Inlet Type | Length/ Perim (ft) | Grate Area (sf) | Left-Slope Longi (%) | Left-Slope Transv (%) | Right-Slope Longi (%) | Right-Slope Transv (%) | Gutter n | Gutter DeprW (ft) | Head Allowed (ft) |
|---|---|---|---|---|---|---|---|---|---|---|
| B4 | Grate | 10.00 | 3.28 | 0.50 | 2.08 | 0.50 | 2.08 | 0.014 | n/a | 1.50 |
| B6 | Grate | 10.00 | 3.28 | 0.50 | 2.08 | 0.50 | 2.08 | 0.014 | n/a | 1.50 |
| B7-A | Curb | 5.00 | 0.00 | 0.31 | 2.08 | 0.40 | 2.08 | 0.014 | 1.50 | 1.50 |
| B5-A | Curb | 5.00 | 0.00 | 0.40 | 2.08 | 0.43 | 2.08 | 0.014 | 1.50 | 1.50 |
| B35-A | Curb | 5.00 | 0.00 | 0.30 | 2.08 | 0.32 | 2.08 | 0.014 | 1.50 | 1.50 |
| B14 | Curb | 5.00 | 0.00 | 0.42 | 2.08 | 0.30 | 2.08 | 0.014 | 1.50 | 1.50 |
| B17 | Curb | 5.00 | 0.00 | 0.30 | 2.08 | 0.70 | 2.08 | 0.014 | 1.50 | 1.50 |
| B16 | Curb | 5.00 | 0.00 | 0.50 | 2.08 | 0.50 | 2.08 | 0.014 | 1.50 | 1.50 |
| B10 | Curb | 5.00 | 0.00 | 0.56 | 2.08 | 0.33 | 2.08 | 0.014 | 1.50 | 1.50 |
| B11 | Curb | 8.00 | 0.00 | 1.00 | 2.08 | 0.56 | 2.08 | 0.014 | 1.50 | 1.50 |
| B12 | Grate | 10.00 | 3.28 | 0.50 | 2.08 | 0.50 | 2.08 | 0.014 | n/a | 1.50 |
| B13 | Curb | 5.00 | 0.00 | 0.30 | 2.08 | 0.42 | 2.08 | 0.014 | 1.50 | 1.50 |
| B23 | Curb | 5.00 | 0.00 | 0.32 | 2.08 | 0.41 | 2.08 | 0.014 | 1.50 | 1.50 |
| B36 | Curb | 5.00 | 0.00 | 2.08 | 2.08 | 0.95 | 2.08 | 0.014 | 1.50 | 1.50 |
| B37 | Curb | 5.00 | 0.00 | 1.09 | 2.08 | 0.50 | 2.08 | 0.014 | 1.50 | 1.50 |
| B28 | Grate | 10.00 | 3.28 | 0.50 | 2.08 | 0.50 | 2.08 | 0.014 | n/a | 1.50 |
| B29 | Grate | 10.00 | 3.28 | 0.50 | 2.08 | 0.50 | 2.08 | 0.014 | n/a | 1.50 |
| B30 | Curb | 5.00 | 0.00 | 0.31 | 2.08 | 0.32 | 2.08 | 0.014 | 1.50 | 1.50 |
| B39 | Curb | 5.00 | 0.00 | 0.30 | 2.08 | 0.52 | 2.08 | 0.014 | 1.50 | 1.50 |
| B45 | Curb | 5.00 | 0.00 | 0.41 | 2.08 | 0.58 | 2.08 | 0.014 | 1.50 | 1.50 |
| B50-A | Curb | 5.00 | 0.00 | 0.33 | 2.08 | 0.32 | 2.08 | 0.014 | 1.50 | 1.50 |
| B55 | Curb | 5.00 | 0.00 | 0.30 | 2.08 | 0.60 | 2.08 | 0.014 | 1.50 | 1.50 |
| B56 | Curb | 5.00 | 0.00 | 0.60 | 2.08 | 0.37 | 2.08 | 0.014 | 1.50 | 1.50 |
| B18 | Curb | 5.00 | 0.00 | 1.16 | 2.08 | 0.50 | 2.08 | 0.014 | 1.50 | 1.50 |
| B19 | Curb | 5.00 | 0.00 | 0.50 | 2.08 | 1.30 | 2.08 | 0.014 | 1.50 | 1.50 |
| B24 | Curb | 5.00 | 0.00 | 1.05 | 2.08 | 0.50 | 2.08 | 0.014 | 1.50 | 1.50 |
| B25 | Curb | 5.00 | 0.00 | 0.50 | 2.08 | 0.98 | 2.08 | 0.014 | 1.50 | 1.50 |
| B27 | Grate | 10.00 | 3.28 | 0.50 | 2.08 | 0.50 | 2.08 | 0.014 | n/a | 1.50 |
| B31 | Curb | 3.00 | 0.00 | 1.24 | 2.08 | 0.50 | 2.08 | 0.014 | 1.50 | 1.50 |
| B33 | Curb | 3.00 | 0.00 | 0.50 | 2.08 | 0.98 | 2.08 | 0.014 | 1.50 | 1.50 |
| B41 | Curb | 3.00 | 0.00 | 1.09 | 2.08 | 0.50 | 2.08 | 0.014 | 1.50 | 1.50 |
| B43 | Curb | 3.00 | 0.00 | 0.50 | 2.08 | 0.97 | 2.08 | 0.014 | 1.50 | 1.50 |
| B46 | Curb | 3.00 | 0.00 | 1.08 | 2.08 | 0.50 | 2.08 | 0.014 | 1.50 | 1.50 |
| B48 | Curb | 3.00 | 0.00 | 0.50 | 2.08 | 1.24 | 2.08 | 0.014 | 1.50 | 1.50 |
| B51 | Curb | 3.00 | 0.00 | 1.06 | 2.08 | 0.50 | 2.08 | 0.014 | 1.50 | 1.50 |
| B53 | Curb | 3.00 | 0.00 | 0.50 | 2.08 | 1.04 | 2.08 | 0.014 | 1.50 | 1.50 |
| B12-A | Grate | 10.00 | 3.28 | 0.50 | 2.08 | 0.50 | 2.08 | 0.014 | n/a | 1.50 |
| B10-A | Curb | 3.00 | 0.00 | 0.30 | 2.08 | 0.30 | 2.08 | 0.014 | 1.50 | 1.50 |
| B13-A | Grate | 10.00 | 3.28 | 0.42 | 2.08 | 0.42 | 2.08 | 0.014 | n/a | 1.50 |
| B5-B | Curb | 5.00 | 0.00 | 0.59 | 2.08 | 0.36 | 2.08 | 0.014 | 1.50 | 1.50 |
| B7-B | Curb | 5.00 | 0.00 | 0.36 | 2.08 | 0.59 | 2.08 | 0.014 | 1.50 | 1.50 |
| B1-B | Curb | 3.00 | 0.00 | 0.14 | 2.08 | 0.42 | 2.08 | 0.014 | 1.50 | 1.50 |
| B1-D | Curb | 3.00 | 0.00 | 0.14 | 2.08 | 0.42 | 2.08 | 0.014 | 1.50 | 1.50 |
| B1-E | Curb | 3.00 | 0.00 | 0.50 | 2.08 | 0.50 | 2.08 | 0.014 | 1.50 | 1.50 |
| B1-F | Curb | 3.00 | 0.00 | 0.48 | 2.08 | 0.48 | 2.08 | 0.014 | 1.50 | 1.50 |
| B1-G | Curb | 3.00 | 0.00 | 0.50 | 2.08 | 0.50 | 2.08 | 0.014 | 1.50 | 1.50 |

Sag Inlets Computation Data.

| Inlet ID | Inlet Type | Length (ft) | Grate Perim (ft) | Grate Area (sf) | Total Q (cfs) | Inlet Capacity (cfs) | Actual Head (ft) | Ponded Left (ft) | Width Right (ft) |
|---|---|---|---|---|---|---|---|---|---|
| B4 | Grate | n/a | 10.00 | 3.28 | 5.824 | 21.590 | 0.329 | 11.39 | 11.39 |
| B6 | Grate | n/a | 10.00 | 3.28 | 4.294 | 21.590 | 0.268 | 10.14 | 10.14 |
| B7-A | Curb | 5.00 | n/a | n/a | 2.444 | 15.022 | 0.283 | 8.94 | 8.56 |
| B5-A | Curb | 5.00 | n/a | n/a | 5.931 | 15.022 | 0.445 | 11.97 | 11.83 |
| B35-A | Curb | 5.00 | n/a | n/a | 3.668 | 15.022 | 0.325 | 10.48 | 10.43 |
| B14 | Curb | 5.00 | n/a | n/a | 1.761 | 15.022 | 0.267 | 7.50 | 7.98 |
| B17 | Curb | 5.00 | n/a | n/a | 1.905 | 15.022 | 0.270 | 8.22 | 7.02 |
| B16 | Curb | 5.00 | n/a | n/a | 9.223 | 15.022 | 0.721 | 13.51 | 13.51 |
| B10 | Curb | 5.00 | n/a | n/a | 3.912 | 15.022 | 0.335 | 9.57 | 10.58 |
| B11 | Curb | 8.00 | n/a | n/a | 3.344 | 24.036 | 0.274 | 8.13 | 9.04 |
| B12 | Grate | n/a | 10.00 | 3.28 | 1.111 | 21.590 | 0.109 | 6.11 | 6.11 |
| B13 | Curb | 5.00 | n/a | n/a | 2.073 | 15.022 | 0.274 | 8.46 | 7.98 |
| B23 | Curb | 5.00 | n/a | n/a | 1.762 | 15.022 | 0.267 | 7.93 | 7.55 |
| B36 | Curb | 5.00 | n/a | n/a | 1.762 | 15.022 | 0.267 | 5.58 | 6.44 |
| B37 | Curb | 5.00 | n/a | n/a | 1.826 | 15.022 | 0.268 | 6.35 | 7.36 |
| B28 | Grate | n/a | 10.00 | 3.28 | 10.719 | 21.590 | 0.494 | 14.28 | 14.28 |
| B29 | Grate | n/a | 10.00 | 3.28 | 2.017 | 21.590 | 0.162 | 7.64 | 7.64 |
| B30 | Curb | 5.00 | n/a | n/a | 2.009 | 15.022 | 0.272 | 8.32 | 8.27 |
| B39 | Curb | 5.00 | n/a | n/a | 3.706 | 15.022 | 0.326 | 10.58 | 9.57 |
| B45 | Curb | 5.00 | n/a | n/a | 2.584 | 15.022 | 0.287 | 8.70 | 8.13 |
| B50-A | Curb | 5.00 | n/a | n/a | 2.452 | 15.022 | 0.283 | 8.89 | 8.94 |
| B55 | Curb | 5.00 | n/a | n/a | 2.744 | 15.022 | 0.292 | 9.42 | 8.27 |
| B56 | Curb | 5.00 | n/a | n/a | 1.674 | 15.022 | 0.266 | 6.88 | 7.55 |
| B18 | Curb | 5.00 | n/a | n/a | 1.453 | 15.022 | 0.262 | 5.77 | 6.73 |
| B19 | Curb | 5.00 | n/a | n/a | 3.262 | 15.022 | 0.309 | 9.13 | 7.64 |
| B24 | Curb | 5.00 | n/a | n/a | 2.867 | 15.022 | 0.296 | 7.60 | 8.70 |
| B25 | Curb | 5.00 | n/a | n/a | 1.545 | 15.022 | 0.263 | 6.92 | 6.11 |
| B27 | Grate | n/a | 10.00 | 3.28 | 2.456 | 21.590 | 0.185 | 8.22 | 8.22 |
| B31 | Curb | 3.00 | n/a | n/a | 1.983 | 9.013 | 0.310 | 6.39 | 7.60 |
| B33 | Curb | 3.00 | n/a | n/a | 4.819 | 9.013 | 0.607 | 10.58 | 9.33 |
| B41 | Curb | 3.00 | n/a | n/a | 4.222 | 9.013 | 0.524 | 8.70 | 10.10 |
| B43 | Curb | 3.00 | n/a | n/a | 2.044 | 9.013 | 0.314 | 7.69 | 6.78 |
| B46 | Curb | 3.00 | n/a | n/a | 0.863 | 9.013 | 0.261 | 4.81 | 5.58 |
| B48 | Curb | 3.00 | n/a | n/a | 0.863 | 9.013 | 0.261 | 5.58 | 4.66 |
| B51 | Curb | 3.00 | n/a | n/a | 1.572 | 9.013 | 0.288 | 6.06 | 6.97 |
| B53 | Curb | 3.00 | n/a | n/a | 0.431 | 9.013 | 0.253 | 4.28 | 3.75 |
| B12-A | Grate | n/a | 10.00 | 3.28 | 6.423 | 21.590 | 0.351 | 11.78 | 11.78 |
| B10-A | Curb | 3.00 | n/a | n/a | 7.989 | 9.013 | 1.232 | 14.09 | 14.09 |
| B13-A | Grate | n/a | 10.00 | 3.28 | 6.910 | 21.590 | 0.369 | 12.55 | 12.55 |
| B5-B | Curb | 5.00 | n/a | n/a | 0.797 | 15.022 | 0.254 | 5.24 | 5.72 |
| B7-B | Curb | 5.00 | n/a | n/a | 1.379 | 15.022 | 0.261 | 7.07 | 6.39 |
| B1-B | Curb | 3.00 | n/a | n/a | 2.409 | 9.013 | 0.339 | 10.38 | 8.46 |
| B1-D | Curb | 3.00 | n/a | n/a | 3.608 | 9.013 | 0.450 | 12.07 | 9.81 |
| B1-E | Curb | 3.00 | n/a | n/a | 2.996 | 9.013 | 0.388 | 8.85 | 8.85 |
| B1-F | Curb | 3.00 | n/a | n/a | 0.338 | 9.013 | 0.252 | 3.94 | 3.94 |
| B1-G | Curb | 3.00 | n/a | n/a | 3.175 | 9.013 | 0.405 | 9.04 | 9.04 |

Cumulative Junction Discharge Computations

| Node I.D. | Node Type | Weighted C-Value | Cumulat. Dr.Area (acres) | Cumulat. Tc (min) | Intens. (in/hr) | User Supply Q cfs) | Additional Q in Node (cfs) | Total Disch. (cfs) |
|---|---|---|---|---|---|---|---|---|
| B3 | Curb | 0.900 | 0.08 | 21.41 | 7.44 | | 0.00 | 0.536 |
| B101-A | JctBx | 0.798 | 93.97 | 36.94 | 5.91 | | 0.00 | 443.183 |
| B102 | CrcMh | 0.799 | 97.83 | 37.68 | 5.86 | | 0.00 | 457.477 |
| B4 | Grate | 0.800 | 1.04 | 25.07 | 7.00 | | 0.00 | 5.824 |
| B6 | Grate | 0.800 | 0.76 | 24.52 | 7.06 | | 0.00 | 4.294 |
| B7-A | Curb | 0.820 | 0.41 | 22.74 | 7.27 | | 0.00 | 2.444 |
| B5-A | Curb | 0.800 | 0.71 | 24.41 | 7.08 | | 0.00 | 4.019 |
| B120 | Junct | 0.645 | 84.42 | 39.93 | 5.69 | | 0.00 | 309.940 |
| B35 | CrcMh | 0.800 | 3.92 | 27.72 | 6.72 | | 0.00 | 21.066 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| B35-A | Curb | 0.415 | 1.27 | 25.43 | 6.96 | 0.00 | 3.668 |
| B14 | Curb | 0.900 | 0.27 | 22.94 | 7.25 | 0.00 | 1.761 |
| B107 | JctBx | 0.748 | 305.02 | 44.85 | 5.38 | 0.00 | 1227.085 |
| B108 | CrcMh | 0.750 | 312.68 | 45.15 | 5.36 | 0.00 | 1255.731 |
| B109 | Junct | 0.665 | 116.67 | 44.46 | 5.40 | 0.00 | 419.023 |
| B17 | Curb | 0.800 | 0.33 | 23.21 | 7.22 | 0.00 | 1.905 |
| B110 | CrcMh | 0.665 | 116.34 | 44.32 | 5.41 | 0.00 | 418.232 |
| B16 | Curb | 0.800 | 1.67 | 25.95 | 6.90 | 0.00 | 9.223 |
| B112 | CrcMh | 0.662 | 111.48 | 42.81 | 5.50 | 0.00 | 406.395 |
| B21 | CrcMh | 0.800 | 2.82 | 27.00 | 6.79 | 0.00 | 15.322 |
| B22 | Junct | 0.800 | 9.89 | 29.11 | 6.58 | 0.00 | 52.057 |
| B102-B | CrcMh | 0.799 | 98.16 | 37.68 | 5.86 | 0.00 | 459.216 |
| B8 | CrcMh | 0.800 | 4.02 | 27.78 | 6.71 | 0.00 | 21.584 |
| B9 | CrcMh | 0.800 | 2.30 | 26.58 | 6.84 | 0.00 | 12.578 |
| B105 | JctBx | 0.800 | 99.37 | 38.26 | 5.81 | 0.00 | 461.770 |
| B10 | Curb | 0.800 | 0.69 | 24.31 | 7.09 | 0.00 | 3.912 |
| B11 | Curb | 0.900 | 0.52 | 23.81 | 7.15 | 0.00 | 3.344 |
| B12 | Grate | 0.800 | 0.19 | 22.45 | 7.31 | 0.00 | 1.111 |
| B106 | Junct | 0.800 | 102.68 | 39.25 | 5.74 | 0.00 | 471.490 |
| B13 | Curb | 0.800 | 0.36 | 23.37 | 7.20 | 0.00 | 2.073 |
| B5-C | Curb | 0.850 | 0.94 | 24.90 | 7.02 | 0.00 | 5.609 |
| B102-A | Junct | 0.799 | 96.03 | 37.52 | 5.87 | 0.00 | 449.925 |
| B114 | Junct | 0.648 | 98.53 | 42.64 | 5.51 | 0.00 | 352.274 |
| B23 | Curb | 0.900 | 0.27 | 22.93 | 7.25 | 0.00 | 1.762 |
| B121 | CrcMh | 0.641 | 79.23 | 39.79 | 5.70 | 0.00 | 289.563 |
| B122 | CrcMh | 0.805 | 10.69 | 31.67 | 6.34 | 0.00 | 54.582 |
| B36 | Curb | 0.900 | 0.27 | 22.93 | 7.25 | 0.00 | 1.762 |
| B37 | Curb | 0.900 | 0.28 | 22.98 | 7.24 | 0.00 | 1.826 |
| B58 | CrcMh | 0.800 | 10.14 | 30.04 | 6.49 | 0.00 | 52.653 |
| B137 | CrcMh | 0.800 | 4.02 | 27.90 | 6.70 | 0.00 | 21.584 |
| B124 | Junct | 0.615 | 68.54 | 39.71 | 5.71 | 0.00 | 240.695 |
| B38 | CrcMh | 0.650 | 5.75 | 28.61 | 6.63 | 0.00 | 24.774 |
| B115 | Junct | 0.648 | 98.26 | 42.64 | 5.51 | 0.00 | 350.934 |
| B116 | Junct | 0.648 | 97.73 | 42.43 | 5.53 | 0.00 | 349.914 |
| B28 | Grate | 0.800 | 1.95 | 26.25 | 6.87 | 0.00 | 10.719 |
| B117 | CrcMh | 0.645 | 95.78 | 41.62 | 5.58 | 0.00 | 344.537 |
| B29 | Grate | 0.800 | 0.35 | 23.32 | 7.20 | 0.00 | 2.017 |
| B119 | Junct | 0.651 | 87.83 | 41.49 | 5.59 | 0.00 | 319.587 |
| B30 | Curb | 0.900 | 0.30 | 21.41 | 7.44 | 0.00 | 2.009 |
| B1 | CrcMh | 0.800 | 89.26 | 36.87 | 5.92 | 0.00 | 422.408 |
| B101 | CrcMh | 0.798 | 93.97 | 36.94 | 5.91 | 0.00 | 443.183 |
| B2 | Curb | 0.800 | 0.53 | 24.01 | 7.12 | 0.00 | 3.020 |
| B125 | Junct | 0.612 | 62.79 | 38.78 | 5.78 | 0.00 | 221.892 |
| B39 | Curb | 0.804 | 0.65 | 24.26 | 7.09 | 0.00 | 3.706 |
| B126 | CrcMh | 0.610 | 62.14 | 38.69 | 5.78 | 0.00 | 219.116 |
| B127 | CrcMh | 0.562 | 9.95 | 28.45 | 6.64 | 0.00 | 37.177 |
| B40 | CrcMh | 0.650 | 5.73 | 28.60 | 6.63 | 0.00 | 24.691 |
| B129 | Junct | 0.615 | 46.46 | 36.85 | 5.92 | 0.00 | 169.102 |
| B130 | CrcMh | 0.613 | 46.06 | 36.79 | 5.92 | 0.00 | 167.107 |
| B45 | Curb | 0.900 | 0.40 | 23.53 | 7.18 | 0.00 | 2.584 |
| B132 | Junct | 0.615 | 43.63 | 35.66 | 6.01 | 0.00 | 161.123 |
| B50 | CrcMh | 0.650 | 9.14 | 29.76 | 6.52 | 0.00 | 38.719 |
| B133 | Junct | 0.605 | 34.49 | 35.21 | 6.04 | 0.00 | 126.160 |
| B50-A | Curb | 0.795 | 0.43 | 23.60 | 7.17 | 0.00 | 2.452 |
| B134 | CrcMh | 0.603 | 34.06 | 35.01 | 6.06 | 0.00 | 124.424 |
| B135 | CrcMh | 0.612 | 31.42 | 34.34 | 6.11 | 0.00 | 117.634 |
| B55 | Curb | 0.800 | 0.48 | 23.80 | 7.15 | 0.00 | 2.744 |
| B56 | Curb | 0.664 | 0.35 | 23.33 | 7.20 | 0.00 | 1.674 |
| B136 | JctBx | 0.609 | 30.59 | 33.35 | 6.20 | 0.00 | 115.531 |
| B57 | CrcMh | 0.609 | 30.59 | 33.26 | 6.20 | 0.00 | 115.531 |
| B18 | Curb | 0.800 | 0.25 | 22.81 | 7.26 | 0.00 | 1.453 |
| B19 | Curb | 0.708 | 0.65 | 24.28 | 7.09 | 0.00 | 3.262 |
| B113 | CrcMh | 0.669 | 3.06 | 27.11 | 6.78 | 0.00 | 13.875 |
| B24 | Curb | 0.707 | 0.57 | 24.07 | 7.11 | 0.00 | 2.867 |
| B25 | Curb | 0.736 | 0.29 | 23.04 | 7.24 | 0.00 | 1.545 |
| B27 | Grate | 0.650 | 0.53 | 23.94 | 7.13 | 0.00 | 2.456 |
| B118 | CrcMh | 0.563 | 7.60 | 27.32 | 6.76 | 0.00 | 28.911 |
| B31 | Curb | 0.563 | 3.63 | 27.29 | 6.76 | 0.00 | 13.807 |
| B33 | Curb | 0.563 | 3.97 | 27.01 | 6.79 | 0.00 | 15.184 |
| B32 | CrcMh | 0.550 | 3.21 | 27.28 | 6.76 | 0.00 | 11.940 |
| B34 | CrcMh | 0.550 | 2.81 | 27.00 | 6.79 | 0.00 | 10.497 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| B41 | Curb | 0.558 | 6.26 | 28.41 | 6.65 | 0.00 | 23.238 |
| B43 | Curb | 0.569 | 3.69 | 27.35 | 6.76 | 0.00 | 14.182 |
| B42 | CrcMh | 0.550 | 5.26 | 28.40 | 6.65 | 0.00 | 19.236 |
| B44 | CrcMh | 0.550 | 3.30 | 27.34 | 6.76 | 0.00 | 12.263 |
| B46 | Curb | 0.579 | 1.19 | 25.08 | 7.00 | 0.00 | 4.826 |
| B48 | Curb | 0.579 | 2.43 | 25.17 | 6.99 | 0.00 | 9.830 |
| B47 | CrcMh | 0.550 | 1.04 | 25.06 | 7.00 | 0.00 | 4.005 |
| B49 | CrcMh | 0.550 | 1.09 | 25.15 | 6.99 | 0.00 | 4.191 |
| B51 | Curb | 0.507 | 1.44 | 25.26 | 6.98 | 0.00 | 5.099 |
| B53 | Curb | 0.490 | 2.64 | 25.33 | 6.97 | 0.00 | 9.010 |
| B52 | CrcMh | 0.450 | 1.14 | 25.23 | 6.98 | 0.00 | 3.582 |
| B54 | CrcMh | 0.450 | 1.12 | 25.21 | 6.98 | 0.00 | 3.520 |
| B15 | CrcMh | 0.800 | 85.67 | 36.90 | 5.91 | 0.00 | 405.264 |
| B20 | CrcMh | 0.650 | 2.29 | 26.57 | 6.84 | 0.00 | 10.177 |
| B26 | CrcMh | 0.650 | 2.20 | 26.49 | 6.85 | 0.00 | 9.789 |
| B12-A | Grate | 0.800 | 1.15 | 25.24 | 6.98 | 0.00 | 6.423 |
| B111 | JctBx | 0.674 | 3.19 | 27.16 | 6.78 | 0.00 | 14.557 |
| B128 | Junct | 0.619 | 52.19 | 38.60 | 5.79 | 0.00 | 186.984 |
| B29-A | CrcMh | 0.800 | 3.11 | 27.21 | 6.77 | 0.00 | 16.844 |
| B117-A | Junct | 0.650 | 87.53 | 41.13 | 5.61 | 0.00 | 319.452 |
| B10-A | Curb | 0.800 | 1.44 | 25.66 | 6.94 | 0.00 | 7.989 |
| B13-A | Grate | 0.800 | 1.24 | 25.38 | 6.97 | 0.00 | 6.910 |
| B105-A | CrcMh | 0.800 | 100.81 | 38.43 | 5.80 | 0.00 | 467.471 |
| B105-B | CrcMh | 0.800 | 102.05 | 39.16 | 5.75 | 0.00 | 468.975 |
| B107-A | CrcMh | 0.000 | 0.00 | 0.00 | 0.00 | 0.00 | 0.000 |
| B101-B | CrcMh | 0.798 | 95.09 | 37.33 | 5.88 | 0.00 | 446.312 |
| B5-B | Curb | 0.900 | 0.12 | 21.92 | 7.38 | 0.00 | 0.797 |
| B7-B | Curb | 0.900 | 0.21 | 22.57 | 7.29 | 0.00 | 1.379 |
| B101-C | CrcMh | 0.800 | 0.76 | 24.62 | 7.05 | 0.00 | 4.294 |
| B138 | CrcMh | 0.800 | 6.32 | 28.28 | 6.66 | 0.00 | 33.678 |
| B139 | CrcMh | 0.800 | 6.51 | 29.49 | 6.54 | 0.00 | 34.074 |
| B140 | CrcMh | 0.800 | 7.66 | 30.68 | 6.43 | 0.00 | 39.414 |
| B1-A | CrcMh | 0.800 | 1.42 | 25.63 | 6.94 | 0.00 | 7.882 |
| B1-B | Curb | 0.800 | 0.42 | 23.59 | 7.17 | 0.00 | 2.409 |
| B1-C | Curb | 0.800 | 0.26 | 22.91 | 7.25 | 0.00 | 1.509 |
| B1-D | Curb | 0.800 | 0.61 | 24.16 | 7.10 | 0.00 | 3.467 |
| B1-E | Curb | 0.650 | 0.65 | 24.28 | 7.09 | 0.00 | 2.996 |
| B1-F | Curb | 0.729 | 1.31 | 47.84 | 5.20 | 0.00 | 4.970 |
| B1-G | Curb | 0.650 | 0.69 | 24.37 | 7.08 | 0.00 | 3.175 |
| B101-E | CrcMh | 0.763 | 2.79 | 28.49 | 6.64 | 0.00 | 14.133 |
| B101-F | CrcMh | 0.798 | 93.36 | 36.90 | 5.91 | 0.00 | 440.481 |
| B101-D | CrcMh | 0.800 | 2.10 | 27.49 | 6.74 | 0.00 | 11.325 |
| OUT | Outlt | 0.750 | 312.68 | 45.15 | 5.36 | 0.00 | 1255.731 |

Conveyance Configuration Data

| Run # | Node US | I.D. DS | FlowLine Elev. US (ft) | DS (ft) | Shape # | Span (ft) | Rise (ft) | Length (ft) | Slope (%) | n_value |
|---|---|---|---|---|---|---|---|---|---|---|
| 144 | B42 | B41 | 75.85 | 72.86 | Cir 1 | 0.00 | 1.50 | 18.0 | 16.845 | 0.013 |
| 145 | B41 | B127 | 72.86 | 72.70 | Cir 1 | 0.00 | 2.00 | 16.0 | 1.000 | 0.013 |
| 146 | B44 | B43 | 75.85 | 72.86 | Cir 1 | 0.00 | 1.50 | 18.0 | 16.845 | 0.013 |
| 1 | B1 | B101-F | 71.72 | 71.32 | Box 2 | 8.00 | 5.00 | 26.0 | 1.539 | 0.015 |
| 3 | B101 | B101-A | 71.30 | 71.28 | Cir 1 | 0.00 | 5.00 | 9.0 | 0.222 | 0.013 |
| 30 | B2 | B101 | 74.00 | 73.90 | Cir 1 | 0.00 | 2.00 | 8.0 | 1.250 | 0.013 |
| 31 | B3 | B101 | 74.46 | 73.90 | Cir 1 | 0.00 | 2.00 | 31.4 | 1.782 | 0.013 |
| 4 | B101-A | B101-B | 71.28 | 70.96 | Box 2 | 9.00 | 5.00 | 162.0 | 0.198 | 0.015 |
| 35 | B4 | B102 | 73.50 | 73.15 | Cir 1 | 0.00 | 2.00 | 15.0 | 2.334 | 0.013 |
| 32 | B5-A | B101-B | 73.90 | 73.80 | Cir 1 | 0.00 | 2.00 | 5.0 | 2.000 | 0.013 |
| 36 | B6 | B101-C | 74.87 | 74.49 | Cir 1 | 0.00 | 1.25 | 36.0 | 1.056 | 0.013 |
| 33 | B7-A | B101-B | 73.90 | 73.80 | Cir 1 | 0.00 | 2.00 | 20.0 | 0.500 | 0.013 |
| 7 | B102 | B102-B | 70.67 | 70.38 | Box 2 | 9.00 | 5.00 | 150.0 | 0.193 | 0.015 |
| 8 | B102-B | B105 | 70.38 | 69.91 | Box 2 | 9.00 | 5.00 | 245.0 | 0.192 | 0.015 |
| 60 | B8 | B137 | 71.30 | 70.80 | Cir 1 | 0.00 | 1.50 | 89.0 | 0.562 | 0.013 |
| 62 | B9 | B138 | 72.94 | 72.62 | Cir 1 | 0.00 | 2.00 | 124.0 | 0.258 | 0.013 |
| 64 | B12 | B139 | 72.70 | 72.62 | Cir 1 | 0.00 | 2.00 | 8.0 | 1.000 | 0.013 |
| 40 | B10 | B105 | 72.47 | 72.39 | Cir 1 | 0.00 | 2.00 | 8.0 | 1.000 | 0.013 |
| 41 | B11 | B105 | 70.08 | 69.89 | Cir 1 | 0.00 | 5.00 | 19.0 | 1.000 | 0.013 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 9 | B105 | B105-A | 69.91 | 69.76 | Box 2 | 9.00 | 5.00 | 73.0 | 0.205 | 0.015 |
| 12 | B106 | B107 | 69.12 | 68.82 | Box 2 | 9.00 | 5.00 | 235.0 | 0.128 | 0.015 |
| 66 | B12-A | B140 | 69.26 | 69.18 | Cir 1 | 0.00 | 1.50 | 8.0 | 1.000 | 0.013 |
| 114 | B117-A | B119 | 68.49 | 68.46 | Box 2 | 8.00 | 6.00 | 76.0 | 0.039 | 0.015 |
| 63 | B138 | B139 | 69.82 | 69.79 | Cir 1 | 0.00 | 5.00 | 155.0 | 0.019 | 0.013 |
| 65 | B139 | B140 | 69.79 | 69.36 | Cir 1 | 0.00 | 5.00 | 317.0 | 0.136 | 0.013 |
| 67 | B140 | B108 | 69.36 | 68.57 | Cir 1 | 0.00 | 5.00 | 280.0 | 0.282 | 0.013 |
| 148 | B127 | B126 | 72.20 | 71.76 | Cir 1 | 0.00 | 2.50 | 44.0 | 1.000 | 0.013 |
| 109 | B126 | B125 | 68.81 | 68.80 | Box 2 | 8.00 | 6.00 | 19.0 | 0.053 | 0.015 |
| 108 | B128 | B126 | 68.82 | 68.81 | Box 2 | 8.00 | 6.00 | 19.0 | 0.053 | 0.015 |
| 107 | B129 | B128 | 68.99 | 68.82 | Box 2 | 8.00 | 6.00 | 342.0 | 0.050 | 0.015 |
| 106 | B130 | B129 | 69.00 | 68.99 | Box 2 | 8.00 | 6.00 | 14.0 | 0.071 | 0.015 |
| 105 | B132 | B130 | 69.10 | 69.00 | Box 2 | 8.00 | 6.00 | 215.0 | 0.047 | 0.015 |
| 104 | B133 | B132 | 69.15 | 69.10 | Box 2 | 8.00 | 6.00 | 85.0 | 0.059 | 0.015 |
| 103 | B134 | B133 | 69.16 | 69.15 | Box 2 | 8.00 | 6.00 | 31.0 | 0.032 | 0.015 |
| 102 | B135 | B134 | 69.22 | 69.16 | Box 2 | 8.00 | 6.00 | 119.0 | 0.050 | 0.015 |
| 101 | B136 | B135 | 69.31 | 69.22 | Box 2 | 8.00 | 6.00 | 175.0 | 0.051 | 0.015 |
| 100 | B57 | B136 | 70.97 | 70.96 | Box 1 | 4.00 | 4.00 | 40.0 | 0.025 | 0.015 |
| 142 | B45 | B129 | 72.52 | 72.50 | Cir 1 | 0.00 | 2.00 | 4.0 | 0.500 | 0.013 |
| 138 | B47 | B46 | 75.19 | 74.00 | Cir 1 | 0.00 | 1.50 | 16.0 | 7.458 | 0.013 |
| 139 | B46 | B48 | 73.92 | 73.36 | Cir 1 | 0.00 | 2.00 | 32.0 | 1.750 | 0.013 |
| 140 | B49 | B48 | 74.93 | 73.36 | Cir 1 | 0.00 | 1.50 | 16.0 | 9.860 | 0.013 |
| 141 | B48 | B130 | 73.36 | 72.50 | Cir 1 | 0.00 | 2.00 | 44.0 | 1.955 | 0.013 |
| 137 | B50 | B132 | 72.00 | 71.60 | Cir 1 | 0.00 | 3.00 | 50.0 | 0.800 | 0.013 |
| 136 | B50-A | B133 | 72.52 | 72.50 | Cir 1 | 0.00 | 2.00 | 4.0 | 0.500 | 0.013 |
| 132 | B52 | B51 | 75.49 | 74.59 | Cir 1 | 0.00 | 1.25 | 16.0 | 5.634 | 0.013 |
| 134 | B54 | B53 | 75.28 | 74.27 | Cir 1 | 0.00 | 1.25 | 16.0 | 6.325 | 0.013 |
| 133 | B51 | B53 | 73.01 | 72.51 | Cir 1 | 0.00 | 2.00 | 31.0 | 1.613 | 0.013 |
| 135 | B53 | B134 | 72.51 | 72.30 | Cir 1 | 0.00 | 2.00 | 44.0 | 0.477 | 0.013 |
| 130 | B55 | B135 | 72.77 | 72.73 | Cir 1 | 0.00 | 2.00 | 4.0 | 1.000 | 0.013 |
| 44 | B13 | B106 | 71.73 | 71.62 | Cir 1 | 0.00 | 2.00 | 7.0 | 1.572 | 0.013 |
| 157 | B29-A | B117-A | 71.60 | 71.52 | Cir 1 | 0.00 | 2.00 | 30.0 | 0.267 | 0.013 |
| 10 | B105-A | B105-B | 69.76 | 69.16 | Box 2 | 11.0 | 5.00 | 303.0 | 0.198 | 0.015 |
| 11 | B105-B | B106 | 69.16 | 69.08 | Box 2 | 11.0 | 5.00 | 39.0 | 0.205 | 0.015 |
| 42 | B10-A | B105-A | 72.37 | 72.29 | Cir 1 | 0.00 | 2.00 | 15.0 | 0.533 | 0.015 |
| 43 | B13-A | B105-B | 71.83 | 71.70 | Cir 1 | 0.00 | 2.00 | 14.0 | 0.929 | 0.013 |
| 45 | B14 | B106 | 72.92 | 72.60 | Cir 1 | 0.00 | 2.00 | 32.0 | 1.000 | 0.013 |
| 50 | B15 | B107 | 68.49 | 68.00 | Box 1 | 10.0 | 8.00 | 487.0 | 0.101 | 0.015 |
| 13 | B107 | B108 | 68.00 | 67.74 | Box 1 | 10.0 | 8.00 | 280.0 | 0.093 | 0.015 |
| 14 | B108 | OUT | 67.74 | 67.73 | Box 1 | 10.0 | 8.00 | 17.0 | 0.059 | 0.015 |
| 122 | B109 | B107 | 68.05 | 68.00 | Box 2 | 8.00 | 6.00 | 103.0 | 0.049 | 0.015 |
| 178 | B17 | B109 | 71.55 | 71.50 | Cir 1 | 0.00 | 2.00 | 4.0 | 1.250 | 0.013 |
| 177 | B16 | B110 | 72.10 | 71.57 | Cir 1 | 0.00 | 2.00 | 26.0 | 2.039 | 0.013 |
| 121 | B110 | B109 | 68.07 | 68.05 | Box 2 | 8.00 | 6.00 | 35.0 | 0.057 | 0.015 |
| 120 | B112 | B110 | 68.26 | 68.07 | Box 2 | 8.00 | 6.00 | 385.0 | 0.049 | 0.015 |
| 176 | B20 | B111 | 73.91 | 73.34 | Cir 1 | 0.00 | 1.50 | 203.0 | 0.281 | 0.013 |
| 173 | B18 | B111 | 71.85 | 71.65 | Cir 1 | 0.00 | 2.00 | 20.0 | 1.000 | 0.013 |
| 174 | B19 | B111 | 71.77 | 71.65 | Cir 1 | 0.00 | 2.00 | 12.0 | 1.000 | 0.013 |
| 175 | B111 | B110 | 68.15 | 68.07 | Box 1 | 9.00 | 6.00 | 42.0 | 0.190 | 0.015 |
| 172 | B26 | B113 | 74.02 | 73.45 | Cir 1 | 0.00 | 1.50 | 207.0 | 0.275 | 0.013 |
| 170 | B24 | B113 | 72.68 | 72.48 | Cir 1 | 0.00 | 2.00 | 12.0 | 1.667 | 0.013 |
| 171 | B25 | B113 | 72.68 | 72.48 | Cir 1 | 0.00 | 2.00 | 22.0 | 0.909 | 0.013 |
| 173 | B113 | B112 | 72.48 | 71.76 | Cir 1 | 0.00 | 2.00 | 40.0 | 1.800 | 0.013 |
| 168 | B21 | B22 | 73.00 | 72.17 | Cir 1 | 0.00 | 2.00 | 172.0 | 0.483 | 0.013 |
| 169 | B22 | B112 | 71.44 | 70.76 | Cir 1 | 0.00 | 3.00 | 34.0 | 2.000 | 0.013 |
| 167 | B23 | B114 | 71.80 | 71.78 | Cir 1 | 0.00 | 2.00 | 4.0 | 0.500 | 0.013 |
| 119 | B114 | B112 | 68.28 | 68.26 | Box 2 | 8.00 | 6.00 | 39.0 | 0.051 | 0.015 |
| 118 | B115 | B114 | 68.32 | 68.28 | Box 2 | 8.00 | 6.00 | 80.0 | 0.050 | 0.015 |
| 117 | B116 | B115 | 68.35 | 68.32 | Box 2 | 8.00 | 6.00 | 53.0 | 0.057 | 0.015 |
| 116 | B117 | B116 | 68.44 | 68.35 | Box 2 | 8.00 | 6.00 | 185.0 | 0.049 | 0.015 |
| 166 | B27 | B115 | 72.73 | 72.28 | Cir 1 | 0.00 | 1.50 | 180.0 | 0.250 | 0.013 |
| 5 | B101-B | B102-A | 70.96 | 70.84 | Box 2 | 9.00 | 5.00 | 74.0 | 0.162 | 0.015 |
| 37 | B101-C | B102 | 73.50 | 73.15 | Cir 1 | 0.00 | 2.00 | 20.0 | 1.750 | 0.013 |
| 38 | B5-B | B102-B | 73.20 | 72.87 | Cir 1 | 0.00 | 2.00 | 4.0 | 8.278 | 0.013 |
| 39 | B7-B | B102-B | 73.20 | 72.89 | Cir 1 | 0.00 | 2.00 | 20.0 | 1.550 | 0.013 |
| 20 | B1-A | B101-D | 73.73 | 72.75 | Cir 1 | 0.00 | 1.50 | 497.0 | 0.197 | 0.013 |
| 21 | B1-B | B101-D | 74.43 | 74.20 | Cir 1 | 0.00 | 1.50 | 50.0 | 0.460 | 0.013 |
| 22 | B1-C | B101-D | 73.63 | 73.60 | Cir 1 | 0.00 | 2.00 | 33.0 | 0.091 | 0.013 |
| 27 | B101-D | B101-E | 72.75 | 71.56 | Cir 1 | 0.00 | 2.00 | 303.0 | 0.393 | 0.013 |
| 26 | B1-G | B101-E | 74.26 | 73.96 | Cir 1 | 0.00 | 2.00 | 77.0 | 0.390 | 0.013 |
| 23 | B1-D | B1-F | 74.64 | 74.32 | Cir 1 | 0.00 | 2.00 | 1610.0 | 0.020 | 0.013 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 24 | B1-E | B1-F | 74.89 | 74.32 | Cir | 1 | 0.00 | 2.00 | 88.0 | 0.648 | 0.013 |
| 28 | B101-E | B101-F | 71.56 | 71.32 | Cir | 1 | 0.00 | 2.50 | 19.0 | 1.263 | 0.013 |
| 2 | B101-F | B101 | 71.32 | 71.31 | Box | 1 | 9.00 | 5.00 | 24.0 | 0.042 | 0.015 |
| 147 | B43 | B127 | 72.86 | 72.70 | Cir | 1 | 0.00 | 2.00 | 16.0 | 1.000 | 0.013 |
| 25 | B1-F | B101-F | 74.32 | 73.69 | Cir | 1 | 0.00 | 2.00 | 52.0 | 1.212 | 0.013 |
| 34 | B5-C | B102-A | 73.39 | 73.34 | Cir | 1 | 0.00 | 2.00 | 5.0 | 1.000 | 0.013 |
| 6 | B102-A | B102 | 70.84 | 70.67 | Box | 2 | 9.00 | 5.00 | 70.0 | 0.243 | 0.015 |
| 131 | B56 | B135 | 72.93 | 72.73 | Cir | 1 | 0.00 | 2.00 | 15.0 | 1.333 | 0.013 |
| 165 | B28 | B116 | 72.01 | 71.82 | Cir | 1 | 0.00 | 2.00 | 19.0 | 1.000 | 0.013 |
| 164 | B29 | B117 | 71.58 | 71.44 | Cir | 1 | 0.00 | 2.00 | 32.0 | 0.438 | 0.013 |
| 158 | B30 | B119 | 71.95 | 71.94 | Cir | 1 | 0.00 | 2.00 | 4.0 | 0.250 | 0.013 |
| 159 | B32 | B31 | 75.27 | 73.54 | Cir | 1 | 0.00 | 1.50 | 15.0 | 11.611 | 0.013 |
| 160 | B31 | B118 | 72.95 | 72.72 | Cir | 1 | 0.00 | 2.00 | 16.0 | 1.438 | 0.013 |
| 161 | B34 | B33 | 75.49 | 72.62 | Cir | 1 | 0.00 | 1.50 | 15.0 | 19.493 | 0.013 |
| 162 | B33 | B118 | 72.93 | 72.72 | Cir | 1 | 0.00 | 2.00 | 15.0 | 1.400 | 0.013 |
| 163 | B118 | B117 | 72.72 | 71.76 | Cir | 1 | 0.00 | 2.00 | 42.0 | 2.286 | 0.013 |
| 115 | B119 | B117 | 68.46 | 68.44 | Box | 2 | 8.00 | 6.00 | 32.0 | 0.063 | 0.015 |
| 113 | B120 | B117-A | 68.63 | 68.49 | Box | 2 | 8.00 | 6.00 | 276.0 | 0.051 | 0.015 |
| 112 | B121 | B120 | 68.65 | 68.63 | Box | 2 | 8.00 | 6.00 | 33.0 | 0.061 | 0.015 |
| 111 | B124 | B121 | 68.71 | 68.65 | Box | 2 | 8.00 | 6.00 | 28.0 | 0.214 | 0.015 |
| 110 | B125 | B124 | 68.80 | 68.71 | Box | 2 | 8.00 | 6.00 | 193.0 | 0.047 | 0.015 |
| 151 | B58 | B122 | 71.60 | 71.25 | Box | 1 | 4.00 | 3.00 | 430.0 | 0.081 | 0.015 |
| 152 | B36 | B122 | 72.28 | 72.25 | Cir | 1 | 0.00 | 2.00 | 17.0 | 0.176 | 0.013 |
| 153 | B37 | B122 | 72.51 | 72.25 | Cir | 1 | 0.00 | 2.00 | 27.0 | 0.963 | 0.013 |
| 154 | B122 | B121 | 70.40 | 70.15 | Box | 1 | 4.00 | 3.00 | 31.0 | 0.806 | 0.015 |
| 156 | B35 | B120 | 74.77 | 72.08 | Cir | 1 | 0.00 | 2.00 | 20.0 | 13.573 | 0.013 |
| 155 | B35-A | B120 | 72.40 | 72.08 | Cir | 1 | 0.00 | 2.00 | 17.0 | 1.883 | 0.013 |
| 150 | B38 | B124 | 72.00 | 70.95 | Cir | 1 | 0.00 | 2.00 | 38.0 | 2.764 | 0.013 |
| 149 | B39 | B125 | 72.30 | 72.26 | Cir | 1 | 0.00 | 2.00 | 4.0 | 1.000 | 0.013 |
| 143 | B40 | B128 | 71.84 | 71.83 | Cir | 1 | 0.00 | 2.00 | 52.0 | 0.019 | 0.013 |
| 61 | B137 | B138 | 70.44 | 70.22 | Cir | 1 | 0.00 | 5.00 | 105.0 | 0.210 | 0.013 |

Conveyance Hydraulic Computations. Tailwater = 77.000 (ft)

| Run # | Hyd. Gr.line US (ft) | DS (ft) | Crit.Elev US (ft) | Fr.Slope (%) | Depth Unif. (ft) | Depth Actual (ft) | Velocity Unif. (f/s) | Velocity Actual (f/s) | Q (cfs) | Cap (cfs) | Junc Loss (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 144* | 81.58 | 80.98 | 77.94 | 3.325 | 0.70 | 1.50 | 23.70 | 10.96 | 19.2 | 43.3 | 0.000 |
| 145* | 80.98 | 80.82 | 77.94 | 1.046 | 1.69 | 2.00 | 8.19 | 7.40 | 23.2 | 22.7 | 0.000 |
| 146* | 81.12 | 80.88 | 78.01 | 1.351 | 0.55 | 1.50 | 21.02 | 7.43 | 12.3 | 43.3 | 0.000 |
| 1* | 81.07 | 81.03 | 79.25 | 0.160 | 1.84 | 5.00 | 14.34 | 9.47 | 422.4 | 1310.1 | 0.000 |
| 3 | 80.90 | 80.64 | 78.33 | 2.871 | 5.00 | 5.00 | 22.57 | 22.57 | 443.2 | 123.3 | 0.000 |
| 30* | 80.90 | 80.90 | 78.65 | 0.018 | 0.47 | 2.00 | 5.42 | 3.75 | 3.0 | 25.4 | 0.000 |
| 31* | 80.90 | 80.90 | 78.34 | 0.001 | 0.19 | 2.00 | 3.67 | 1.31 | 0.5 | 30.3 | 0.000 |
| 4 | 80.64 | 80.54 | 78.58 | 0.131 | 3.54 | 5.00 | 6.95 | 4.92 | 443.2 | 543.7 | 0.000 |
| 35* | 80.45 | 80.44 | 77.68 | 0.066 | 0.56 | 2.00 | 8.18 | 4.56 | 5.8 | 34.7 | 0.000 |
| 32* | 80.54 | 80.54 | 78.16 | 0.031 | 0.48 | 2.00 | 6.96 | 4.08 | 4.0 | 32.1 | 0.000 |
| 36* | 80.60 | 80.45 | 77.63 | 0.438 | 0.73 | 1.25 | 5.75 | 4.90 | 4.3 | 6.7 | 0.000 |
| 33* | 80.54 | 80.54 | 78.33 | 0.012 | 0.53 | 2.00 | 3.68 | 3.53 | 2.4 | 16.1 | 0.000 |
| 7 | 80.44 | 80.36 | 77.67 | 0.140 | 3.65 | 5.00 | 6.96 | 5.08 | 457.5 | 537.9 | 0.000 |
| 8 | 80.36 | 80.23 | 78.33 | 0.141 | 3.67 | 5.00 | 6.95 | 5.10 | 459.2 | 535.8 | 0.000 |
| 60 | 82.20 | 78.47 | 79.35 | 4.186 | 1.50 | 1.50 | 12.21 | 12.21 | 21.6 | 7.9 | 0.000 |
| 62 | 78.64 | 78.26 | 78.52 | 0.307 | 2.00 | 2.00 | 4.00 | 4.00 | 12.6 | 11.5 | 0.000 |
| 64* | 78.25 | 78.25 | 78.46 | 0.002 | 0.30 | 2.00 | 3.73 | 2.85 | 1.1 | 22.7 | 0.000 |
| 40* | 80.23 | 80.23 | 78.81 | 0.030 | 0.56 | 2.00 | 5.40 | 4.04 | 3.9 | 22.7 | 0.000 |
| 41* | 80.23 | 80.23 | 78.47 | 0.000 | 0.40 | 5.00 | 4.59 | 3.30 | 3.3 | 261.6 | 0.000 |
| 9 | 80.23 | 80.19 | 78.45 | 0.142 | 3.59 | 5.00 | 7.14 | 5.13 | 461.8 | 554.5 | 0.000 |
| 12 | 79.81 | 79.46 | 79.15 | 0.149 | 4.36 | 5.00 | 6.01 | 5.24 | 471.5 | 437.1 | 0.000 |
| 66* | 77.90 | 77.87 | 77.80 | 0.371 | 0.85 | 1.50 | 6.24 | 5.25 | 6.4 | 10.5 | 0.000 |
| 114 | 80.21 | 80.17 | 79.48 | 0.055 | 5.72 | 6.00 | 3.49 | 3.33 | 319.5 | 270.7 | 0.000 |
| 63 | 78.26 | 78.25 | 78.22 | 0.017 | 3.75 | 5.00 | 2.13 | 1.72 | 33.7 | 36.4 | 0.000 |
| 65 | 78.25 | 77.87 | 78.29 | 0.017 | 2.06 | 5.00 | 4.46 | 1.74 | 34.1 | 96.3 | 0.000 |
| 67 | 77.87 | 77.15 | 79.05 | 0.023 | 1.83 | 5.00 | 6.07 | 2.01 | 39.4 | 138.9 | 0.000 |
| 148* | 80.82 | 80.46 | 77.94 | 0.815 | 1.87 | 2.50 | 9.46 | 8.58 | 37.2 | 41.2 | 0.000 |
| 109 | 80.46 | 80.45 | 78.36 | 0.026 | 3.84 | 6.00 | 3.56 | 2.28 | 219.1 | 312.5 | 0.000 |
| 108 | 80.47 | 80.46 | 78.01 | 0.019 | 3.42 | 6.00 | 3.42 | 1.95 | 187.0 | 312.5 | 0.000 |
| 107 | 80.58 | 80.47 | 78.31 | 0.015 | 3.23 | 6.00 | 3.27 | 1.76 | 169.1 | 303.7 | 0.000 |
| 106 | 80.59 | 80.58 | 77.94 | 0.015 | 2.81 | 6.00 | 3.71 | 1.74 | 167.1 | 364.1 | 0.000 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 105 | 80.66 | 80.59 | 77.78 | 0.014 | 3.19 | 6.00 | 3.16 | 1.68 | 161.1 | 293.8 | 0.000 |
| 104 | 80.70 | 80.66 | 77.64 | 0.009 | 2.48 | 6.00 | 3.17 | 1.31 | 126.2 | 330.4 | 0.000 |
| 103 | 80.71 | 80.70 | 77.44 | 0.008 | 3.05 | 6.00 | 2.55 | 1.30 | 124.4 | 244.7 | 0.000 |
| 102 | 80.76 | 80.71 | 77.63 | 0.007 | 2.48 | 6.00 | 2.96 | 1.23 | 117.6 | 305.9 | 0.000 |
| 101 | 80.84 | 80.76 | 77.76 | 0.007 | 2.44 | 6.00 | 2.96 | 1.20 | 115.5 | 308.9 | 0.000 |
| 100 | 81.05 | 80.84 | 78.13 | 0.531 | 4.00 | 4.00 | 7.22 | 7.22 | 115.5 | 25.1 | 0.000 |
| 142* | 80.58 | 80.58 | 78.66 | 0.013 | 0.54 | 2.00 | 3.74 | 3.59 | 2.6 | 16.1 | 0.000 |
| 138* | 80.71 | 80.69 | 77.97 | 0.144 | 0.38 | 1.50 | 11.44 | 4.41 | 4.0 | 28.8 | 0.000 |
| 139* | 80.69 | 80.67 | 77.97 | 0.045 | 0.54 | 2.00 | 7.00 | 4.30 | 4.8 | 30.1 | 0.000 |
| 140* | 80.70 | 80.67 | 78.07 | 0.158 | 0.36 | 1.50 | 12.80 | 4.48 | 4.2 | 33.1 | 0.000 |
| 141* | 80.67 | 80.59 | 78.07 | 0.187 | 0.77 | 2.00 | 8.89 | 5.42 | 9.8 | 31.8 | 0.000 |
| 137* | 80.83 | 80.66 | 78.00 | 0.334 | 1.76 | 3.00 | 8.98 | 7.62 | 38.7 | 59.9 | 0.000 |
| 136* | 80.70 | 80.70 | 77.64 | 0.012 | 0.53 | 2.00 | 3.69 | 3.54 | 2.5 | 16.1 | 0.000 |
| 132* | 80.92 | 80.87 | 75.49 | 0.305 | 0.41 | 1.25 | 10.19 | 4.56 | 3.6 | 15.4 | 0.000 |
| 134* | 80.90 | 80.85 | 77.42 | 0.294 | 0.40 | 1.25 | 10.57 | 4.53 | 3.5 | 16.3 | 0.000 |
| 133* | 80.87 | 80.85 | 77.89 | 0.050 | 0.57 | 2.00 | 6.90 | 4.37 | 5.1 | 28.9 | 0.000 |
| 135 | 80.85 | 80.71 | 77.42 | 0.157 | 1.09 | 2.00 | 5.15 | 2.87 | 9.0 | 15.7 | 0.000 |
| 130* | 80.76 | 80.76 | 78.05 | 0.015 | 0.47 | 2.00 | 4.87 | 3.65 | 2.7 | 22.7 | 0.000 |
| 44 | 79.92 | 79.81 | 79.87 | 0.008 | 0.37 | 2.00 | 5.26 | 0.66 | 2.1 | 28.5 | 0.000 |
| 157 | 80.38 | 80.21 | 79.02 | 0.550 | 2.00 | 2.00 | 5.36 | 5.36 | 16.8 | 11.7 | 0.000 |
| 10 | 80.19 | 79.86 | 79.29 | 0.089 | 3.07 | 5.00 | 6.93 | 4.25 | 467.5 | 695.8 | 0.000 |
| 11 | 79.86 | 79.81 | 79.49 | 0.090 | 3.04 | 5.00 | 7.02 | 4.26 | 469.0 | 708.2 | 0.000 |
| 42 | 80.24 | 80.19 | 79.29 | 0.165 | 1.07 | 2.00 | 4.68 | 2.54 | 8.0 | 14.4 | 0.000 |
| 43* | 79.87 | 79.86 | 79.49 | 0.093 | 0.77 | 2.00 | 6.16 | 4.81 | 6.9 | 21.9 | 0.000 |
| 45* | 79.81 | 79.81 | 79.23 | 0.006 | 0.38 | 2.00 | 4.28 | 3.26 | 1.8 | 22.7 | 0.000 |
| 50 | 79.51 | 79.46 | 78.50 | 0.090 | 6.47 | 8.00 | 6.26 | 5.07 | 405.3 | 428.1 | 0.000 |
| 13 | 79.46 | 77.15 | 79.85 | 0.827 | 8.00 | 8.00 | 15.34 | 15.34 | 1227.1 | 411.3 | 0.000 |
| 14 | 77.15 | 77.00 | 78.00 | 0.866 | 8.00 | 8.00 | 15.70 | 15.70 | 1255.7 | 327.3 | 0.000 |
| 122 | 79.56 | 79.46 | 78.07 | 0.095 | 6.00 | 6.00 | 4.36 | 4.36 | 419.0 | 300.1 | 0.000 |
| 178* | 79.56 | 79.56 | 78.07 | 0.007 | 0.37 | 2.00 | 4.74 | 3.30 | 1.9 | 25.4 | 0.000 |
| 177* | 79.64 | 79.59 | 80.13 | 0.165 | 0.73 | 2.00 | 8.87 | 5.30 | 9.2 | 32.4 | 0.000 |
| 121 | 79.59 | 79.56 | 78.71 | 0.094 | 6.00 | 6.00 | 4.36 | 4.36 | 418.2 | 325.6 | 0.000 |
| 120 | 79.93 | 79.59 | 78.74 | 0.089 | 6.00 | 6.00 | 4.23 | 4.23 | 406.4 | 302.6 | 0.000 |
| 176 | 81.56 | 79.67 | 78.14 | 0.931 | 1.50 | 1.50 | 5.76 | 5.76 | 10.2 | 5.6 | 0.000 |
| 173* | 79.67 | 79.67 | 79.18 | 0.004 | 0.34 | 2.00 | 4.04 | 3.07 | 1.5 | 22.7 | 0.000 |
| 174* | 79.67 | 79.67 | 78.72 | 0.021 | 0.51 | 2.00 | 5.12 | 3.83 | 3.3 | 22.7 | 0.000 |
| 175 | 79.67 | 79.59 | 79.19 | 0.000 | 0.58 | 6.00 | 2.78 | 0.27 | 14.6 | 345.5 | 0.000 |
| 172 | 81.87 | 80.08 | 77.95 | 0.861 | 1.50 | 1.50 | 5.54 | 5.54 | 9.8 | 5.5 | 0.000 |
| 170* | 80.09 | 80.08 | 78.85 | 0.016 | 0.42 | 2.00 | 5.91 | 3.70 | 2.9 | 29.3 | 0.000 |
| 171* | 80.09 | 80.08 | 79.06 | 0.005 | 0.36 | 2.00 | 3.98 | 3.08 | 1.5 | 21.7 | 0.000 |
| 173* | 80.08 | 79.93 | 78.85 | 0.373 | 0.95 | 2.00 | 9.44 | 6.19 | 13.9 | 30.5 | 0.000 |
| 168 | 80.19 | 80.14 | 80.23 | 0.455 | 1.60 | 2.00 | 5.70 | 4.88 | 15.3 | 15.8 | 0.000 |
| 169* | 80.14 | 79.93 | 79.23 | 0.604 | 1.59 | 3.00 | 13.68 | 8.78 | 52.1 | 94.7 | 0.000 |
| 167* | 79.96 | 79.96 | 79.59 | 0.006 | 0.45 | 2.00 | 3.35 | 3.26 | 1.8 | 16.1 | 0.000 |
| 119 | 79.96 | 79.93 | 79.59 | 0.067 | 5.63 | 6.00 | 3.91 | 3.67 | 352.3 | 308.5 | 0.000 |
| 118 | 80.01 | 79.96 | 79.04 | 0.066 | 5.63 | 6.00 | 3.90 | 3.66 | 350.9 | 304.6 | 0.000 |
| 117 | 80.05 | 80.01 | 78.65 | 0.066 | 5.34 | 6.00 | 4.09 | 3.64 | 349.9 | 324.1 | 0.000 |
| 116 | 80.17 | 80.05 | 78.71 | 0.064 | 5.63 | 6.00 | 3.83 | 3.59 | 344.5 | 300.5 | 0.000 |
| 166 | 80.37 | 80.01 | 78.30 | 0.054 | 0.72 | 1.50 | 2.93 | 1.39 | 2.5 | 5.3 | 0.000 |
| 5 | 80.54 | 80.51 | 78.16 | 0.133 | 3.83 | 5.00 | 6.48 | 4.96 | 446.3 | 492.6 | 0.000 |
| 37* | 80.45 | 80.44 | 78.13 | 0.036 | 0.51 | 2.00 | 6.76 | 4.15 | 4.3 | 30.1 | 0.000 |
| 38* | 80.36 | 80.36 | 78.33 | 0.001 | 0.16 | 2.00 | 7.08 | 2.59 | 0.8 | 65.4 | 0.000 |
| 39* | 80.36 | 80.36 | 78.33 | 0.004 | 0.30 | 2.00 | 4.64 | 3.19 | 1.4 | 28.3 | 0.000 |
| 20 | 84.26 | 81.49 | 77.51 | 0.558 | 1.50 | 1.50 | 4.46 | 4.46 | 7.9 | 4.7 | 0.000 |
| 21 | 81.69 | 81.49 | 78.74 | 0.052 | 0.60 | 1.50 | 3.64 | 1.36 | 2.4 | 7.2 | 0.000 |
| 22 | 81.52 | 81.49 | 78.10 | 0.004 | 0.64 | 2.00 | 1.74 | 0.48 | 1.5 | 6.8 | 0.000 |
| 27 | 81.49 | 81.05 | 77.78 | 0.249 | 1.35 | 2.00 | 5.01 | 3.61 | 11.3 | 14.2 | 0.000 |
| 26 | 81.33 | 81.05 | 78.79 | 0.020 | 0.64 | 2.00 | 3.63 | 1.01 | 3.2 | 14.2 | 0.000 |
| 23 | 81.43 | 81.05 | 78.49 | 0.023 | 1.88 | 2.00 | 1.13 | 1.10 | 3.5 | 3.2 | 0.000 |
| 24* | 81.07 | 81.05 | 79.42 | 0.017 | 0.55 | 2.00 | 4.28 | 3.74 | 3.0 | 18.3 | 0.000 |
| 28* | 81.05 | 81.03 | 78.96 | 0.118 | 0.95 | 2.50 | 8.26 | 5.67 | 14.1 | 46.3 | 0.000 |
| 2 | 81.03 | 80.90 | 78.32 | 0.519 | 5.00 | 5.00 | 9.79 | 9.79 | 440.5 | 124.9 | 0.000 |
| 147* | 80.88 | 80.82 | 78.01 | 0.390 | 1.15 | 2.00 | 7.61 | 6.25 | 14.2 | 22.7 | 0.000 |
| 25* | 81.05 | 81.03 | 78.42 | 0.048 | 0.61 | 2.00 | 6.18 | 4.34 | 5.0 | 25.0 | 0.000 |
| 34* | 80.52 | 80.51 | 77.96 | 0.061 | 0.68 | 2.00 | 5.97 | 4.50 | 5.6 | 22.7 | 0.000 |
| 6 | 80.51 | 80.44 | 78.17 | 0.135 | 3.32 | 5.00 | 7.53 | 5.00 | 449.9 | 602.9 | 0.000 |
| 131* | 80.76 | 80.76 | 77.63 | 0.005 | 0.34 | 2.00 | 4.67 | 3.19 | 1.7 | 26.2 | 0.000 |
| 165* | 80.09 | 80.05 | 78.65 | 0.223 | 0.97 | 2.00 | 7.11 | 5.60 | 10.7 | 22.7 | 0.000 |
| 164 | 80.31 | 80.17 | 78.72 | 0.008 | 0.50 | 2.00 | 3.32 | 0.64 | 2.0 | 15.0 | 0.000 |
| 158 | 80.18 | 80.17 | 78.88 | 0.008 | 0.57 | 2.00 | 2.72 | 0.64 | 2.0 | 11.4 | 0.000 |
| 159* | 81.10 | 80.91 | 78.64 | 1.281 | 0.60 | 1.50 | 18.22 | 7.28 | 11.9 | 35.9 | 0.000 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 160* | 80.91 | 80.85 | 78.64 | 0.369 | 1.01 | 2.00 | 8.67 | 6.18 | 13.8 | 27.2 | 0.000 |
| 161* | 81.06 | 80.91 | 78.52 | 0.990 | 0.49 | 1.50 | 21.22 | 6.69 | 10.5 | 46.6 | 0.000 |
| 162* | 80.91 | 80.85 | 78.52 | 0.447 | 1.08 | 2.00 | 8.79 | 6.44 | 15.2 | 26.9 | 0.000 |
| 163* | 80.85 | 80.17 | 77.32 | 1.619 | 1.41 | 2.00 | 12.21 | 9.54 | 28.9 | 34.4 | 0.000 |
| 115 | 80.17 | 80.17 | 78.40 | 0.055 | 4.78 | 6.00 | 4.18 | 3.33 | 319.6 | 340.6 | 0.000 |
| 113 | 80.36 | 80.21 | 79.34 | 0.052 | 5.06 | 6.00 | 3.83 | 3.23 | 309.9 | 306.8 | 0.000 |
| 112 | 80.36 | 80.36 | 78.10 | 0.045 | 4.50 | 6.00 | 4.02 | 3.02 | 289.6 | 335.4 | 0.000 |
| 111 | 80.41 | 80.36 | 78.63 | 0.031 | 2.47 | 6.00 | 6.08 | 2.51 | 240.7 | 630.6 | 0.000 |
| 110 | 80.45 | 80.41 | 78.40 | 0.027 | 4.03 | 6.00 | 3.44 | 2.31 | 221.9 | 294.2 | 0.000 |
| 151 | 81.48 | 80.44 | 78.27 | 0.241 | 3.00 | 3.00 | 4.39 | 4.39 | 52.7 | 30.6 | 0.000 |
| 152 | 80.47 | 80.44 | 78.90 | 0.006 | 0.58 | 2.00 | 2.31 | 0.56 | 1.8 | 9.5 | 0.000 |
| 153* | 80.44 | 80.44 | 78.29 | 0.006 | 0.39 | 2.00 | 4.27 | 3.42 | 1.8 | 22.3 | 0.000 |
| 154* | 80.44 | 80.36 | 77.85 | 0.259 | 1.64 | 3.00 | 8.30 | 7.60 | 54.6 | 96.3 | 0.000 |
| 156* | 80.53 | 80.36 | 79.34 | 0.860 | 0.69 | 2.00 | 22.12 | 7.62 | 21.1 | 83.7 | 0.000 |
| 155* | 80.36 | 80.36 | 78.52 | 0.026 | 0.46 | 2.00 | 6.63 | 3.97 | 3.7 | 31.2 | 0.000 |
| 150* | 80.86 | 80.41 | 78.63 | 1.189 | 1.18 | 2.00 | 12.78 | 8.48 | 24.8 | 37.8 | 0.000 |
| 149* | 80.45 | 80.45 | 78.40 | 0.027 | 0.55 | 2.00 | 5.31 | 3.98 | 3.7 | 22.7 | 0.000 |
| 143 | 81.08 | 80.47 | 79.00 | 1.181 | 2.00 | 2.00 | 7.86 | 7.86 | 24.7 | 3.2 | 0.000 |
| 61 | 78.47 | 78.26 | 78.24 | 0.007 | 1.44 | 5.00 | 4.61 | 1.10 | 21.6 | 119.7 | 0.000 |

* Supercritical flow.

SUMMARY OF STORM DRAIN STRUCTURE QUANTITIES

NOTE:
The convey length should be from upstream to downstream inside box.
This length may also be used as Pay Item.
Using hydraulic length, from node center to node center, may result in profile error, and this length should not be used as Pay Item.

LINKS:

| Type of Convey Structure | Material | Rise (ft) | Span (ft) | Number of Links of this type | Quantity (ft) |
|---|---|---|---|---|---|
| Circular | Concrete | 1.5 | 0.0 | 13 | 1332.0 |
| Circular | Concrete | 2.0 | 0.0 | 55 | 3354.43 |
| Box | Concrete | 5.0 | 8.0 | 1 | 52.0 |
| Circular | Concrete | 5.0 | 0.0 | 6 | 885.0 |
| Box | Concrete | 5.0 | 9.0 | 8 | 2042.0 |
| Circular | Concrete | 1.25 | 0.0 | 3 | 68.0 |
| Box | Concrete | 6.0 | 8.0 | 22 | 5074.0 |
| Circular | Concrete | 2.5 | 0.0 | 2 | 63.0 |
| Box | Concrete | 4.0 | 4.0 | 1 | 40.0 |
| Circular | Concrete | 3.0 | 0.0 | 2 | 84.0 |
| Box | Concrete | 5.0 | 11.0 | 2 | 684.0 |
| Box | Concrete | 8.0 | 10.0 | 3 | 784.0 |
| Box | Concrete | 6.0 | 9.0 | 1 | 42.0 |
| Box | Concrete | 3.0 | 4.0 | 2 | 461.0 |

NODES:

| Type of Inlet Structure | Type of Grate | Inlet Length (ft) | Grate Width (ft) | Grate Length (ft) | Grate Area (ft) | Grate Perimeter (ft) | Quantity (each) |
|---|---|---|---|---|---|---|---|
| Curb On Grade | | 3.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3 |
| Junction Box | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 5 |
| Circular Manhole | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 51 |
| Grate In Sag | Parallel | 0.0 | 0.0 | 0.0 | 3.28 | 10.0 | 8 |
| Curb In Sag | | 5.0 | 0.0 | 0.0 | 0.0 | 0.0 | 23 |
| Conduit Junction | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 16 |
| Curb In Sag | | 8.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1 |
| Curb On Grade | | 8.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1 |
| Curb In Sag | | 3.0 | 0.0 | 0.0 | 0.0 | 0.0 | 14 |
| Outlet | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1 |

END

NORMAL TERMINATION OF HOUSTORM.

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Warning Messages for current project:

        Runoff Frequency of: 2 Years
Discharge decreased downstream node Id= B101-C Previous intensity used.
Discharge decreased downstream node Id= B137 Previous intensity used.
Discharge decreased downstream node Id= B136 Previous intensity used.
Discharge decreased downstream node Id= B101-F Previous intensity used.
Discharge decreased downstream node Id= B101-A Previous intensity used.
Discharge decreased downstream node Id= B102-B Previous intensity used.
Discharge decreased downstream node Id= B105-B Previous intensity used.
Discharge decreased downstream node Id= B119 Previous intensity used.
Discharge decreased downstream node Id= B114 Previous intensity used.
Computed ponded width exceeds allowable width at inlet Id= B5-C
Capacity of grade inlet exceeded at inlet Id= B2
Tailwater set to uniform depth elevation = 75.73(ft)
Run# 14  Insufficient capacity.
Run# 13  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B135 Run # 102
Run# 100  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B57 Run # 100
Upstream HGL exceeds critical elevation (Design) at node Id= B48 Run # 141
Upstream HGL exceeds critical elevation (Design) at node Id= B50 Run # 137
Upstream HGL exceeds critical elevation (Design) at node Id= B50-A Run # 136
Upstream HGL exceeds critical elevation (Design) at node Id= B53 Run # 135
Upstream HGL exceeds critical elevation (Design) at node Id= B55 Run # 130
Upstream HGL exceeds critical elevation (Design) at node Id= B56 Run # 131
Run# 143  Insufficient capacity.
Run# 60  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B8 Run # 60
Upstream HGL exceeds critical elevation (Design) at node Id= B9 Run # 62
Upstream HGL exceeds critical elevation (Design) at node Id= B46 Run # 139
Upstream HGL exceeds critical elevation (Design) at node Id= B49 Run # 140
Upstream HGL exceeds critical elevation (Design) at node Id= B54 Run # 134
Upstream HGL exceeds critical elevation (Design) at node Id= B51 Run # 133
Upstream HGL exceeds critical elevation (Design) at node Id= B43 Run # 147
Upstream HGL exceeds critical elevation (Design) at node Id= B41 Run # 145
Upstream HGL exceeds critical elevation (Design) at node Id= B44 Run # 146
Upstream HGL exceeds critical elevation (Design) at node Id= B47 Run # 138
Upstream HGL exceeds critical elevation (Design) at node Id= B52 Run # 132
Upstream HGL exceeds critical elevation (Analysis)at node Id= B52 Run # 132
Upstream HGL exceeds critical elevation (Design) at node Id= B42 Run # 144
Upstream HGL exceeds critical elevation (Design) at node Id= B102 Run # 7
Upstream HGL exceeds critical elevation (Analysis)at node Id= B102 Run # 7
Upstream HGL exceeds critical elevation (Design) at node Id= B4 Run # 35
Upstream HGL exceeds critical elevation (Analysis)at node Id= B4 Run # 35
Upstream HGL exceeds critical elevation (Design) at node Id= B6 Run # 36
Upstream HGL exceeds critical elevation (Analysis)at node Id= B6 Run # 36
Upstream HGL exceeds critical elevation (Design) at node Id= B101-B Run # 5
Upstream HGL exceeds critical elevation (Design) at node Id= B5-C Run # 34
Upstream HGL exceeds critical elevation (Analysis)at node Id= B5-C Run # 34
Upstream HGL exceeds critical elevation (Design) at node Id= B5-A Run # 32
Upstream HGL exceeds critical elevation (Design) at node Id= B7-A Run # 33
Run# 3  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B101 Run # 3
Upstream HGL exceeds critical elevation (Analysis)at node Id= B101 Run # 3
Upstream HGL exceeds critical elevation (Design) at node Id= B2 Run # 30
Upstream HGL exceeds critical elevation (Design) at node Id= B3 Run # 31
Upstream HGL exceeds critical elevation (Analysis)at node Id= B3 Run # 31
Run# 2  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B101-F Run # 2
Upstream HGL exceeds critical elevation (Analysis)at node Id= B101-F Run # 2
Upstream HGL exceeds critical elevation (Design) at node Id= B1-F Run # 25
Upstream HGL exceeds critical elevation (Analysis)at node Id= B1-F Run # 25
Upstream HGL exceeds critical elevation (Design) at node Id= B1-D Run # 23
Upstream HGL exceeds critical elevation (Analysis)at node Id= B1-D Run # 23
Upstream HGL exceeds critical elevation (Design) at node Id= B1-E Run # 24
Upstream HGL exceeds critical elevation (Design) at node Id= B101-D Run # 27
Upstream HGL exceeds critical elevation (Analysis)at node Id= B101-D Run # 27
Upstream HGL exceeds critical elevation (Design) at node Id= B1-G Run # 26
Upstream HGL exceeds critical elevation (Design) at node Id= B1-A Run # 20
Upstream HGL exceeds critical elevation (Analysis)at node Id= B1-A Run # 20
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Upstream HGL exceeds critical elevation (Design) at node Id= B1-B Run # 21
Upstream HGL exceeds critical elevation (Analysis)at node Id= B1-B Run # 21
Upstream HGL exceeds critical elevation (Design) at node Id= B1-C Run # 22
Upstream HGL exceeds critical elevation (Analysis)at node Id= B1-C Run # 22

        Runoff Frequency of: 100 Years
Discharge decreased downstream node Id= B101-C Previous intensity used.
Discharge decreased downstream node Id= B137 Previous intensity used.
Discharge decreased downstream node Id= B136 Previous intensity used.
Discharge decreased downstream node Id= B101-F Previous intensity used.
Discharge decreased downstream node Id= B101-A Previous intensity used.
Discharge decreased downstream node Id= B102-B Previous intensity used.
Discharge decreased downstream node Id= B114 Previous intensity used.
Capacity of grade inlet exceeded at inlet Id= B5-C
Computed ponded width exceeds allowable width at inlet Id= B5-C
Capacity of grade inlet exceeded at inlet Id= B2
Computed ponded width exceeds allowable width at inlet Id= B2
Capacity of grade inlet exceeded at inlet Id= B1-C
Computed ponded width exceeds allowable width at inlet Id= B1-C
Computed right ponded width exceeds allowable width at inlet Id= B4
Computed left ponded width exceeds allowable width at inlet Id= B4
Computed right ponded width exceeds allowable width at inlet Id= B5-A
Computed left ponded width exceeds allowable width at inlet Id= B5-A
Computed right ponded width exceeds allowable width at inlet Id= B16
Computed left ponded width exceeds allowable width at inlet Id= B16
Computed right ponded width exceeds allowable width at inlet Id= B28
Computed left ponded width exceeds allowable width at inlet Id= B28
Computed right ponded width exceeds allowable width at inlet Id= B12-A
Computed left ponded width exceeds allowable width at inlet Id= B12-A
Computed left ponded width exceeds allowable width at inlet Id= B10-A
Computed right ponded width exceeds allowable width at inlet Id= B13-A
Computed left ponded width exceeds allowable width at inlet Id= B13-A
Computed left ponded width exceeds allowable width at inlet Id= B1-D
Run# 14  Insufficient capacity.
Run# 13  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B107 Run # 13
Run# 122  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B109 Run # 122
Upstream HGL exceeds critical elevation (Analysis)at node Id= B109 Run # 122
Upstream HGL exceeds critical elevation (Design) at node Id= B17 Run # 178
Upstream HGL exceeds critical elevation (Analysis)at node Id= B17 Run # 178
Run# 121  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B110 Run # 121
Upstream HGL exceeds critical elevation (Analysis)at node Id= B110 Run # 121
Run# 120  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B112 Run # 120
Upstream HGL exceeds critical elevation (Analysis)at node Id= B112 Run # 120
Upstream HGL exceeds critical elevation (Design) at node Id= B111 Run # 175
Upstream HGL exceeds critical elevation (Analysis)at node Id= B111 Run # 175
Upstream HGL exceeds critical elevation (Design) at node Id= B113 Run # 173
Upstream HGL exceeds critical elevation (Analysis)at node Id= B113 Run # 173
Upstream HGL exceeds critical elevation (Design) at node Id= B22 Run # 169
Upstream HGL exceeds critical elevation (Analysis)at node Id= B22 Run # 169
Run# 119  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B114 Run # 119
Upstream HGL exceeds critical elevation (Analysis)at node Id= B114 Run # 119
Run# 118  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B115 Run # 118
Upstream HGL exceeds critical elevation (Analysis)at node Id= B115 Run # 118
Run# 117  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B116 Run # 117
Upstream HGL exceeds critical elevation (Analysis)at node Id= B116 Run # 117
Run# 116  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B117 Run # 116
Upstream HGL exceeds critical elevation (Analysis)at node Id= B117 Run # 116
Upstream HGL exceeds critical elevation (Design) at node Id= B27 Run # 166
Upstream HGL exceeds critical elevation (Analysis)at node Id= B27 Run # 166
Upstream HGL exceeds critical elevation (Design) at node Id= B28 Run # 165
Upstream HGL exceeds critical elevation (Analysis)at node Id= B28 Run # 165
Upstream HGL exceeds critical elevation (Design) at node Id= B29 Run # 164
Upstream HGL exceeds critical elevation (Analysis)at node Id= B29 Run # 164
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Upstream HGL exceeds critical elevation (Design) at node Id= B118 Run # 163
Upstream HGL exceeds critical elevation (Analysis)at node Id= B118 Run # 163
Upstream HGL exceeds critical elevation (Design) at node Id= B119 Run # 115
Upstream HGL exceeds critical elevation (Analysis)at node Id= B119 Run # 115
Run# 12  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B106 Run # 12
Upstream HGL exceeds critical elevation (Analysis)at node Id= B106 Run # 12
Upstream HGL exceeds critical elevation (Design) at node Id= B12-A Run # 66
Upstream HGL exceeds critical elevation (Analysis)at node Id= B12-A Run # 66
Run# 114  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B117-A Run # 114
Upstream HGL exceeds critical elevation (Analysis)at node Id= B117-A Run # 114
Upstream HGL exceeds critical elevation (Design) at node Id= B13 Run # 44
Upstream HGL exceeds critical elevation (Analysis)at node Id= B13 Run # 44
Run# 157  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B29-A Run # 157
Upstream HGL exceeds critical elevation (Analysis)at node Id= B29-A Run # 157
Upstream HGL exceeds critical elevation (Design) at node Id= B105-B Run # 11
Upstream HGL exceeds critical elevation (Analysis)at node Id= B105-B Run # 11
Upstream HGL exceeds critical elevation (Design) at node Id= B13-A Run # 43
Upstream HGL exceeds critical elevation (Analysis)at node Id= B13-A Run # 43
Upstream HGL exceeds critical elevation (Design) at node Id= B14 Run # 45
Upstream HGL exceeds critical elevation (Analysis)at node Id= B14 Run # 45
Upstream HGL exceeds critical elevation (Design) at node Id= B15 Run # 50
Upstream HGL exceeds critical elevation (Analysis)at node Id= B15 Run # 50
Upstream HGL exceeds critical elevation (Design) at node Id= B16 Run # 177
Run# 176  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B20 Run # 176
Upstream HGL exceeds critical elevation (Analysis)at node Id= B20 Run # 176
Upstream HGL exceeds critical elevation (Design) at node Id= B18 Run # 173
Upstream HGL exceeds critical elevation (Analysis)at node Id= B18 Run # 173
Upstream HGL exceeds critical elevation (Design) at node Id= B19 Run # 174
Upstream HGL exceeds critical elevation (Analysis)at node Id= B19 Run # 174
Run# 172  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B26 Run # 172
Upstream HGL exceeds critical elevation (Analysis)at node Id= B26 Run # 172
Upstream HGL exceeds critical elevation (Design) at node Id= B24 Run # 170
Upstream HGL exceeds critical elevation (Analysis)at node Id= B24 Run # 170
Upstream HGL exceeds critical elevation (Design) at node Id= B25 Run # 171
Upstream HGL exceeds critical elevation (Analysis)at node Id= B25 Run # 171
Upstream HGL exceeds critical elevation (Design) at node Id= B21 Run # 168
Upstream HGL exceeds critical elevation (Design) at node Id= B23 Run # 167
Upstream HGL exceeds critical elevation (Analysis)at node Id= B23 Run # 167
Upstream HGL exceeds critical elevation (Design) at node Id= B30 Run # 158
Upstream HGL exceeds critical elevation (Analysis)at node Id= B30 Run # 158
Upstream HGL exceeds critical elevation (Design) at node Id= B31 Run # 160
Upstream HGL exceeds critical elevation (Analysis)at node Id= B31 Run # 160
Upstream HGL exceeds critical elevation (Design) at node Id= B33 Run # 162
Upstream HGL exceeds critical elevation (Analysis)at node Id= B33 Run # 162
Run# 113  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B120 Run # 113
Upstream HGL exceeds critical elevation (Analysis)at node Id= B120 Run # 113
Upstream HGL exceeds critical elevation (Design) at node Id= B121 Run # 112
Upstream HGL exceeds critical elevation (Analysis)at node Id= B121 Run # 112
Upstream HGL exceeds critical elevation (Design) at node Id= B124 Run # 111
Upstream HGL exceeds critical elevation (Analysis)at node Id= B124 Run # 111
Upstream HGL exceeds critical elevation (Design) at node Id= B125 Run # 110
Upstream HGL exceeds critical elevation (Analysis)at node Id= B125 Run # 110
Upstream HGL exceeds critical elevation (Design) at node Id= B122 Run # 154
Upstream HGL exceeds critical elevation (Analysis)at node Id= B122 Run # 154
Upstream HGL exceeds critical elevation (Design) at node Id= B35 Run # 156
Upstream HGL exceeds critical elevation (Analysis)at node Id= B35 Run # 156
Upstream HGL exceeds critical elevation (Design) at node Id= B35-A Run # 155
Upstream HGL exceeds critical elevation (Analysis)at node Id= B35-A Run # 155
Upstream HGL exceeds critical elevation (Design) at node Id= B38 Run # 150
Upstream HGL exceeds critical elevation (Analysis)at node Id= B38 Run # 150
Upstream HGL exceeds critical elevation (Design) at node Id= B39 Run # 149
Upstream HGL exceeds critical elevation (Analysis)at node Id= B39 Run # 149
Upstream HGL exceeds critical elevation (Design) at node Id= B12 Run # 64
Upstream HGL exceeds critical elevation (Design) at node Id= B138 Run # 63
Upstream HGL exceeds critical elevation (Analysis)at node Id= B138 Run # 63
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Upstream HGL exceeds critical elevation (Design) at node Id= B126 Run # 109
Upstream HGL exceeds critical elevation (Analysis)at node Id= B126 Run # 109
Upstream HGL exceeds critical elevation (Design) at node Id= B128 Run # 108
Upstream HGL exceeds critical elevation (Analysis)at node Id= B128 Run # 108
Upstream HGL exceeds critical elevation (Design) at node Id= B129 Run # 107
Upstream HGL exceeds critical elevation (Analysis)at node Id= B129 Run # 107
Upstream HGL exceeds critical elevation (Design) at node Id= B130 Run # 106
Upstream HGL exceeds critical elevation (Analysis)at node Id= B130 Run # 106
Upstream HGL exceeds critical elevation (Design) at node Id= B132 Run # 105
Upstream HGL exceeds critical elevation (Analysis)at node Id= B132 Run # 105
Upstream HGL exceeds critical elevation (Design) at node Id= B133 Run # 104
Upstream HGL exceeds critical elevation (Analysis)at node Id= B133 Run # 104
Upstream HGL exceeds critical elevation (Design) at node Id= B134 Run # 103
Upstream HGL exceeds critical elevation (Analysis)at node Id= B134 Run # 103
Upstream HGL exceeds critical elevation (Design) at node Id= B135 Run # 102
Upstream HGL exceeds critical elevation (Analysis)at node Id= B135 Run # 102
Upstream HGL exceeds critical elevation (Design) at node Id= B136 Run # 101
Upstream HGL exceeds critical elevation (Analysis)at node Id= B136 Run # 101
Run# 100  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B57 Run # 100
Upstream HGL exceeds critical elevation (Analysis)at node Id= B57 Run # 100
Upstream HGL exceeds critical elevation (Design) at node Id= B45 Run # 142
Upstream HGL exceeds critical elevation (Analysis)at node Id= B45 Run # 142
Upstream HGL exceeds critical elevation (Design) at node Id= B48 Run # 141
Upstream HGL exceeds critical elevation (Analysis)at node Id= B48 Run # 141
Upstream HGL exceeds critical elevation (Design) at node Id= B50 Run # 137
Upstream HGL exceeds critical elevation (Analysis)at node Id= B50 Run # 137
Upstream HGL exceeds critical elevation (Design) at node Id= B50-A Run # 136
Upstream HGL exceeds critical elevation (Analysis)at node Id= B50-A Run # 136
Upstream HGL exceeds critical elevation (Design) at node Id= B53 Run # 135
Upstream HGL exceeds critical elevation (Analysis)at node Id= B53 Run # 135
Upstream HGL exceeds critical elevation (Design) at node Id= B55 Run # 130
Upstream HGL exceeds critical elevation (Analysis)at node Id= B55 Run # 130
Upstream HGL exceeds critical elevation (Design) at node Id= B105-A Run # 10
Upstream HGL exceeds critical elevation (Analysis)at node Id= B105-A Run # 10
Upstream HGL exceeds critical elevation (Design) at node Id= B10-A Run # 42
Upstream HGL exceeds critical elevation (Analysis)at node Id= B10-A Run # 42
Upstream HGL exceeds critical elevation (Design) at node Id= B56 Run # 131
Upstream HGL exceeds critical elevation (Analysis)at node Id= B56 Run # 131
Upstream HGL exceeds critical elevation (Design) at node Id= B32 Run # 159
Upstream HGL exceeds critical elevation (Analysis)at node Id= B32 Run # 159
Upstream HGL exceeds critical elevation (Design) at node Id= B34 Run # 161
Upstream HGL exceeds critical elevation (Analysis)at node Id= B34 Run # 161
Run# 151  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B58 Run # 151
Upstream HGL exceeds critical elevation (Analysis)at node Id= B58 Run # 151
Upstream HGL exceeds critical elevation (Design) at node Id= B36 Run # 152
Upstream HGL exceeds critical elevation (Analysis)at node Id= B36 Run # 152
Upstream HGL exceeds critical elevation (Design) at node Id= B37 Run # 153
Upstream HGL exceeds critical elevation (Analysis)at node Id= B37 Run # 153
Run# 143  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B40 Run # 143
Upstream HGL exceeds critical elevation (Analysis)at node Id= B40 Run # 143
Upstream HGL exceeds critical elevation (Design) at node Id= B137 Run # 61
Upstream HGL exceeds critical elevation (Analysis)at node Id= B137 Run # 61
Run# 60  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B8 Run # 60
Upstream HGL exceeds critical elevation (Analysis)at node Id= B8 Run # 60
Run# 62  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B9 Run # 62
Upstream HGL exceeds critical elevation (Analysis)at node Id= B9 Run # 62
Upstream HGL exceeds critical elevation (Design) at node Id= B105 Run # 9
Upstream HGL exceeds critical elevation (Analysis)at node Id= B105 Run # 9
Upstream HGL exceeds critical elevation (Design) at node Id= B127 Run # 148
Upstream HGL exceeds critical elevation (Analysis)at node Id= B127 Run # 148
Upstream HGL exceeds critical elevation (Design) at node Id= B46 Run # 139
Upstream HGL exceeds critical elevation (Analysis)at node Id= B46 Run # 139
Upstream HGL exceeds critical elevation (Design) at node Id= B49 Run # 140
Upstream HGL exceeds critical elevation (Analysis)at node Id= B49 Run # 140
Upstream HGL exceeds critical elevation (Design) at node Id= B54 Run # 134
Upstream HGL exceeds critical elevation (Analysis)at node Id= B54 Run # 134
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Upstream HGL exceeds critical elevation (Design) at node Id= B51 Run # 133
Upstream HGL exceeds critical elevation (Analysis)at node Id= B51 Run # 133
Upstream HGL exceeds critical elevation (Design) at node Id= B43 Run # 147
Upstream HGL exceeds critical elevation (Analysis)at node Id= B43 Run # 147
Run# 145  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B41 Run # 145
Upstream HGL exceeds critical elevation (Analysis)at node Id= B41 Run # 145
Upstream HGL exceeds critical elevation (Design) at node Id= B44 Run # 146
Upstream HGL exceeds critical elevation (Analysis)at node Id= B44 Run # 146
Upstream HGL exceeds critical elevation (Design) at node Id= B102-B Run # 8
Upstream HGL exceeds critical elevation (Analysis)at node Id= B102-B Run # 8
Upstream HGL exceeds critical elevation (Design) at node Id= B10 Run # 40
Upstream HGL exceeds critical elevation (Analysis)at node Id= B10 Run # 40
Upstream HGL exceeds critical elevation (Design) at node Id= B11 Run # 41
Upstream HGL exceeds critical elevation (Analysis)at node Id= B11 Run # 41
Upstream HGL exceeds critical elevation (Design) at node Id= B47 Run # 138
Upstream HGL exceeds critical elevation (Analysis)at node Id= B47 Run # 138
Upstream HGL exceeds critical elevation (Design) at node Id= B52 Run # 132
Upstream HGL exceeds critical elevation (Analysis)at node Id= B52 Run # 132
Upstream HGL exceeds critical elevation (Design) at node Id= B5-B Run # 38
Upstream HGL exceeds critical elevation (Analysis)at node Id= B5-B Run # 38
Upstream HGL exceeds critical elevation (Design) at node Id= B7-B Run # 39
Upstream HGL exceeds critical elevation (Analysis)at node Id= B7-B Run # 39
Upstream HGL exceeds critical elevation (Design) at node Id= B42 Run # 144
Upstream HGL exceeds critical elevation (Analysis)at node Id= B42 Run # 144
Upstream HGL exceeds critical elevation (Design) at node Id= B102 Run # 7
Upstream HGL exceeds critical elevation (Analysis)at node Id= B102 Run # 7
Upstream HGL exceeds critical elevation (Design) at node Id= B101-C Run # 37
Upstream HGL exceeds critical elevation (Analysis)at node Id= B101-C Run # 37
Upstream HGL exceeds critical elevation (Design) at node Id= B102-A Run # 6
Upstream HGL exceeds critical elevation (Analysis)at node Id= B102-A Run # 6
Upstream HGL exceeds critical elevation (Design) at node Id= B4 Run # 35
Upstream HGL exceeds critical elevation (Analysis)at node Id= B4 Run # 35
Upstream HGL exceeds critical elevation (Design) at node Id= B6 Run # 36
Upstream HGL exceeds critical elevation (Analysis)at node Id= B6 Run # 36
Upstream HGL exceeds critical elevation (Design) at node Id= B101-B Run # 5
Upstream HGL exceeds critical elevation (Analysis)at node Id= B101-B Run # 5
Upstream HGL exceeds critical elevation (Design) at node Id= B5-C Run # 34
Upstream HGL exceeds critical elevation (Analysis)at node Id= B5-C Run # 34
Upstream HGL exceeds critical elevation (Design) at node Id= B101-A Run # 4
Upstream HGL exceeds critical elevation (Analysis)at node Id= B101-A Run # 4
Upstream HGL exceeds critical elevation (Design) at node Id= B5-A Run # 32
Upstream HGL exceeds critical elevation (Analysis)at node Id= B5-A Run # 32
Upstream HGL exceeds critical elevation (Design) at node Id= B7-A Run # 33
Upstream HGL exceeds critical elevation (Analysis)at node Id= B7-A Run # 33
Run# 3  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B101 Run # 3
Upstream HGL exceeds critical elevation (Analysis)at node Id= B101 Run # 3
Upstream HGL exceeds critical elevation (Design) at node Id= B2 Run # 30
Upstream HGL exceeds critical elevation (Analysis)at node Id= B2 Run # 30
Upstream HGL exceeds critical elevation (Design) at node Id= B3 Run # 31
Upstream HGL exceeds critical elevation (Analysis)at node Id= B3 Run # 31
Run# 2  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B101-F Run # 2
Upstream HGL exceeds critical elevation (Analysis)at node Id= B101-F Run # 2
Upstream HGL exceeds critical elevation (Design) at node Id= B1-F Run # 25
Upstream HGL exceeds critical elevation (Analysis)at node Id= B1-F Run # 25
Upstream HGL exceeds critical elevation (Design) at node Id= B1 Run # 1
Upstream HGL exceeds critical elevation (Analysis)at node Id= B1 Run # 1
Run# 23  Insufficient capacity.
Upstream HGL exceeds critical elevation (Design) at node Id= B1-D Run # 23
Upstream HGL exceeds critical elevation (Analysis)at node Id= B1-D Run # 23
Upstream HGL exceeds critical elevation (Design) at node Id= B1-E Run # 24
Upstream HGL exceeds critical elevation (Analysis)at node Id= B1-E Run # 24
Upstream HGL exceeds critical elevation (Design) at node Id= B101-E Run # 28
Upstream HGL exceeds critical elevation (Analysis)at node Id= B101-E Run # 28
Upstream HGL exceeds critical elevation (Design) at node Id= B101-D Run # 27
Upstream HGL exceeds critical elevation (Analysis)at node Id= B101-D Run # 27
Upstream HGL exceeds critical elevation (Design) at node Id= B1-G Run # 26
Upstream HGL exceeds critical elevation (Analysis)at node Id= B1-G Run # 26
Run# 20  Insufficient capacity.
```

```
Upstream HGL exceeds critical elevation (Design) at node Id= B1-A Run # 20
Upstream HGL exceeds critical elevation (Analysis)at node Id= B1-A Run # 20
Upstream HGL exceeds critical elevation (Design) at node Id= B1-B Run # 21
Upstream HGL exceeds critical elevation (Analysis)at node Id= B1-B Run # 21
Upstream HGL exceeds critical elevation (Design) at node Id= B1-C Run # 22
Upstream HGL exceeds critical elevation (Analysis)at node Id= B1-C Run # 22
```

# APPENDIX D

# TRAFFIC

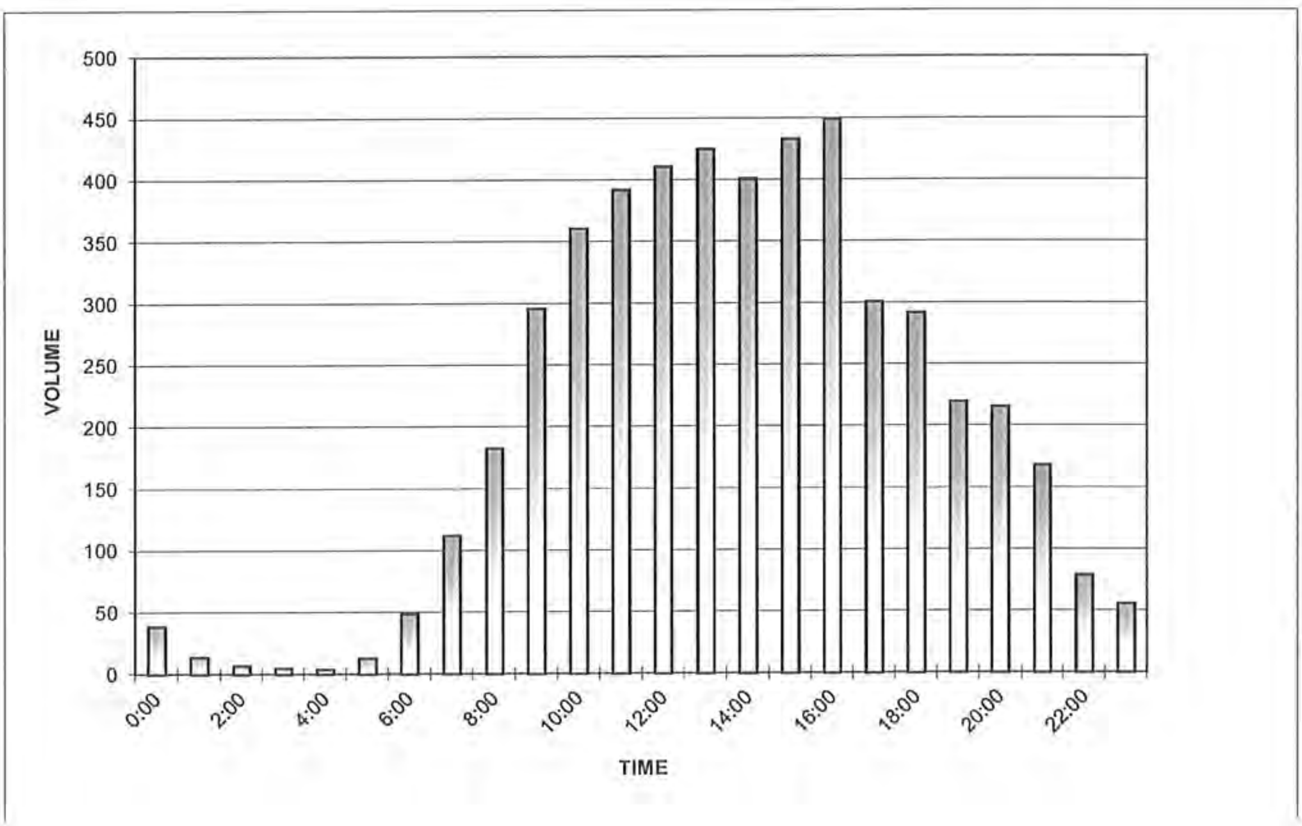
# Appendix D.1
# ATR's and TMC's

Date Began:
5/7/2011

## EB Barryknoll Ln. between Bettina Ct. and Strey Ln.

| TIME | 0:00 | 0:15 | 0:30 | 0:45 | TOTAL |
|---|---|---|---|---|---|
| 0:00 | 16 | 10 | 5 | 8 | 39 |
| 1:00 | 4 | 3 | 3 | 4 | 14 |
| 2:00 | 2 | 2 | 0 | 3 | 7 |
| 3:00 | 1 | 1 | 1 | 2 | 5 |
| 4:00 | 1 | 0 | 0 | 3 | 4 |
| 5:00 | 2 | 1 | 7 | 3 | 13 |
| 6:00 | 8 | 12 | 12 | 17 | 49 |
| 7:00 | 15 | 21 | 36 | 40 | 112 |
| 8:00 | 29 | 34 | 52 | 68 | 183 |
| 9:00 | 56 | 64 | 84 | 92 | 296 |
| 10:00 | 85 | 84 | 94 | 98 | 361 |
| 11:00 | 118 | 82 | 90 | 102 | 392 |
| 12:00 | 90 | 98 | 106 | 117 | 411 |
| 13:00 | 106 | 93 | 114 | 112 | 425 |
| 14:00 | 114 | 91 | 104 | 92 | 401 |
| 15:00 | 101 | 122 | 110 | 100 | 433 |
| 16:00 | 112 | 108 | 126 | 103 | 449 |
| 17:00 | 87 | 72 | 67 | 75 | 301 |
| 18:00 | 73 | 71 | 76 | 72 | 292 |
| 19:00 | 60 | 56 | 52 | 52 | 220 |
| 20:00 | 57 | 47 | 66 | 46 | 216 |
| 21:00 | 50 | 43 | 33 | 42 | 168 |
| 22:00 | 27 | 15 | 21 | 16 | 79 |
| 23:00 | 15 | 16 | 20 | 5 | 56 |
| | | | | TOTAL: | 4926 |

| |
|---|
| The A.M. peak hour from 9:15 to 10:15 is 325 |
| The P.M. peak hour from 16:00 to 17:00 is 449 |

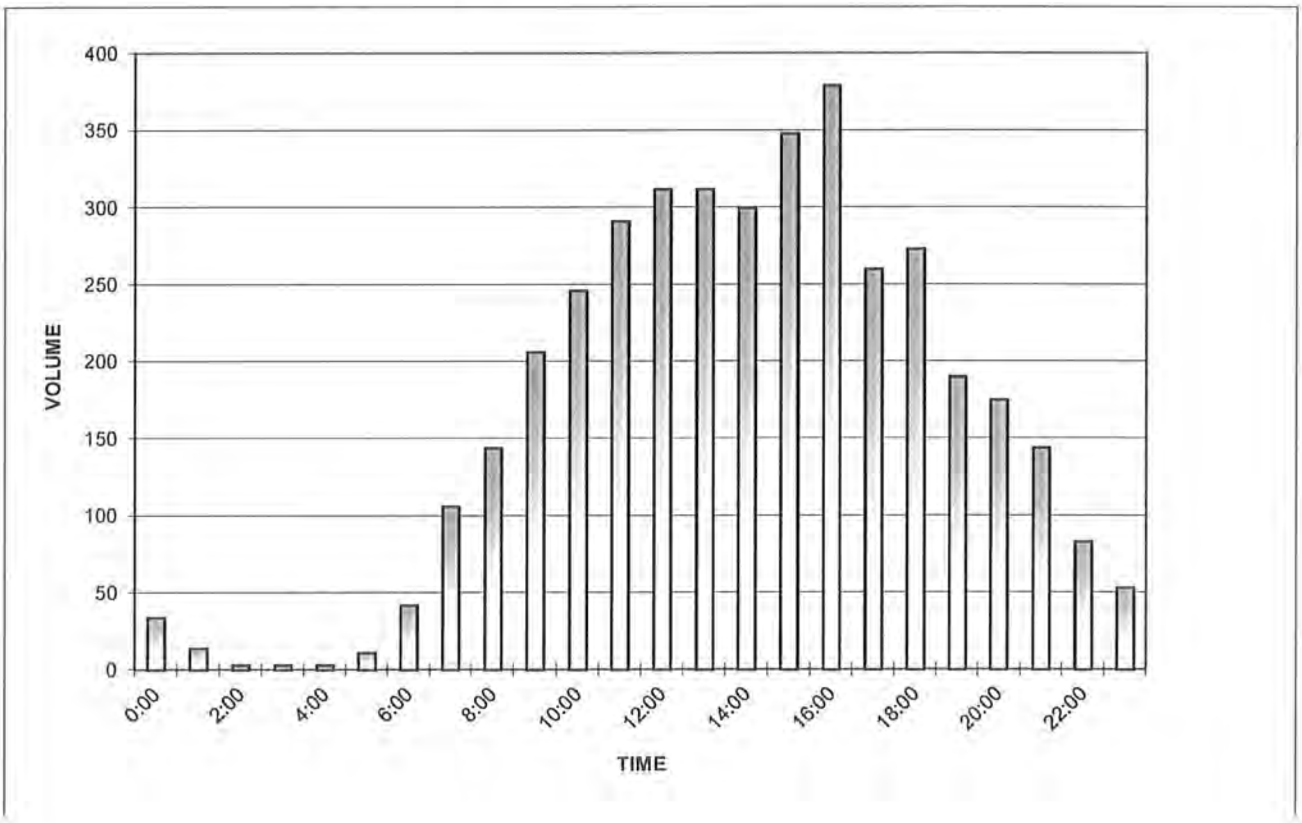


Date Began:
5/7/2011

## EB Barryknoll Ln. West of Bunker Hill Rd.

| TIME | 0:00 | 0:15 | 0:30 | 0:45 | TOTAL |
|---|---|---|---|---|---|
| 0:00 | 14 | 10 | 3 | 7 | 34 |
| 1:00 | 4 | 3 | 2 | 5 | 14 |
| 2:00 | 0 | 1 | 0 | 2 | 3 |
| 3:00 | 0 | 1 | 1 | 1 | 3 |
| 4:00 | 0 | 2 | 0 | 1 | 3 |
| 5:00 | 1 | 3 | 3 | 4 | 11 |
| 6:00 | 12 | 6 | 8 | 16 | 42 |
| 7:00 | 14 | 21 | 39 | 32 | 106 |
| 8:00 | 26 | 32 | 34 | 52 | 144 |
| 9:00 | 39 | 54 | 52 | 61 | 206 |
| 10:00 | 51 | 56 | 73 | 66 | 246 |
| 11:00 | 76 | 80 | 59 | 76 | 291 |
| 12:00 | 69 | 77 | 74 | 92 | 312 |
| 13:00 | 80 | 72 | 82 | 78 | 312 |
| 14:00 | 84 | 58 | 78 | 80 | 300 |
| 15:00 | 78 | 96 | 82 | 92 | 348 |
| 16:00 | 82 | 94 | 103 | 100 | 379 |
| 17:00 | 74 | 56 | 68 | 62 | 260 |
| 18:00 | 89 | 60 | 58 | 66 | 273 |
| 19:00 | 54 | 45 | 43 | 48 | 190 |
| 20:00 | 46 | 42 | 56 | 31 | 175 |
| 21:00 | 44 | 35 | 29 | 36 | 144 |
| 22:00 | 28 | 20 | 22 | 13 | 83 |
| 23:00 | 12 | 24 | 10 | 7 | 53 |
| | | | | TOTAL: | 3932 |

| |
|---|
| The A.M. peak hour from 9:15 to 10:15 is 218 |
| The P.M. peak hour from 16:00 to 17:00 is 379 |

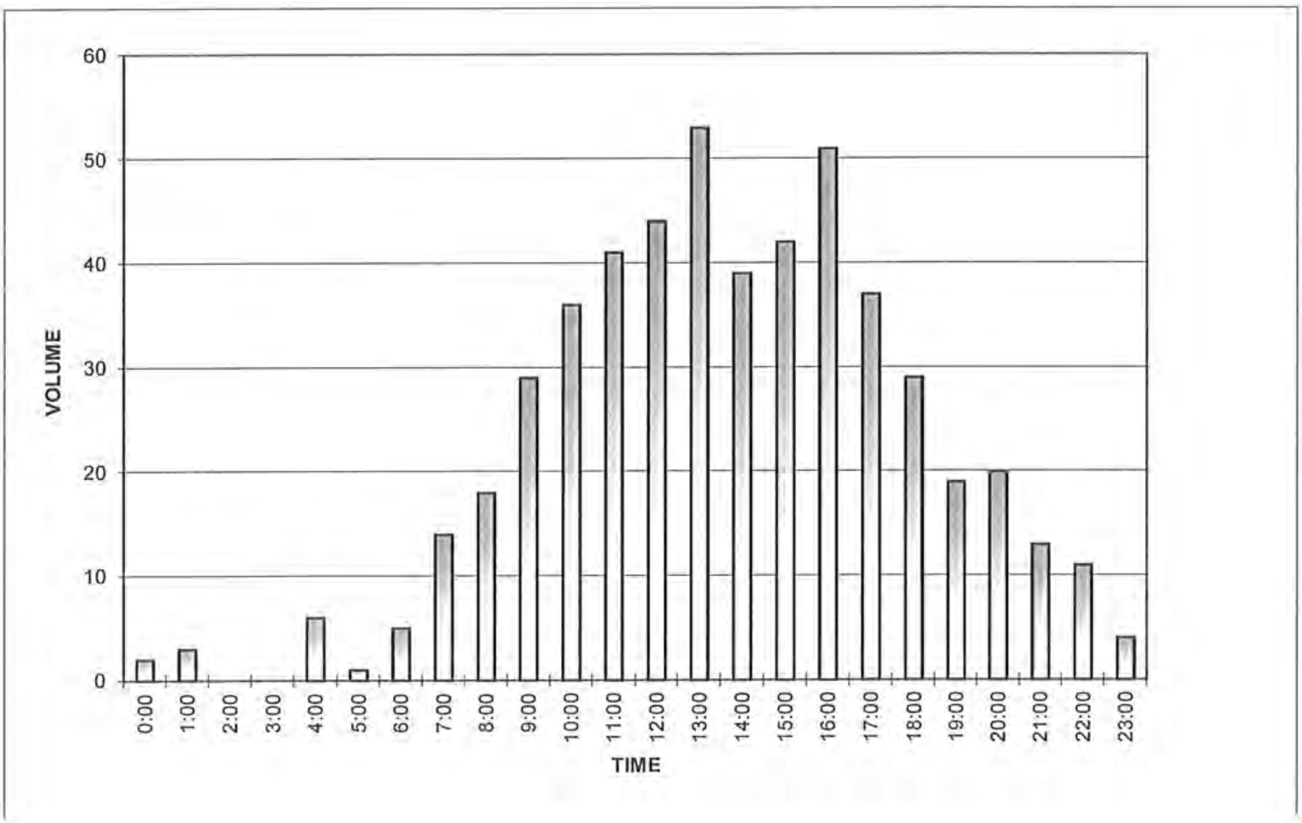


Date Began:
5/7/2011

## EB Barryknoll Ln. West of Gessner Rd.

| TIME | 0:00 | 0:15 | 0:30 | 0:45 | TOTAL |
|---|---|---|---|---|---|
| 0:00 | 1 | 0 | 0 | 1 | 2 |
| 1:00 | 2 | 0 | 0 | 1 | 3 |
| 2:00 | 0 | 0 | 0 | 0 | 0 |
| 3:00 | 0 | 0 | 0 | 0 | 0 |
| 4:00 | 0 | 0 | 3 | 3 | 6 |
| 5:00 | 0 | 0 | 1 | 0 | 1 |
| 6:00 | 2 | 2 | 0 | 1 | 5 |
| 7:00 | 2 | 5 | 4 | 3 | 14 |
| 8:00 | 4 | 3 | 7 | 4 | 18 |
| 9:00 | 6 | 9 | 8 | 6 | 29 |
| 10:00 | 8 | 9 | 7 | 12 | 36 |
| 11:00 | 9 | 11 | 10 | 11 | 41 |
| 12:00 | 8 | 12 | 11 | 13 | 44 |
| 13:00 | 12 | 15 | 14 | 12 | 53 |
| 14:00 | 14 | 9 | 6 | 10 | 39 |
| 15:00 | 8 | 12 | 14 | 8 | 42 |
| 16:00 | 13 | 12 | 14 | 12 | 51 |
| 17:00 | 14 | 9 | 7 | 7 | 37 |
| 18:00 | 4 | 10 | 8 | 7 | 29 |
| 19:00 | 3 | 8 | 6 | 2 | 19 |
| 20:00 | 7 | 5 | 4 | 4 | 20 |
| 21:00 | 3 | 2 | 2 | 6 | 13 |
| 22:00 | 5 | 2 | 2 | 2 | 11 |
| 23:00 | 0 | 2 | 1 | 1 | 4 |
| | | | | TOTAL: | 517 |

| |
|---|
| The A.M. peak hour from 9:15 to 10:15 is 31 |
| The P.M. peak hour from 16:15 to 17:15 is 52 |

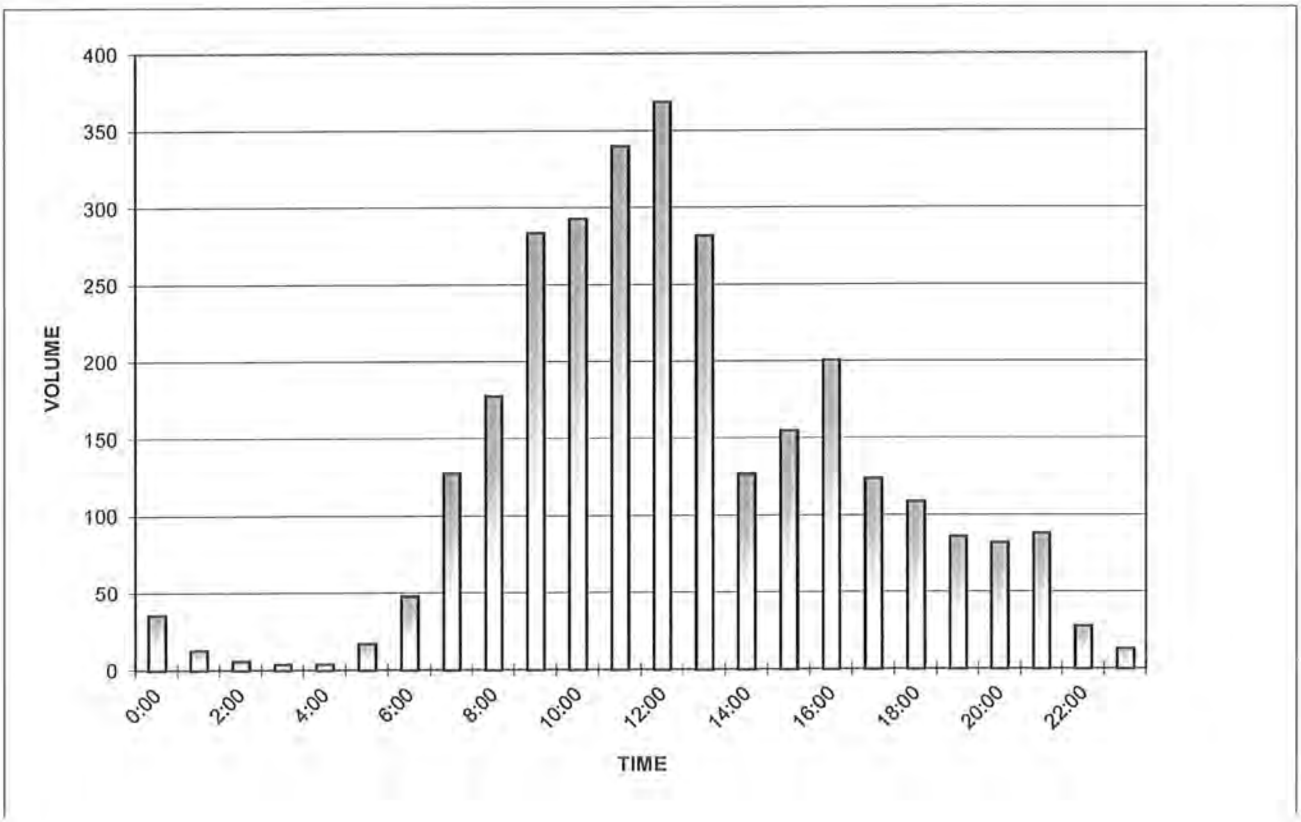


Date Began:
5/7/2011

## EB Barryknoll Ln. West of Memorial City Way

| TIME | 0:00 | 0:15 | 0:30 | 0:45 | TOTAL |
|---|---|---|---|---|---|
| 0:00 | 14 | 12 | 3 | 7 | 36 |
| 1:00 | 4 | 3 | 2 | 4 | 13 |
| 2:00 | 1 | 1 | 0 | 4 | 6 |
| 3:00 | 1 | 1 | 1 | 1 | 4 |
| 4:00 | 1 | 0 | 0 | 3 | 4 |
| 5:00 | 2 | 2 | 8 | 5 | 17 |
| 6:00 | 7 | 10 | 12 | 19 | 48 |
| 7:00 | 18 | 24 | 42 | 44 | 128 |
| 8:00 | 28 | 37 | 47 | 66 | 178 |
| 9:00 | 59 | 69 | 77 | 79 | 284 |
| 10:00 | 58 | 71 | 90 | 74 | 293 |
| 11:00 | 98 | 80 | 76 | 86 | 340 |
| 12:00 | 78 | 90 | 96 | 105 | 369 |
| 13:00 | 96 | 79 | 72 | 35 | 282 |
| 14:00 | 36 | 29 | 26 | 36 | 127 |
| 15:00 | 24 | 49 | 34 | 48 | 155 |
| 16:00 | 50 | 46 | 49 | 56 | 201 |
| 17:00 | 44 | 32 | 22 | 26 | 124 |
| 18:00 | 30 | 24 | 32 | 23 | 109 |
| 19:00 | 22 | 28 | 20 | 16 | 86 |
| 20:00 | 26 | 14 | 24 | 18 | 82 |
| 21:00 | 17 | 26 | 21 | 24 | 88 |
| 22:00 | 10 | 10 | 4 | 4 | 28 |
| 23:00 | 4 | 6 | 1 | 2 | 13 |
| | | | | TOTAL: | 3015 |

| |
|---|
| The A.M. peak hour from 9:00 to 10:00 is 284 |
| The P.M. peak hour from 16:00 to 17:00 is 201 |

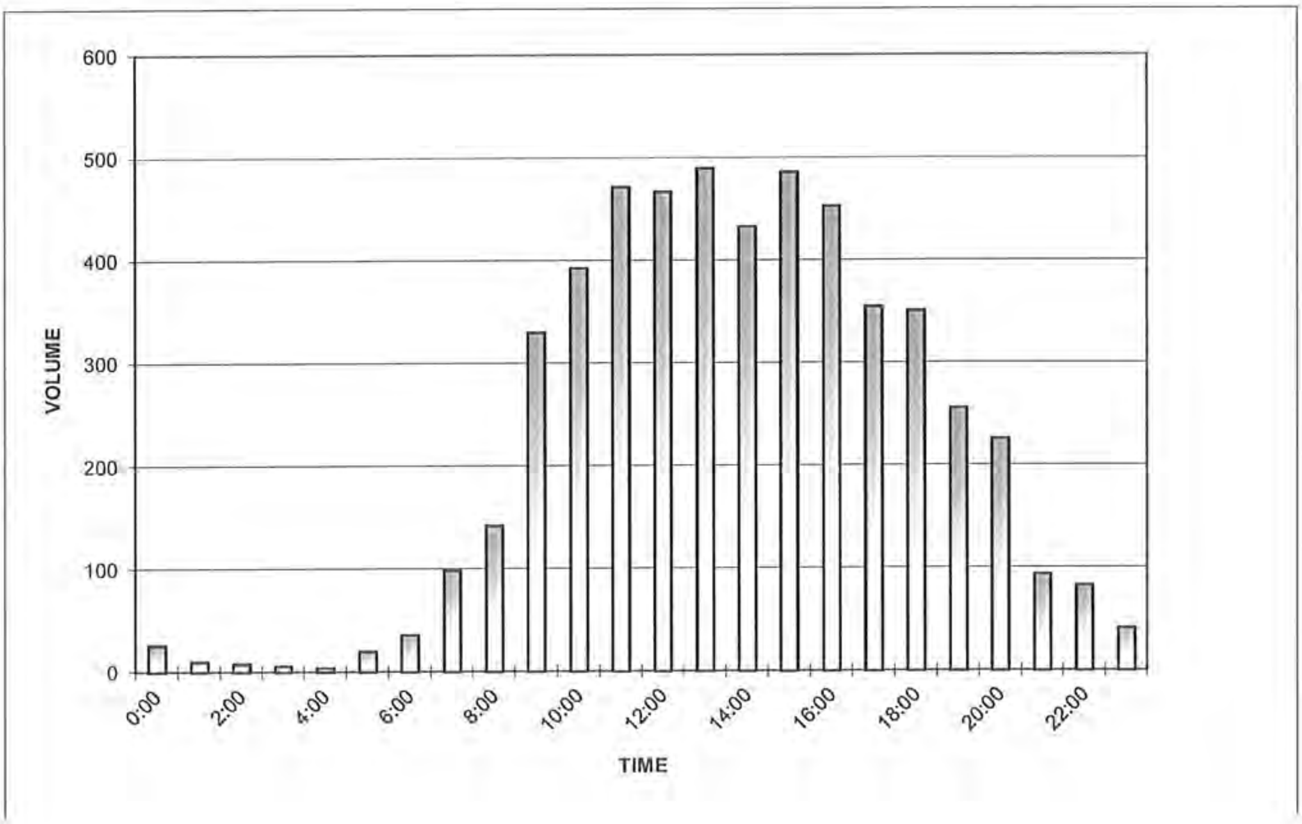


Date Began:
5/7/2011

## EB Barryknoll Ln. West of Plantation Rd.

| TIME | 0:00 | 0:15 | 0:30 | 0:45 | TOTAL |
|---|---|---|---|---|---|
| 0:00 | 12 | 3 | 7 | 4 | 26 |
| 1:00 | 2 | 2 | 2 | 4 | 10 |
| 2:00 | 1 | 4 | 2 | 1 | 8 |
| 3:00 | 1 | 1 | 3 | 1 | 6 |
| 4:00 | 0 | 0 | 0 | 4 | 4 |
| 5:00 | 2 | 3 | 10 | 5 | 20 |
| 6:00 | 6 | 9 | 7 | 14 | 36 |
| 7:00 | 11 | 26 | 27 | 35 | 99 |
| 8:00 | 26 | 22 | 40 | 54 | 142 |
| 9:00 | 60 | 69 | 81 | 120 | 330 |
| 10:00 | 96 | 82 | 100 | 115 | 393 |
| 11:00 | 128 | 98 | 112 | 134 | 472 |
| 12:00 | 89 | 109 | 123 | 146 | 467 |
| 13:00 | 129 | 109 | 131 | 121 | 490 |
| 14:00 | 125 | 106 | 107 | 95 | 433 |
| 15:00 | 140 | 120 | 119 | 107 | 486 |
| 16:00 | 120 | 111 | 118 | 104 | 453 |
| 17:00 | 107 | 82 | 102 | 64 | 355 |
| 18:00 | 94 | 89 | 78 | 90 | 351 |
| 19:00 | 71 | 68 | 58 | 59 | 256 |
| 20:00 | 78 | 56 | 44 | 48 | 226 |
| 21:00 | 35 | 16 | 16 | 27 | 94 |
| 22:00 | 31 | 23 | 18 | 11 | 83 |
| 23:00 | 12 | 8 | 14 | 7 | 41 |
| | | | | TOTAL: | 5281 |

| |
|---|
| The A.M. peak hour from 9:15 to 10:15 is 366 |
| The P.M. peak hour from 15:00 to 16:00 is 486 |

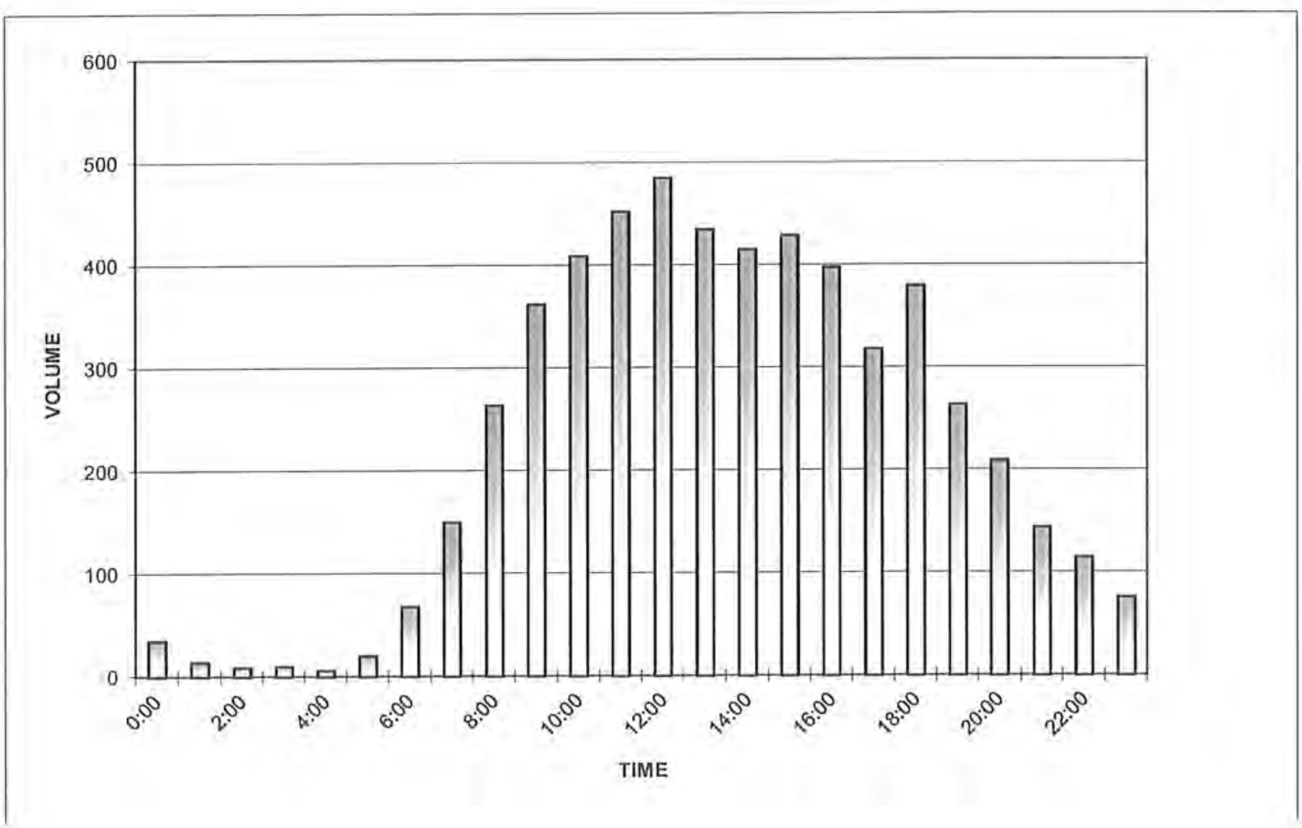


Date Began:
5/7/2011

## NB Bunker Hill Rd. South of Barryknoll Ln.

| TIME | 0:00 | 0:15 | 0:30 | 0:45 | TOTAL |
|---|---|---|---|---|---|
| 0:00 | 7 | 9 | 11 | 8 | 35 |
| 1:00 | 6 | 1 | 5 | 2 | 14 |
| 2:00 | 1 | 4 | 0 | 4 | 9 |
| 3:00 | 1 | 1 | 6 | 2 | 10 |
| 4:00 | 0 | 3 | 2 | 1 | 6 |
| 5:00 | 1 | 1 | 10 | 8 | 20 |
| 6:00 | 14 | 15 | 12 | 27 | 68 |
| 7:00 | 26 | 32 | 39 | 53 | 150 |
| 8:00 | 53 | 67 | 62 | 82 | 264 |
| 9:00 | 76 | 82 | 102 | 102 | 362 |
| 10:00 | 90 | 115 | 97 | 107 | 409 |
| 11:00 | 118 | 104 | 114 | 116 | 452 |
| 12:00 | 111 | 132 | 120 | 122 | 485 |
| 13:00 | 117 | 93 | 119 | 106 | 435 |
| 14:00 | 105 | 110 | 100 | 100 | 415 |
| 15:00 | 107 | 111 | 121 | 90 | 429 |
| 16:00 | 86 | 120 | 100 | 92 | 398 |
| 17:00 | 94 | 83 | 71 | 70 | 318 |
| 18:00 | 96 | 122 | 82 | 80 | 380 |
| 19:00 | 69 | 65 | 71 | 59 | 264 |
| 20:00 | 49 | 58 | 50 | 52 | 209 |
| 21:00 | 36 | 34 | 42 | 32 | 144 |
| 22:00 | 32 | 31 | 31 | 21 | 115 |
| 23:00 | 20 | 15 | 20 | 21 | 76 |
| | | | | TOTAL: | 5467 |

| The A.M. peak hour from 9:15 to 10:15 is 376 |
|---|
| The P.M. peak hour from 14:45 to 15:45 is 439 |

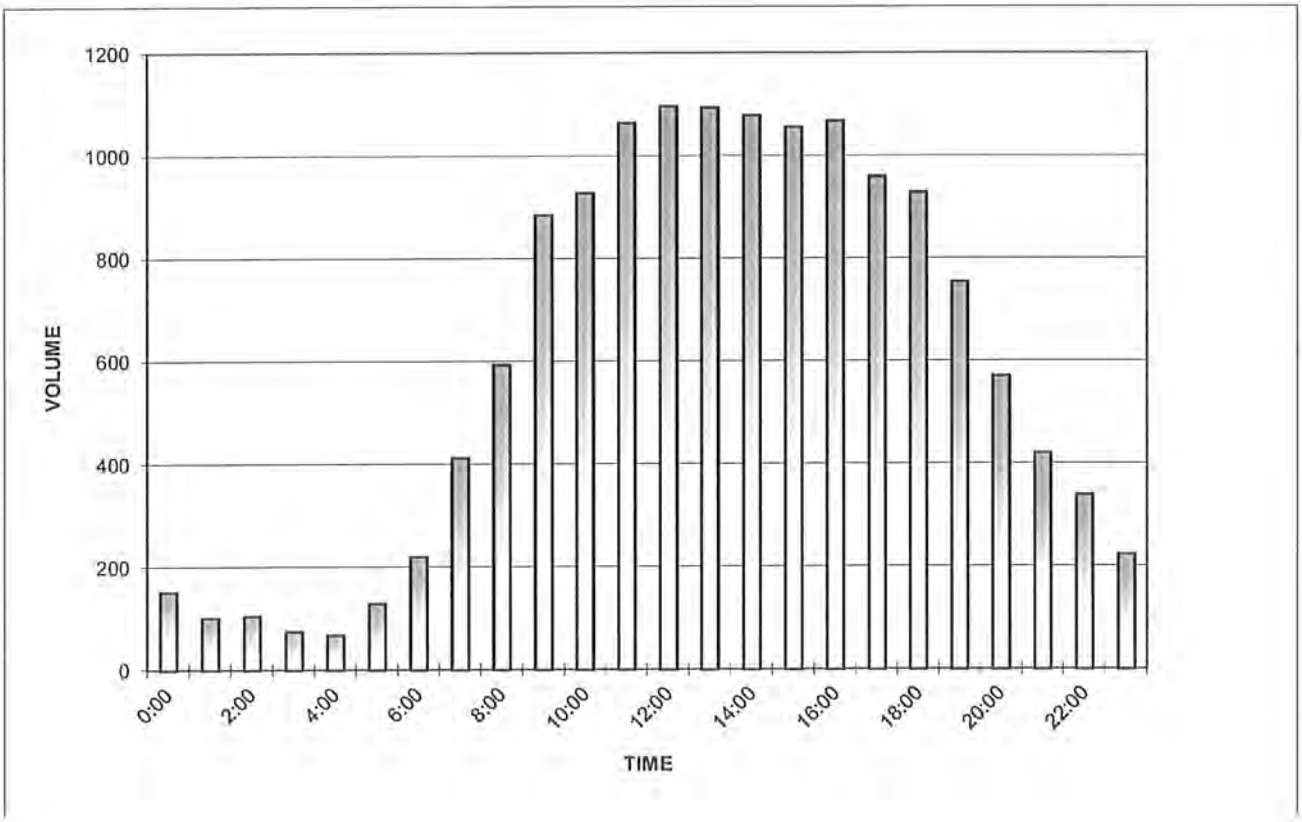


Date Began:
5/7/2011

**NB Gessner Rd. South of Barryknoll Ln.**

| TIME | 0:00 | 0:15 | 0:30 | 0:45 | TOTAL |
|---|---|---|---|---|---|
| 0:00 | 44 | 42 | 39 | 27 | 152 |
| 1:00 | 20 | 17 | 33 | 32 | 102 |
| 2:00 | 28 | 42 | 18 | 17 | 105 |
| 3:00 | 21 | 24 | 10 | 20 | 75 |
| 4:00 | 16 | 17 | 17 | 18 | 68 |
| 5:00 | 19 | 31 | 37 | 42 | 129 |
| 6:00 | 40 | 44 | 54 | 82 | 220 |
| 7:00 | 81 | 90 | 120 | 122 | 413 |
| 8:00 | 118 | 132 | 172 | 172 | 594 |
| 9:00 | 170 | 206 | 232 | 277 | 885 |
| 10:00 | 208 | 236 | 236 | 248 | 928 |
| 11:00 | 260 | 260 | 250 | 295 | 1065 |
| 12:00 | 254 | 256 | 302 | 285 | 1097 |
| 13:00 | 255 | 273 | 268 | 298 | 1094 |
| 14:00 | 258 | 301 | 246 | 274 | 1079 |
| 15:00 | 268 | 265 | 277 | 246 | 1056 |
| 16:00 | 268 | 265 | 262 | 273 | 1068 |
| 17:00 | 267 | 232 | 239 | 222 | 960 |
| 18:00 | 251 | 222 | 228 | 228 | 929 |
| 19:00 | 204 | 198 | 170 | 183 | 755 |
| 20:00 | 190 | 137 | 131 | 114 | 572 |
| 21:00 | 102 | 110 | 108 | 101 | 421 |
| 22:00 | 98 | 94 | 78 | 70 | 340 |
| 23:00 | 59 | 56 | 58 | 51 | 224 |
| | | | | TOTAL: | 14331 |

| |
|---|
| The A.M. peak hour from 9:15 to 10:15 is 923 |
| The P.M. peak hour from 14:15 to 15:15 is 1089 |

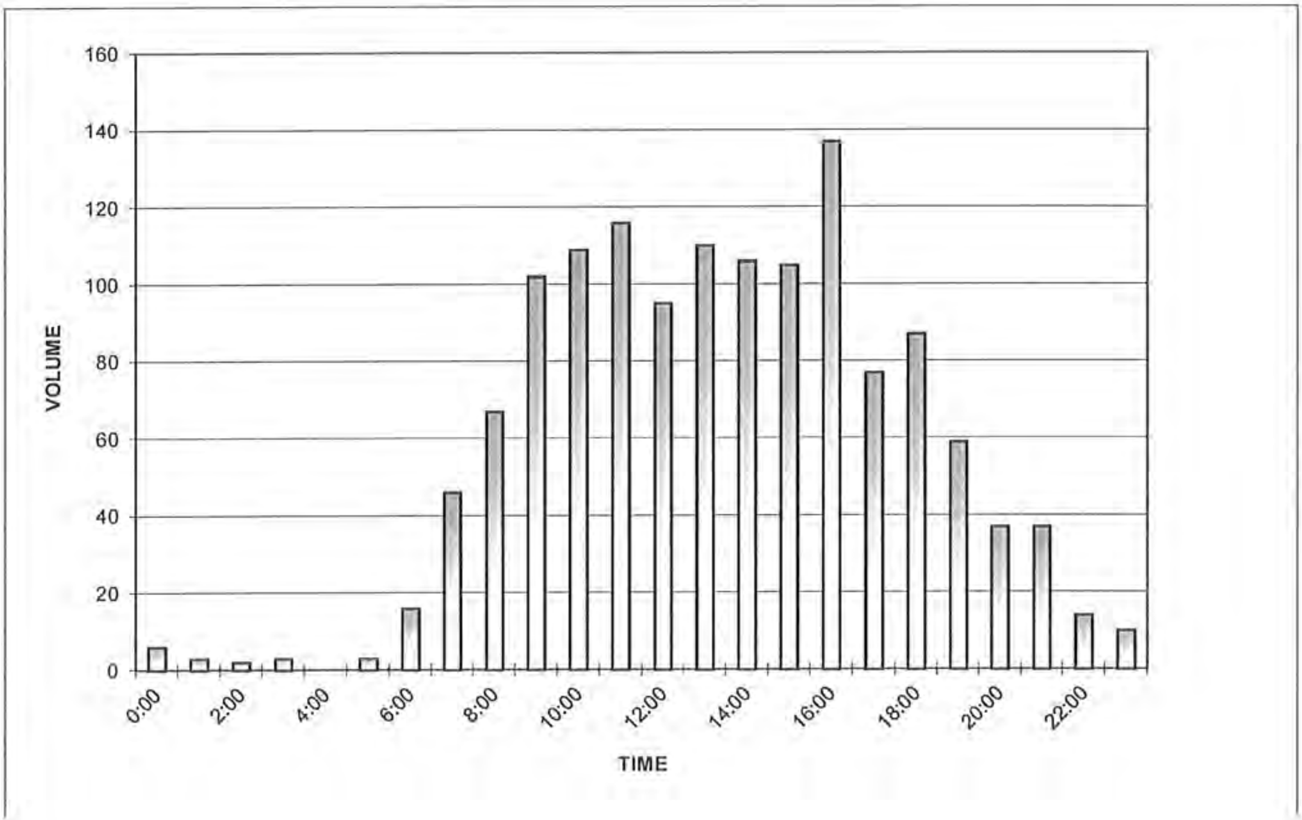


Date Began:
5/7/2011

**NB Plantation Rd. South of Barryknoll Ln.**

| TIME | 0:00 | 0:15 | 0:30 | 0:45 | TOTAL |
|---|---|---|---|---|---|
| 0:00 | 2 | 1 | 2 | 1 | 6 |
| 1:00 | 1 | 0 | 1 | 1 | 3 |
| 2:00 | 0 | 0 | 0 | 2 | 2 |
| 3:00 | 1 | 1 | 1 | 0 | 3 |
| 4:00 | 0 | 0 | 0 | 0 | 0 |
| 5:00 | 0 | 0 | 1 | 2 | 3 |
| 6:00 | 2 | 3 | 6 | 5 | 16 |
| 7:00 | 6 | 8 | 14 | 18 | 46 |
| 8:00 | 10 | 16 | 19 | 22 | 67 |
| 9:00 | 19 | 23 | 28 | 32 | 102 |
| 10:00 | 28 | 29 | 26 | 26 | 109 |
| 11:00 | 33 | 30 | 23 | 30 | 116 |
| 12:00 | 18 | 32 | 22 | 23 | 95 |
| 13:00 | 35 | 20 | 24 | 31 | 110 |
| 14:00 | 29 | 22 | 32 | 23 | 106 |
| 15:00 | 23 | 33 | 29 | 20 | 105 |
| 16:00 | 35 | 32 | 36 | 34 | 137 |
| 17:00 | 18 | 15 | 19 | 25 | 77 |
| 18:00 | 31 | 13 | 23 | 20 | 87 |
| 19:00 | 20 | 17 | 10 | 12 | 59 |
| 20:00 | 10 | 9 | 13 | 5 | 37 |
| 21:00 | 11 | 10 | 7 | 9 | 37 |
| 22:00 | 3 | 2 | 3 | 6 | 14 |
| 23:00 | 5 | 2 | 3 | 0 | 10 |
| | | | | TOTAL: | 1347 |

| |
|---|
| The A.M. peak hour from 9:15 to 10:15 is 111 |
| The P.M. peak hour from 16:00 to 17:00 is 137 |

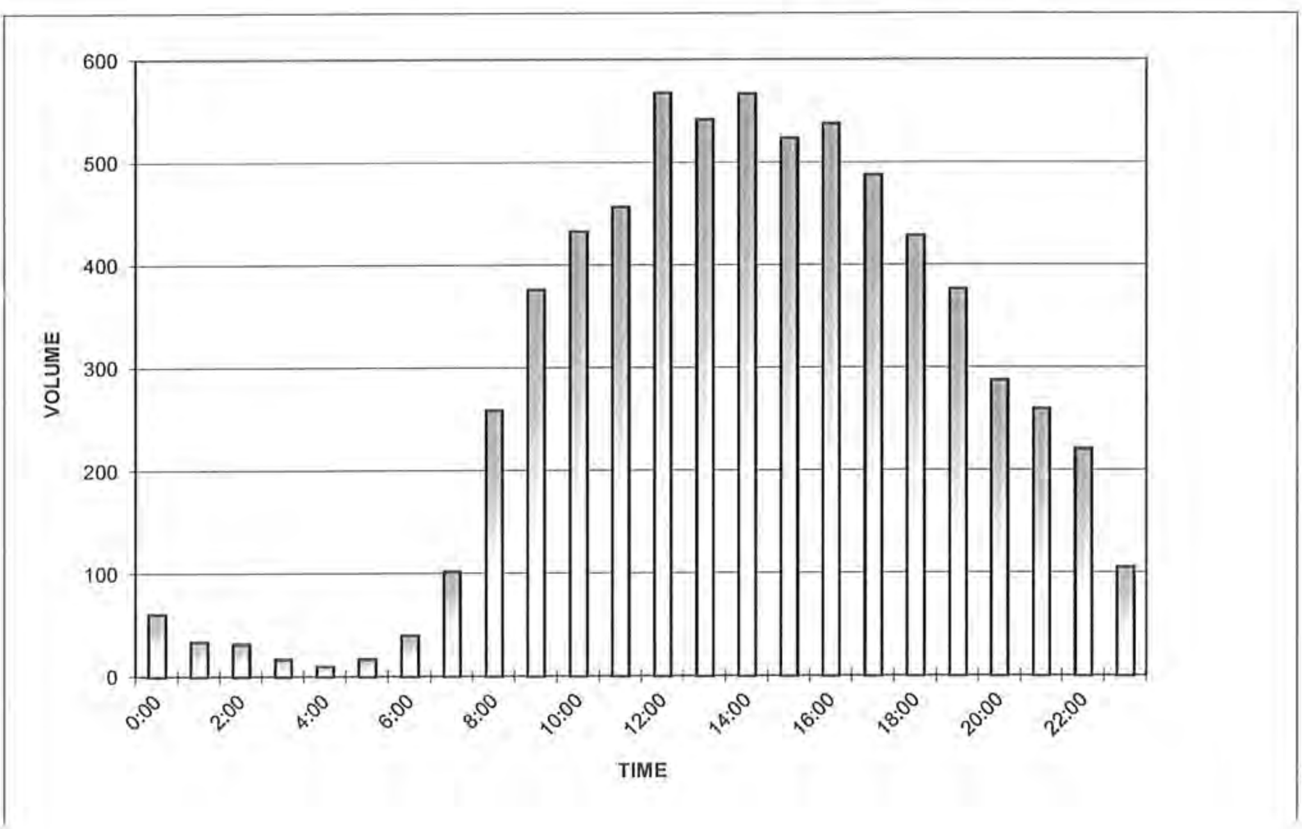


Date Began:
5/7/2011

## SB Bunker Hill Rd. North of Barryknoll Ln.

| TIME | 0:00 | 0:15 | 0:30 | 0:45 | TOTAL |
|---|---|---|---|---|---|
| 0:00 | 22 | 17 | 13 | 9 | 61 |
| 1:00 | 11 | 5 | 11 | 7 | 34 |
| 2:00 | 7 | 11 | 7 | 7 | 32 |
| 3:00 | 5 | 4 | 4 | 4 | 17 |
| 4:00 | 5 | 2 | 3 | 0 | 10 |
| 5:00 | 4 | 1 | 6 | 6 | 17 |
| 6:00 | 7 | 7 | 10 | 16 | 40 |
| 7:00 | 8 | 14 | 38 | 42 | 102 |
| 8:00 | 64 | 55 | 68 | 72 | 259 |
| 9:00 | 92 | 82 | 84 | 118 | 376 |
| 10:00 | 103 | 110 | 108 | 112 | 433 |
| 11:00 | 107 | 113 | 112 | 125 | 457 |
| 12:00 | 138 | 144 | 142 | 144 | 568 |
| 13:00 | 162 | 128 | 130 | 122 | 542 |
| 14:00 | 148 | 146 | 132 | 141 | 567 |
| 15:00 | 124 | 140 | 129 | 131 | 524 |
| 16:00 | 149 | 131 | 130 | 128 | 538 |
| 17:00 | 117 | 114 | 144 | 113 | 488 |
| 18:00 | 114 | 118 | 105 | 92 | 429 |
| 19:00 | 102 | 98 | 103 | 74 | 377 |
| 20:00 | 86 | 68 | 74 | 60 | 288 |
| 21:00 | 72 | 55 | 83 | 50 | 260 |
| 22:00 | 62 | 66 | 53 | 40 | 221 |
| 23:00 | 34 | 28 | 18 | 26 | 106 |
| | | | | TOTAL: | 6746 |

| |
|---|
| The A.M. peak hour from 9:15 to 10:15 is 387 |
| The P.M. peak hour from 15:15 to 16:15 is 549 |

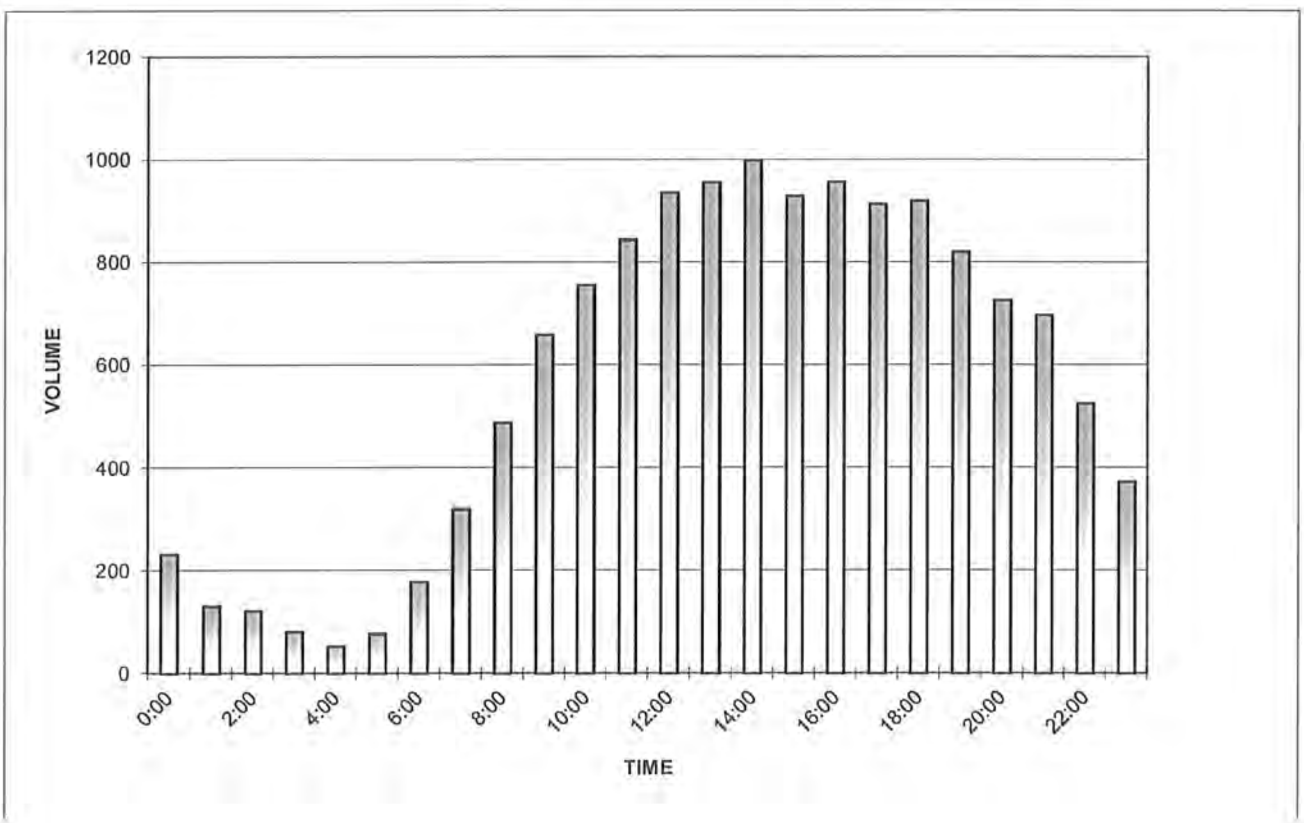


## SB Gessner Rd. North of Barryknoll Ln.

Date Began:
5/7/2011

| TIME | 0:00 | 0:15 | 0:30 | 0:45 | TOTAL |
|---|---|---|---|---|---|
| 0:00 | 84 | 64 | 53 | 31 | 232 |
| 1:00 | 40 | 41 | 24 | 26 | 131 |
| 2:00 | 36 | 46 | 26 | 14 | 122 |
| 3:00 | 20 | 18 | 27 | 16 | 81 |
| 4:00 | 9 | 15 | 11 | 18 | 53 |
| 5:00 | 10 | 15 | 26 | 26 | 77 |
| 6:00 | 42 | 38 | 40 | 58 | 178 |
| 7:00 | 50 | 68 | 94 | 108 | 320 |
| 8:00 | 106 | 108 | 126 | 148 | 488 |
| 9:00 | 158 | 162 | 152 | 187 | 659 |
| 10:00 | 192 | 158 | 200 | 206 | 756 |
| 11:00 | 216 | 208 | 194 | 226 | 844 |
| 12:00 | 226 | 239 | 237 | 234 | 936 |
| 13:00 | 220 | 234 | 258 | 244 | 956 |
| 14:00 | 240 | 272 | 244 | 243 | 999 |
| 15:00 | 242 | 220 | 240 | 228 | 930 |
| 16:00 | 238 | 249 | 233 | 237 | 957 |
| 17:00 | 218 | 249 | 226 | 221 | 914 |
| 18:00 | 240 | 236 | 224 | 220 | 920 |
| 19:00 | 216 | 199 | 202 | 203 | 820 |
| 20:00 | 204 | 181 | 181 | 160 | 726 |
| 21:00 | 190 | 186 | 167 | 154 | 697 |
| 22:00 | 148 | 141 | 123 | 113 | 525 |
| 23:00 | 108 | 110 | 84 | 71 | 373 |
| | | | | TOTAL: | 13694 |

| |
|---|
| The A.M. peak hour from 9:15 to 10:15 is 693 |
| The P.M. peak hour from 14:15 to 15:15 is 1001 |

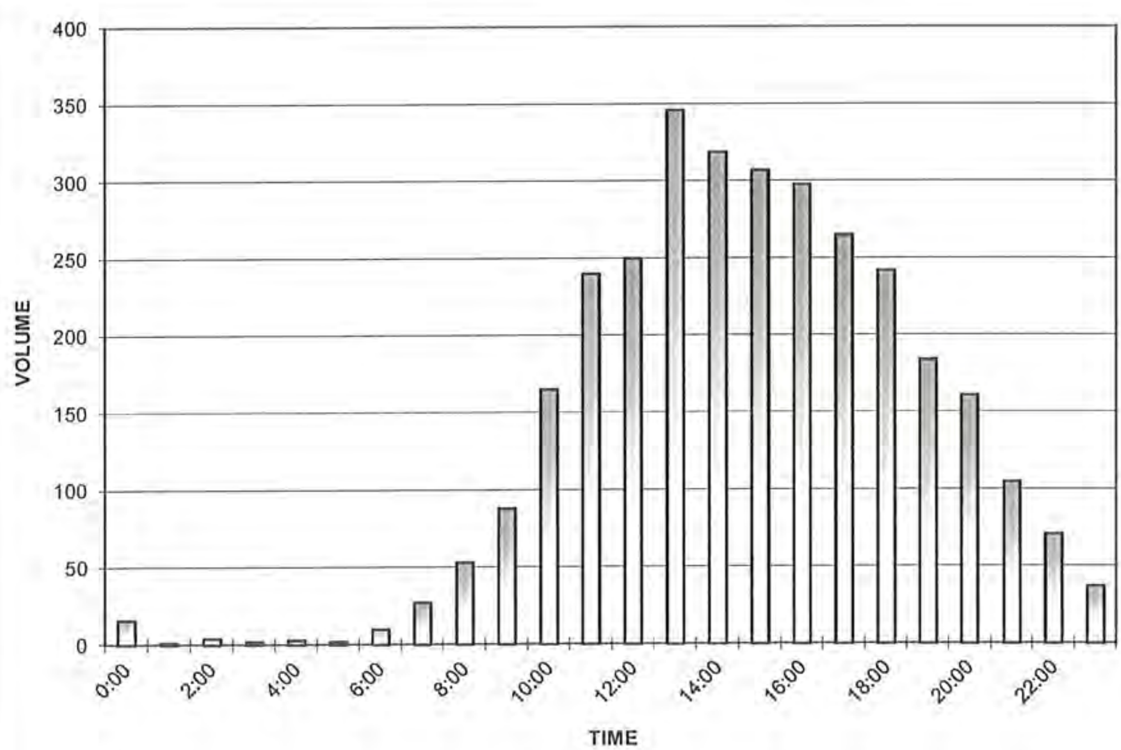


Date Began:
5/7/2011

## SB Memorial City Way North of Barryknoll Ln.

| TIME | 0:00 | 0:15 | 0:30 | 0:45 | TOTAL |
|---|---|---|---|---|---|
| 0:00 | 4 | 5 | 3 | 4 | 16 |
| 1:00 | 0 | 1 | 0 | 0 | 1 |
| 2:00 | 0 | 1 | 1 | 2 | 4 |
| 3:00 | 1 | 0 | 1 | 0 | 2 |
| 4:00 | 0 | 2 | 0 | 1 | 3 |
| 5:00 | 0 | 0 | 1 | 1 | 2 |
| 6:00 | 5 | 2 | 2 | 1 | 10 |
| 7:00 | 5 | 3 | 6 | 13 | 27 |
| 8:00 | 13 | 14 | 10 | 16 | 53 |
| 9:00 | 15 | 27 | 15 | 31 | 88 |
| 10:00 | 29 | 48 | 44 | 44 | 165 |
| 11:00 | 68 | 57 | 55 | 60 | 240 |
| 12:00 | 49 | 67 | 54 | 80 | 250 |
| 13:00 | 88 | 85 | 79 | 94 | 346 |
| 14:00 | 86 | 90 | 58 | 85 | 319 |
| 15:00 | 84 | 86 | 69 | 68 | 307 |
| 16:00 | 78 | 68 | 83 | 69 | 298 |
| 17:00 | 68 | 75 | 64 | 58 | 265 |
| 18:00 | 64 | 57 | 64 | 57 | 242 |
| 19:00 | 54 | 48 | 38 | 44 | 184 |
| 20:00 | 38 | 41 | 48 | 34 | 161 |
| 21:00 | 34 | 25 | 19 | 27 | 105 |
| 22:00 | 20 | 21 | 18 | 12 | 71 |
| 23:00 | 9 | 9 | 8 | 11 | 37 |
| | | | | TOTAL: | 3196 |

| |
|---|
| The A.M. peak hour from 9:15 to 10:15 is 102 |
| The P.M. peak hour from 14:45 to 15:45 is 324 |

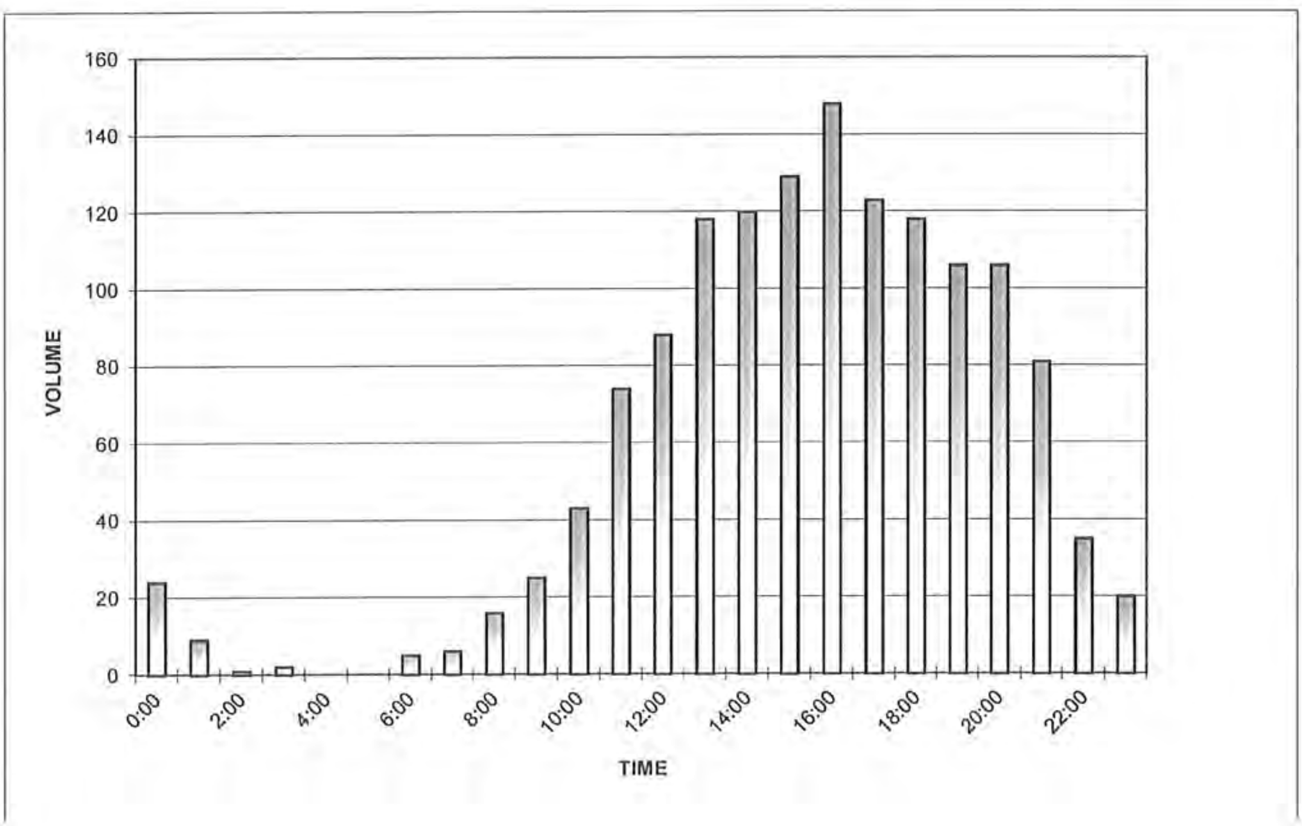


Date Began:
5/7/2011

## SB Plantation Rd. North of Barryknoll Ln.

| TIME | 0:00 | 0:15 | 0:30 | 0:45 | TOTAL |
|---|---|---|---|---|---|
| 0:00 | 10 | 7 | 2 | 5 | 24 |
| 1:00 | 4 | 3 | 0 | 2 | 9 |
| 2:00 | 1 | 0 | 0 | 0 | 1 |
| 3:00 | 1 | 1 | 0 | 0 | 2 |
| 4:00 | 0 | 0 | 0 | 0 | 0 |
| 5:00 | 0 | 0 | 0 | 0 | 0 |
| 6:00 | 2 | 1 | 0 | 2 | 5 |
| 7:00 | 2 | 0 | 1 | 3 | 6 |
| 8:00 | 5 | 1 | 6 | 4 | 16 |
| 9:00 | 9 | 5 | 1 | 10 | 25 |
| 10:00 | 11 | 7 | 8 | 17 | 43 |
| 11:00 | 13 | 23 | 16 | 22 | 74 |
| 12:00 | 25 | 23 | 15 | 25 | 88 |
| 13:00 | 23 | 32 | 32 | 31 | 118 |
| 14:00 | 32 | 33 | 27 | 28 | 120 |
| 15:00 | 35 | 27 | 19 | 48 | 129 |
| 16:00 | 41 | 28 | 39 | 40 | 148 |
| 17:00 | 36 | 25 | 19 | 43 | 123 |
| 18:00 | 30 | 24 | 30 | 34 | 118 |
| 19:00 | 30 | 23 | 28 | 25 | 106 |
| 20:00 | 18 | 34 | 25 | 29 | 106 |
| 21:00 | 17 | 25 | 20 | 19 | 81 |
| 22:00 | 14 | 7 | 9 | 5 | 35 |
| 23:00 | 3 | 5 | 5 | 7 | 20 |
| | | | | TOTAL: | 1397 |

| |
|---|
| The A.M. peak hour from 9:15 to 10:15 is 27 |
| The P.M. peak hour from 15:45 to 16:45 is 156 |

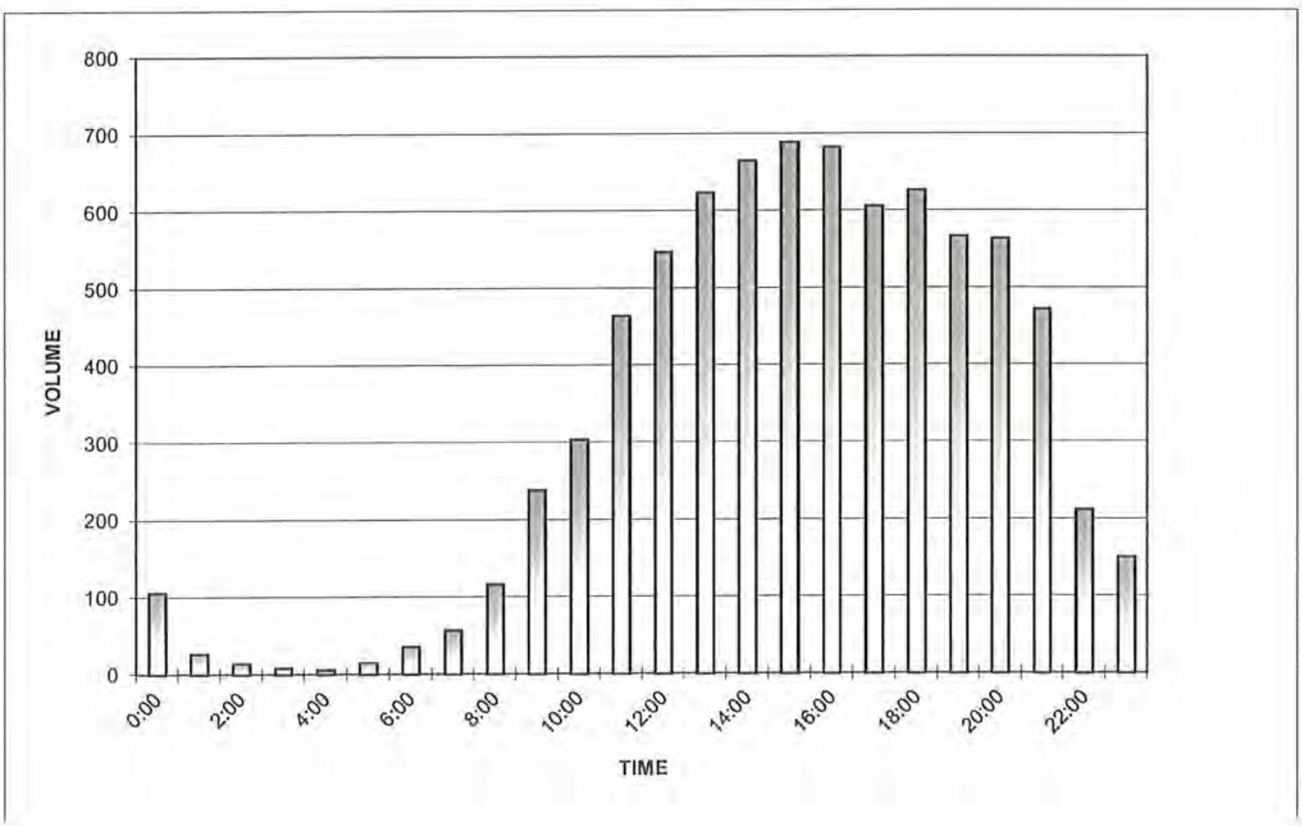


Date Began:
5/7/2011

## WB Barryknoll Ln. East of Gessner Rd.

| TIME | 0:00 | 0:15 | 0:30 | 0:45 | TOTAL |
|---|---|---|---|---|---|
| 0:00 | 47 | 31 | 10 | 18 | 106 |
| 1:00 | 9 | 5 | 5 | 8 | 27 |
| 2:00 | 6 | 2 | 4 | 2 | 14 |
| 3:00 | 7 | 0 | 2 | 0 | 9 |
| 4:00 | 1 | 2 | 2 | 1 | 6 |
| 5:00 | 4 | 0 | 5 | 6 | 15 |
| 6:00 | 17 | 10 | 1 | 8 | 36 |
| 7:00 | 12 | 9 | 18 | 18 | 57 |
| 8:00 | 26 | 26 | 37 | 27 | 116 |
| 9:00 | 45 | 55 | 56 | 82 | 238 |
| 10:00 | 58 | 74 | 86 | 86 | 304 |
| 11:00 | 128 | 98 | 116 | 122 | 464 |
| 12:00 | 118 | 139 | 126 | 164 | 547 |
| 13:00 | 148 | 148 | 164 | 164 | 624 |
| 14:00 | 174 | 170 | 151 | 170 | 665 |
| 15:00 | 175 | 168 | 170 | 176 | 689 |
| 16:00 | 174 | 183 | 150 | 176 | 683 |
| 17:00 | 162 | 140 | 146 | 158 | 606 |
| 18:00 | 160 | 158 | 164 | 145 | 627 |
| 19:00 | 147 | 150 | 146 | 124 | 567 |
| 20:00 | 140 | 150 | 144 | 130 | 564 |
| 21:00 | 132 | 130 | 116 | 94 | 472 |
| 22:00 | 72 | 70 | 32 | 38 | 212 |
| 23:00 | 36 | 58 | 27 | 30 | 151 |
| | | | | TOTAL: | 7799 |

| |
|---|
| The A.M. peak hour from 9:15 to 10:15 is 251 |
| The P.M. peak hour from 15:30 to 16:30 is 703 |

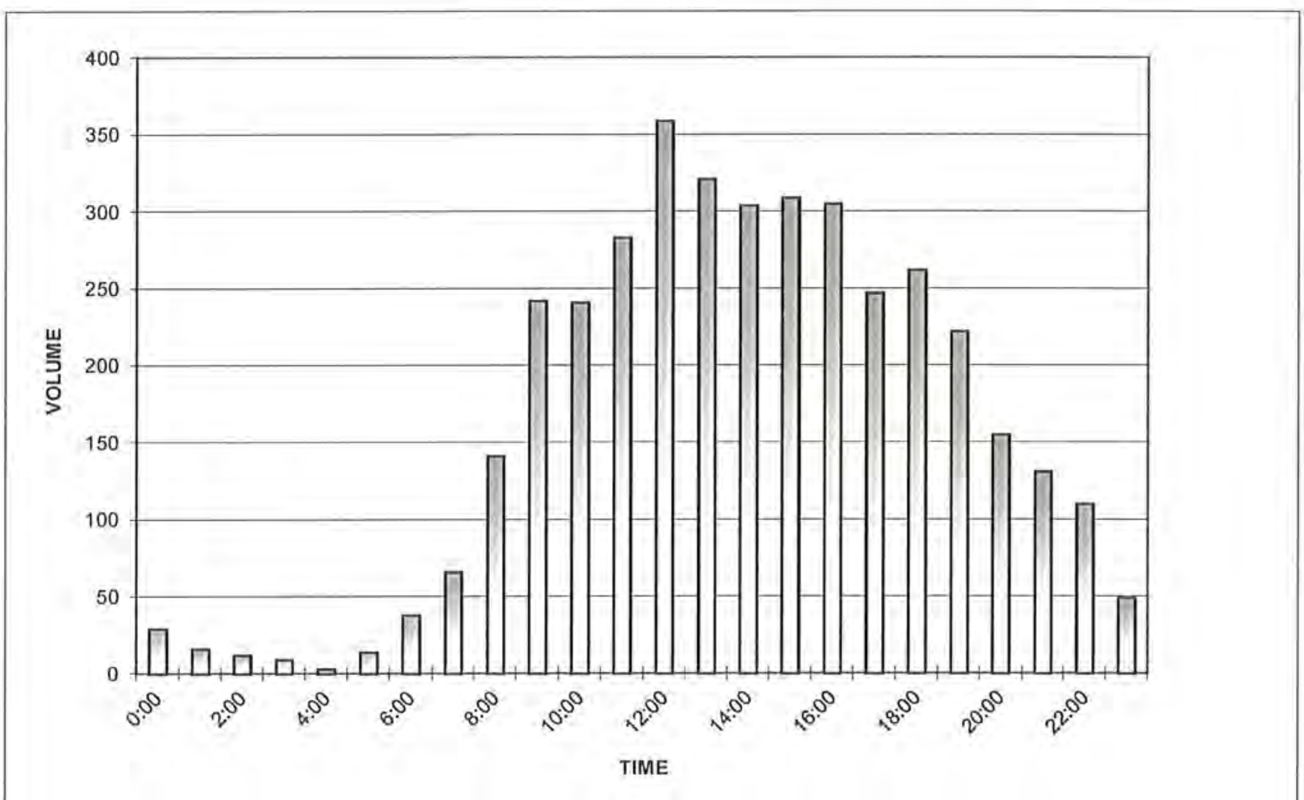


Date Began:
5/7/2011

## WB Barryknoll Ln. East of Memorial City Way

| TIME | 0:00 | 0:15 | 0:30 | 0:45 | TOTAL |
|---|---|---|---|---|---|
| 0:00 | 12 | 9 | 6 | 2 | 29 |
| 1:00 | 7 | 2 | 3 | 4 | 16 |
| 2:00 | 2 | 5 | 2 | 3 | 12 |
| 3:00 | 3 | 2 | 2 | 2 | 9 |
| 4:00 | 0 | 1 | 2 | 0 | 3 |
| 5:00 | 1 | 2 | 4 | 7 | 14 |
| 6:00 | 15 | 7 | 6 | 10 | 38 |
| 7:00 | 8 | 15 | 24 | 19 | 66 |
| 8:00 | 28 | 32 | 43 | 38 | 141 |
| 9:00 | 56 | 58 | 56 | 72 | 242 |
| 10:00 | 50 | 61 | 64 | 66 | 241 |
| 11:00 | 67 | 58 | 76 | 82 | 283 |
| 12:00 | 76 | 96 | 96 | 91 | 359 |
| 13:00 | 87 | 76 | 85 | 73 | 321 |
| 14:00 | 79 | 74 | 82 | 69 | 304 |
| 15:00 | 82 | 79 | 74 | 74 | 309 |
| 16:00 | 82 | 86 | 59 | 78 | 305 |
| 17:00 | 58 | 55 | 77 | 57 | 247 |
| 18:00 | 59 | 82 | 69 | 52 | 262 |
| 19:00 | 55 | 55 | 59 | 53 | 222 |
| 20:00 | 46 | 46 | 37 | 26 | 155 |
| 21:00 | 40 | 32 | 28 | 31 | 131 |
| 22:00 | 23 | 44 | 21 | 22 | 110 |
| 23:00 | 9 | 14 | 19 | 7 | 49 |
| | | | | TOTAL: | 3868 |

| |
|---|
| The A.M. peak hour from 9:00 to 10:00 is 242 |
| The P.M. peak hour from 15:30 to 16:30 is 316 |

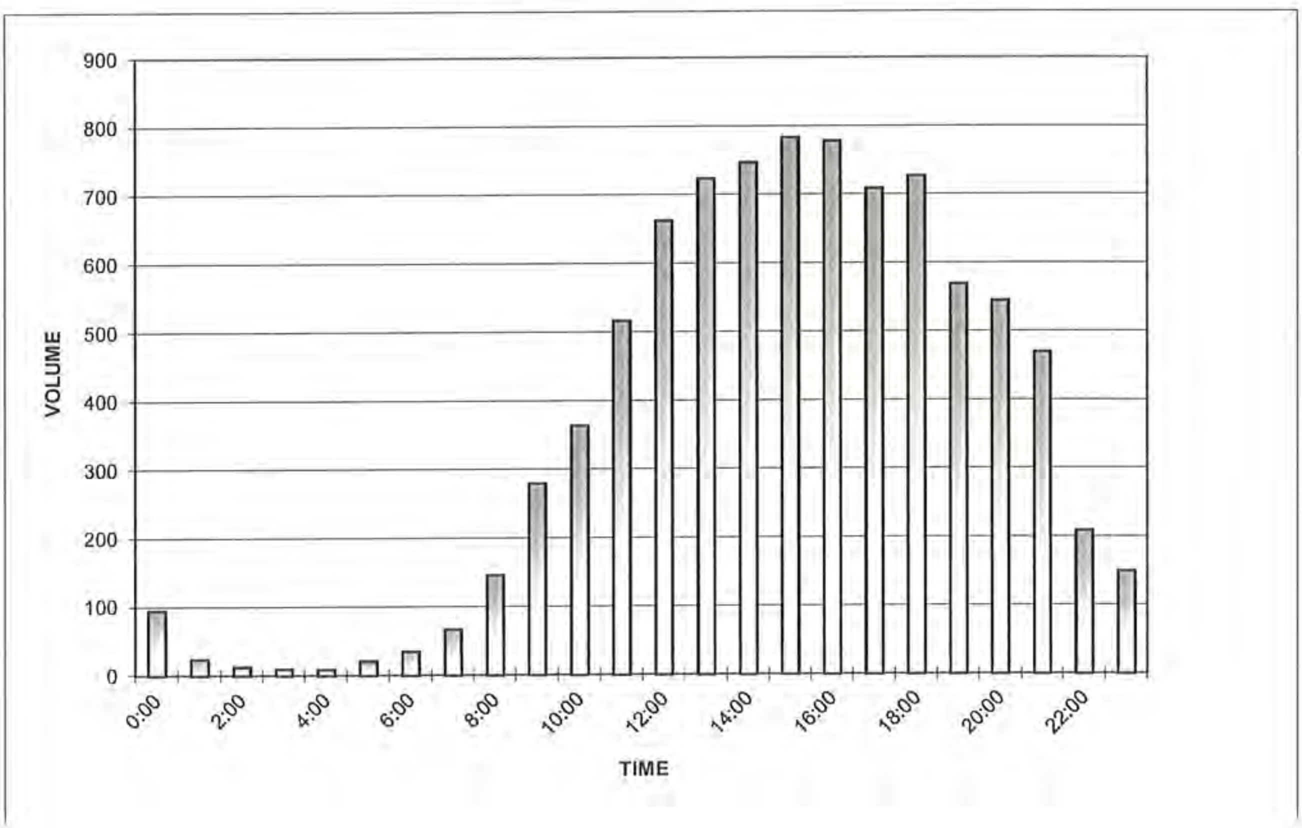


Date Began:
5/7/2011

## WB Barryknoll Ln. East of Plantation Rd.

| TIME | 0:00 | 0:15 | 0:30 | 0:45 | TOTAL |
|---|---|---|---|---|---|
| 0:00 | 44 | 27 | 9 | 15 | 95 |
| 1:00 | 10 | 3 | 4 | 7 | 24 |
| 2:00 | 3 | 2 | 4 | 4 | 13 |
| 3:00 | 6 | 2 | 1 | 1 | 10 |
| 4:00 | 1 | 2 | 4 | 2 | 9 |
| 5:00 | 5 | 0 | 6 | 10 | 21 |
| 6:00 | 19 | 7 | 2 | 7 | 35 |
| 7:00 | 9 | 12 | 22 | 24 | 67 |
| 8:00 | 37 | 34 | 44 | 31 | 146 |
| 9:00 | 53 | 68 | 65 | 94 | 280 |
| 10:00 | 66 | 97 | 96 | 105 | 364 |
| 11:00 | 129 | 105 | 144 | 139 | 517 |
| 12:00 | 127 | 172 | 166 | 198 | 663 |
| 13:00 | 176 | 182 | 174 | 192 | 724 |
| 14:00 | 214 | 198 | 158 | 177 | 747 |
| 15:00 | 194 | 208 | 176 | 206 | 784 |
| 16:00 | 209 | 204 | 192 | 174 | 779 |
| 17:00 | 192 | 188 | 166 | 164 | 710 |
| 18:00 | 180 | 184 | 194 | 170 | 728 |
| 19:00 | 162 | 142 | 150 | 116 | 570 |
| 20:00 | 136 | 141 | 147 | 121 | 545 |
| 21:00 | 132 | 121 | 123 | 94 | 470 |
| 22:00 | 62 | 75 | 30 | 42 | 209 |
| 23:00 | 33 | 61 | 30 | 26 | 150 |
| | | | | TOTAL: | 8660 |

| |
|---|
| The A.M. peak hour from 9:15 to 10:15 is 293 |
| The P.M. peak hour from 15:45 to 16:45 is 811 |

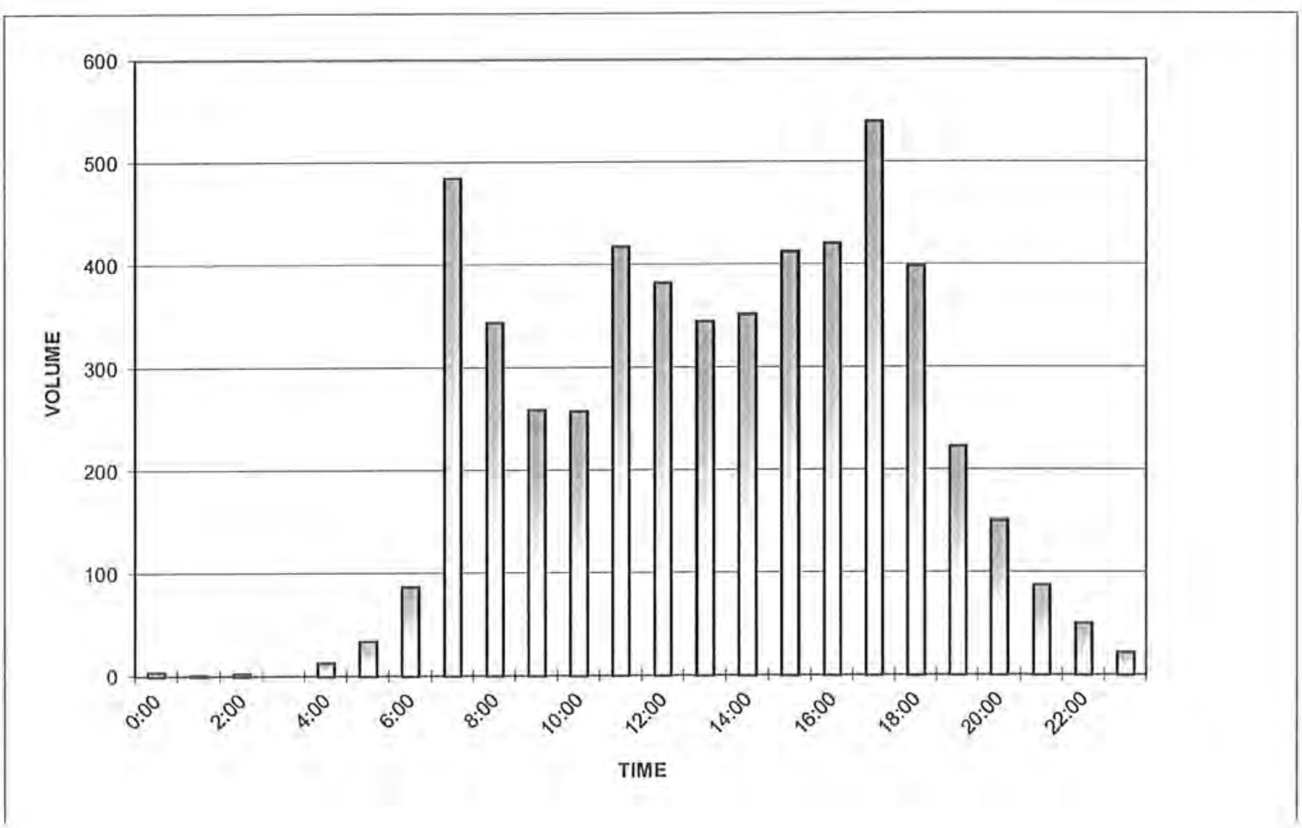


Date Began:
5/4/2011

**EB Barryknoll Ln. between Bettina Ct. and Strey Ln.**

| TIME | 0:00 | 0:15 | 0:30 | 0:45 | TOTAL |
|---|---|---|---|---|---|
| 0:00 | 0 | 1 | 1 | 2 | 4 |
| 1:00 | 0 | 1 | 0 | 0 | 1 |
| 2:00 | 0 | 3 | 0 | 0 | 3 |
| 3:00 | 0 | 0 | 0 | 0 | 0 |
| 4:00 | 2 | 4 | 1 | 6 | 13 |
| 5:00 | 7 | 5 | 8 | 14 | 34 |
| 6:00 | 16 | 18 | 24 | 29 | 87 |
| 7:00 | 76 | 115 | 174 | 120 | 485 |
| 8:00 | 106 | 88 | 80 | 70 | 344 |
| 9:00 | 60 | 44 | 76 | 79 | 259 |
| 10:00 | 60 | 67 | 62 | 69 | 258 |
| 11:00 | 84 | 83 | 134 | 117 | 418 |
| 12:00 | 103 | 94 | 95 | 91 | 383 |
| 13:00 | 88 | 86 | 79 | 92 | 345 |
| 14:00 | 86 | 82 | 96 | 88 | 352 |
| 15:00 | 120 | 78 | 118 | 97 | 413 |
| 16:00 | 105 | 104 | 100 | 112 | 421 |
| 17:00 | 144 | 142 | 144 | 110 | 540 |
| 18:00 | 109 | 110 | 96 | 84 | 399 |
| 19:00 | 63 | 65 | 47 | 48 | 223 |
| 20:00 | 36 | 43 | 46 | 26 | 151 |
| 21:00 | 27 | 23 | 20 | 18 | 88 |
| 22:00 | 17 | 11 | 14 | 9 | 51 |
| 23:00 | 11 | 4 | 3 | 4 | 22 |
| | | | | TOTAL: | 5294 |

| |
|---|
| The A.M. peak hour from 7:15 to 8:15 is 515 |
| The P.M. peak hour from 16:45 to 17:45 is 542 |



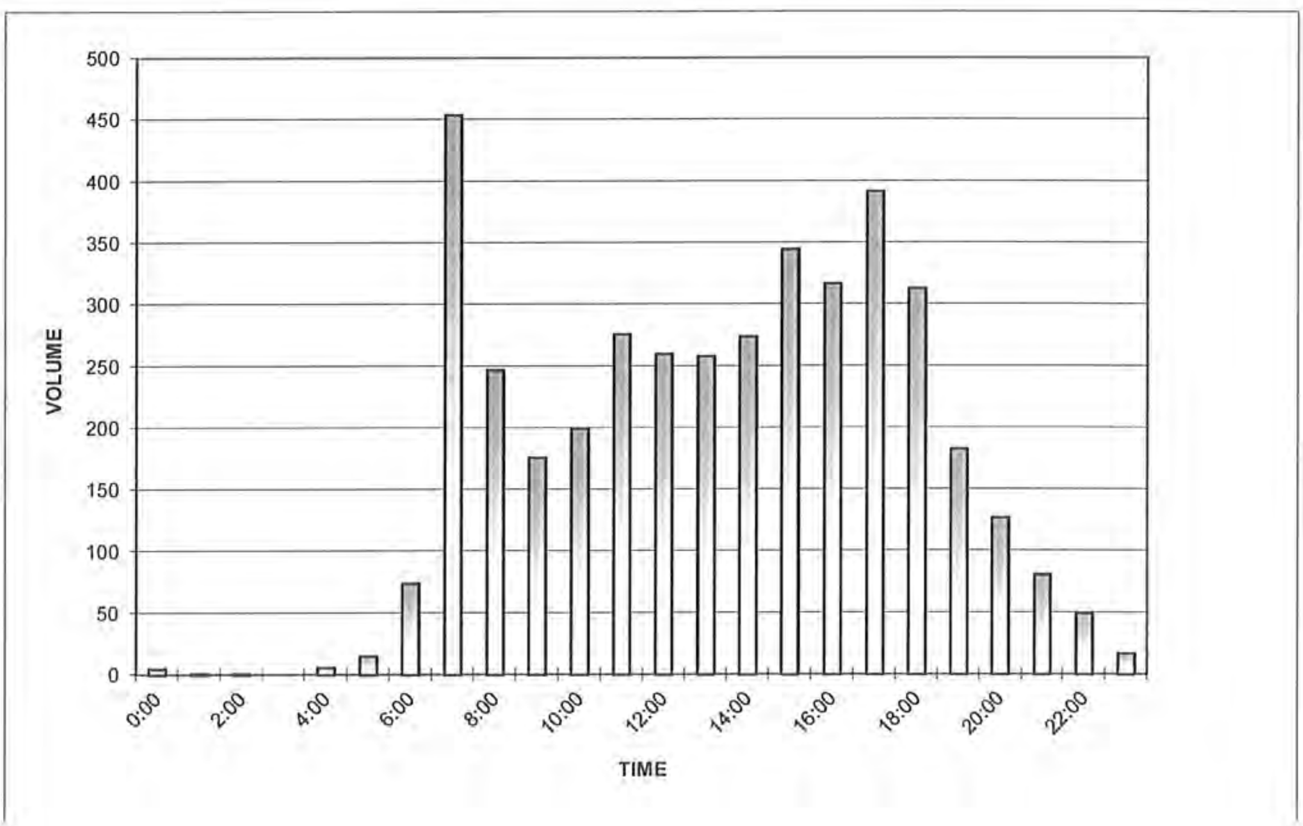
Date Began:
5/4/2011

**EB Barryknoll Ln. West of Bunker Hill Rd.**

| TIME | 0:00 | 0:15 | 0:30 | 0:45 | TOTAL |
|---|---|---|---|---|---|
| 0:00 | 1 | 1 | 2 | 1 | 5 |
| 1:00 | 1 | 0 | 0 | 0 | 1 |
| 2:00 | 0 | 1 | 0 | 0 | 1 |
| 3:00 | 0 | 0 | 0 | 0 | 0 |
| 4:00 | 2 | 1 | 0 | 3 | 6 |
| 5:00 | 4 | 3 | 5 | 3 | 15 |
| 6:00 | 14 | 14 | 22 | 24 | 74 |
| 7:00 | 71 | 104 | 169 | 110 | 454 |
| 8:00 | 76 | 62 | 61 | 48 | 247 |
| 9:00 | 42 | 39 | 39 | 56 | 176 |
| 10:00 | 54 | 59 | 45 | 42 | 200 |
| 11:00 | 63 | 59 | 74 | 80 | 276 |
| 12:00 | 77 | 63 | 62 | 58 | 260 |
| 13:00 | 64 | 60 | 68 | 66 | 258 |
| 14:00 | 77 | 58 | 84 | 55 | 274 |
| 15:00 | 106 | 78 | 93 | 68 | 345 |
| 16:00 | 70 | 75 | 78 | 94 | 317 |
| 17:00 | 94 | 94 | 114 | 90 | 392 |
| 18:00 | 76 | 100 | 80 | 57 | 313 |
| 19:00 | 54 | 60 | 29 | 40 | 183 |
| 20:00 | 28 | 34 | 38 | 27 | 127 |
| 21:00 | 32 | 18 | 18 | 13 | 81 |
| 22:00 | 15 | 14 | 13 | 8 | 50 |
| 23:00 | 6 | 4 | 2 | 5 | 17 |
| | | | | TOTAL: | 4072 |

The A.M. peak hour from 7:15 to 8:15 is 459

The P.M. peak hour from 16:45 to 17:45 is 396

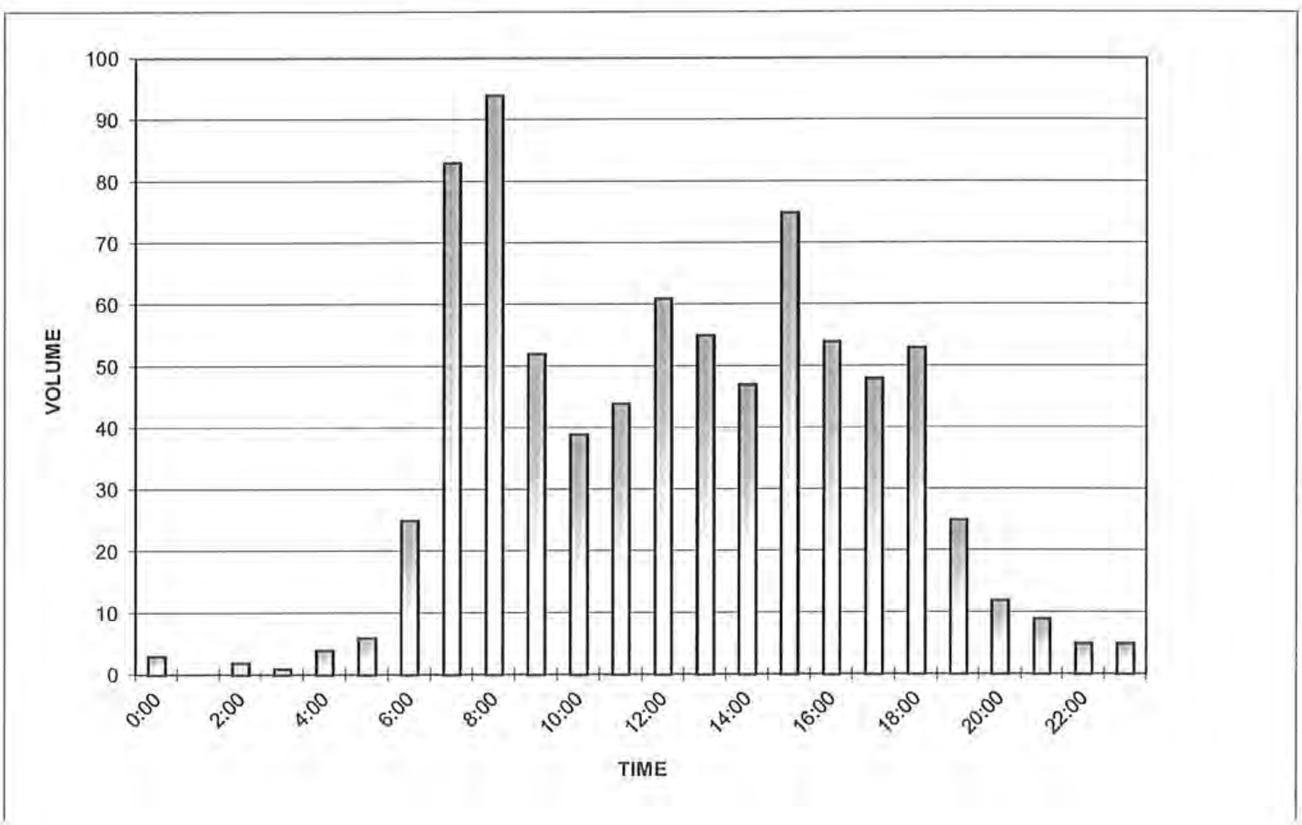


## EB Barryknoll Ln. West of Gessner Rd.

Date Began:
5/4/2011

| TIME | 0:00 | 0:15 | 0:30 | 0:45 | TOTAL |
|---|---|---|---|---|---|
| 0:00 | 0 | 1 | 0 | 2 | 3 |
| 1:00 | 0 | 0 | 0 | 0 | 0 |
| 2:00 | 0 | 0 | 1 | 1 | 2 |
| 3:00 | 0 | 0 | 1 | 0 | 1 |
| 4:00 | 0 | 0 | 2 | 2 | 4 |
| 5:00 | 0 | 1 | 0 | 5 | 6 |
| 6:00 | 4 | 3 | 11 | 7 | 25 |
| 7:00 | 8 | 16 | 31 | 28 | 83 |
| 8:00 | 26 | 24 | 22 | 22 | 94 |
| 9:00 | 16 | 10 | 12 | 14 | 52 |
| 10:00 | 8 | 11 | 8 | 12 | 39 |
| 11:00 | 12 | 8 | 14 | 10 | 44 |
| 12:00 | 12 | 16 | 18 | 15 | 61 |
| 13:00 | 14 | 15 | 12 | 14 | 55 |
| 14:00 | 4 | 13 | 14 | 16 | 47 |
| 15:00 | 14 | 12 | 23 | 26 | 75 |
| 16:00 | 8 | 16 | 20 | 10 | 54 |
| 17:00 | 9 | 11 | 13 | 15 | 48 |
| 18:00 | 11 | 20 | 12 | 10 | 53 |
| 19:00 | 5 | 9 | 5 | 6 | 25 |
| 20:00 | 2 | 1 | 6 | 3 | 12 |
| 21:00 | 2 | 1 | 2 | 4 | 9 |
| 22:00 | 2 | 2 | 0 | 1 | 5 |
| 23:00 | 2 | 1 | 1 | 1 | 5 |
| | | | | TOTAL: | 802 |

| |
|---|
| The A.M. peak hour from 7:30 to 8:30 is 109 |
| The P.M. peak hour from 15:00 to 16:00 is 75 |

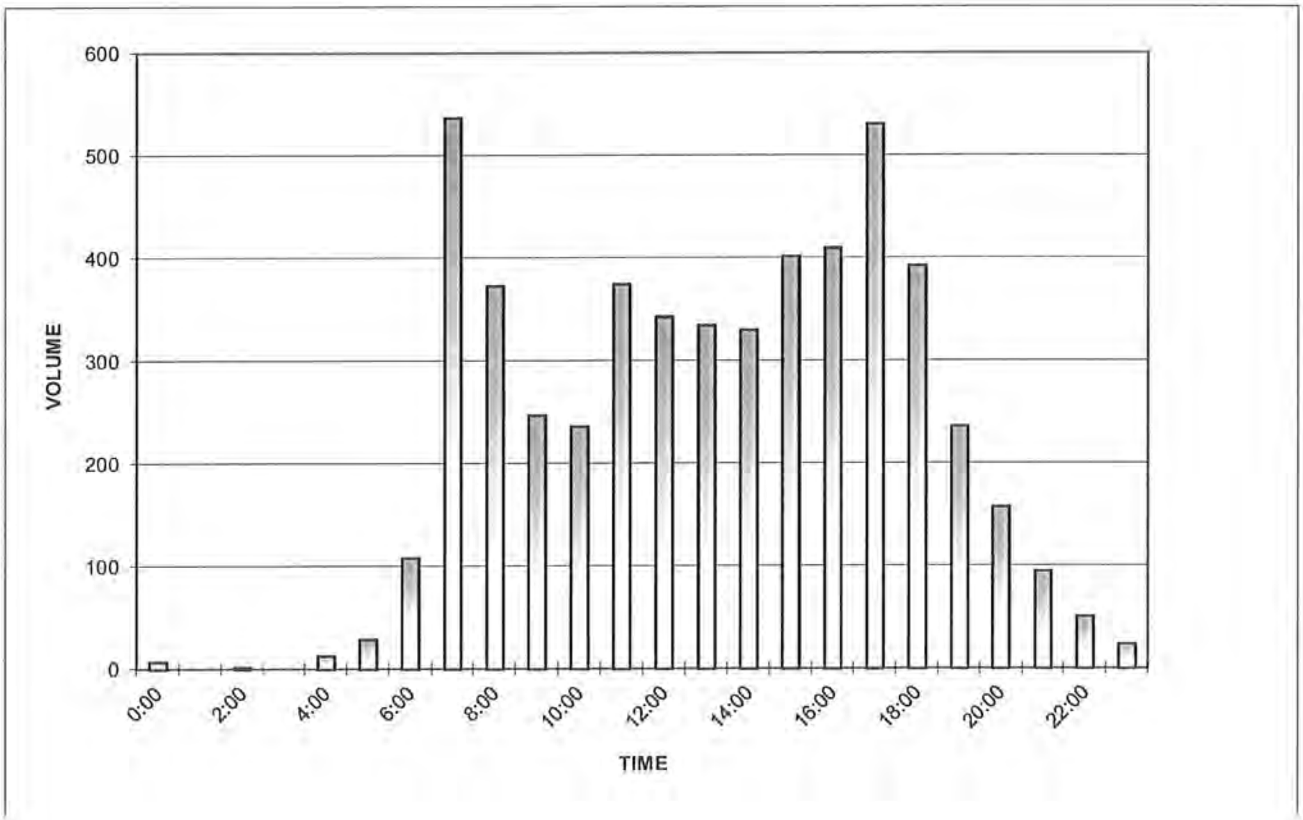


Date Began:
5/4/2011

## EB Barryknoll Ln. West of Memorial City Way

| TIME | 0:00 | 0:15 | 0:30 | 0:45 | TOTAL |
|---|---|---|---|---|---|
| 0:00 | 1 | 2 | 2 | 2 | 7 |
| 1:00 | 0 | 0 | 0 | 0 | 0 |
| 2:00 | 0 | 1 | 0 | 1 | 2 |
| 3:00 | 0 | 0 | 0 | 0 | 0 |
| 4:00 | 2 | 3 | 2 | 6 | 13 |
| 5:00 | 7 | 3 | 9 | 10 | 29 |
| 6:00 | 15 | 26 | 29 | 38 | 108 |
| 7:00 | 83 | 124 | 190 | 140 | 537 |
| 8:00 | 115 | 92 | 88 | 78 | 373 |
| 9:00 | 66 | 42 | 63 | 76 | 247 |
| 10:00 | 52 | 68 | 58 | 58 | 236 |
| 11:00 | 80 | 78 | 110 | 107 | 375 |
| 12:00 | 99 | 82 | 80 | 82 | 343 |
| 13:00 | 84 | 84 | 82 | 85 | 335 |
| 14:00 | 78 | 76 | 100 | 76 | 330 |
| 15:00 | 121 | 82 | 109 | 90 | 402 |
| 16:00 | 98 | 104 | 97 | 111 | 410 |
| 17:00 | 140 | 131 | 145 | 115 | 531 |
| 18:00 | 106 | 116 | 92 | 79 | 393 |
| 19:00 | 70 | 68 | 49 | 49 | 236 |
| 20:00 | 35 | 47 | 48 | 28 | 158 |
| 21:00 | 30 | 23 | 22 | 20 | 95 |
| 22:00 | 17 | 14 | 13 | 7 | 51 |
| 23:00 | 8 | 4 | 5 | 7 | 24 |
| | | | | TOTAL: | 5235 |

| |
|---|
| The A.M. peak hour from 7:15 to 8:15 is 569 |
| The P.M. peak hour from 17:00 to 18:00 is 531 |

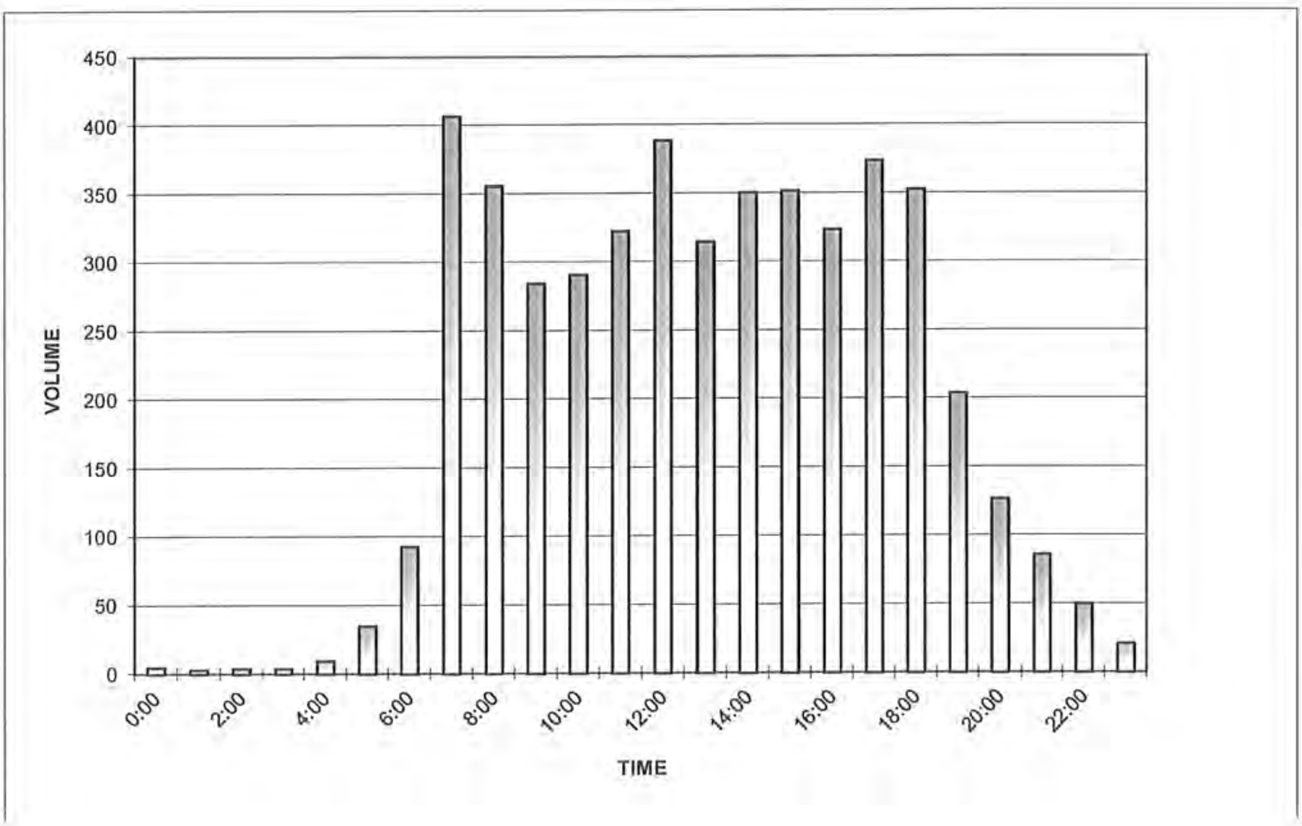


Date Began:
5/4/2011

**EB Barryknoll Ln. West of Plantation Rd.**

| TIME | 0:00 | 0:15 | 0:30 | 0:45 | TOTAL |
|---|---|---|---|---|---|
| 0:00 | 1 | 2 | 1 | 1 | 5 |
| 1:00 | 0 | 1 | 0 | 2 | 3 |
| 2:00 | 1 | 3 | 0 | 0 | 4 |
| 3:00 | 1 | 1 | 2 | 0 | 4 |
| 4:00 | 0 | 3 | 1 | 6 | 10 |
| 5:00 | 6 | 6 | 9 | 14 | 35 |
| 6:00 | 18 | 22 | 22 | 31 | 93 |
| 7:00 | 80 | 106 | 131 | 90 | 407 |
| 8:00 | 96 | 96 | 88 | 76 | 356 |
| 9:00 | 57 | 58 | 90 | 80 | 285 |
| 10:00 | 68 | 63 | 76 | 84 | 291 |
| 11:00 | 54 | 78 | 113 | 78 | 323 |
| 12:00 | 86 | 91 | 102 | 110 | 389 |
| 13:00 | 77 | 90 | 64 | 84 | 315 |
| 14:00 | 72 | 92 | 86 | 101 | 351 |
| 15:00 | 92 | 60 | 94 | 106 | 352 |
| 16:00 | 86 | 74 | 86 | 78 | 324 |
| 17:00 | 102 | 84 | 94 | 94 | 374 |
| 18:00 | 86 | 90 | 92 | 85 | 353 |
| 19:00 | 60 | 49 | 47 | 48 | 204 |
| 20:00 | 39 | 34 | 36 | 18 | 127 |
| 21:00 | 24 | 19 | 15 | 28 | 86 |
| 22:00 | 16 | 11 | 12 | 11 | 50 |
| 23:00 | 6 | 7 | 3 | 5 | 21 |
| | | | | TOTAL: | 4762 |

| |
|---|
| The A.M. peak hour from 7:15 to 8:15 is 423 |
| The P.M. peak hour from 17:00 to 18:00 is 374 |

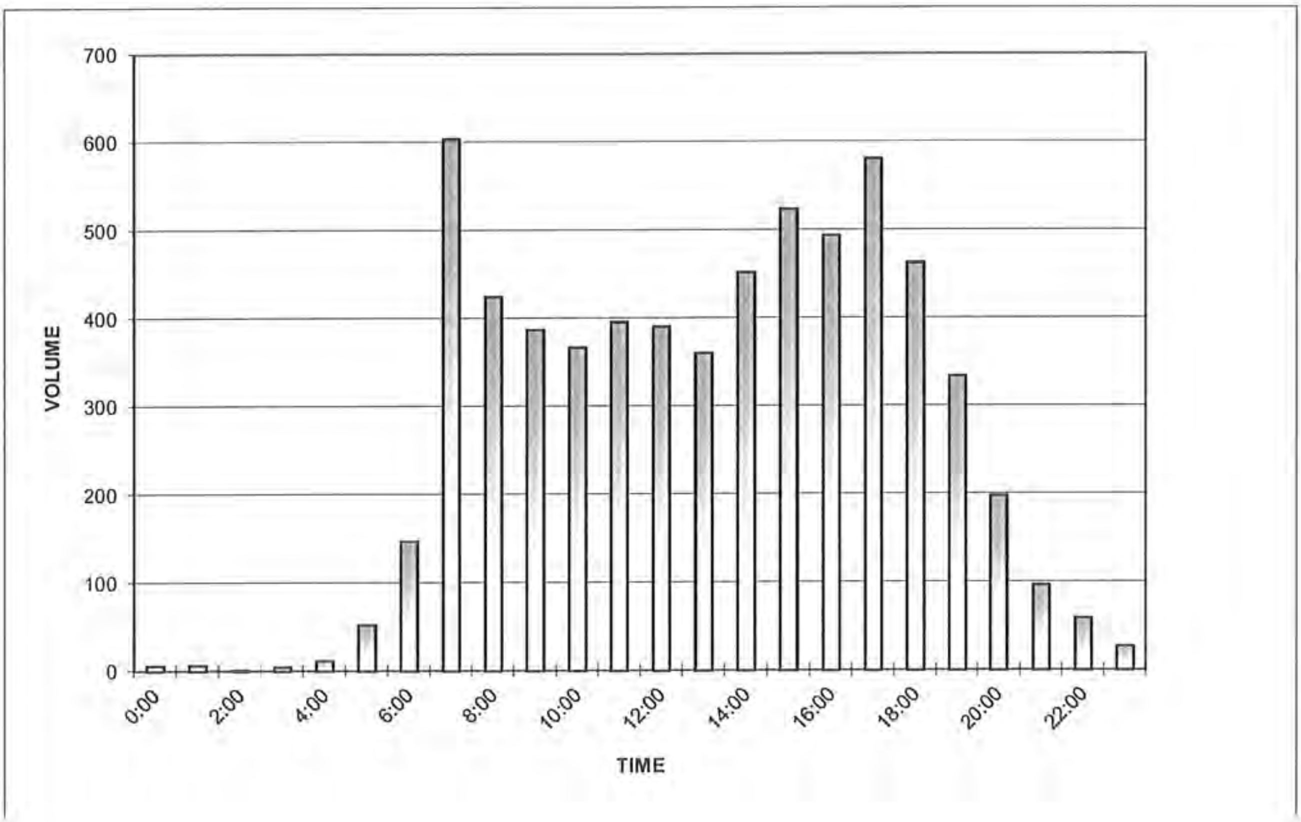


Date Began:
5/4/2011

## NB Bunker Hill Rd. South of Barryknoll Ln.

| TIME | 0:00 | 0:15 | 0:30 | 0:45 | TOTAL |
|---|---|---|---|---|---|
| 0:00 | 3 | 1 | 0 | 2 | 6 |
| 1:00 | 0 | 3 | 4 | 0 | 7 |
| 2:00 | 0 | 1 | 0 | 0 | 1 |
| 3:00 | 0 | 2 | 0 | 3 | 5 |
| 4:00 | 4 | 0 | 2 | 6 | 12 |
| 5:00 | 8 | 10 | 13 | 21 | 52 |
| 6:00 | 22 | 34 | 44 | 47 | 147 |
| 7:00 | 86 | 140 | 178 | 200 | 604 |
| 8:00 | 134 | 100 | 98 | 93 | 425 |
| 9:00 | 94 | 90 | 96 | 107 | 387 |
| 10:00 | 94 | 82 | 85 | 106 | 367 |
| 11:00 | 86 | 95 | 95 | 120 | 396 |
| 12:00 | 114 | 86 | 99 | 92 | 391 |
| 13:00 | 91 | 102 | 90 | 78 | 361 |
| 14:00 | 101 | 102 | 113 | 136 | 452 |
| 15:00 | 135 | 155 | 130 | 104 | 524 |
| 16:00 | 116 | 123 | 147 | 108 | 494 |
| 17:00 | 132 | 156 | 140 | 153 | 581 |
| 18:00 | 124 | 108 | 133 | 98 | 463 |
| 19:00 | 99 | 77 | 86 | 72 | 334 |
| 20:00 | 62 | 50 | 44 | 42 | 198 |
| 21:00 | 36 | 33 | 16 | 12 | 97 |
| 22:00 | 18 | 12 | 18 | 11 | 59 |
| 23:00 | 6 | 6 | 10 | 5 | 27 |
| | | | | TOTAL: | 6390 |

| |
|---|
| The A.M. peak hour from 7:15 to 8:15 is 652 |
| The P.M. peak hour from 17:00 to 18:00 is 581 |

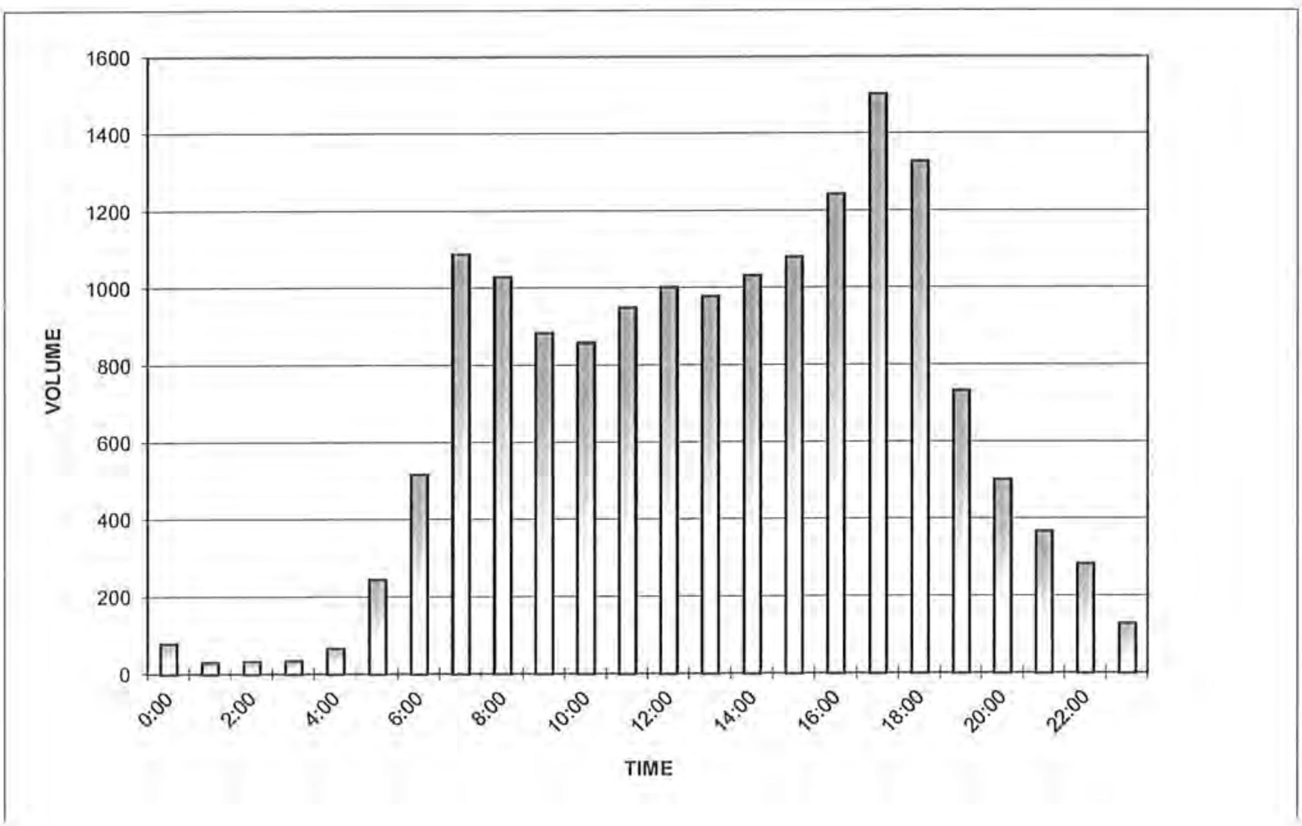


Date Began:
5/4/2011

**NB Gessner Rd. South of Barryknoll Ln.**

| TIME | 0:00 | 0:15 | 0:30 | 0:45 | TOTAL |
|---|---|---|---|---|---|
| 0:00 | 26 | 20 | 23 | 11 | 80 |
| 1:00 | 11 | 10 | 4 | 6 | 31 |
| 2:00 | 8 | 13 | 6 | 7 | 34 |
| 3:00 | 8 | 6 | 10 | 11 | 35 |
| 4:00 | 14 | 12 | 19 | 22 | 67 |
| 5:00 | 35 | 42 | 78 | 90 | 245 |
| 6:00 | 78 | 116 | 160 | 165 | 519 |
| 7:00 | 218 | 278 | 346 | 248 | 1090 |
| 8:00 | 301 | 236 | 256 | 238 | 1031 |
| 9:00 | 206 | 222 | 227 | 230 | 885 |
| 10:00 | 198 | 211 | 202 | 248 | 859 |
| 11:00 | 229 | 219 | 260 | 242 | 950 |
| 12:00 | 271 | 242 | 240 | 250 | 1003 |
| 13:00 | 244 | 242 | 249 | 244 | 979 |
| 14:00 | 274 | 238 | 276 | 246 | 1034 |
| 15:00 | 262 | 264 | 280 | 275 | 1081 |
| 16:00 | 290 | 280 | 326 | 348 | 1244 |
| 17:00 | 366 | 400 | 368 | 370 | 1504 |
| 18:00 | 376 | 346 | 327 | 280 | 1329 |
| 19:00 | 232 | 192 | 154 | 155 | 733 |
| 20:00 | 143 | 127 | 128 | 105 | 503 |
| 21:00 | 102 | 87 | 89 | 90 | 368 |
| 22:00 | 86 | 76 | 72 | 50 | 284 |
| 23:00 | 47 | 26 | 34 | 22 | 129 |
| | | | | TOTAL: | 16017 |

| |
|---|
| The A.M. peak hour from 7:15 to 8:15 is 1173 |
| The P.M. peak hour from 17:15 to 18:15 is 1514 |

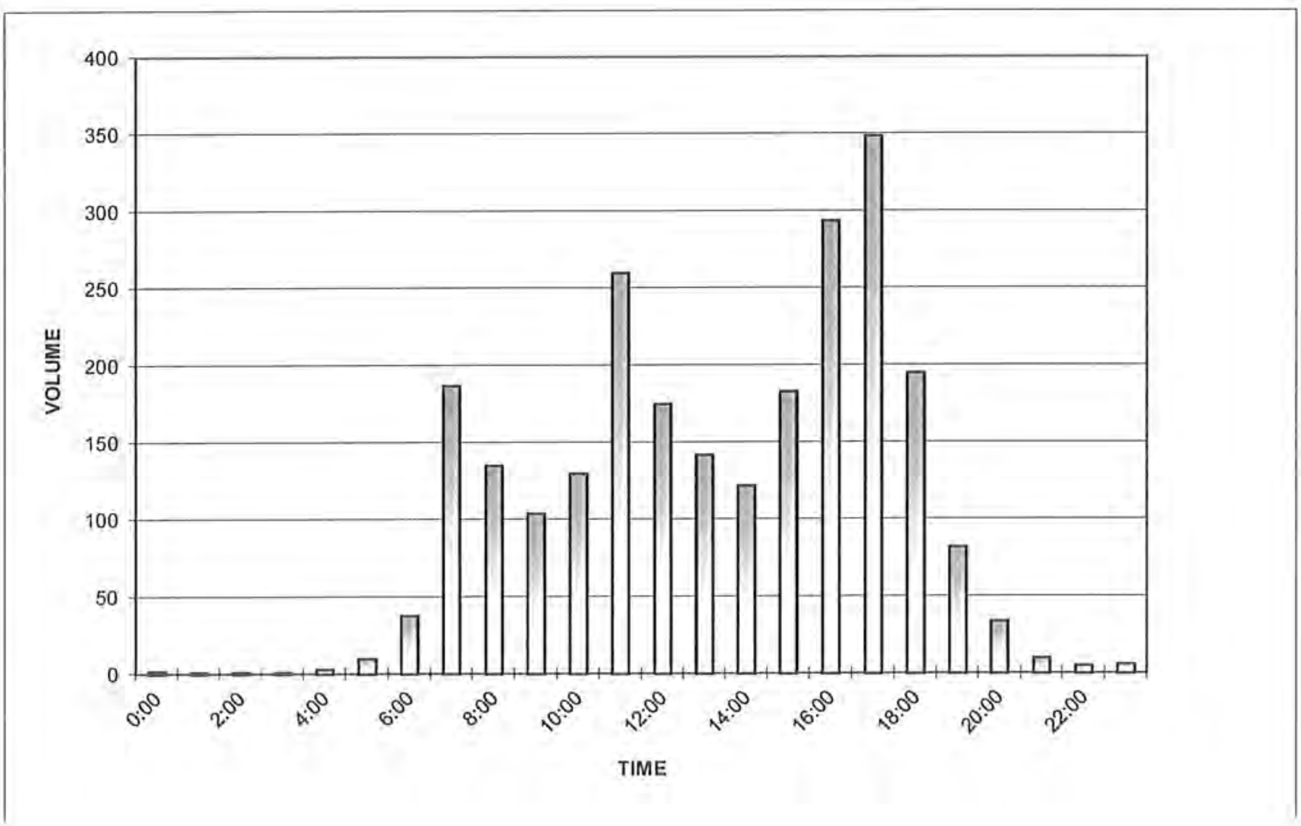


Date Began:
5/4/2011

**NB Plantation Rd. South of Barryknoll Ln.**

| TIME | 0:00 | 0:15 | 0:30 | 0:45 | TOTAL |
|---|---|---|---|---|---|
| 0:00 | 0 | 1 | 0 | 1 | 2 |
| 1:00 | 0 | 0 | 1 | 0 | 1 |
| 2:00 | 0 | 0 | 0 | 1 | 1 |
| 3:00 | 0 | 1 | 0 | 0 | 1 |
| 4:00 | 0 | 1 | 1 | 1 | 3 |
| 5:00 | 2 | 2 | 3 | 3 | 10 |
| 6:00 | 4 | 5 | 17 | 12 | 38 |
| 7:00 | 17 | 41 | 73 | 56 | 187 |
| 8:00 | 50 | 24 | 29 | 32 | 135 |
| 9:00 | 22 | 21 | 31 | 30 | 104 |
| 10:00 | 34 | 34 | 36 | 26 | 130 |
| 11:00 | 53 | 65 | 80 | 62 | 260 |
| 12:00 | 54 | 44 | 42 | 35 | 175 |
| 13:00 | 35 | 34 | 34 | 39 | 142 |
| 14:00 | 40 | 27 | 27 | 28 | 122 |
| 15:00 | 52 | 42 | 44 | 45 | 183 |
| 16:00 | 72 | 70 | 74 | 78 | 294 |
| 17:00 | 96 | 86 | 93 | 74 | 349 |
| 18:00 | 57 | 62 | 41 | 35 | 195 |
| 19:00 | 27 | 21 | 20 | 14 | 82 |
| 20:00 | 8 | 17 | 6 | 3 | 34 |
| 21:00 | 2 | 5 | 1 | 2 | 10 |
| 22:00 | 1 | 1 | 3 | 0 | 5 |
| 23:00 | 4 | 1 | 1 | 0 | 6 |
| | | | | TOTAL: | 2469 |

| |
|---|
| The A.M. peak hour from 7:15 to 8:15 is 220 |
| The P.M. peak hour from 16:45 to 17:45 is 353 |

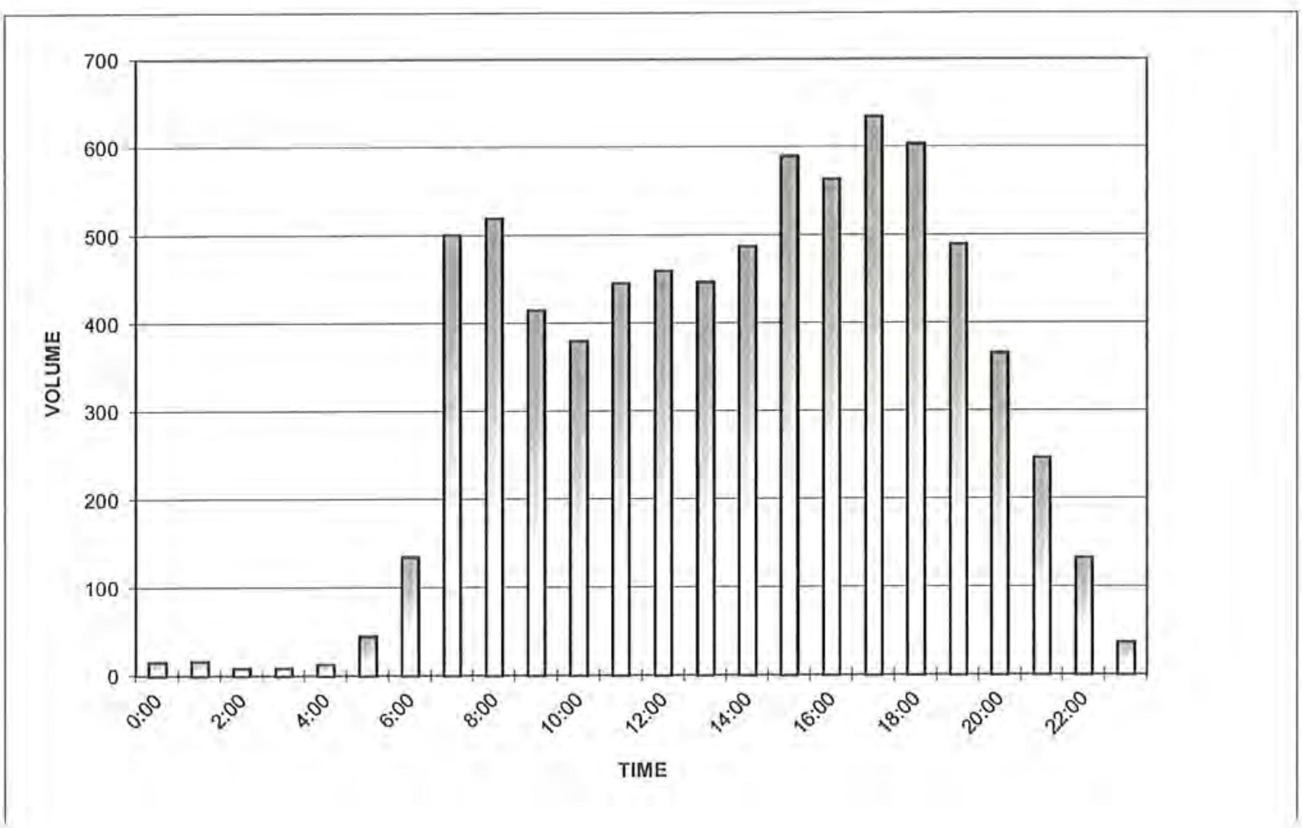


## SB Bunker Hill Rd. North of Barryknoll Ln.

Date Began:
5/4/2011

| TIME | 0:00 | 0:15 | 0:30 | 0:45 | TOTAL |
|---|---|---|---|---|---|
| 0:00 | 5 | 3 | 4 | 4 | 16 |
| 1:00 | 8 | 3 | 3 | 3 | 17 |
| 2:00 | 1 | 3 | 3 | 2 | 9 |
| 3:00 | 0 | 1 | 2 | 6 | 9 |
| 4:00 | 4 | 4 | 3 | 2 | 13 |
| 5:00 | 8 | 8 | 10 | 19 | 45 |
| 6:00 | 23 | 27 | 37 | 48 | 135 |
| 7:00 | 60 | 89 | 164 | 188 | 501 |
| 8:00 | 134 | 130 | 132 | 124 | 520 |
| 9:00 | 106 | 92 | 96 | 121 | 415 |
| 10:00 | 102 | 76 | 98 | 104 | 380 |
| 11:00 | 116 | 116 | 114 | 100 | 446 |
| 12:00 | 108 | 119 | 116 | 117 | 460 |
| 13:00 | 120 | 113 | 110 | 104 | 447 |
| 14:00 | 112 | 124 | 118 | 134 | 488 |
| 15:00 | 171 | 172 | 120 | 127 | 590 |
| 16:00 | 140 | 136 | 142 | 146 | 564 |
| 17:00 | 176 | 155 | 146 | 158 | 635 |
| 18:00 | 156 | 168 | 142 | 138 | 604 |
| 19:00 | 129 | 118 | 135 | 108 | 490 |
| 20:00 | 107 | 90 | 91 | 78 | 366 |
| 21:00 | 82 | 71 | 52 | 42 | 247 |
| 22:00 | 36 | 45 | 32 | 20 | 133 |
| 23:00 | 6 | 11 | 11 | 9 | 37 |
| | | | | TOTAL: | 7567 |

| |
|---|
| The A.M. peak hour from 7:30 to 8:30 is 616 |
| The P.M. peak hour from 17:00 to 18:00 is 635 |

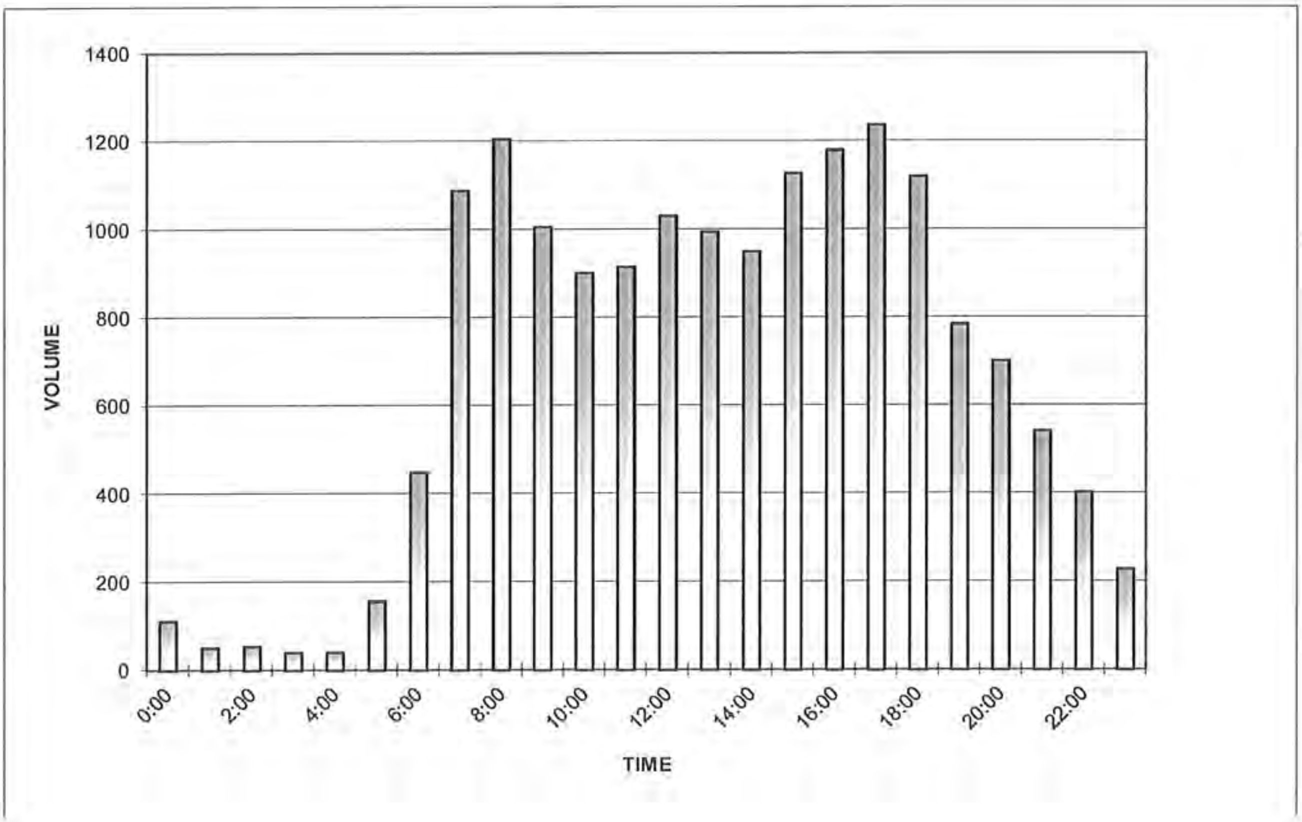


Date Began:
5/4/2011

**SB Gessner Rd. North of Barryknoll Ln.**

| TIME | 0:00 | 0:15 | 0:30 | 0:45 | TOTAL |
|---|---|---|---|---|---|
| 0:00 | 32 | 41 | 20 | 18 | 111 |
| 1:00 | 14 | 14 | 9 | 14 | 51 |
| 2:00 | 10 | 18 | 14 | 12 | 54 |
| 3:00 | 4 | 11 | 9 | 16 | 40 |
| 4:00 | 4 | 11 | 17 | 8 | 40 |
| 5:00 | 19 | 28 | 46 | 64 | 157 |
| 6:00 | 62 | 103 | 130 | 154 | 449 |
| 7:00 | 202 | 264 | 271 | 352 | 1089 |
| 8:00 | 286 | 340 | 294 | 286 | 1206 |
| 9:00 | 256 | 264 | 252 | 234 | 1006 |
| 10:00 | 227 | 223 | 212 | 240 | 902 |
| 11:00 | 194 | 232 | 251 | 238 | 915 |
| 12:00 | 246 | 284 | 224 | 278 | 1032 |
| 13:00 | 250 | 244 | 265 | 236 | 995 |
| 14:00 | 217 | 266 | 221 | 246 | 950 |
| 15:00 | 262 | 298 | 284 | 284 | 1128 |
| 16:00 | 311 | 256 | 306 | 307 | 1180 |
| 17:00 | 316 | 324 | 296 | 302 | 1238 |
| 18:00 | 284 | 304 | 280 | 253 | 1121 |
| 19:00 | 202 | 222 | 183 | 178 | 785 |
| 20:00 | 184 | 170 | 182 | 166 | 702 |
| 21:00 | 156 | 148 | 121 | 118 | 543 |
| 22:00 | 138 | 103 | 94 | 68 | 403 |
| 23:00 | 68 | 70 | 51 | 40 | 229 |
| | | | | TOTAL: | 16326 |

The A.M. peak hour from 7:45 to 8:45 is 1272
The P.M. peak hour from 16:30 to 17:30 is 1253

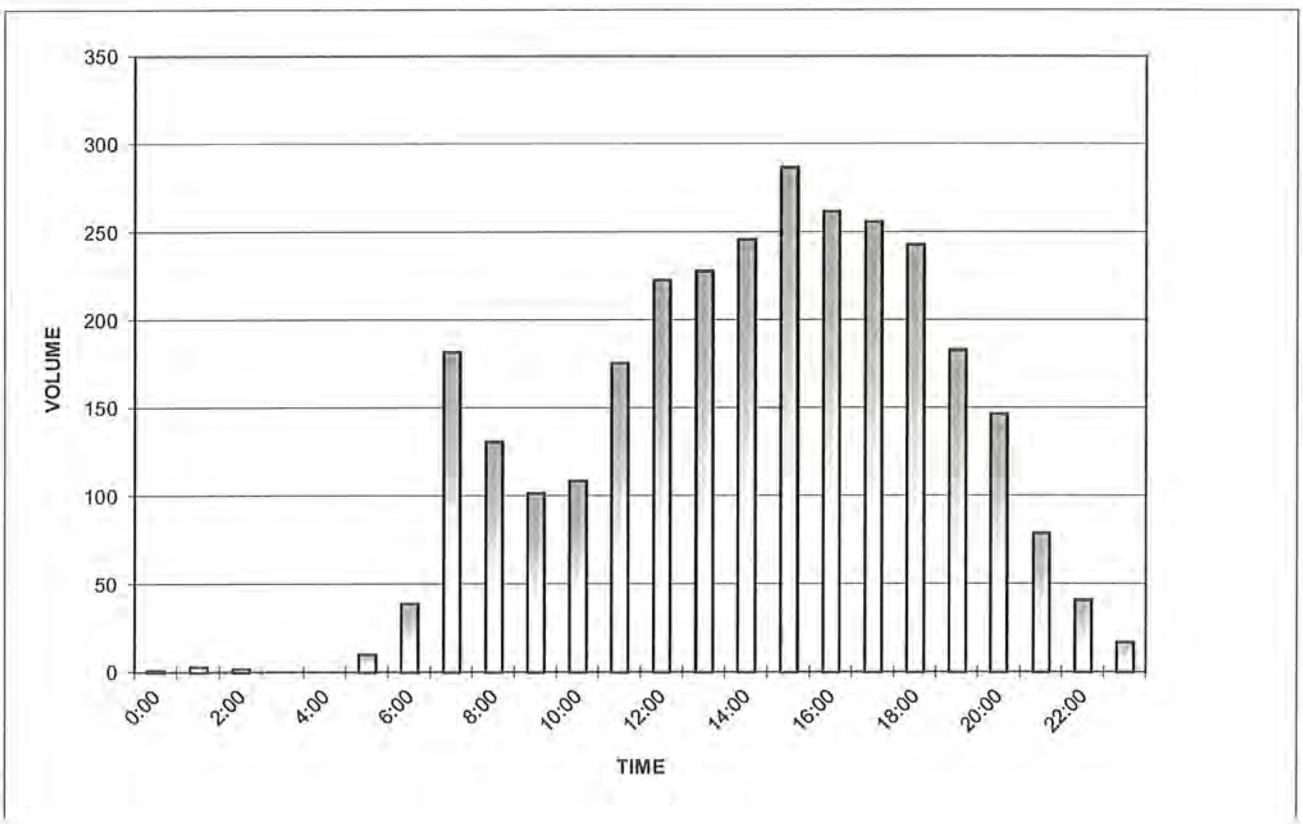


## SB Memorial City Way North of Barryknoll Ln.

Date Began:
5/4/2011

| TIME | 0:00 | 0:15 | 0:30 | 0:45 | TOTAL |
|---|---|---|---|---|---|
| 0:00 | 0 | 0 | 0 | 1 | 1 |
| 1:00 | 0 | 1 | 0 | 2 | 3 |
| 2:00 | 0 | 0 | 1 | 1 | 2 |
| 3:00 | 0 | 0 | 0 | 0 | 0 |
| 4:00 | 0 | 0 | 0 | 0 | 0 |
| 5:00 | 2 | 1 | 2 | 5 | 10 |
| 6:00 | 3 | 9 | 12 | 15 | 39 |
| 7:00 | 25 | 32 | 47 | 78 | 182 |
| 8:00 | 32 | 34 | 25 | 40 | 131 |
| 9:00 | 24 | 30 | 27 | 21 | 102 |
| 10:00 | 20 | 26 | 29 | 34 | 109 |
| 11:00 | 40 | 35 | 39 | 62 | 176 |
| 12:00 | 46 | 54 | 50 | 73 | 223 |
| 13:00 | 59 | 66 | 57 | 46 | 228 |
| 14:00 | 64 | 68 | 68 | 46 | 246 |
| 15:00 | 80 | 80 | 71 | 56 | 287 |
| 16:00 | 65 | 57 | 74 | 66 | 262 |
| 17:00 | 68 | 65 | 67 | 56 | 256 |
| 18:00 | 78 | 55 | 56 | 54 | 243 |
| 19:00 | 44 | 54 | 46 | 39 | 183 |
| 20:00 | 27 | 37 | 45 | 38 | 147 |
| 21:00 | 24 | 17 | 26 | 12 | 79 |
| 22:00 | 10 | 12 | 8 | 11 | 41 |
| 23:00 | 6 | 1 | 7 | 3 | 17 |
| | | | | TOTAL: | 2967 |

| |
|---|
| The A.M. peak hour from 7:30 to 8:30 is 191 |
| The P.M. peak hour from 15:00 to 16:00 is 287 |

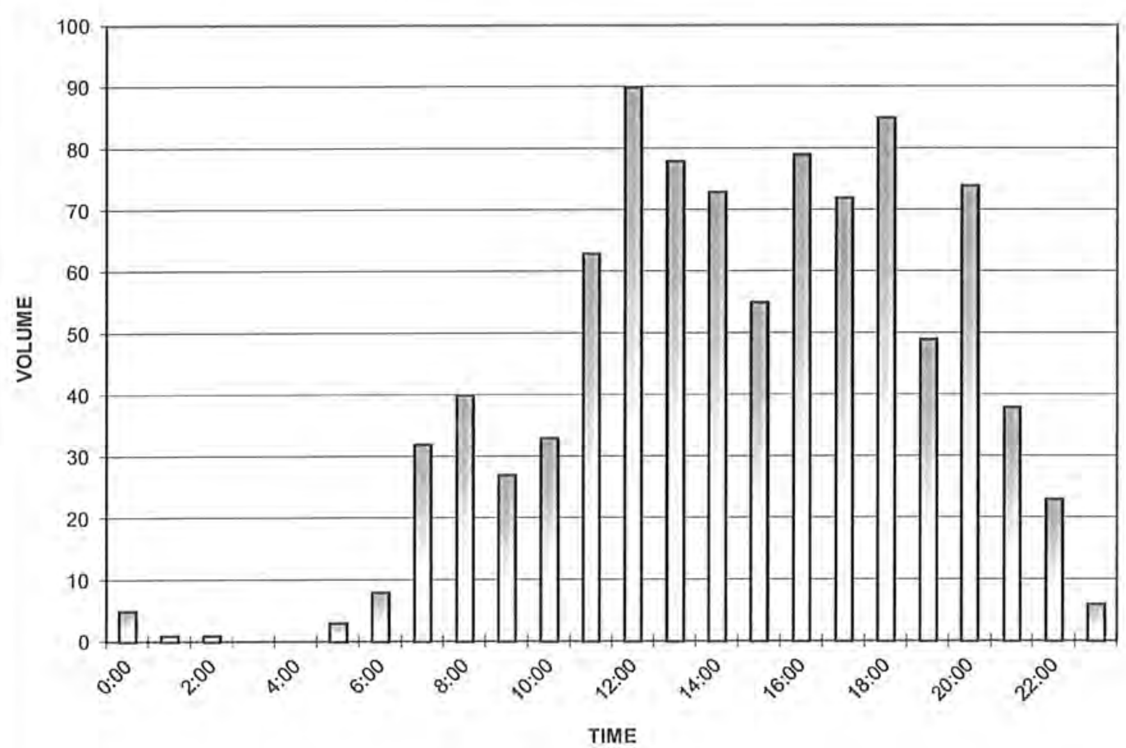


Date Began:
5/4/2011

**SB Plantation Rd. North of Barryknoll Ln.**

| TIME | 0:00 | 0:15 | 0:30 | 0:45 | TOTAL |
|---|---|---|---|---|---|
| 0:00 | 4 | 1 | 0 | 0 | 5 |
| 1:00 | 1 | 0 | 0 | 0 | 1 |
| 2:00 | 0 | 1 | 0 | 0 | 1 |
| 3:00 | 0 | 0 | 0 | 0 | 0 |
| 4:00 | 0 | 0 | 0 | 0 | 0 |
| 5:00 | 0 | 0 | 2 | 1 | 3 |
| 6:00 | 1 | 1 | 3 | 3 | 8 |
| 7:00 | 3 | 7 | 6 | 16 | 32 |
| 8:00 | 8 | 12 | 8 | 12 | 40 |
| 9:00 | 4 | 6 | 10 | 7 | 27 |
| 10:00 | 6 | 5 | 6 | 16 | 33 |
| 11:00 | 7 | 16 | 15 | 25 | 63 |
| 12:00 | 17 | 25 | 21 | 27 | 90 |
| 13:00 | 17 | 21 | 16 | 24 | 78 |
| 14:00 | 15 | 17 | 25 | 16 | 73 |
| 15:00 | 20 | 15 | 9 | 11 | 55 |
| 16:00 | 14 | 19 | 22 | 24 | 79 |
| 17:00 | 14 | 19 | 14 | 25 | 72 |
| 18:00 | 24 | 23 | 20 | 18 | 85 |
| 19:00 | 10 | 11 | 18 | 10 | 49 |
| 20:00 | 16 | 17 | 29 | 12 | 74 |
| 21:00 | 13 | 11 | 10 | 4 | 38 |
| 22:00 | 10 | 4 | 5 | 4 | 23 |
| 23:00 | 2 | 0 | 1 | 3 | 6 |
| | | | | TOTAL: | 935 |

| |
|---|
| The A.M. peak hour from 7:45 to 8:45 is 44 |
| The P.M. peak hour from 17:45 to 18:45 is 92 |

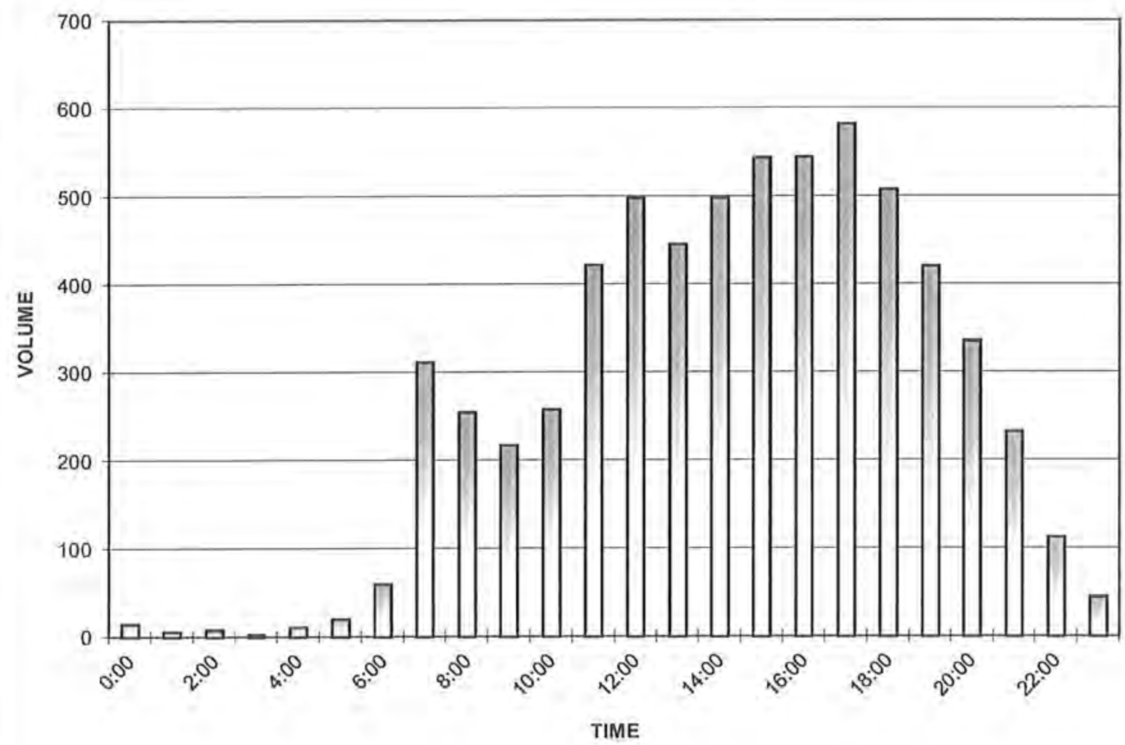


Date Began:
5/4/2011

## WB Barryknoll Ln. East of Gessner Rd.

| TIME | 0:00 | 0:15 | 0:30 | 0:45 | TOTAL |
|---|---|---|---|---|---|
| 0:00 | 6 | 5 | 1 | 3 | 15 |
| 1:00 | 1 | 4 | 0 | 1 | 6 |
| 2:00 | 0 | 5 | 3 | 0 | 8 |
| 3:00 | 1 | 0 | 1 | 1 | 3 |
| 4:00 | 0 | 5 | 4 | 2 | 11 |
| 5:00 | 5 | 5 | 6 | 4 | 20 |
| 6:00 | 7 | 8 | 25 | 20 | 60 |
| 7:00 | 46 | 56 | 78 | 132 | 312 |
| 8:00 | 97 | 56 | 50 | 52 | 255 |
| 9:00 | 34 | 54 | 52 | 78 | 218 |
| 10:00 | 56 | 56 | 62 | 84 | 258 |
| 11:00 | 86 | 122 | 104 | 110 | 422 |
| 12:00 | 118 | 128 | 130 | 122 | 498 |
| 13:00 | 131 | 110 | 105 | 100 | 446 |
| 14:00 | 138 | 121 | 115 | 125 | 499 |
| 15:00 | 129 | 150 | 136 | 129 | 544 |
| 16:00 | 129 | 126 | 160 | 130 | 545 |
| 17:00 | 154 | 142 | 145 | 142 | 583 |
| 18:00 | 134 | 138 | 120 | 116 | 508 |
| 19:00 | 116 | 100 | 113 | 92 | 421 |
| 20:00 | 78 | 94 | 94 | 70 | 336 |
| 21:00 | 79 | 72 | 57 | 25 | 233 |
| 22:00 | 32 | 31 | 26 | 24 | 113 |
| 23:00 | 21 | 9 | 7 | 8 | 45 |
| | | | | TOTAL: | 6359 |

| |
|---|
| The A.M. peak hour from 7:30 to 8:30 is 363 |
| The P.M. peak hour from 16:30 to 17:30 is 586 |

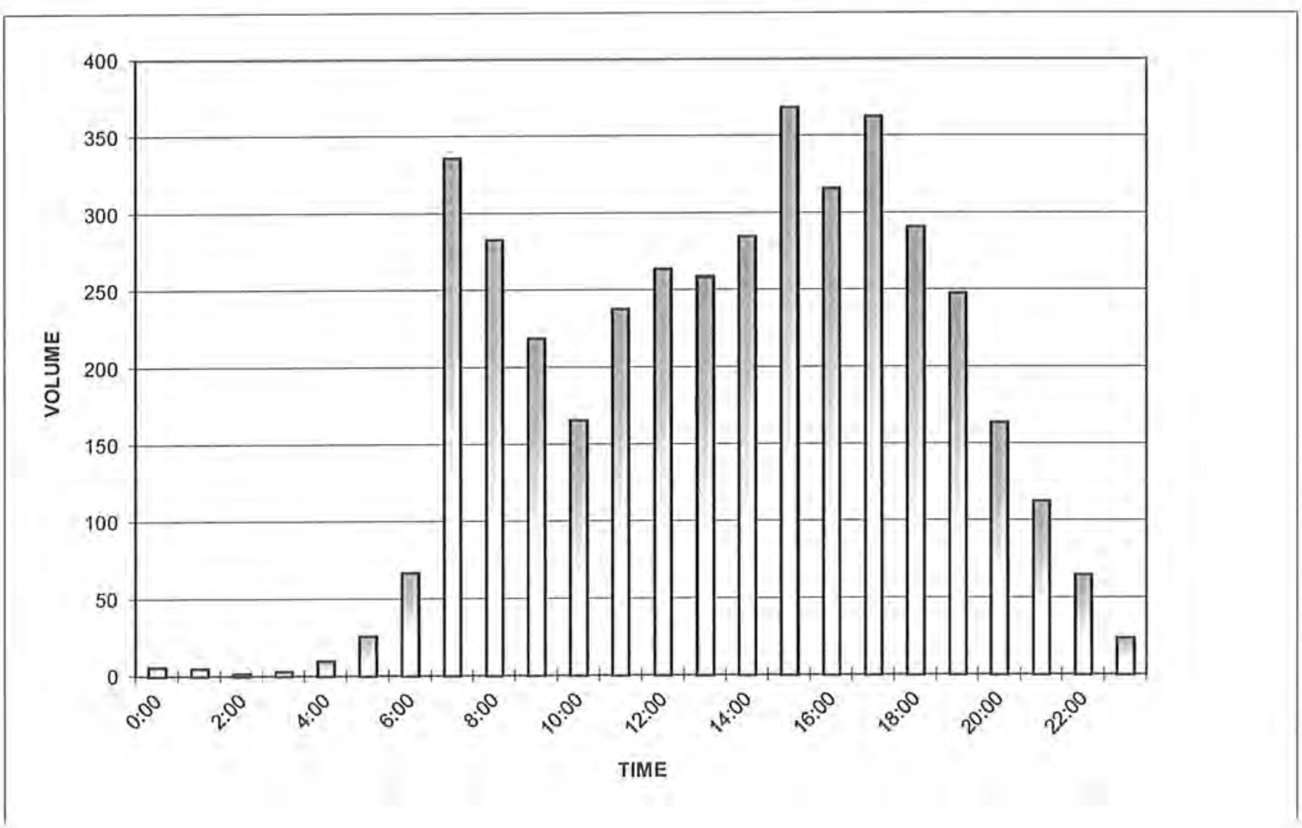


Date Began:
5/4/2011

**WB Barryknoll Ln. East of Memorial City Way**

| TIME | 0:00 | 0:15 | 0:30 | 0:45 | TOTAL |
|---|---|---|---|---|---|
| 0:00 | 2 | 0 | 1 | 3 | 6 |
| 1:00 | 1 | 2 | 1 | 1 | 5 |
| 2:00 | 0 | 0 | 1 | 1 | 2 |
| 3:00 | 0 | 1 | 0 | 2 | 3 |
| 4:00 | 2 | 4 | 1 | 3 | 10 |
| 5:00 | 5 | 6 | 8 | 7 | 26 |
| 6:00 | 9 | 15 | 19 | 24 | 67 |
| 7:00 | 36 | 48 | 84 | 168 | 336 |
| 8:00 | 90 | 73 | 64 | 56 | 283 |
| 9:00 | 44 | 44 | 65 | 66 | 219 |
| 10:00 | 48 | 40 | 36 | 42 | 166 |
| 11:00 | 54 | 64 | 60 | 60 | 238 |
| 12:00 | 70 | 56 | 78 | 60 | 264 |
| 13:00 | 79 | 72 | 57 | 51 | 259 |
| 14:00 | 71 | 54 | 66 | 94 | 285 |
| 15:00 | 111 | 126 | 72 | 60 | 369 |
| 16:00 | 72 | 76 | 86 | 82 | 316 |
| 17:00 | 83 | 106 | 89 | 85 | 363 |
| 18:00 | 77 | 74 | 86 | 54 | 291 |
| 19:00 | 76 | 62 | 63 | 47 | 248 |
| 20:00 | 43 | 40 | 45 | 36 | 164 |
| 21:00 | 43 | 33 | 21 | 16 | 113 |
| 22:00 | 16 | 20 | 15 | 14 | 65 |
| 23:00 | 6 | 7 | 5 | 6 | 24 |
| | | | | TOTAL: | 4122 |

| |
|---|
| The A.M. peak hour from 7:30 to 8:30 is 415 |
| The P.M. peak hour from 14:45 to 15:45 is 403 |

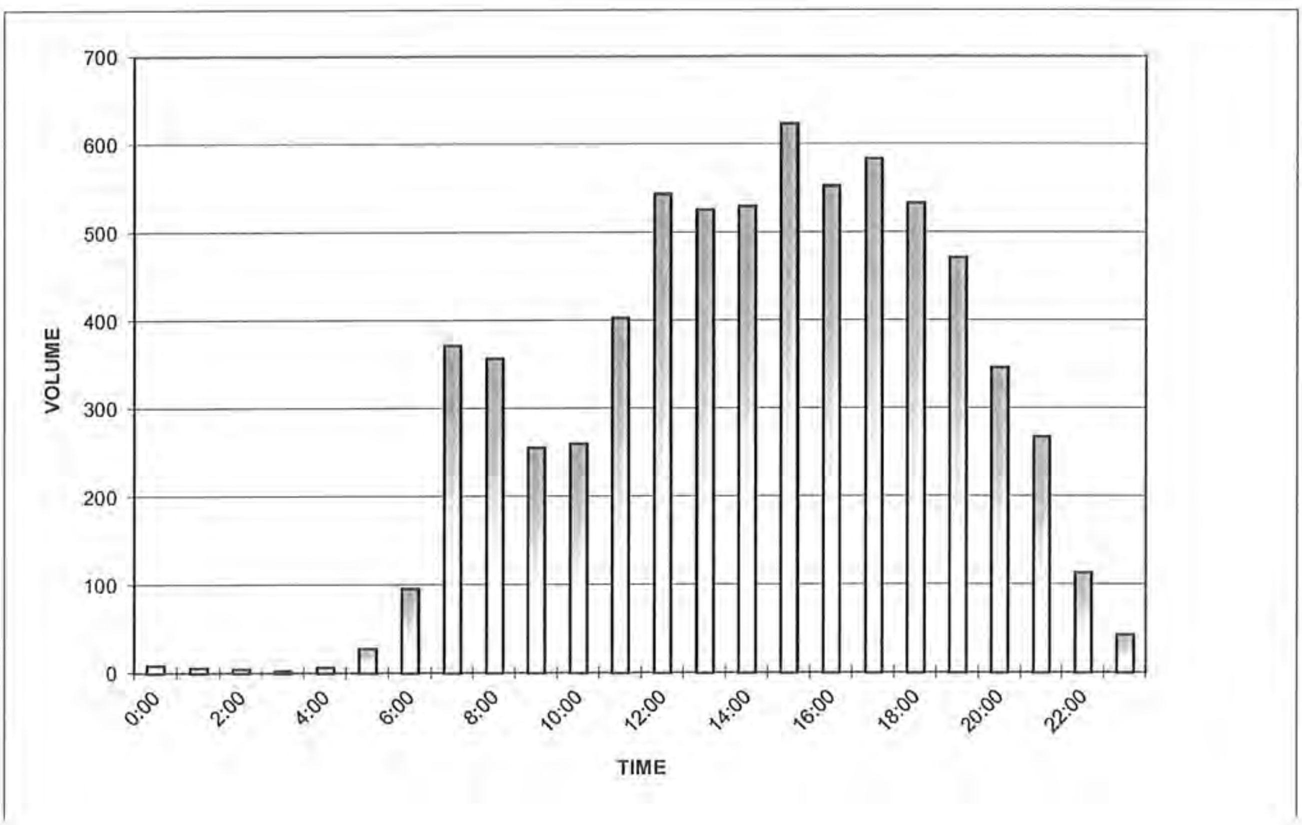


## WB Barryknoll Ln. East of Plantation Rd.

Date Began:
5/4/2011

| TIME | 0:00 | 0:15 | 0:30 | 0:45 | TOTAL |
|---|---|---|---|---|---|
| 0:00 | 2 | 4 | 1 | 2 | 9 |
| 1:00 | 0 | 5 | 1 | 0 | 6 |
| 2:00 | 0 | 2 | 2 | 1 | 5 |
| 3:00 | 0 | 1 | 1 | 1 | 3 |
| 4:00 | 0 | 3 | 2 | 2 | 7 |
| 5:00 | 5 | 6 | 8 | 9 | 28 |
| 6:00 | 14 | 14 | 37 | 31 | 96 |
| 7:00 | 54 | 72 | 90 | 156 | 372 |
| 8:00 | 102 | 82 | 94 | 79 | 357 |
| 9:00 | 59 | 56 | 64 | 77 | 256 |
| 10:00 | 56 | 58 | 60 | 86 | 260 |
| 11:00 | 94 | 102 | 94 | 113 | 403 |
| 12:00 | 121 | 119 | 146 | 158 | 544 |
| 13:00 | 139 | 147 | 122 | 118 | 526 |
| 14:00 | 146 | 130 | 120 | 134 | 530 |
| 15:00 | 164 | 184 | 150 | 126 | 624 |
| 16:00 | 136 | 122 | 150 | 145 | 553 |
| 17:00 | 151 | 143 | 146 | 144 | 584 |
| 18:00 | 142 | 144 | 128 | 120 | 534 |
| 19:00 | 125 | 123 | 124 | 100 | 472 |
| 20:00 | 86 | 96 | 94 | 71 | 347 |
| 21:00 | 86 | 86 | 68 | 28 | 268 |
| 22:00 | 30 | 38 | 26 | 20 | 114 |
| 23:00 | 19 | 11 | 7 | 6 | 43 |
| | | | | TOTAL: | 6941 |

| |
|---|
| The A.M. peak hour from 7:45 to 8:45 is 434 |
| The P.M. peak hour from 14:45 to 15:45 is 632 |



***Barryknoll Ln. at Bunker Hill Rd.***

Wednesday, May 04, 2011

Turning Movment Count

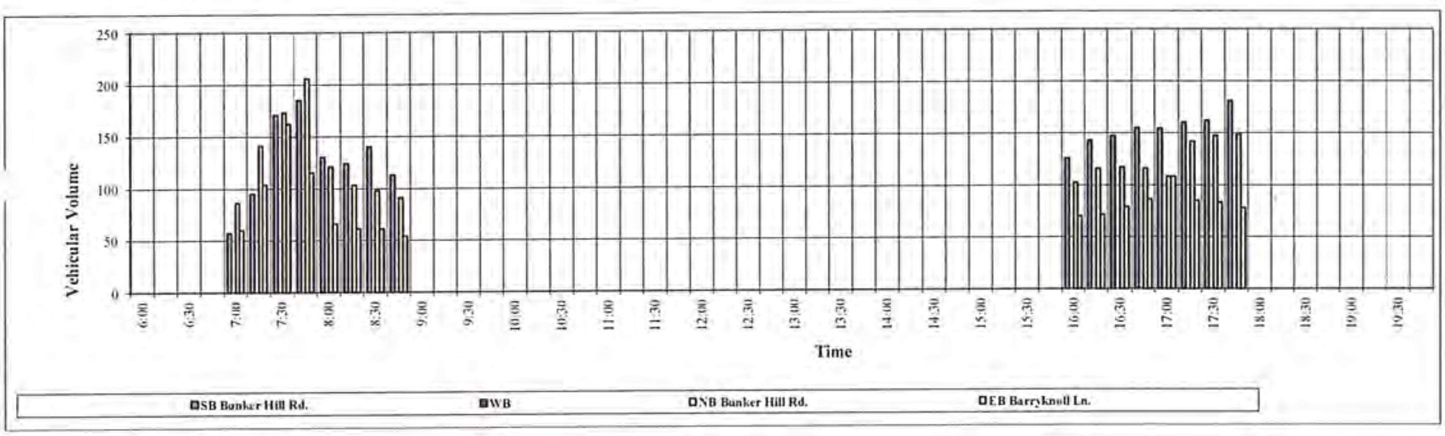
| | Southbound | | | | | Westbound | | | | | Northbound | | | | | Eastbound | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Bunker Hill Rd. | | | | | | | | | | Bunker Hill Rd. | | | | | Barryknoll Ln. | | | | |
| Time | Left | Thru | Right | U-turn | Peds | Left | Thru | Right | U-turn | Peds | Left | Thru | Right | U-turn | Peds | Left | Thru | Right | U-turn | Peds |
| 6:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 7:00 | 0 | 46 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 78 | 0 | 0 | 0 | 47 | 0 | 13 | 0 | 1 |
| 7:15 | 0 | 65 | 30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 130 | 0 | 0 | 0 | 77 | 0 | 27 | 0 | 0 |
| 7:30 | 0 | 122 | 49 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 26 | 147 | 0 | 0 | 0 | 107 | 0 | 55 | 0 | 0 |
| 7:45 | 0 | 123 | 62 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 65 | 141 | 0 | 0 | 0 | 71 | 0 | 44 | 0 | 0 |
| **Hr. Total:** | **0** | **356** | **152** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **110** | **496** | **0** | **0** | **0** | **302** | **0** | **139** | **0** | **1** |
| 8:00 | 0 | 89 | 41 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 | 93 | 0 | 0 | 0 | 29 | 0 | 37 | 0 | 0 |
| 8:15 | 0 | 91 | 33 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 18 | 85 | 0 | 0 | 0 | 35 | 0 | 26 | 0 | 0 |
| 8:30 | 0 | 106 | 34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20 | 78 | 0 | 0 | 0 | 41 | 0 | 20 | 0 | 0 |
| 8:45 | 0 | 80 | 33 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 18 | 73 | 0 | 0 | 0 | 33 | 0 | 21 | 0 | 0 |
| **Hr. Total:** | **0** | **366** | **141** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **84** | **329** | **0** | **0** | **0** | **138** | **0** | **104** | **0** | **0** |
| 9:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 10:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 11:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 12:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 13:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 14:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 15:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 16:00 | 0 | 89 | 37 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 77 | 0 | 0 | 1 | 54 | 0 | 16 | 0 | 0 |
| 16:15 | 0 | 92 | 51 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 101 | 0 | 0 | 0 | 44 | 0 | 27 | 0 | 0 |
| 16:30 | 0 | 88 | 59 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 103 | 0 | 0 | 0 | 56 | 0 | 23 | 0 | 1 |
| 16:45 | 0 | 101 | 54 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 19 | 97 | 0 | 0 | 0 | 63 | 0 | 23 | 0 | 0 |
| **Hr. Total:** | **0** | **370** | **201** | **0** | **2** | **0** | **0** | **0** | **0** | **0** | **73** | **378** | **0** | **0** | **1** | **217** | **0** | **89** | **0** | **1** |

***Barryknoll Ln. at Bunker Hill Rd.***

Wednesday, May 04, 2011

Turning Movment Count

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17:00 | 0 | 94 | 60 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 23 | 85 | 0 | 0 | 0 | 78 | 0 | 30 | 0 | 0 |
| 17:15 | 0 | 106 | 54 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30 | 112 | 0 | 0 | 0 | 54 | 0 | 31 | 0 | 0 |
| 17:30 | 0 | 102 | 60 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 24 | 123 | 0 | 0 | 0 | 50 | 0 | 33 | 0 | 0 |
| 17:45 | 0 | 123 | 58 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 37 | 111 | 0 | 0 | 1 | 49 | 0 | 29 | 0 | 0 |
| **Hr. Total:** | **0** | **425** | **232** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **114** | **431** | **0** | **0** | **1** | **231** | **0** | **123** | **0** | **0** |
| 18:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 18:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 18:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 18:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 19:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 19:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 19:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 19:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **Gr. Total** | 0 | 1517 | 726 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 381 | 1634 | 0 | 0 | 2 | 888 | 0 | 455 | 0 | 2 |
| **% of Tot.** | 0% | 27% | 13% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 7% | 29% | 0% | 0% | 0% | 16% | 0% | 8% | 0% | 0% |
| **Apprch%** | 40% | | | | | 0% | | | | | 36% | | | | | 24% | | | | |
| **% of Apprch** | 0% | 68% | 32% | 0% | 0% | ##### | ##### | ##### | ##### | ##### | 19% | 81% | 0% | 0% | 0% | 66% | 0% | 34% | 0% | 0% |
| | **Left** | **Thru** | **Right** | **U-turn** | **Peds** | **Left** | **Thru** | **Right** | **U-turn** | **Peds** | **Left** | **Thru** | **Right** | **U-turn** | **Peds** | **Left** | **Thru** | **Right** | **U-turn** | **Peds** |
| | Bunker Hill Rd. | | | | | | | | | | Bunker Hill Rd. | | | | | Barryknoll Ln. | | | | |
| | **From North** | | | | | **From East** | | | | | **From South** | | | | | **From West** | | | | |



## *Barryknoll Ln. at Gessner Rd.*

Wednesday, May 04, 2011

Turning Movment Count

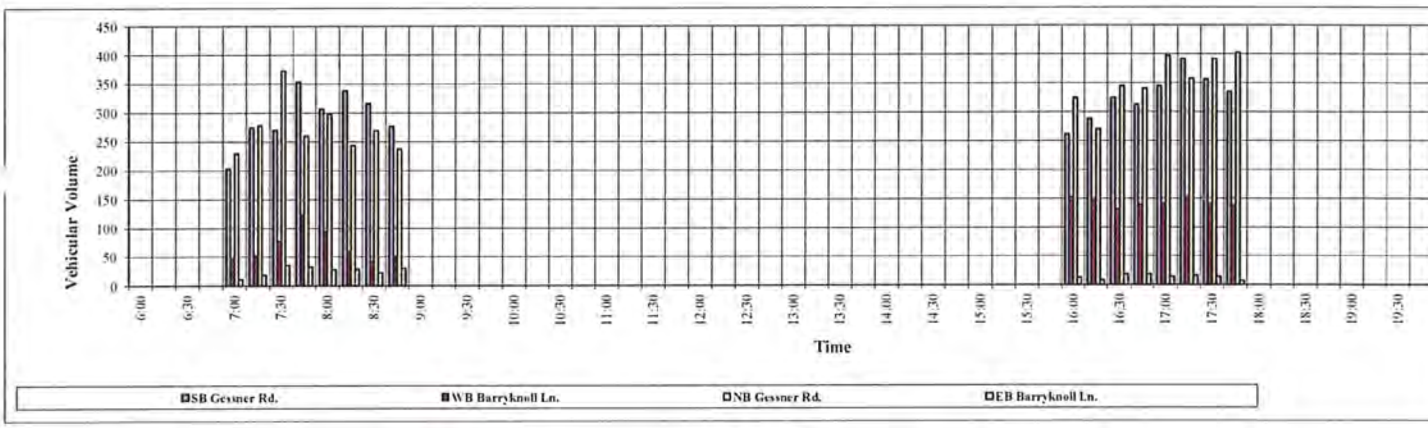
| | Southbound | | | | | Westbound | | | | | Northbound | | | | | Eastbound | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Gessner Rd. | | | | | Barryknoll Ln. | | | | | Gessner Rd. | | | | | Barryknoll Ln. | | | | |
| Time | Left | Thru | Right | U-turn | Peds | Left | Thru | Right | U-turn | Peds | Left | Thru | Right | U-turn | Peds | Left | Thru | Right | U-turn | Peds |
| 6:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 7:00 | 24 | 179 | 0 | 0 | 0 | 25 | 3 | 18 | 0 | 1 | 1 | 180 | 49 | 0 | 1 | 0 | 9 | 2 | 0 | 0 |
| 7:15 | 28 | 245 | 1 | 0 | 0 | 21 | 10 | 22 | 0 | 0 | 0 | 215 | 63 | 0 | 0 | 4 | 11 | 3 | 0 | 1 |
| 7:30 | 32 | 238 | 0 | 0 | 0 | 33 | 10 | 34 | 0 | 0 | 0 | 293 | 79 | 0 | 0 | 3 | 24 | 8 | 0 | 0 |
| 7:45 | 42 | 308 | 3 | 0 | 0 | 44 | 33 | 46 | 0 | 0 | 1 | 226 | 32 | 0 | 0 | 3 | 22 | 7 | 0 | 0 |
| **Hr. Total:** | **126** | **970** | **4** | **0** | **0** | **123** | **56** | **120** | **0** | **1** | **2** | **914** | **223** | **0** | **1** | **10** | **66** | **20** | **0** | **1** |
| 8:00 | 39 | 267 | 0 | 0 | 1 | 17 | 37 | 40 | 0 | 0 | 0 | 254 | 43 | 1 | 0 | 2 | 20 | 6 | 0 | 0 |
| 8:15 | 46 | 292 | 0 | 0 | 0 | 19 | 19 | 21 | 0 | 0 | 0 | 196 | 48 | 0 | 0 | 3 | 16 | 10 | 0 | 0 |
| 8:30 | 22 | 291 | 3 | 0 | 0 | 14 | 7 | 22 | 0 | 1 | 0 | 225 | 43 | 1 | 0 | 2 | 13 | 8 | 0 | 1 |
| 8:45 | 35 | 241 | 1 | 0 | 0 | 20 | 4 | 26 | 0 | 0 | 2 | 194 | 40 | 1 | 1 | 0 | 14 | 16 | 0 | 0 |
| **Hr. Total:** | **142** | **1091** | **4** | **0** | **1** | **70** | **67** | **109** | **0** | **1** | **2** | **869** | **174** | **3** | **1** | **7** | **63** | **40** | **0** | **1** |
| 9:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 10:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 11:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 12:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 13:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 14:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 15:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 16:00 | 37 | 224 | 1 | 0 | 0 | 61 | 23 | 68 | 0 | 0 | 1 | 288 | 35 | 0 | 1 | 0 | 10 | 3 | 0 | 1 |
| 16:15 | 30 | 254 | 3 | 1 | 0 | 51 | 18 | 77 | 0 | 0 | 0 | 219 | 48 | 3 | 1 | 1 | 6 | 1 | 0 | 1 |
| 16:30 | 35 | 287 | 3 | 0 | 0 | 45 | 26 | 61 | 0 | 0 | 1 | 303 | 38 | 3 | 2 | 2 | 10 | 6 | 0 | 0 |
| 16:45 | 27 | 285 | 1 | 0 | 0 | 53 | 21 | 65 | 0 | 0 | 5 | 284 | 49 | 3 | 1 | 0 | 15 | 4 | 0 | 0 |
| **Hr. Total:** | **129** | **1050** | **8** | **1** | **0** | **210** | **88** | **271** | **0** | **0** | **7** | **1094** | **170** | **9** | **5** | **3** | **41** | **14** | **0** | **2** |

## *Barryknoll Ln. at Gessner Rd.*

Wednesday, May 04, 2011

Turning Movment Count

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **17:00** | 35 | 305 | 5 | 0 | 0 | 58 | 20 | 63 | 0 | 4 | 4 | 348 | 40 | 5 | 5 | 1 | 10 | 3 | 0 | 3 |
| **17:15** | 31 | 357 | 3 | 1 | 0 | 58 | 32 | 63 | 0 | 1 | 1 | 302 | 53 | 2 | 2 | 1 | 12 | 3 | 0 | 0 |
| **17:30** | 34 | 322 | 1 | 0 | 0 | 58 | 39 | 43 | 0 | 0 | 3 | 345 | 41 | 3 | 0 | 3 | 10 | 1 | 0 | 1 |
| **17:45** | 36 | 294 | 4 | 1 | 0 | 61 | 28 | 49 | 0 | 0 | 1 | 338 | 62 | 1 | 0 | 1 | 3 | 3 | 0 | 0 |
| **Hr. Total:** | **136** | **1278** | **13** | **2** | **0** | **235** | **119** | **218** | **0** | **5** | **9** | **1333** | **196** | **11** | **7** | **6** | **35** | **10** | **0** | **4** |
| **18:00** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **18:15** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **18:30** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **18:45** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **19:00** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **19:15** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **19:30** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **19:45** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **Gr. Total** | 533 | 4389 | 29 | 3 | 1 | 638 | 330 | 718 | 0 | 7 | 20 | 4210 | 763 | 23 | 14 | 26 | 205 | 84 | 0 | 8 |
| **% of Tot.** | 4% | 37% | 0% | 0% | 0% | 5% | 3% | 6% | 0% | 0% | 0% | 35% | 6% | 0% | 0% | 0% | 2% | 1% | 0% | 0% |
| **Apprch%** | | | 41% | | | | | 14% | | | | | 42% | | | | | 3% | | |
| **% of Apprch** | 11% | 89% | 1% | 0% | 0% | 38% | 20% | 43% | 0% | 0% | 0% | 84% | 15% | 0% | 0% | 8% | 65% | 27% | 0% | 3% |
| | **Left** | **Thru** | **Right** | **U-turn** | **Peds** | **Left** | **Thru** | **Right** | **U-turn** | **Peds** | **Left** | **Thru** | **Right** | **U-turn** | **Peds** | **Left** | **Thru** | **Right** | **U-turn** | **Peds** |
| | Gessner Rd. | | | | | Barryknoll Ln. | | | | | Gessner Rd. | | | | | Barryknoll Ln. | | | | |
| | **From North** | | | | | **From East** | | | | | **From South** | | | | | **From West** | | | | |



## *Barryknoll Ln. at Memorial City Way*

Wednesday, May 04, 2011

Turning Movment Count

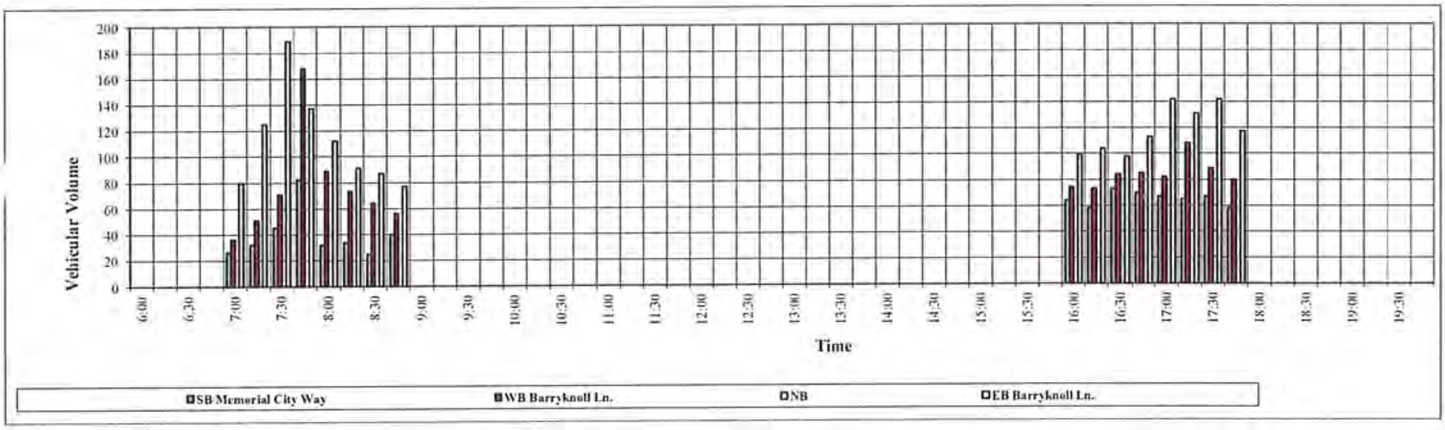
| | Southbound | | | | | Westbound | | | | | Northbound | | | | | Eastbound | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Memorial City Way | | | | | Barryknoll Ln. | | | | | | | | | | Barryknoll Ln. | | | | |
| Time | Left | Thru | Right | U-turn | Peds | Left | Thru | Right | U-turn | Peds | Left | Thru | Right | U-turn | Peds | Left | Thru | Right | U-turn | Peds |
| 6:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 7:00 | 6 | 0 | 20 | 0 | 1 | 0 | 27 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 55 | 0 | 0 | 0 |
| 7:15 | 5 | 0 | 27 | 0 | 0 | 0 | 43 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 34 | 91 | 0 | 0 | 0 |
| 7:30 | 14 | 0 | 31 | 0 | 0 | 0 | 63 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 40 | 149 | 0 | 0 | 0 |
| 7:45 | 16 | 0 | 66 | 0 | 1 | 0 | 152 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 41 | 96 | 0 | 0 | 0 |
| **Hr. Total:** | **41** | **0** | **144** | **0** | **2** | **0** | **285** | **41** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **140** | **391** | **0** | **0** | **0** |
| 8:00 | 12 | 0 | 20 | 0 | 0 | 0 | 74 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 46 | 66 | 0 | 0 | 0 |
| 8:15 | 8 | 0 | 26 | 0 | 0 | 0 | 63 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 24 | 67 | 0 | 0 | 0 |
| 8:30 | 3 | 0 | 22 | 0 | 0 | 0 | 53 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 | 59 | 0 | 0 | 0 |
| 8:45 | 13 | 0 | 27 | 0 | 0 | 0 | 51 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 34 | 43 | 0 | 0 | 0 |
| **Hr. Total:** | **36** | **0** | **95** | **0** | **0** | **0** | **241** | **41** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **132** | **235** | **0** | **0** | **0** |
| 9:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 10:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 11:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 12:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 13:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 14:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 15:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 16:00 | 12 | 0 | 52 | 0 | 0 | 0 | 60 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 31 | 68 | 0 | 0 | 0 |
| 16:15 | 12 | 0 | 46 | 0 | 0 | 0 | 64 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 33 | 71 | 0 | 0 | 0 |
| 16:30 | 10 | 0 | 63 | 0 | 1 | 0 | 71 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 33 | 65 | 0 | 0 | 0 |
| 16:45 | 16 | 0 | 54 | 0 | 2 | 0 | 68 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 29 | 84 | 0 | 0 | 0 |
| **Hr. Total:** | **50** | **0** | **215** | **0** | **3** | **0** | **263** | **53** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **126** | **288** | **0** | **0** | **0** |

## *Barryknoll Ln. at Memorial City Way*

Wednesday, May 04, 2011

Turning Movment Count

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **17:00** | 11 | 0 | 56 | 0 | 2 | 0 | 74 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 43 | 99 | 0 | 0 | 0 |
| **17:15** | 13 | 0 | 52 | 0 | 1 | 0 | 89 | 19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 38 | 93 | 0 | 0 | 1 |
| **17:30** | 15 | 0 | 52 | 0 | 0 | 0 | 77 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 47 | 95 | 0 | 0 | 2 |
| **17:45** | 7 | 0 | 51 | 0 | 1 | 0 | 71 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30 | 87 | 0 | 0 | 0 |
| **Hr. Total:** | **46** | **0** | **211** | **0** | **4** | **0** | **311** | **48** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **158** | **374** | **0** | **0** | **3** |
| **18:00** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **18:15** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **18:30** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **18:45** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **19:00** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **19:15** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **19:30** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **19:45** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **Gr. Total** | 173 | 0 | 665 | 0 | 9 | 0 | 1100 | 183 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 556 | 1288 | 0 | 0 | 3 |
| **% of Tot.** | 4% | 0% | 17% | 0% | 0% | 0% | 28% | 5% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 14% | 32% | 0% | 0% | 0% |
| **Apprch%** | | | 21% | | | | | 32% | | | | | 0% | | | | | 47% | | |
| **% of Apprch** | 21% | 0% | 79% | 0% | 1% | 0% | 86% | 14% | 0% | 0% | ##### | ##### | ##### | ##### | ##### | 30% | 70% | 0% | 0% | 0% |
| | **Left** | **Thru** | **Right** | **U-turn** | **Peds** | **Left** | **Thru** | **Right** | **U-turn** | **Peds** | **Left** | **Thru** | **Right** | **U-turn** | **Peds** | **Left** | **Thru** | **Right** | **U-turn** | **Peds** |
| | Memorial City Way | | | | | Barryknoll Ln. | | | | | | | | | | Barryknoll Ln. | | | | |
| | **From North** | | | | | **From East** | | | | | **From South** | | | | | **From West** | | | | |



## *Barryknoll Ln. at Plantation Rd.*

Wednesday, May 04, 2011

Turning Movment Count

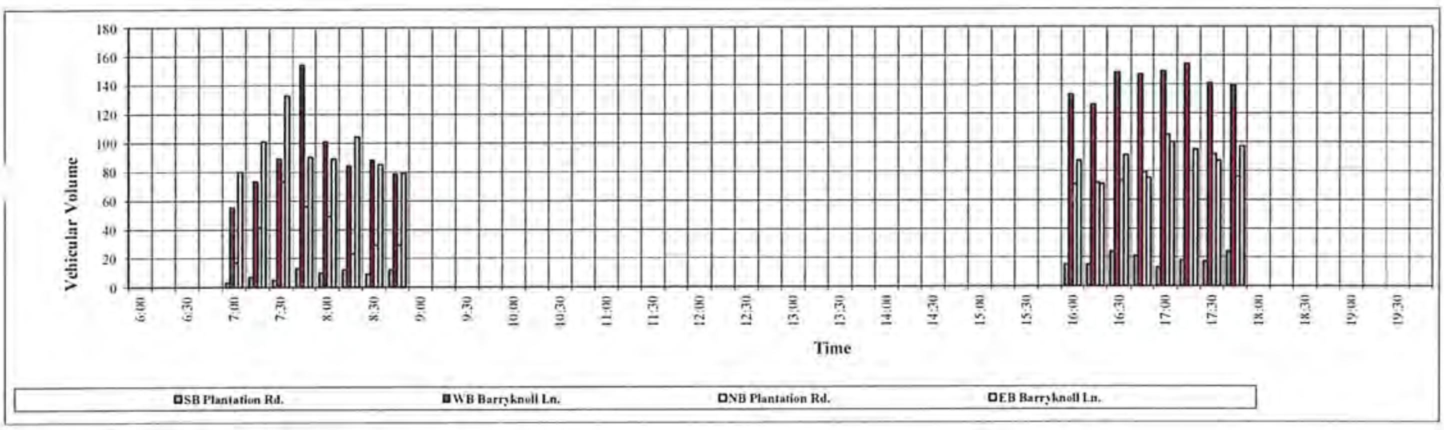
| | Southbound | | | | | Westbound | | | | | Northbound | | | | | Eastbound | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Plantation Rd. | | | | | Barryknoll Ln. | | | | | Plantation Rd. | | | | | Barryknoll Ln. | | | | |
| Time | Left | Thru | Right | U-turn | Peds | Left | Thru | Right | U-turn | Peds | Left | Thru | Right | U-turn | Peds | Left | Thru | Right | U-turn | Peds |
| 6:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 7:00 | 1 | 0 | 2 | 0 | 0 | 12 | 41 | 2 | 0 | 0 | 1 | 0 | 16 | 0 | 1 | 0 | 60 | 20 | 0 | 0 |
| 7:15 | 0 | 6 | 1 | 0 | 0 | 18 | 50 | 5 | 0 | 0 | 4 | 2 | 35 | 0 | 0 | 3 | 77 | 21 | 0 | 0 |
| 7:30 | 0 | 5 | 0 | 0 | 0 | 26 | 60 | 3 | 0 | 0 | 12 | 4 | 57 | 0 | 0 | 2 | 110 | 21 | 0 | 0 |
| 7:45 | 3 | 10 | 0 | 0 | 0 | 41 | 102 | 11 | 0 | 0 | 19 | 4 | 33 | 0 | 0 | 2 | 49 | 39 | 0 | 0 |
| **Hr. Total:** | **4** | **21** | **3** | **0** | **0** | **97** | **253** | **21** | **0** | **0** | **36** | **10** | **141** | **0** | **1** | **7** | **296** | **101** | **0** | **0** |
| 8:00 | 4 | 6 | 0 | 0 | 0 | 24 | 74 | 3 | 0 | 0 | 18 | 6 | 25 | 0 | 0 | 3 | 58 | 28 | 0 | 1 |
| 8:15 | 4 | 6 | 2 | 0 | 2 | 30 | 48 | 6 | 0 | 0 | 4 | 1 | 18 | 0 | 1 | 2 | 73 | 29 | 0 | 2 |
| 8:30 | 2 | 4 | 3 | 0 | 0 | 37 | 41 | 10 | 0 | 1 | 3 | 3 | 23 | 0 | 1 | 1 | 60 | 24 | 0 | 1 |
| 8:45 | 3 | 8 | 1 | 0 | 0 | 32 | 41 | 5 | 0 | 0 | 4 | 0 | 25 | 0 | 0 | 4 | 50 | 25 | 0 | 1 |
| **Hr. Total:** | **13** | **24** | **6** | **0** | **2** | **123** | **204** | **24** | **0** | **1** | **29** | **10** | **91** | **0** | **2** | **10** | **241** | **106** | **0** | **5** |
| 9:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 10:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 11:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 12:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 13:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 14:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 15:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 16:00 | 4 | 3 | 8 | 0 | 0 | 24 | 104 | 5 | 0 | 3 | 19 | 14 | 38 | 0 | 2 | 11 | 74 | 2 | 0 | 0 |
| 16:15 | 5 | 5 | 5 | 0 | 0 | 25 | 95 | 6 | 0 | 1 | 19 | 12 | 41 | 0 | 0 | 4 | 64 | 3 | 0 | 0 |
| 16:30 | 10 | 4 | 10 | 0 | 1 | 26 | 115 | 7 | 0 | 2 | 27 | 16 | 30 | 0 | 0 | 12 | 68 | 11 | 0 | 1 |
| 16:45 | 9 | 7 | 5 | 0 | 1 | 29 | 105 | 13 | 0 | 1 | 25 | 5 | 49 | 0 | 1 | 2 | 64 | 9 | 0 | 0 |
| **Hr. Total:** | **28** | **19** | **28** | **0** | **2** | **104** | **419** | **31** | **0** | **7** | **90** | **47** | **158** | **0** | **3** | **29** | **270** | **25** | **0** | **1** |

***Barryknoll Ln. at Plantation Rd.***

Wednesday, May 04, 2011

Turning Movment Count

| | Plantation Rd. From North Left | Plantation Rd. From North Thru | Plantation Rd. From North Right | Plantation Rd. From North U-turn | Plantation Rd. From North Peds | Barryknoll Ln. From East Left | Barryknoll Ln. From East Thru | Barryknoll Ln. From East Right | Barryknoll Ln. From East U-turn | Barryknoll Ln. From East Peds | Plantation Rd. From South Left | Plantation Rd. From South Thru | Plantation Rd. From South Right | Plantation Rd. From South U-turn | Plantation Rd. From South Peds | Barryknoll Ln. From West Left | Barryknoll Ln. From West Thru | Barryknoll Ln. From West Right | Barryknoll Ln. From West U-turn | Barryknoll Ln. From West Peds |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17:00 | 5 | 2 | 6 | 0 | 1 | 26 | 119 | 4 | 0 | 0 | 35 | 17 | 53 | 0 | 1 | 9 | 83 | 8 | 0 | 1 |
| 17:15 | 6 | 3 | 9 | 0 | 0 | 26 | 120 | 8 | 0 | 0 | 15 | 11 | 54 | 0 | 0 | 3 | 90 | 2 | 0 | 1 |
| 17:30 | 3 | 5 | 9 | 0 | 1 | 17 | 115 | 9 | 0 | 0 | 21 | 13 | 58 | 0 | 0 | 4 | 78 | 5 | 0 | 0 |
| 17:45 | 7 | 6 | 11 | 0 | 0 | 22 | 113 | 4 | 0 | 0 | 20 | 12 | 44 | 0 | 1 | 10 | 82 | 5 | 0 | 0 |
| **Hr. Total:** | **21** | **16** | **35** | **0** | **2** | **91** | **467** | **25** | **0** | **0** | **91** | **53** | **209** | **0** | **2** | **26** | **333** | **20** | **0** | **2** |
| 18:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 18:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 18:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 18:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 19:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 19:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 19:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 19:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **Gr. Total** | 66 | 80 | 72 | 0 | 6 | 415 | 1343 | 101 | 0 | 8 | 246 | 120 | 599 | 0 | 8 | 72 | 1140 | 252 | 0 | 8 |
| **% of Tot.** | 1% | 2% | 2% | 0% | 0% | 9% | 30% | 2% | 0% | 0% | 5% | 3% | 13% | 0% | 0% | 2% | 25% | 6% | 0% | 0% |
| **Apprch%** | | | 5% | | | | | 41% | | | | | 21% | | | | | 32% | | |
| **% of Apprch** | 30% | 37% | 33% | 0% | 3% | 22% | 72% | 5% | 0% | 0% | 25% | 12% | 62% | 0% | 1% | 5% | 78% | 17% | 0% | 1% |



## *Barryknoll Ln. at Bunker Hill Rd.*

Saturday, May 14, 2011

Turning Movment Count

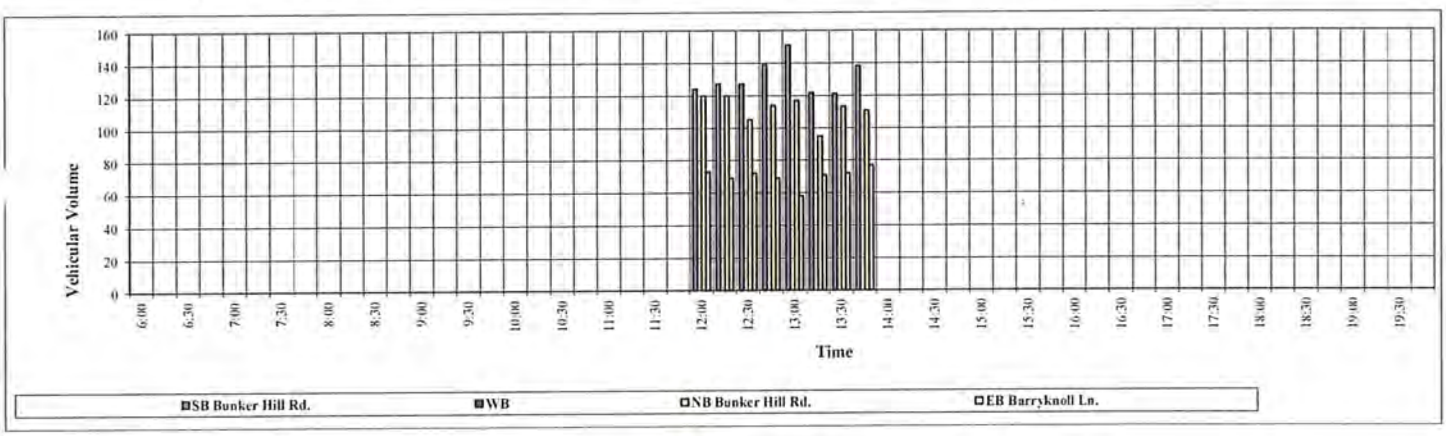
| | Southbound | | | | | Westbound | | | | | Northbound | | | | | Eastbound | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Bunker Hill Rd. | | | | | | | | | | Bunker Hill Rd. | | | | | Barryknoll Ln. | | | | |
| **Time** | **Left** | **Thru** | **Right** | **U-turn** | **Peds** | **Left** | **Thru** | **Right** | **U-turn** | **Peds** | **Left** | **Thru** | **Right** | **U-turn** | **Peds** | **Left** | **Thru** | **Right** | **U-turn** | **Peds** |
| **6:00** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **6:15** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **6:30** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **6:45** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **7:00** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **7:15** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **7:30** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **7:45** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **8:00** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **8:15** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **8:30** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **8:45** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **9:00** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **9:15** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **9:30** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **9:45** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **10:00** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **10:15** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **10:30** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **10:45** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **11:00** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **11:15** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **11:30** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **11:45** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **12:00** | 0 | 79 | 45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 22 | 98 | 0 | 0 | 0 | 47 | 0 | 26 | 0 | 0 |
| **12:15** | 0 | 82 | 45 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 22 | 98 | 0 | 0 | 1 | 47 | 0 | 22 | 0 | 1 |
| **12:30** | 0 | 71 | 56 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 22 | 83 | 0 | 0 | 0 | 43 | 0 | 29 | 0 | 0 |
| **12:45** | 0 | 78 | 61 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 20 | 94 | 0 | 0 | 0 | 55 | 0 | 14 | 0 | 0 |
| **Hr. Total:** | **0** | **310** | **207** | **0** | **0** | **0** | **0** | **0** | **0** | **5** | **86** | **373** | **0** | **0** | **1** | **192** | **0** | **91** | **0** | **1** |
| **13:00** | 0 | 92 | 59 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 19 | 98 | 0 | 0 | 0 | 46 | 0 | 12 | 0 | 0 |
| **13:15** | 0 | 85 | 37 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 11 | 84 | 0 | 0 | 0 | 46 | 0 | 25 | 0 | 0 |
| **13:30** | 0 | 85 | 36 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 23 | 90 | 0 | 0 | 0 | 50 | 0 | 22 | 0 | 0 |
| **13:45** | 0 | 88 | 50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20 | 91 | 0 | 0 | 2 | 57 | 0 | 20 | 0 | 1 |
| **Hr. Total:** | **0** | **350** | **182** | **0** | **0** | **0** | **0** | **0** | **0** | **3** | **73** | **363** | **0** | **0** | **2** | **199** | **0** | **79** | **0** | **1** |
| **14:00** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **14:15** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **14:30** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **14:45** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **15:00** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **15:15** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **15:30** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **15:45** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **16:00** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **16:15** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **16:30** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **16:45** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |

***Barryknoll Ln. at Bunker Hill Rd.***

Saturday, May 14, 2011

Turning Movment Count

| | From North – Bunker Hill Rd. Left | Thru | Right | U-turn | Peds | From East Left | Thru | Right | U-turn | Peds | From South – Bunker Hill Rd. Left | Thru | Right | U-turn | Peds | From West – Barryknoll Ln. Left | Thru | Right | U-turn | Peds |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 18:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 18:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 18:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 18:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 19:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 19:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 19:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 19:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| Gr. Total | 0 | 660 | 389 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 159 | 736 | 0 | 0 | 3 | 391 | 0 | 170 | 0 | 2 |
| % of Tot. | 0% | 26% | 16% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 6% | 29% | 0% | 0% | 0% | 16% | 0% | 7% | 0% | 0% |
| Apprch% | 42% | | | | | 0% | | | | | 36% | | | | | 22% | | | | |
| % of Apprch | 0% | 63% | 37% | 0% | 0% | ##### | ##### | ##### | ##### | ##### | 18% | 82% | 0% | 0% | 0% | 70% | 0% | 30% | 0% | 0% |



## *Barryknoll Ln. at Gessner Rd.*

Saturday, May 14, 2011

Turning Movment Count

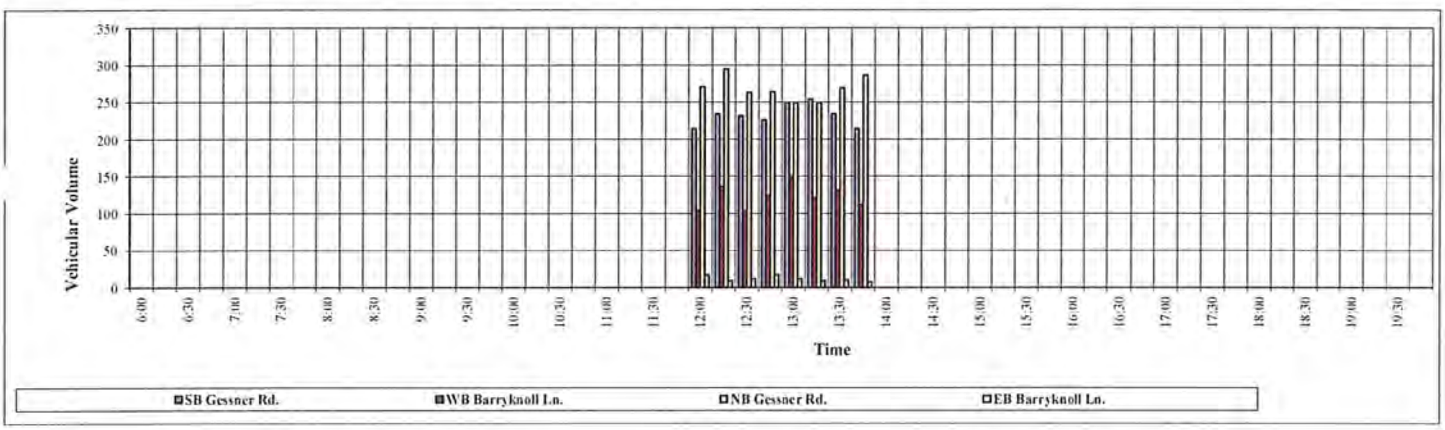
| | Southbound | | | | | Westbound | | | | | Northbound | | | | | Eastbound | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Gessner Rd. | | | | | Barryknoll Ln. | | | | | Gessner Rd. | | | | | Barryknoll Ln. | | | | |
| Time | Left | Thru | Right | U-turn | Peds | Left | Thru | Right | U-turn | Peds | Left | Thru | Right | U-turn | Peds | Left | Thru | Right | U-turn | Peds |
| 6:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 7:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 8:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 9:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 10:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 11:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 12:00 | 20 | 192 | 2 | 0 | 0 | 47 | 13 | 44 | 0 | 0 | 0 | 208 | 63 | 0 | 0 | 1 | 12 | 4 | 0 | 0 |
| 12:15 | 31 | 199 | 3 | 1 | 0 | 55 | 22 | 59 | 0 | 0 | 0 | 238 | 57 | 0 | 0 | 0 | 6 | 3 | 0 | 1 |
| 12:30 | 23 | 206 | 3 | 0 | 0 | 44 | 16 | 43 | 0 | 0 | 3 | 191 | 69 | 0 | 0 | 4 | 4 | 4 | 0 | 0 |
| 12:45 | 35 | 188 | 3 | 0 | 0 | 49 | 13 | 62 | 0 | 0 | 0 | 195 | 68 | 1 | 0 | 2 | 14 | 2 | 0 | 1 |
| **Hr. Total:** | **109** | **785** | **11** | **1** | **0** | **195** | **64** | **208** | **0** | **0** | **3** | **832** | **257** | **1** | **0** | **7** | **36** | **13** | **0** | **2** |
| 13:00 | 28 | 218 | 2 | 1 | 0 | 52 | 25 | 71 | 0 | 0 | 2 | 191 | 56 | 0 | 0 | 0 | 6 | 6 | 0 | 0 |
| 13:15 | 24 | 227 | 2 | 1 | 0 | 51 | 11 | 59 | 0 | 0 | 0 | 192 | 57 | 0 | 0 | 0 | 7 | 2 | 0 | 0 |
| 13:30 | 31 | 201 | 2 | 0 | 0 | 60 | 18 | 53 | 0 | 0 | 1 | 198 | 70 | 0 | 0 | 0 | 9 | 2 | 0 | 0 |
| 13:45 | 28 | 186 | 0 | 0 | 1 | 46 | 9 | 57 | 0 | 1 | 1 | 199 | 86 | 0 | 0 | 0 | 5 | 3 | 0 | 2 |
| **Hr. Total:** | **111** | **832** | **6** | **2** | **1** | **209** | **63** | **240** | **0** | **1** | **4** | **780** | **269** | **0** | **0** | **0** | **27** | **13** | **0** | **2** |
| 14:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 15:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 16:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |

## *Barryknoll Ln. at Gessner Rd.*

Saturday, May 14, 2011

Turning Movment Count

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 18:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 18:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 18:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 18:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 19:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 19:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 19:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 19:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **Gr. Total** | 220 | 1617 | 17 | 3 | 1 | 404 | 127 | 448 | 0 | 1 | 7 | 1612 | 526 | 1 | 0 | 7 | 63 | 26 | 0 | 4 |
| **% of Tot.** | 4% | 32% | 0% | 0% | 0% | 8% | 3% | 9% | 0% | 0% | 0% | 32% | 10% | 0% | 0% | 0% | 1% | 1% | 0% | 0% |
| **Apprch%** | | | 37% | | | | | 19% | | | | | 42% | | | | | 2% | | |
| **% of Apprch** | 12% | 87% | 1% | 0% | 0% | 41% | 13% | 46% | 0% | 0% | 0% | 75% | 25% | 0% | 0% | 7% | 66% | 27% | 0% | 4% |
| | **Left** | **Thru** | **Right** | **U-turn** | **Peds** | **Left** | **Thru** | **Right** | **U-turn** | **Peds** | **Left** | **Thru** | **Right** | **U-turn** | **Peds** | **Left** | **Thru** | **Right** | **U-turn** | **Peds** |
| | Gessner Rd. | | | | | Barryknoll Ln. | | | | | Gessner Rd. | | | | | Barryknoll Ln. | | | | |
| | **From North** | | | | | **From East** | | | | | **From South** | | | | | **From West** | | | | |



## *Barryknoll Ln. at Memorial City Way*

Saturday, May 14, 2011

Turning Movment Count

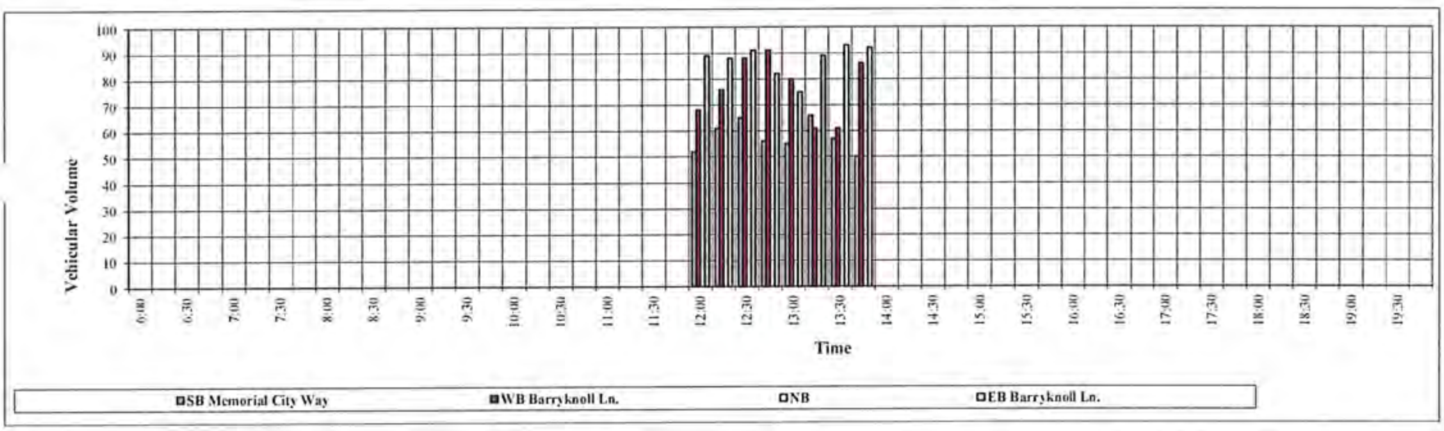
| | Southbound | | | | | Westbound | | | | | Northbound | | | | | Eastbound | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Memorial City Way | | | | | Barryknoll Ln. | | | | | | | | | | Barryknoll Ln. | | | | |
| Time | Left | Thru | Right | U-turn | Peds | Left | Thru | Right | U-turn | Peds | Left | Thru | Right | U-turn | Peds | Left | Thru | Right | U-turn | Peds |
| 6:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 7:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 8:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 9:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 10:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 11:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 12:00 | 14 | 0 | 38 | 0 | 1 | 0 | 61 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 64 | 0 | 0 | 0 |
| 12:15 | 10 | 0 | 51 | 0 | 0 | 0 | 69 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 36 | 52 | 0 | 0 | 0 |
| 12:30 | 17 | 0 | 48 | 0 | 1 | 0 | 74 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21 | 70 | 0 | 0 | 0 |
| 12:45 | 8 | 0 | 48 | 0 | 0 | 0 | 74 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 57 | 0 | 0 | 0 |
| **Hr. Total:** | **49** | **0** | **185** | **0** | **2** | **0** | **278** | **45** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **107** | **243** | **0** | **0** | **0** |
| 13:00 | 11 | 0 | 44 | 0 | 0 | 0 | 73 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 23 | 52 | 0 | 0 | 0 |
| 13:15 | 15 | 0 | 51 | 0 | 0 | 0 | 51 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 24 | 65 | 0 | 0 | 0 |
| 13:30 | 15 | 0 | 42 | 0 | 0 | 0 | 54 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 27 | 66 | 0 | 0 | 0 |
| 13:45 | 16 | 0 | 34 | 0 | 0 | 0 | 72 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21 | 71 | 0 | 0 | 0 |
| **Hr. Total:** | **57** | **0** | **171** | **0** | **0** | **0** | **250** | **38** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **95** | **254** | **0** | **0** | **0** |
| 14:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 15:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 16:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |

## *Barryknoll Ln. at Memorial City Way*

Saturday, May 14, 2011

Turning Movment Count

| | From North | | | | | From East | | | | | From South | | | | | From West | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Memorial City Way | | | | | Barryknoll Ln. | | | | | | | | | | Barryknoll Ln. | | | | |
| | Left | Thru | Right | U-turn | Peds | Left | Thru | Right | U-turn | Peds | Left | Thru | Right | U-turn | Peds | Left | Thru | Right | U-turn | Peds |
| **17:00** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **17:15** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **17:30** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **17:45** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **18:00** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **18:15** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **18:30** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **18:45** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **19:00** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **19:15** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **19:30** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **19:45** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **Gr. Total** | 106 | 0 | 356 | 0 | 2 | 0 | 528 | 83 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 202 | 497 | 0 | 0 | 0 |
| **% of Tot.** | 6% | 0% | 20% | 0% | 0% | 0% | 30% | 5% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 11% | 28% | 0% | 0% | 0% |
| **Apprch%** | 26% | | | | | 34% | | | | | 0% | | | | | 39% | | | | |
| **% of Apprch** | 23% | 0% | 77% | 0% | 0% | 0% | 86% | 14% | 0% | 0% | ##### | ##### | ##### | ##### | ##### | 29% | 71% | 0% | 0% | 0% |



## *Barryknoll Ln. at Plantation Rd.*

Saturday, May 14, 2011

Turning Movment Count

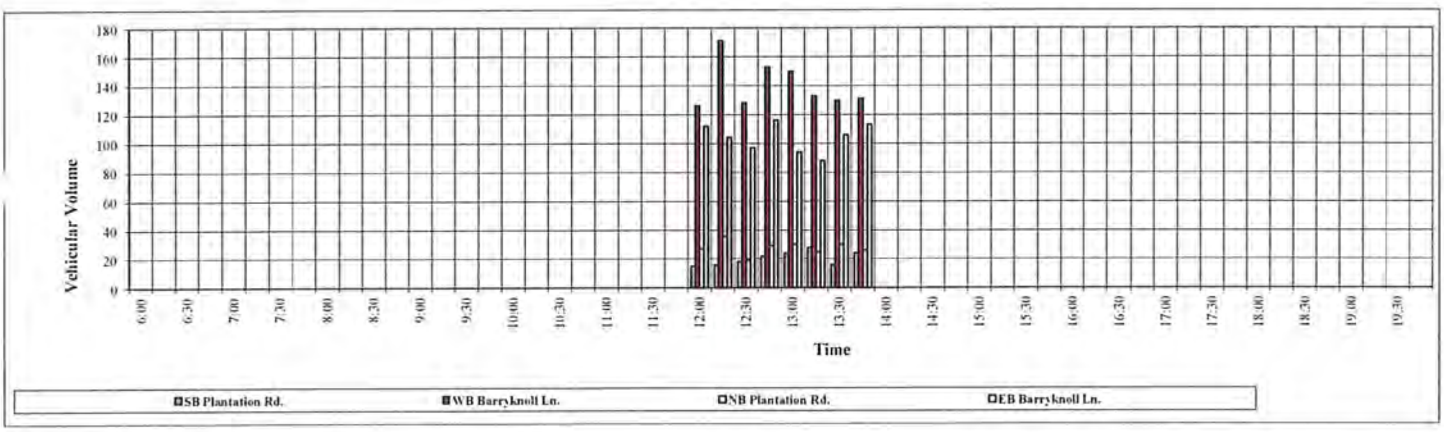
| | Southbound | | | | | Westbound | | | | | Northbound | | | | | Eastbound | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Plantation Rd. | | | | | Barryknoll Ln. | | | | | Plantation Rd. | | | | | Barryknoll Ln. | | | | |
| Time | Left | Thru | Right | U-turn | Peds | Left | Thru | Right | U-turn | Peds | Left | Thru | Right | U-turn | Peds | Left | Thru | Right | U-turn | Peds |
| 6:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 7:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 8:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 9:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 10:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 11:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 12:00 | 5 | 4 | 6 | 0 | 0 | 23 | 94 | 9 | 0 | 0 | 5 | 4 | 18 | 0 | 0 | 13 | 96 | 3 | 0 | 0 |
| 12:15 | 5 | 1 | 10 | 0 | 0 | 21 | 135 | 15 | 0 | 0 | 7 | 5 | 24 | 0 | 0 | 12 | 86 | 6 | 0 | 0 |
| 12:30 | 8 | 3 | 7 | 0 | 0 | 31 | 88 | 9 | 0 | 0 | 2 | 2 | 15 | 0 | 0 | 10 | 82 | 5 | 0 | 1 |
| 12:45 | 5 | 3 | 14 | 0 | 0 | 24 | 120 | 9 | 0 | 0 | 3 | 3 | 23 | 0 | 0 | 13 | 101 | 2 | 0 | 0 |
| **Hr. Total:** | **23** | **11** | **37** | **0** | **0** | **99** | **437** | **42** | **0** | **0** | **17** | **14** | **80** | **0** | **0** | **48** | **365** | **16** | **0** | **1** |
| 13:00 | 5 | 1 | 18 | 0 | 0 | 26 | 118 | 6 | 0 | 2 | 5 | 1 | 24 | 0 | 0 | 8 | 86 | 0 | 0 | 0 |
| 13:15 | 10 | 1 | 17 | 0 | 0 | 21 | 107 | 5 | 0 | 0 | 2 | 2 | 21 | 0 | 0 | 15 | 68 | 5 | 0 | 0 |
| 13:30 | 4 | 2 | 10 | 0 | 0 | 18 | 112 | 0 | 0 | 0 | 6 | 3 | 21 | 0 | 0 | 12 | 91 | 3 | 0 | 2 |
| 13:45 | 5 | 6 | 13 | 0 | 1 | 23 | 100 | 8 | 0 | 1 | 4 | 3 | 19 | 0 | 0 | 19 | 90 | 4 | 0 | 0 |
| **Hr. Total:** | **24** | **10** | **58** | **0** | **1** | **88** | **437** | **19** | **0** | **3** | **17** | **9** | **85** | **0** | **0** | **54** | **335** | **12** | **0** | **2** |
| 14:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 15:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 16:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |

## *Barryknoll Ln. at Plantation Rd.*

Saturday, May 14, 2011

Turning Movment Count

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 18:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 18:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 18:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 18:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| 19:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 19:15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 19:30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 19:45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hr. Total:** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **Gr. Total** | 47 | 21 | 95 | 0 | 1 | 187 | 874 | 61 | 0 | 3 | 34 | 23 | 165 | 0 | 0 | 102 | 700 | 28 | 0 | 3 |
| **% of Tot.** | 2% | 1% | 4% | 0% | 0% | 8% | 37% | 3% | 0% | 0% | 1% | 1% | 7% | 0% | 0% | 4% | 30% | 1% | 0% | 0% |
| **Apprch%** | | | 7% | | | | | 48% | | | | | 9% | | | | | 36% | | |
| **% of Apprch** | 29% | 13% | 58% | 0% | 1% | 17% | 78% | 5% | 0% | 0% | 15% | 10% | 74% | 0% | 0% | 12% | 84% | 3% | 0% | 0% |
| | **Left** | **Thru** | **Right** | **U-turn** | **Peds** | **Left** | **Thru** | **Right** | **U-turn** | **Peds** | **Left** | **Thru** | **Right** | **U-turn** | **Peds** | **Left** | **Thru** | **Right** | **U-turn** | **Peds** |
| | Plantation Rd. | | | | | Barryknoll Ln. | | | | | Plantation Rd. | | | | | Barryknoll Ln. | | | | |
| | **From North** | | | | | **From East** | | | | | **From South** | | | | | **From West** | | | | |



# Appendix D.2
## Peak Hours Determination

## Peak Hours Calculations Summary

| Weekday AM and Weekday PM Peak Hours Calculations | | | | | | |
|---|---|---|---|---|---|---|
| Time | Bayyknoll Lane @ Bunker Hill Road | Barryknoll Lane @ Gessner Road | Barryknoll Lane @ Memorial City Way | Barryknoll Lane @ Plantation Road | Hour Total | Rank |
| **Weekday AM Peak Hour Period Calculation** | | | | | | |
| 7:00 | 203 | 490 | 142 | 155 | | |
| 7:15 | 340 | 623 | 208 | 222 | | |
| 7:30 | 506 | 754 | 305 | 300 | | |
| 7:45 | 506 | 767 | 387 | 313 | 990 | 4 |
| 8:00 | 317 | 726 | 233 | 249 | 1084 | 2 |
| 8:15 | 288 | 670 | 198 | 223 | 1085 | 1 |
| 8:30 | 299 | 651 | 176 | 211 | 996 | 3 |
| 8:45 | 258 | 594 | 173 | 198 | 881 | 5 |
| **Weekday PM Peak Hour Period Calculation** | | | | | | |
| 16:00 | 298 | 751 | 237 | 306 | | |
| 16:15 | 330 | 712 | 235 | 284 | | |
| 16:30 | 343 | 820 | 255 | 336 | | |
| 16:45 | 357 | 812 | 268 | 322 | 1248 | 5 |
| 17:00 | 370 | 897 | 291 | 367 | 1309 | 4 |
| 17:15 | 387 | 919 | 304 | 347 | 1372 | 3 |
| 17:30 | 392 | 903 | 298 | 337 | 1373 | 2 |
| 17:45 | 407 | 882 | 255 | 336 | 1387 | 1 |

| Weekend Peak Hour Calculation | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Time | EB Barryknoll Lane between Bettina Court and Strey Lane | Eastbound Barryknoll Lane West of Bunker Hill Road | Eastbound Barryknoll Lane West of Gessner Road | Eastbound Barryknoll Lane West of Memorial City Way | Eastbound Barryknoll Lane West of Plantation Road | Northbound Bunker Hill Road South of Barryknoll Lane | Northbound Gessner Road South of Barryknoll Lane | Northbound Plantation Road South of Barryknoll Lane | Southbound Bunker Hill Road North of Barryknoll Lane | Southbound Gessner Road North of Barryknoll Lane | Southbound Memorial City Way North of Barryknoll Lane | Southbound Plantation Road North of Barryknoll Lane | Westbound Barryknoll Lane East of Gessner Road | Westbound Barryknoll Lane East of Memorial City Way | Westbound Barryknoll Lane East of Plantation Road | (15 Minute) Total | Hour Total | Rank |
| 0:00 | 16 | 14 | 1 | 14 | 12 | 7 | 44 | 2 | 22 | 84 | 4 | 10 | 47 | 12 | 44 | 333 | | |
| 0:15 | 10 | 10 | 0 | 12 | 3 | 9 | 42 | 1 | 17 | 64 | 5 | 7 | 31 | 9 | 27 | 247 | | |
| 0:30 | 5 | 3 | 0 | 3 | 7 | 11 | 39 | 2 | 13 | 53 | 3 | 2 | 10 | 6 | 9 | 166 | | |
| 0:45 | 8 | 7 | 1 | 7 | 4 | 8 | 27 | 1 | 9 | 31 | 4 | 5 | 18 | 2 | 15 | 147 | 893 | 72 |
| 1:00 | 4 | 4 | 2 | 4 | 2 | 6 | 20 | 1 | 11 | 40 | 0 | 4 | 9 | 7 | 10 | 124 | 684 | 74 |
| 1:15 | 3 | 3 | 0 | 3 | 2 | 1 | 17 | 0 | 5 | 41 | 1 | 3 | 5 | 2 | 3 | 89 | 526 | 77 |
| 1:30 | 3 | 2 | 0 | 2 | 2 | 5 | 33 | 1 | 11 | 24 | 0 | 0 | 5 | 3 | 4 | 95 | 455 | 79 |
| 1:45 | 4 | 5 | 1 | 4 | 4 | 2 | 32 | 1 | 7 | 26 | 0 | 2 | 8 | 4 | 7 | 107 | 415 | 80 |
| 2:00 | 2 | 0 | 0 | 1 | 1 | 1 | 28 | 0 | 7 | 36 | 0 | 1 | 6 | 2 | 3 | 88 | 379 | 83 |
| 2:15 | 2 | 1 | 0 | 1 | 4 | 4 | 42 | 0 | 11 | 46 | 1 | 0 | 2 | 5 | 2 | 121 | 411 | 81 |
| 2:30 | 0 | 0 | 0 | 0 | 2 | 0 | 18 | 0 | 7 | 26 | 1 | 0 | 4 | 2 | 4 | 64 | 380 | 82 |
| 2:45 | 3 | 2 | 0 | 4 | 1 | 4 | 17 | 2 | 7 | 14 | 2 | 0 | 2 | 3 | 4 | 65 | 338 | 85 |
| 3:00 | 1 | 0 | 0 | 1 | 1 | 1 | 21 | 1 | 5 | 20 | 1 | 1 | 7 | 3 | 6 | 69 | 319 | 86 |
| 3:15 | 1 | 1 | 0 | 1 | 1 | 1 | 24 | 1 | 4 | 18 | 0 | 1 | 0 | 2 | 2 | 57 | 255 | 88 |
| 3:30 | 1 | 1 | 0 | 1 | 3 | 6 | 10 | 1 | 4 | 27 | 1 | 0 | 2 | 2 | 1 | 60 | 251 | 89 |
| 3:45 | 2 | 1 | 0 | 1 | 1 | 2 | 20 | 0 | 4 | 16 | 0 | 0 | 0 | 2 | 1 | 50 | 236 | 90 |
| 4:00 | 1 | 0 | 0 | 1 | 0 | 0 | 16 | 0 | 5 | 9 | 0 | 0 | 1 | 0 | 1 | 34 | 201 | 92 |
| 4:15 | 0 | 2 | 0 | 0 | 0 | 3 | 17 | 0 | 2 | 15 | 2 | 0 | 2 | 1 | 2 | 46 | 190 | 94 |
| 4:30 | 0 | 0 | 3 | 0 | 0 | 2 | 17 | 0 | 3 | 11 | 0 | 0 | 2 | 2 | 4 | 44 | 174 | 96 |
| 4:45 | 3 | 1 | 3 | 3 | 4 | 1 | 18 | 0 | 0 | 18 | 1 | 0 | 1 | 0 | 2 | 55 | 179 | 95 |
| 5:00 | 2 | 1 | 0 | 2 | 2 | 1 | 19 | 0 | 4 | 10 | 0 | 0 | 4 | 1 | 5 | 51 | 196 | 93 |
| 5:15 | 1 | 3 | 0 | 2 | 3 | 1 | 31 | 0 | 1 | 15 | 0 | 0 | 0 | 2 | 0 | 59 | 209 | 91 |
| 5:30 | 7 | 3 | 1 | 8 | 10 | 10 | 37 | 1 | 6 | 26 | 1 | 0 | 5 | 4 | 6 | 125 | 290 | 87 |
| 5:45 | 3 | 4 | 0 | 5 | 5 | 8 | 42 | 2 | 6 | 26 | 1 | 0 | 6 | 7 | 10 | 125 | 360 | 84 |
| 6:00 | 8 | 12 | 2 | 7 | 6 | 14 | 40 | 2 | 7 | 42 | 5 | 2 | 17 | 15 | 19 | 198 | 507 | 78 |
| 6:15 | 12 | 6 | 2 | 10 | 9 | 15 | 44 | 3 | 7 | 38 | 2 | 1 | 10 | 7 | 7 | 173 | 621 | 76 |
| 6:30 | 12 | 8 | 0 | 12 | 7 | 12 | 54 | 6 | 10 | 40 | 2 | 0 | 1 | 6 | 2 | 172 | 668 | 75 |
| 6:45 | 17 | 16 | 1 | 19 | 14 | 27 | 82 | 5 | 16 | 58 | 1 | 2 | 8 | 10 | 7 | 283 | 826 | 73 |
| 7:00 | 15 | 14 | 2 | 18 | 11 | 26 | 81 | 6 | 8 | 50 | 5 | 2 | 12 | 8 | 9 | 267 | 895 | 71 |
| 7:15 | 21 | 21 | 5 | 24 | 26 | 32 | 90 | 8 | 14 | 68 | 3 | 0 | 9 | 15 | 12 | 348 | 1070 | 69 |
| 7:30 | 36 | 39 | 4 | 42 | 27 | 39 | 120 | 14 | 38 | 94 | 6 | 1 | 18 | 24 | 22 | 524 | 1422 | 65 |
| 7:45 | 40 | 32 | 3 | 44 | 35 | 53 | 122 | 18 | 42 | 108 | 13 | 3 | 18 | 19 | 24 | 574 | 1713 | 62 |
| 8:00 | 29 | 26 | 4 | 28 | 26 | 53 | 118 | 10 | 64 | 106 | 13 | 5 | 26 | 28 | 37 | 573 | 2019 | 60 |
| 8:15 | 34 | 32 | 3 | 37 | 22 | 67 | 132 | 16 | 55 | 108 | 14 | 1 | 26 | 32 | 34 | 613 | 2284 | 58 |
| 8:30 | 52 | 34 | 7 | 47 | 40 | 62 | 172 | 19 | 68 | 126 | 10 | 6 | 37 | 43 | 44 | 767 | 2527 | 56 |
| 8:45 | 68 | 52 | 4 | 66 | 54 | 82 | 172 | 22 | 72 | 148 | 16 | 4 | 27 | 38 | 31 | 856 | 2809 | 55 |
| 9:00 | 56 | 39 | 6 | 59 | 60 | 76 | 170 | 19 | 92 | 158 | 15 | 9 | 45 | 56 | 53 | 913 | 3149 | 52 |
| 9:15 | 64 | 54 | 9 | 69 | 69 | 82 | 206 | 23 | 82 | 162 | 27 | 5 | 55 | 58 | 68 | 1033 | 3569 | 49 |
| 9:30 | 84 | 52 | 8 | 77 | 81 | 102 | 232 | 28 | 84 | 152 | 15 | 1 | 56 | 56 | 65 | 1093 | 3895 | 46 |
| 9:45 | 92 | 61 | 6 | 79 | 120 | 102 | 277 | 32 | 118 | 187 | 31 | 10 | 82 | 72 | 94 | 1363 | 4402 | 42 |
| 10:00 | 85 | 51 | 8 | 58 | 96 | 90 | 208 | 28 | 103 | 192 | 29 | 11 | 58 | 50 | 66 | 1133 | 4622 | 40 |
| 10:15 | 84 | 56 | 9 | 71 | 82 | 115 | 236 | 29 | 110 | 158 | 48 | 7 | 74 | 61 | 97 | 1237 | 4826 | 38 |
| 10:30 | 94 | 73 | 7 | 90 | 100 | 97 | 236 | 26 | 108 | 200 | 44 | 8 | 86 | 64 | 96 | 1329 | 5062 | 36 |
| 10:45 | 98 | 66 | 12 | 74 | 115 | 107 | 248 | 26 | 112 | 206 | 44 | 17 | 86 | 66 | 105 | 1382 | 5081 | 35 |
| 11:00 | 118 | 76 | 9 | 98 | 128 | 118 | 260 | 33 | 107 | 216 | 68 | 13 | 128 | 67 | 129 | 1568 | 5516 | 33 |
| 11:15 | 82 | 80 | 11 | 80 | 98 | 104 | 260 | 30 | 113 | 208 | 57 | 23 | 98 | 58 | 105 | 1407 | 5686 | 31 |
| 11:30 | 90 | 59 | 10 | 76 | 112 | 114 | 250 | 23 | 112 | 194 | 55 | 16 | 116 | 76 | 144 | 1447 | 5804 | 25 |
| 11:45 | 102 | 76 | 11 | 86 | 134 | 116 | 295 | 30 | 125 | 226 | 60 | 22 | 122 | 82 | 139 | 1626 | 6048 | 23 |
| 12:00 | 90 | 69 | 8 | 78 | 89 | 111 | 254 | 18 | 138 | 226 | 49 | 25 | 118 | 76 | 127 | 1476 | 5956 | 24 |
| 12:15 | 98 | 77 | 12 | 90 | 109 | 132 | 256 | 32 | 144 | 239 | 67 | 23 | 139 | 96 | 172 | 1686 | 6235 | 21 |
| 12:30 | 106 | 74 | 11 | 96 | 123 | 120 | 302 | 22 | 142 | 237 | 54 | 15 | 126 | 96 | 166 | 1690 | 6478 | 19 |
| **12:45** | 117 | 92 | 13 | 105 | 146 | 122 | 285 | 23 | 144 | 234 | 80 | 25 | 164 | 91 | 198 | 1839 | 6691 | 14 |
| **13:00** | 106 | 80 | 12 | 96 | 129 | 117 | 255 | 35 | 162 | 220 | 88 | 23 | 148 | 87 | 176 | 1734 | 6949 | 2 |
| **13:15** | 93 | 72 | 15 | 79 | 109 | 93 | 273 | 20 | 128 | 234 | 85 | 32 | 148 | 76 | 182 | 1639 | 6902 | 4 |
| **13:30** | 114 | 82 | 14 | 72 | 131 | 119 | 268 | 24 | 130 | 258 | 79 | 32 | 164 | 85 | 174 | 1746 | 6958 | 1 |
| 13:45 | 112 | 78 | 12 | 35 | 121 | 106 | 298 | 31 | 122 | 244 | 94 | 31 | 164 | 73 | 192 | 1713 | 6832 | 7 |
| 14:00 | 114 | 84 | 14 | 36 | 125 | 105 | 258 | 29 | 148 | 240 | 86 | 32 | 174 | 79 | 214 | 1738 | 6836 | 6 |
| 14:15 | 91 | 58 | 9 | 29 | 106 | 110 | 301 | 22 | 146 | 272 | 90 | 33 | 170 | 74 | 198 | 1709 | 6906 | 3 |
| 14:30 | 104 | 78 | 6 | 26 | 107 | 100 | 246 | 32 | 132 | 244 | 58 | 27 | 151 | 82 | 158 | 1551 | 6711 | 12 |
| 14:45 | 92 | 80 | 10 | 36 | 95 | 100 | 274 | 23 | 141 | 243 | 85 | 28 | 170 | 69 | 177 | 1623 | 6621 | 16 |
| 15:00 | 101 | 78 | 8 | 24 | 140 | 107 | 268 | 23 | 124 | 242 | 84 | 35 | 175 | 82 | 194 | 1685 | 6568 | 18 |
| 15:15 | 122 | 96 | 12 | 49 | 120 | 111 | 265 | 33 | 140 | 220 | 86 | 27 | 168 | 79 | 208 | 1736 | 6595 | 17 |
| 15:30 | 110 | 82 | 14 | 34 | 119 | 121 | 277 | 29 | 129 | 240 | 69 | 19 | 170 | 74 | 176 | 1663 | 6707 | 13 |
| 15:45 | 100 | 92 | 8 | 48 | 107 | 90 | 246 | 20 | 131 | 228 | 68 | 48 | 176 | 74 | 206 | 1642 | 6726 | 11 |
| 16:00 | 112 | 82 | 13 | 50 | 120 | 86 | 268 | 35 | 149 | 238 | 78 | 41 | 174 | 82 | 209 | 1737 | 6778 | 10 |
| 16:15 | 108 | 94 | 12 | 46 | 111 | 120 | 265 | 32 | 131 | 249 | 68 | 28 | 183 | 86 | 204 | 1737 | 6779 | 9 |
| 16:30 | 126 | 103 | 14 | 49 | 118 | 100 | 262 | 36 | 130 | 233 | 83 | 39 | 150 | 59 | 192 | 1694 | 6810 | 8 |
| 16:45 | 103 | 100 | 12 | 56 | 104 | 92 | 273 | 34 | 128 | 237 | 69 | 40 | 176 | 78 | 174 | 1676 | 6844 | 5 |
| 17:00 | 87 | 74 | 14 | 44 | 107 | 94 | 267 | 18 | 117 | 218 | 68 | 36 | 162 | 58 | 192 | 1556 | 6663 | 15 |
| 17:15 | 72 | 56 | 9 | 32 | 82 | 83 | 232 | 15 | 114 | 249 | 75 | 25 | 140 | 55 | 188 | 1427 | 6353 | 20 |
| 17:30 | 67 | 68 | 7 | 22 | 102 | 71 | 239 | 19 | 144 | 226 | 64 | 19 | 146 | 77 | 166 | 1437 | 6096 | 22 |
| 17:45 | 75 | 62 | 7 | 26 | 64 | 70 | 222 | 25 | 113 | 221 | 58 | 43 | 158 | 57 | 164 | 1365 | 5785 | 27 |
| 18:00 | 73 | 89 | 4 | 30 | 94 | 96 | 251 | 31 | 114 | 240 | 64 | 30 | 160 | 59 | 180 | 1515 | 5744 | 30 |
| 18:15 | 71 | 60 | 10 | 24 | 89 | 122 | 222 | 13 | 118 | 236 | 57 | 24 | 158 | 82 | 184 | 1470 | 5787 | 26 |
| 18:30 | 76 | 58 | 8 | 32 | 78 | 82 | 228 | 23 | 105 | 224 | 64 | 30 | 164 | 69 | 194 | 1435 | 5785 | 27 |
| 18:45 | 72 | 66 | 7 | 23 | 90 | 80 | 228 | 20 | 92 | 220 | 57 | 34 | 145 | 52 | 170 | 1356 | 5776 | 29 |
| 19:00 | 60 | 54 | 3 | 22 | 71 | 69 | 204 | 20 | 102 | 216 | 54 | 30 | 147 | 55 | 162 | 1269 | 5530 | 32 |
| 19:15 | 56 | 45 | 8 | 28 | 68 | 65 | 198 | 17 | 98 | 199 | 48 | 23 | 150 | 55 | 142 | 1200 | 5260 | 34 |
| 19:30 | 52 | 43 | 6 | 20 | 58 | 71 | 170 | 10 | 103 | 202 | 38 | 28 | 146 | 59 | 150 | 1156 | 4981 | 37 |
| 19:45 | 52 | 48 | 2 | 16 | 59 | 59 | 183 | 12 | 74 | 203 | 44 | 25 | 124 | 53 | 116 | 1070 | 4695 | 39 |
| 20:00 | 57 | 46 | 7 | 26 | 78 | 49 | 190 | 10 | 86 | 204 | 38 | 18 | 140 | 46 | 136 | 1131 | 4557 | 41 |
| 20:15 | 47 | 42 | 5 | 14 | 56 | 58 | 137 | 9 | 68 | 181 | 41 | 34 | 150 | 46 | 141 | 1029 | 4386 | 43 |
| 20:30 | 66 | 56 | 4 | 24 | 44 | 50 | 131 | 13 | 74 | 181 | 48 | 25 | 144 | 37 | 147 | 1044 | 4274 | 44 |
| 20:45 | 46 | 31 | 4 | 18 | 48 | 52 | 114 | 5 | 60 | 160 | 34 | 29 | 130 | 26 | 121 | 878 | 4082 | 45 |
| 21:00 | 50 | 44 | 3 | 17 | 35 | 36 | 102 | 11 | 72 | 190 | 34 | 17 | 132 | 40 | 132 | 915 | 3866 | 47 |
| 21:15 | 43 | 35 | 2 | 26 | 16 | 34 | 110 | 10 | 55 | 186 | 25 | 25 | 130 | 32 | 121 | 850 | 3687 | 48 |
| 21:30 | 33 | 29 | 2 | 21 | 16 | 42 | 108 | 7 | 83 | 167 | 19 | 20 | 116 | 28 | 123 | 814 | 3457 | 50 |
| 21:45 | 42 | 36 | 6 | 24 | 27 | 32 | 101 | 9 | 50 | 154 | 27 | 19 | 94 | 31 | 94 | 746 | 3325 | 51 |
| 22:00 | 27 | 28 | 5 | 10 | 31 | 32 | 98 | 3 | 62 | 148 | 20 | 14 | 72 | 23 | 62 | 635 | 3045 | 53 |
| 22:15 | 15 | 20 | 2 | 10 | 23 | 31 | 94 | 2 | 66 | 141 | 21 | 7 | 70 | 44 | 75 | 621 | 2816 | 54 |
| 22:30 | 21 | 22 | 2 | 4 | 18 | 31 | 78 | 3 | 53 | 123 | 18 | 9 | 32 | 21 | 30 | 465 | 2467 | 57 |
| 22:45 | 16 | 13 | 2 | 4 | 11 | 21 | 70 | 6 | 40 | 113 | 12 | 5 | 38 | 22 | 42 | 415 | 2136 | 59 |
| 23:00 | 15 | 12 | 0 | 4 | 12 | 20 | 59 | 5 | 34 | 108 | 9 | 3 | 36 | 9 | 33 | 359 | 1860 | 61 |
| 23:15 | 16 | 24 | 2 | 6 | 8 | 15 | 56 | 2 | 28 | 110 | 9 | 5 | 58 | 14 | 61 | 414 | 1653 | 63 |
| 23:30 | 20 | 10 | 1 | 1 | 14 | 20 | 58 | 3 | 18 | 84 | 8 | 5 | 27 | 19 | 30 | 318 | 1506 | 64 |
| 23:45 | 5 | 7 | 1 | 2 | 7 | 21 | 51 | 0 | 26 | 71 | 11 | 7 | 30 | 7 | 26 | 272 | 1363 | 66 |
| | | | | | | | | | | | | | | | | | 1337 | 67 |
| | | | | | | | | | | | | | | | | | 1170 | 68 |
| | | | | | | | | | | | | | | | | | 1018 | 70 |

# Appendix D.3
## Growth Rate Calculations

# Annualized Growth Rates Calculations

| Location | HGAC 2009 Daily Traffic | HGAC 2035 Daily Traffic | Annualized Calculated Growth Rate (2009 - 2035) | Average Annualized Growth Rate (2009 - 2035) | Annualized Used Growth Rate (2009 - 2035) |
|---|---|---|---|---|---|
| Northbound Gessner Road | 15,849 | 29,601 | 2.4 | 2.0 | 2.7 |
| Southbound Gessner Road | 13,466 | 26,955 | 2.7 | | 2.7 |
| Northbound Bunker Hill Road | 5,536 | 7,927 | 1.4 | | 1.5 |
| Southbound Bunker Hill Road | 4,860 | 7,205 | 1.5 | | 1.5 |
| Eastbound Barryknoll Lane | - | - | - | | 2.0 |
| Westbound Barryknoll Lane | - | - | - | | 2.0 |
| Northbound Plantation Road | - | - | - | | 2.0 |
| Southbound Plantation Road | - | - | - | | 2.0 |
| Northbound Memorial City Way | - | - | - | | 2.0 |
| Southbound Memorial City Way | - | - | - | | 2.0 |

# Appendix D.4
## Synchro Output Files

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBU | NBL | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Volume (vph) | 11 | 82 | 31 | 113 | 99 | 141 | 1 | 1 | 969 | 202 | 159 | 1105 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 14 | 12 | 10 | 10 | 10 | 12 | 11 | 11 | 11 | 11 | 11 |
| Total Lost time (s) | | 5.5 | | 5.5 | 5.5 | 5.5 | | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 |
| Lane Util. Factor | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 0.91 | 1.00 | 1.00 | 0.91 |
| Frpb, ped/bikes | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Flpb, ped/bikes | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.97 | | 1.00 | 1.00 | 0.85 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 |
| Flt Protected | | 1.00 | | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (prot) | | 1911 | | 1652 | 1739 | 1478 | | 1711 | 4916 | 1531 | 1711 | 4914 |
| Flt Permitted | | 0.96 | | 0.50 | 1.00 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (perm) | | 1849 | | 868 | 1739 | 1478 | | 1711 | 4916 | 1531 | 1711 | 4914 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 12 | 89 | 34 | 123 | 108 | 153 | 1 | 1 | 1053 | 220 | 173 | 1201 |
| RTOR Reduction (vph) | 0 | 11 | 0 | 0 | 0 | 122 | 0 | 0 | 0 | 112 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 124 | 0 | 123 | 108 | 31 | 0 | 2 | 1053 | 108 | 173 | 1204 |
| Confl. Peds. (#/hr) | | | | | | | | | | | | |
| Turn Type | Perm | | | pm+pt | | Perm | Prot | Prot | | Perm | Prot | |
| Protected Phases | | 2 | | 1 | 6 | | 3 | 3 | 8 | | 7 | 4 |
| Permitted Phases | 2 | | | 6 | | 6 | | | | 8 | | |
| Actuated Green, G (s) | | 13.3 | | 24.3 | 24.3 | 24.3 | | 1.3 | 58.8 | 58.8 | 21.4 | 78.9 |
| Effective Green, g (s) | | 13.3 | | 24.3 | 24.3 | 24.3 | | 1.3 | 58.8 | 58.8 | 21.4 | 78.9 |
| Actuated g/C Ratio | | 0.11 | | 0.20 | 0.20 | 0.20 | | 0.01 | 0.49 | 0.49 | 0.18 | 0.66 |
| Clearance Time (s) | | 5.5 | | 5.5 | 5.5 | 5.5 | | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 |
| Vehicle Extension (s) | | 3.0 | | 3.0 | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | 205 | | 212 | 352 | 299 | | 19 | 2409 | 750 | 305 | 3231 |
| v/s Ratio Prot | | | | c0.03 | 0.06 | | | 0.00 | c0.21 | | c0.10 | 0.25 |
| v/s Ratio Perm | | 0.07 | | c0.09 | | 0.02 | | | | 0.07 | | |
| v/c Ratio | | 0.61 | | 0.58 | 0.31 | 0.10 | | 0.11 | 0.44 | 0.14 | 0.57 | 0.37 |
| Uniform Delay, d1 | | 50.9 | | 48.9 | 40.7 | 39.0 | | 58.8 | 19.9 | 16.8 | 45.1 | 9.3 |
| Progression Factor | | 1.00 | | 0.93 | 0.92 | 1.30 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | | 5.0 | | 3.9 | 0.5 | 0.2 | | 2.4 | 0.6 | 0.4 | 2.4 | 0.3 |
| Delay (s) | | 55.9 | | 49.6 | 38.0 | 51.0 | | 61.2 | 20.4 | 17.2 | 47.5 | 9.7 |
| Level of Service | | E | | D | D | D | | E | C | B | D | A |
| Approach Delay (s) | | 55.9 | | | 46.9 | | | | 19.9 | | | 14.4 |
| Approach LOS | | E | | | D | | | | B | | | B |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 22.3 | HCM Level of Service | C |
| HCM Volume to Capacity ratio | 0.49 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 15.5 |
| Intersection Capacity Utilization | 53.9% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | SBR |
|---|---|
| Lane Configurations | |
| Volume (vph) | 3 |
| Ideal Flow (vphpl) | 1900 |
| Lane Width | 11 |
| Total Lost time (s) | |
| Lane Util. Factor | |
| Frpb, ped/bikes | |
| Flpb, ped/bikes | |
| Frt | |
| Flt Protected | |
| Satd. Flow (prot) | |
| Flt Permitted | |
| Satd. Flow (perm) | |
| Peak-hour factor, PHF | 0.92 |
| Adj. Flow (vph) | 3 |
| RTOR Reduction (vph) | 0 |
| Lane Group Flow (vph) | 0 |
| Confl. Peds. (#/hr) | 1 |
| Turn Type | |
| Protected Phases | |
| Permitted Phases | |
| Actuated Green, G (s) | |
| Effective Green, g (s) | |
| Actuated g/C Ratio | |
| Clearance Time (s) | |
| Vehicle Extension (s) | |
| Lane Grp Cap (vph) | |
| v/s Ratio Prot | |
| v/s Ratio Perm | |
| v/c Ratio | |
| Uniform Delay, d1 | |
| Progression Factor | |
| Incremental Delay, d2 | |
| Delay (s) | |
| Level of Service | |
| Approach Delay (s) | |
| Approach LOS | |

Intersection Summary

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Volume (vph) | 9 | 290 | 117 | 121 | 284 | 23 | 53 | 15 | 133 | 11 | 27 | 2 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 10 | 10 | 10 | 10 | 10 | 10 | 12 | 12 | 12 | 12 | 12 | 12 |
| Total Lost time (s) | | 5.0 | | | 5.0 | | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 |
| Lane Util. Factor | | 0.95 | | | 0.95 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frpb, ped/bikes | | 0.99 | | | 1.00 | | 1.00 | 1.00 | 0.99 | | 1.00 | 0.99 |
| Flpb, ped/bikes | | 1.00 | | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | | 0.96 | | | 0.99 | | 1.00 | 1.00 | 0.85 | | 1.00 | 0.85 |
| Flt Protected | | 1.00 | | | 0.99 | | 0.95 | 1.00 | 1.00 | | 0.99 | 1.00 |
| Satd. Flow (prot) | | 3136 | | | 3231 | | 1770 | 1863 | 1562 | | 1836 | 1560 |
| Flt Permitted | | 0.95 | | | 0.74 | | 0.73 | 1.00 | 1.00 | | 0.91 | 1.00 |
| Satd. Flow (perm) | | 2969 | | | 2412 | | 1360 | 1863 | 1562 | | 1699 | 1560 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 10 | 315 | 127 | 132 | 309 | 25 | 58 | 16 | 145 | 12 | 29 | 2 |
| RTOR Reduction (vph) | 0 | 34 | 0 | 0 | 4 | 0 | 0 | 0 | 128 | 0 | 0 | 2 |
| Lane Group Flow (vph) | 0 | 418 | 0 | 0 | 462 | 0 | 58 | 16 | 17 | 0 | 41 | 0 |
| Confl. Peds. (#/hr) | | | 3 | | | | | | 1 | | | 2 |
| Turn Type | Perm | | | Perm | | | Perm | | Perm | Perm | | Perm |
| Protected Phases | | 2 | | | 6 | | | 8 | | | 4 | |
| Permitted Phases | 2 | | | 6 | | | 8 | | 8 | 4 | | 4 |
| Actuated Green, G (s) | | 44.0 | | | 44.0 | | 7.0 | 7.0 | 7.0 | | 7.0 | 7.0 |
| Effective Green, g (s) | | 44.0 | | | 44.0 | | 7.0 | 7.0 | 7.0 | | 7.0 | 7.0 |
| Actuated g/C Ratio | | 0.73 | | | 0.73 | | 0.12 | 0.12 | 0.12 | | 0.12 | 0.12 |
| Clearance Time (s) | | 5.0 | | | 5.0 | | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 |
| Vehicle Extension (s) | | 3.0 | | | 3.0 | | 3.0 | 3.0 | 3.0 | | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | 2177 | | | 1769 | | 159 | 217 | 182 | | 198 | 182 |
| v/s Ratio Prot | | | | | | | | 0.01 | | | | |
| v/s Ratio Perm | | 0.14 | | | c0.19 | | c0.04 | | 0.01 | | 0.02 | 0.00 |
| v/c Ratio | | 0.19 | | | 0.26 | | 0.36 | 0.07 | 0.09 | | 0.21 | 0.00 |
| Uniform Delay, d1 | | 2.5 | | | 2.6 | | 24.4 | 23.6 | 23.7 | | 24.0 | 23.4 |
| Progression Factor | | 0.69 | | | 0.43 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.2 | | | 0.4 | | 1.4 | 0.1 | 0.2 | | 0.5 | 0.0 |
| Delay (s) | | 1.9 | | | 1.5 | | 25.9 | 23.8 | 23.9 | | 24.5 | 23.4 |
| Level of Service | | A | | | A | | C | C | C | | C | C |
| Approach Delay (s) | | 1.9 | | | 1.5 | | | 24.4 | | | 24.5 | |
| Approach LOS | | A | | | A | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 6.7 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.28 | | |
| Actuated Cycle Length (s) | 60.0 | Sum of lost time (s) | 9.0 |
| Intersection Capacity Utilization | 45.5% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (vph) | 151 | 378 | 352 | 49 | 50 | 143 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 10 | 10 | 10 | 10 | 10 | 10 |
| Total Lost time (s) | | 5.0 | 5.0 | | 5.0 | 5.0 |
| Lane Util. Factor | | 0.95 | 0.95 | | 1.00 | 1.00 |
| Frpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | 0.99 |
| Flpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | | 1.00 | 0.98 | | 1.00 | 0.85 |
| Flt Protected | | 0.99 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | | 3257 | 3243 | | 1652 | 1458 |
| Flt Permitted | | 0.72 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | | 2392 | 3243 | | 1652 | 1458 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 164 | 411 | 383 | 53 | 54 | 155 |
| RTOR Reduction (vph) | 0 | 0 | 10 | 0 | 0 | 138 |
| Lane Group Flow (vph) | 0 | 575 | 426 | 0 | 54 | 17 |
| Confl. Peds. (#/hr) | | | | | | 1 |
| Turn Type | Perm | | | | | Perm |
| Protected Phases | | 2 | 6 | | 4 | |
| Permitted Phases | 2 | | | | | 4 |
| Actuated Green, G (s) | | 43.4 | 43.4 | | 6.6 | 6.6 |
| Effective Green, g (s) | | 43.4 | 43.4 | | 6.6 | 6.6 |
| Actuated g/C Ratio | | 0.72 | 0.72 | | 0.11 | 0.11 |
| Clearance Time (s) | | 5.0 | 5.0 | | 5.0 | 5.0 |
| Vehicle Extension (s) | | 3.0 | 3.0 | | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | 1730 | 2346 | | 182 | 160 |
| v/s Ratio Prot | | | 0.13 | | c0.03 | |
| v/s Ratio Perm | | c0.24 | | | | 0.01 |
| v/c Ratio | | 0.33 | 0.18 | | 0.30 | 0.11 |
| Uniform Delay, d1 | | 3.0 | 2.6 | | 24.6 | 24.0 |
| Progression Factor | | 1.13 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.5 | 0.2 | | 0.9 | 0.3 |
| Delay (s) | | 3.9 | 2.8 | | 25.5 | 24.3 |
| Level of Service | | A | A | | C | C |
| Approach Delay (s) | | 3.9 | 2.8 | | 24.6 | |
| Approach LOS | | A | A | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 7.1 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.33 | | |
| Actuated Cycle Length (s) | 60.0 | Sum of lost time (s) | 10.0 |
| Intersection Capacity Utilization | 43.4% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (vph) | 242 | 162 | 137 | 466 | 425 | 185 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 10 | 10 | 11 | 11 | 11 | 11 |
| Total Lost time (s) | 5.0 | 5.0 | | 4.7 | 4.7 | |
| Lane Util. Factor | 1.00 | 1.00 | | 0.95 | 0.95 | |
| Frt | 1.00 | 0.85 | | 1.00 | 0.95 | |
| Flt Protected | 0.95 | 1.00 | | 0.99 | 1.00 | |
| Satd. Flow (prot) | 1652 | 1478 | | 3383 | 3266 | |
| Flt Permitted | 0.95 | 1.00 | | 0.70 | 1.00 | |
| Satd. Flow (perm) | 1652 | 1478 | | 2380 | 3266 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 263 | 176 | 149 | 507 | 462 | 201 |
| RTOR Reduction (vph) | 0 | 131 | 0 | 0 | 59 | 0 |
| Lane Group Flow (vph) | 263 | 45 | 0 | 656 | 604 | 0 |
| Turn Type | | Perm | Perm | | | |
| Protected Phases | 2 | | | 8 | 4 | |
| Permitted Phases | | 2 | 8 | | | |
| Actuated Green, G (s) | 15.2 | 15.2 | | 35.1 | 35.1 | |
| Effective Green, g (s) | 15.2 | 15.2 | | 35.1 | 35.1 | |
| Actuated g/C Ratio | 0.25 | 0.25 | | 0.59 | 0.59 | |
| Clearance Time (s) | 5.0 | 5.0 | | 4.7 | 4.7 | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 419 | 374 | | 1392 | 1911 | |
| v/s Ratio Prot | c0.16 | | | | 0.19 | |
| v/s Ratio Perm | | 0.03 | | c0.28 | | |
| v/c Ratio | 0.63 | 0.12 | | 0.47 | 0.32 | |
| Uniform Delay, d1 | 19.9 | 17.2 | | 7.1 | 6.3 | |
| Progression Factor | 1.03 | 2.61 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 2.8 | 0.1 | | 1.1 | 0.4 | |
| Delay (s) | 23.4 | 45.1 | | 8.3 | 6.8 | |
| Level of Service | C | D | | A | A | |
| Approach Delay (s) | 32.1 | | | 8.3 | 6.8 | |
| Approach LOS | C | | | A | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 13.7 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.52 | | |
| Actuated Cycle Length (s) | 60.0 | Sum of lost time (s) | 9.7 |
| Intersection Capacity Utilization | 59.9% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBU | NBL | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Volume (vph) | 11 | 82 | 31 | 113 | 99 | 141 | 1 | 1 | 969 | 202 | 159 | 1105 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 14 | 12 | 11 | 11 | 11 | 12 | 11 | 11 | 11 | 11 | 11 |
| Total Lost time (s) | | 5.5 | | 5.5 | 5.5 | 5.5 | | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 |
| Lane Util. Factor | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 0.91 | 1.00 | 1.00 | 0.91 |
| Frpb, ped/bikes | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Flpb, ped/bikes | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.97 | | 1.00 | 1.00 | 0.85 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 |
| Flt Protected | | 1.00 | | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (prot) | | 1912 | | 1711 | 1801 | 1531 | | 1711 | 4916 | 1531 | 1711 | 4913 |
| Flt Permitted | | 0.96 | | 0.41 | 1.00 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (perm) | | 1843 | | 743 | 1801 | 1531 | | 1711 | 4916 | 1531 | 1711 | 4913 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Growth Factor (vph) | 135% | 135% | 135% | 135% | 135% | 135% | 149% | 149% | 149% | 149% | 149% | 149% |
| Adj. Flow (vph) | 16 | 120 | 45 | 166 | 145 | 207 | 2 | 2 | 1569 | 327 | 258 | 1790 |
| RTOR Reduction (vph) | 0 | 10 | 0 | 0 | 0 | 160 | 0 | 0 | 0 | 124 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 171 | 0 | 166 | 145 | 47 | 0 | 4 | 1569 | 203 | 258 | 1795 |
| Confl. Peds. (#/hr) | | | | | | | | | | | | |
| Turn Type | Perm | | | pm+pt | | Perm | Prot | Prot | | Perm | Prot | |
| Protected Phases | | 2 | | 1 | 6 | | 3 | 3 | 8 | | 7 | 4 |
| Permitted Phases | 2 | | | 6 | | 6 | | | | 8 | | |
| Actuated Green, G (s) | | 15.4 | | 27.4 | 27.4 | 27.4 | | 1.3 | 52.2 | 52.2 | 24.9 | 75.8 |
| Effective Green, g (s) | | 15.4 | | 27.4 | 27.4 | 27.4 | | 1.3 | 52.2 | 52.2 | 24.9 | 75.8 |
| Actuated g/C Ratio | | 0.13 | | 0.23 | 0.23 | 0.23 | | 0.01 | 0.44 | 0.44 | 0.21 | 0.63 |
| Clearance Time (s) | | 5.5 | | 5.5 | 5.5 | 5.5 | | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 |
| Vehicle Extension (s) | | 3.0 | | 3.0 | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | 237 | | 222 | 411 | 350 | | 19 | 2138 | 666 | 355 | 3103 |
| v/s Ratio Prot | | | | c0.04 | 0.08 | | | 0.00 | c0.32 | | c0.15 | 0.37 |
| v/s Ratio Perm | | 0.09 | | c0.13 | | 0.03 | | | | 0.13 | | |
| v/c Ratio | | 0.72 | | 0.75 | 0.35 | 0.14 | | 0.21 | 0.73 | 0.30 | 0.73 | 0.58 |
| Uniform Delay, d1 | | 50.2 | | 49.4 | 38.9 | 36.9 | | 58.8 | 28.1 | 22.1 | 44.4 | 12.8 |
| Progression Factor | | 1.00 | | 0.99 | 0.98 | 1.50 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | | 10.0 | | 12.3 | 0.5 | 0.2 | | 5.5 | 2.3 | 1.2 | 7.2 | 0.8 |
| Delay (s) | | 60.2 | | 61.3 | 38.4 | 55.4 | | 64.3 | 30.4 | 23.3 | 51.6 | 13.6 |
| Level of Service | | E | | E | D | E | | E | C | C | D | B |
| Approach Delay (s) | | 60.2 | | | 52.5 | | | | 29.3 | | | 18.4 |
| Approach LOS | | E | | | D | | | | C | | | B |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 28.3 | HCM Level of Service | C |
| HCM Volume to Capacity ratio | 0.73 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 15.5 |
| Intersection Capacity Utilization | 76.2% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | SBR |
|---|---|
| Lane Configurations | |
| Volume (vph) | 3 |
| Ideal Flow (vphpl) | 1900 |
| Lane Width | 11 |
| Total Lost time (s) | |
| Lane Util. Factor | |
| Frpb, ped/bikes | |
| Flpb, ped/bikes | |
| Frt | |
| Flt Protected | |
| Satd. Flow (prot) | |
| Flt Permitted | |
| Satd. Flow (perm) | |
| Peak-hour factor, PHF | 0.92 |
| Growth Factor (vph) | 149% |
| Adj. Flow (vph) | 5 |
| RTOR Reduction (vph) | 0 |
| Lane Group Flow (vph) | 0 |
| Confl. Peds. (#/hr) | 1 |
| Turn Type | |
| Protected Phases | |
| Permitted Phases | |
| Actuated Green, G (s) | |
| Effective Green, g (s) | |
| Actuated g/C Ratio | |
| Clearance Time (s) | |
| Vehicle Extension (s) | |
| Lane Grp Cap (vph) | |
| v/s Ratio Prot | |
| v/s Ratio Perm | |
| v/c Ratio | |
| Uniform Delay, d1 | |
| Progression Factor | |
| Incremental Delay, d2 | |
| Delay (s) | |
| Level of Service | |
| Approach Delay (s) | |
| Approach LOS | |

| Intersection Summary |
|---|

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Volume (vph) | 9 | 290 | 117 | 121 | 284 | 23 | 53 | 15 | 133 | 11 | 27 | 2 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 11 | 11 | 11 | 11 | 11 | 11 | 12 | 12 | 12 | 12 | 12 | 12 |
| Total Lost time (s) | 5.0 | 5.0 | | | 5.0 | | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 |
| Lane Util. Factor | 1.00 | 1.00 | | | 0.95 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 0.99 | | | 1.00 | | 1.00 | 1.00 | 0.99 | | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 0.96 | | | 0.99 | | 1.00 | 1.00 | 0.85 | | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | | 0.99 | | 0.95 | 1.00 | 1.00 | | 0.99 | 1.00 |
| Satd. Flow (prot) | 1711 | 1709 | | | 3346 | | 1770 | 1863 | 1562 | | 1836 | 1560 |
| Flt Permitted | 0.41 | 1.00 | | | 0.66 | | 0.73 | 1.00 | 1.00 | | 0.92 | 1.00 |
| Satd. Flow (perm) | 744 | 1709 | | | 2251 | | 1360 | 1863 | 1562 | | 1721 | 1560 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Growth Factor (vph) | 135% | 135% | 135% | 135% | 135% | 135% | 135% | 135% | 135% | 100% | 100% | 100% |
| Adj. Flow (vph) | 13 | 426 | 172 | 178 | 417 | 34 | 78 | 22 | 195 | 12 | 29 | 2 |
| RTOR Reduction (vph) | 0 | 17 | 0 | 0 | 5 | 0 | 0 | 0 | 166 | 0 | 0 | 2 |
| Lane Group Flow (vph) | 13 | 581 | 0 | 0 | 624 | 0 | 78 | 22 | 29 | 0 | 41 | 0 |
| Confl. Peds. (#/hr) | | | 3 | | | | | | 1 | | | 2 |
| Turn Type | Perm | | | Perm | | | Perm | | Perm | Perm | | Perm |
| Protected Phases | | 2 | | | 6 | | | 8 | | | 4 | |
| Permitted Phases | 2 | | | 6 | | | 8 | | 8 | 4 | | 4 |
| Actuated Green, G (s) | 42.0 | 42.0 | | | 42.0 | | 9.0 | 9.0 | 9.0 | | 9.0 | 9.0 |
| Effective Green, g (s) | 42.0 | 42.0 | | | 42.0 | | 9.0 | 9.0 | 9.0 | | 9.0 | 9.0 |
| Actuated g/C Ratio | 0.70 | 0.70 | | | 0.70 | | 0.15 | 0.15 | 0.15 | | 0.15 | 0.15 |
| Clearance Time (s) | 5.0 | 5.0 | | | 5.0 | | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 |
| Vehicle Extension (s) | 3.0 | 3.0 | | | 3.0 | | 3.0 | 3.0 | 3.0 | | 3.0 | 3.0 |
| Lane Grp Cap (vph) | 521 | 1196 | | | 1576 | | 204 | 279 | 234 | | 258 | 234 |
| v/s Ratio Prot | | c0.34 | | | | | | 0.01 | | | | |
| v/s Ratio Perm | 0.02 | | | | 0.28 | | c0.06 | | 0.02 | | 0.02 | 0.00 |
| v/c Ratio | 0.02 | 0.49 | | | 0.40 | | 0.38 | 0.08 | 0.12 | | 0.16 | 0.00 |
| Uniform Delay, d1 | 2.7 | 4.1 | | | 3.7 | | 23.0 | 21.9 | 22.1 | | 22.2 | 21.7 |
| Progression Factor | 0.82 | 0.89 | | | 0.40 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.1 | 1.1 | | | 0.7 | | 1.2 | 0.1 | 0.2 | | 0.3 | 0.0 |
| Delay (s) | 2.3 | 4.8 | | | 2.2 | | 24.2 | 22.1 | 22.3 | | 22.5 | 21.7 |
| Level of Service | A | A | | | A | | C | C | C | | C | C |
| Approach Delay (s) | | 4.7 | | | 2.2 | | | 22.8 | | | 22.5 | |
| Approach LOS | | A | | | A | | | C | | | C | |

**Intersection Summary**

HCM Average Control Delay 7.6 HCM Level of Service A
HCM Volume to Capacity ratio 0.47
Actuated Cycle Length (s) 60.0 Sum of lost time (s) 9.0
Intersection Capacity Utilization 68.9% ICU Level of Service C
Analysis Period (min) 15
c Critical Lane Group

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (vph) | 151 | 378 | 352 | 49 | 50 | 143 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 10 | 10 | 10 | 10 | 10 | 10 |
| Total Lost time (s) | | 5.0 | 5.0 | | 5.0 | 5.0 |
| Lane Util. Factor | | 0.95 | 0.95 | | 1.00 | 1.00 |
| Frpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | 0.99 |
| Flpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | | 1.00 | 0.98 | | 1.00 | 0.85 |
| Flt Protected | | 0.99 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | | 3257 | 3243 | | 1652 | 1458 |
| Flt Permitted | | 0.66 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | | 2196 | 3243 | | 1652 | 1458 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Growth Factor (vph) | 135% | 135% | 135% | 135% | 135% | 135% |
| Adj. Flow (vph) | 222 | 555 | 517 | 72 | 73 | 210 |
| RTOR Reduction (vph) | 0 | 0 | 11 | 0 | 0 | 181 |
| Lane Group Flow (vph) | 0 | 777 | 578 | 0 | 73 | 29 |
| Confl. Peds. (#/hr) | | | | | | 1 |
| Turn Type | Perm | | | | | Perm |
| Protected Phases | | 2 | 6 | | 4 | |
| Permitted Phases | 2 | | | | | 4 |
| Actuated Green, G (s) | | 41.7 | 41.7 | | 8.3 | 8.3 |
| Effective Green, g (s) | | 41.7 | 41.7 | | 8.3 | 8.3 |
| Actuated g/C Ratio | | 0.70 | 0.70 | | 0.14 | 0.14 |
| Clearance Time (s) | | 5.0 | 5.0 | | 5.0 | 5.0 |
| Vehicle Extension (s) | | 3.0 | 3.0 | | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | 1526 | 2254 | | 229 | 202 |
| v/s Ratio Prot | | | 0.18 | | c0.04 | |
| v/s Ratio Perm | | c0.35 | | | | 0.02 |
| v/c Ratio | | 0.51 | 0.26 | | 0.32 | 0.14 |
| Uniform Delay, d1 | | 4.3 | 3.4 | | 23.3 | 22.7 |
| Progression Factor | | 1.30 | 1.47 | | 1.00 | 1.00 |
| Incremental Delay, d2 | | 1.2 | 0.3 | | 0.8 | 0.3 |
| Delay (s) | | 6.8 | 5.2 | | 24.1 | 23.1 |
| Level of Service | | A | A | | C | C |
| Approach Delay (s) | | 6.8 | 5.2 | | 23.3 | |
| Approach LOS | | A | A | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 9.1 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.48 | | |
| Actuated Cycle Length (s) | 60.0 | Sum of lost time (s) | 10.0 |
| Intersection Capacity Utilization | 51.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (vph) | 242 | 162 | 137 | 466 | 425 | 185 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 10 | 10 | 11 | 11 | 11 | 11 |
| Total Lost time (s) | 5.0 | 5.0 | | 4.7 | 4.7 | |
| Lane Util. Factor | 1.00 | 1.00 | | 0.95 | 0.95 | |
| Frt | 1.00 | 0.85 | | 1.00 | 0.95 | |
| Flt Protected | 0.95 | 1.00 | | 0.99 | 1.00 | |
| Satd. Flow (prot) | 1652 | 1478 | | 3383 | 3266 | |
| Flt Permitted | 0.95 | 1.00 | | 0.61 | 1.00 | |
| Satd. Flow (perm) | 1652 | 1478 | | 2071 | 3266 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Growth Factor (vph) | 135% | 135% | 126% | 126% | 126% | 126% |
| Adj. Flow (vph) | 355 | 238 | 188 | 638 | 582 | 253 |
| RTOR Reduction (vph) | 0 | 124 | 0 | 0 | 66 | 0 |
| Lane Group Flow (vph) | 355 | 114 | 0 | 826 | 769 | 0 |
| Turn Type | | Perm | Perm | | | |
| Protected Phases | 2 | | | 8 | 4 | |
| Permitted Phases | | 2 | 8 | | | |
| Actuated Green, G (s) | 18.3 | 18.3 | | 32.0 | 32.0 | |
| Effective Green, g (s) | 18.3 | 18.3 | | 32.0 | 32.0 | |
| Actuated g/C Ratio | 0.30 | 0.30 | | 0.53 | 0.53 | |
| Clearance Time (s) | 5.0 | 5.0 | | 4.7 | 4.7 | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 504 | 451 | | 1105 | 1742 | |
| v/s Ratio Prot | c0.21 | | | | 0.24 | |
| v/s Ratio Perm | | 0.08 | | c0.40 | | |
| v/c Ratio | 0.70 | 0.25 | | 0.75 | 0.44 | |
| Uniform Delay, d1 | 18.5 | 15.7 | | 10.9 | 8.5 | |
| Progression Factor | 0.99 | 1.51 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 4.0 | 0.3 | | 4.6 | 0.8 | |
| Delay (s) | 22.4 | 23.9 | | 15.5 | 9.4 | |
| Level of Service | C | C | | B | A | |
| Approach Delay (s) | 23.0 | | | 15.5 | 9.4 | |
| Approach LOS | C | | | B | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 15.2 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.73 | | |
| Actuated Cycle Length (s) | 60.0 | Sum of lost time (s) | 9.7 |
| Intersection Capacity Utilization | 73.6% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBU | NBL | NBT | NBR | SBU | SBL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Volume (vph) | 6 | 35 | 10 | 235 | 119 | 218 | 11 | 9 | 1333 | 196 | 2 | 136 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 14 | 12 | 11 | 11 | 11 | 12 | 11 | 11 | 11 | 12 | 11 |
| Total Lost time (s) | | 5.5 | | 5.5 | 5.5 | 5.5 | | 5.0 | 5.0 | 5.0 | | 5.0 |
| Lane Util. Factor | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 0.91 | 1.00 | | 1.00 |
| Frpb, ped/bikes | | 1.00 | | 1.00 | 1.00 | 0.98 | | 1.00 | 1.00 | 0.96 | | 1.00 |
| Flpb, ped/bikes | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 |
| Frt | | 0.97 | | 1.00 | 1.00 | 0.85 | | 1.00 | 1.00 | 0.85 | | 1.00 |
| Flt Protected | | 0.99 | | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 | 1.00 | | 0.95 |
| Satd. Flow (prot) | | 1915 | | 1711 | 1801 | 1503 | | 1711 | 4916 | 1467 | | 1711 |
| Flt Permitted | | 0.52 | | 0.67 | 1.00 | 1.00 | | 0.95 | 1.00 | 1.00 | | 0.95 |
| Satd. Flow (perm) | | 996 | | 1210 | 1801 | 1503 | | 1711 | 4916 | 1467 | | 1711 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Growth Factor (vph) | 135% | 135% | 135% | 135% | 135% | 135% | 149% | 149% | 149% | 149% | 149% | 149% |
| Adj. Flow (vph) | 9 | 51 | 15 | 345 | 175 | 320 | 18 | 15 | 2159 | 317 | 3 | 220 |
| RTOR Reduction (vph) | 0 | 8 | 0 | 0 | 0 | 179 | 0 | 0 | 0 | 84 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 67 | 0 | 345 | 175 | 141 | 0 | 33 | 2159 | 233 | 0 | 223 |
| Confl. Peds. (#/hr) | | | 4 | | | 5 | | | | 7 | | |
| Turn Type | Perm | | | pm+pt | | Perm | Prot | Prot | | Perm | Prot | Prot |
| Protected Phases | | 2 | | 1 | 6 | | 3 | 3 | 8 | | 7 | 7 |
| Permitted Phases | 2 | | | 6 | | 6 | | | | 8 | | |
| Actuated Green, G (s) | | 8.5 | | 32.2 | 32.2 | 32.2 | | 5.4 | 55.3 | 55.3 | | 17.0 |
| Effective Green, g (s) | | 8.5 | | 32.2 | 32.2 | 32.2 | | 5.4 | 55.3 | 55.3 | | 17.0 |
| Actuated g/C Ratio | | 0.07 | | 0.27 | 0.27 | 0.27 | | 0.05 | 0.46 | 0.46 | | 0.14 |
| Clearance Time (s) | | 5.5 | | 5.5 | 5.5 | 5.5 | | 5.0 | 5.0 | 5.0 | | 5.0 |
| Vehicle Extension (s) | | 3.0 | | 3.0 | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 | | 3.0 |
| Lane Grp Cap (vph) | | 71 | | 401 | 483 | 403 | | 77 | 2265 | 676 | | 242 |
| v/s Ratio Prot | | | | c0.13 | 0.10 | | | 0.02 | c0.44 | | | c0.13 |
| v/s Ratio Perm | | 0.07 | | c0.10 | | 0.09 | | | | 0.16 | | |
| v/c Ratio | | 0.94 | | 0.86 | 0.36 | 0.35 | | 0.43 | 0.95 | 0.35 | | 0.92 |
| Uniform Delay, d1 | | 55.5 | | 41.8 | 35.6 | 35.4 | | 55.8 | 31.1 | 20.7 | | 50.8 |
| Progression Factor | | 1.00 | | 0.90 | 0.91 | 1.07 | | 1.00 | 1.00 | 1.00 | | 1.00 |
| Incremental Delay, d2 | | 84.7 | | 15.6 | 0.4 | 0.5 | | 3.8 | 10.7 | 1.4 | | 37.1 |
| Delay (s) | | 140.2 | | 53.1 | 32.7 | 38.6 | | 59.6 | 41.8 | 22.1 | | 88.0 |
| Level of Service | | F | | D | C | D | | E | D | C | | F |
| Approach Delay (s) | | 140.2 | | | 43.3 | | | | 39.6 | | | |
| Approach LOS | | F | | | D | | | | D | | | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 37.1 | HCM Level of Service | D |
| HCM Volume to Capacity ratio | 0.91 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 15.5 |
| Intersection Capacity Utilization | 93.5% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | SBT | SBR |
|---|---|---|
| Lane Configurations | ↑↑↑ | |
| Volume (vph) | 1278 | 13 |
| Ideal Flow (vphpl) | 1900 | 1900 |
| Lane Width | 11 | 11 |
| Total Lost time (s) | 5.0 | |
| Lane Util. Factor | 0.91 | |
| Frpb, ped/bikes | 1.00 | |
| Flpb, ped/bikes | 1.00 | |
| Frt | 1.00 | |
| Flt Protected | 1.00 | |
| Satd. Flow (prot) | 4908 | |
| Flt Permitted | 1.00 | |
| Satd. Flow (perm) | 4908 | |
| Peak-hour factor, PHF | 0.92 | 0.92 |
| Growth Factor (vph) | 149% | 149% |
| Adj. Flow (vph) | 2070 | 21 |
| RTOR Reduction (vph) | 1 | 0 |
| Lane Group Flow (vph) | 2090 | 0 |
| Confl. Peds. (#/hr) | | |
| Turn Type | | |
| Protected Phases | 4 | |
| Permitted Phases | | |
| Actuated Green, G (s) | 66.9 | |
| Effective Green, g (s) | 66.9 | |
| Actuated g/C Ratio | 0.56 | |
| Clearance Time (s) | 5.0 | |
| Vehicle Extension (s) | 3.0 | |
| Lane Grp Cap (vph) | 2736 | |
| v/s Ratio Prot | 0.43 | |
| v/s Ratio Perm | | |
| v/c Ratio | 0.76 | |
| Uniform Delay, d1 | 20.5 | |
| Progression Factor | 1.00 | |
| Incremental Delay, d2 | 2.1 | |
| Delay (s) | 22.6 | |
| Level of Service | C | |
| Approach Delay (s) | 28.9 | |
| Approach LOS | C | |

Intersection Summary

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | ↰ | ↑↱ | | | ↰↑↱ | | ↰ | ↑ | ↱ | | ↰↑ | ↱ |
| Volume (vph) | 26 | 333 | 20 | 91 | 467 | 25 | 91 | 53 | 209 | 21 | 16 | 35 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 11 | 11 | 11 | 11 | 11 | 11 | 12 | 12 | 12 | 12 | 12 | 12 |
| Total Lost time (s) | 5.0 | 5.0 | | | 5.0 | | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 |
| Lane Util. Factor | 1.00 | 1.00 | | | 0.95 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | 0.99 | | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 0.99 | | | 0.99 | | 1.00 | 1.00 | 0.85 | | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | | 0.99 | | 0.95 | 1.00 | 1.00 | | 0.97 | 1.00 |
| Satd. Flow (prot) | 1711 | 1783 | | | 3373 | | 1770 | 1863 | 1560 | | 1811 | 1560 |
| Flt Permitted | 0.31 | 1.00 | | | 0.79 | | 0.73 | 1.00 | 1.00 | | 0.84 | 1.00 |
| Satd. Flow (perm) | 567 | 1783 | | | 2675 | | 1362 | 1863 | 1560 | | 1566 | 1560 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Growth Factor (vph) | 135% | 135% | 135% | 135% | 135% | 135% | 135% | 135% | 135% | 100% | 100% | 100% |
| Adj. Flow (vph) | 38 | 489 | 29 | 134 | 685 | 37 | 134 | 78 | 307 | 23 | 17 | 38 |
| RTOR Reduction (vph) | 0 | 3 | 0 | 0 | 4 | 0 | 0 | 0 | 248 | 0 | 0 | 31 |
| Lane Group Flow (vph) | 38 | 515 | 0 | 0 | 852 | 0 | 134 | 78 | 59 | 0 | 40 | 7 |
| Confl. Peds. (#/hr) | | | 2 | | | | | | 2 | | | 2 |
| Turn Type | Perm | | | Perm | | | Perm | | Perm | Perm | | Perm |
| Protected Phases | | 2 | | | 6 | | | 8 | | | 4 | |
| Permitted Phases | 2 | | | 6 | | | 8 | | 8 | 4 | | 4 |
| Actuated Green, G (s) | 39.4 | 39.4 | | | 39.4 | | 11.6 | 11.6 | 11.6 | | 11.6 | 11.6 |
| Effective Green, g (s) | 39.4 | 39.4 | | | 39.4 | | 11.6 | 11.6 | 11.6 | | 11.6 | 11.6 |
| Actuated g/C Ratio | 0.66 | 0.66 | | | 0.66 | | 0.19 | 0.19 | 0.19 | | 0.19 | 0.19 |
| Clearance Time (s) | 5.0 | 5.0 | | | 5.0 | | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 |
| Vehicle Extension (s) | 3.0 | 3.0 | | | 3.0 | | 3.0 | 3.0 | 3.0 | | 3.0 | 3.0 |
| Lane Grp Cap (vph) | 372 | 1171 | | | 1757 | | 263 | 360 | 302 | | 303 | 302 |
| v/s Ratio Prot | | 0.29 | | | | | | 0.04 | | | | |
| v/s Ratio Perm | 0.07 | | | | c0.32 | | c0.10 | | 0.04 | | 0.03 | 0.00 |
| v/c Ratio | 0.10 | 0.44 | | | 0.48 | | 0.51 | 0.22 | 0.20 | | 0.13 | 0.02 |
| Uniform Delay, d1 | 3.8 | 5.0 | | | 5.2 | | 21.7 | 20.4 | 20.3 | | 20.0 | 19.6 |
| Progression Factor | 0.38 | 0.56 | | | 0.54 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.4 | 0.9 | | | 0.9 | | 1.6 | 0.3 | 0.3 | | 0.2 | 0.0 |
| Delay (s) | 1.9 | 3.7 | | | 3.8 | | 23.2 | 20.7 | 20.6 | | 20.2 | 19.6 |
| Level of Service | A | A | | | A | | C | C | C | | C | B |
| Approach Delay (s) | | 3.6 | | | 3.8 | | | 21.3 | | | 19.9 | |
| Approach LOS | | A | | | A | | | C | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 8.9 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.49 | | |
| Actuated Cycle Length (s) | 60.0 | Sum of lost time (s) | 9.0 |
| Intersection Capacity Utilization | 72.5% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (vph) | 158 | 374 | 311 | 48 | 46 | 211 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 10 | 10 | 10 | 10 | 10 | 10 |
| Total Lost time (s) | | 5.0 | 5.0 | | 5.0 | 5.0 |
| Lane Util. Factor | | 0.95 | 0.95 | | 1.00 | 1.00 |
| Frpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | 0.98 |
| Flpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | | 1.00 | 0.98 | | 1.00 | 0.85 |
| Flt Protected | | 0.99 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | | 3255 | 3237 | | 1652 | 1451 |
| Flt Permitted | | 0.68 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | | 2239 | 3237 | | 1652 | 1451 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Growth Factor (vph) | 135% | 135% | 135% | 135% | 135% | 135% |
| Adj. Flow (vph) | 232 | 549 | 456 | 70 | 68 | 310 |
| RTOR Reduction (vph) | 0 | 0 | 13 | 0 | 0 | 265 |
| Lane Group Flow (vph) | 0 | 781 | 513 | 0 | 68 | 45 |
| Confl. Peds. (#/hr) | | | | | | 4 |
| Turn Type | Perm | | | | | Perm |
| Protected Phases | | 2 | 6 | | 4 | |
| Permitted Phases | 2 | | | | | 4 |
| Actuated Green, G (s) | | 41.3 | 41.3 | | 8.7 | 8.7 |
| Effective Green, g (s) | | 41.3 | 41.3 | | 8.7 | 8.7 |
| Actuated g/C Ratio | | 0.69 | 0.69 | | 0.14 | 0.14 |
| Clearance Time (s) | | 5.0 | 5.0 | | 5.0 | 5.0 |
| Vehicle Extension (s) | | 3.0 | 3.0 | | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | 1541 | 2228 | | 240 | 210 |
| v/s Ratio Prot | | | 0.16 | | c0.04 | |
| v/s Ratio Perm | | c0.35 | | | | 0.03 |
| v/c Ratio | | 0.51 | 0.23 | | 0.28 | 0.21 |
| Uniform Delay, d1 | | 4.5 | 3.5 | | 22.9 | 22.6 |
| Progression Factor | | 1.03 | 1.69 | | 1.00 | 1.00 |
| Incremental Delay, d2 | | 1.1 | 0.2 | | 0.7 | 0.5 |
| Delay (s) | | 5.7 | 6.1 | | 23.5 | 23.1 |
| Level of Service | | A | A | | C | C |
| Approach Delay (s) | | 5.7 | 6.1 | | 23.2 | |
| Approach LOS | | A | A | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 9.7 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.47 | | |
| Actuated Cycle Length (s) | 60.0 | Sum of lost time (s) | 10.0 |
| Intersection Capacity Utilization | 50.6% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | ↰ | ↱ | | ↰↑ | ↑↱ | |
| Volume (vph) | 231 | 123 | 114 | 431 | 425 | 232 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 10 | 10 | 11 | 11 | 11 | 11 |
| Total Lost time (s) | 5.0 | 5.0 | | 4.7 | 4.7 | |
| Lane Util. Factor | 1.00 | 1.00 | | 0.95 | 0.95 | |
| Frt | 1.00 | 0.85 | | 1.00 | 0.95 | |
| Flt Protected | 0.95 | 1.00 | | 0.99 | 1.00 | |
| Satd. Flow (prot) | 1652 | 1478 | | 3386 | 3240 | |
| Flt Permitted | 0.95 | 1.00 | | 0.62 | 1.00 | |
| Satd. Flow (perm) | 1652 | 1478 | | 2112 | 3240 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Growth Factor (vph) | 135% | 135% | 126% | 126% | 126% | 126% |
| Adj. Flow (vph) | 339 | 180 | 156 | 590 | 582 | 318 |
| RTOR Reduction (vph) | 0 | 126 | 0 | 0 | 96 | 0 |
| Lane Group Flow (vph) | 339 | 54 | 0 | 746 | 804 | 0 |
| Turn Type | | Perm | Perm | | | |
| Protected Phases | 2 | | | 8 | 4 | |
| Permitted Phases | | 2 | 8 | | | |
| Actuated Green, G (s) | 17.6 | 17.6 | | 32.7 | 32.7 | |
| Effective Green, g (s) | 17.6 | 17.6 | | 32.7 | 32.7 | |
| Actuated g/C Ratio | 0.29 | 0.29 | | 0.55 | 0.55 | |
| Clearance Time (s) | 5.0 | 5.0 | | 4.7 | 4.7 | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 485 | 434 | | 1151 | 1766 | |
| v/s Ratio Prot | c0.21 | | | | 0.25 | |
| v/s Ratio Perm | | 0.04 | | c0.35 | | |
| v/c Ratio | 0.70 | 0.12 | | 0.65 | 0.46 | |
| Uniform Delay, d1 | 18.8 | 15.5 | | 9.6 | 8.3 | |
| Progression Factor | 0.81 | 1.52 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 4.0 | 0.1 | | 2.8 | 0.8 | |
| Delay (s) | 19.2 | 23.8 | | 12.4 | 9.1 | |
| Level of Service | B | C | | B | A | |
| Approach Delay (s) | 20.8 | | | 12.4 | 9.1 | |
| Approach LOS | C | | | B | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 13.1 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.67 | | |
| Actuated Cycle Length (s) | 60.0 | Sum of lost time (s) | 9.7 |
| Intersection Capacity Utilization | 72.6% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBU | NBL | NBT | NBR | SBU | SBL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Volume (vph) | 2 | 36 | 12 | 212 | 67 | 245 | 1 | 3 | 776 | 251 | 2 | 118 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 14 | 12 | 11 | 11 | 11 | 12 | 11 | 11 | 11 | 12 | 11 |
| Total Lost time (s) | | 5.5 | | 5.5 | 5.5 | 5.5 | | 5.0 | 5.0 | 5.0 | | 5.0 |
| Lane Util. Factor | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 0.91 | 1.00 | | 1.00 |
| Frpb, ped/bikes | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 |
| Flpb, ped/bikes | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 |
| Frt | | 0.97 | | 1.00 | 1.00 | 0.85 | | 1.00 | 1.00 | 0.85 | | 1.00 |
| Flt Protected | | 1.00 | | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 | 1.00 | | 0.95 |
| Satd. Flow (prot) | | 1912 | | 1711 | 1801 | 1531 | | 1711 | 4916 | 1531 | | 1711 |
| Flt Permitted | | 0.98 | | 0.67 | 1.00 | 1.00 | | 0.95 | 1.00 | 1.00 | | 0.95 |
| Satd. Flow (perm) | | 1881 | | 1206 | 1801 | 1531 | | 1711 | 4916 | 1531 | | 1711 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Growth Factor (vph) | 135% | 135% | 135% | 135% | 135% | 135% | 149% | 149% | 149% | 149% | 149% | 149% |
| Adj. Flow (vph) | 3 | 53 | 18 | 311 | 98 | 360 | 2 | 5 | 1257 | 407 | 3 | 191 |
| RTOR Reduction (vph) | 0 | 11 | 0 | 0 | 0 | 200 | 0 | 0 | 0 | 190 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 63 | 0 | 311 | 98 | 160 | 0 | 7 | 1257 | 217 | 0 | 194 |
| Confl. Peds. (#/hr) | | | 1 | | | | | | | | | |
| Turn Type | Perm | | | pm+pt | | Perm | Prot | Prot | | Perm | Prot | Prot |
| Protected Phases | | 2 | | 1 | 6 | | 3 | 3 | 8 | | 7 | 7 |
| Permitted Phases | 2 | | | 6 | | 6 | | | | 8 | | |
| Actuated Green, G (s) | | 8.2 | | 29.3 | 29.3 | 29.3 | | 1.4 | 53.4 | 53.4 | | 21.8 |
| Effective Green, g (s) | | 8.2 | | 29.3 | 29.3 | 29.3 | | 1.4 | 53.4 | 53.4 | | 21.8 |
| Actuated g/C Ratio | | 0.07 | | 0.24 | 0.24 | 0.24 | | 0.01 | 0.44 | 0.44 | | 0.18 |
| Clearance Time (s) | | 5.5 | | 5.5 | 5.5 | 5.5 | | 5.0 | 5.0 | 5.0 | | 5.0 |
| Vehicle Extension (s) | | 3.0 | | 3.0 | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 | | 3.0 |
| Lane Grp Cap (vph) | | 129 | | 360 | 440 | 374 | | 20 | 2188 | 681 | | 311 |
| v/s Ratio Prot | | | | c0.11 | 0.05 | | | 0.00 | c0.26 | | | c0.11 |
| v/s Ratio Perm | | 0.03 | | c0.10 | | 0.10 | | | | 0.14 | | |
| v/c Ratio | | 0.49 | | 0.86 | 0.22 | 0.43 | | 0.35 | 0.57 | 0.32 | | 0.62 |
| Uniform Delay, d1 | | 53.9 | | 43.5 | 36.2 | 38.3 | | 58.8 | 24.8 | 21.5 | | 45.3 |
| Progression Factor | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 |
| Incremental Delay, d2 | | 2.9 | | 18.8 | 0.3 | 0.8 | | 10.3 | 1.1 | 1.2 | | 3.9 |
| Delay (s) | | 56.8 | | 62.3 | 36.5 | 39.1 | | 69.1 | 25.9 | 22.8 | | 49.2 |
| Level of Service | | E | | E | D | D | | E | C | C | | D |
| Approach Delay (s) | | 56.8 | | | 48.1 | | | | 25.3 | | | |
| Approach LOS | | E | | | D | | | | C | | | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 27.2 | HCM Level of Service | C |
| HCM Volume to Capacity ratio | 0.66 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 15.5 |
| Intersection Capacity Utilization | 75.0% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | SBT | SBR |
|---|---|---|
| Lane Configurations | ↑↑↑ | |
| Volume (vph) | 834 | 9 |
| Ideal Flow (vphpl) | 1900 | 1900 |
| Lane Width | 11 | 11 |
| Total Lost time (s) | 5.0 | |
| Lane Util. Factor | 0.91 | |
| Frpb, ped/bikes | 1.00 | |
| Flpb, ped/bikes | 1.00 | |
| Frt | 1.00 | |
| Flt Protected | 1.00 | |
| Satd. Flow (prot) | 4908 | |
| Flt Permitted | 1.00 | |
| Satd. Flow (perm) | 4908 | |
| Peak-hour factor, PHF | 0.92 | 0.92 |
| Growth Factor (vph) | 149% | 149% |
| Adj. Flow (vph) | 1351 | 15 |
| RTOR Reduction (vph) | 1 | 0 |
| Lane Group Flow (vph) | 1365 | 0 |
| Confl. Peds. (#/hr) | | |
| Turn Type | | |
| Protected Phases | 4 | |
| Permitted Phases | | |
| Actuated Green, G (s) | 73.8 | |
| Effective Green, g (s) | 73.8 | |
| Actuated g/C Ratio | 0.62 | |
| Clearance Time (s) | 5.0 | |
| Vehicle Extension (s) | 3.0 | |
| Lane Grp Cap (vph) | 3018 | |
| v/s Ratio Prot | 0.28 | |
| v/s Ratio Perm | | |
| v/c Ratio | 0.45 | |
| Uniform Delay, d1 | 12.3 | |
| Progression Factor | 1.00 | |
| Incremental Delay, d2 | 0.5 | |
| Delay (s) | 12.8 | |
| Level of Service | B | |
| Approach Delay (s) | 17.3 | |
| Approach LOS | B | |

Intersection Summary

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Volume (vph) | 48 | 346 | 10 | 89 | 457 | 20 | 16 | 9 | 89 | 24 | 7 | 59 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 11 | 11 | 11 | 11 | 11 | 11 | 12 | 12 | 12 | 12 | 12 | 12 |
| Total Lost time (s) | 5.0 | 5.0 | | | 5.0 | | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 |
| Lane Util. Factor | 1.00 | 1.00 | | | 0.95 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | | | 0.99 | | 1.00 | 1.00 | 0.85 | | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | | 0.99 | | 0.95 | 1.00 | 1.00 | | 0.96 | 1.00 |
| Satd. Flow (prot) | 1711 | 1792 | | | 3374 | | 1770 | 1863 | 1583 | | 1794 | 1583 |
| Flt Permitted | 0.34 | 1.00 | | | 0.80 | | 0.73 | 1.00 | 1.00 | | 0.77 | 1.00 |
| Satd. Flow (perm) | 610 | 1792 | | | 2717 | | 1369 | 1863 | 1583 | | 1431 | 1583 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Growth Factor (vph) | 135% | 135% | 135% | 135% | 135% | 135% | 135% | 135% | 135% | 100% | 100% | 100% |
| Adj. Flow (vph) | 70 | 508 | 15 | 131 | 671 | 29 | 23 | 13 | 131 | 26 | 8 | 64 |
| RTOR Reduction (vph) | 0 | 2 | 0 | 0 | 4 | 0 | 0 | 0 | 114 | 0 | 0 | 56 |
| Lane Group Flow (vph) | 70 | 521 | 0 | 0 | 827 | 0 | 23 | 13 | 17 | 0 | 34 | 8 |
| Confl. Peds. (#/hr) | | | 2 | | | 2 | | | | | | |
| Turn Type | Perm | | | Perm | | | Perm | | Perm | Perm | | Perm |
| Protected Phases | | 2 | | | 6 | | | 8 | | | 4 | |
| Permitted Phases | 2 | | | 6 | | | 8 | | 8 | 4 | | 4 |
| Actuated Green, G (s) | 30.3 | 30.3 | | | 30.3 | | 5.7 | 5.7 | 5.7 | | 5.7 | 5.7 |
| Effective Green, g (s) | 30.3 | 30.3 | | | 30.3 | | 5.7 | 5.7 | 5.7 | | 5.7 | 5.7 |
| Actuated g/C Ratio | 0.67 | 0.67 | | | 0.67 | | 0.13 | 0.13 | 0.13 | | 0.13 | 0.13 |
| Clearance Time (s) | 5.0 | 5.0 | | | 5.0 | | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 |
| Vehicle Extension (s) | 3.0 | 3.0 | | | 3.0 | | 3.0 | 3.0 | 3.0 | | 3.0 | 3.0 |
| Lane Grp Cap (vph) | 411 | 1207 | | | 1829 | | 173 | 236 | 201 | | 181 | 201 |
| v/s Ratio Prot | | 0.29 | | | | | | 0.01 | | | | |
| v/s Ratio Perm | 0.11 | | | | c0.30 | | 0.02 | | 0.01 | | c0.02 | 0.01 |
| v/c Ratio | 0.17 | 0.43 | | | 0.45 | | 0.13 | 0.06 | 0.08 | | 0.19 | 0.04 |
| Uniform Delay, d1 | 2.7 | 3.4 | | | 3.5 | | 17.5 | 17.3 | 17.3 | | 17.6 | 17.2 |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | 0.9 | 1.1 | | | 0.8 | | 0.4 | 0.1 | 0.2 | | 0.5 | 0.1 |
| Delay (s) | 3.6 | 4.5 | | | 4.3 | | 17.8 | 17.4 | 17.5 | | 18.1 | 17.3 |
| Level of Service | A | A | | | A | | B | B | B | | B | B |
| Approach Delay (s) | | 4.4 | | | 4.3 | | | 17.5 | | | 17.6 | |
| Approach LOS | | A | | | A | | | B | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 6.4 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.41 | | |
| Actuated Cycle Length (s) | 45.0 | Sum of lost time (s) | 9.0 |
| Intersection Capacity Utilization | 66.8% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (vph) | 99 | 240 | 252 | 41 | 49 | 185 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 10 | 10 | 10 | 10 | 10 | 10 |
| Total Lost time (s) | | 5.0 | 5.0 | | 5.0 | 5.0 |
| Lane Util. Factor | | 0.95 | 0.95 | | 1.00 | 1.00 |
| Frt | | 1.00 | 0.98 | | 1.00 | 0.85 |
| Flt Protected | | 0.99 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | | 3256 | 3234 | | 1652 | 1478 |
| Flt Permitted | | 0.74 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | | 2438 | 3234 | | 1652 | 1478 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Growth Factor (vph) | 135% | 135% | 135% | 135% | 135% | 135% |
| Adj. Flow (vph) | 145 | 352 | 370 | 60 | 72 | 271 |
| RTOR Reduction (vph) | 0 | 0 | 21 | 0 | 0 | 223 |
| Lane Group Flow (vph) | 0 | 497 | 409 | 0 | 72 | 48 |
| Turn Type | Perm | | | | | Perm |
| Protected Phases | | 2 | 6 | | 4 | |
| Permitted Phases | 2 | | | | | 4 |
| Actuated Green, G (s) | | 27.1 | 27.1 | | 7.9 | 7.9 |
| Effective Green, g (s) | | 27.1 | 27.1 | | 7.9 | 7.9 |
| Actuated g/C Ratio | | 0.60 | 0.60 | | 0.18 | 0.18 |
| Clearance Time (s) | | 5.0 | 5.0 | | 5.0 | 5.0 |
| Vehicle Extension (s) | | 3.0 | 3.0 | | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | 1468 | 1948 | | 290 | 259 |
| v/s Ratio Prot | | | 0.13 | | c0.04 | |
| v/s Ratio Perm | | c0.20 | | | | 0.03 |
| v/c Ratio | | 0.34 | 0.21 | | 0.25 | 0.18 |
| Uniform Delay, d1 | | 4.5 | 4.1 | | 16.0 | 15.8 |
| Progression Factor | | 0.66 | 0.32 | | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.6 | 0.2 | | 0.5 | 0.3 |
| Delay (s) | | 3.5 | 1.5 | | 16.4 | 16.1 |
| Level of Service | | A | A | | B | B |
| Approach Delay (s) | | 3.5 | 1.5 | | 16.2 | |
| Approach LOS | | A | A | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 6.3 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.32 | | |
| Actuated Cycle Length (s) | 45.0 | Sum of lost time (s) | 10.0 |
| Intersection Capacity Utilization | 41.5% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (vph) | 197 | 73 | 73 | 366 | 340 | 193 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 10 | 10 | 11 | 11 | 11 | 11 |
| Total Lost time (s) | 5.0 | 5.0 | | 4.7 | 4.7 | |
| Lane Util. Factor | 1.00 | 1.00 | | 0.95 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.85 | | 1.00 | 0.95 | |
| Flt Protected | 0.95 | 1.00 | | 0.99 | 1.00 | |
| Satd. Flow (prot) | 1652 | 1478 | | 3393 | 3236 | |
| Flt Permitted | 0.95 | 1.00 | | 0.76 | 1.00 | |
| Satd. Flow (perm) | 1652 | 1478 | | 2588 | 3236 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Growth Factor (vph) | 135% | 135% | 126% | 126% | 126% | 126% |
| Adj. Flow (vph) | 289 | 107 | 100 | 501 | 466 | 264 |
| RTOR Reduction (vph) | 0 | 76 | 0 | 0 | 134 | 0 |
| Lane Group Flow (vph) | 289 | 31 | 0 | 601 | 596 | 0 |
| Confl. Peds. (#/hr) | 5 | | | | | |
| Turn Type | | Perm | Perm | | | |
| Protected Phases | 2 | | | 8 | 4 | |
| Permitted Phases | | 2 | 8 | | | |
| Actuated Green, G (s) | 13.2 | 13.2 | | 22.1 | 22.1 | |
| Effective Green, g (s) | 13.2 | 13.2 | | 22.1 | 22.1 | |
| Actuated g/C Ratio | 0.29 | 0.29 | | 0.49 | 0.49 | |
| Clearance Time (s) | 5.0 | 5.0 | | 4.7 | 4.7 | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 485 | 434 | | 1271 | 1589 | |
| v/s Ratio Prot | c0.17 | | | | 0.18 | |
| v/s Ratio Perm | | 0.02 | | c0.23 | | |
| v/c Ratio | 0.60 | 0.07 | | 0.47 | 0.37 | |
| Uniform Delay, d1 | 13.6 | 11.5 | | 7.6 | 7.1 | |
| Progression Factor | 0.76 | 0.66 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 1.9 | 0.1 | | 1.3 | 0.7 | |
| Delay (s) | 12.2 | 7.6 | | 8.9 | 7.8 | |
| Level of Service | B | A | | A | A | |
| Approach Delay (s) | 11.0 | | | 8.9 | 7.8 | |
| Approach LOS | B | | | A | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 8.9 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.52 | | |
| Actuated Cycle Length (s) | 45.0 | Sum of lost time (s) | 9.7 |
| Intersection Capacity Utilization | 61.8% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBU | NBL | NBT | NBR | SBU | SBL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Volume (vph) | 6 | 35 | 10 | 235 | 119 | 218 | 11 | 9 | 1333 | 196 | 2 | 136 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 14 | 12 | 10 | 10 | 10 | 12 | 11 | 11 | 11 | 12 | 11 |
| Total Lost time (s) | | 5.5 | | 5.5 | 5.5 | 5.5 | | 5.0 | 5.0 | 5.0 | | 5.0 |
| Lane Util. Factor | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 0.91 | 1.00 | | 1.00 |
| Frpb, ped/bikes | | 1.00 | | 1.00 | 1.00 | 0.98 | | 1.00 | 1.00 | 0.96 | | 1.00 |
| Flpb, ped/bikes | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 |
| Frt | | 0.97 | | 1.00 | 1.00 | 0.85 | | 1.00 | 1.00 | 0.85 | | 1.00 |
| Flt Protected | | 0.99 | | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 | 1.00 | | 0.95 |
| Satd. Flow (prot) | | 1916 | | 1652 | 1739 | 1451 | | 1711 | 4916 | 1467 | | 1711 |
| Flt Permitted | | 0.72 | | 0.77 | 1.00 | 1.00 | | 0.95 | 1.00 | 1.00 | | 0.95 |
| Satd. Flow (perm) | | 1386 | | 1334 | 1739 | 1451 | | 1711 | 4916 | 1467 | | 1711 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 7 | 38 | 11 | 255 | 129 | 237 | 12 | 10 | 1449 | 213 | 2 | 148 |
| RTOR Reduction (vph) | 0 | 8 | 0 | 0 | 0 | 184 | 0 | 0 | 0 | 77 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 48 | 0 | 255 | 129 | 53 | 0 | 22 | 1449 | 136 | 0 | 150 |
| Confl. Peds. (#/hr) | | | 4 | | | 5 | | | | 7 | | |
| Turn Type | Perm | | | pm+pt | | Perm | Prot | Prot | | Perm | Prot | Prot |
| Protected Phases | | 2 | | 1 | 6 | | 3 | 3 | 8 | | 7 | 7 |
| Permitted Phases | 2 | | | 6 | | 6 | | | | 8 | | |
| Actuated Green, G (s) | | 7.4 | | 26.8 | 26.8 | 26.8 | | 4.8 | 61.0 | 61.0 | | 16.7 |
| Effective Green, g (s) | | 7.4 | | 26.8 | 26.8 | 26.8 | | 4.8 | 61.0 | 61.0 | | 16.7 |
| Actuated g/C Ratio | | 0.06 | | 0.22 | 0.22 | 0.22 | | 0.04 | 0.51 | 0.51 | | 0.14 |
| Clearance Time (s) | | 5.5 | | 5.5 | 5.5 | 5.5 | | 5.0 | 5.0 | 5.0 | | 5.0 |
| Vehicle Extension (s) | | 3.0 | | 3.0 | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 | | 3.0 |
| Lane Grp Cap (vph) | | 85 | | 335 | 388 | 324 | | 68 | 2499 | 746 | | 238 |
| v/s Ratio Prot | | | | c0.09 | 0.07 | | | 0.01 | c0.29 | | | c0.09 |
| v/s Ratio Perm | | 0.03 | | c0.08 | | 0.04 | | | | 0.09 | | |
| v/c Ratio | | 0.56 | | 0.76 | 0.33 | 0.16 | | 0.32 | 0.58 | 0.18 | | 0.63 |
| Uniform Delay, d1 | | 54.7 | | 43.2 | 39.1 | 37.6 | | 56.0 | 20.6 | 16.0 | | 48.7 |
| Progression Factor | | 1.00 | | 0.90 | 0.90 | 1.48 | | 1.00 | 1.00 | 1.00 | | 1.00 |
| Incremental Delay, d2 | | 7.8 | | 9.5 | 0.5 | 0.2 | | 2.8 | 1.0 | 0.5 | | 5.3 |
| Delay (s) | | 62.5 | | 48.5 | 35.8 | 55.8 | | 58.8 | 21.6 | 16.5 | | 54.1 |
| Level of Service | | E | | D | D | E | | E | C | B | | D |
| Approach Delay (s) | | 62.5 | | | 48.6 | | | | 21.4 | | | |
| Approach LOS | | E | | | D | | | | C | | | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 24.7 | HCM Level of Service | C |
| HCM Volume to Capacity ratio | 0.63 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 15.5 |
| Intersection Capacity Utilization | 73.2% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | SBT | SBR |
|---|---|---|
| Lane Configurations | ↑↑↑ | |
| Volume (vph) | 1278 | 13 |
| Ideal Flow (vphpl) | 1900 | 1900 |
| Lane Width | 11 | 11 |
| Total Lost time (s) | 5.0 | |
| Lane Util. Factor | 0.91 | |
| Frpb, ped/bikes | 1.00 | |
| Flpb, ped/bikes | 1.00 | |
| Frt | 1.00 | |
| Flt Protected | 1.00 | |
| Satd. Flow (prot) | 4908 | |
| Flt Permitted | 1.00 | |
| Satd. Flow (perm) | 4908 | |
| Peak-hour factor, PHF | 0.92 | 0.92 |
| Adj. Flow (vph) | 1389 | 14 |
| RTOR Reduction (vph) | 1 | 0 |
| Lane Group Flow (vph) | 1402 | 0 |
| Confl. Peds. (#/hr) | | |
| Turn Type | | |
| Protected Phases | 4 | |
| Permitted Phases | | |
| Actuated Green, G (s) | 72.9 | |
| Effective Green, g (s) | 72.9 | |
| Actuated g/C Ratio | 0.61 | |
| Clearance Time (s) | 5.0 | |
| Vehicle Extension (s) | 3.0 | |
| Lane Grp Cap (vph) | 2982 | |
| v/s Ratio Prot | 0.29 | |
| v/s Ratio Perm | | |
| v/c Ratio | 0.47 | |
| Uniform Delay, d1 | 12.9 | |
| Progression Factor | 1.00 | |
| Incremental Delay, d2 | 0.5 | |
| Delay (s) | 13.5 | |
| Level of Service | B | |
| Approach Delay (s) | 17.4 | |
| Approach LOS | B | |

| Intersection Summary |
|---|

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ↰↑↱ | | | ↰↑↱ | | ↰ | ↑ | ↱ | | ↰↑ | ↱ |
| Volume (vph) | 26 | 333 | 20 | 91 | 467 | 25 | 91 | 53 | 209 | 21 | 16 | 35 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 10 | 10 | 10 | 10 | 10 | 10 | 12 | 12 | 12 | 12 | 12 | 12 |
| Total Lost time (s) | | 5.0 | | | 5.0 | | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 |
| Lane Util. Factor | | 0.95 | | | 0.95 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frpb, ped/bikes | | 1.00 | | | 1.00 | | 1.00 | 1.00 | 0.99 | | 1.00 | 0.99 |
| Flpb, ped/bikes | | 1.00 | | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | | 0.99 | | | 0.99 | | 1.00 | 1.00 | 0.85 | | 1.00 | 0.85 |
| Flt Protected | | 1.00 | | | 0.99 | | 0.95 | 1.00 | 1.00 | | 0.97 | 1.00 |
| Satd. Flow (prot) | | 3261 | | | 3257 | | 1770 | 1863 | 1560 | | 1811 | 1560 |
| Flt Permitted | | 0.90 | | | 0.82 | | 0.73 | 1.00 | 1.00 | | 0.84 | 1.00 |
| Satd. Flow (perm) | | 2946 | | | 2704 | | 1362 | 1863 | 1560 | | 1561 | 1560 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 28 | 362 | 22 | 99 | 508 | 27 | 99 | 58 | 227 | 23 | 17 | 38 |
| RTOR Reduction (vph) | 0 | 5 | 0 | 0 | 4 | 0 | 0 | 0 | 189 | 0 | 0 | 32 |
| Lane Group Flow (vph) | 0 | 407 | 0 | 0 | 630 | 0 | 99 | 58 | 38 | 0 | 40 | 6 |
| Confl. Peds. (#/hr) | | | 2 | | | | | | 2 | | | 2 |
| Turn Type | Perm | | | Perm | | | Perm | | Perm | Perm | | Perm |
| Protected Phases | | 2 | | | 6 | | | 8 | | | 4 | |
| Permitted Phases | 2 | | | 6 | | | 8 | | 8 | 4 | | 4 |
| Actuated Green, G (s) | | 40.9 | | | 40.9 | | 10.1 | 10.1 | 10.1 | | 10.1 | 10.1 |
| Effective Green, g (s) | | 40.9 | | | 40.9 | | 10.1 | 10.1 | 10.1 | | 10.1 | 10.1 |
| Actuated g/C Ratio | | 0.68 | | | 0.68 | | 0.17 | 0.17 | 0.17 | | 0.17 | 0.17 |
| Clearance Time (s) | | 5.0 | | | 5.0 | | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 |
| Vehicle Extension (s) | | 3.0 | | | 3.0 | | 3.0 | 3.0 | 3.0 | | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | 2008 | | | 1843 | | 229 | 314 | 263 | | 263 | 263 |
| v/s Ratio Prot | | | | | | | | 0.03 | | | | |
| v/s Ratio Perm | | 0.14 | | | c0.23 | | c0.07 | | 0.02 | | 0.03 | 0.00 |
| v/c Ratio | | 0.20 | | | 0.34 | | 0.43 | 0.18 | 0.15 | | 0.15 | 0.02 |
| Uniform Delay, d1 | | 3.5 | | | 4.0 | | 22.4 | 21.4 | 21.3 | | 21.3 | 20.8 |
| Progression Factor | | 0.77 | | | 0.71 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.2 | | | 0.5 | | 1.3 | 0.3 | 0.3 | | 0.3 | 0.0 |
| Delay (s) | | 2.9 | | | 3.3 | | 23.7 | 21.7 | 21.5 | | 21.6 | 20.9 |
| Level of Service | | A | | | A | | C | C | C | | C | C |
| Approach Delay (s) | | 2.9 | | | 3.3 | | | 22.1 | | | 21.2 | |
| Approach LOS | | A | | | A | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 8.9 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.36 | | |
| Actuated Cycle Length (s) | 60.0 | Sum of lost time (s) | 9.0 |
| Intersection Capacity Utilization | 50.3% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (vph) | 158 | 374 | 311 | 48 | 46 | 211 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 10 | 10 | 10 | 10 | 10 | 10 |
| Total Lost time (s) | | 5.0 | 5.0 | | 5.0 | 5.0 |
| Lane Util. Factor | | 0.95 | 0.95 | | 1.00 | 1.00 |
| Frpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | 0.98 |
| Flpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | | 1.00 | 0.98 | | 1.00 | 0.85 |
| Flt Protected | | 0.99 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | | 3255 | 3237 | | 1652 | 1451 |
| Flt Permitted | | 0.73 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | | 2408 | 3237 | | 1652 | 1451 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 172 | 407 | 338 | 52 | 50 | 229 |
| RTOR Reduction (vph) | 0 | 0 | 12 | 0 | 0 | 198 |
| Lane Group Flow (vph) | 0 | 579 | 378 | 0 | 50 | 31 |
| Confl. Peds. (#/hr) | | | | | | 4 |
| Turn Type | Perm | | | | | Perm |
| Protected Phases | | 2 | 6 | | 4 | |
| Permitted Phases | 2 | | | | | 4 |
| Actuated Green, G (s) | | 42.0 | 42.0 | | 8.0 | 8.0 |
| Effective Green, g (s) | | 42.0 | 42.0 | | 8.0 | 8.0 |
| Actuated g/C Ratio | | 0.70 | 0.70 | | 0.13 | 0.13 |
| Clearance Time (s) | | 5.0 | 5.0 | | 5.0 | 5.0 |
| Vehicle Extension (s) | | 3.0 | 3.0 | | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | 1686 | 2266 | | 220 | 193 |
| v/s Ratio Prot | | | 0.12 | | c0.03 | |
| v/s Ratio Perm | | c0.24 | | | | 0.02 |
| v/c Ratio | | 0.34 | 0.17 | | 0.23 | 0.16 |
| Uniform Delay, d1 | | 3.6 | 3.1 | | 23.2 | 23.0 |
| Progression Factor | | 0.79 | 1.27 | | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.5 | 0.2 | | 0.5 | 0.4 |
| Delay (s) | | 3.3 | 4.0 | | 23.8 | 23.4 |
| Level of Service | | A | A | | C | C |
| Approach Delay (s) | | 3.3 | 4.0 | | 23.5 | |
| Approach LOS | | A | A | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 8.1 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.32 | | |
| Actuated Cycle Length (s) | 60.0 | Sum of lost time (s) | 10.0 |
| Intersection Capacity Utilization | 44.1% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (vph) | 231 | 123 | 114 | 431 | 425 | 232 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 10 | 10 | 11 | 11 | 11 | 11 |
| Total Lost time (s) | 5.0 | 5.0 | | 4.7 | 4.7 | |
| Lane Util. Factor | 1.00 | 1.00 | | 0.95 | 0.95 | |
| Frt | 1.00 | 0.85 | | 1.00 | 0.95 | |
| Flt Protected | 0.95 | 1.00 | | 0.99 | 1.00 | |
| Satd. Flow (prot) | 1652 | 1478 | | 3386 | 3240 | |
| Flt Permitted | 0.95 | 1.00 | | 0.71 | 1.00 | |
| Satd. Flow (perm) | 1652 | 1478 | | 2427 | 3240 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 251 | 134 | 124 | 468 | 462 | 252 |
| RTOR Reduction (vph) | 0 | 101 | 0 | 0 | 86 | 0 |
| Lane Group Flow (vph) | 251 | 33 | 0 | 592 | 628 | 0 |
| Turn Type | | Perm | Perm | | | |
| Protected Phases | 2 | | | 8 | 4 | |
| Permitted Phases | | 2 | 8 | | | |
| Actuated Green, G (s) | 14.7 | 14.7 | | 35.6 | 35.6 | |
| Effective Green, g (s) | 14.7 | 14.7 | | 35.6 | 35.6 | |
| Actuated g/C Ratio | 0.24 | 0.24 | | 0.59 | 0.59 | |
| Clearance Time (s) | 5.0 | 5.0 | | 4.7 | 4.7 | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 405 | 362 | | 1440 | 1922 | |
| v/s Ratio Prot | c0.15 | | | | 0.19 | |
| v/s Ratio Perm | | 0.02 | | c0.24 | | |
| v/c Ratio | 0.62 | 0.09 | | 0.41 | 0.33 | |
| Uniform Delay, d1 | 20.2 | 17.5 | | 6.6 | 6.2 | |
| Progression Factor | 0.88 | 1.56 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 2.7 | 0.1 | | 0.9 | 0.5 | |
| Delay (s) | 20.4 | 27.4 | | 7.4 | 6.6 | |
| Level of Service | C | C | | A | A | |
| Approach Delay (s) | 22.9 | | | 7.4 | 6.6 | |
| Approach LOS | C | | | A | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 10.6 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.47 | | |
| Actuated Cycle Length (s) | 60.0 | Sum of lost time (s) | 9.7 |
| Intersection Capacity Utilization | 59.2% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBU | NBL | NBT | NBR | SBU | SBL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Volume (vph) | 2 | 36 | 12 | 212 | 67 | 245 | 1 | 3 | 776 | 251 | 2 | 118 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 14 | 12 | 10 | 10 | 10 | 12 | 11 | 11 | 11 | 12 | 11 |
| Total Lost time (s) | | 5.5 | | 5.5 | 5.5 | 5.5 | | 5.0 | 5.0 | 5.0 | | 5.0 |
| Lane Util. Factor | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 0.91 | 1.00 | | 1.00 |
| Frpb, ped/bikes | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 |
| Flpb, ped/bikes | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 |
| Frt | | 0.97 | | 1.00 | 1.00 | 0.85 | | 1.00 | 1.00 | 0.85 | | 1.00 |
| Flt Protected | | 1.00 | | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 | 1.00 | | 0.95 |
| Satd. Flow (prot) | | 1913 | | 1652 | 1739 | 1478 | | 1711 | 4916 | 1531 | | 1711 |
| Flt Permitted | | 0.98 | | 0.78 | 1.00 | 1.00 | | 0.95 | 1.00 | 1.00 | | 0.95 |
| Satd. Flow (perm) | | 1885 | | 1356 | 1739 | 1478 | | 1711 | 4916 | 1531 | | 1711 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 2 | 39 | 13 | 230 | 73 | 266 | 1 | 3 | 843 | 273 | 2 | 128 |
| RTOR Reduction (vph) | 0 | 11 | 0 | 0 | 0 | 213 | 0 | 0 | 0 | 132 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 43 | 0 | 230 | 73 | 53 | 0 | 4 | 843 | 141 | 0 | 130 |
| Confl. Peds. (#/hr) | | | 1 | | | | | | | | | |
| Turn Type | Perm | | | pm+pt | | Perm | Prot | Prot | | Perm | Prot | Prot |
| Protected Phases | | 2 | | 1 | 6 | | 3 | 3 | 8 | | 7 | 7 |
| Permitted Phases | 2 | | | 6 | | 6 | | | | 8 | | |
| Actuated Green, G (s) | | 7.1 | | 23.7 | 23.7 | 23.7 | | 1.3 | 61.9 | 61.9 | | 18.9 |
| Effective Green, g (s) | | 7.1 | | 23.7 | 23.7 | 23.7 | | 1.3 | 61.9 | 61.9 | | 18.9 |
| Actuated g/C Ratio | | 0.06 | | 0.20 | 0.20 | 0.20 | | 0.01 | 0.52 | 0.52 | | 0.16 |
| Clearance Time (s) | | 5.5 | | 5.5 | 5.5 | 5.5 | | 5.0 | 5.0 | 5.0 | | 5.0 |
| Vehicle Extension (s) | | 3.0 | | 3.0 | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 | | 3.0 |
| Lane Grp Cap (vph) | | 112 | | 295 | 343 | 292 | | 19 | 2536 | 790 | | 269 |
| v/s Ratio Prot | | | | c0.07 | 0.04 | | | 0.00 | c0.17 | | | c0.08 |
| v/s Ratio Perm | | 0.02 | | c0.08 | | 0.04 | | | | 0.09 | | |
| v/c Ratio | | 0.38 | | 0.78 | 0.21 | 0.18 | | 0.21 | 0.33 | 0.18 | | 0.48 |
| Uniform Delay, d1 | | 54.3 | | 45.3 | 40.3 | 40.1 | | 58.8 | 17.0 | 15.5 | | 46.1 |
| Progression Factor | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 |
| Incremental Delay, d2 | | 2.2 | | 12.3 | 0.3 | 0.3 | | 5.5 | 0.4 | 0.5 | | 1.4 |
| Delay (s) | | 56.5 | | 57.6 | 40.6 | 40.4 | | 64.3 | 17.3 | 16.0 | | 47.5 |
| Level of Service | | E | | E | D | D | | E | B | B | | D |
| Approach Delay (s) | | 56.5 | | | 47.4 | | | | 17.2 | | | |
| Approach LOS | | E | | | D | | | | B | | | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 22.7 | HCM Level of Service | C |
| HCM Volume to Capacity ratio | 0.46 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 15.5 |
| Intersection Capacity Utilization | 59.1% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | SBT | SBR |
|---|---|---|
| Lane Configurations | ↑↑↑ | |
| Volume (vph) | 834 | 9 |
| Ideal Flow (vphpl) | 1900 | 1900 |
| Lane Width | 11 | 11 |
| Total Lost time (s) | 5.0 | |
| Lane Util. Factor | 0.91 | |
| Frpb, ped/bikes | 1.00 | |
| Flpb, ped/bikes | 1.00 | |
| Frt | 1.00 | |
| Flt Protected | 1.00 | |
| Satd. Flow (prot) | 4908 | |
| Flt Permitted | 1.00 | |
| Satd. Flow (perm) | 4908 | |
| Peak-hour factor, PHF | 0.92 | 0.92 |
| Adj. Flow (vph) | 907 | 10 |
| RTOR Reduction (vph) | 1 | 0 |
| Lane Group Flow (vph) | 916 | 0 |
| Confl. Peds. (#/hr) | | |
| Turn Type | | |
| Protected Phases | 4 | |
| Permitted Phases | | |
| Actuated Green, G (s) | 79.5 | |
| Effective Green, g (s) | 79.5 | |
| Actuated g/C Ratio | 0.66 | |
| Clearance Time (s) | 5.0 | |
| Vehicle Extension (s) | 3.0 | |
| Lane Grp Cap (vph) | 3252 | |
| v/s Ratio Prot | 0.19 | |
| v/s Ratio Perm | | |
| v/c Ratio | 0.28 | |
| Uniform Delay, d1 | 8.4 | |
| Progression Factor | 1.00 | |
| Incremental Delay, d2 | 0.2 | |
| Delay (s) | 8.6 | |
| Level of Service | A | |
| Approach Delay (s) | 13.4 | |
| Approach LOS | B | |

Intersection Summary

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ↰↑↱ | | | ↰↑↱ | | ↰ | ↑ | ↱ | | ↰↑ | ↱ |
| Volume (vph) | 48 | 346 | 10 | 89 | 457 | 20 | 16 | 9 | 89 | 24 | 7 | 59 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 10 | 10 | 10 | 10 | 10 | 10 | 12 | 12 | 12 | 12 | 12 | 12 |
| Total Lost time (s) | | 5.0 | | | 5.0 | | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 |
| Lane Util. Factor | | 0.95 | | | 0.95 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frpb, ped/bikes | | 1.00 | | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Flpb, ped/bikes | | 1.00 | | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | | 1.00 | | | 0.99 | | 1.00 | 1.00 | 0.85 | | 1.00 | 0.85 |
| Flt Protected | | 0.99 | | | 0.99 | | 0.95 | 1.00 | 1.00 | | 0.96 | 1.00 |
| Satd. Flow (prot) | | 3270 | | | 3257 | | 1770 | 1863 | 1583 | | 1794 | 1583 |
| Flt Permitted | | 0.85 | | | 0.83 | | 0.91 | 1.00 | 1.00 | | 0.80 | 1.00 |
| Satd. Flow (perm) | | 2810 | | | 2721 | | 1693 | 1863 | 1583 | | 1494 | 1583 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 52 | 376 | 11 | 97 | 497 | 22 | 17 | 10 | 97 | 26 | 8 | 64 |
| RTOR Reduction (vph) | 0 | 2 | 0 | 0 | 3 | 0 | 0 | 0 | 88 | 0 | 0 | 58 |
| Lane Group Flow (vph) | 0 | 437 | 0 | 0 | 613 | 0 | 17 | 10 | 9 | 0 | 34 | 6 |
| Confl. Peds. (#/hr) | | | 2 | | | 2 | | | | | | |
| Turn Type | Perm | | | Perm | | | Perm | | Perm | Perm | | Perm |
| Protected Phases | | 2 | | | 6 | | | 8 | | | 4 | |
| Permitted Phases | 2 | | | 6 | | | 8 | | 8 | 4 | | 4 |
| Actuated Green, G (s) | | 31.6 | | | 31.6 | | 4.4 | 4.4 | 4.4 | | 4.4 | 4.4 |
| Effective Green, g (s) | | 31.6 | | | 31.6 | | 4.4 | 4.4 | 4.4 | | 4.4 | 4.4 |
| Actuated g/C Ratio | | 0.70 | | | 0.70 | | 0.10 | 0.10 | 0.10 | | 0.10 | 0.10 |
| Clearance Time (s) | | 5.0 | | | 5.0 | | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 |
| Vehicle Extension (s) | | 3.0 | | | 3.0 | | 3.0 | 3.0 | 3.0 | | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | 1973 | | | 1911 | | 166 | 182 | 155 | | 146 | 155 |
| v/s Ratio Prot | | | | | | | | 0.01 | | | | |
| v/s Ratio Perm | | 0.16 | | | c0.23 | | 0.01 | | 0.01 | | c0.02 | 0.00 |
| v/c Ratio | | 0.22 | | | 0.32 | | 0.10 | 0.05 | 0.06 | | 0.23 | 0.04 |
| Uniform Delay, d1 | | 2.4 | | | 2.6 | | 18.5 | 18.4 | 18.4 | | 18.7 | 18.4 |
| Progression Factor | | 1.00 | | | 1.15 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.3 | | | 0.4 | | 0.3 | 0.1 | 0.2 | | 0.8 | 0.1 |
| Delay (s) | | 2.6 | | | 3.4 | | 18.8 | 18.5 | 18.6 | | 19.6 | 18.5 |
| Level of Service | | A | | | A | | B | B | B | | B | B |
| Approach Delay (s) | | 2.6 | | | 3.4 | | | 18.6 | | | 18.9 | |
| Approach LOS | | A | | | A | | | B | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 5.8 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.31 | | |
| Actuated Cycle Length (s) | 45.0 | Sum of lost time (s) | 9.0 |
| Intersection Capacity Utilization | 47.2% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (vph) | 99 | 240 | 252 | 41 | 49 | 185 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 10 | 10 | 10 | 10 | 10 | 10 |
| Total Lost time (s) | | 5.0 | 5.0 | | 5.0 | 5.0 |
| Lane Util. Factor | | 0.95 | 0.95 | | 1.00 | 1.00 |
| Frt | | 1.00 | 0.98 | | 1.00 | 0.85 |
| Flt Protected | | 0.99 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | | 3256 | 3233 | | 1652 | 1478 |
| Flt Permitted | | 0.79 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | | 2606 | 3233 | | 1652 | 1478 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 108 | 261 | 274 | 45 | 53 | 201 |
| RTOR Reduction (vph) | 0 | 0 | 16 | 0 | 0 | 173 |
| Lane Group Flow (vph) | 0 | 369 | 303 | 0 | 53 | 28 |
| Turn Type | Perm | | | | | Perm |
| Protected Phases | | 2 | 6 | | 4 | |
| Permitted Phases | 2 | | | | | 4 |
| Actuated Green, G (s) | | 28.7 | 28.7 | | 6.3 | 6.3 |
| Effective Green, g (s) | | 28.7 | 28.7 | | 6.3 | 6.3 |
| Actuated g/C Ratio | | 0.64 | 0.64 | | 0.14 | 0.14 |
| Clearance Time (s) | | 5.0 | 5.0 | | 5.0 | 5.0 |
| Vehicle Extension (s) | | 3.0 | 3.0 | | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | 1662 | 2062 | | 231 | 207 |
| v/s Ratio Prot | | | 0.09 | | c0.03 | |
| v/s Ratio Perm | | c0.14 | | | | 0.02 |
| v/c Ratio | | 0.22 | 0.15 | | 0.23 | 0.14 |
| Uniform Delay, d1 | | 3.4 | 3.3 | | 17.2 | 17.0 |
| Progression Factor | | 0.75 | 0.19 | | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.3 | 0.1 | | 0.5 | 0.3 |
| Delay (s) | | 2.9 | 0.8 | | 17.7 | 17.3 |
| Level of Service | | A | A | | B | B |
| Approach Delay (s) | | 2.9 | 0.8 | | 17.4 | |
| Approach LOS | | A | A | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 6.1 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.22 | | |
| Actuated Cycle Length (s) | 45.0 | Sum of lost time (s) | 10.0 |
| Intersection Capacity Utilization | 40.8% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (vph) | 197 | 73 | 73 | 366 | 340 | 193 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 10 | 10 | 11 | 11 | 11 | 11 |
| Total Lost time (s) | 5.0 | 5.0 | | 4.7 | 4.7 | |
| Lane Util. Factor | 1.00 | 1.00 | | 0.95 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.85 | | 1.00 | 0.95 | |
| Flt Protected | 0.95 | 1.00 | | 0.99 | 1.00 | |
| Satd. Flow (prot) | 1652 | 1478 | | 3393 | 3235 | |
| Flt Permitted | 0.95 | 1.00 | | 0.81 | 1.00 | |
| Satd. Flow (perm) | 1652 | 1478 | | 2760 | 3235 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Adj. Flow (vph) | 214 | 79 | 79 | 398 | 370 | 210 |
| RTOR Reduction (vph) | 0 | 62 | 0 | 0 | 91 | 0 |
| Lane Group Flow (vph) | 214 | 17 | 0 | 477 | 489 | 0 |
| Confl. Peds. (#/hr) | 5 | | | | | |
| Turn Type | | Perm | Perm | | | |
| Protected Phases | 2 | | | 8 | 4 | |
| Permitted Phases | | 2 | 8 | | | |
| Actuated Green, G (s) | 9.8 | 9.8 | | 25.5 | 25.5 | |
| Effective Green, g (s) | 9.8 | 9.8 | | 25.5 | 25.5 | |
| Actuated g/C Ratio | 0.22 | 0.22 | | 0.57 | 0.57 | |
| Clearance Time (s) | 5.0 | 5.0 | | 4.7 | 4.7 | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 360 | 322 | | 1564 | 1833 | |
| v/s Ratio Prot | c0.13 | | | | 0.15 | |
| v/s Ratio Perm | | 0.01 | | c0.17 | | |
| v/c Ratio | 0.59 | 0.05 | | 0.30 | 0.27 | |
| Uniform Delay, d1 | 15.8 | 13.9 | | 5.1 | 5.0 | |
| Progression Factor | 0.84 | 0.90 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 2.6 | 0.1 | | 0.5 | 0.4 | |
| Delay (s) | 15.9 | 12.6 | | 5.6 | 5.3 | |
| Level of Service | B | B | | A | A | |
| Approach Delay (s) | 15.0 | | | 5.6 | 5.3 | |
| Approach LOS | B | | | A | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 7.5 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.39 | | |
| Actuated Cycle Length (s) | 45.0 | Sum of lost time (s) | 9.7 |
| Intersection Capacity Utilization | 50.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBU | NBL | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Volume (vph) | 11 | 82 | 31 | 113 | 99 | 141 | 1 | 1 | 969 | 202 | 159 | 1105 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 14 | 12 | 10 | 10 | 10 | 12 | 11 | 11 | 11 | 11 | 11 |
| Total Lost time (s) | | 5.5 | | 5.5 | 5.5 | 5.5 | | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 |
| Lane Util. Factor | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 0.91 | 1.00 | 1.00 | 0.91 |
| Frpb, ped/bikes | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Flpb, ped/bikes | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.97 | | 1.00 | 1.00 | 0.85 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 |
| Flt Protected | | 1.00 | | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (prot) | | 1912 | | 1652 | 1739 | 1478 | | 1711 | 4916 | 1531 | 1711 | 4913 |
| Flt Permitted | | 0.96 | | 0.41 | 1.00 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (perm) | | 1843 | | 717 | 1739 | 1478 | | 1711 | 4916 | 1531 | 1711 | 4913 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Growth Factor (vph) | 135% | 135% | 135% | 135% | 135% | 135% | 149% | 149% | 149% | 149% | 149% | 149% |
| Adj. Flow (vph) | 16 | 120 | 45 | 166 | 145 | 207 | 2 | 2 | 1569 | 327 | 258 | 1790 |
| RTOR Reduction (vph) | 0 | 10 | 0 | 0 | 0 | 160 | 0 | 0 | 0 | 124 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 171 | 0 | 166 | 145 | 47 | 0 | 4 | 1569 | 203 | 258 | 1795 |
| Confl. Peds. (#/hr) | | | | | | | | | | | | |
| Turn Type | Perm | | | pm+pt | | Perm | Prot | Prot | | Perm | Prot | |
| Protected Phases | | 2 | | 1 | 6 | | 3 | 3 | 8 | | 7 | 4 |
| Permitted Phases | 2 | | | 6 | | 6 | | | | 8 | | |
| Actuated Green, G (s) | | 15.4 | | 27.5 | 27.5 | 27.5 | | 1.3 | 52.2 | 52.2 | 24.8 | 75.7 |
| Effective Green, g (s) | | 15.4 | | 27.5 | 27.5 | 27.5 | | 1.3 | 52.2 | 52.2 | 24.8 | 75.7 |
| Actuated g/C Ratio | | 0.13 | | 0.23 | 0.23 | 0.23 | | 0.01 | 0.44 | 0.44 | 0.21 | 0.63 |
| Clearance Time (s) | | 5.5 | | 5.5 | 5.5 | 5.5 | | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 |
| Vehicle Extension (s) | | 3.0 | | 3.0 | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | 237 | | 216 | 399 | 339 | | 19 | 2138 | 666 | 354 | 3099 |
| v/s Ratio Prot | | | | c0.04 | 0.08 | | | 0.00 | c0.32 | | c0.15 | 0.37 |
| v/s Ratio Perm | | 0.09 | | c0.13 | | 0.03 | | | | 0.13 | | |
| v/c Ratio | | 0.72 | | 0.77 | 0.36 | 0.14 | | 0.21 | 0.73 | 0.30 | 0.73 | 0.58 |
| Uniform Delay, d1 | | 50.2 | | 49.3 | 38.9 | 36.8 | | 58.8 | 28.1 | 22.1 | 44.5 | 12.9 |
| Progression Factor | | 1.00 | | 0.99 | 0.97 | 1.48 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | | 10.0 | | 14.4 | 0.5 | 0.2 | | 5.5 | 2.3 | 1.2 | 7.3 | 0.8 |
| Delay (s) | | 60.2 | | 63.3 | 38.4 | 54.8 | | 64.3 | 30.4 | 23.3 | 51.8 | 13.7 |
| Level of Service | | E | | E | D | D | | E | C | C | D | B |
| Approach Delay (s) | | 60.2 | | | 52.9 | | | | 29.3 | | | 18.5 |
| Approach LOS | | E | | | D | | | | C | | | B |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 28.3 | HCM Level of Service | C |
| HCM Volume to Capacity ratio | 0.73 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 15.5 |
| Intersection Capacity Utilization | 76.2% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | SBR |
|---|---|
| Lane Configurations | |
| Volume (vph) | 3 |
| Ideal Flow (vphpl) | 1900 |
| Lane Width | 11 |
| Total Lost time (s) | |
| Lane Util. Factor | |
| Frpb, ped/bikes | |
| Flpb, ped/bikes | |
| Frt | |
| Flt Protected | |
| Satd. Flow (prot) | |
| Flt Permitted | |
| Satd. Flow (perm) | |
| Peak-hour factor, PHF | 0.92 |
| Growth Factor (vph) | 149% |
| Adj. Flow (vph) | 5 |
| RTOR Reduction (vph) | 0 |
| Lane Group Flow (vph) | 0 |
| Confl. Peds. (#/hr) | 1 |
| Turn Type | |
| Protected Phases | |
| Permitted Phases | |
| Actuated Green, G (s) | |
| Effective Green, g (s) | |
| Actuated g/C Ratio | |
| Clearance Time (s) | |
| Vehicle Extension (s) | |
| Lane Grp Cap (vph) | |
| v/s Ratio Prot | |
| v/s Ratio Perm | |
| v/c Ratio | |
| Uniform Delay, d1 | |
| Progression Factor | |
| Incremental Delay, d2 | |
| Delay (s) | |
| Level of Service | |
| Approach Delay (s) | |
| Approach LOS | |

| Intersection Summary |
|---|

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Volume (vph) | 9 | 290 | 117 | 121 | 284 | 23 | 53 | 15 | 133 | 11 | 27 | 2 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 10 | 10 | 10 | 10 | 10 | 10 | 12 | 12 | 12 | 12 | 12 | 12 |
| Total Lost time (s) | | 5.0 | | | 5.0 | | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 |
| Lane Util. Factor | | 0.95 | | | 0.95 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frpb, ped/bikes | | 0.99 | | | 1.00 | | 1.00 | 1.00 | 0.99 | | 1.00 | 0.99 |
| Flpb, ped/bikes | | 1.00 | | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | | 0.96 | | | 0.99 | | 1.00 | 1.00 | 0.85 | | 1.00 | 0.85 |
| Flt Protected | | 1.00 | | | 0.99 | | 0.95 | 1.00 | 1.00 | | 0.99 | 1.00 |
| Satd. Flow (prot) | | 3136 | | | 3231 | | 1770 | 1863 | 1562 | | 1836 | 1560 |
| Flt Permitted | | 0.94 | | | 0.67 | | 0.73 | 1.00 | 1.00 | | 0.92 | 1.00 |
| Satd. Flow (perm) | | 2956 | | | 2198 | | 1360 | 1863 | 1562 | | 1721 | 1560 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Growth Factor (vph) | 135% | 135% | 135% | 135% | 135% | 135% | 135% | 135% | 135% | 100% | 100% | 100% |
| Adj. Flow (vph) | 13 | 426 | 172 | 178 | 417 | 34 | 78 | 22 | 195 | 12 | 29 | 2 |
| RTOR Reduction (vph) | 0 | 50 | 0 | 0 | 5 | 0 | 0 | 0 | 166 | 0 | 0 | 2 |
| Lane Group Flow (vph) | 0 | 562 | 0 | 0 | 624 | 0 | 78 | 22 | 29 | 0 | 41 | 0 |
| Confl. Peds. (#/hr) | | | 3 | | | | | | 1 | | | 2 |
| Turn Type | Perm | | | Perm | | | Perm | | Perm | Perm | | Perm |
| Protected Phases | | 2 | | | 6 | | | 8 | | | 4 | |
| Permitted Phases | 2 | | | 6 | | | 8 | | 8 | 4 | | 4 |
| Actuated Green, G (s) | | 42.0 | | | 42.0 | | 9.0 | 9.0 | 9.0 | | 9.0 | 9.0 |
| Effective Green, g (s) | | 42.0 | | | 42.0 | | 9.0 | 9.0 | 9.0 | | 9.0 | 9.0 |
| Actuated g/C Ratio | | 0.70 | | | 0.70 | | 0.15 | 0.15 | 0.15 | | 0.15 | 0.15 |
| Clearance Time (s) | | 5.0 | | | 5.0 | | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 |
| Vehicle Extension (s) | | 3.0 | | | 3.0 | | 3.0 | 3.0 | 3.0 | | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | 2069 | | | 1539 | | 204 | 279 | 234 | | 258 | 234 |
| v/s Ratio Prot | | | | | | | | 0.01 | | | | |
| v/s Ratio Perm | | 0.19 | | | c0.28 | | c0.06 | | 0.02 | | 0.02 | 0.00 |
| v/c Ratio | | 0.27 | | | 0.41 | | 0.38 | 0.08 | 0.12 | | 0.16 | 0.00 |
| Uniform Delay, d1 | | 3.3 | | | 3.8 | | 23.0 | 21.9 | 22.1 | | 22.2 | 21.7 |
| Progression Factor | | 0.76 | | | 0.42 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.3 | | | 0.8 | | 1.2 | 0.1 | 0.2 | | 0.3 | 0.0 |
| Delay (s) | | 2.8 | | | 2.3 | | 24.2 | 22.1 | 22.3 | | 22.5 | 21.7 |
| Level of Service | | A | | | A | | C | C | C | | C | C |
| Approach Delay (s) | | 2.8 | | | 2.3 | | | 22.8 | | | 22.5 | |
| Approach LOS | | A | | | A | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 6.9 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.40 | | |
| Actuated Cycle Length (s) | 60.0 | Sum of lost time (s) | 9.0 |
| Intersection Capacity Utilization | 54.9% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (vph) | 151 | 378 | 352 | 49 | 50 | 143 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 10 | 10 | 10 | 10 | 10 | 10 |
| Total Lost time (s) | | 5.0 | 5.0 | | 5.0 | 5.0 |
| Lane Util. Factor | | 0.95 | 0.95 | | 1.00 | 1.00 |
| Frpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | 0.99 |
| Flpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | | 1.00 | 0.98 | | 1.00 | 0.85 |
| Flt Protected | | 0.99 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | | 3257 | 3243 | | 1652 | 1458 |
| Flt Permitted | | 0.66 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | | 2196 | 3243 | | 1652 | 1458 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Growth Factor (vph) | 135% | 135% | 135% | 135% | 135% | 135% |
| Adj. Flow (vph) | 222 | 555 | 517 | 72 | 73 | 210 |
| RTOR Reduction (vph) | 0 | 0 | 11 | 0 | 0 | 181 |
| Lane Group Flow (vph) | 0 | 777 | 578 | 0 | 73 | 29 |
| Confl. Peds. (#/hr) | | | | | | 1 |
| Turn Type | Perm | | | | | Perm |
| Protected Phases | | 2 | 6 | | 4 | |
| Permitted Phases | 2 | | | | | 4 |
| Actuated Green, G (s) | | 41.7 | 41.7 | | 8.3 | 8.3 |
| Effective Green, g (s) | | 41.7 | 41.7 | | 8.3 | 8.3 |
| Actuated g/C Ratio | | 0.70 | 0.70 | | 0.14 | 0.14 |
| Clearance Time (s) | | 5.0 | 5.0 | | 5.0 | 5.0 |
| Vehicle Extension (s) | | 3.0 | 3.0 | | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | 1526 | 2254 | | 229 | 202 |
| v/s Ratio Prot | | | 0.18 | | c0.04 | |
| v/s Ratio Perm | | c0.35 | | | | 0.02 |
| v/c Ratio | | 0.51 | 0.26 | | 0.32 | 0.14 |
| Uniform Delay, d1 | | 4.3 | 3.4 | | 23.3 | 22.7 |
| Progression Factor | | 1.41 | 1.47 | | 1.00 | 1.00 |
| Incremental Delay, d2 | | 1.2 | 0.3 | | 0.8 | 0.3 |
| Delay (s) | | 7.3 | 5.2 | | 24.1 | 23.1 |
| Level of Service | | A | A | | C | C |
| Approach Delay (s) | | 7.3 | 5.2 | | 23.3 | |
| Approach LOS | | A | A | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 9.3 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.48 | | |
| Actuated Cycle Length (s) | 60.0 | Sum of lost time (s) | 10.0 |
| Intersection Capacity Utilization | 51.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (vph) | 242 | 162 | 137 | 466 | 425 | 185 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 10 | 10 | 11 | 11 | 11 | 11 |
| Total Lost time (s) | 5.0 | 5.0 | | 4.7 | 4.7 | |
| Lane Util. Factor | 1.00 | 1.00 | | 0.95 | 0.95 | |
| Frt | 1.00 | 0.85 | | 1.00 | 0.95 | |
| Flt Protected | 0.95 | 1.00 | | 0.99 | 1.00 | |
| Satd. Flow (prot) | 1652 | 1478 | | 3383 | 3266 | |
| Flt Permitted | 0.95 | 1.00 | | 0.61 | 1.00 | |
| Satd. Flow (perm) | 1652 | 1478 | | 2071 | 3266 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Growth Factor (vph) | 135% | 135% | 126% | 126% | 126% | 126% |
| Adj. Flow (vph) | 355 | 238 | 188 | 638 | 582 | 253 |
| RTOR Reduction (vph) | 0 | 124 | 0 | 0 | 66 | 0 |
| Lane Group Flow (vph) | 355 | 114 | 0 | 826 | 769 | 0 |
| Turn Type | | Perm | Perm | | | |
| Protected Phases | 2 | | | 8 | 4 | |
| Permitted Phases | | 2 | 8 | | | |
| Actuated Green, G (s) | 18.3 | 18.3 | | 32.0 | 32.0 | |
| Effective Green, g (s) | 18.3 | 18.3 | | 32.0 | 32.0 | |
| Actuated g/C Ratio | 0.30 | 0.30 | | 0.53 | 0.53 | |
| Clearance Time (s) | 5.0 | 5.0 | | 4.7 | 4.7 | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 504 | 451 | | 1105 | 1742 | |
| v/s Ratio Prot | c0.21 | | | | 0.24 | |
| v/s Ratio Perm | | 0.08 | | c0.40 | | |
| v/c Ratio | 0.70 | 0.25 | | 0.75 | 0.44 | |
| Uniform Delay, d1 | 18.5 | 15.7 | | 10.9 | 8.5 | |
| Progression Factor | 1.02 | 1.58 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 4.0 | 0.3 | | 4.6 | 0.8 | |
| Delay (s) | 22.8 | 25.1 | | 15.5 | 9.4 | |
| Level of Service | C | C | | B | A | |
| Approach Delay (s) | 23.7 | | | 15.5 | 9.4 | |
| Approach LOS | C | | | B | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 15.4 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.73 | | |
| Actuated Cycle Length (s) | 60.0 | Sum of lost time (s) | 9.7 |
| Intersection Capacity Utilization | 73.6% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBU | NBL | NBT | NBR | SBU | SBL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Volume (vph) | 6 | 35 | 10 | 235 | 119 | 218 | 11 | 9 | 1333 | 196 | 2 | 136 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 14 | 12 | 10 | 10 | 10 | 12 | 11 | 11 | 11 | 12 | 11 |
| Total Lost time (s) | | 5.5 | | 5.5 | 5.5 | 5.5 | | 5.0 | 5.0 | 5.0 | | 5.0 |
| Lane Util. Factor | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 0.91 | 1.00 | | 1.00 |
| Frpb, ped/bikes | | 1.00 | | 1.00 | 1.00 | 0.98 | | 1.00 | 1.00 | 0.96 | | 1.00 |
| Flpb, ped/bikes | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 |
| Frt | | 0.97 | | 1.00 | 1.00 | 0.85 | | 1.00 | 1.00 | 0.85 | | 1.00 |
| Flt Protected | | 0.99 | | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 | 1.00 | | 0.95 |
| Satd. Flow (prot) | | 1915 | | 1652 | 1739 | 1451 | | 1711 | 4916 | 1467 | | 1711 |
| Flt Permitted | | 0.52 | | 0.67 | 1.00 | 1.00 | | 0.95 | 1.00 | 1.00 | | 0.95 |
| Satd. Flow (perm) | | 1009 | | 1168 | 1739 | 1451 | | 1711 | 4916 | 1467 | | 1711 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Growth Factor (vph) | 135% | 135% | 135% | 135% | 135% | 135% | 149% | 149% | 149% | 149% | 149% | 149% |
| Adj. Flow (vph) | 9 | 51 | 15 | 345 | 175 | 320 | 18 | 15 | 2159 | 317 | 3 | 220 |
| RTOR Reduction (vph) | 0 | 8 | 0 | 0 | 0 | 178 | 0 | 0 | 0 | 84 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 67 | 0 | 345 | 175 | 142 | 0 | 33 | 2159 | 233 | 0 | 223 |
| Confl. Peds. (#/hr) | | | 4 | | | 5 | | | | 7 | | |
| Turn Type | Perm | | | pm+pt | | Perm | Prot | Prot | | Perm | Prot | Prot |
| Protected Phases | | 2 | | 1 | 6 | | 3 | 3 | 8 | | 7 | 7 |
| Permitted Phases | 2 | | | 6 | | 6 | | | | 8 | | |
| Actuated Green, G (s) | | 8.5 | | 32.8 | 32.8 | 32.8 | | 5.4 | 54.7 | 54.7 | | 17.0 |
| Effective Green, g (s) | | 8.5 | | 32.8 | 32.8 | 32.8 | | 5.4 | 54.7 | 54.7 | | 17.0 |
| Actuated g/C Ratio | | 0.07 | | 0.27 | 0.27 | 0.27 | | 0.05 | 0.46 | 0.46 | | 0.14 |
| Clearance Time (s) | | 5.5 | | 5.5 | 5.5 | 5.5 | | 5.0 | 5.0 | 5.0 | | 5.0 |
| Vehicle Extension (s) | | 3.0 | | 3.0 | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 | | 3.0 |
| Lane Grp Cap (vph) | | 71 | | 395 | 475 | 397 | | 77 | 2241 | 669 | | 242 |
| v/s Ratio Prot | | | | c0.14 | 0.10 | | | 0.02 | c0.44 | | | c0.13 |
| v/s Ratio Perm | | 0.07 | | c0.10 | | 0.10 | | | | 0.16 | | |
| v/c Ratio | | 0.94 | | 0.87 | 0.37 | 0.36 | | 0.43 | 0.96 | 0.35 | | 0.92 |
| Uniform Delay, d1 | | 55.5 | | 41.6 | 35.2 | 35.1 | | 55.8 | 31.7 | 21.1 | | 50.8 |
| Progression Factor | | 1.00 | | 0.90 | 0.91 | 1.08 | | 1.00 | 1.00 | 1.00 | | 1.00 |
| Incremental Delay, d2 | | 84.7 | | 17.2 | 0.4 | 0.5 | | 3.8 | 12.2 | 1.4 | | 37.1 |
| Delay (s) | | 140.2 | | 54.4 | 32.4 | 38.3 | | 59.6 | 43.8 | 22.5 | | 88.0 |
| Level of Service | | F | | D | C | D | | E | D | C | | F |
| Approach Delay (s) | | 140.2 | | | 43.7 | | | | 41.4 | | | |
| Approach LOS | | F | | | D | | | | D | | | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 38.2 | HCM Level of Service | D |
| HCM Volume to Capacity ratio | 0.92 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 15.5 |
| Intersection Capacity Utilization | 93.5% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | SBT | SBR |
|---|---|---|
| Lane Configurations | ↑↑↑ | |
| Volume (vph) | 1278 | 13 |
| Ideal Flow (vphpl) | 1900 | 1900 |
| Lane Width | 11 | 11 |
| Total Lost time (s) | 5.0 | |
| Lane Util. Factor | 0.91 | |
| Frpb, ped/bikes | 1.00 | |
| Flpb, ped/bikes | 1.00 | |
| Frt | 1.00 | |
| Flt Protected | 1.00 | |
| Satd. Flow (prot) | 4908 | |
| Flt Permitted | 1.00 | |
| Satd. Flow (perm) | 4908 | |
| Peak-hour factor, PHF | 0.92 | 0.92 |
| Growth Factor (vph) | 149% | 149% |
| Adj. Flow (vph) | 2070 | 21 |
| RTOR Reduction (vph) | 1 | 0 |
| Lane Group Flow (vph) | 2090 | 0 |
| Confl. Peds. (#/hr) | | |
| Turn Type | | |
| Protected Phases | 4 | |
| Permitted Phases | | |
| Actuated Green, G (s) | 66.3 | |
| Effective Green, g (s) | 66.3 | |
| Actuated g/C Ratio | 0.55 | |
| Clearance Time (s) | 5.0 | |
| Vehicle Extension (s) | 3.0 | |
| Lane Grp Cap (vph) | 2712 | |
| v/s Ratio Prot | 0.43 | |
| v/s Ratio Perm | | |
| v/c Ratio | 0.77 | |
| Uniform Delay, d1 | 20.9 | |
| Progression Factor | 1.00 | |
| Incremental Delay, d2 | 2.2 | |
| Delay (s) | 23.1 | |
| Level of Service | C | |
| Approach Delay (s) | 29.4 | |
| Approach LOS | C | |

Intersection Summary

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Volume (vph) | 26 | 333 | 20 | 91 | 467 | 25 | 91 | 53 | 209 | 21 | 16 | 35 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 10 | 10 | 10 | 10 | 10 | 10 | 12 | 12 | 12 | 12 | 12 | 12 |
| Total Lost time (s) | | 5.0 | | | 5.0 | | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 |
| Lane Util. Factor | | 0.95 | | | 0.95 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frpb, ped/bikes | | 1.00 | | | 1.00 | | 1.00 | 1.00 | 0.99 | | 1.00 | 0.99 |
| Flpb, ped/bikes | | 1.00 | | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | | 0.99 | | | 0.99 | | 1.00 | 1.00 | 0.85 | | 1.00 | 0.85 |
| Flt Protected | | 1.00 | | | 0.99 | | 0.95 | 1.00 | 1.00 | | 0.97 | 1.00 |
| Satd. Flow (prot) | | 3262 | | | 3256 | | 1770 | 1863 | 1560 | | 1811 | 1560 |
| Flt Permitted | | 0.87 | | | 0.77 | | 0.73 | 1.00 | 1.00 | | 0.84 | 1.00 |
| Satd. Flow (perm) | | 2845 | | | 2536 | | 1362 | 1863 | 1560 | | 1566 | 1560 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Growth Factor (vph) | 135% | 135% | 135% | 135% | 135% | 135% | 135% | 135% | 135% | 100% | 100% | 100% |
| Adj. Flow (vph) | 38 | 489 | 29 | 134 | 685 | 37 | 134 | 78 | 307 | 23 | 17 | 38 |
| RTOR Reduction (vph) | 0 | 5 | 0 | 0 | 4 | 0 | 0 | 0 | 248 | 0 | 0 | 31 |
| Lane Group Flow (vph) | 0 | 551 | 0 | 0 | 852 | 0 | 134 | 78 | 59 | 0 | 40 | 7 |
| Confl. Peds. (#/hr) | | | 2 | | | | | | 2 | | | 2 |
| Turn Type | Perm | | | Perm | | | Perm | | Perm | Perm | | Perm |
| Protected Phases | | 2 | | | 6 | | | 8 | | | 4 | |
| Permitted Phases | 2 | | | 6 | | | 8 | | 8 | 4 | | 4 |
| Actuated Green, G (s) | | 39.4 | | | 39.4 | | 11.6 | 11.6 | 11.6 | | 11.6 | 11.6 |
| Effective Green, g (s) | | 39.4 | | | 39.4 | | 11.6 | 11.6 | 11.6 | | 11.6 | 11.6 |
| Actuated g/C Ratio | | 0.66 | | | 0.66 | | 0.19 | 0.19 | 0.19 | | 0.19 | 0.19 |
| Clearance Time (s) | | 5.0 | | | 5.0 | | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 |
| Vehicle Extension (s) | | 3.0 | | | 3.0 | | 3.0 | 3.0 | 3.0 | | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | 1868 | | | 1665 | | 263 | 360 | 302 | | 303 | 302 |
| v/s Ratio Prot | | | | | | | | 0.04 | | | | |
| v/s Ratio Perm | | 0.19 | | | c0.34 | | c0.10 | | 0.04 | | 0.03 | 0.00 |
| v/c Ratio | | 0.29 | | | 0.51 | | 0.51 | 0.22 | 0.20 | | 0.13 | 0.02 |
| Uniform Delay, d1 | | 4.4 | | | 5.3 | | 21.7 | 20.4 | 20.3 | | 20.0 | 19.6 |
| Progression Factor | | 0.42 | | | 0.57 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.3 | | | 1.1 | | 1.6 | 0.3 | 0.3 | | 0.2 | 0.0 |
| Delay (s) | | 2.1 | | | 4.1 | | 23.2 | 20.7 | 20.6 | | 20.2 | 19.6 |
| Level of Service | | A | | | A | | C | C | C | | C | B |
| Approach Delay (s) | | 2.1 | | | 4.1 | | | 21.3 | | | 19.9 | |
| Approach LOS | | A | | | A | | | C | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 8.6 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.51 | | |
| Actuated Cycle Length (s) | 60.0 | Sum of lost time (s) | 9.0 |
| Intersection Capacity Utilization | 61.5% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (vph) | 158 | 374 | 311 | 48 | 46 | 211 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 10 | 10 | 10 | 10 | 10 | 10 |
| Total Lost time (s) | | 5.0 | 5.0 | | 5.0 | 5.0 |
| Lane Util. Factor | | 0.95 | 0.95 | | 1.00 | 1.00 |
| Frpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | 0.98 |
| Flpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | | 1.00 | 0.98 | | 1.00 | 0.85 |
| Flt Protected | | 0.99 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | | 3255 | 3237 | | 1652 | 1451 |
| Flt Permitted | | 0.68 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | | 2239 | 3237 | | 1652 | 1451 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Growth Factor (vph) | 135% | 135% | 135% | 135% | 135% | 135% |
| Adj. Flow (vph) | 232 | 549 | 456 | 70 | 68 | 310 |
| RTOR Reduction (vph) | 0 | 0 | 13 | 0 | 0 | 265 |
| Lane Group Flow (vph) | 0 | 781 | 513 | 0 | 68 | 45 |
| Confl. Peds. (#/hr) | | | | | | 4 |
| Turn Type | Perm | | | | | Perm |
| Protected Phases | | 2 | 6 | | 4 | |
| Permitted Phases | 2 | | | | | 4 |
| Actuated Green, G (s) | | 41.3 | 41.3 | | 8.7 | 8.7 |
| Effective Green, g (s) | | 41.3 | 41.3 | | 8.7 | 8.7 |
| Actuated g/C Ratio | | 0.69 | 0.69 | | 0.14 | 0.14 |
| Clearance Time (s) | | 5.0 | 5.0 | | 5.0 | 5.0 |
| Vehicle Extension (s) | | 3.0 | 3.0 | | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | 1541 | 2228 | | 240 | 210 |
| v/s Ratio Prot | | | 0.16 | | c0.04 | |
| v/s Ratio Perm | | c0.35 | | | | 0.03 |
| v/c Ratio | | 0.51 | 0.23 | | 0.28 | 0.21 |
| Uniform Delay, d1 | | 4.5 | 3.5 | | 22.9 | 22.6 |
| Progression Factor | | 0.86 | 1.69 | | 1.00 | 1.00 |
| Incremental Delay, d2 | | 1.1 | 0.2 | | 0.7 | 0.5 |
| Delay (s) | | 5.0 | 6.1 | | 23.5 | 23.1 |
| Level of Service | | A | A | | C | C |
| Approach Delay (s) | | 5.0 | 6.1 | | 23.2 | |
| Approach LOS | | A | A | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 9.4 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.47 | | |
| Actuated Cycle Length (s) | 60.0 | Sum of lost time (s) | 10.0 |
| Intersection Capacity Utilization | 50.6% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | ↰ | ↱ | | ↰↑ | ↑↱ | |
| Volume (vph) | 231 | 123 | 114 | 431 | 425 | 232 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 10 | 10 | 11 | 11 | 11 | 11 |
| Total Lost time (s) | 5.0 | 5.0 | | 4.7 | 4.7 | |
| Lane Util. Factor | 1.00 | 1.00 | | 0.95 | 0.95 | |
| Frt | 1.00 | 0.85 | | 1.00 | 0.95 | |
| Flt Protected | 0.95 | 1.00 | | 0.99 | 1.00 | |
| Satd. Flow (prot) | 1652 | 1478 | | 3386 | 3240 | |
| Flt Permitted | 0.95 | 1.00 | | 0.62 | 1.00 | |
| Satd. Flow (perm) | 1652 | 1478 | | 2112 | 3240 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Growth Factor (vph) | 135% | 135% | 126% | 126% | 126% | 126% |
| Adj. Flow (vph) | 339 | 180 | 156 | 590 | 582 | 318 |
| RTOR Reduction (vph) | 0 | 126 | 0 | 0 | 96 | 0 |
| Lane Group Flow (vph) | 339 | 54 | 0 | 746 | 804 | 0 |
| Turn Type | | Perm | Perm | | | |
| Protected Phases | 2 | | | 8 | 4 | |
| Permitted Phases | | 2 | 8 | | | |
| Actuated Green, G (s) | 17.6 | 17.6 | | 32.7 | 32.7 | |
| Effective Green, g (s) | 17.6 | 17.6 | | 32.7 | 32.7 | |
| Actuated g/C Ratio | 0.29 | 0.29 | | 0.55 | 0.55 | |
| Clearance Time (s) | 5.0 | 5.0 | | 4.7 | 4.7 | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 485 | 434 | | 1151 | 1766 | |
| v/s Ratio Prot | c0.21 | | | | 0.25 | |
| v/s Ratio Perm | | 0.04 | | c0.35 | | |
| v/c Ratio | 0.70 | 0.12 | | 0.65 | 0.46 | |
| Uniform Delay, d1 | 18.8 | 15.5 | | 9.6 | 8.3 | |
| Progression Factor | 0.80 | 1.47 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 4.0 | 0.1 | | 2.8 | 0.8 | |
| Delay (s) | 18.9 | 22.9 | | 12.4 | 9.1 | |
| Level of Service | B | C | | B | A | |
| Approach Delay (s) | 20.3 | | | 12.4 | 9.1 | |
| Approach LOS | C | | | B | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 12.9 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.67 | | |
| Actuated Cycle Length (s) | 60.0 | Sum of lost time (s) | 9.7 |
| Intersection Capacity Utilization | 72.6% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBU | NBL | NBT | NBR | SBU | SBL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Volume (vph) | 2 | 36 | 12 | 212 | 67 | 245 | 1 | 3 | 776 | 251 | 2 | 118 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 14 | 12 | 10 | 10 | 10 | 12 | 11 | 11 | 11 | 12 | 11 |
| Total Lost time (s) | | 5.5 | | 5.5 | 5.5 | 5.5 | | 5.0 | 5.0 | 5.0 | | 5.0 |
| Lane Util. Factor | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 0.91 | 1.00 | | 1.00 |
| Frpb, ped/bikes | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 |
| Flpb, ped/bikes | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 |
| Frt | | 0.97 | | 1.00 | 1.00 | 0.85 | | 1.00 | 1.00 | 0.85 | | 1.00 |
| Flt Protected | | 1.00 | | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 | 1.00 | | 0.95 |
| Satd. Flow (prot) | | 1912 | | 1652 | 1739 | 1478 | | 1711 | 4916 | 1531 | | 1711 |
| Flt Permitted | | 0.98 | | 0.67 | 1.00 | 1.00 | | 0.95 | 1.00 | 1.00 | | 0.95 |
| Satd. Flow (perm) | | 1881 | | 1164 | 1739 | 1478 | | 1711 | 4916 | 1531 | | 1711 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Growth Factor (vph) | 135% | 135% | 135% | 135% | 135% | 135% | 149% | 149% | 149% | 149% | 149% | 149% |
| Adj. Flow (vph) | 3 | 53 | 18 | 311 | 98 | 360 | 2 | 5 | 1257 | 407 | 3 | 191 |
| RTOR Reduction (vph) | 0 | 11 | 0 | 0 | 0 | 199 | 0 | 0 | 0 | 191 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 63 | 0 | 311 | 98 | 161 | 0 | 7 | 1257 | 216 | 0 | 194 |
| Confl. Peds. (#/hr) | | | 1 | | | | | | | | | |
| Turn Type | Perm | | | pm+pt | | Perm | Prot | Prot | | Perm | Prot | Prot |
| Protected Phases | | 2 | | 1 | 6 | | 3 | 3 | 8 | | 7 | 7 |
| Permitted Phases | 2 | | | 6 | | 6 | | | | 8 | | |
| Actuated Green, G (s) | | 8.2 | | 29.7 | 29.7 | 29.7 | | 1.4 | 53.1 | 53.1 | | 21.7 |
| Effective Green, g (s) | | 8.2 | | 29.7 | 29.7 | 29.7 | | 1.4 | 53.1 | 53.1 | | 21.7 |
| Actuated g/C Ratio | | 0.07 | | 0.25 | 0.25 | 0.25 | | 0.01 | 0.44 | 0.44 | | 0.18 |
| Clearance Time (s) | | 5.5 | | 5.5 | 5.5 | 5.5 | | 5.0 | 5.0 | 5.0 | | 5.0 |
| Vehicle Extension (s) | | 3.0 | | 3.0 | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 | | 3.0 |
| Lane Grp Cap (vph) | | 129 | | 353 | 430 | 366 | | 20 | 2175 | 677 | | 309 |
| v/s Ratio Prot | | | | c0.12 | 0.06 | | | 0.00 | c0.26 | | | c0.11 |
| v/s Ratio Perm | | 0.03 | | c0.10 | | 0.11 | | | | 0.14 | | |
| v/c Ratio | | 0.49 | | 0.88 | 0.23 | 0.44 | | 0.35 | 0.58 | 0.32 | | 0.63 |
| Uniform Delay, d1 | | 53.9 | | 43.4 | 36.0 | 38.1 | | 58.8 | 25.1 | 21.7 | | 45.4 |
| Progression Factor | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 |
| Incremental Delay, d2 | | 2.9 | | 21.7 | 0.3 | 0.8 | | 10.3 | 1.1 | 1.2 | | 4.0 |
| Delay (s) | | 56.8 | | 65.1 | 36.3 | 39.0 | | 69.1 | 26.2 | 22.9 | | 49.4 |
| Level of Service | | E | | E | D | D | | E | C | C | | D |
| Approach Delay (s) | | 56.8 | | | 49.2 | | | | 25.6 | | | |
| Approach LOS | | E | | | D | | | | C | | | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 27.5 | HCM Level of Service | C |
| HCM Volume to Capacity ratio | 0.67 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 15.5 |
| Intersection Capacity Utilization | 75.0% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | SBT | SBR |
|---|---|---|
| Lane Configurations | ↑↑↑ | |
| Volume (vph) | 834 | 9 |
| Ideal Flow (vphpl) | 1900 | 1900 |
| Lane Width | 11 | 11 |
| Total Lost time (s) | 5.0 | |
| Lane Util. Factor | 0.91 | |
| Frpb, ped/bikes | 1.00 | |
| Flpb, ped/bikes | 1.00 | |
| Frt | 1.00 | |
| Flt Protected | 1.00 | |
| Satd. Flow (prot) | 4908 | |
| Flt Permitted | 1.00 | |
| Satd. Flow (perm) | 4908 | |
| Peak-hour factor, PHF | 0.92 | 0.92 |
| Growth Factor (vph) | 149% | 149% |
| Adj. Flow (vph) | 1351 | 15 |
| RTOR Reduction (vph) | 1 | 0 |
| Lane Group Flow (vph) | 1365 | 0 |
| Confl. Peds. (#/hr) | | |
| Turn Type | | |
| Protected Phases | 4 | |
| Permitted Phases | | |
| Actuated Green, G (s) | 73.4 | |
| Effective Green, g (s) | 73.4 | |
| Actuated g/C Ratio | 0.61 | |
| Clearance Time (s) | 5.0 | |
| Vehicle Extension (s) | 3.0 | |
| Lane Grp Cap (vph) | 3002 | |
| v/s Ratio Prot | 0.28 | |
| v/s Ratio Perm | | |
| v/c Ratio | 0.45 | |
| Uniform Delay, d1 | 12.5 | |
| Progression Factor | 1.00 | |
| Incremental Delay, d2 | 0.5 | |
| Delay (s) | 13.0 | |
| Level of Service | B | |
| Approach Delay (s) | 17.6 | |
| Approach LOS | B | |

Intersection Summary

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ↰↑↱ | | | ↰↑↱ | | ↰ | ↑ | ↱ | | ↰ | ↱ |
| Volume (vph) | 48 | 346 | 10 | 89 | 457 | 20 | 16 | 9 | 89 | 24 | 7 | 59 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 10 | 10 | 10 | 10 | 10 | 10 | 12 | 12 | 12 | 12 | 12 | 12 |
| Total Lost time (s) | | 5.0 | | | 5.0 | | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 |
| Lane Util. Factor | | 0.95 | | | 0.95 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frpb, ped/bikes | | 1.00 | | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Flpb, ped/bikes | | 1.00 | | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | | 1.00 | | | 0.99 | | 1.00 | 1.00 | 0.85 | | 1.00 | 0.85 |
| Flt Protected | | 0.99 | | | 0.99 | | 0.95 | 1.00 | 1.00 | | 0.96 | 1.00 |
| Satd. Flow (prot) | | 3269 | | | 3258 | | 1770 | 1863 | 1583 | | 1794 | 1583 |
| Flt Permitted | | 0.81 | | | 0.78 | | 0.73 | 1.00 | 1.00 | | 0.77 | 1.00 |
| Satd. Flow (perm) | | 2656 | | | 2554 | | 1369 | 1863 | 1583 | | 1431 | 1583 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Growth Factor (vph) | 135% | 135% | 135% | 135% | 135% | 135% | 135% | 135% | 135% | 100% | 100% | 100% |
| Adj. Flow (vph) | 70 | 508 | 15 | 131 | 671 | 29 | 23 | 13 | 131 | 26 | 8 | 64 |
| RTOR Reduction (vph) | 0 | 3 | 0 | 0 | 4 | 0 | 0 | 0 | 114 | 0 | 0 | 56 |
| Lane Group Flow (vph) | 0 | 590 | 0 | 0 | 827 | 0 | 23 | 13 | 17 | 0 | 34 | 8 |
| Confl. Peds. (#/hr) | | | 2 | | | 2 | | | | | | |
| Turn Type | Perm | | | Perm | | | Perm | | Perm | Perm | | Perm |
| Protected Phases | | 2 | | | 6 | | | 8 | | | 4 | |
| Permitted Phases | 2 | | | 6 | | | 8 | | 8 | 4 | | 4 |
| Actuated Green, G (s) | | 30.3 | | | 30.3 | | 5.7 | 5.7 | 5.7 | | 5.7 | 5.7 |
| Effective Green, g (s) | | 30.3 | | | 30.3 | | 5.7 | 5.7 | 5.7 | | 5.7 | 5.7 |
| Actuated g/C Ratio | | 0.67 | | | 0.67 | | 0.13 | 0.13 | 0.13 | | 0.13 | 0.13 |
| Clearance Time (s) | | 5.0 | | | 5.0 | | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 |
| Vehicle Extension (s) | | 3.0 | | | 3.0 | | 3.0 | 3.0 | 3.0 | | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | 1788 | | | 1720 | | 173 | 236 | 201 | | 181 | 201 |
| v/s Ratio Prot | | | | | | | | 0.01 | | | | |
| v/s Ratio Perm | | 0.22 | | | c0.32 | | 0.02 | | 0.01 | | c0.02 | 0.01 |
| v/c Ratio | | 0.33 | | | 0.48 | | 0.13 | 0.06 | 0.08 | | 0.19 | 0.04 |
| Uniform Delay, d1 | | 3.1 | | | 3.6 | | 17.5 | 17.3 | 17.3 | | 17.6 | 17.2 |
| Progression Factor | | 1.00 | | | 1.02 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.5 | | | 1.0 | | 0.4 | 0.1 | 0.2 | | 0.5 | 0.1 |
| Delay (s) | | 3.6 | | | 4.6 | | 17.8 | 17.4 | 17.5 | | 18.1 | 17.3 |
| Level of Service | | A | | | A | | B | B | B | | B | B |
| Approach Delay (s) | | 3.6 | | | 4.6 | | | 17.5 | | | 17.6 | |
| Approach LOS | | A | | | A | | | B | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 6.3 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.43 | | |
| Actuated Cycle Length (s) | 45.0 | Sum of lost time (s) | 9.0 |
| Intersection Capacity Utilization | 56.7% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (vph) | 99 | 240 | 252 | 41 | 49 | 185 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 10 | 10 | 10 | 10 | 10 | 10 |
| Total Lost time (s) | | 5.0 | 5.0 | | 5.0 | 5.0 |
| Lane Util. Factor | | 0.95 | 0.95 | | 1.00 | 1.00 |
| Frt | | 1.00 | 0.98 | | 1.00 | 0.85 |
| Flt Protected | | 0.99 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | | 3256 | 3234 | | 1652 | 1478 |
| Flt Permitted | | 0.74 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | | 2438 | 3234 | | 1652 | 1478 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Growth Factor (vph) | 135% | 135% | 135% | 135% | 135% | 135% |
| Adj. Flow (vph) | 145 | 352 | 370 | 60 | 72 | 271 |
| RTOR Reduction (vph) | 0 | 0 | 21 | 0 | 0 | 223 |
| Lane Group Flow (vph) | 0 | 497 | 409 | 0 | 72 | 48 |
| Turn Type | Perm | | | | | Perm |
| Protected Phases | | 2 | 6 | | 4 | |
| Permitted Phases | 2 | | | | | 4 |
| Actuated Green, G (s) | | 27.1 | 27.1 | | 7.9 | 7.9 |
| Effective Green, g (s) | | 27.1 | 27.1 | | 7.9 | 7.9 |
| Actuated g/C Ratio | | 0.60 | 0.60 | | 0.18 | 0.18 |
| Clearance Time (s) | | 5.0 | 5.0 | | 5.0 | 5.0 |
| Vehicle Extension (s) | | 3.0 | 3.0 | | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | 1468 | 1948 | | 290 | 259 |
| v/s Ratio Prot | | | 0.13 | | c0.04 | |
| v/s Ratio Perm | | c0.20 | | | | 0.03 |
| v/c Ratio | | 0.34 | 0.21 | | 0.25 | 0.18 |
| Uniform Delay, d1 | | 4.5 | 4.1 | | 16.0 | 15.8 |
| Progression Factor | | 0.69 | 0.32 | | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.6 | 0.2 | | 0.5 | 0.3 |
| Delay (s) | | 3.7 | 1.5 | | 16.4 | 16.1 |
| Level of Service | | A | A | | B | B |
| Approach Delay (s) | | 3.7 | 1.5 | | 16.2 | |
| Approach LOS | | A | A | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 6.3 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.32 | | |
| Actuated Cycle Length (s) | 45.0 | Sum of lost time (s) | 10.0 |
| Intersection Capacity Utilization | 41.5% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (vph) | 197 | 73 | 73 | 366 | 340 | 193 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 10 | 10 | 11 | 11 | 11 | 11 |
| Total Lost time (s) | 5.0 | 5.0 | | 4.7 | 4.7 | |
| Lane Util. Factor | 1.00 | 1.00 | | 0.95 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.85 | | 1.00 | 0.95 | |
| Flt Protected | 0.95 | 1.00 | | 0.99 | 1.00 | |
| Satd. Flow (prot) | 1652 | 1478 | | 3393 | 3236 | |
| Flt Permitted | 0.95 | 1.00 | | 0.76 | 1.00 | |
| Satd. Flow (perm) | 1652 | 1478 | | 2588 | 3236 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Growth Factor (vph) | 135% | 135% | 126% | 126% | 126% | 126% |
| Adj. Flow (vph) | 289 | 107 | 100 | 501 | 466 | 264 |
| RTOR Reduction (vph) | 0 | 76 | 0 | 0 | 134 | 0 |
| Lane Group Flow (vph) | 289 | 31 | 0 | 601 | 596 | 0 |
| Confl. Peds. (#/hr) | 5 | | | | | |
| Turn Type | | Perm | Perm | | | |
| Protected Phases | 2 | | | 8 | 4 | |
| Permitted Phases | | 2 | 8 | | | |
| Actuated Green, G (s) | 13.2 | 13.2 | | 22.1 | 22.1 | |
| Effective Green, g (s) | 13.2 | 13.2 | | 22.1 | 22.1 | |
| Actuated g/C Ratio | 0.29 | 0.29 | | 0.49 | 0.49 | |
| Clearance Time (s) | 5.0 | 5.0 | | 4.7 | 4.7 | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 485 | 434 | | 1271 | 1589 | |
| v/s Ratio Prot | c0.17 | | | | 0.18 | |
| v/s Ratio Perm | | 0.02 | | c0.23 | | |
| v/c Ratio | 0.60 | 0.07 | | 0.47 | 0.37 | |
| Uniform Delay, d1 | 13.6 | 11.5 | | 7.6 | 7.1 | |
| Progression Factor | 0.78 | 0.70 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 1.9 | 0.1 | | 1.3 | 0.7 | |
| Delay (s) | 12.5 | 8.1 | | 8.9 | 7.8 | |
| Level of Service | B | A | | A | A | |
| Approach Delay (s) | 11.3 | | | 8.9 | 7.8 | |
| Approach LOS | B | | | A | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 9.0 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.52 | | |
| Actuated Cycle Length (s) | 45.0 | Sum of lost time (s) | 9.7 |
| Intersection Capacity Utilization | 61.8% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBU | NBL | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ✥ | | ↰ | ↑ | ↱ | | ↰ | ↑↑↑ | ↱ | ↰ | ↑↑↑ |
| Volume (vph) | 11 | 82 | 31 | 113 | 99 | 141 | 1 | 1 | 969 | 202 | 159 | 1105 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 14 | 12 | 11 | 11 | 11 | 12 | 11 | 11 | 11 | 11 | 11 |
| Total Lost time (s) | | 5.5 | | 5.5 | 5.5 | 5.5 | | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 |
| Lane Util. Factor | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 0.91 | 1.00 | 1.00 | 0.91 |
| Frpb, ped/bikes | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Flpb, ped/bikes | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.97 | | 1.00 | 1.00 | 0.85 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 |
| Flt Protected | | 1.00 | | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (prot) | | 1912 | | 1711 | 1801 | 1531 | | 1711 | 4916 | 1531 | 1711 | 4913 |
| Flt Permitted | | 0.96 | | 0.41 | 1.00 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 |
| Satd. Flow (perm) | | 1843 | | 743 | 1801 | 1531 | | 1711 | 4916 | 1531 | 1711 | 4913 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Growth Factor (vph) | 135% | 135% | 135% | 135% | 135% | 135% | 149% | 149% | 149% | 149% | 149% | 149% |
| Adj. Flow (vph) | 16 | 120 | 45 | 166 | 145 | 207 | 2 | 2 | 1569 | 327 | 258 | 1790 |
| RTOR Reduction (vph) | 0 | 10 | 0 | 0 | 0 | 160 | 0 | 0 | 0 | 124 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 171 | 0 | 166 | 145 | 47 | 0 | 4 | 1569 | 203 | 258 | 1795 |
| Confl. Peds. (#/hr) | | | | | | | | | | | | |
| Turn Type | Perm | | | pm+pt | | Perm | Prot | Prot | | Perm | Prot | |
| Protected Phases | | 2 | | 1 | 6 | | 3 | 3 | 8 | | 7 | 4 |
| Permitted Phases | 2 | | | 6 | | 6 | | | | 8 | | |
| Actuated Green, G (s) | | 15.4 | | 27.4 | 27.4 | 27.4 | | 1.3 | 52.2 | 52.2 | 24.9 | 75.8 |
| Effective Green, g (s) | | 15.4 | | 27.4 | 27.4 | 27.4 | | 1.3 | 52.2 | 52.2 | 24.9 | 75.8 |
| Actuated g/C Ratio | | 0.13 | | 0.23 | 0.23 | 0.23 | | 0.01 | 0.44 | 0.44 | 0.21 | 0.63 |
| Clearance Time (s) | | 5.5 | | 5.5 | 5.5 | 5.5 | | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 |
| Vehicle Extension (s) | | 3.0 | | 3.0 | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | 237 | | 222 | 411 | 350 | | 19 | 2138 | 666 | 355 | 3103 |
| v/s Ratio Prot | | | | c0.04 | 0.08 | | | 0.00 | c0.32 | | c0.15 | 0.37 |
| v/s Ratio Perm | | 0.09 | | c0.13 | | 0.03 | | | | 0.13 | | |
| v/c Ratio | | 0.72 | | 0.75 | 0.35 | 0.14 | | 0.21 | 0.73 | 0.30 | 0.73 | 0.58 |
| Uniform Delay, d1 | | 50.2 | | 49.4 | 38.9 | 36.9 | | 58.8 | 28.1 | 22.1 | 44.4 | 12.8 |
| Progression Factor | | 1.00 | | 0.99 | 0.97 | 1.50 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | | 10.0 | | 12.3 | 0.5 | 0.2 | | 5.5 | 2.3 | 1.2 | 7.2 | 0.8 |
| Delay (s) | | 60.2 | | 61.2 | 38.4 | 55.3 | | 64.3 | 30.4 | 23.3 | 51.6 | 13.6 |
| Level of Service | | E | | E | D | E | | E | C | C | D | B |
| Approach Delay (s) | | 60.2 | | | 52.5 | | | | 29.3 | | | 18.4 |
| Approach LOS | | E | | | D | | | | C | | | B |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 28.2 | HCM Level of Service | C |
| HCM Volume to Capacity ratio | 0.73 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 15.5 |
| Intersection Capacity Utilization | 76.2% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | SBR |
|---|---|
| Lane Configurations | |
| Volume (vph) | 3 |
| Ideal Flow (vphpl) | 1900 |
| Lane Width | 11 |
| Total Lost time (s) | |
| Lane Util. Factor | |
| Frpb, ped/bikes | |
| Flpb, ped/bikes | |
| Frt | |
| Flt Protected | |
| Satd. Flow (prot) | |
| Flt Permitted | |
| Satd. Flow (perm) | |
| Peak-hour factor, PHF | 0.92 |
| Growth Factor (vph) | 149% |
| Adj. Flow (vph) | 5 |
| RTOR Reduction (vph) | 0 |
| Lane Group Flow (vph) | 0 |
| Confl. Peds. (#/hr) | 1 |
| Turn Type | |
| Protected Phases | |
| Permitted Phases | |
| Actuated Green, G (s) | |
| Effective Green, g (s) | |
| Actuated g/C Ratio | |
| Clearance Time (s) | |
| Vehicle Extension (s) | |
| Lane Grp Cap (vph) | |
| v/s Ratio Prot | |
| v/s Ratio Perm | |
| v/c Ratio | |
| Uniform Delay, d1 | |
| Progression Factor | |
| Incremental Delay, d2 | |
| Delay (s) | |
| Level of Service | |
| Approach Delay (s) | |
| Approach LOS | |

Intersection Summary

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Volume (vph) | 9 | 290 | 117 | 121 | 284 | 23 | 53 | 15 | 133 | 11 | 27 | 2 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 11 | 11 | 11 | 11 | 11 | 11 | 12 | 12 | 12 | 12 | 12 | 12 |
| Total Lost time (s) | | 5.0 | | | 5.0 | | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 |
| Lane Util. Factor | | 0.95 | | | 0.95 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frpb, ped/bikes | | 0.99 | | | 1.00 | | 1.00 | 1.00 | 0.99 | | 1.00 | 0.99 |
| Flpb, ped/bikes | | 1.00 | | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | | 0.96 | | | 0.99 | | 1.00 | 1.00 | 0.85 | | 1.00 | 0.85 |
| Flt Protected | | 1.00 | | | 0.99 | | 0.95 | 1.00 | 1.00 | | 0.99 | 1.00 |
| Satd. Flow (prot) | | 3248 | | | 3346 | | 1770 | 1863 | 1562 | | 1836 | 1560 |
| Flt Permitted | | 0.94 | | | 0.67 | | 0.73 | 1.00 | 1.00 | | 0.92 | 1.00 |
| Satd. Flow (perm) | | 3061 | | | 2276 | | 1360 | 1863 | 1562 | | 1721 | 1560 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Growth Factor (vph) | 135% | 135% | 135% | 135% | 135% | 135% | 135% | 135% | 135% | 100% | 100% | 100% |
| Adj. Flow (vph) | 13 | 426 | 172 | 178 | 417 | 34 | 78 | 22 | 195 | 12 | 29 | 2 |
| RTOR Reduction (vph) | 0 | 50 | 0 | 0 | 5 | 0 | 0 | 0 | 166 | 0 | 0 | 2 |
| Lane Group Flow (vph) | 0 | 562 | 0 | 0 | 624 | 0 | 78 | 22 | 29 | 0 | 41 | 0 |
| Confl. Peds. (#/hr) | | | 3 | | | | | | 1 | | | 2 |
| Turn Type | Perm | | | Perm | | | Perm | | Perm | Perm | | Perm |
| Protected Phases | | 2 | | | 6 | | | 8 | | | 4 | |
| Permitted Phases | 2 | | | 6 | | | 8 | | 8 | 4 | | 4 |
| Actuated Green, G (s) | | 42.0 | | | 42.0 | | 9.0 | 9.0 | 9.0 | | 9.0 | 9.0 |
| Effective Green, g (s) | | 42.0 | | | 42.0 | | 9.0 | 9.0 | 9.0 | | 9.0 | 9.0 |
| Actuated g/C Ratio | | 0.70 | | | 0.70 | | 0.15 | 0.15 | 0.15 | | 0.15 | 0.15 |
| Clearance Time (s) | | 5.0 | | | 5.0 | | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 |
| Vehicle Extension (s) | | 3.0 | | | 3.0 | | 3.0 | 3.0 | 3.0 | | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | 2143 | | | 1593 | | 204 | 279 | 234 | | 258 | 234 |
| v/s Ratio Prot | | | | | | | | 0.01 | | | | |
| v/s Ratio Perm | | 0.18 | | | c0.27 | | c0.06 | | 0.02 | | 0.02 | 0.00 |
| v/c Ratio | | 0.26 | | | 0.39 | | 0.38 | 0.08 | 0.12 | | 0.16 | 0.00 |
| Uniform Delay, d1 | | 3.3 | | | 3.7 | | 23.0 | 21.9 | 22.1 | | 22.2 | 21.7 |
| Progression Factor | | 0.76 | | | 0.40 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.2 | | | 0.7 | | 1.2 | 0.1 | 0.2 | | 0.3 | 0.0 |
| Delay (s) | | 2.8 | | | 2.2 | | 24.2 | 22.1 | 22.3 | | 22.5 | 21.7 |
| Level of Service | | A | | | A | | C | C | C | | C | C |
| Approach Delay (s) | | 2.8 | | | 2.2 | | | 22.8 | | | 22.5 | |
| Approach LOS | | A | | | A | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 6.8 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.39 | | |
| Actuated Cycle Length (s) | 60.0 | Sum of lost time (s) | 9.0 |
| Intersection Capacity Utilization | 54.9% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (vph) | 151 | 378 | 352 | 49 | 50 | 143 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 10 | 10 | 10 | 10 | 10 | 10 |
| Total Lost time (s) | | 5.0 | 5.0 | | 5.0 | 5.0 |
| Lane Util. Factor | | 0.95 | 0.95 | | 1.00 | 1.00 |
| Frpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | 0.99 |
| Flpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | | 1.00 | 0.98 | | 1.00 | 0.85 |
| Flt Protected | | 0.99 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | | 3257 | 3243 | | 1652 | 1458 |
| Flt Permitted | | 0.66 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | | 2196 | 3243 | | 1652 | 1458 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Growth Factor (vph) | 135% | 135% | 135% | 135% | 135% | 135% |
| Adj. Flow (vph) | 222 | 555 | 517 | 72 | 73 | 210 |
| RTOR Reduction (vph) | 0 | 0 | 11 | 0 | 0 | 181 |
| Lane Group Flow (vph) | 0 | 777 | 578 | 0 | 73 | 29 |
| Confl. Peds. (#/hr) | | | | | | 1 |
| Turn Type | Perm | | | | | Perm |
| Protected Phases | | 2 | 6 | | 4 | |
| Permitted Phases | 2 | | | | | 4 |
| Actuated Green, G (s) | | 41.7 | 41.7 | | 8.3 | 8.3 |
| Effective Green, g (s) | | 41.7 | 41.7 | | 8.3 | 8.3 |
| Actuated g/C Ratio | | 0.70 | 0.70 | | 0.14 | 0.14 |
| Clearance Time (s) | | 5.0 | 5.0 | | 5.0 | 5.0 |
| Vehicle Extension (s) | | 3.0 | 3.0 | | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | 1526 | 2254 | | 229 | 202 |
| v/s Ratio Prot | | | 0.18 | | c0.04 | |
| v/s Ratio Perm | | c0.35 | | | | 0.02 |
| v/c Ratio | | 0.51 | 0.26 | | 0.32 | 0.14 |
| Uniform Delay, d1 | | 4.3 | 3.4 | | 23.3 | 22.7 |
| Progression Factor | | 1.41 | 1.47 | | 1.00 | 1.00 |
| Incremental Delay, d2 | | 1.2 | 0.3 | | 0.8 | 0.3 |
| Delay (s) | | 7.3 | 5.2 | | 24.1 | 23.1 |
| Level of Service | | A | A | | C | C |
| Approach Delay (s) | | 7.3 | 5.2 | | 23.3 | |
| Approach LOS | | A | A | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 9.3 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.48 | | |
| Actuated Cycle Length (s) | 60.0 | Sum of lost time (s) | 10.0 |
| Intersection Capacity Utilization | 51.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (vph) | 242 | 162 | 137 | 466 | 425 | 185 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 10 | 10 | 11 | 11 | 11 | 11 |
| Total Lost time (s) | 5.0 | 5.0 | | 4.7 | 4.7 | |
| Lane Util. Factor | 1.00 | 1.00 | | 0.95 | 0.95 | |
| Frt | 1.00 | 0.85 | | 1.00 | 0.95 | |
| Flt Protected | 0.95 | 1.00 | | 0.99 | 1.00 | |
| Satd. Flow (prot) | 1652 | 1478 | | 3383 | 3266 | |
| Flt Permitted | 0.95 | 1.00 | | 0.61 | 1.00 | |
| Satd. Flow (perm) | 1652 | 1478 | | 2071 | 3266 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Growth Factor (vph) | 135% | 135% | 126% | 126% | 126% | 126% |
| Adj. Flow (vph) | 355 | 238 | 188 | 638 | 582 | 253 |
| RTOR Reduction (vph) | 0 | 124 | 0 | 0 | 66 | 0 |
| Lane Group Flow (vph) | 355 | 114 | 0 | 826 | 769 | 0 |
| Turn Type | | Perm | Perm | | | |
| Protected Phases | 2 | | | 8 | 4 | |
| Permitted Phases | | 2 | 8 | | | |
| Actuated Green, G (s) | 18.3 | 18.3 | | 32.0 | 32.0 | |
| Effective Green, g (s) | 18.3 | 18.3 | | 32.0 | 32.0 | |
| Actuated g/C Ratio | 0.30 | 0.30 | | 0.53 | 0.53 | |
| Clearance Time (s) | 5.0 | 5.0 | | 4.7 | 4.7 | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 504 | 451 | | 1105 | 1742 | |
| v/s Ratio Prot | c0.21 | | | | 0.24 | |
| v/s Ratio Perm | | 0.08 | | c0.40 | | |
| v/c Ratio | 0.70 | 0.25 | | 0.75 | 0.44 | |
| Uniform Delay, d1 | 18.5 | 15.7 | | 10.9 | 8.5 | |
| Progression Factor | 1.02 | 1.58 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 4.0 | 0.3 | | 4.6 | 0.8 | |
| Delay (s) | 22.8 | 25.1 | | 15.5 | 9.4 | |
| Level of Service | C | C | | B | A | |
| Approach Delay (s) | 23.7 | | | 15.5 | 9.4 | |
| Approach LOS | C | | | B | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 15.4 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.73 | | |
| Actuated Cycle Length (s) | 60.0 | Sum of lost time (s) | 9.7 |
| Intersection Capacity Utilization | 73.6% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBU | NBL | NBT | NBR | SBU | SBL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Volume (vph) | 6 | 35 | 10 | 235 | 119 | 218 | 11 | 9 | 1333 | 196 | 2 | 136 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 14 | 12 | 11 | 11 | 11 | 12 | 11 | 11 | 11 | 12 | 11 |
| Total Lost time (s) | | 5.5 | | 5.5 | 5.5 | 5.5 | | 5.0 | 5.0 | 5.0 | | 5.0 |
| Lane Util. Factor | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 0.91 | 1.00 | | 1.00 |
| Frpb, ped/bikes | | 1.00 | | 1.00 | 1.00 | 0.98 | | 1.00 | 1.00 | 0.96 | | 1.00 |
| Flpb, ped/bikes | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 |
| Frt | | 0.97 | | 1.00 | 1.00 | 0.85 | | 1.00 | 1.00 | 0.85 | | 1.00 |
| Flt Protected | | 0.99 | | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 | 1.00 | | 0.95 |
| Satd. Flow (prot) | | 1915 | | 1711 | 1801 | 1503 | | 1711 | 4916 | 1467 | | 1711 |
| Flt Permitted | | 0.52 | | 0.67 | 1.00 | 1.00 | | 0.95 | 1.00 | 1.00 | | 0.95 |
| Satd. Flow (perm) | | 996 | | 1210 | 1801 | 1503 | | 1711 | 4916 | 1467 | | 1711 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Growth Factor (vph) | 135% | 135% | 135% | 135% | 135% | 135% | 149% | 149% | 149% | 149% | 149% | 149% |
| Adj. Flow (vph) | 9 | 51 | 15 | 345 | 175 | 320 | 18 | 15 | 2159 | 317 | 3 | 220 |
| RTOR Reduction (vph) | 0 | 8 | 0 | 0 | 0 | 179 | 0 | 0 | 0 | 84 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 67 | 0 | 345 | 175 | 141 | 0 | 33 | 2159 | 233 | 0 | 223 |
| Confl. Peds. (#/hr) | | | 4 | | | 5 | | | | 7 | | |
| Turn Type | Perm | | | pm+pt | | Perm | Prot | Prot | | Perm | Prot | Prot |
| Protected Phases | | 2 | | 1 | 6 | | 3 | 3 | 8 | | 7 | 7 |
| Permitted Phases | 2 | | | 6 | | 6 | | | | 8 | | |
| Actuated Green, G (s) | | 8.5 | | 32.2 | 32.2 | 32.2 | | 5.4 | 55.3 | 55.3 | | 17.0 |
| Effective Green, g (s) | | 8.5 | | 32.2 | 32.2 | 32.2 | | 5.4 | 55.3 | 55.3 | | 17.0 |
| Actuated g/C Ratio | | 0.07 | | 0.27 | 0.27 | 0.27 | | 0.05 | 0.46 | 0.46 | | 0.14 |
| Clearance Time (s) | | 5.5 | | 5.5 | 5.5 | 5.5 | | 5.0 | 5.0 | 5.0 | | 5.0 |
| Vehicle Extension (s) | | 3.0 | | 3.0 | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 | | 3.0 |
| Lane Grp Cap (vph) | | 71 | | 401 | 483 | 403 | | 77 | 2265 | 676 | | 242 |
| v/s Ratio Prot | | | | c0.13 | 0.10 | | | 0.02 | c0.44 | | | c0.13 |
| v/s Ratio Perm | | 0.07 | | c0.10 | | 0.09 | | | | 0.16 | | |
| v/c Ratio | | 0.94 | | 0.86 | 0.36 | 0.35 | | 0.43 | 0.95 | 0.35 | | 0.92 |
| Uniform Delay, d1 | | 55.5 | | 41.8 | 35.6 | 35.4 | | 55.8 | 31.1 | 20.7 | | 50.8 |
| Progression Factor | | 1.00 | | 0.90 | 0.91 | 1.08 | | 1.00 | 1.00 | 1.00 | | 1.00 |
| Incremental Delay, d2 | | 84.7 | | 15.6 | 0.4 | 0.5 | | 3.8 | 10.7 | 1.4 | | 37.1 |
| Delay (s) | | 140.2 | | 53.1 | 32.8 | 38.7 | | 59.6 | 41.8 | 22.1 | | 88.0 |
| Level of Service | | F | | D | C | D | | E | D | C | | F |
| Approach Delay (s) | | 140.2 | | | 43.4 | | | | 39.6 | | | |
| Approach LOS | | F | | | D | | | | D | | | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 37.1 | HCM Level of Service | D |
| HCM Volume to Capacity ratio | 0.91 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 15.5 |
| Intersection Capacity Utilization | 93.5% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | SBT | SBR |
|---|---|---|
| Lane Configurations | ↑↑↑ | |
| Volume (vph) | 1278 | 13 |
| Ideal Flow (vphpl) | 1900 | 1900 |
| Lane Width | 11 | 11 |
| Total Lost time (s) | 5.0 | |
| Lane Util. Factor | 0.91 | |
| Frpb, ped/bikes | 1.00 | |
| Flpb, ped/bikes | 1.00 | |
| Frt | 1.00 | |
| Flt Protected | 1.00 | |
| Satd. Flow (prot) | 4908 | |
| Flt Permitted | 1.00 | |
| Satd. Flow (perm) | 4908 | |
| Peak-hour factor, PHF | 0.92 | 0.92 |
| Growth Factor (vph) | 149% | 149% |
| Adj. Flow (vph) | 2070 | 21 |
| RTOR Reduction (vph) | 1 | 0 |
| Lane Group Flow (vph) | 2090 | 0 |
| Confl. Peds. (#/hr) | | |
| Turn Type | | |
| Protected Phases | 4 | |
| Permitted Phases | | |
| Actuated Green, G (s) | 66.9 | |
| Effective Green, g (s) | 66.9 | |
| Actuated g/C Ratio | 0.56 | |
| Clearance Time (s) | 5.0 | |
| Vehicle Extension (s) | 3.0 | |
| Lane Grp Cap (vph) | 2736 | |
| v/s Ratio Prot | 0.43 | |
| v/s Ratio Perm | | |
| v/c Ratio | 0.76 | |
| Uniform Delay, d1 | 20.5 | |
| Progression Factor | 1.00 | |
| Incremental Delay, d2 | 2.1 | |
| Delay (s) | 22.6 | |
| Level of Service | C | |
| Approach Delay (s) | 28.9 | |
| Approach LOS | C | |

Intersection Summary

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ↰↑↱ | | | ↰↑↱ | | ↰ | ↑ | ↱ | | ↰ | ↱ |
| Volume (vph) | 26 | 333 | 20 | 91 | 467 | 25 | 91 | 53 | 209 | 21 | 16 | 35 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 11 | 11 | 11 | 11 | 11 | 11 | 12 | 12 | 12 | 12 | 12 | 12 |
| Total Lost time (s) | | 5.0 | | | 5.0 | | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 |
| Lane Util. Factor | | 0.95 | | | 0.95 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frpb, ped/bikes | | 1.00 | | | 1.00 | | 1.00 | 1.00 | 0.99 | | 1.00 | 0.99 |
| Flpb, ped/bikes | | 1.00 | | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | | 0.99 | | | 0.99 | | 1.00 | 1.00 | 0.85 | | 1.00 | 0.85 |
| Flt Protected | | 1.00 | | | 0.99 | | 0.95 | 1.00 | 1.00 | | 0.97 | 1.00 |
| Satd. Flow (prot) | | 3379 | | | 3373 | | 1770 | 1863 | 1560 | | 1811 | 1560 |
| Flt Permitted | | 0.87 | | | 0.77 | | 0.73 | 1.00 | 1.00 | | 0.84 | 1.00 |
| Satd. Flow (perm) | | 2947 | | | 2627 | | 1362 | 1863 | 1560 | | 1566 | 1560 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Growth Factor (vph) | 135% | 135% | 135% | 135% | 135% | 135% | 135% | 135% | 135% | 100% | 100% | 100% |
| Adj. Flow (vph) | 38 | 489 | 29 | 134 | 685 | 37 | 134 | 78 | 307 | 23 | 17 | 38 |
| RTOR Reduction (vph) | 0 | 5 | 0 | 0 | 4 | 0 | 0 | 0 | 248 | 0 | 0 | 31 |
| Lane Group Flow (vph) | 0 | 551 | 0 | 0 | 852 | 0 | 134 | 78 | 59 | 0 | 40 | 7 |
| Confl. Peds. (#/hr) | | | 2 | | | | | | 2 | | | 2 |
| Turn Type | Perm | | | Perm | | | Perm | | Perm | Perm | | Perm |
| Protected Phases | | 2 | | | 6 | | | 8 | | | 4 | |
| Permitted Phases | 2 | | | 6 | | | 8 | | 8 | 4 | | 4 |
| Actuated Green, G (s) | | 39.4 | | | 39.4 | | 11.6 | 11.6 | 11.6 | | 11.6 | 11.6 |
| Effective Green, g (s) | | 39.4 | | | 39.4 | | 11.6 | 11.6 | 11.6 | | 11.6 | 11.6 |
| Actuated g/C Ratio | | 0.66 | | | 0.66 | | 0.19 | 0.19 | 0.19 | | 0.19 | 0.19 |
| Clearance Time (s) | | 5.0 | | | 5.0 | | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 |
| Vehicle Extension (s) | | 3.0 | | | 3.0 | | 3.0 | 3.0 | 3.0 | | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | 1935 | | | 1725 | | 263 | 360 | 302 | | 303 | 302 |
| v/s Ratio Prot | | | | | | | | 0.04 | | | | |
| v/s Ratio Perm | | 0.19 | | | c0.32 | | c0.10 | | 0.04 | | 0.03 | 0.00 |
| v/c Ratio | | 0.28 | | | 0.49 | | 0.51 | 0.22 | 0.20 | | 0.13 | 0.02 |
| Uniform Delay, d1 | | 4.3 | | | 5.2 | | 21.7 | 20.4 | 20.3 | | 20.0 | 19.6 |
| Progression Factor | | 0.41 | | | 0.55 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.3 | | | 1.0 | | 1.6 | 0.3 | 0.3 | | 0.2 | 0.0 |
| Delay (s) | | 2.1 | | | 3.9 | | 23.2 | 20.7 | 20.6 | | 20.2 | 19.6 |
| Level of Service | | A | | | A | | C | C | C | | C | B |
| Approach Delay (s) | | 2.1 | | | 3.9 | | | 21.3 | | | 19.9 | |
| Approach LOS | | A | | | A | | | C | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 8.5 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.50 | | |
| Actuated Cycle Length (s) | 60.0 | Sum of lost time (s) | 9.0 |
| Intersection Capacity Utilization | 61.5% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (vph) | 158 | 374 | 311 | 48 | 46 | 211 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 10 | 10 | 10 | 10 | 10 | 10 |
| Total Lost time (s) | | 5.0 | 5.0 | | 5.0 | 5.0 |
| Lane Util. Factor | | 0.95 | 0.95 | | 1.00 | 1.00 |
| Frpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | 0.98 |
| Flpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | | 1.00 | 0.98 | | 1.00 | 0.85 |
| Flt Protected | | 0.99 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | | 3255 | 3237 | | 1652 | 1451 |
| Flt Permitted | | 0.68 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | | 2239 | 3237 | | 1652 | 1451 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Growth Factor (vph) | 135% | 135% | 135% | 135% | 135% | 135% |
| Adj. Flow (vph) | 232 | 549 | 456 | 70 | 68 | 310 |
| RTOR Reduction (vph) | 0 | 0 | 13 | 0 | 0 | 265 |
| Lane Group Flow (vph) | 0 | 781 | 513 | 0 | 68 | 45 |
| Confl. Peds. (#/hr) | | | | | | 4 |
| Turn Type | Perm | | | | | Perm |
| Protected Phases | | 2 | 6 | | 4 | |
| Permitted Phases | 2 | | | | | 4 |
| Actuated Green, G (s) | | 41.3 | 41.3 | | 8.7 | 8.7 |
| Effective Green, g (s) | | 41.3 | 41.3 | | 8.7 | 8.7 |
| Actuated g/C Ratio | | 0.69 | 0.69 | | 0.14 | 0.14 |
| Clearance Time (s) | | 5.0 | 5.0 | | 5.0 | 5.0 |
| Vehicle Extension (s) | | 3.0 | 3.0 | | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | 1541 | 2228 | | 240 | 210 |
| v/s Ratio Prot | | | 0.16 | | c0.04 | |
| v/s Ratio Perm | | c0.35 | | | | 0.03 |
| v/c Ratio | | 0.51 | 0.23 | | 0.28 | 0.21 |
| Uniform Delay, d1 | | 4.5 | 3.5 | | 22.9 | 22.6 |
| Progression Factor | | 0.87 | 1.69 | | 1.00 | 1.00 |
| Incremental Delay, d2 | | 1.1 | 0.2 | | 0.7 | 0.5 |
| Delay (s) | | 5.0 | 6.1 | | 23.5 | 23.1 |
| Level of Service | | A | A | | C | C |
| Approach Delay (s) | | 5.0 | 6.1 | | 23.2 | |
| Approach LOS | | A | A | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 9.4 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.47 | | |
| Actuated Cycle Length (s) | 60.0 | Sum of lost time (s) | 10.0 |
| Intersection Capacity Utilization | 50.6% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (vph) | 231 | 123 | 114 | 431 | 425 | 232 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 10 | 10 | 11 | 11 | 11 | 11 |
| Total Lost time (s) | 5.0 | 5.0 | | 4.7 | 4.7 | |
| Lane Util. Factor | 1.00 | 1.00 | | 0.95 | 0.95 | |
| Frt | 1.00 | 0.85 | | 1.00 | 0.95 | |
| Flt Protected | 0.95 | 1.00 | | 0.99 | 1.00 | |
| Satd. Flow (prot) | 1652 | 1478 | | 3386 | 3240 | |
| Flt Permitted | 0.95 | 1.00 | | 0.62 | 1.00 | |
| Satd. Flow (perm) | 1652 | 1478 | | 2112 | 3240 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Growth Factor (vph) | 135% | 135% | 126% | 126% | 126% | 126% |
| Adj. Flow (vph) | 339 | 180 | 156 | 590 | 582 | 318 |
| RTOR Reduction (vph) | 0 | 126 | 0 | 0 | 96 | 0 |
| Lane Group Flow (vph) | 339 | 54 | 0 | 746 | 804 | 0 |
| Turn Type | | Perm | Perm | | | |
| Protected Phases | 2 | | | 8 | 4 | |
| Permitted Phases | | 2 | 8 | | | |
| Actuated Green, G (s) | 17.6 | 17.6 | | 32.7 | 32.7 | |
| Effective Green, g (s) | 17.6 | 17.6 | | 32.7 | 32.7 | |
| Actuated g/C Ratio | 0.29 | 0.29 | | 0.55 | 0.55 | |
| Clearance Time (s) | 5.0 | 5.0 | | 4.7 | 4.7 | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 485 | 434 | | 1151 | 1766 | |
| v/s Ratio Prot | c0.21 | | | | 0.25 | |
| v/s Ratio Perm | | 0.04 | | c0.35 | | |
| v/c Ratio | 0.70 | 0.12 | | 0.65 | 0.46 | |
| Uniform Delay, d1 | 18.8 | 15.5 | | 9.6 | 8.3 | |
| Progression Factor | 0.80 | 1.47 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 4.0 | 0.1 | | 2.8 | 0.8 | |
| Delay (s) | 19.0 | 23.0 | | 12.4 | 9.1 | |
| Level of Service | B | C | | B | A | |
| Approach Delay (s) | 20.4 | | | 12.4 | 9.1 | |
| Approach LOS | C | | | B | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 13.0 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.67 | | |
| Actuated Cycle Length (s) | 60.0 | Sum of lost time (s) | 9.7 |
| Intersection Capacity Utilization | 72.6% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBU | NBL | NBT | NBR | SBU | SBL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Volume (vph) | 2 | 36 | 12 | 212 | 67 | 245 | 1 | 3 | 776 | 251 | 2 | 118 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 12 | 14 | 12 | 11 | 11 | 11 | 12 | 11 | 11 | 11 | 12 | 11 |
| Total Lost time (s) | | 5.5 | | 5.5 | 5.5 | 5.5 | | 5.0 | 5.0 | 5.0 | | 5.0 |
| Lane Util. Factor | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 0.91 | 1.00 | | 1.00 |
| Frpb, ped/bikes | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 |
| Flpb, ped/bikes | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 |
| Frt | | 0.97 | | 1.00 | 1.00 | 0.85 | | 1.00 | 1.00 | 0.85 | | 1.00 |
| Flt Protected | | 1.00 | | 0.95 | 1.00 | 1.00 | | 0.95 | 1.00 | 1.00 | | 0.95 |
| Satd. Flow (prot) | | 1912 | | 1711 | 1801 | 1531 | | 1711 | 4916 | 1531 | | 1711 |
| Flt Permitted | | 0.98 | | 0.67 | 1.00 | 1.00 | | 0.95 | 1.00 | 1.00 | | 0.95 |
| Satd. Flow (perm) | | 1881 | | 1206 | 1801 | 1531 | | 1711 | 4916 | 1531 | | 1711 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Growth Factor (vph) | 135% | 135% | 135% | 135% | 135% | 135% | 149% | 149% | 149% | 149% | 149% | 149% |
| Adj. Flow (vph) | 3 | 53 | 18 | 311 | 98 | 360 | 2 | 5 | 1257 | 407 | 3 | 191 |
| RTOR Reduction (vph) | 0 | 11 | 0 | 0 | 0 | 200 | 0 | 0 | 0 | 190 | 0 | 0 |
| Lane Group Flow (vph) | 0 | 63 | 0 | 311 | 98 | 160 | 0 | 7 | 1257 | 217 | 0 | 194 |
| Confl. Peds. (#/hr) | | | 1 | | | | | | | | | |
| Turn Type | Perm | | | pm+pt | | Perm | Prot | Prot | | Perm | Prot | Prot |
| Protected Phases | | 2 | | 1 | 6 | | 3 | 3 | 8 | | 7 | 7 |
| Permitted Phases | 2 | | | 6 | | 6 | | | | 8 | | |
| Actuated Green, G (s) | | 8.2 | | 29.3 | 29.3 | 29.3 | | 1.4 | 53.4 | 53.4 | | 21.8 |
| Effective Green, g (s) | | 8.2 | | 29.3 | 29.3 | 29.3 | | 1.4 | 53.4 | 53.4 | | 21.8 |
| Actuated g/C Ratio | | 0.07 | | 0.24 | 0.24 | 0.24 | | 0.01 | 0.44 | 0.44 | | 0.18 |
| Clearance Time (s) | | 5.5 | | 5.5 | 5.5 | 5.5 | | 5.0 | 5.0 | 5.0 | | 5.0 |
| Vehicle Extension (s) | | 3.0 | | 3.0 | 3.0 | 3.0 | | 3.0 | 3.0 | 3.0 | | 3.0 |
| Lane Grp Cap (vph) | | 129 | | 360 | 440 | 374 | | 20 | 2188 | 681 | | 311 |
| v/s Ratio Prot | | | | c0.11 | 0.05 | | | 0.00 | c0.26 | | | c0.11 |
| v/s Ratio Perm | | 0.03 | | c0.10 | | 0.10 | | | | 0.14 | | |
| v/c Ratio | | 0.49 | | 0.86 | 0.22 | 0.43 | | 0.35 | 0.57 | 0.32 | | 0.62 |
| Uniform Delay, d1 | | 53.9 | | 43.5 | 36.2 | 38.3 | | 58.8 | 24.8 | 21.5 | | 45.3 |
| Progression Factor | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 |
| Incremental Delay, d2 | | 2.9 | | 18.8 | 0.3 | 0.8 | | 10.3 | 1.1 | 1.2 | | 3.9 |
| Delay (s) | | 56.8 | | 62.3 | 36.5 | 39.1 | | 69.1 | 25.9 | 22.8 | | 49.2 |
| Level of Service | | E | | E | D | D | | E | C | C | | D |
| Approach Delay (s) | | 56.8 | | | 48.1 | | | | 25.3 | | | |
| Approach LOS | | E | | | D | | | | C | | | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 27.2 | HCM Level of Service | C |
| HCM Volume to Capacity ratio | 0.66 | | |
| Actuated Cycle Length (s) | 120.0 | Sum of lost time (s) | 15.5 |
| Intersection Capacity Utilization | 75.0% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | SBT | SBR |
|---|---|---|
| Lane Configurations | ↑↑↑ | |
| Volume (vph) | 834 | 9 |
| Ideal Flow (vphpl) | 1900 | 1900 |
| Lane Width | 11 | 11 |
| Total Lost time (s) | 5.0 | |
| Lane Util. Factor | 0.91 | |
| Frpb, ped/bikes | 1.00 | |
| Flpb, ped/bikes | 1.00 | |
| Frt | 1.00 | |
| Flt Protected | 1.00 | |
| Satd. Flow (prot) | 4908 | |
| Flt Permitted | 1.00 | |
| Satd. Flow (perm) | 4908 | |
| Peak-hour factor, PHF | 0.92 | 0.92 |
| Growth Factor (vph) | 149% | 149% |
| Adj. Flow (vph) | 1351 | 15 |
| RTOR Reduction (vph) | 1 | 0 |
| Lane Group Flow (vph) | 1365 | 0 |
| Confl. Peds. (#/hr) | | |
| Turn Type | | |
| Protected Phases | 4 | |
| Permitted Phases | | |
| Actuated Green, G (s) | 73.8 | |
| Effective Green, g (s) | 73.8 | |
| Actuated g/C Ratio | 0.62 | |
| Clearance Time (s) | 5.0 | |
| Vehicle Extension (s) | 3.0 | |
| Lane Grp Cap (vph) | 3018 | |
| v/s Ratio Prot | 0.28 | |
| v/s Ratio Perm | | |
| v/c Ratio | 0.45 | |
| Uniform Delay, d1 | 12.3 | |
| Progression Factor | 1.00 | |
| Incremental Delay, d2 | 0.5 | |
| Delay (s) | 12.8 | |
| Level of Service | B | |
| Approach Delay (s) | 17.3 | |
| Approach LOS | B | |

Intersection Summary

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Volume (vph) | 48 | 346 | 10 | 89 | 457 | 20 | 16 | 9 | 89 | 24 | 7 | 59 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 11 | 11 | 11 | 11 | 11 | 11 | 12 | 12 | 12 | 12 | 12 | 12 |
| Total Lost time (s) | | 5.0 | | | 5.0 | | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 |
| Lane Util. Factor | | 0.95 | | | 0.95 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frpb, ped/bikes | | 1.00 | | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Flpb, ped/bikes | | 1.00 | | | 1.00 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | | 1.00 | | | 0.99 | | 1.00 | 1.00 | 0.85 | | 1.00 | 0.85 |
| Flt Protected | | 0.99 | | | 0.99 | | 0.95 | 1.00 | 1.00 | | 0.96 | 1.00 |
| Satd. Flow (prot) | | 3386 | | | 3374 | | 1770 | 1863 | 1583 | | 1794 | 1583 |
| Flt Permitted | | 0.81 | | | 0.78 | | 0.73 | 1.00 | 1.00 | | 0.77 | 1.00 |
| Satd. Flow (perm) | | 2751 | | | 2646 | | 1369 | 1863 | 1583 | | 1431 | 1583 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Growth Factor (vph) | 135% | 135% | 135% | 135% | 135% | 135% | 135% | 135% | 135% | 100% | 100% | 100% |
| Adj. Flow (vph) | 70 | 508 | 15 | 131 | 671 | 29 | 23 | 13 | 131 | 26 | 8 | 64 |
| RTOR Reduction (vph) | 0 | 3 | 0 | 0 | 4 | 0 | 0 | 0 | 114 | 0 | 0 | 56 |
| Lane Group Flow (vph) | 0 | 590 | 0 | 0 | 827 | 0 | 23 | 13 | 17 | 0 | 34 | 8 |
| Confl. Peds. (#/hr) | | | 2 | | | 2 | | | | | | |
| Turn Type | Perm | | | Perm | | | Perm | | Perm | Perm | | Perm |
| Protected Phases | | 2 | | | 6 | | | 8 | | | 4 | |
| Permitted Phases | 2 | | | 6 | | | 8 | | 8 | 4 | | 4 |
| Actuated Green, G (s) | | 30.3 | | | 30.3 | | 5.7 | 5.7 | 5.7 | | 5.7 | 5.7 |
| Effective Green, g (s) | | 30.3 | | | 30.3 | | 5.7 | 5.7 | 5.7 | | 5.7 | 5.7 |
| Actuated g/C Ratio | | 0.67 | | | 0.67 | | 0.13 | 0.13 | 0.13 | | 0.13 | 0.13 |
| Clearance Time (s) | | 5.0 | | | 5.0 | | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 |
| Vehicle Extension (s) | | 3.0 | | | 3.0 | | 3.0 | 3.0 | 3.0 | | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | 1852 | | | 1782 | | 173 | 236 | 201 | | 181 | 201 |
| v/s Ratio Prot | | | | | | | | 0.01 | | | | |
| v/s Ratio Perm | | 0.21 | | | c0.31 | | 0.02 | | 0.01 | | c0.02 | 0.01 |
| v/c Ratio | | 0.32 | | | 0.46 | | 0.13 | 0.06 | 0.08 | | 0.19 | 0.04 |
| Uniform Delay, d1 | | 3.1 | | | 3.5 | | 17.5 | 17.3 | 17.3 | | 17.6 | 17.2 |
| Progression Factor | | 1.00 | | | 1.01 | | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.5 | | | 0.9 | | 0.4 | 0.1 | 0.2 | | 0.5 | 0.1 |
| Delay (s) | | 3.5 | | | 4.4 | | 17.8 | 17.4 | 17.5 | | 18.1 | 17.3 |
| Level of Service | | A | | | A | | B | B | B | | B | B |
| Approach Delay (s) | | 3.5 | | | 4.4 | | | 17.5 | | | 17.6 | |
| Approach LOS | | A | | | A | | | B | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 6.1 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.42 | | |
| Actuated Cycle Length (s) | 45.0 | Sum of lost time (s) | 9.0 |
| Intersection Capacity Utilization | 56.7% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (vph) | 99 | 240 | 252 | 41 | 49 | 185 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 10 | 10 | 10 | 10 | 10 | 10 |
| Total Lost time (s) | | 5.0 | 5.0 | | 5.0 | 5.0 |
| Lane Util. Factor | | 0.95 | 0.95 | | 1.00 | 1.00 |
| Frt | | 1.00 | 0.98 | | 1.00 | 0.85 |
| Flt Protected | | 0.99 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | | 3256 | 3234 | | 1652 | 1478 |
| Flt Permitted | | 0.74 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | | 2438 | 3234 | | 1652 | 1478 |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Growth Factor (vph) | 135% | 135% | 135% | 135% | 135% | 135% |
| Adj. Flow (vph) | 145 | 352 | 370 | 60 | 72 | 271 |
| RTOR Reduction (vph) | 0 | 0 | 21 | 0 | 0 | 223 |
| Lane Group Flow (vph) | 0 | 497 | 409 | 0 | 72 | 48 |
| Turn Type | Perm | | | | | Perm |
| Protected Phases | | 2 | 6 | | 4 | |
| Permitted Phases | 2 | | | | | 4 |
| Actuated Green, G (s) | | 27.1 | 27.1 | | 7.9 | 7.9 |
| Effective Green, g (s) | | 27.1 | 27.1 | | 7.9 | 7.9 |
| Actuated g/C Ratio | | 0.60 | 0.60 | | 0.18 | 0.18 |
| Clearance Time (s) | | 5.0 | 5.0 | | 5.0 | 5.0 |
| Vehicle Extension (s) | | 3.0 | 3.0 | | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | 1468 | 1948 | | 290 | 259 |
| v/s Ratio Prot | | | 0.13 | | c0.04 | |
| v/s Ratio Perm | | c0.20 | | | | 0.03 |
| v/c Ratio | | 0.34 | 0.21 | | 0.25 | 0.18 |
| Uniform Delay, d1 | | 4.5 | 4.1 | | 16.0 | 15.8 |
| Progression Factor | | 0.69 | 0.32 | | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.6 | 0.2 | | 0.5 | 0.3 |
| Delay (s) | | 3.7 | 1.5 | | 16.4 | 16.1 |
| Level of Service | | A | A | | B | B |
| Approach Delay (s) | | 3.7 | 1.5 | | 16.2 | |
| Approach LOS | | A | A | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 6.3 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.32 | | |
| Actuated Cycle Length (s) | 45.0 | Sum of lost time (s) | 10.0 |
| Intersection Capacity Utilization | 41.5% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (vph) | 197 | 73 | 73 | 366 | 340 | 193 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Lane Width | 10 | 10 | 11 | 11 | 11 | 11 |
| Total Lost time (s) | 5.0 | 5.0 | | 4.7 | 4.7 | |
| Lane Util. Factor | 1.00 | 1.00 | | 0.95 | 0.95 | |
| Frpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.85 | | 1.00 | 0.95 | |
| Flt Protected | 0.95 | 1.00 | | 0.99 | 1.00 | |
| Satd. Flow (prot) | 1652 | 1478 | | 3393 | 3236 | |
| Flt Permitted | 0.95 | 1.00 | | 0.76 | 1.00 | |
| Satd. Flow (perm) | 1652 | 1478 | | 2588 | 3236 | |
| Peak-hour factor, PHF | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Growth Factor (vph) | 135% | 135% | 126% | 126% | 126% | 126% |
| Adj. Flow (vph) | 289 | 107 | 100 | 501 | 466 | 264 |
| RTOR Reduction (vph) | 0 | 76 | 0 | 0 | 134 | 0 |
| Lane Group Flow (vph) | 289 | 31 | 0 | 601 | 596 | 0 |
| Confl. Peds. (#/hr) | 5 | | | | | |
| Turn Type | | Perm | Perm | | | |
| Protected Phases | 2 | | | 8 | 4 | |
| Permitted Phases | | 2 | 8 | | | |
| Actuated Green, G (s) | 13.2 | 13.2 | | 22.1 | 22.1 | |
| Effective Green, g (s) | 13.2 | 13.2 | | 22.1 | 22.1 | |
| Actuated g/C Ratio | 0.29 | 0.29 | | 0.49 | 0.49 | |
| Clearance Time (s) | 5.0 | 5.0 | | 4.7 | 4.7 | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 485 | 434 | | 1271 | 1589 | |
| v/s Ratio Prot | c0.17 | | | | 0.18 | |
| v/s Ratio Perm | | 0.02 | | c0.23 | | |
| v/c Ratio | 0.60 | 0.07 | | 0.47 | 0.37 | |
| Uniform Delay, d1 | 13.6 | 11.5 | | 7.6 | 7.1 | |
| Progression Factor | 0.78 | 0.71 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 1.9 | 0.1 | | 1.3 | 0.7 | |
| Delay (s) | 12.5 | 8.2 | | 8.9 | 7.8 | |
| Level of Service | B | A | | A | A | |
| Approach Delay (s) | 11.3 | | | 8.9 | 7.8 | |
| Approach LOS | B | | | A | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 9.0 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.52 | | |
| Actuated Cycle Length (s) | 45.0 | Sum of lost time (s) | 9.7 |
| Intersection Capacity Utilization | 61.8% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

# APPENDIX E

# ROADWAY

# Appendix E.1
# Roadway Photos

# Appendix E.1 Roadway Photos

Figure E.1 – Barryknoll Lane at Gessner (Looking East)

Figure E.2 - Barryknoll Lane at Plantation Road (Looking West)

Figure E.3 - Barryknoll Lane near Plantation Road (Looking West)

Figure E.4 - Barryknoll Lane at Bettina Court (Looking South-East)

Figure E.5 - Barryknoll Lane near Bettina Court (Looking East)

Figure E.6 - Barryknoll Lane at Strey Lane (Looking South)

Figure E.7 - Barryknoll Lane at Hollyridge Drive (Looking South)

Figure E.8 – Barryknoll Lane near Memorial City Way (Looking West)

Figure E.9 - Barryknoll Lane at Memorial City Way (Looking North)

Figure E.10 – Intersection Barryknoll Lane and Memorial City Way

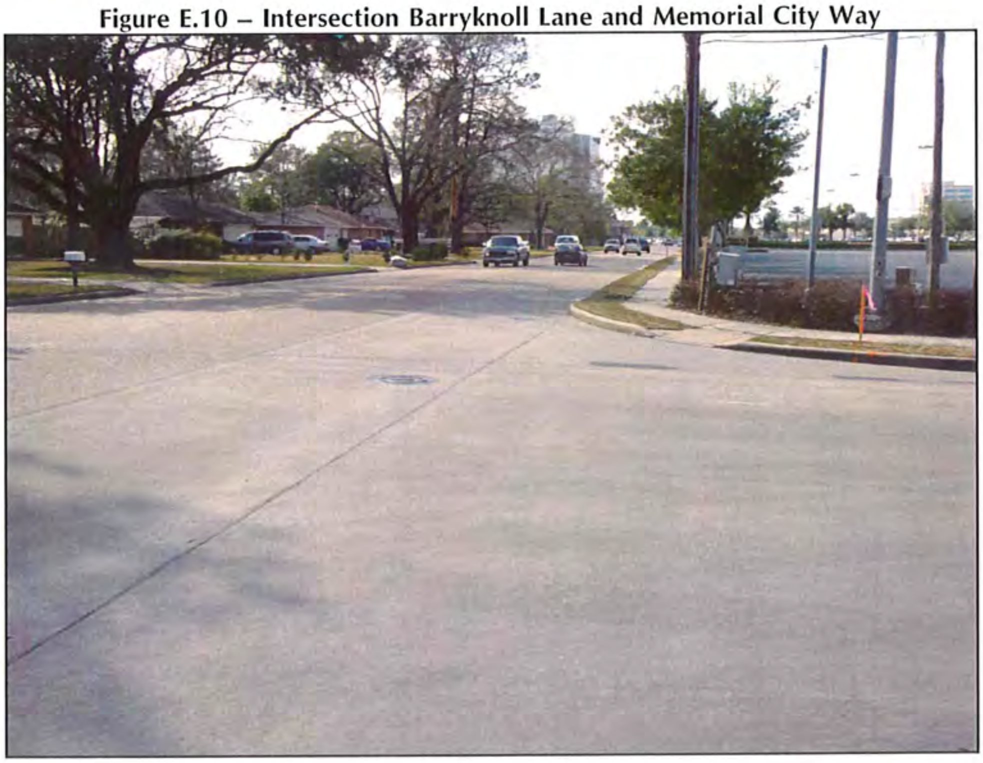


Figure E.11 – Barryknoll Lane near Memorial City Way (Looking East)

Figure E.12 - Barryknoll Lane at Riedel Drive (Looking South)

Figure E.13 – Barryknoll Lane (Looking West)

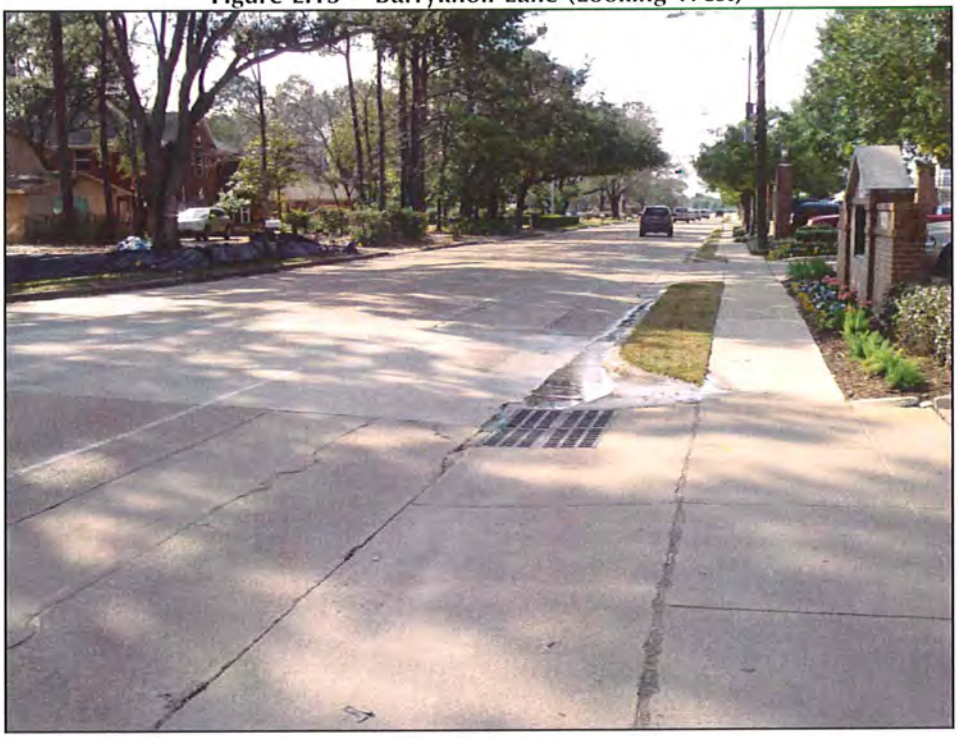


Figure E.14 – Barryknoll Lane (Looking East)

**Figure E.15 - Barryknoll Lane (Looking West)**

**Figure E.16 – Barryknoll Lane at Barracuda Court (Looking South)**

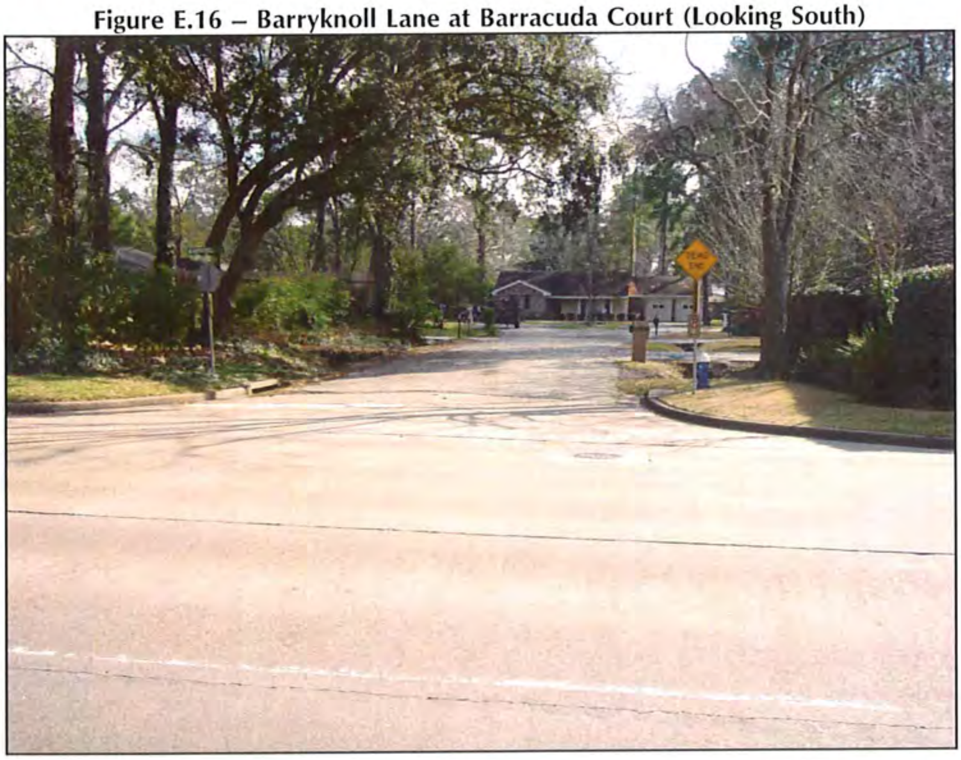
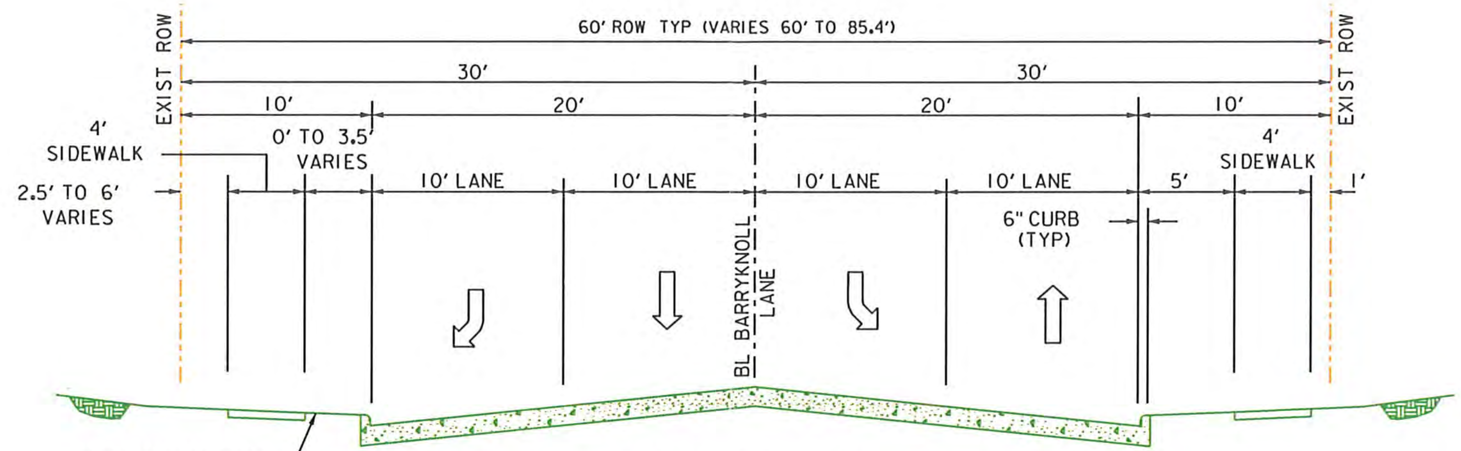


**Figure E.17 – Barryknoll Lane at Dolphin Court (Looking South)**

**Figure E.18 – Intersection Barryknoll Lane and Bunker Hill Road**

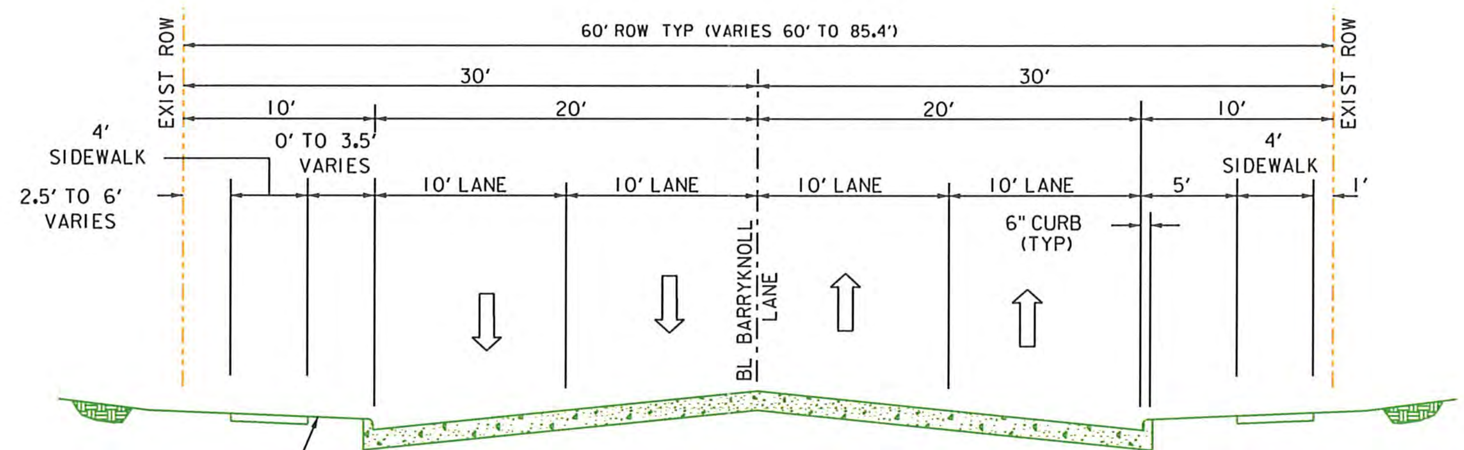
# Appendix E.2
# Barryknoll Lane Existing Conditions

# Appendix E.2.a
# Barryknoll Lane Existing Typical Sections



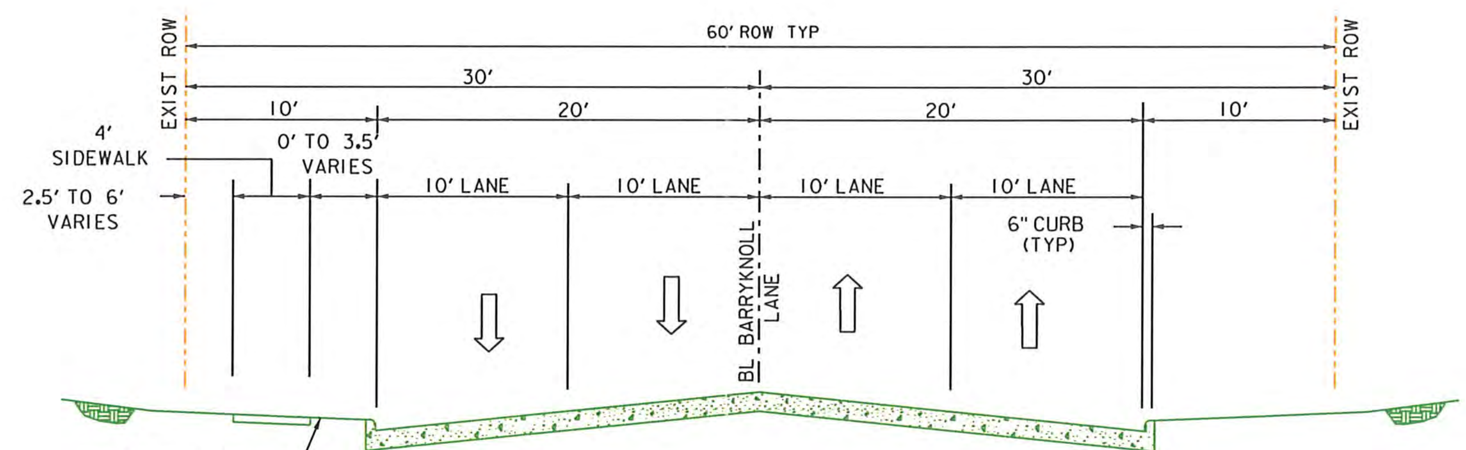

## BARRYKNOLL LANE

GESSNER ROAD TO APPROX 200 EAST OF INTERSECTION OF GESSNER ROAD AND BARRYKNOLL LANE




## BARRYKNOLL LANE

APPROX 200 EAST OF INTERSECTION OF GESSNER AND BARRYKNOLL LANE TO BETTINA COURT




## BARRYKNOLL LANE

INTERSECTION OF BETTINA COURT AND BARRYKNOLL LANE TO BUNKER HILL

LEGEND

- PROPOSED ROW
- EXIST ROW
- PROPOSED TRAFFIC FLOW
- EXISITING TRAFFIC FLOW

0 5 10 20
(IN FEET)
1 INCH = 10 FEET

| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
|---|---|---|---|---|---|---|---|---|---|

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Firm No.: F-2614
Date: NOV. 2011

| | |
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| T.G.B. DRN CKD BY | NOV 2011 DATE |
| M.J.G. DES BY | NOV 2011 DATE |
| T.G.B. DES CKD BY | NOV 2011 DATE |
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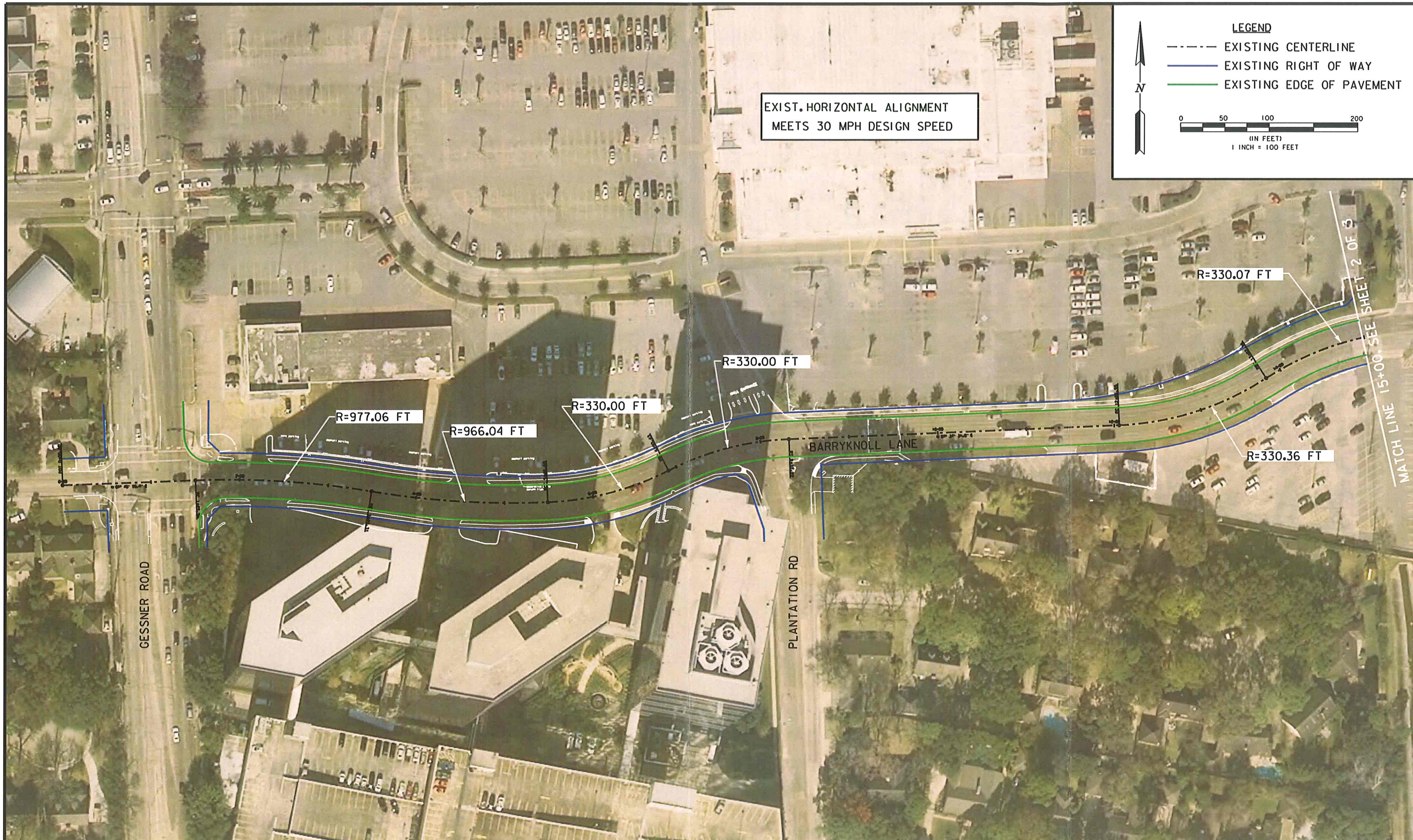
APPENDIX E.2.a
BARRYKNOLL LANE
EXISTING TYPICAL SECTIONS

CONTRACT NO. | DRAWING NO. | REV.

# Appendix E.2.b
# Barryknoll Lane Existing Layout

# Appendix E.3
## Roadway Improvement Alternatives

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| T.G.B. DRN CKD BY | NOV 2011 DATE |
| M.J.G. DES BY | NOV 2011 DATE |
| T.G.B. DES CKD BY | NOV 2011 DATE |
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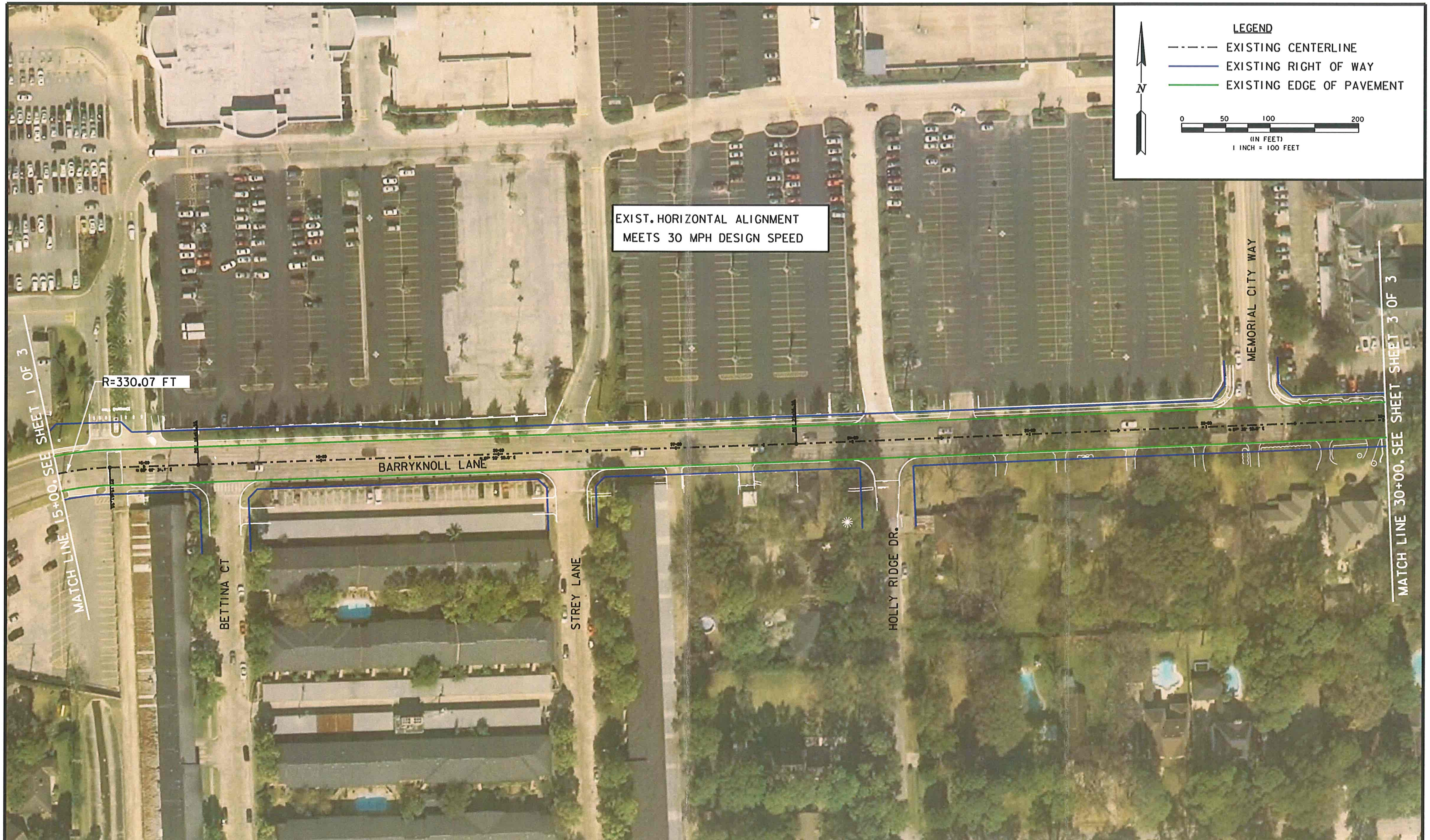
BARRYKNOLL LANE

APPENDIX E.2.b
EXISTING LAYOUT
SHEET 1 OF 3

CONTRACT NO. | DRAWING NO. | REV.




| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
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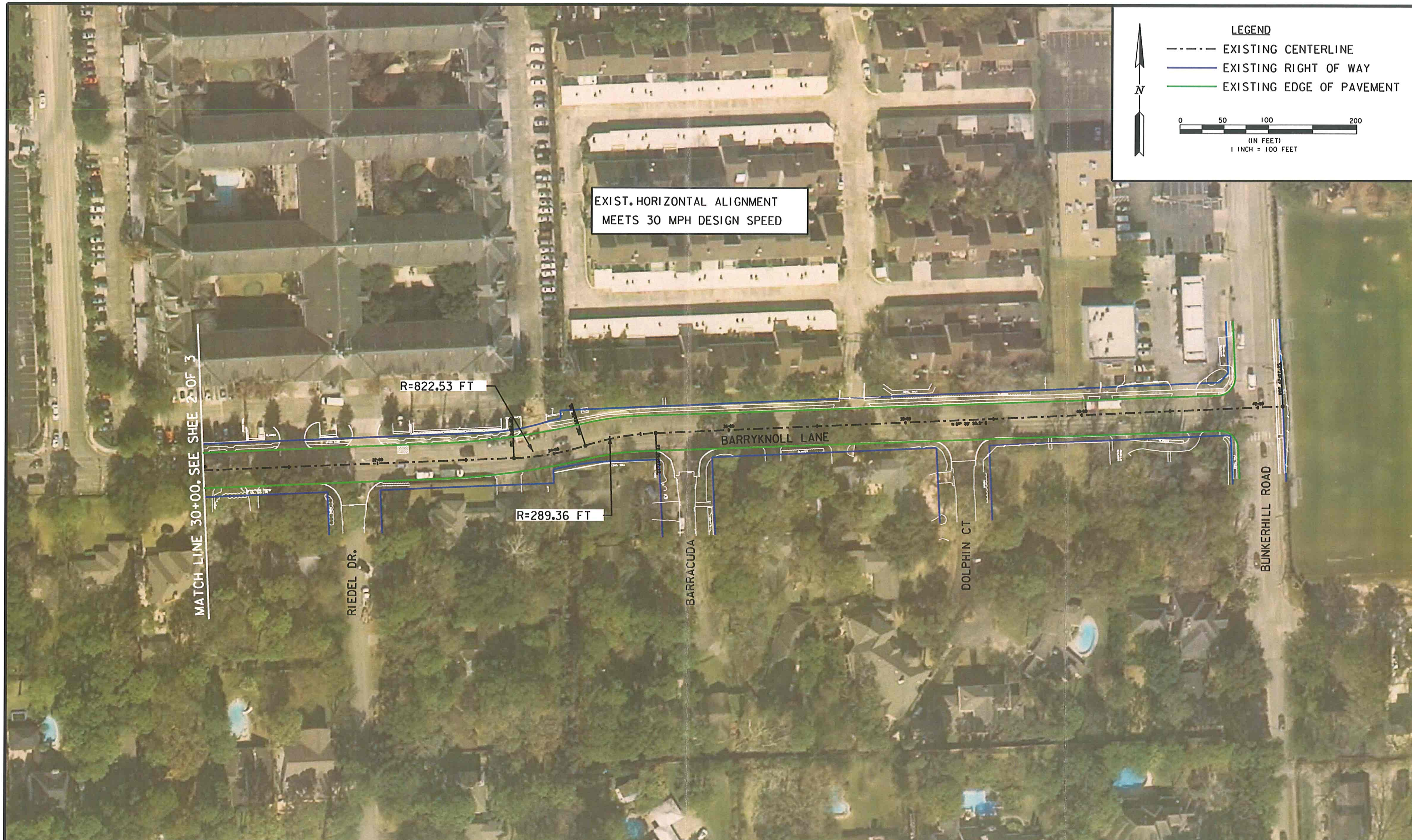
| | |
|---|---|
| M.J.G. DRN BY | NOV 2011 DATE |
| T.G.B. DRN CKD BY | NOV 2011 DATE |
| M.J.G. DES BY | NOV 2011 DATE |
| T.G.B. DES CKD BY | NOV 2011 DATE |
| APPROVED BY | DATE |
| SCALE: AS SHOWN | |

BARRYKNOLL LANE

APPENDIX E.2.b
EXISTING LAYOUT
SHEET 2 OF 3

CONTRACT NO. | DRAWING NO. | REV.




| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
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|---|---|---|
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| T.G.B. | DRN CKD BY | NOV 2011 DATE |
| M.J.G. | DES BY | NOV 2011 DATE |
| T.G.B. | DES CKD BY | NOV 2011 DATE |
| | APPROVED BY | DATE |

SCALE: AS SHOWN

BARRYKNOLL LANE

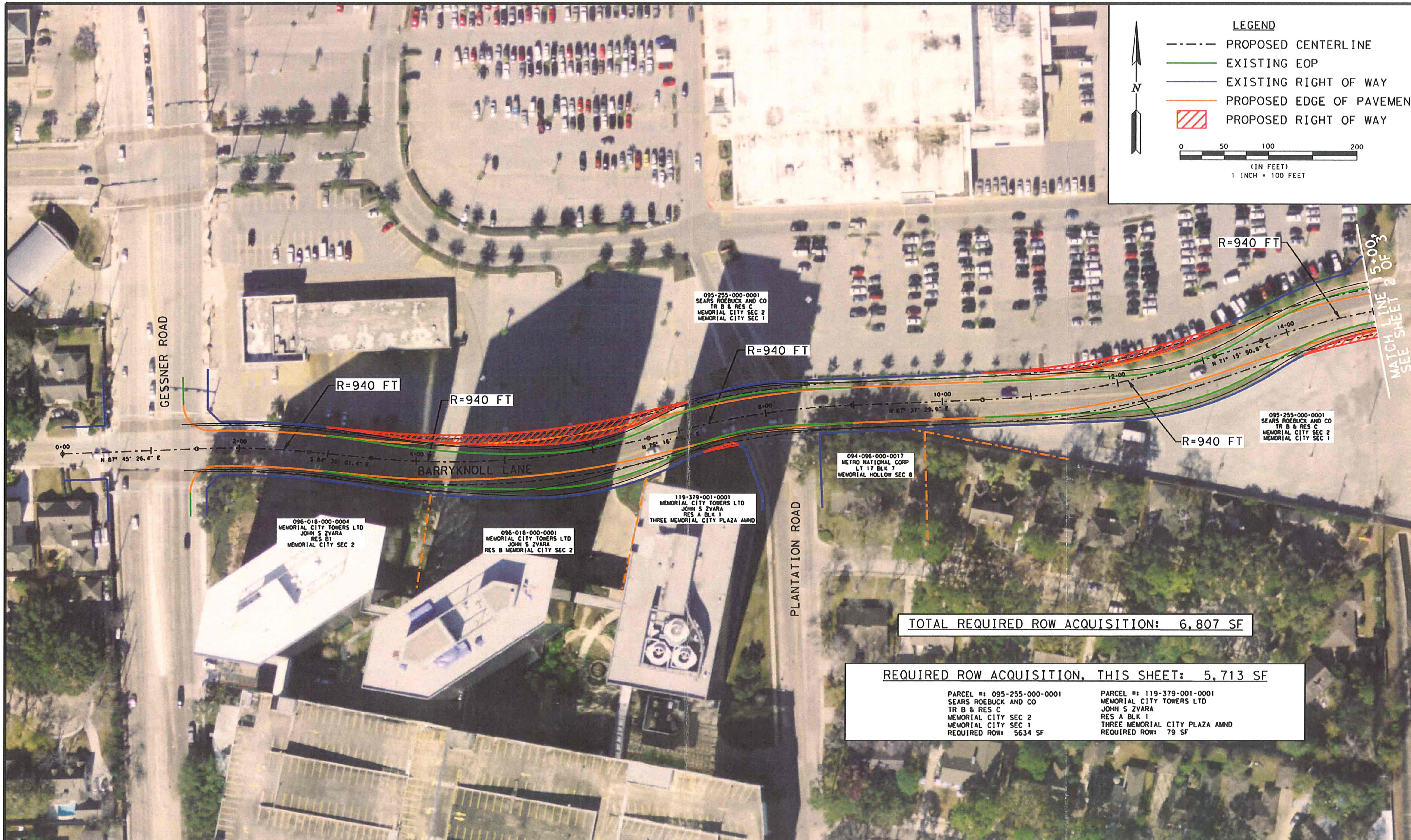
APPENDIX E.2.b
EXISTING LAYOUT
SHEET 3 OF 3

CONTRACT NO. | DRAWING NO. | REV.

# Appendix E.3
## Roadway Improvement Alternatives

TIRZ 17 REDEVELOPMENT AUTHORITY

## Appendix E.3.a
## Prop 45 mph Design Speed

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| T. G. B. — DRN CKD BY | AUG 2011 — DATE |
| M. J. G. — DES BY | AUG 2011 — DATE |
| T. G. B. — DES CKD BY | AUG 2011 — DATE |
| APPROVED BY | DATE |
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APPENDIX E.3.a
BARRYKNOLL LANE
ALIGNMENT ALTERNATIVE
45 MPH DESIGN SPEED
SHEET 1 OF 3

CONTRACT NO. | DRAWING NO. | REV.


| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
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|---|---|
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| T. G. B. (DRN CKD BY) | AUG 2011 (DATE) |
| M. J. G. (DES BY) | AUG 2011 (DATE) |
| T. G. B. (DES CKD BY) | AUG 2011 (DATE) |
| APPROVED BY | DATE |
| SCALE: AS SHOWN | |

APPENDIX E.3.a
BARRYKNOLL LANE
ALIGNMENT ALTERNATIVE
45 MPH DESIGN SPEED
SHEET 2 OF 3

CONTRACT NO. | DRAWING NO. | REV.


| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
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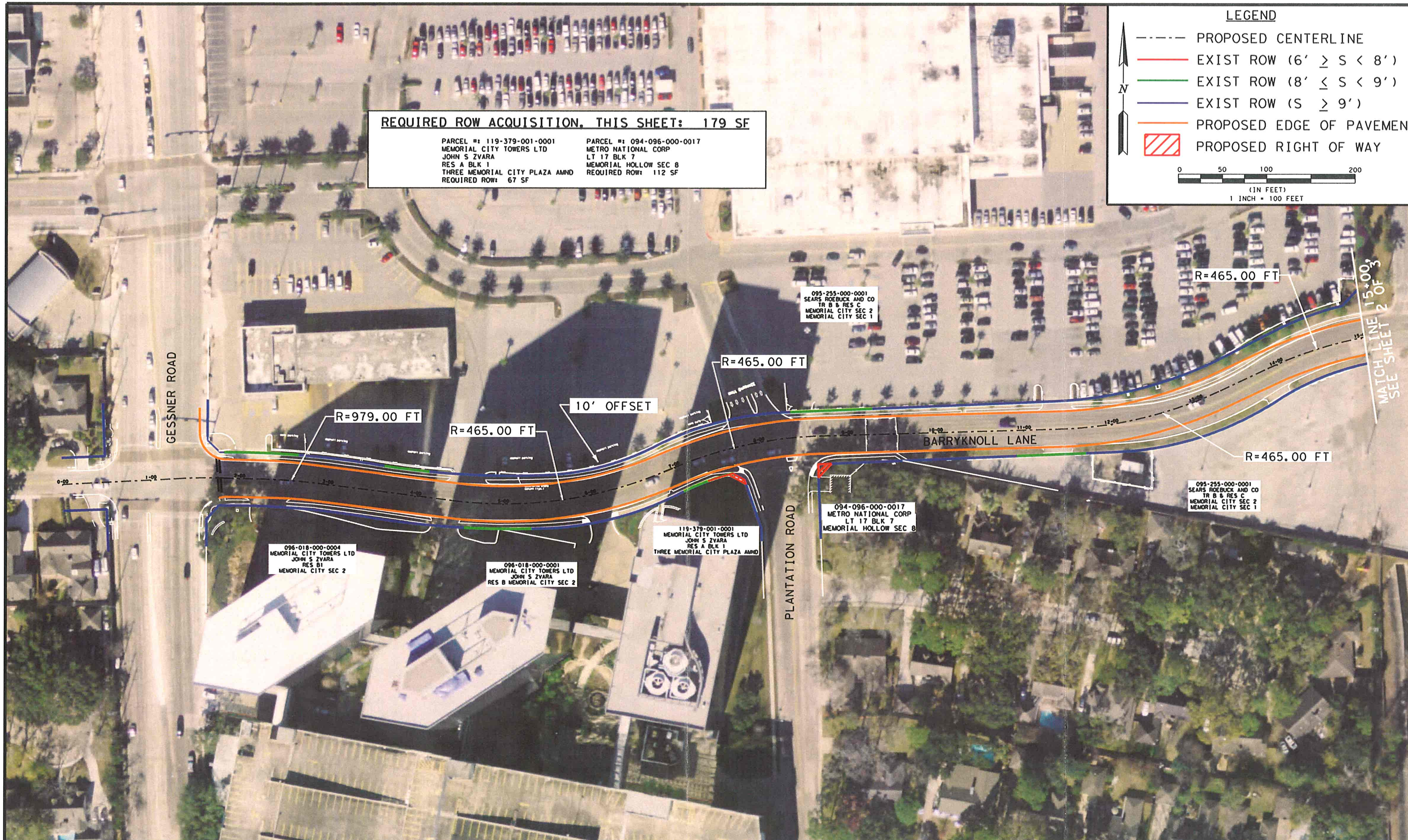
Firm No.: F-2614
Date: AUG 2011

| | |
|---|---|
| M. J. G. — DRN BY | AUG 2011 — DATE |
| T. G. B. — DRN CKD BY | AUG 2011 — DATE |
| M. J. G. — DES BY | AUG 2011 — DATE |
| T. G. B. — DES CKD BY | AUG 2011 — DATE |
| APPROVED BY | DATE |
| SCALE: AS SHOWN | |

APPENDIX E.3.a
BARRYKNOLL LANE
ALIGNMENT ALTERNATIVE
45 MPH DESIGN SPEED
SHEET 3 OF 3

CONTRACT NO. | DRAWING NO. | REV.




**REQUIRED ROW ACQUISITION, THIS SHEET: 179 SF**

| | |
|---|---|
| PARCEL #: 119-379-001-0001 | PARCEL #: 094-096-000-0017 |
| MEMORIAL CITY TOWERS LTD | METRO NATIONAL CORP |
| JOHN S ZVARA | LT 17 BLK 7 |
| RES A BLK 1 | MEMORIAL HOLLOW SEC 8 |
| THREE MEMORIAL CITY PLAZA AMND | REQUIRED ROW: 112 SF |
| REQUIRED ROW: 67 SF | |

| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
|---|---|---|---|---|---|---|---|---|---|

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TIRZ 17 REDEVELOPMENT AUTHORITY

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Engineer: Tara G. Burrer, P.E.
P.E. Serial No.: 99997
Firm: Lockwood, Andrews & Newnam Inc.
Firm No.: F-2614
Date: AUG 2011

| | |
|---|---|
| M. J. G. (DRN BY) | AUG 2011 (DATE) |
| T. G. B. (DRN CKD BY) | AUG 2011 (DATE) |
| M. J. G. (DES BY) | AUG 2011 (DATE) |
| T. G. B. (DES CKD BY) | AUG 2011 (DATE) |
| APPROVED BY | DATE |

SCALE: AS SHOWN

BARRYKNOLL LANE

APPENDIX E.3b
PROP 35 MPH LAYOUT W/ 10' LANES
40' PAVEMENT
SHEET 1 OF 3

CONTRACT NO. | DRAWING NO. | REV.

# Appendix E.3.b
# Prop 35mph Design Speed w/ 10' Lanes


| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
|---|---|---|---|---|---|---|---|---|---|

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TIRZ 17 REDEVELOPMENT AUTHORITY

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P.E. Serial No.: 99997
Firm: Lockwood, Andrews & Newnam Inc.
Firm No.: F-2614
Date: AUG 2011

| | | |
|---|---|---|
| DRN BY | M.J.G. | AUG 2011 |
| DRN CKD BY | T.G.B. | AUG 2011 |
| DES BY | M.J.G. | AUG 2011 |
| DES CKD BY | T.G.B. | AUG 2011 |
| APPROVED BY | | DATE |
| SCALE: | AS SHOWN | |

APPENDIX E.3b
PROP 35 MPH LAYOUT W/ 10' LANES
40' PAVEMENT
SHEET 2 OF 3

CONTRACT NO. | DRAWING NO. | REV.


| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
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TIRZ 17 REDEVELOPMENT AUTHORITY

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|---|---|
| M.J.G. DRN BY | AUG 2011 DATE |
| T.G.B. DRN CKD BY | AUG 2011 DATE |
| M.J.G. DES BY | AUG 2011 DATE |
| T.G.B. DES CKD BY | AUG 2011 DATE |
| APPROVED BY | DATE |
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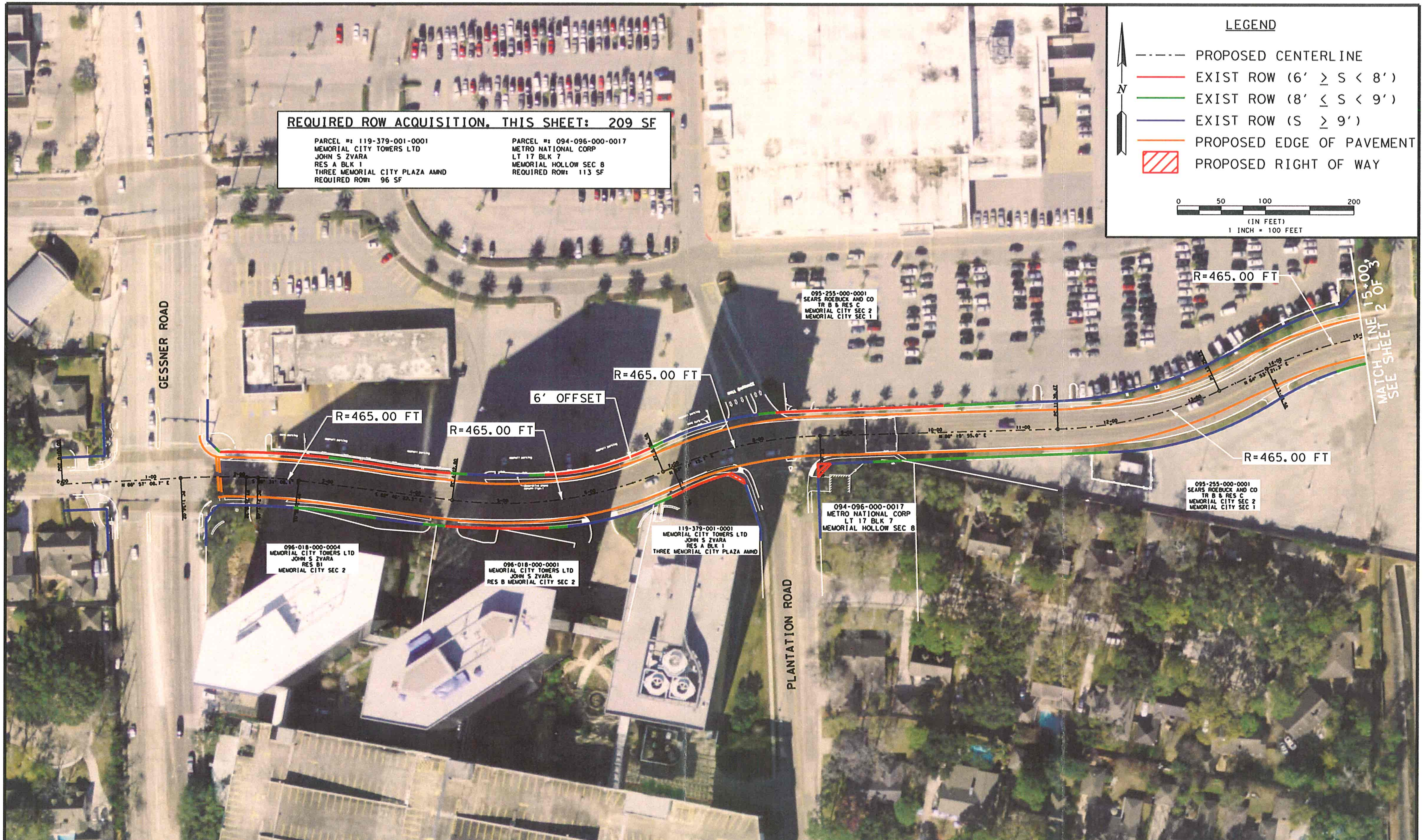
APPENDIX E.3b
PROP 35 MPH LAYOUT W/ 10' LANES
40' PAVEMENT
SHEET 3 OF 3

CONTRACT NO. | DRAWING NO. | REV.

# Appendix E.3.c
# Prop 35mph Design Speed w/ 11' Lanes




| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
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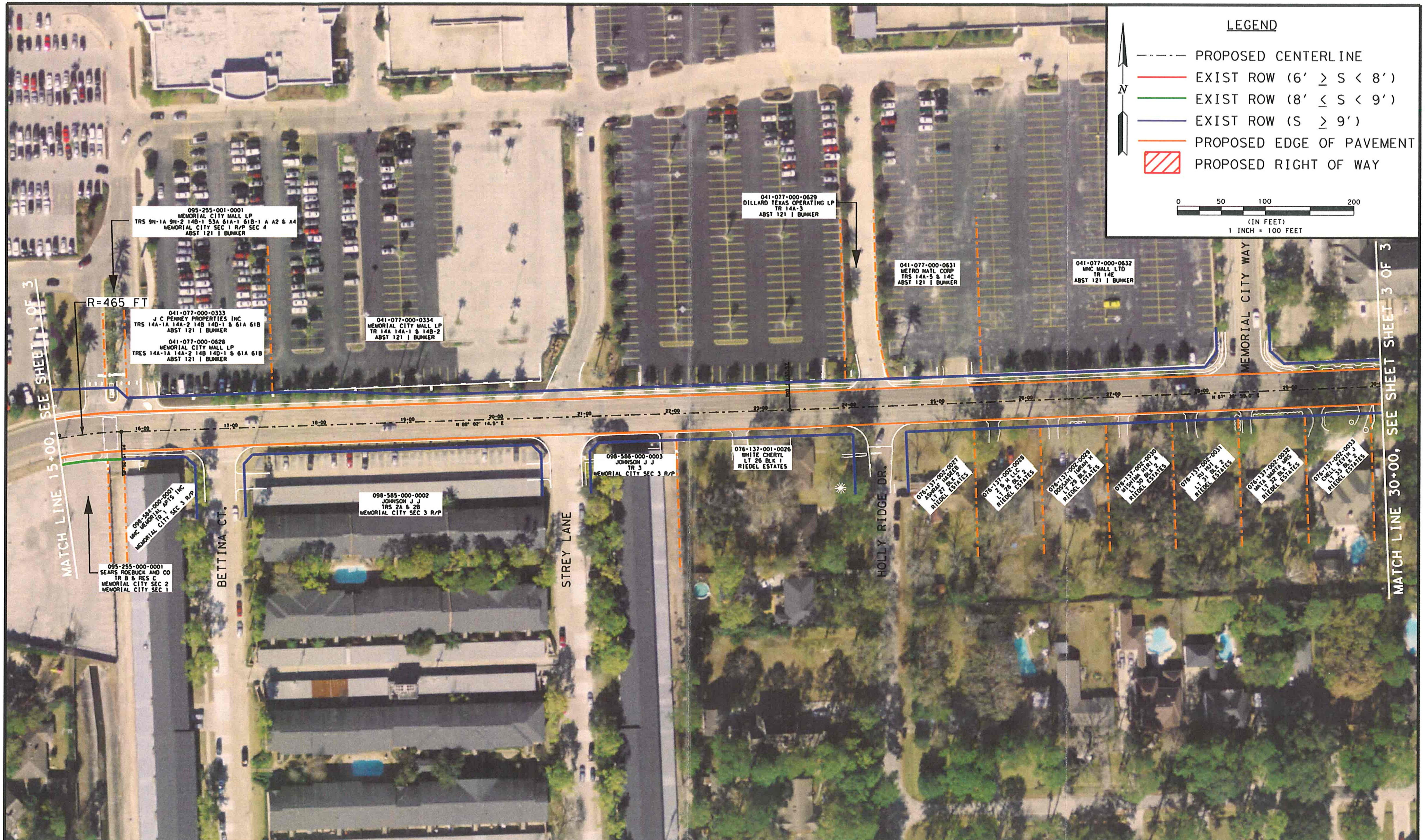
|---|---|
| M. J. G. — DRN BY | AUG 2011 — DATE |
| T. G. B. — DRN CKD BY | AUG 2011 — DATE |
| M. J. G. — DES BY | AUG 2011 — DATE |
| T. G. B. — DES CKD BY | AUG 2011 — DATE |
| APPROVED BY | DATE |
| SCALE: AS SHOWN | |

BARRYKNOLL LANE

APPENDIX E.3.c
PROP 35 MPH LAYOUT W/ 11' LANES
44' PAVEMENT
SHEET 1 OF 3

CONTRACT NO. | DRAWING NO. | REV.




| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
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| M. J. G. DRN BY | AUG 2011 DATE |
| T. G. B. DRN CKD BY | AUG 2011 DATE |
| M. J. G. DES BY | AUG 2011 DATE |
| T. G. B. DES CKD BY | AUG 2011 DATE |
| APPROVED BY | DATE |
| SCALE: AS SHOWN | |

APPENDIX E.3.c
PROP 35 MPH LAYOUT W/ 11' LANES
44' PAVEMENT
SHEET 2 OF 3

CONTRACT NO. | DRAWING NO. | REV.


| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
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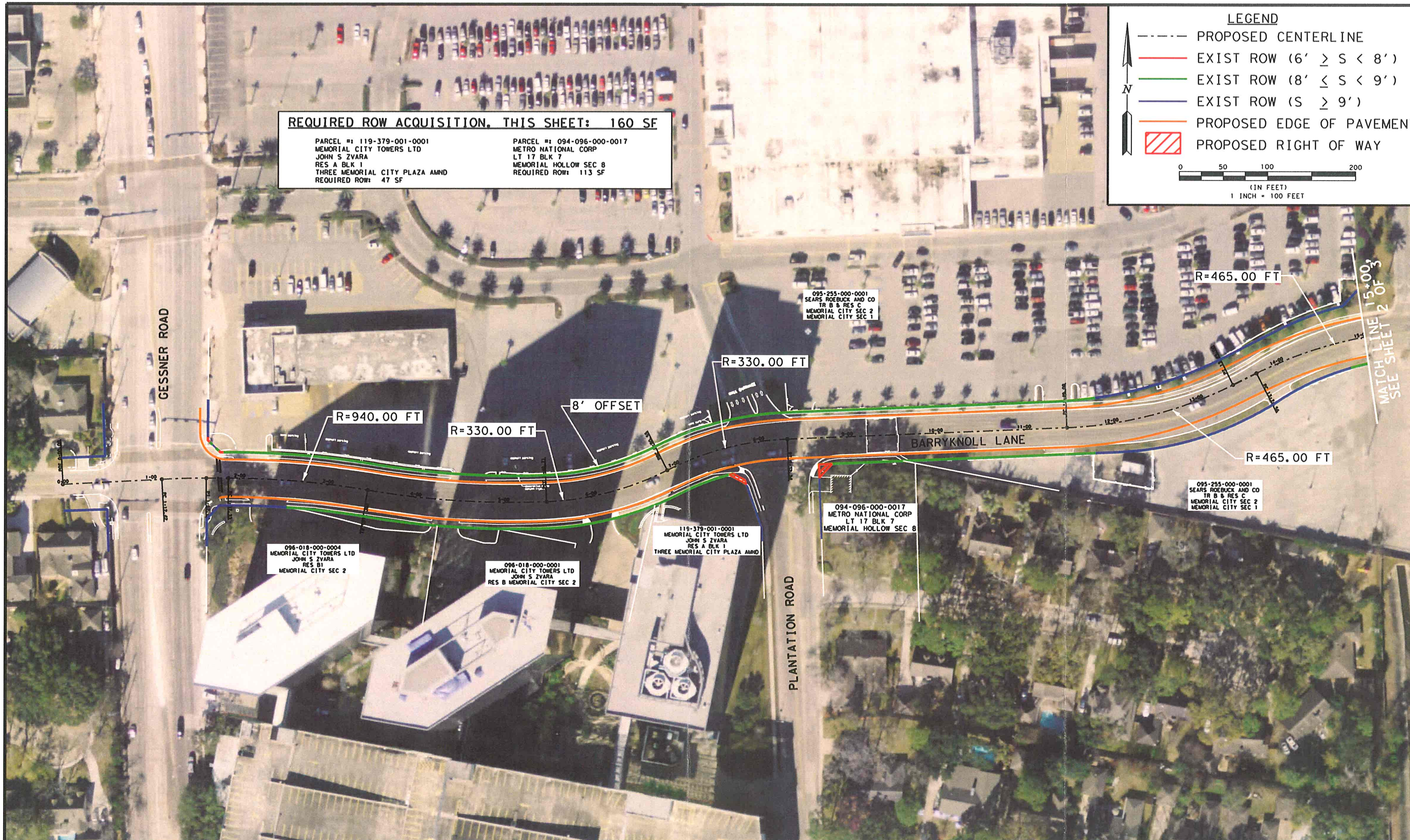
|---|---|
| M.J.G. DRN BY | AUG 2011 DATE |
| T.G.B. DRN CKD BY | AUG 2011 DATE |
| M.J.G. DES BY | AUG 2011 DATE |
| T.G.B. DES CKD BY | AUG 2011 DATE |
| APPROVED BY | DATE |
| SCALE: AS SHOWN | |

APPENDIX E.3.c
PROP 35 MPH LAYOUT W/ 11' LANES
44' PAVEMENT
SHEET 3 OF 3

CONTRACT NO. | DRAWING NO. | REV.

TIRZ 17 REDEVELOPMENT AUTHORITY

**Appendix E.3.d**
**Prop 30mph Design Speed w/ 11' Lanes**




| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
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Date: AUG 2011

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| M. J. G. — DRN BY | AUG 2011 — DATE |
| T. G. B. — DRN CKD BY | AUG 2011 — DATE |
| M. J. G. — DES BY | AUG 2011 — DATE |
| T. G. B. — DES CKD BY | AUG 2011 — DATE |
| APPROVED BY | DATE |
| SCALE: AS SHOWN | |

BARRYKNOLL LANE

APPENDIX E.3.d
PROP 30 MPH LAYOUT W/ 11' LANES
44' PAVEMENT
SHEET 1 OF 3

CONTRACT NO. | DRAWING NO. | REV.


| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
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|---|---|---|
| DRN BY | M. J. G. | AUG 2011 |
| DRN CKD BY | T. G. B. | AUG 2011 |
| DES BY | M. J. G. | AUG 2011 |
| DES CKD BY | T. G. B. | AUG 2011 |
| APPROVED BY | | DATE |

SCALE: AS SHOWN

APPENDIX E.3.d
PROP 30 MPH LAYOUT W/ 11' LANES
44' PAVEMENT
SHEET 2 OF 3

CONTRACT NO. | DRAWING NO. | REV.


| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
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Firm No.: F-2614
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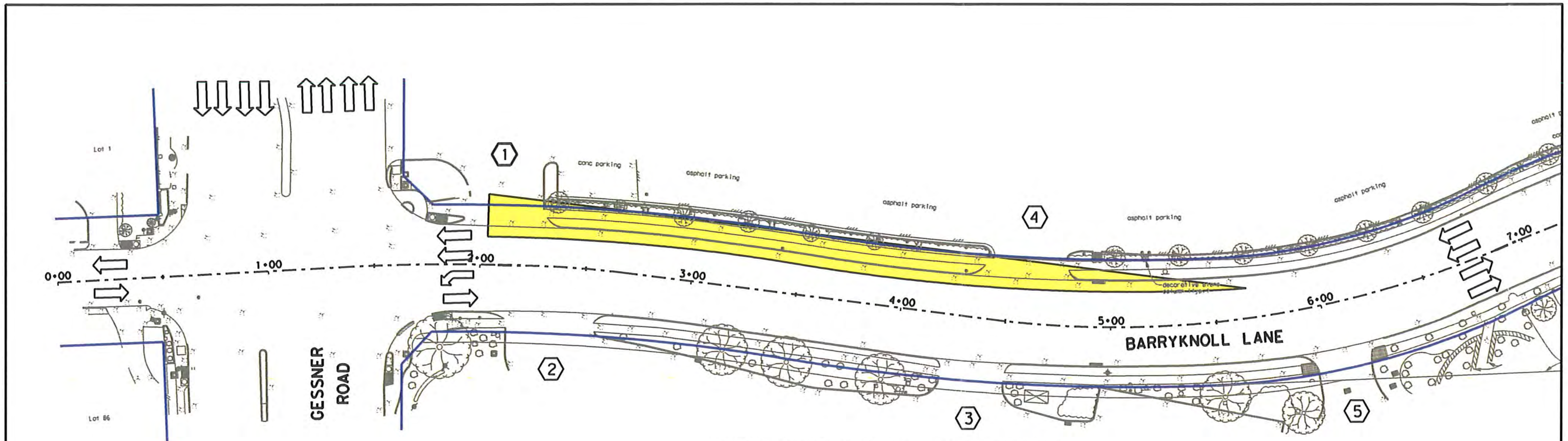
| T. G. B. — DRN CKD BY | AUG 2011 — DATE |
| M. J. G. — DES BY | AUG 2011 — DATE |
| T. G. B. — DES CKD BY | AUG 2011 — DATE |
| APPROVED BY | DATE |
| SCALE: AS SHOWN | |

APPENDIX E.3d
PROP 30 MPH LAYOUT W/ 11' LANES
44' PAVEMENT
SHEET 3 OF 3

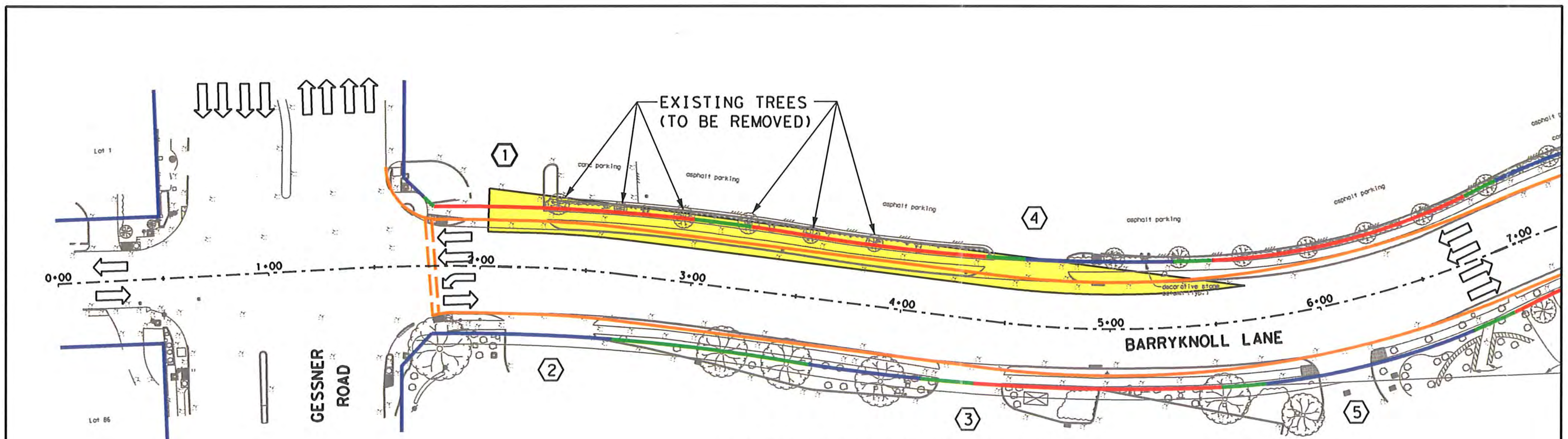
CONTRACT NO. | DRAWING NO. | REV.

# Appendix E.4
# Sight Distance Triangles




## EXISTING SIGHT DISTANCE

(DRIVEWAY 1)




## PROPOSED SIGHT DISTANCE

(DRIVEWAY 1)

LEGEND

- PROPOSED CENTERLINE
- PROPOSED ROADWAY
- SIGHT DISTANCE TRIANGLE
- EXIST ROW (6' ≥ S < 8')
- EXIST ROW (8' ≤ S < 9')
- EXIST ROW (S ≥ 9')
- (X) DRIVEWAY NUMBERS
- TRAFFIC FLOW DIRECTION

N

0 30 60 120
(IN FEET)
1 INCH = 60 FEET

| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
|---|---|---|---|---|---|---|---|---|---|

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Date: AUG 2011

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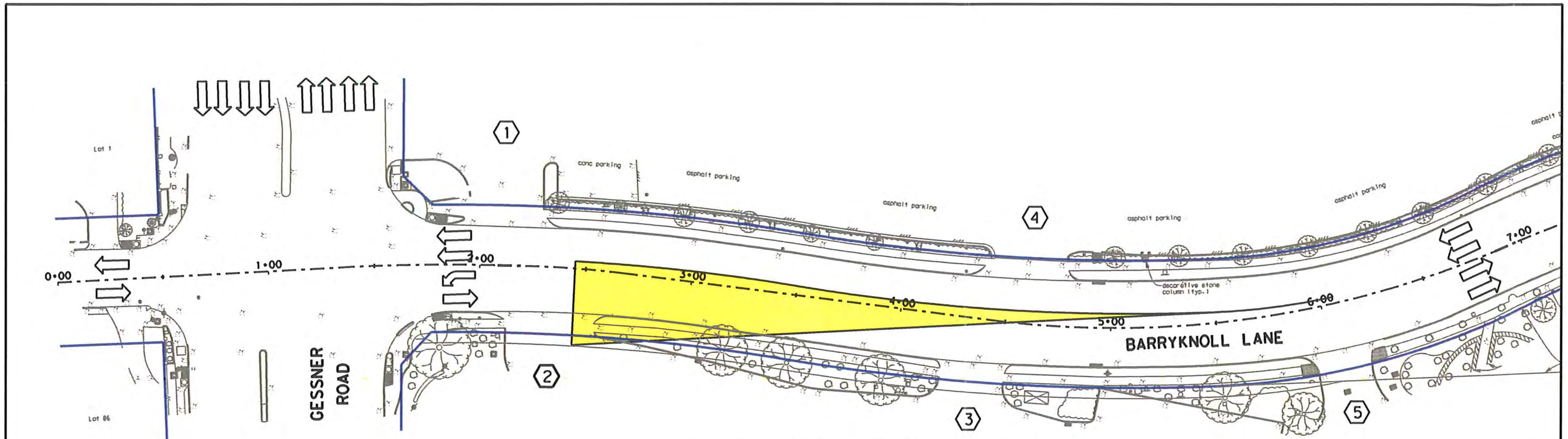
| T. G. B. (DRN CKD BY) | AUG 2011 (DATE) |
| M. J. G. (DES BY) | AUG 2011 (DATE) |
| T. G. B. (DES CKD BY) | AUG 2011 (DATE) |
| APPROVED BY | DATE |
| SCALE: AS SHOWN | |

BARRYKNOLL LANE

APPENDIX E.4
DRIVEWAY 1
SIGHT DISTANCE TRIANGLE

SHEET 1 OF 14

CONTRACT NO. | DRAWING NO. | REV.




## EXISTING SIGHT DISTANCE
(DRIVEWAY 2)


## PROPOSED SIGHT DISTANCE
(DRIVEWAY 2)

LEGEND

- PROPOSED CENTERLINE
- PROPOSED ROADWAY
- SIGHT DISTANCE TRIANGLE
- EXIST ROW (6' ≥ S < 8')
- EXIST ROW (8' ≤ S < 9')
- EXIST ROW (S ≥ 9')
- DRIVEWAY NUMBERS
- TRAFFIC FLOW DIRECTION

N

0 30 60 120
(IN FEET)
1 INCH = 60 FEET

| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
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P.E. Serial No.: 99997
Firm: Lockwood, Andrews & Newnam Inc.
Firm No.: F-2614
Date: AUG 2011

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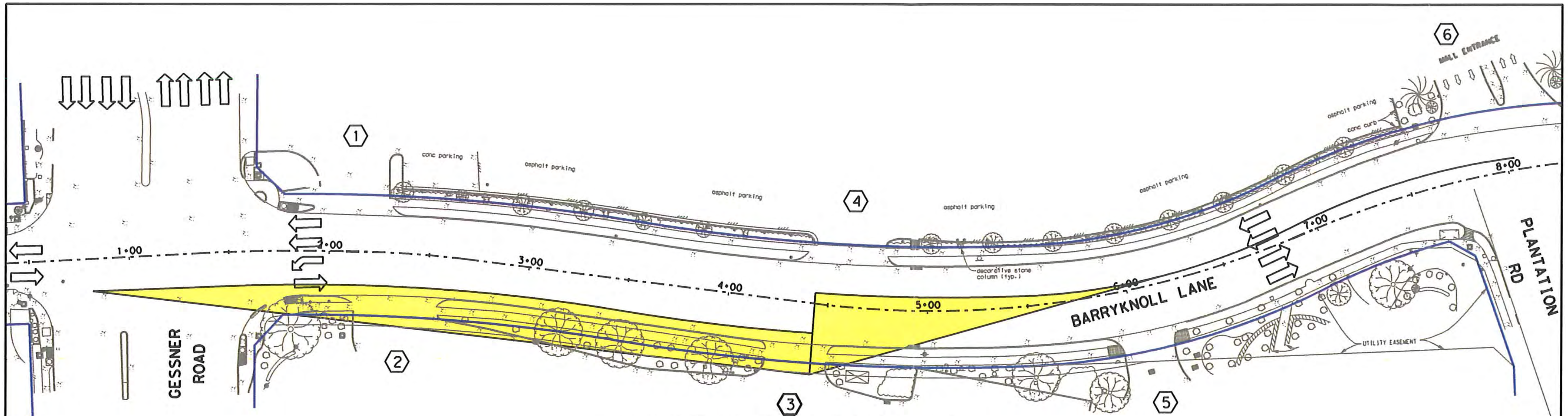
| M.J.G. DRN BY | AUG 2011 DATE |
| T.G.B. DRN CKD BY | AUG 2011 DATE |
| M.J.G. DES BY | AUG 2011 DATE |
| T.G.B. DES CKD BY | AUG 2011 DATE |
| APPROVED BY | DATE |
| SCALE: AS SHOWN | |

BARRYKNOLL LANE

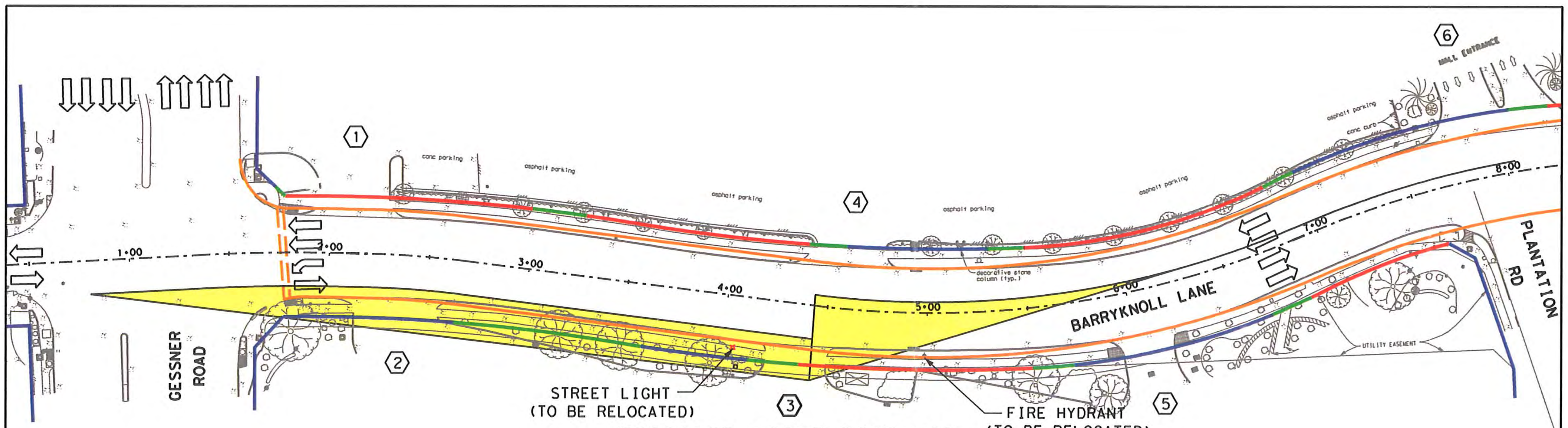
APPENDIX E.4
DRIVEWAY 2
SIGHT DISTANCE TRIANGLE

SHEET 2 OF 14

CONTRACT NO. | DRAWING NO. | REV.




## EXISTING SIGHT DISTANCE
(DRIVEWAY 3)




## PROPOSED SIGHT DISTANCE
(DRIVEWAY 3)

**LEGEND**

- PROPOSED CENTERLINE
- PROPOSED ROADWAY
- SIGHT DISTANCE TRIANGLE
- EXIST ROW (6' ≥ S < 8')
- EXIST ROW (8' ≤ S < 9')
- EXIST ROW (S ≥ 9')
- DRIVEWAY NUMBERS
- TRAFFIC FLOW DIRECTION

0 30 60 120
(IN FEET)
1 INCH = 60 FEET

| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
|---|---|---|---|---|---|---|---|---|---|

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Firm No.: F-2614
Date: AUG 2011

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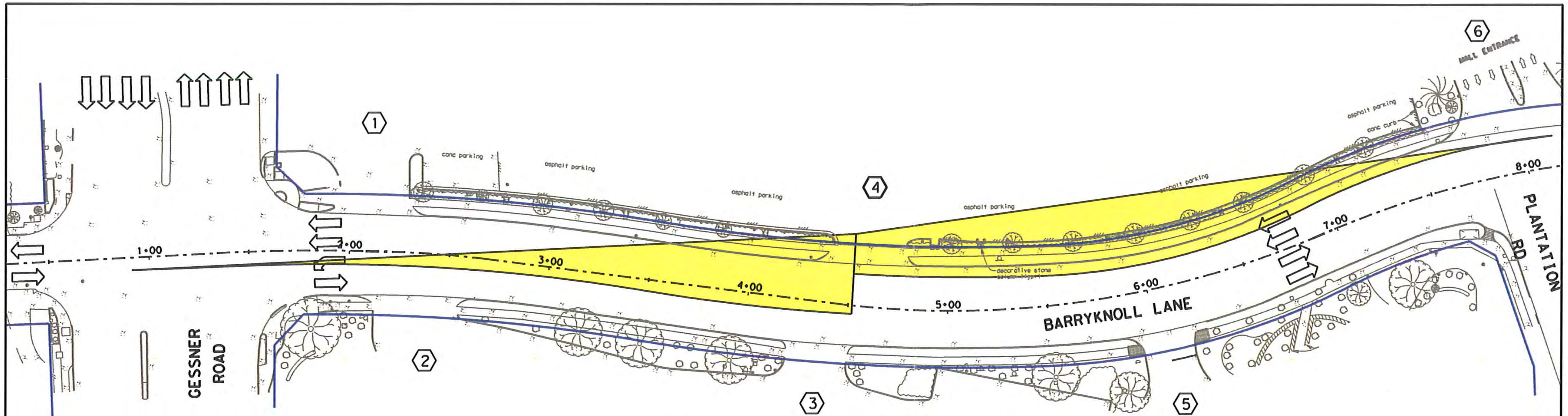
|---|---|
| M. J. G. (DRN BY) | AUG 2011 (DATE) |
| T. G. B. (DRN CKD BY) | AUG 2011 (DATE) |
| M. J. G. (DES BY) | AUG 2011 (DATE) |
| T. G. B. (DES CKD BY) | AUG 2011 (DATE) |
| APPROVED BY | DATE |
| SCALE: AS SHOWN | |

BARRYKNOLL LANE

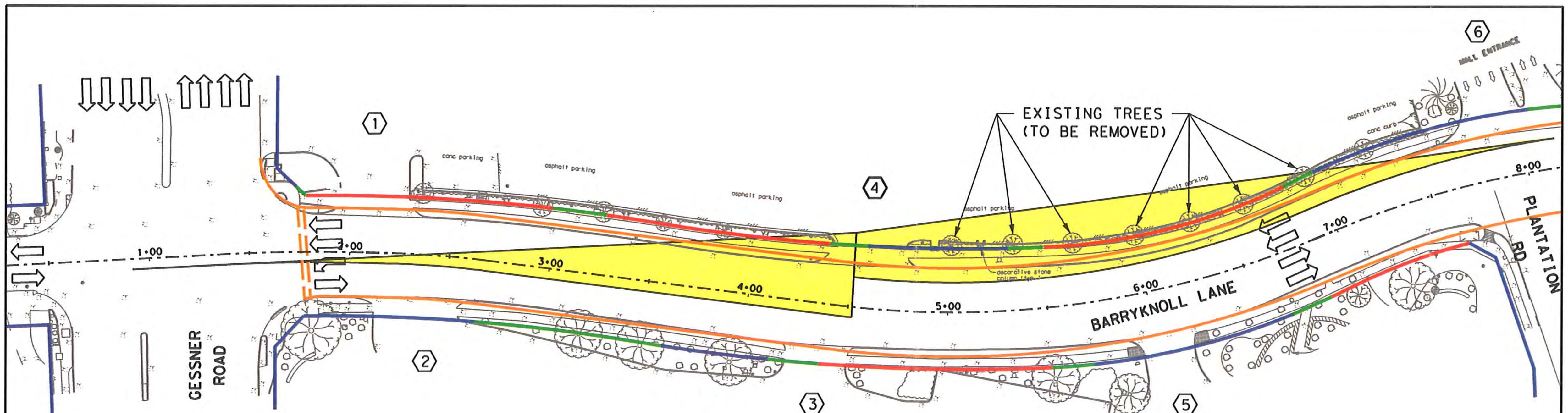
APPENDIX E.4
DRIVEWAY 3
SIGHT DISTANCE TRIANGLE

SHEET 3 OF 14

CONTRACT NO. | DRAWING NO. | REV.




## EXISTING SIGHT DISTANCE
(DRIVEWAY 4)




## PROPOSED SIGHT DISTANCE
(DRIVEWAY 4)

**LEGEND**

- PROPOSED CENTERLINE
- PROPOSED ROADWAY
- SIGHT DISTANCE TRIANGLE
- EXIST ROW (6' ≥ S < 8')
- EXIST ROW (8' ≤ S < 9')
- EXIST ROW (S ≥ 9')
- DRIVEWAY NUMBERS
- TRAFFIC FLOW DIRECTION

N

0 30 60 120
(IN FEET)
1 INCH = 60 FEET

| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
|---|---|---|---|---|---|---|---|---|---|

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Date: AUG 2011

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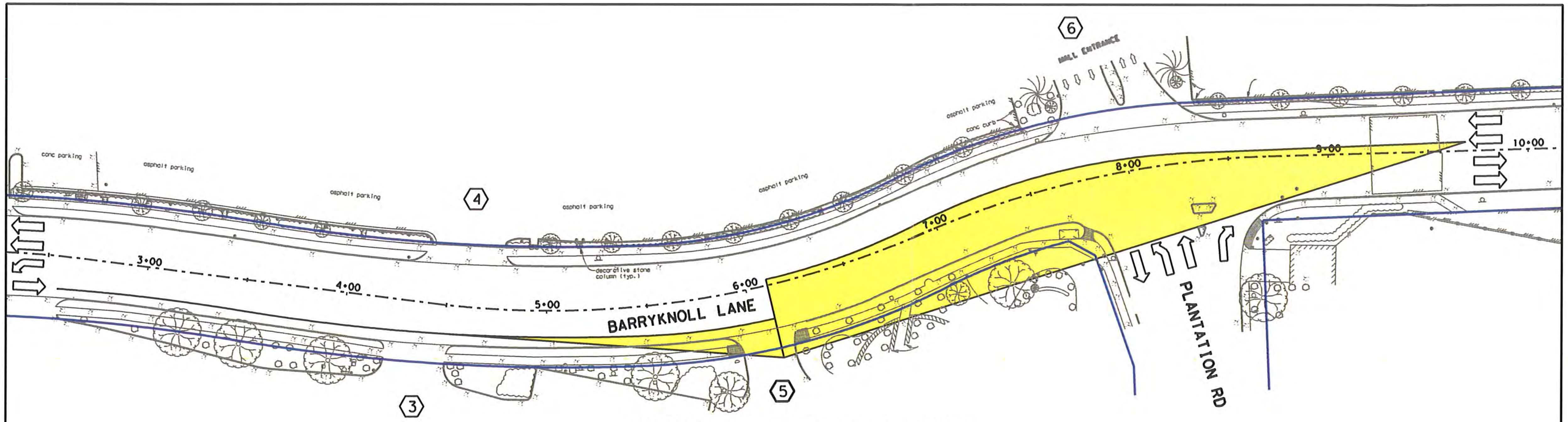
|---|---|
| M.J.G. DRN BY | AUG 2011 DATE |
| T.G.B. DRN CKD BY | AUG 2011 DATE |
| M.J.G. DES BY | AUG 2011 DATE |
| T.G.B. DES CKD BY | AUG 2011 DATE |
| APPROVED BY | DATE |
| SCALE: AS SHOWN | |

BARRYKNOLL LANE

APPENDIX E.4
DRIVEWAY 4
SIGHT DISTANCE TRIANGLE

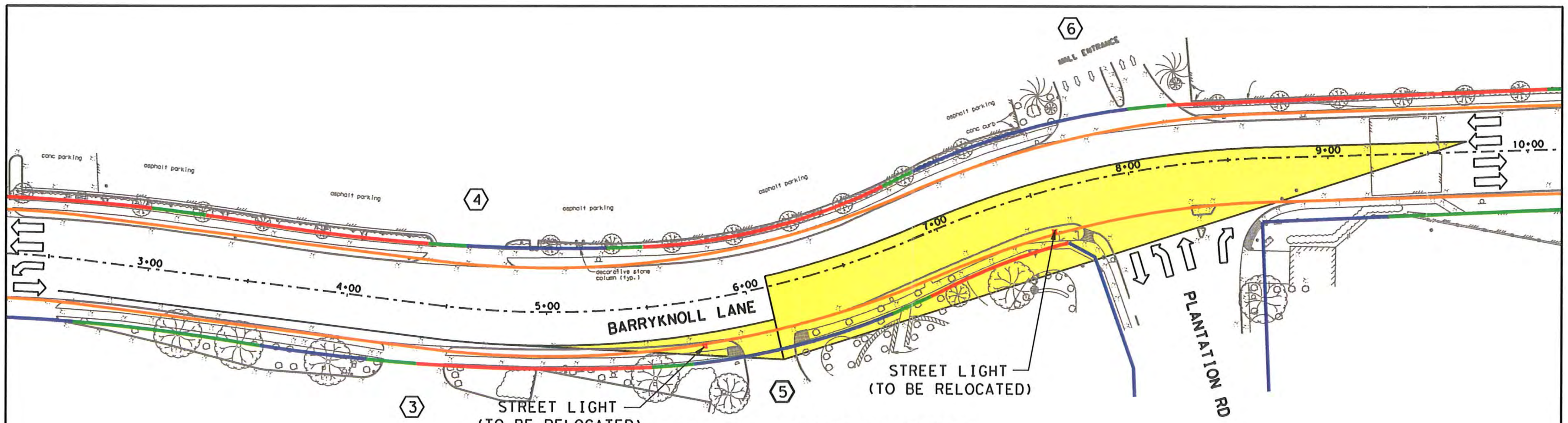
SHEET 4 OF 14

CONTRACT NO. | DRAWING NO. | REV.




## EXISTING SIGHT DISTANCE

(DRIVEWAY 5)




## PROPOSED SIGHT DISTANCE

(DRIVEWAY 5)

**LEGEND**

- PROPOSED CENTERLINE
- PROPOSED ROADWAY
- SIGHT DISTANCE TRIANGLE
- EXIST ROW (6' ≥ S < 8')
- EXIST ROW (8' ≤ S < 9')
- EXIST ROW (S ≥ 9')
- (X) DRIVEWAY NUMBERS
- TRAFFIC FLOW DIRECTION

N

0 30 60 120

(IN FEET)
1 INCH = 60 FEET

| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
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Firm No.: F-2614
Date: AUG 2011

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|---|---|
| M.J.G. DRN BY | AUG 2011 DATE |
| T.G.B. DRN CKD BY | AUG 2011 DATE |
| M.J.G. DES BY | AUG 2011 DATE |
| T.G.B. DES CKD BY | AUG 2011 DATE |
| APPROVED BY | DATE |
| SCALE: AS SHOWN | |

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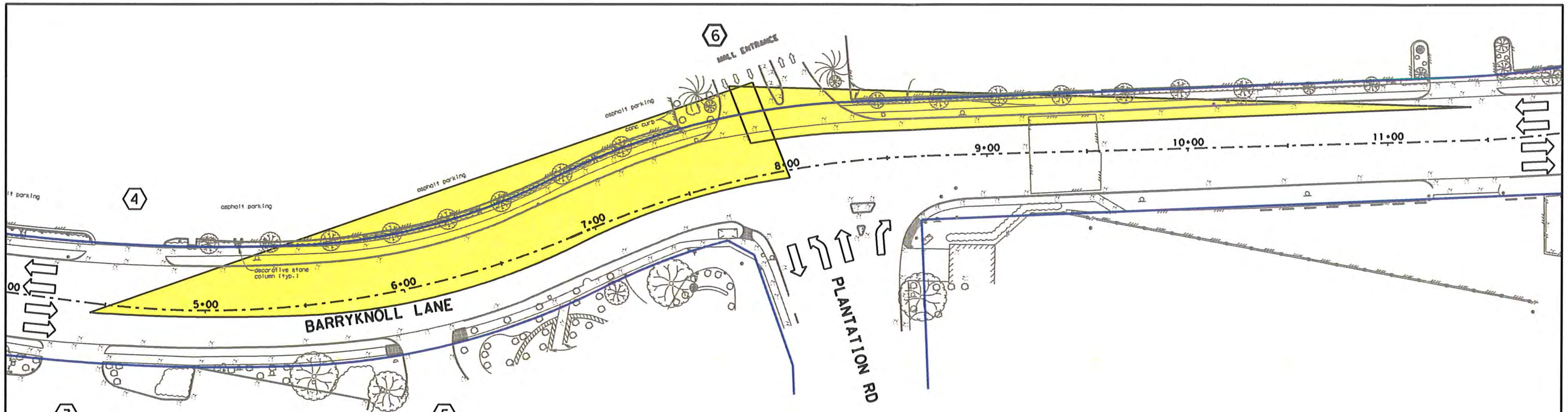
APPENDIX E.4
DRIVEWAY 5
SIGHT DISTANCE TRIANGLE

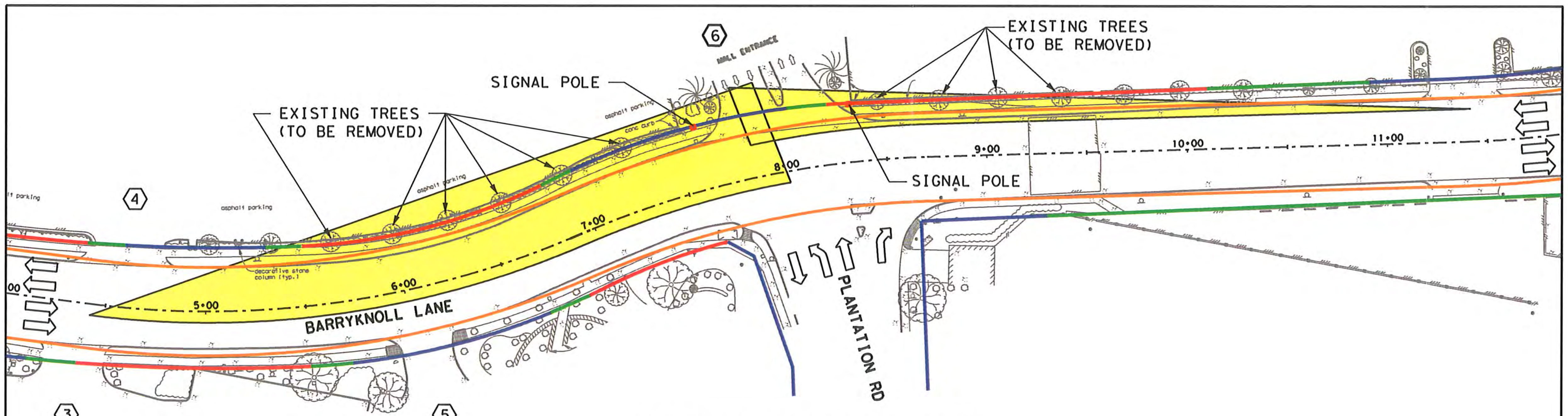
SHEET 5 OF 14

CONTRACT NO. | DRAWING NO. | REV.




## EXISTING SIGHT DISTANCE

(DRIVEWAY 6)




## PROPOSED SIGHT DISTANCE

(DRIVEWAY 6)

LEGEND

- PROPOSED CENTERLINE
- PROPOSED ROADWAY
- SIGHT DISTANCE TRIANGLE
- EXIST ROW (6' ≥ S < 8')
- EXIST ROW (8' ≤ S < 9')
- EXIST ROW (S ≥ 9')
- (X) DRIVEWAY NUMBERS
- TRAFFIC FLOW DIRECTION

0 30 60 120
(IN FEET)
1 INCH = 60 FEET

| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
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Firm No.: F-2614
Date: AUG 2011

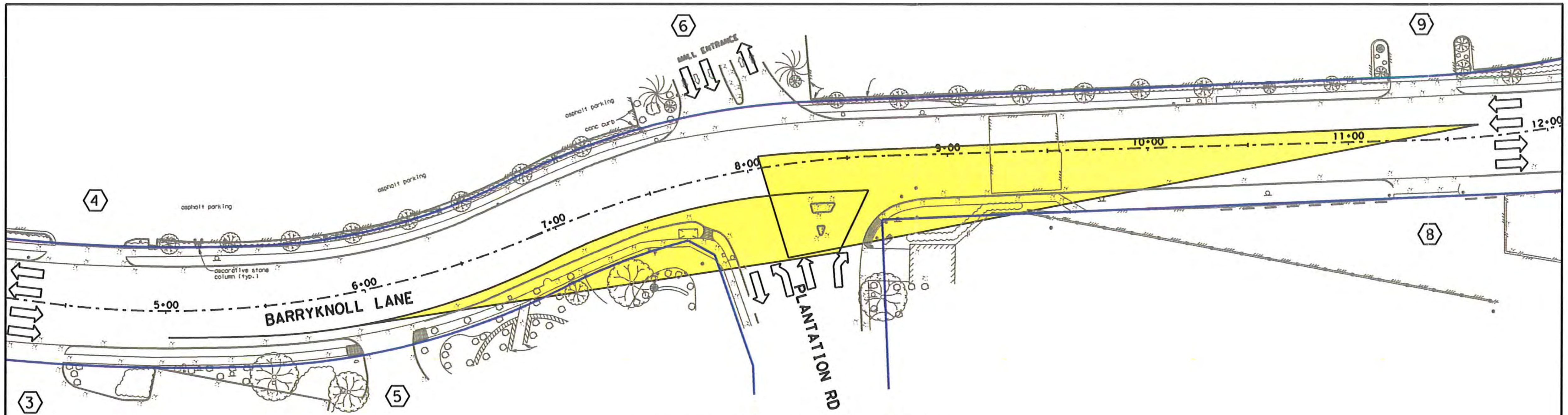
| | | |
|---|---|---|
| M.J.G. | DRN BY | AUG 2011 DATE |
| T.G.B. | DRN CKD BY | AUG 2011 DATE |
| M.J.G. | DES BY | AUG 2011 DATE |
| T.G.B. | DES CKD BY | AUG 2011 DATE |
| | APPROVED BY | DATE |
| SCALE: AS SHOWN | | |

BARRYKNOLL LANE

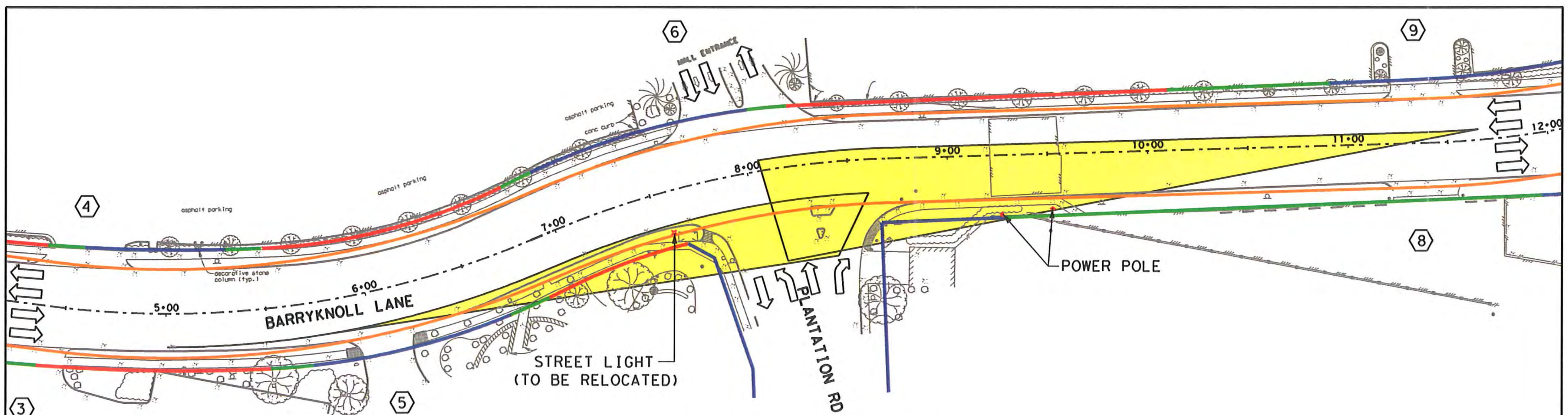
APPENDIX E.4
DRIVEWAY 6
SIGHT DISTANCE TRIANGLE

SHEET 6 OF 14

CONTRACT NO. | DRAWING NO. | REV.




## EXISTING SIGHT DISTANCE
(PLANTATION ROAD)




## PROPOSED SIGHT DISTANCE
(PLANTATION ROAD)

**LEGEND**

- PROPOSED CENTERLINE
- PROPOSED ROADWAY
- SIGHT DISTANCE TRIANGLE
- EXIST ROW (6' ≥ S < 8')
- EXIST ROW (8' ≤ S < 9')
- EXIST ROW (S ≥ 9')
- DRIVEWAY NUMBERS
- TRAFFIC FLOW DIRECTION

N

0 30 60 120
(IN FEET)
1 INCH = 60 FEET

| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
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| | |
|---|---|
| M. J. G. (DRN BY) | AUG 2011 (DATE) |
| T. G. B. (DRN CKD BY) | AUG 2011 (DATE) |
| M. J. G. (DES BY) | AUG 2011 (DATE) |
| T. G. B. (DES CKD BY) | AUG 2011 (DATE) |
| APPROVED BY | DATE |

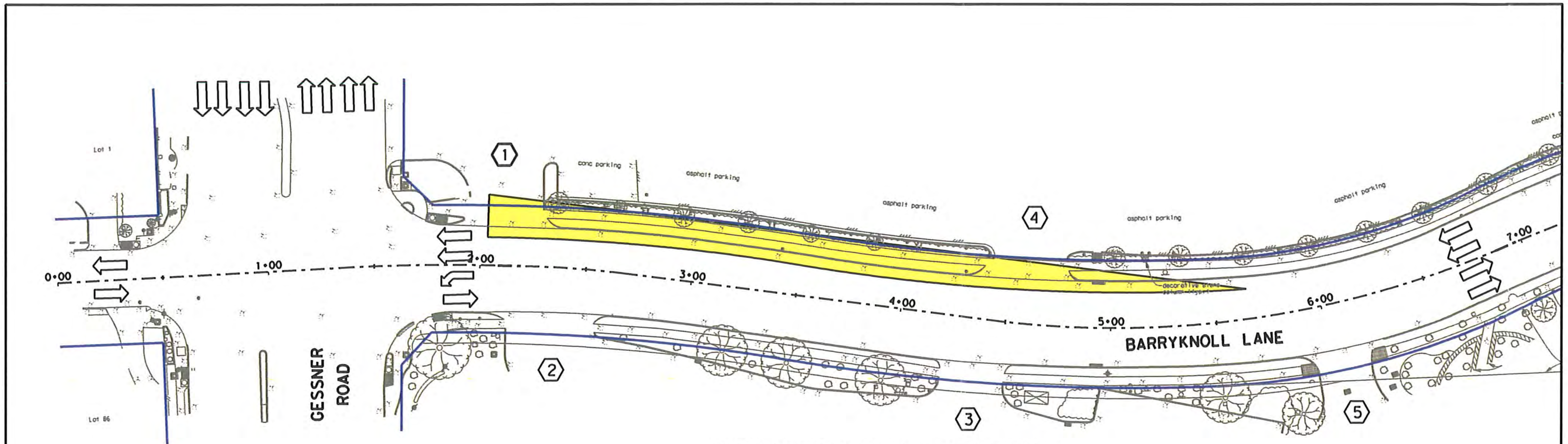
SCALE: AS SHOWN

BARRYKNOLL LANE

APPENDIX F.4
DRIVEWAY 7
SIGHT DISTANCE TRIANGLE

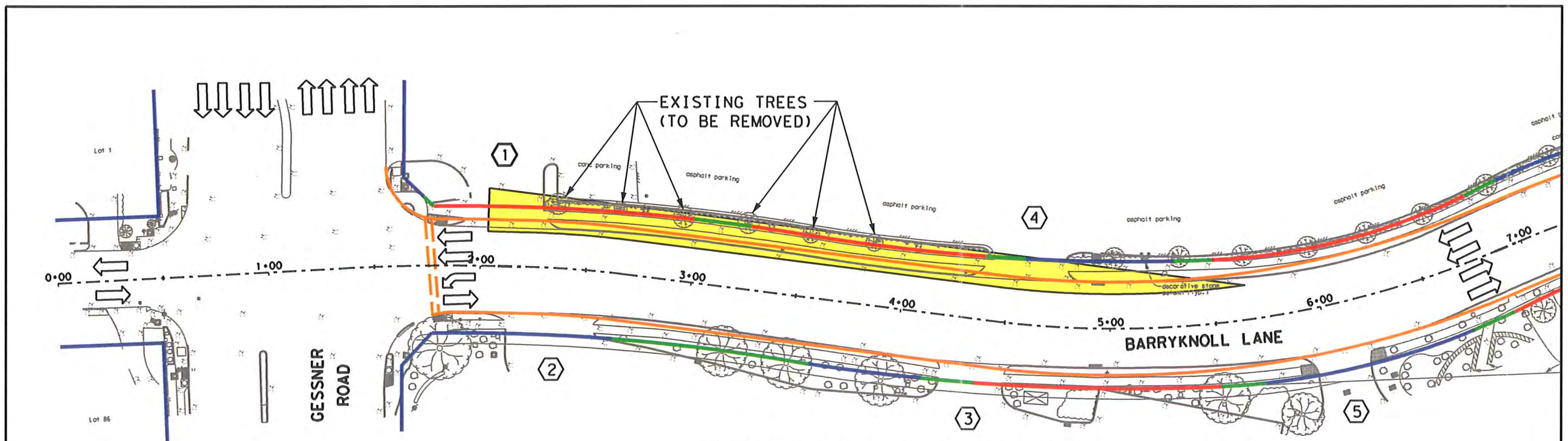
SHEET 7 OF 14

CONTRACT NO. | DRAWING NO. | REV.




## EXISTING SIGHT DISTANCE

(DRIVEWAY 1)




## PROPOSED SIGHT DISTANCE

(DRIVEWAY 1)

N

LEGEND

- PROPOSED CENTERLINE
- PROPOSED ROADWAY
- SIGHT DISTANCE TRIANGLE
- EXIST ROW (6' ≥ S < 8')
- EXIST ROW (8' ≤ S < 9')
- EXIST ROW (S ≥ 9')
- (X) DRIVEWAY NUMBERS
- TRAFFIC FLOW DIRECTION

0 30 60 120
(IN FEET)
1 INCH = 60 FEET

| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
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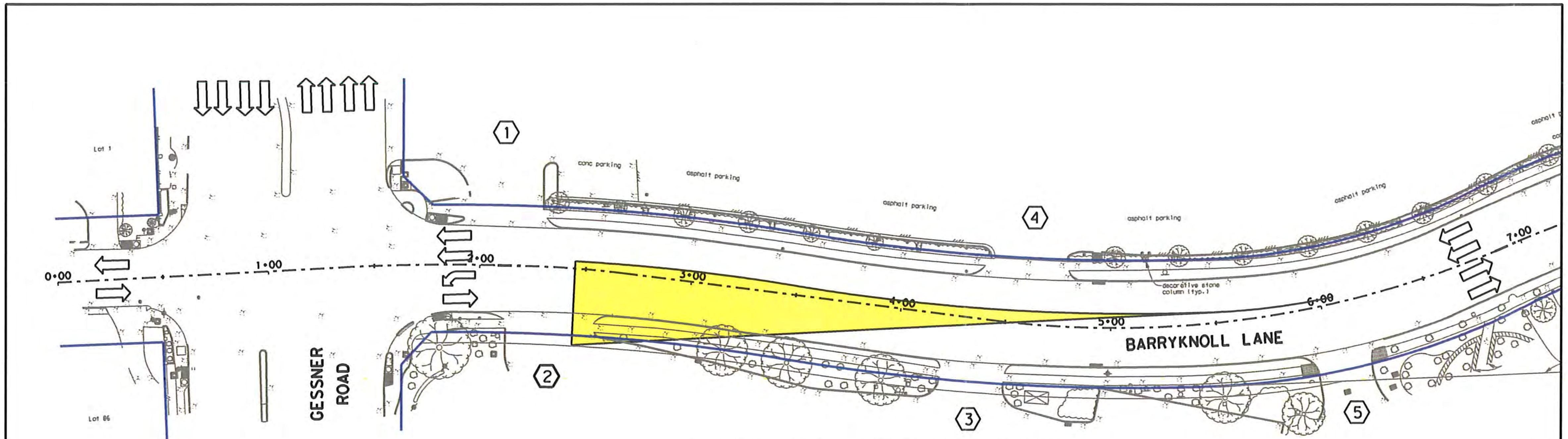
| M.J.G. (DRN BY) | AUG 2011 (DATE) |
| T.G.B. (DRN CKD BY) | AUG 2011 (DATE) |
| M.J.G. (DES BY) | AUG 2011 (DATE) |
| T.G.B. (DES CKD BY) | AUG 2011 (DATE) |
| APPROVED BY | DATE |
| SCALE: AS SHOWN | |

BARRYKNOLL LANE

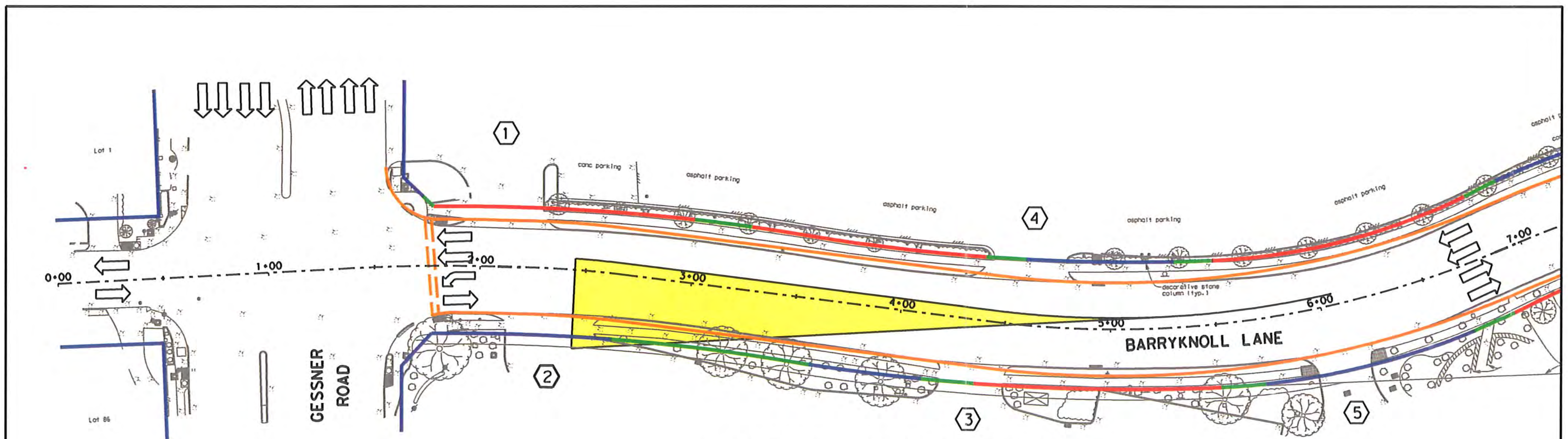
APPENDIX E.4
DRIVEWAY 1
SIGHT DISTANCE TRIANGLE

SHEET 1 OF 14

CONTRACT NO. | DRAWING NO. | REV.




EXISTING SIGHT DISTANCE
(DRIVEWAY 2)




PROPOSED SIGHT DISTANCE
(DRIVEWAY 2)

LEGEND

- PROPOSED CENTERLINE
- PROPOSED ROADWAY
- SIGHT DISTANCE TRIANGLE
- EXIST ROW (6' ≥ S < 8')
- EXIST ROW (8' ≤ S < 9')
- EXIST ROW (S ≥ 9')
- (X) DRIVEWAY NUMBERS
- TRAFFIC FLOW DIRECTION

N

0 30 60 120
(IN FEET)
1 INCH = 60 FEET

| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
|---|---|---|---|---|---|---|---|---|---|

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TIRZ 17 REDEVELOPMENT AUTHORITY

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P.E. Serial No.: 99997
Firm: Lockwood, Andrews & Newnam Inc.
Firm No.: F-2614
Date: AUG 2011

| | | |
|---|---|---|
| M.J.G. | DRN BY | AUG 2011 DATE |
| T.G.B. | DRN CKD BY | AUG 2011 DATE |
| M.J.G. | DES BY | AUG 2011 DATE |
| T.G.B. | DES CKD BY | AUG 2011 DATE |
| | APPROVED BY | DATE |
| SCALE: AS SHOWN | | |

BARRYKNOLL LANE

APPENDIX E.4
DRIVEWAY 2
SIGHT DISTANCE TRIANGLE

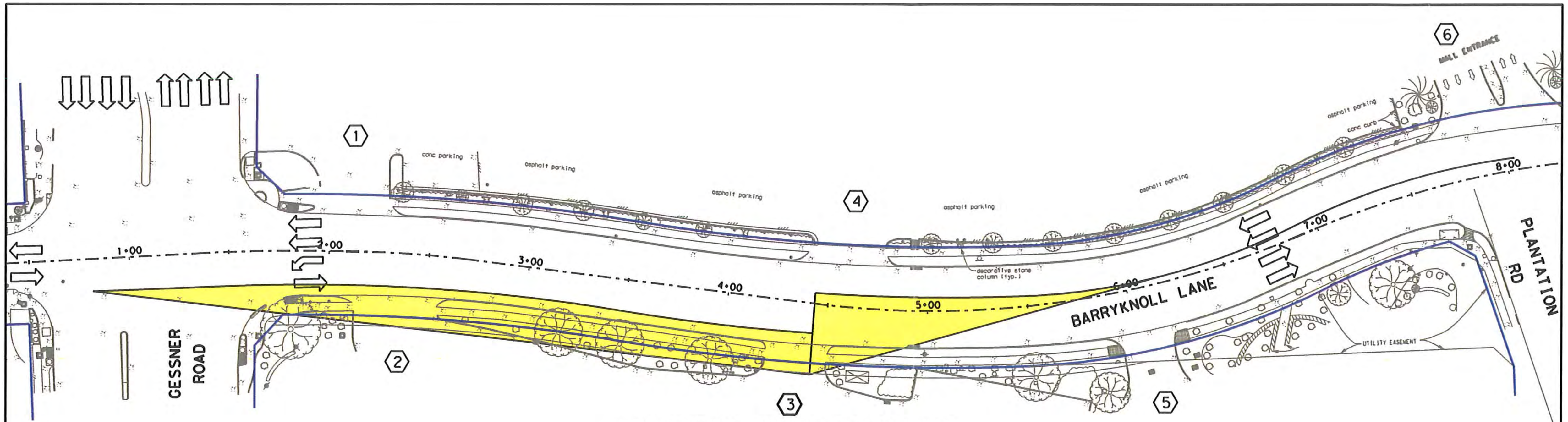
SHEET 2 OF 14

CONTRACT NO. | DRAWING NO. | REV.

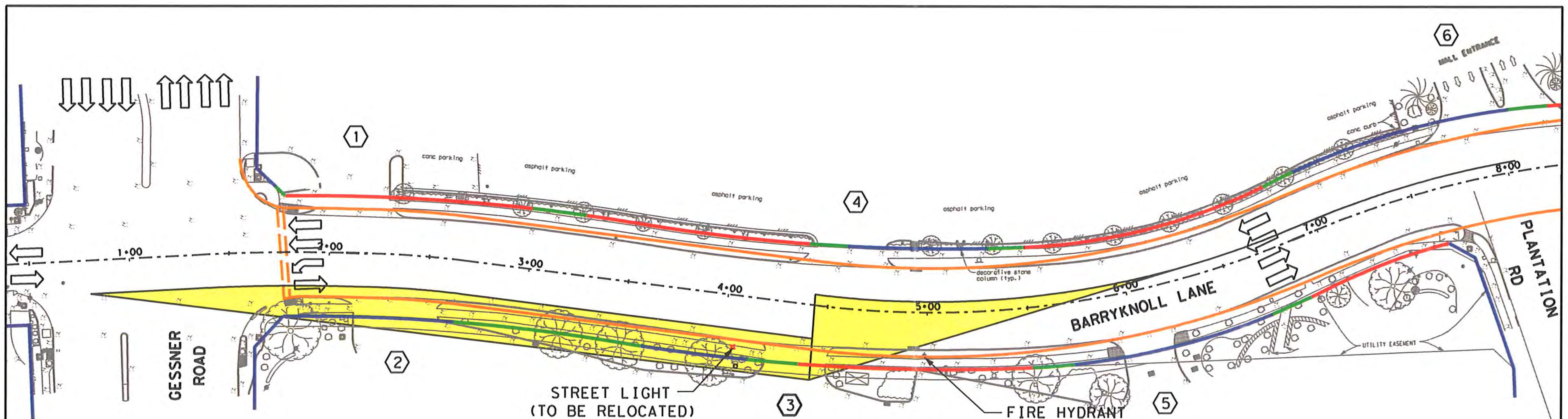
LEGEND

- PROPOSED CENTERLINE
- PROPOSED ROADWAY
- SIGHT DISTANCE TRIANGLE
- EXIST ROW (6' ≥ S < 8')
- EXIST ROW (8' ≤ S < 9')
- EXIST ROW (S ≥ 9')
- (X) DRIVEWAY NUMBERS
- TRAFFIC FLOW DIRECTION

0 30 60 120
(IN FEET)
1 INCH = 60 FEET




EXISTING SIGHT DISTANCE
(DRIVEWAY 3)




PROPOSED SIGHT DISTANCE
(DRIVEWAY 3)

| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
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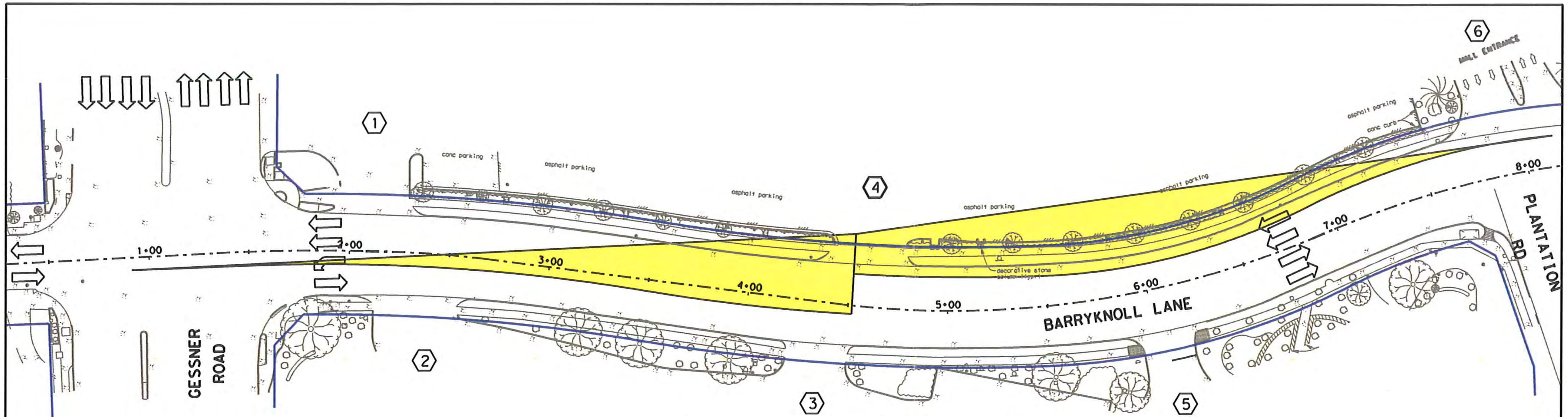
| T. G. B. — DRN CKD BY | AUG 2011 — DATE |
| M. J. G. — DES BY | AUG 2011 — DATE |
| T. G. B. — DES CKD BY | AUG 2011 — DATE |
| APPROVED BY | DATE |
| SCALE: AS SHOWN | |

BARRYKNOLL LANE

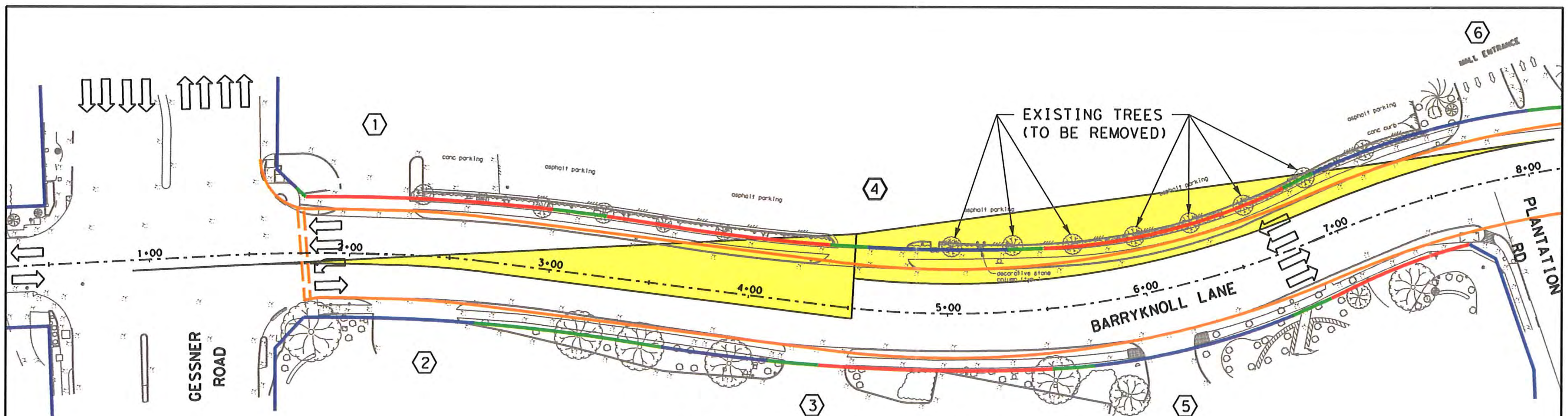
APPENDIX E.4
DRIVEWAY 3
SIGHT DISTANCE TRIANGLE

SHEET 3 OF 14

CONTRACT NO. | DRAWING NO. | REV.




## EXISTING SIGHT DISTANCE
(DRIVEWAY 4)




## PROPOSED SIGHT DISTANCE
(DRIVEWAY 4)

LEGEND

- PROPOSED CENTERLINE
- PROPOSED ROADWAY
- SIGHT DISTANCE TRIANGLE
- EXIST ROW (6' ≥ S < 8')
- EXIST ROW (8' ≤ S < 9')
- EXIST ROW (S ≥ 9')
- (X) DRIVEWAY NUMBERS
- TRAFFIC FLOW DIRECTION

N

0 30 60 120
(IN FEET)
1 INCH = 60 FEET

| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
|---|---|---|---|---|---|---|---|---|---|

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| T. G. B. DRN CKD BY | AUG 2011 DATE |
| M. J. G. DES BY | AUG 2011 DATE |
| T. G. B. DES CKD BY | AUG 2011 DATE |
| APPROVED BY | DATE |
| SCALE: AS SHOWN | |

BARRYKNOLL LANE

APPENDIX E.4
DRIVEWAY 4
SIGHT DISTANCE TRIANGLE

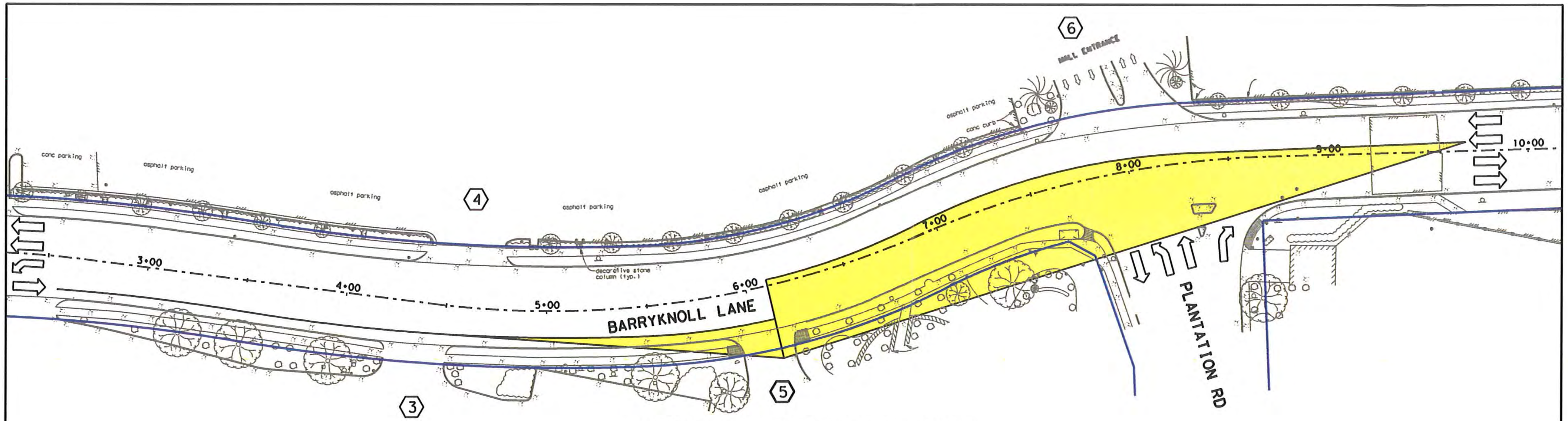
SHEET 4 OF 14

CONTRACT NO. | DRAWING NO. | REV.

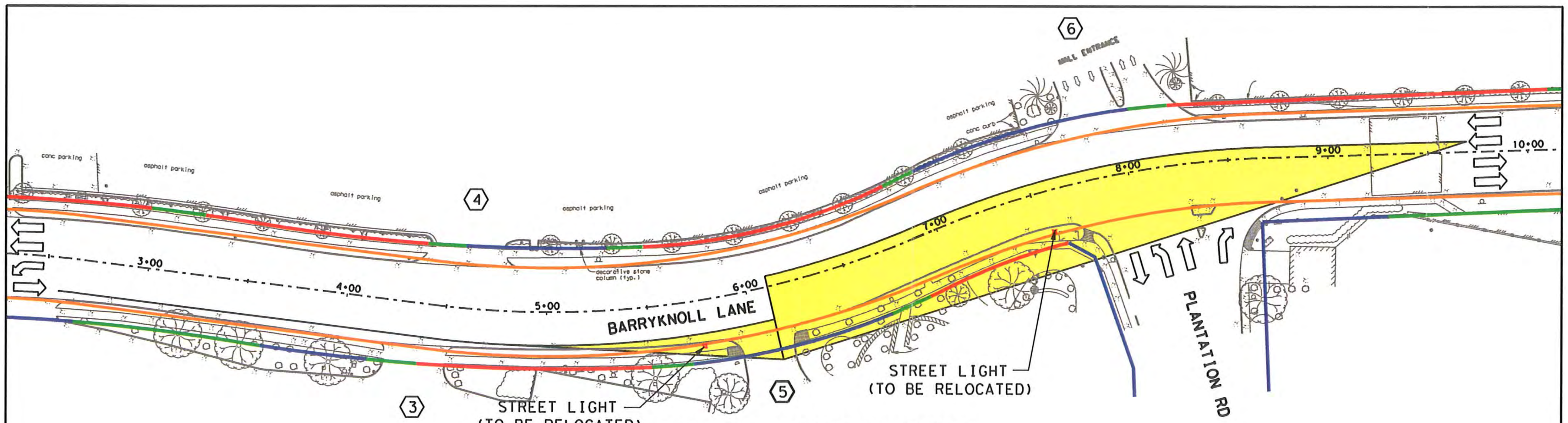
LEGEND

- PROPOSED CENTERLINE
- PROPOSED ROADWAY
- SIGHT DISTANCE TRIANGLE
- EXIST ROW (6' ≥ S < 8')
- EXIST ROW (8' ≤ S < 9')
- EXIST ROW (S ≥ 9')
- (X) DRIVEWAY NUMBERS
- TRAFFIC FLOW DIRECTION

0 30 60 120
(IN FEET)
1 INCH = 60 FEET




EXISTING SIGHT DISTANCE
(DRIVEWAY 5)




PROPOSED SIGHT DISTANCE
(DRIVEWAY 5)

| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
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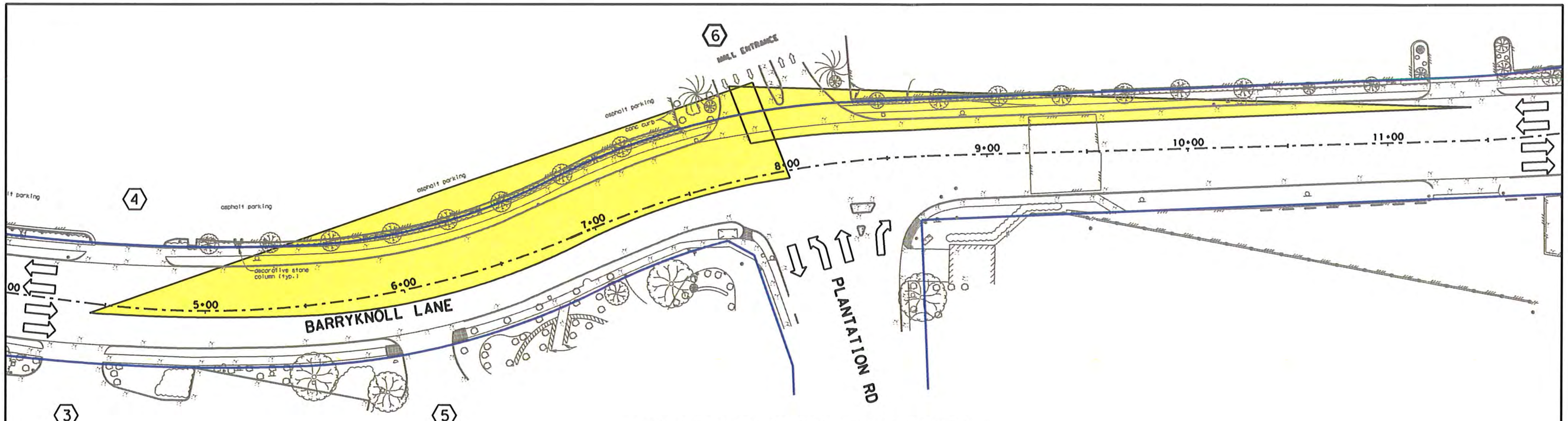
| T.G.B. DRN CKD BY | AUG 2011 DATE |
| M.J.G. DES BY | AUG 2011 DATE |
| T.G.B. DES CKD BY | AUG 2011 DATE |
| APPROVED BY | DATE |
| SCALE: AS SHOWN | |

BARRYKNOLL LANE

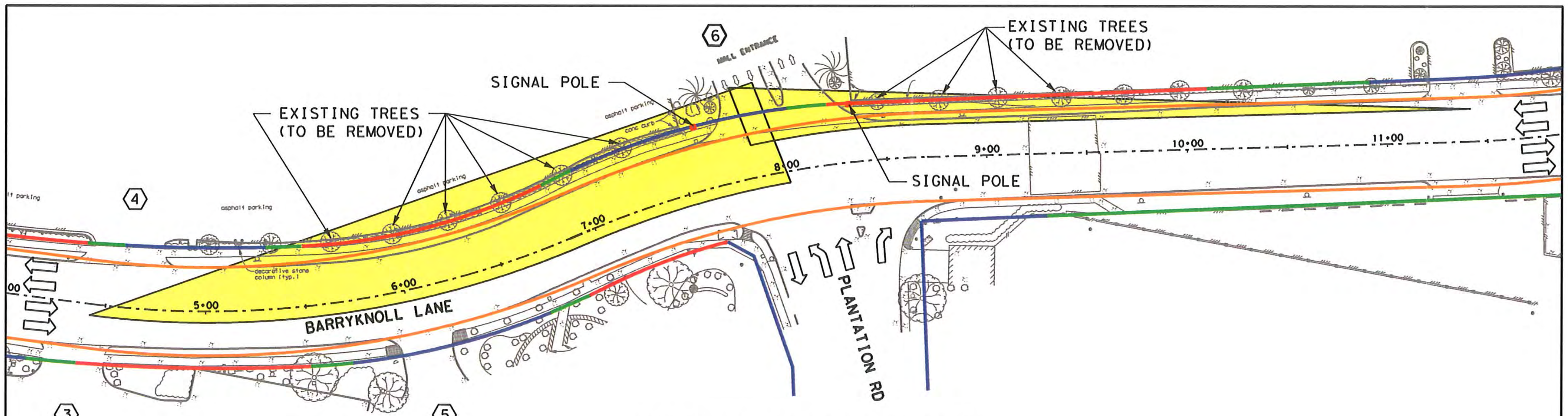
APPENDIX E.4
DRIVEWAY 5
SIGHT DISTANCE TRIANGLE

SHEET 5 OF 14

CONTRACT NO. | DRAWING NO. | REV.




EXISTING SIGHT DISTANCE
(DRIVEWAY 6)




PROPOSED SIGHT DISTANCE
(DRIVEWAY 6)

**LEGEND**

- PROPOSED CENTERLINE
- PROPOSED ROADWAY
- SIGHT DISTANCE TRIANGLE
- EXIST ROW (6' ≥ S < 8')
- EXIST ROW (8' ≤ S < 9')
- EXIST ROW (S ≥ 9')
- (X) DRIVEWAY NUMBERS
- TRAFFIC FLOW DIRECTION

N

0 30 60 120
(IN FEET)
1 INCH = 60 FEET

| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
|---|---|---|---|---|---|---|---|---|---|

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| T. G. B. DES CKD BY | AUG 2011 DATE |
| APPROVED BY | DATE |
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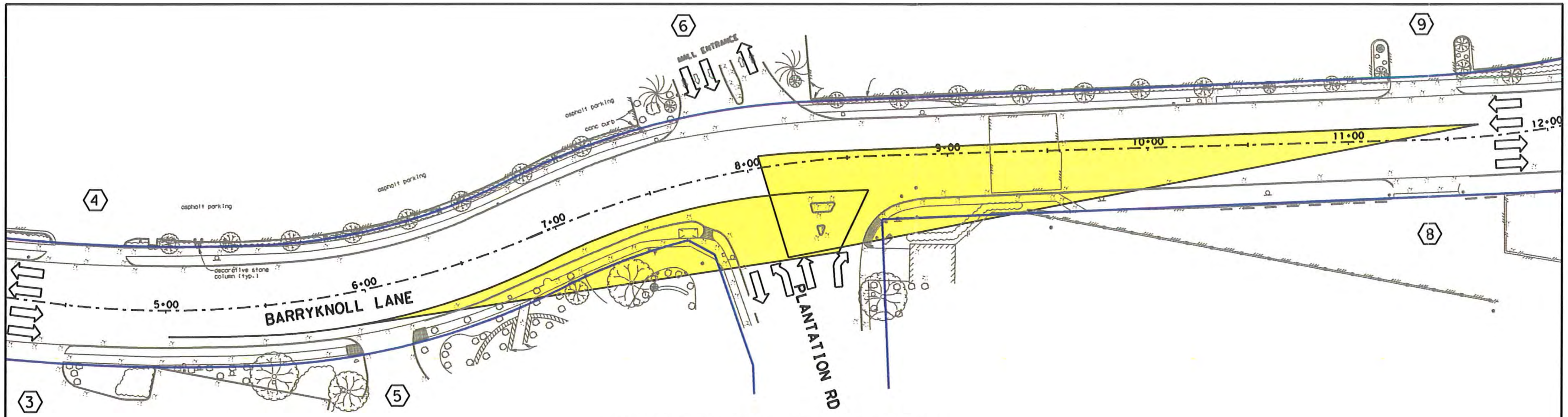
BARRYKNOLL LANE

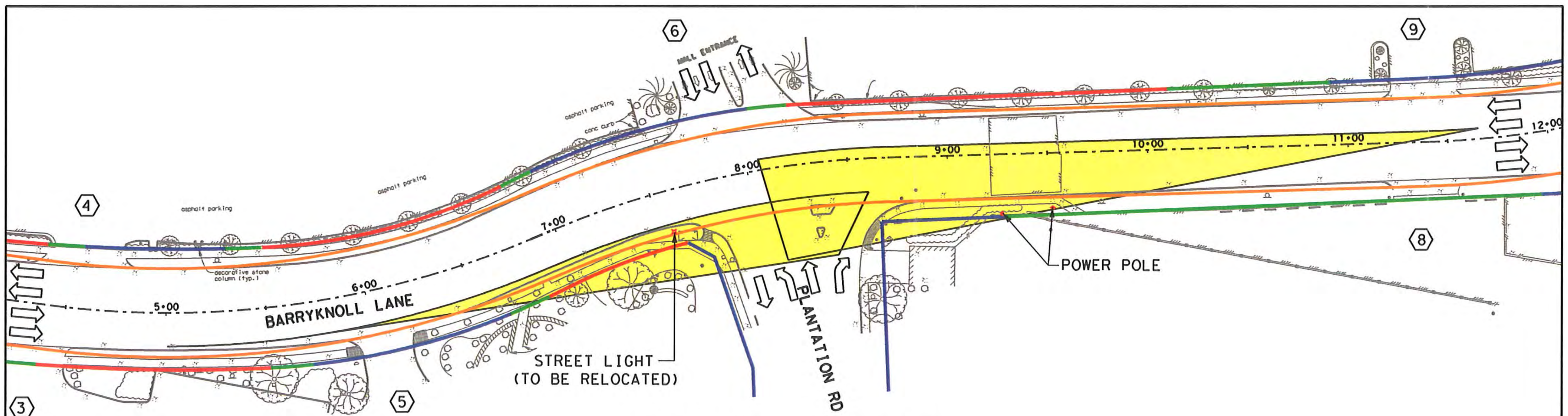
APPENDIX E.4
DRIVEWAY 6
SIGHT DISTANCE TRIANGLE

SHEET 6 OF 14

CONTRACT NO. | DRAWING NO. | REV.




## EXISTING SIGHT DISTANCE
(PLANTATION ROAD)




## PROPOSED SIGHT DISTANCE
(PLANTATION ROAD)

**LEGEND**

- PROPOSED CENTERLINE
- PROPOSED ROADWAY
- SIGHT DISTANCE TRIANGLE
- EXIST ROW (6' ≥ S < 8')
- EXIST ROW (8' ≤ S < 9')
- EXIST ROW (S ≥ 9')
- (X) DRIVEWAY NUMBERS
- TRAFFIC FLOW DIRECTION

N

0 30 60 120
(IN FEET)
1 INCH = 60 FEET

| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
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Firm No.: F-2614
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| T. G. B. DRN CKD BY | AUG 2011 DATE |
| M. J. G. DES BY | AUG 2011 DATE |
| T. G. B. DES CKD BY | AUG 2011 DATE |
| APPROVED BY | DATE |
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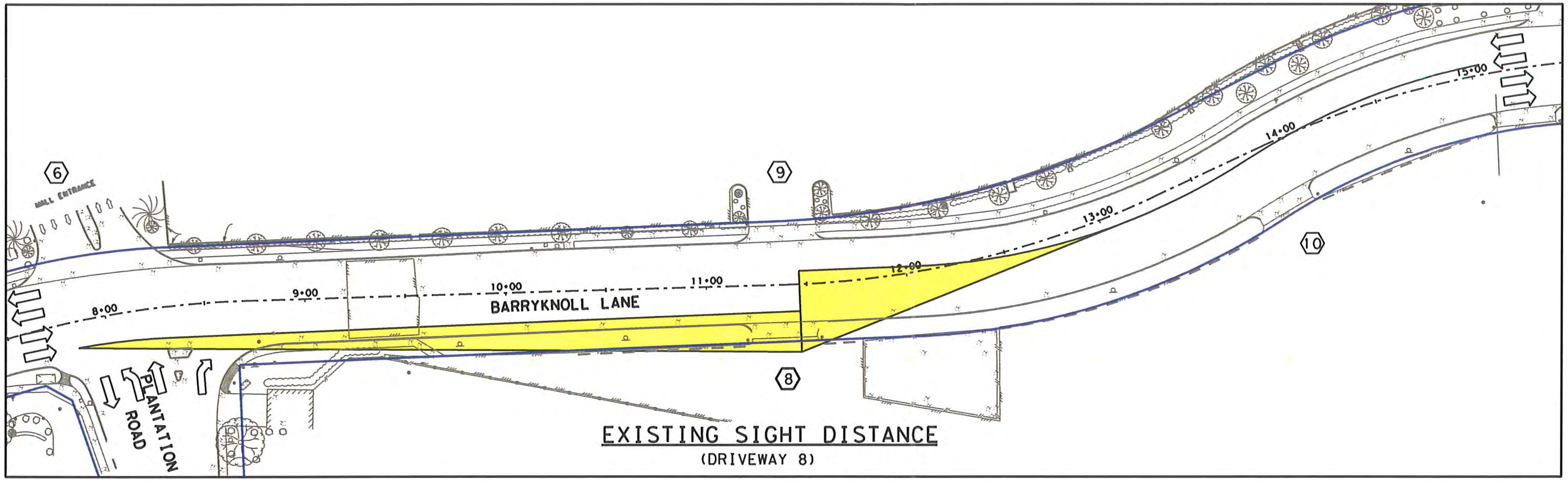
BARRYKNOLL LANE

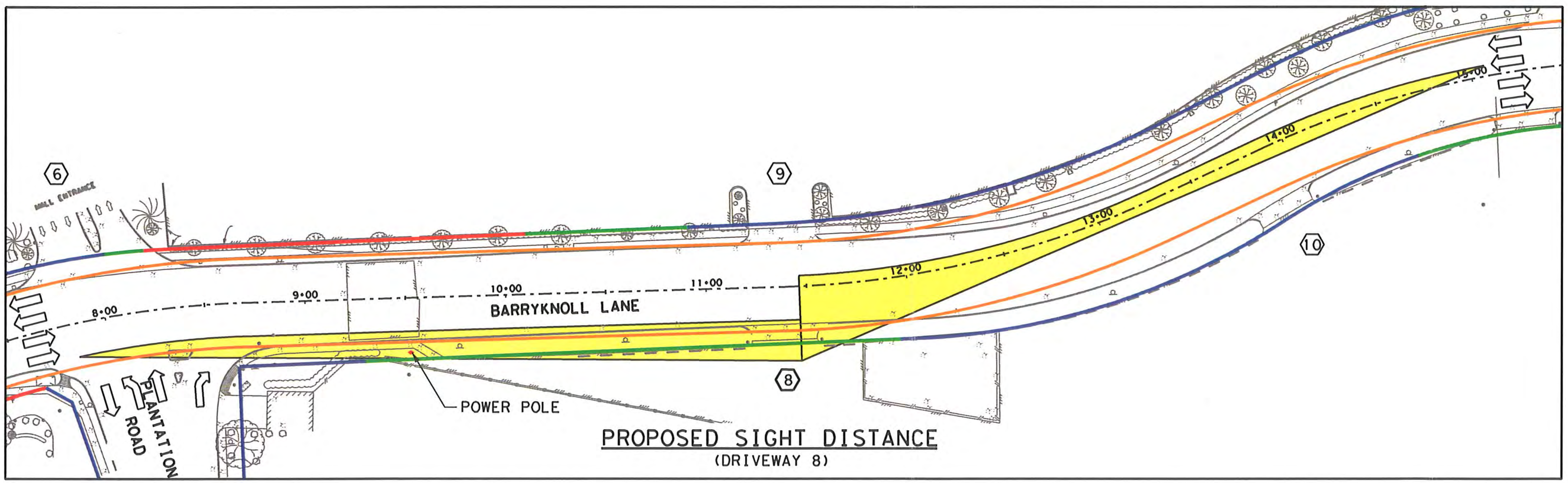
APPENDIX F.4
DRIVEWAY 7
SIGHT DISTANCE TRIANGLE

SHEET 7 OF 14

CONTRACT NO. | DRAWING NO. | REV.




EXISTING SIGHT DISTANCE
(DRIVEWAY 8)




PROPOSED SIGHT DISTANCE
(DRIVEWAY 8)

LEGEND

- PROPOSED CENTERLINE
- PROPOSED ROADWAY
- SIGHT DISTANCE TRIANGLE
- EXIST ROW (6' ≥ S < 8')
- EXIST ROW (8' ≤ S < 9')
- EXIST ROW (S ≥ 9')
- (X) DRIVEWAY NUMBERS
- TRAFFIC FLOW DIRECTION

N

0 30 60 120
(IN FEET)
1 INCH = 60 FEET

| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
|---|---|---|---|---|---|---|---|---|---|

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| M. J. G. — DRN BY | AUG 2011 — DATE |
| T. G. B. — DRN CKD BY | AUG 2011 — DATE |
| M. J. G. — DES BY | AUG 2011 — DATE |
| T. G. B. — DES CKD BY | AUG 2011 — DATE |
| APPROVED BY | DATE |
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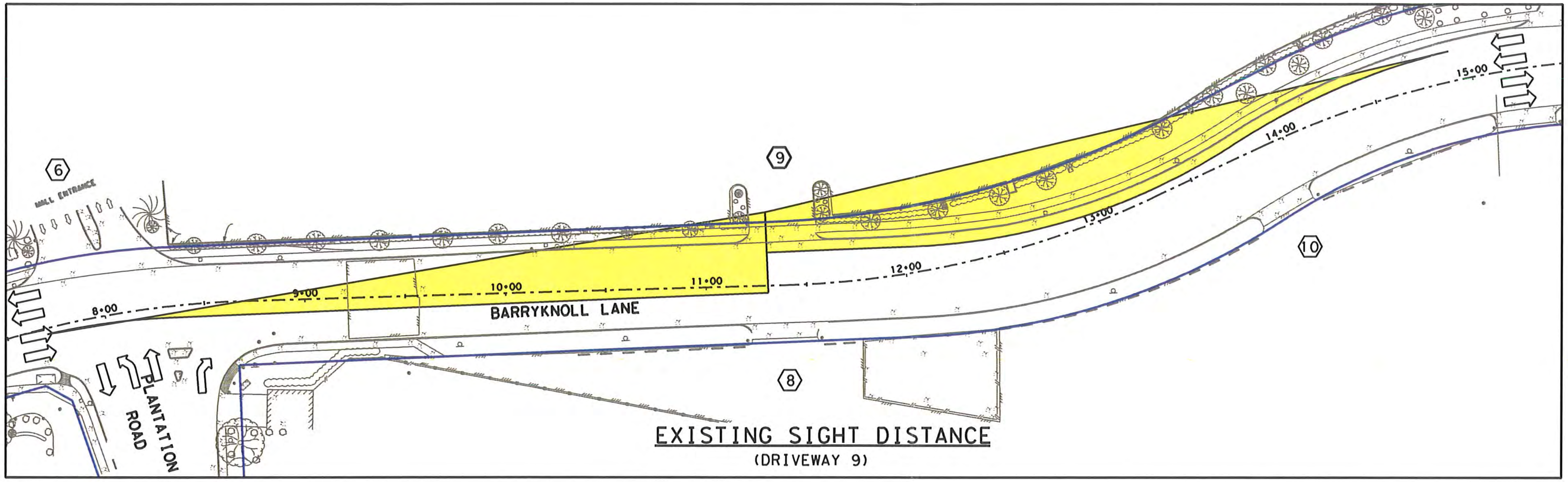
BARRYKNOLL LANE

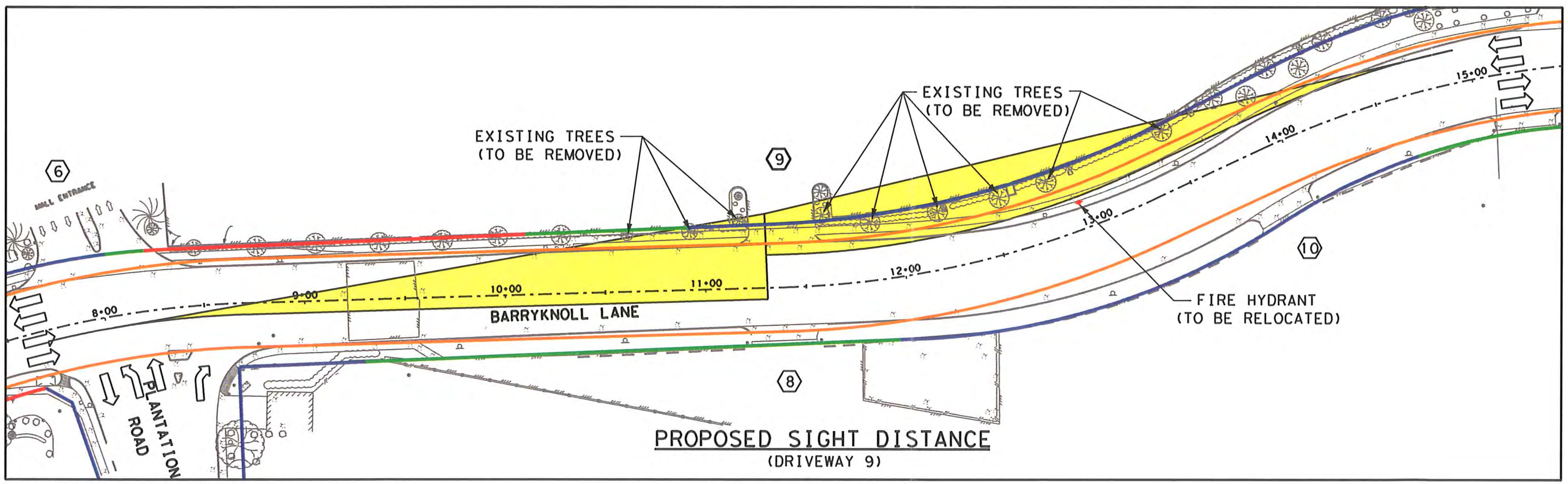
APPENDIX E.4
DRIVEWAY 8
SIGHT DISTANCE TRIANGLE

SHEET 8 OF 14

CONTRACT NO. | DRAWING NO. | REV.




## EXISTING SIGHT DISTANCE
(DRIVEWAY 9)




## PROPOSED SIGHT DISTANCE
(DRIVEWAY 9)

LEGEND

- PROPOSED CENTERLINE
- PROPOSED ROADWAY
- SIGHT DISTANCE TRIANGLE
- EXIST ROW (6' ≥ S < 8')
- EXIST ROW (8' ≤ S < 9')
- EXIST ROW (S ≥ 9')
- (X) DRIVEWAY NUMBERS
- TRAFFIC FLOW DIRECTION

N

0 30 60 120
(IN FEET)
1 INCH = 60 FEET

| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
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| M. J. G. DES BY | AUG 2011 DATE |
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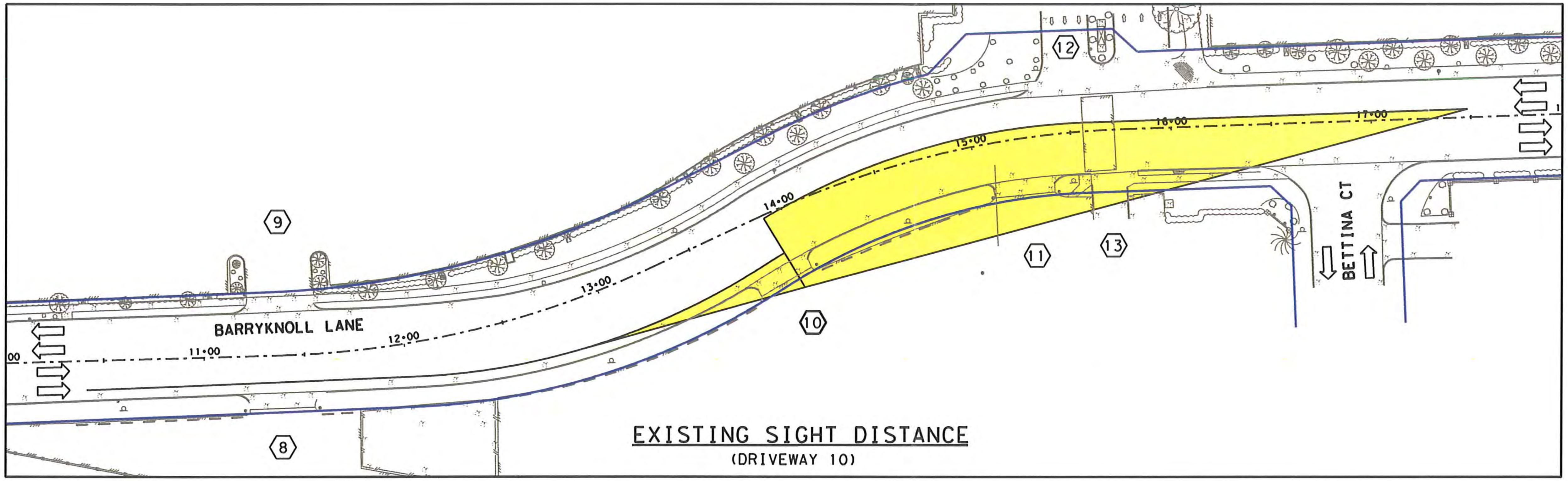
BARRYKNOLL LANE

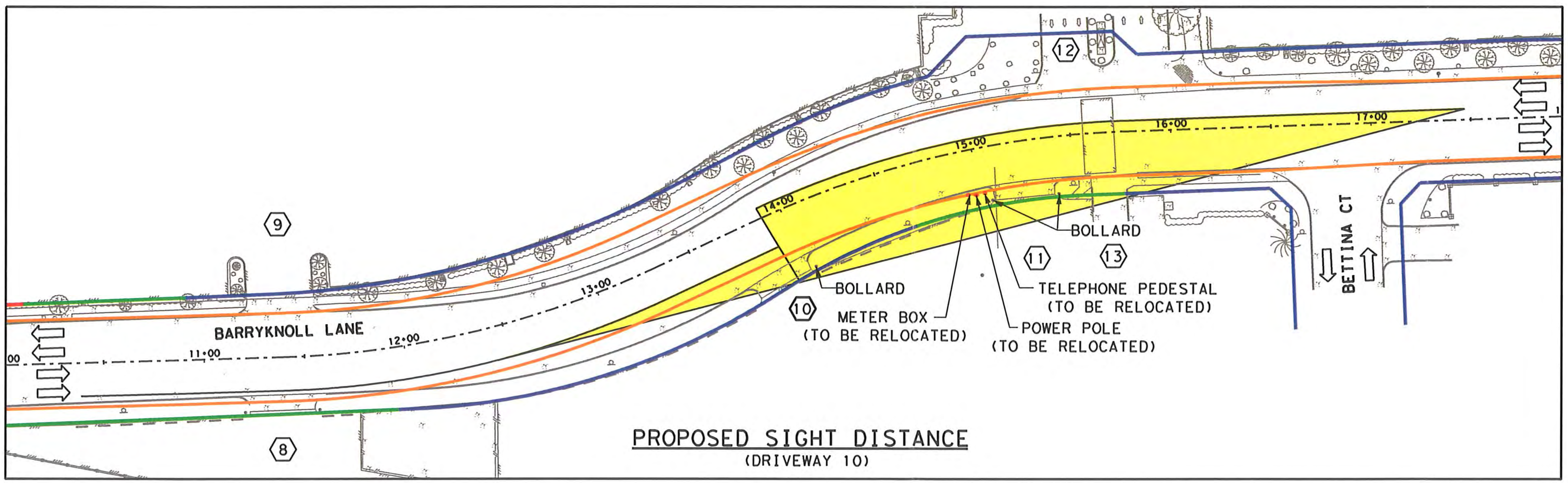
APPENDIX E.4
DRIVEWAY 9
SIGHT DISTANCE TRIANGLE

SHEET 9 OF 14

CONTRACT NO. | DRAWING NO. | REV.




EXISTING SIGHT DISTANCE
(DRIVEWAY 10)




PROPOSED SIGHT DISTANCE
(DRIVEWAY 10)

LEGEND

- PROPOSED CENTERLINE
- PROPOSED ROADWAY
- SIGHT DISTANCE TRIANGLE
- EXIST ROW (6' ≥ S < 8')
- EXIST ROW (8' ≤ S < 9')
- EXIST ROW (S ≥ 9')
- DRIVEWAY NUMBERS
- TRAFFIC FLOW DIRECTION

N

0 30 60 120
(IN FEET)
1 INCH = 60 FEET

| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
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| M.J.G. DES BY | AUG 2011 DATE |
| T.G.B. DES CKD BY | AUG 2011 DATE |
| APPROVED BY | DATE |
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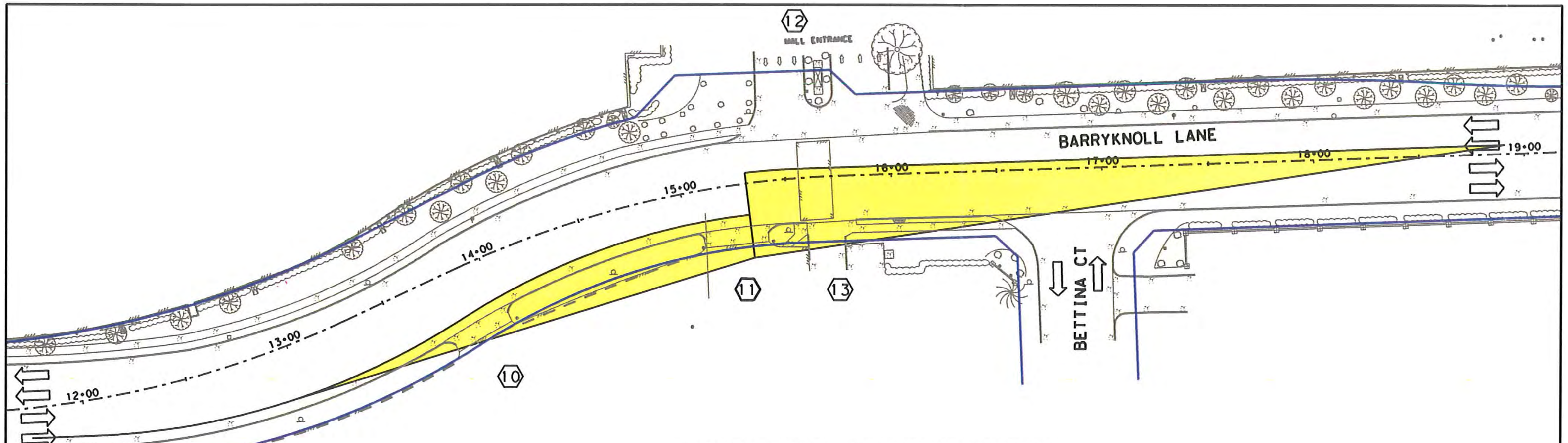
BARRYKNOLL LANE

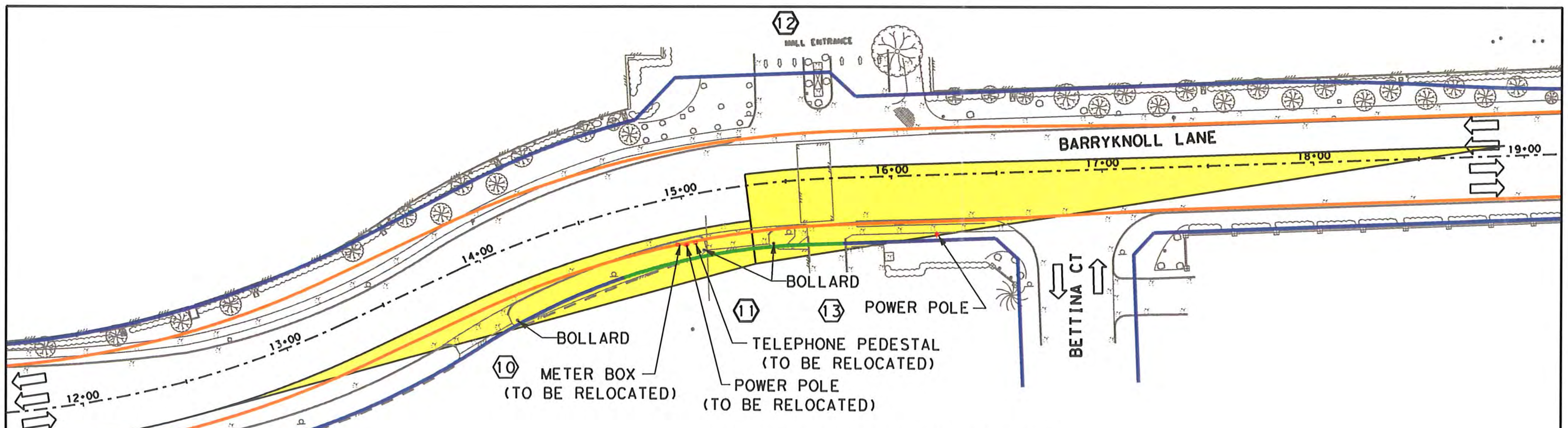
APPENDIX E.4
DRIVEWAY 10
SIGHT DISTANCE TRIANGLE

SHEET 10 OF 14

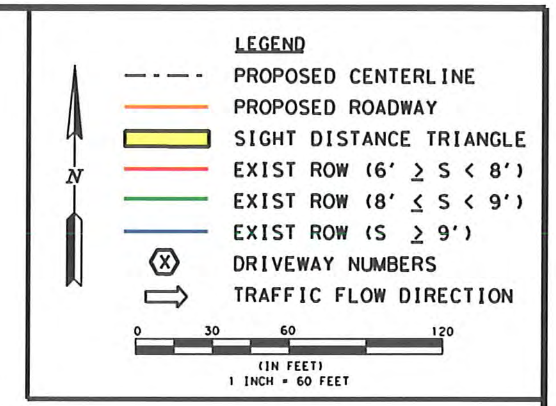
CONTRACT NO. | DRAWING NO. | REV.




EXISTING SIGHT DISTANCE
(DRIVEWAY 11)




PROPOSED SIGHT DISTANCE
(DRIVEWAY 11)




| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
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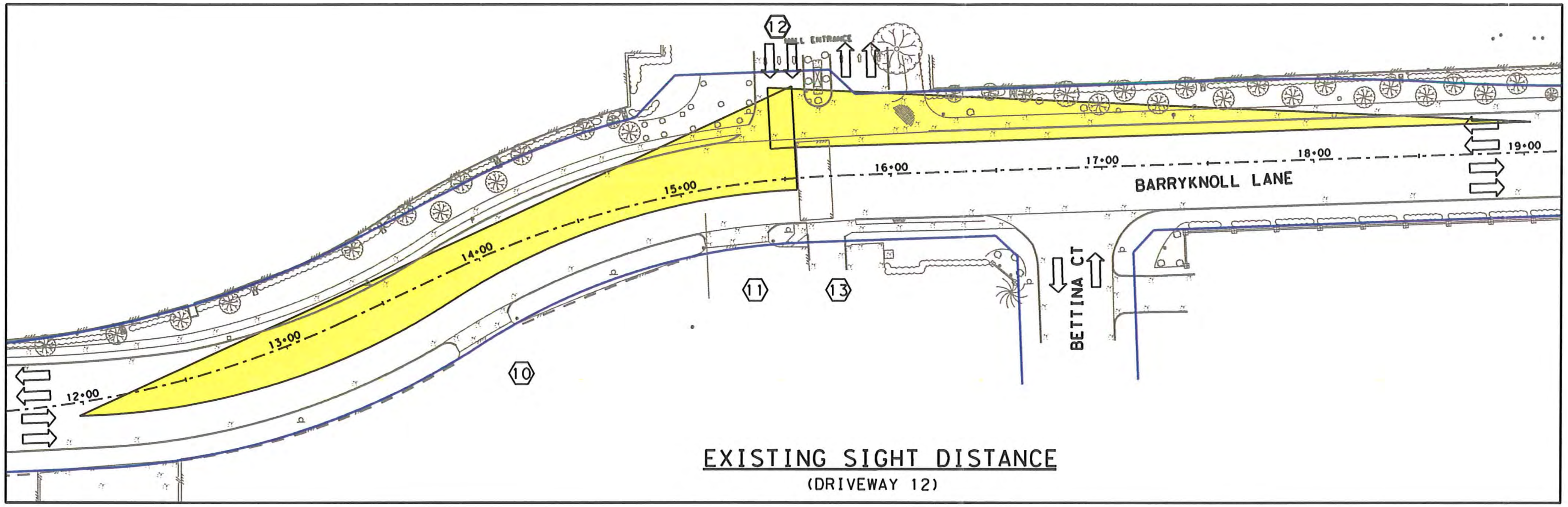
BARRYKNOLL LANE

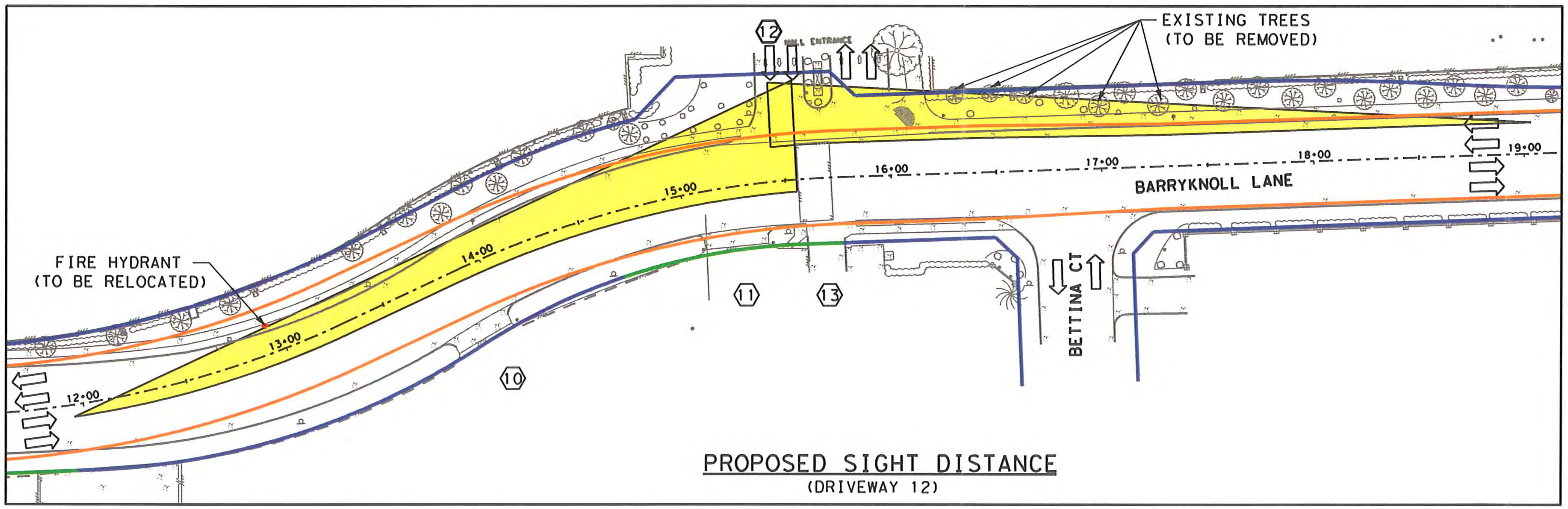
APPENDIX E.4
DRIVEWAY 11
SIGHT DISTANCE TRIANGLE

SHEET 11 OF 14

CONTRACT NO. | DRAWING NO. | REV.




## EXISTING SIGHT DISTANCE
(DRIVEWAY 12)




## PROPOSED SIGHT DISTANCE
(DRIVEWAY 12)

**LEGEND**
- PROPOSED CENTERLINE
- PROPOSED ROADWAY
- SIGHT DISTANCE TRIANGLE
- EXIST ROW (6' ≥ S < 8')
- EXIST ROW (8' ≤ S < 9')
- EXIST ROW (S ≥ 9')
- (X) DRIVEWAY NUMBERS
- TRAFFIC FLOW DIRECTION

N

0 30 60 120
(IN FEET)
1 INCH = 60 FEET

| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
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| M. J. G. DES BY | AUG 2011 DATE |
| T. G. B. DES CKD BY | AUG 2011 DATE |
| APPROVED BY | DATE |
| SCALE: AS SHOWN | |

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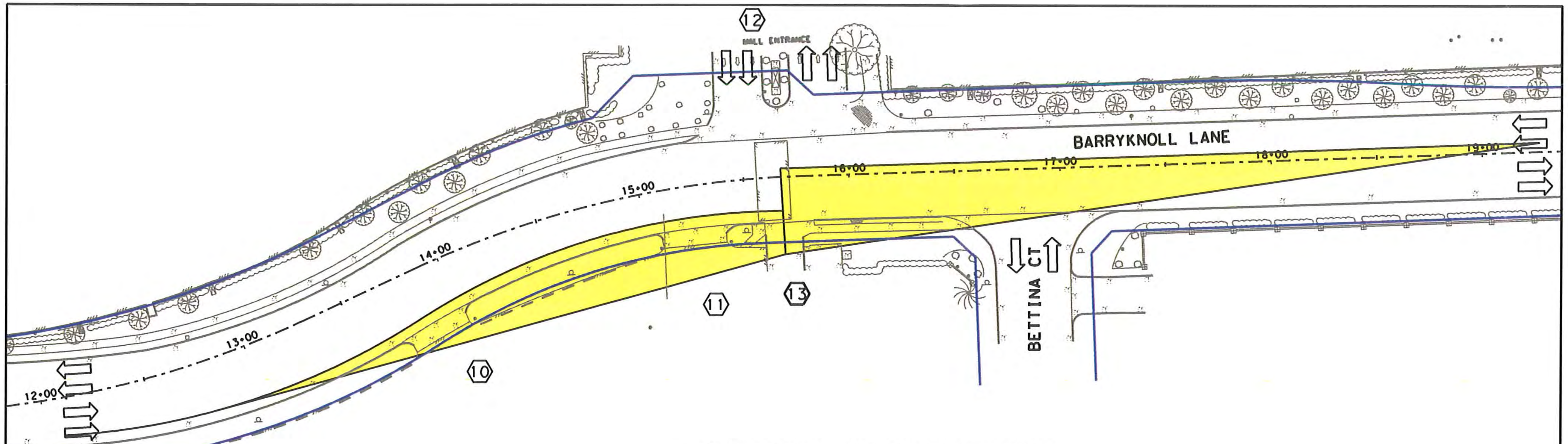
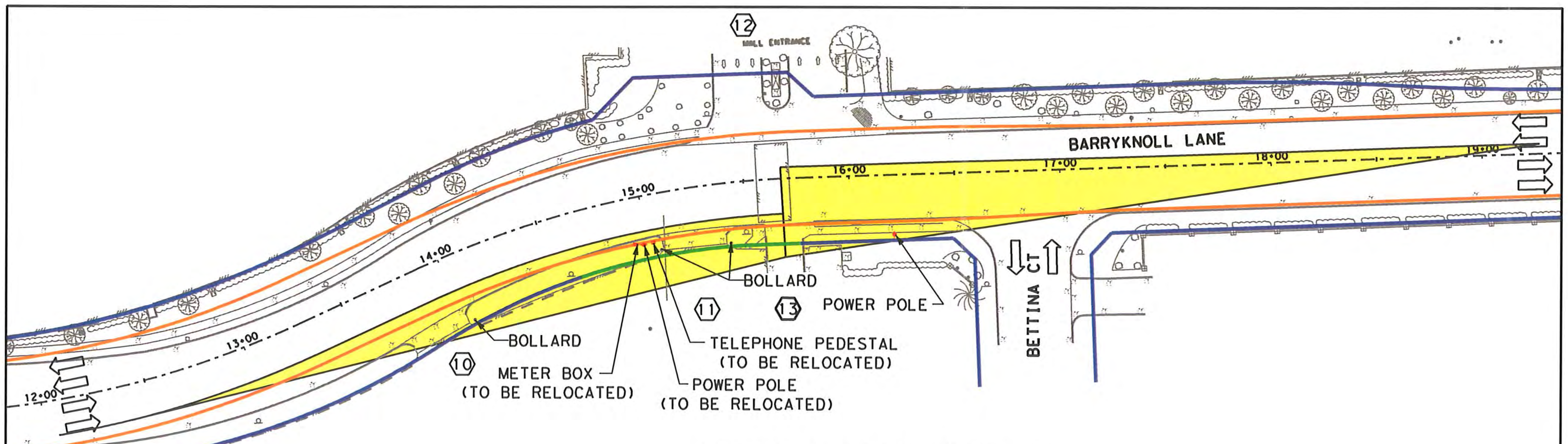
APPENDIX E.4
DRIVEWAY 12
SIGHT DISTANCE TRIANGLE

SHEET 12 OF 14

CONTRACT NO. | DRAWING NO. | REV.




EXISTING SIGHT DISTANCE
(DRIVEWAY 13)




PROPOSED SIGHT DISTANCE
(DRIVEWAY 13)

**LEGEND**

N

- PROPOSED CENTERLINE
- PROPOSED ROADWAY
- SIGHT DISTANCE TRIANGLE
- EXIST ROW (6' ≥ S < 8')
- EXIST ROW (8' ≤ S < 9')
- EXIST ROW (S ≥ 9')
- (X) DRIVEWAY NUMBERS
- TRAFFIC FLOW DIRECTION

0 30 60 120
(IN FEET)
1 INCH = 60 FEET

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Lockwood, Andrews & Newnam, Inc.
A LEO A DALY COMPANY

TIRZ 17 REDEVELOPMENT AUTHORITY

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Engineer: Tara G. Burrer, P.E.
P.E. Serial No.: 99997
Firm: Lockwood, Andrews & Newnam Inc.
Firm No.: F-2614
Date: AUG 2011

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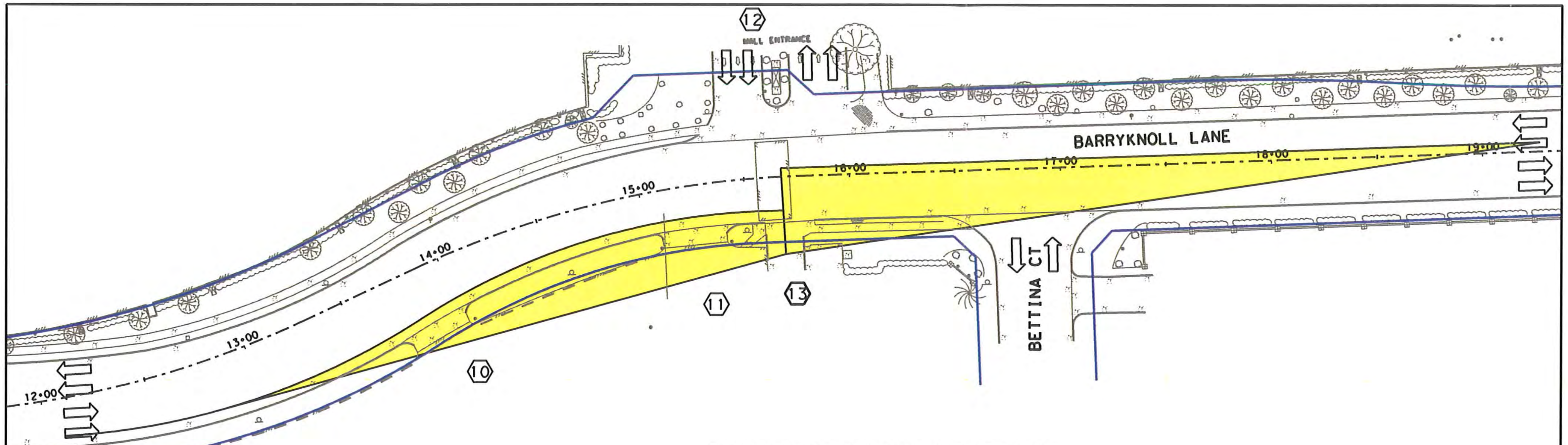
| M. J. G. DRN BY | AUG 2011 DATE |
| T. G. B. DRN CKD BY | AUG 2011 DATE |
| M. J. G. DES BY | AUG 2011 DATE |
| T. G. B. DES CKD BY | AUG 2011 DATE |
| APPROVED BY | DATE |
| SCALE: AS SHOWN | |

BARRYKNOLL LANE

APPENDIX F.4
DRIVEWAY 13
SIGHT DISTANCE TRIANGLE

SHEET 13 OF 14

CONTRACT NO. | DRAWING NO. | REV.

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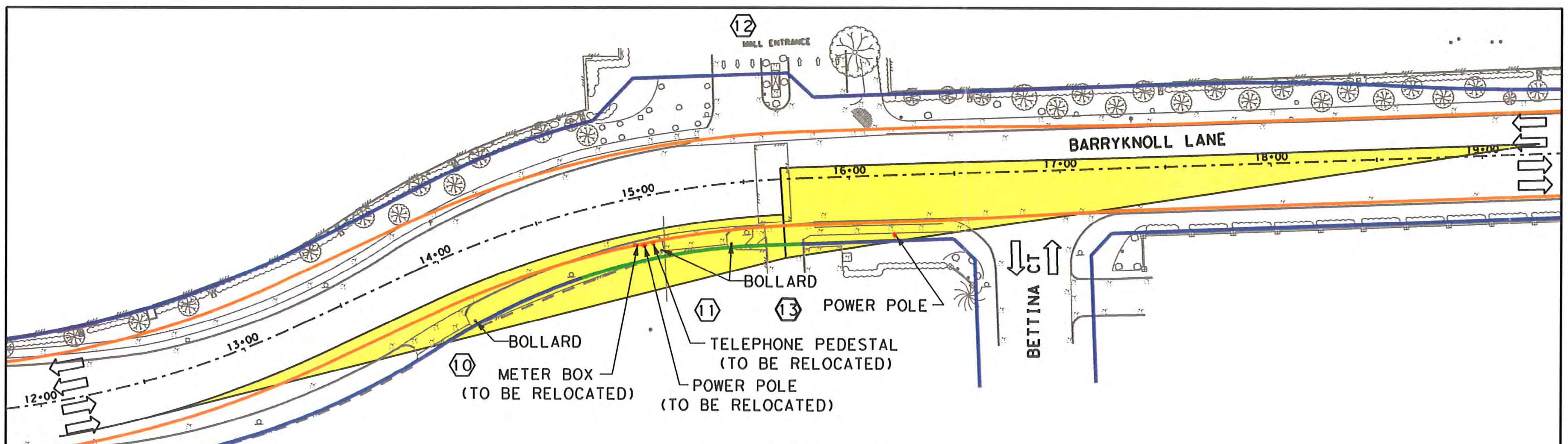
(DRIVEWAY 13)




PROPOSED SIGHT DISTANCE
(DRIVEWAY 13)

LEGEND
- PROPOSED CENTERLINE
- PROPOSED ROADWAY
- SIGHT DISTANCE TRIANGLE
- EXIST ROW (6' ≥ S < 8')
- EXIST ROW (8' ≤ S < 9')
- EXIST ROW (S ≥ 9')
- (X) DRIVEWAY NUMBERS
- TRAFFIC FLOW DIRECTION

N

0 30 60 120
(IN FEET)
1 INCH = 60 FEET

| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
|---|---|---|---|---|---|---|---|---|---|

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TIRZ 17 REDEVELOPMENT AUTHORITY

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| APPROVED BY | DATE |
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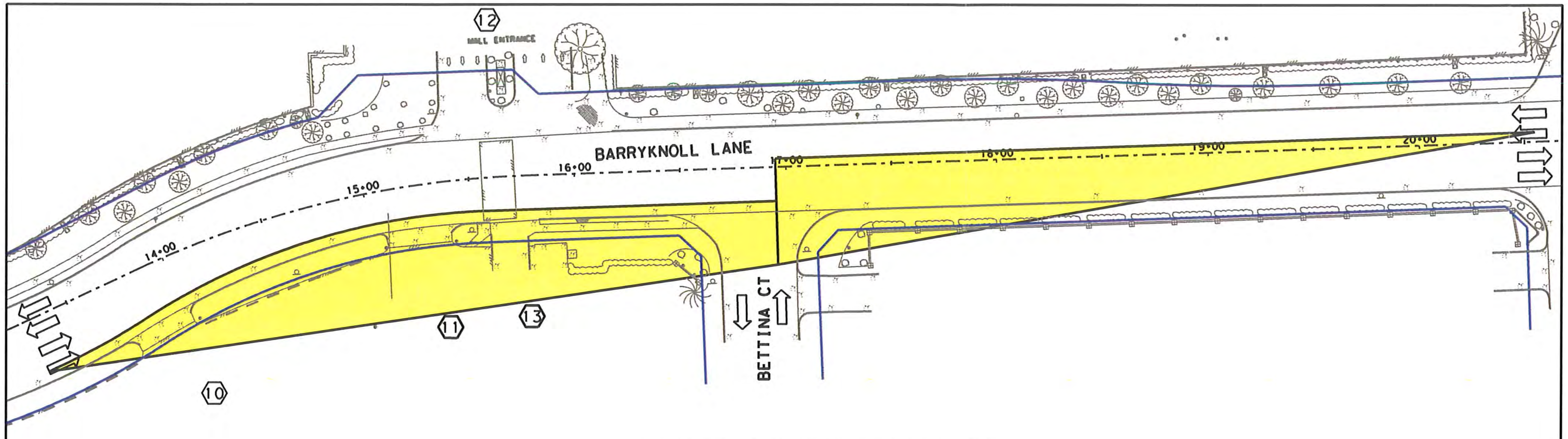
BARRYKNOLL LANE

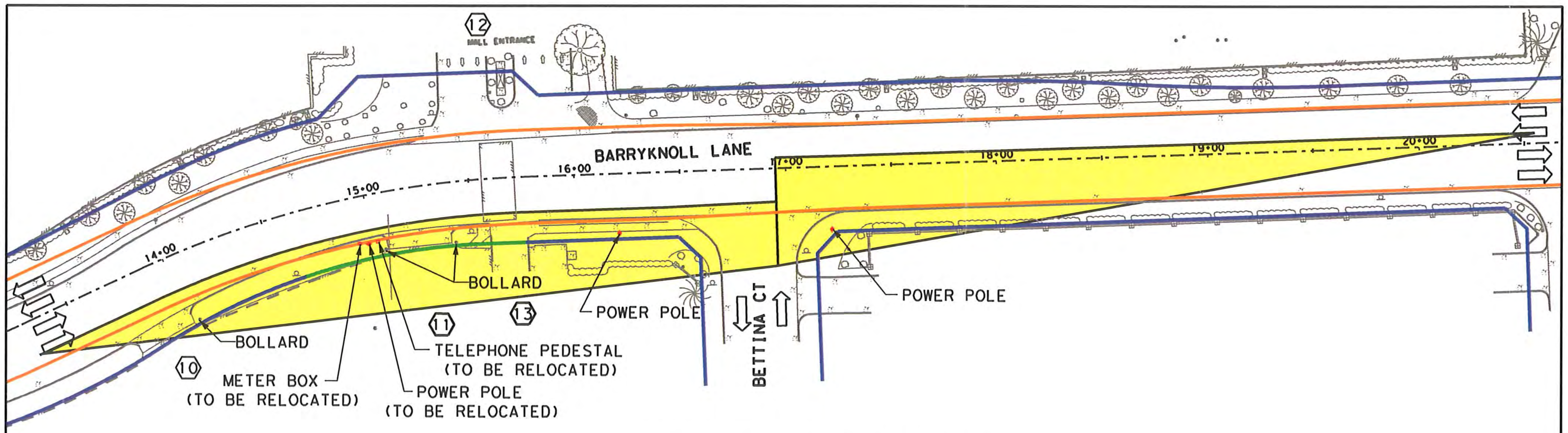
APPENDIX E.4
DRIVEWAY 13
SIGHT DISTANCE TRIANGLE

SHEET 13 OF 14

CONTRACT NO. | DRAWING NO. | REV.




EXISTING SIGHT DISTANCE
(BETTINA CT)




PROPOSED SIGHT DISTANCE
(BETTINA CT)

LEGEND

N

- PROPOSED CENTERLINE
- PROPOSED ROADWAY
- SIGHT DISTANCE TRIANGLE
- EXIST ROW (6' ≥ S < 8')
- EXIST ROW (8' ≤ S < 9')
- EXIST ROW (S ≥ 9')
- (X) DRIVEWAY NUMBERS
- TRAFFIC FLOW DIRECTION

0 30 60 120
(IN FEET)
1 INCH = 60 FEET

| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
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TIRZ 17 REDEVELOPMENT AUTHORITY

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| M. J. G. — DES BY | AUG 2011 — DATE |
| T. G. B. — DES CKD BY | AUG 2011 — DATE |
| APPROVED BY | DATE |
| SCALE: AS SHOWN | |

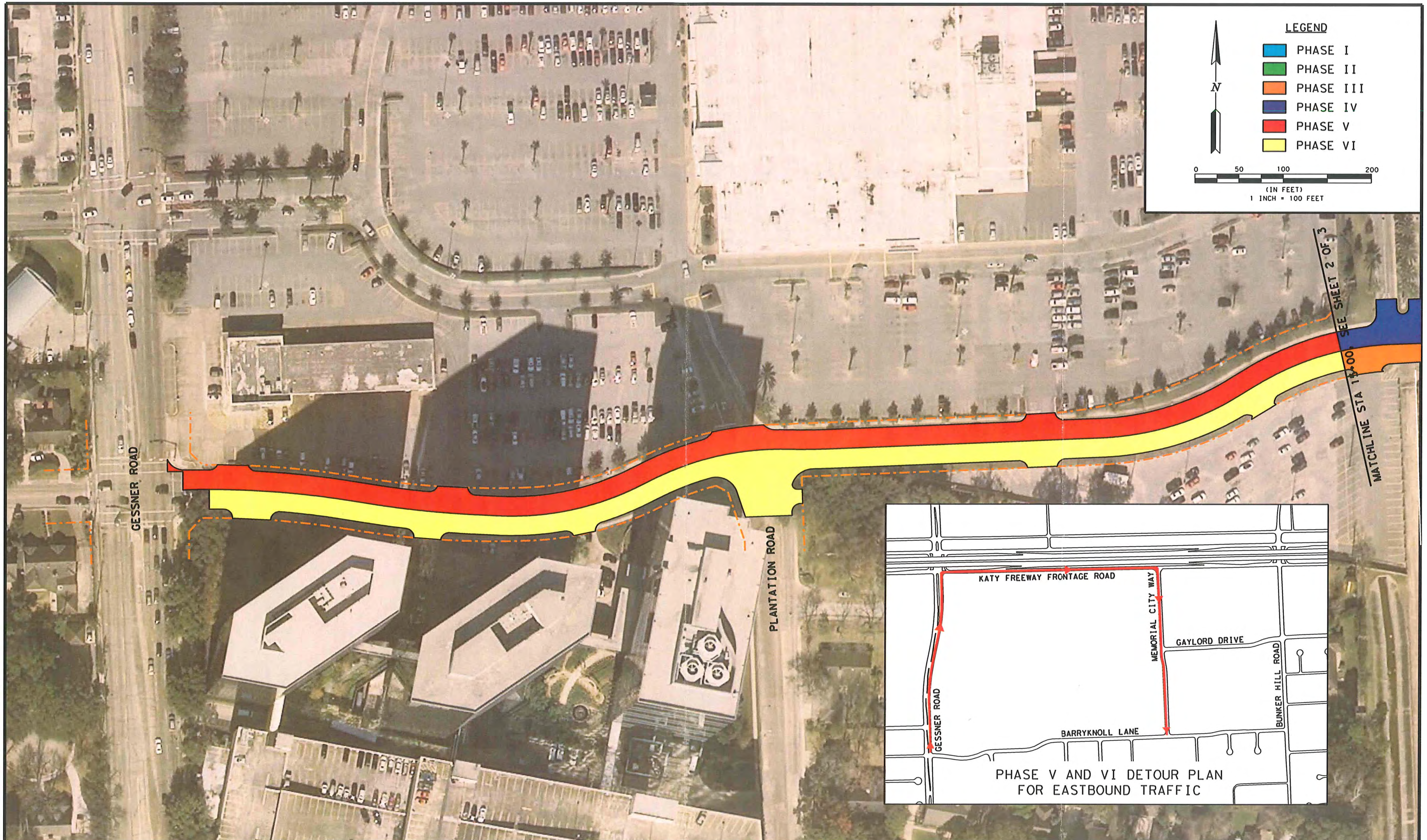
BARRYKNOLL LANE

APPENDIX E.4
BETTINA CT
SIGHT DISTANCE TRIANGLE

SHEET 14 OF 14

CONTRACT NO. | DRAWING NO. | REV.

# Appendix E.5
# Conceptual Traffic Control Plan

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Lockwood, Andrews & Newnam, Inc.
A LEO A DALY COMPANY

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Firm No.: F-2614
Date: NOV. 2011

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|---|---|
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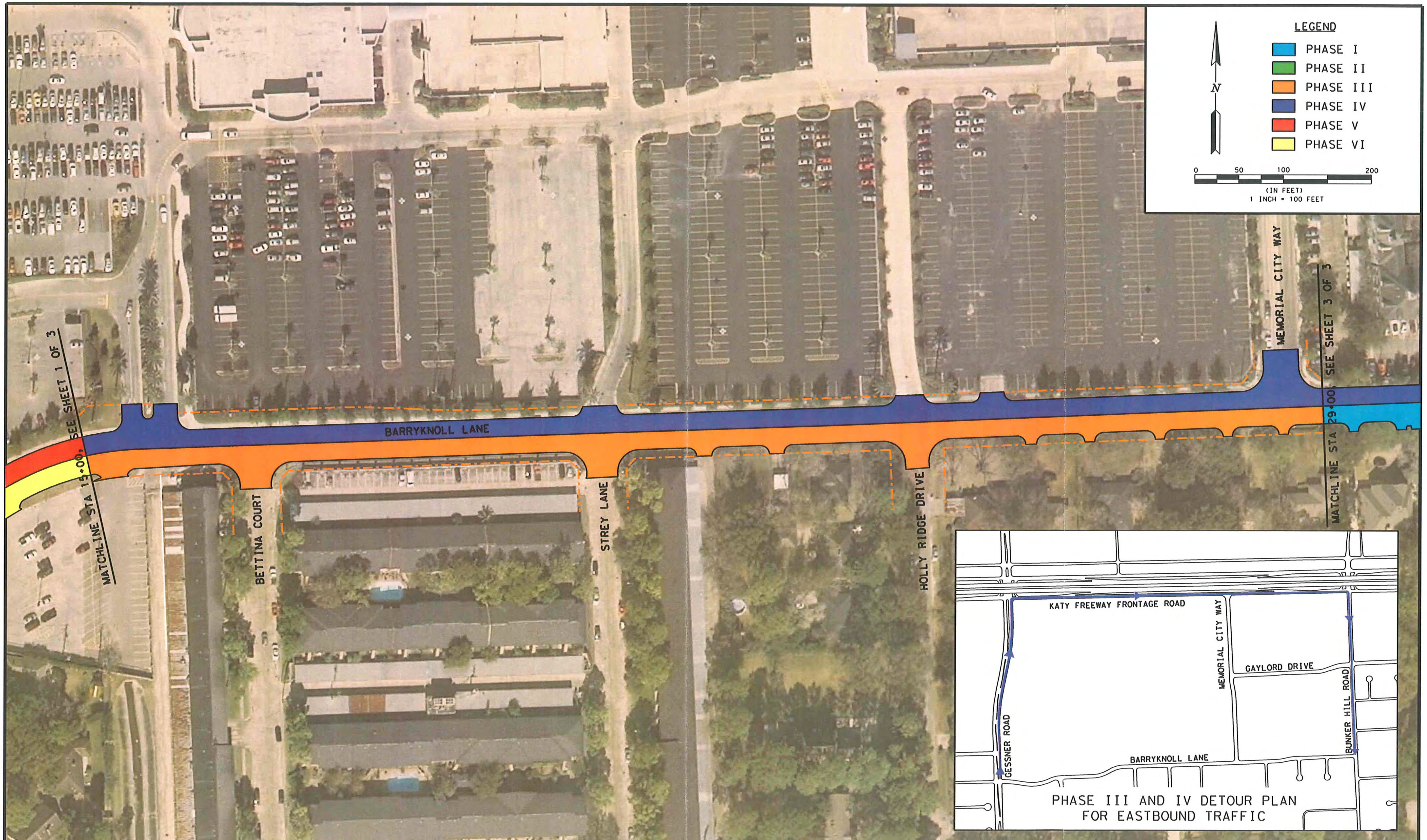
| T. G. B. (DRN CKD BY) | NOV 2011 (DATE) |
| M. J. G. (DES BY) | NOV 2011 (DATE) |
| T. G. B. (DES CKD BY) | NOV 2011 (DATE) |
| APPROVED BY | DATE |
| SCALE: AS SHOWN | |

APPENDIX E.5

BARRYKNOLL LANE
CONCEPTUAL TRAFFIC CONTROL PLAN
SHEET 1 OF 3

CONTRACT NO. | DRAWING NO. | REV.

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Lockwood, Andrews & Newnam, Inc.
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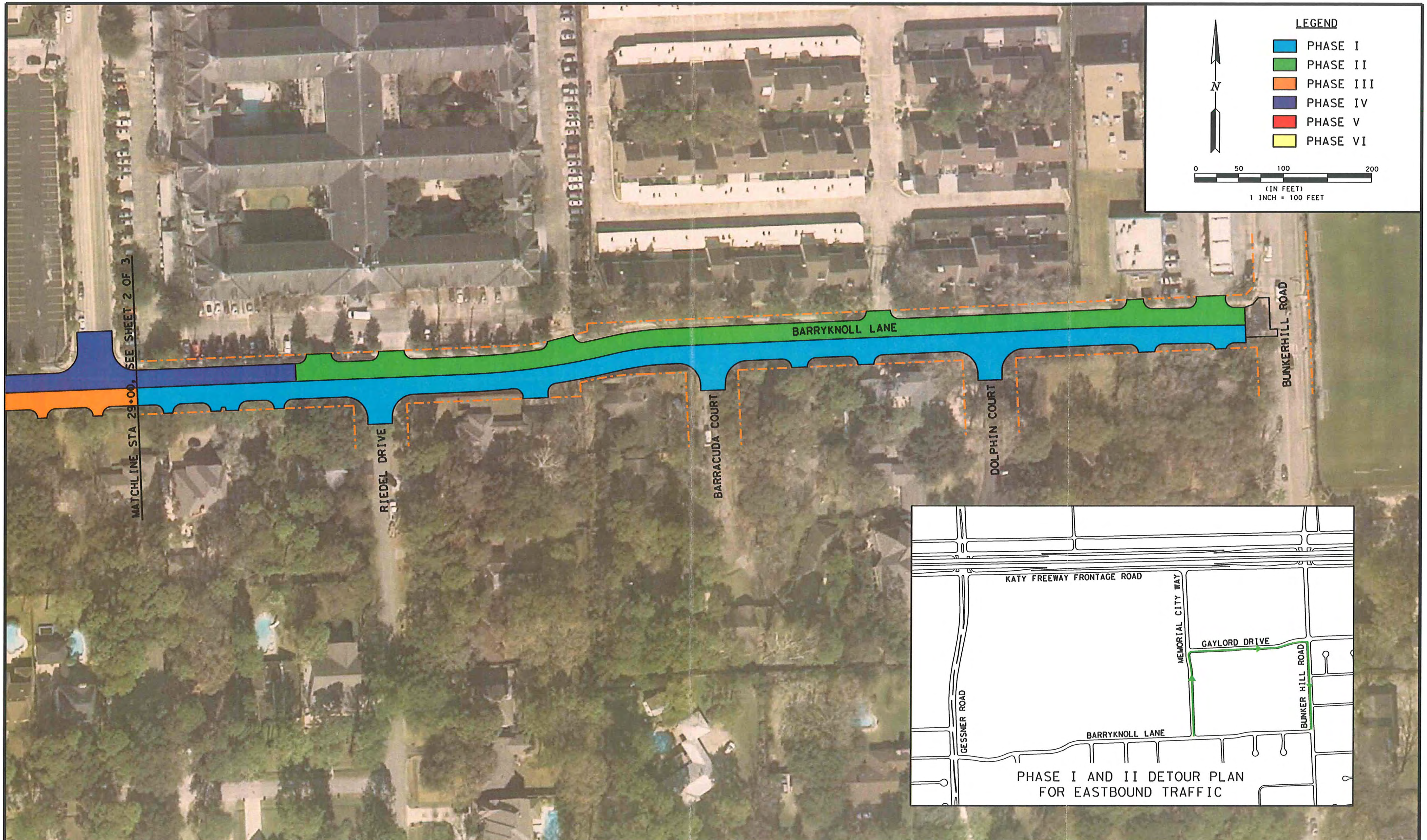
| T. G. B. DRN CKD BY | NOV 2011 DATE |
| M. J. G. DES BY | NOV 2011 DATE |
| T. G. B. DES CKD BY | NOV 2011 DATE |
| APPROVED BY | DATE |
| SCALE: AS SHOWN | |

APPENDIX E.5

BARRYKNOLL LANE
CONCEPTUAL TRAFFIC CONTROL PLAN
SHEET 2 OF 3

CONTRACT NO. | DRAWING NO. | REV.

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|---|---|---|---|---|---|---|---|---|---|

Lockwood, Andrews & Newnam, Inc.
A LEO A DALY COMPANY

TIRZ 17 REDEVELOPMENT AUTHORITY

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| T.G.B. DRN CKD BY | NOV 2011 DATE |
| M.J.G. DES BY | NOV 2011 DATE |
| T.G.B. DES CKD BY | NOV 2011 DATE |
| APPROVED BY | DATE |
| SCALE: AS SHOWN | |

APPENDIX E.5

BARRYKNOLL LANE
CONCEPTUAL TRAFFIC CONTROL PLAN
SHEET 3 OF 3

CONTRACT NO. | DRAWING NO. | REV.

# Appendix E.6
# Variance Request

Lockwood, Andrews
& Newnam, Inc.
A LEO A DALY COMPANY

August 12, 2011

City of Houston
Office of the City Engineer
1002 Washington Avenue
Houston, Texas 77002

Attention: City Engineer's Office

Reference: Variance Request for "S" Distance < 9-feet
Barryknoll Lane Reconstruction
Tax Increment Reinvestment Zone No. 17 (TIRZ 17)

Dear Mr. Kovacich,

Thank you for meeting with us on July 18th to discuss the Barryknoll Project horizontal alignment. Per our discussions, on behalf of the TIRZ 17 Redevelopment Authority (TIRZ 17), please accept this letter as an official request to obtain a border width variance of less than 9-feet along approximately 1,400-feet of Barryknoll Lane. Lockwood, Andrews and Newnam, Inc. (LAN) has been retained by the TIRZ 17 to provide professional engineering services to perform a Preliminary Engineering Study for Barryknoll Lane, between Gessner Road and Bunker Hill Road. The purpose of the Barryknoll Lane Improvement Project is to improve local and regional drainage with the installation of significantly sized storm sewer boxes, thus, requiring complete pavement reconstruction to improve existing drainage conditions. Although the project extends from Gessner Road to Bunker Hill Road, this letter focuses only on the area which will require an "S" distance design variance from Gessner Road to Bettina Court.

Barryknoll Lane is an existing concrete curb and gutter roadway (0.78 miles in length) located approximately 2,000 feet south of Interstate 10, which serves east-west traffic between Gessner Road and Bunker Hill Road. The existing Barryknoll Lane is an undivided roadway striped for four 10-foot lanes. The existing right-of-way width along the alignment is typically 60-feet. According to the City's Major Thoroughfare and Freeway Plan (MTFP), Barryknoll Lane is considered a major collector; however, the existing design speed and right-of-way width does not meet the current City requirements for this street classification. The City of Houston *Infrastructure Design Manual* requires a design speed of 45 mph and a right-of-way width between 80' and 100' for major collectors. The minimum design speed listed in the City of Houston *Infrastructure Design Manual* is 35 mph for local streets. Per the design guidelines, for a 35 mph design speed, a 465-foot minimum horizontal curve is required. The existing Barryknoll Lane alignment does not meet the minimum horizontal alignment criteria for 45 mph or 35 mph. The existing speed limit on Barryknoll Lane is signed for 30 mph within the project limits. Although all of the existing horizontal curves along the alignment between Gessner Road and Bettina Court meet the criteria for a 30 mph design speed (300-ft minimum radius), between Gessner Road and Plantation Road there is a series of consecutive reversing curves with no tangents within approximately 700-feet, followed by two consecutive reversing curves between Plantation Drive and Bettina Court within approximately 400-feet adding to the design speed limitations, see Exhibit 1.

Although the City of Houston *Infrastructure Design Manual* recommends a design speed of 45 mph, severe right-of-way impacts to Memorial City Mall and other adjacent properties make this design speed option infeasible. After evaluating various improvement alternatives, LAN proposes the design speed improvement to meet a minimum 35 mph design speed, via an improved horizontal alignment, with minimal widening to increase the pavement section from 40-feet to 44-feet (striped for four 11-foot lanes). Any right-of-way acquisition, other than corner clips, would prove to be cost prohibitive, thus a design variance is requested to allow for a nonstandard 6- to 9-foot varying border width between the curb and right-of-way line for approximately 1,400-feet between Gessner Road and Bettina Court, see Exhibit 2. With minimal existing or proposed fire hydrants or utility poles, etc. located in this area, a six foot sidewalk located adjacent to the curb is proposed. Since the proposed border width will vary from 6- to 12-feet, all utility appurtenances can be located in areas with a minimum 8-foot border width. Sight distance triangles for each driveway and cross street within the proposed variance area were also developed to confirm that the proposed limited border width will not create additional sight obstructions for motorists. In most cases, the sight distance is equivalent to or better than the existing conditions due to the proposed removal of existing trees for construction, see Exhibit 3.

The table below shows the existing and proposed conditions along Barryknoll Lane between Gessner Road and Bettina Court.

**Barryknoll Design Criteria**

| | Existing Conditions | Proposed Conditions | City Standard |
|---|---|---|---|
| **Design Speed** | 30 mph ($R_{min}$=300') | 35 mph ($R_{min}$=465') | 45 mph ($R_{min}$=940') |
| **Lane Width** | 10-feet | 11-feet | 11-feet |
| **ROW Width** | 60-feet (typ) | 60-feet (typ) (No prop ROW) | 80- to 100-feet |

LAN respectfully requests the City of Houston consider this request for a design variance to allow for a nonstandard varying 6- to 8-foot border width between the curb and existing right-of-way to allow for the reconstruction of Barryknoll to 35 mph standards within the existing right-of-way. Increasing the design speed to 35 mph and the lane width to 11-feet will both reduce lane encroachments and provide improved mobility and safety along Barryknoll Lane, while minimizing impacts to adjacent properties. Please contact me at 713.266.6900 should you have any questions or need additional information.

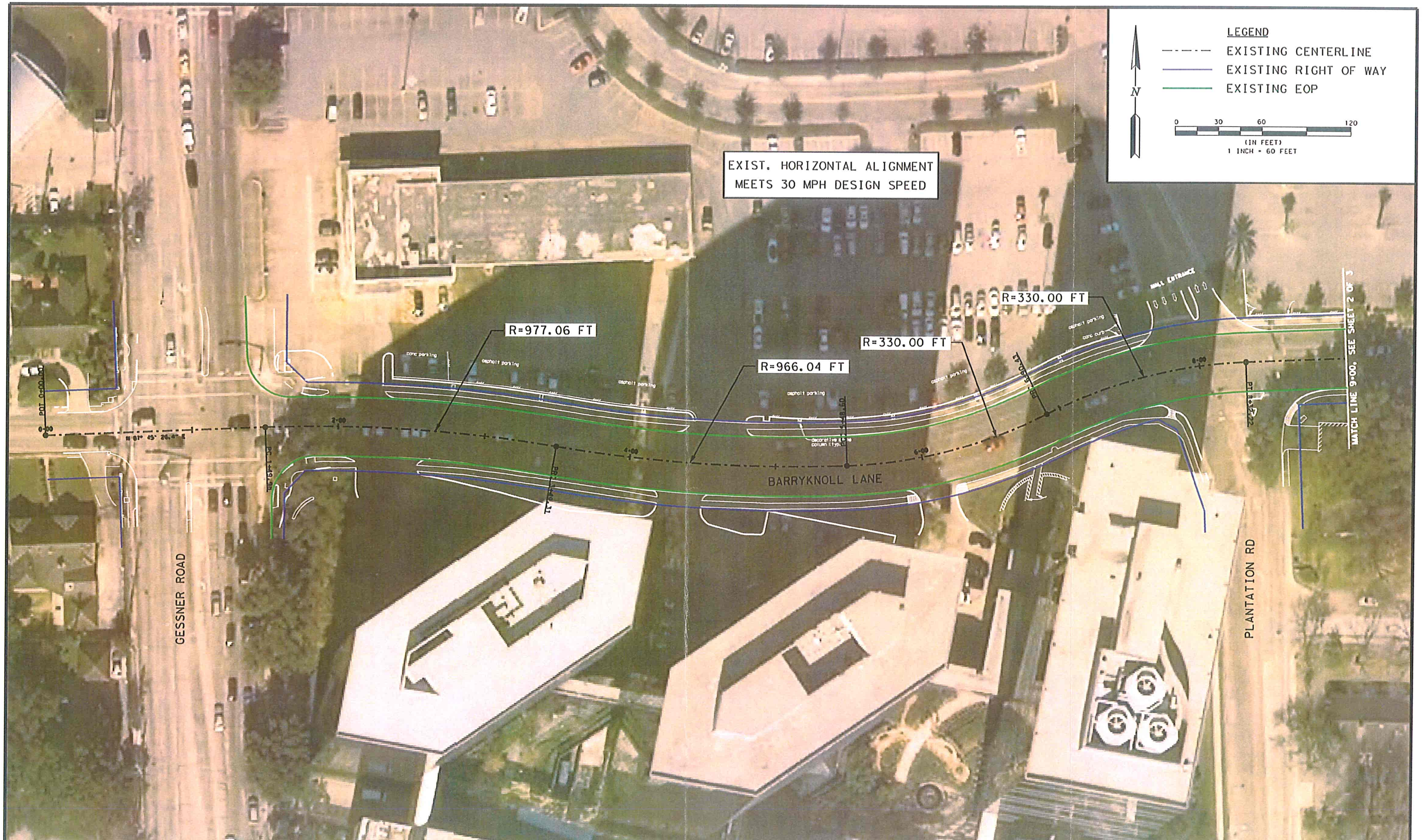
Sincerely,

Tara G. Burrer, P.E.
Project Engineer

RJF:VM:tgb:clp

Enclosure: Exhibit 1 – Barryknoll Lane Existing Layout
Exhibit 2 – Barryknoll Lane Proposed 35 mph Design Speed with 11-foot Lanes
Exhibit 3 – Sight Distance Triangles

cc: File
Pat Walters – TIRZ 17

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Lockwood, Andrews & Newnam, Inc.
A LEO A DALY COMPANY

TIRZ 17 REDEVELOPMENT AUTHORITY

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Firm No.: F-2614
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| T.G.B. DRN CKD BY | AUG 2011 DATE |
| M.J.G. DES BY | AUG 2011 DATE |
| T.G.B. DES CKD BY | AUG 2011 DATE |
| APPROVED BY | DATE |
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BARRYKNOLL LANE

EXHIBIT 1
EXISTING LAYOUT
SHEET 1 OF 3

CONTRACT NO. | DRAWING NO. | REV.


| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
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Lockwood, Andrews & Newnam, Inc.
A LEO A DALY COMPANY

TIRZ 17 REDEVELOPMENT AUTHORITY

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| M. J. G. (DES BY) | AUG 2011 (DATE) |
| T. G. B. (DES CKD BY) | AUG 2011 (DATE) |
| APPROVED BY | DATE |
| SCALE: AS SHOWN | |

BARRYKNOLL LANE

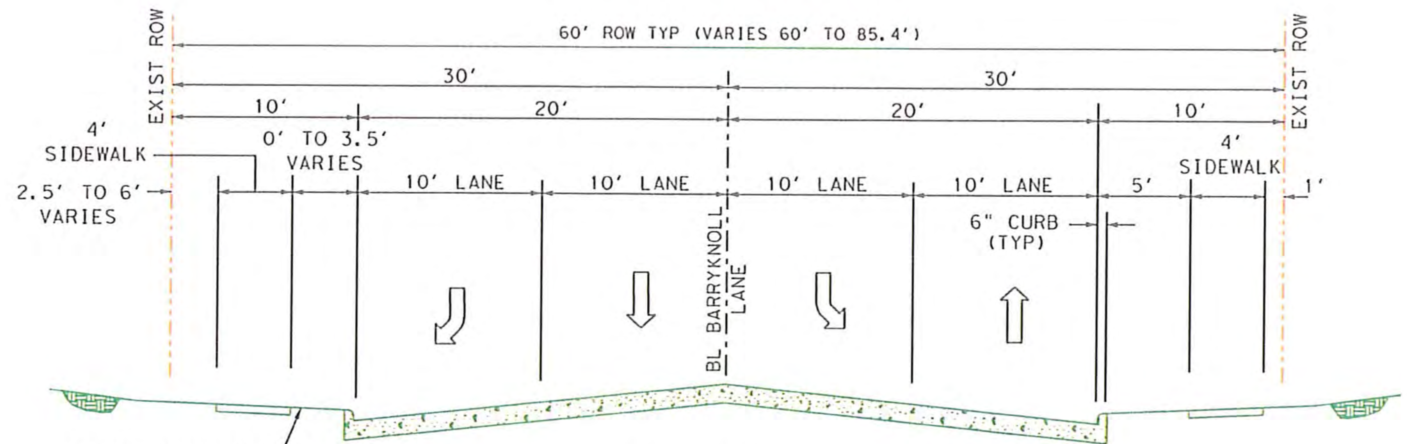
EXHIBIT 1
EXISTING LAYOUT
SHEET 2 OF 3

CONTRACT NO. | DRAWING NO. | REV.

LEGEND

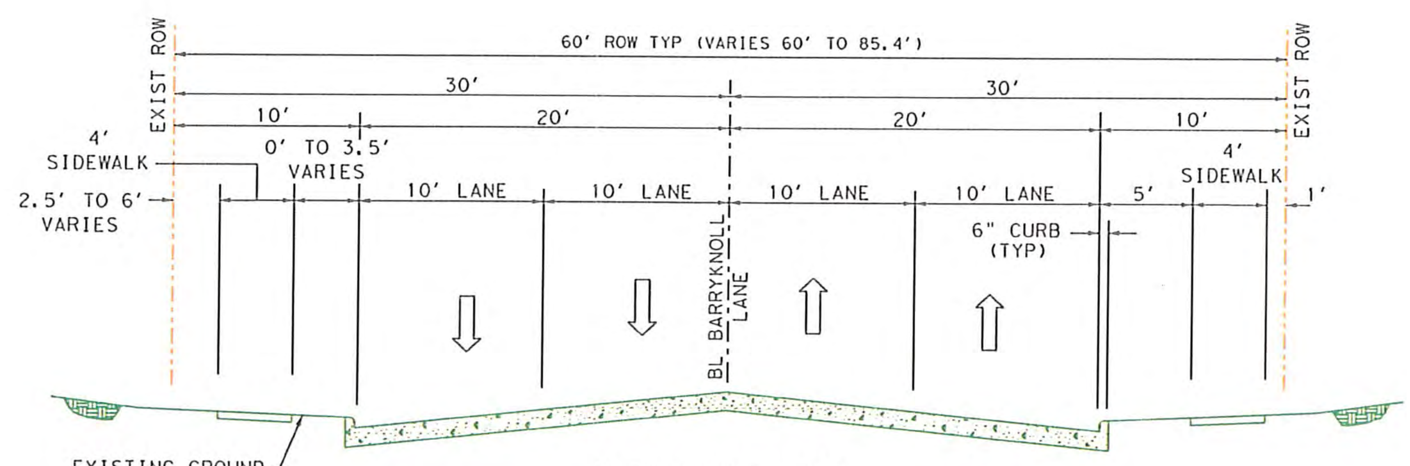
- PROPOSED ROW
- EXIST ROW
- PROPOSED TRAFFIC FLOW
- EXISITING TRAFFIC FLOW

0 5 10 20
(IN FEET)
1 INCH = 10 FEET




## BARRYKNOLL LANE

GESSNER ROAD TO APPROX 200 EAST OF INTERSECTION OF GESSNER ROAD AND BARRYKNOLL LANE




## BARRYKNOLL LANE

APPROX 200 EAST OF INTERSECTION OF GESSNER AND BARRYKNOLL LANE TO BETTINA COURT

| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
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Lockwood, Andrews & Newnam, Inc.
A LEO A DALY COMPANY

TIRZ 17 REDEVELOPMENT AUTHORITY

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| M. J. G. DES BY | AUG 2011 DATE |
| T. G. B. DES CKD BY | AUG 2011 DATE |
| APPROVED BY | DATE |
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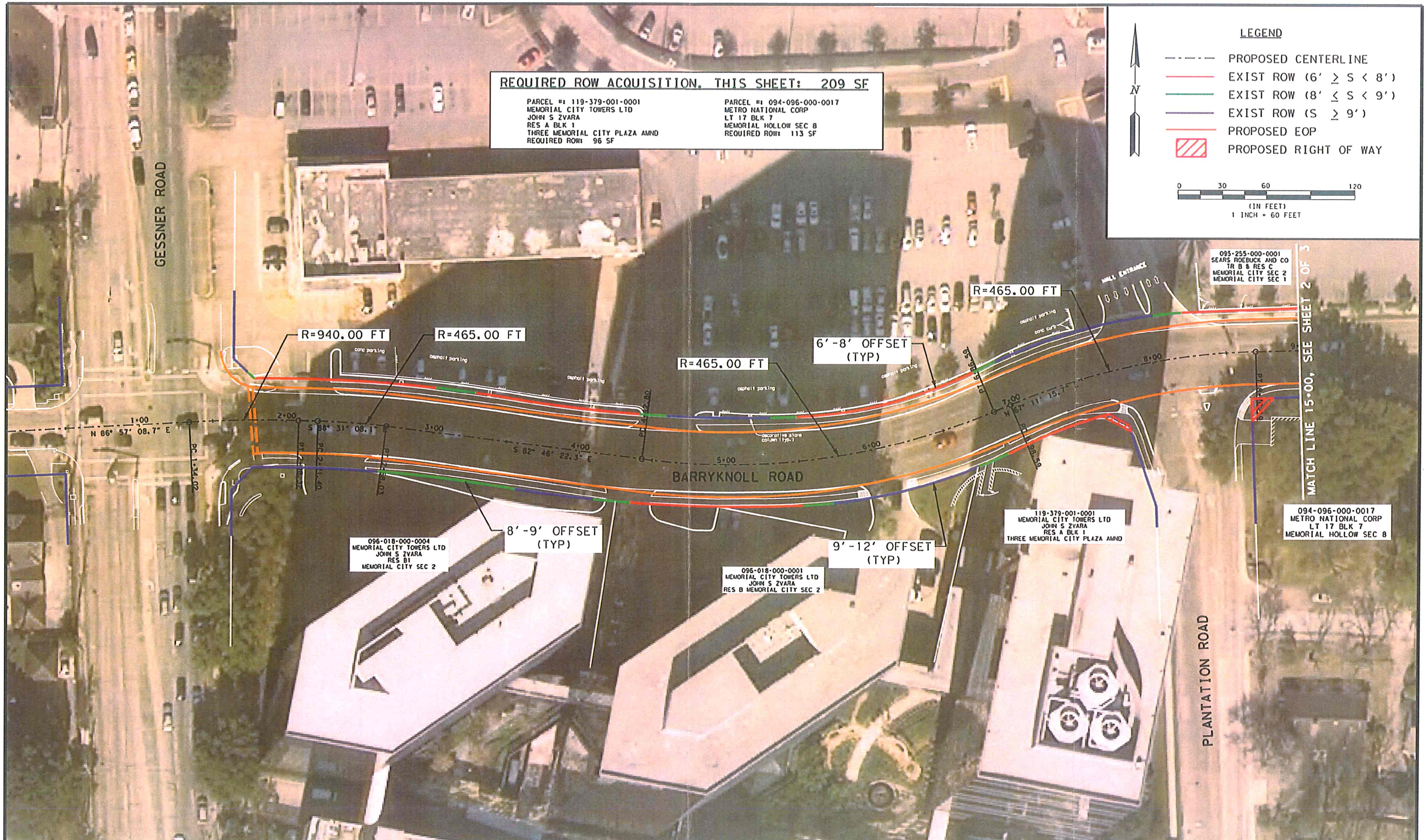
EXHIBIT 1

BARRYKNOLL LANE
EXISTING TYPICAL SECTIONS
SHEET 3 OF 3

CONTRACT NO. | DRAWING NO. | REV.

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| M. J. G. — DES BY | AUG 2011 — DATE |
| T. G. B. — DES CKD BY | AUG 2011 — DATE |
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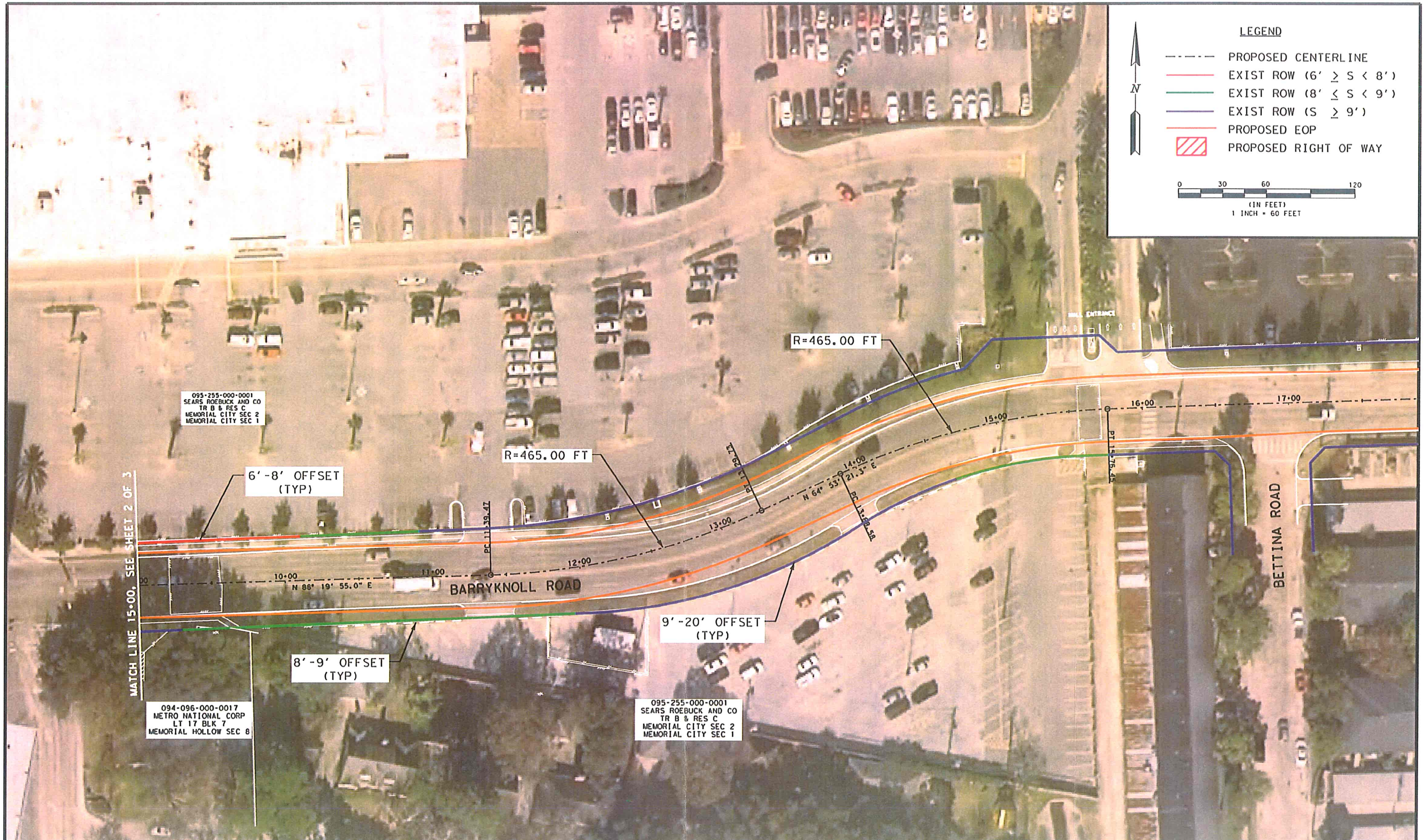
| SCALE: AS SHOWN | |

BARRYKNOLL LANE

EXHIBIT 2
PROP 35 MPH LAYOUT
44' PAVEMENT WIDTH

SHEET 1 OF 3

CONTRACT NO. | DRAWING NO. | REV.

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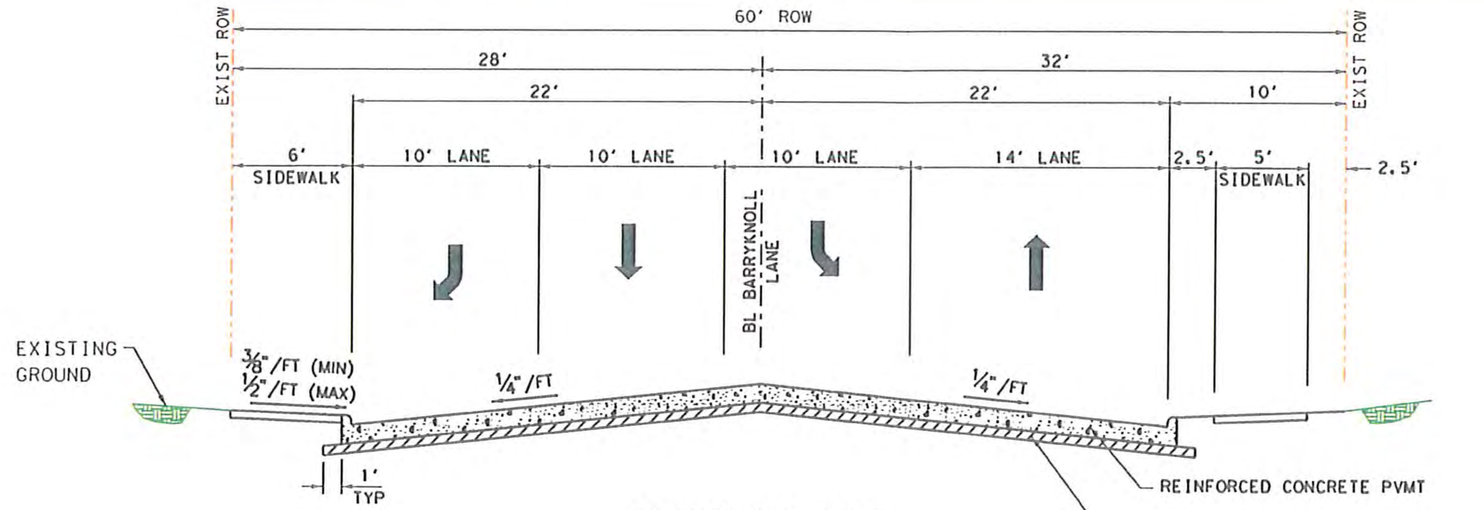
BARRYKNOLL LANE

EXHIBIT 2
PROP 35 MPH LAYOUT
44' PAVEMENT WIDTH

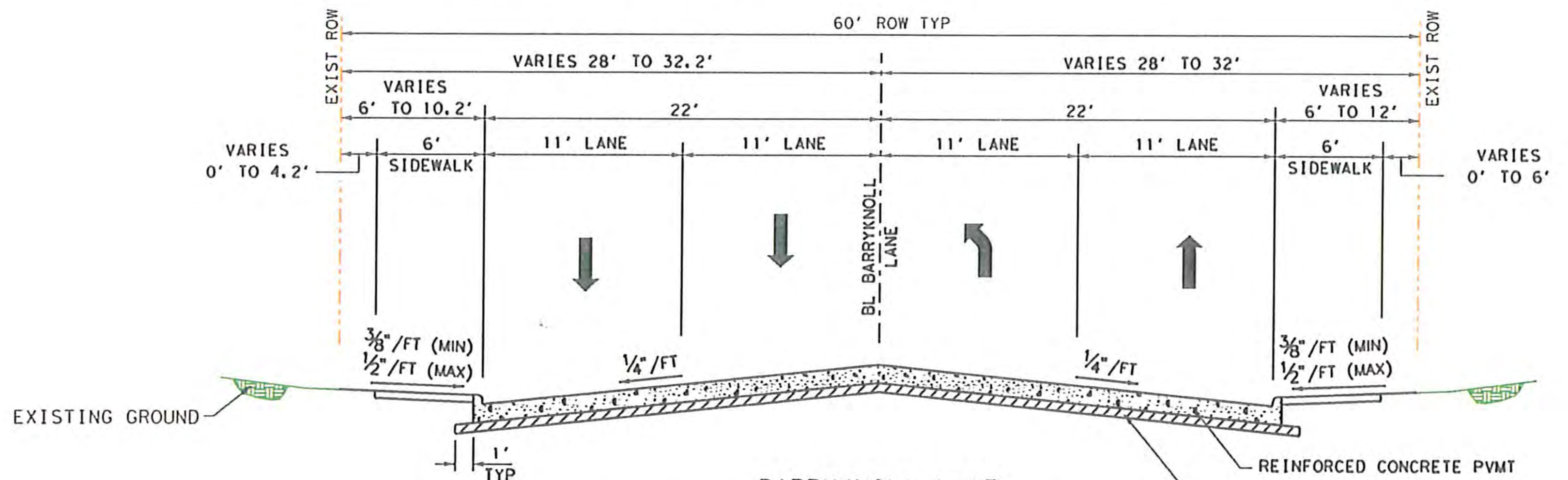
SHEET 2 OF 3

CONTRACT NO. | DRAWING NO. | REV.



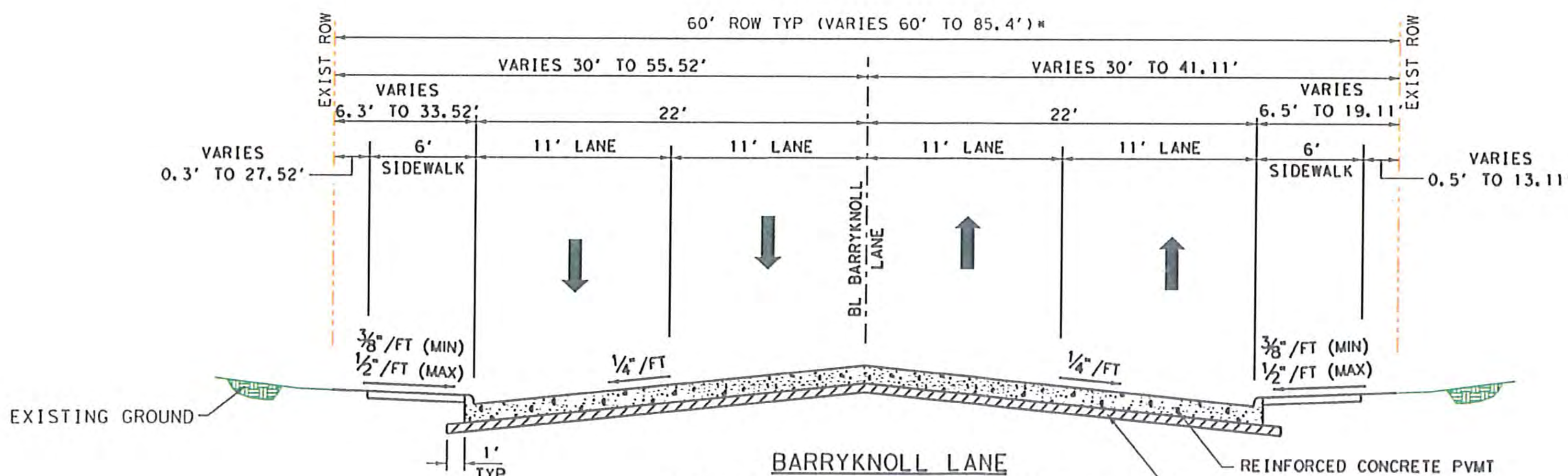

BARRYKNOLL LANE

GESSNER ROAD TO APPROX 350 EAST OF INTERSECTION OF GESSNER AND BARRYKNOLL LANE




BARRYKNOLL LANE

APPROX 300 EAST OF GESSNER ROAD TO PLANTATION ROAD




BARRYKNOLL LANE

PLANTATION ROAD TO BETTINA CT

LEGEND

- PROPOSED ROW
- EXIST ROW
- PROPOSED TRAFFIC FLOW
- EXISITING TRAFFIC FLOW

0 5 10 20
(IN FEET)
1 INCH = 10 FEET

| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
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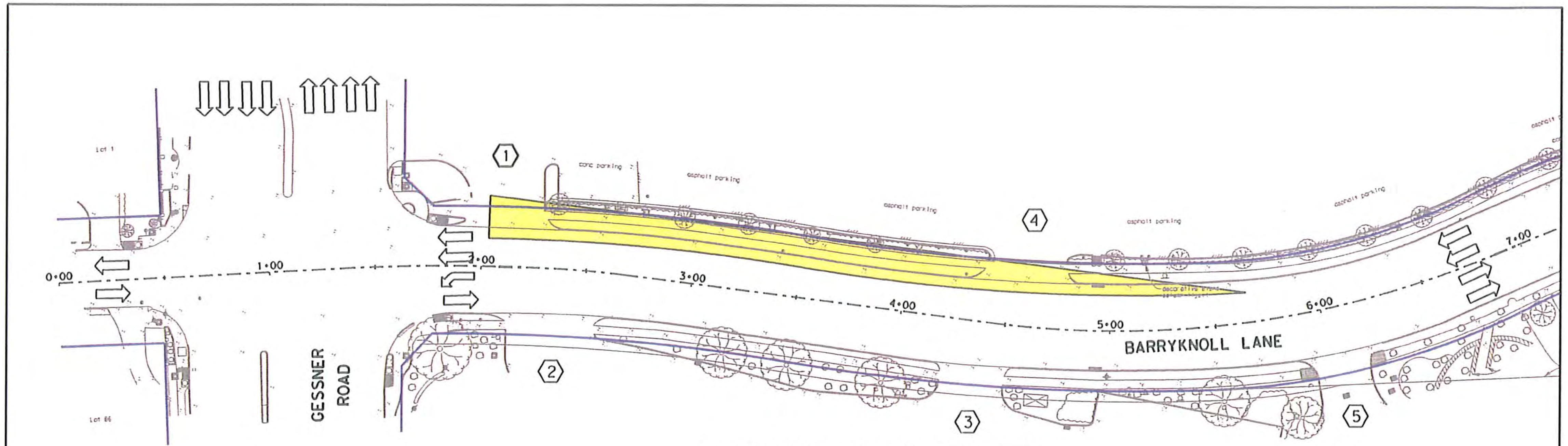
BARRYKNOLL LANE

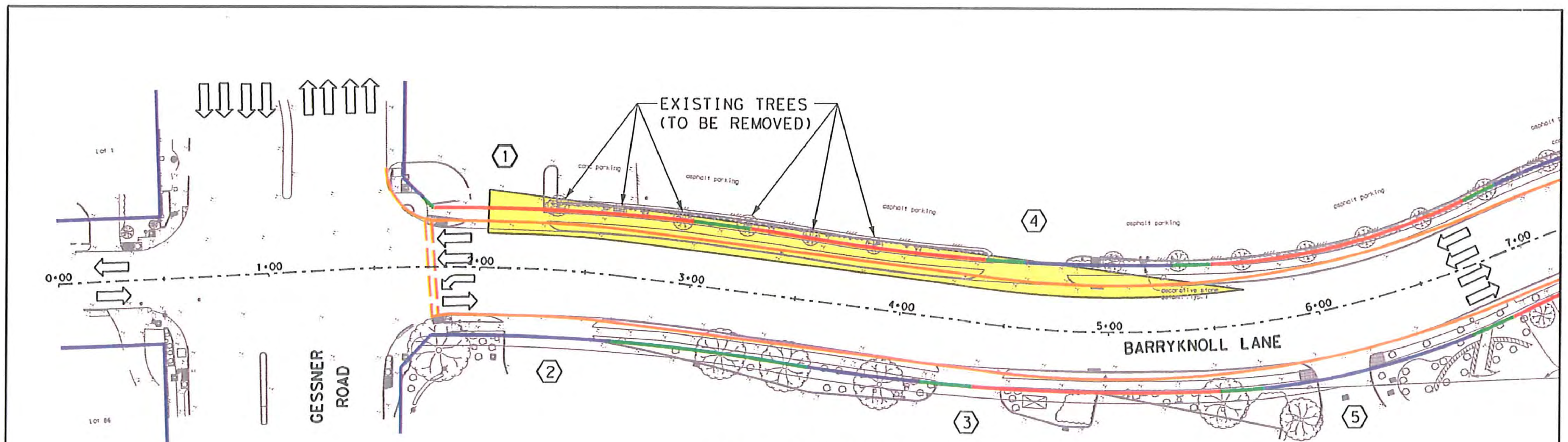
EXHIBIT 2
PROP 35 MPH LAYOUT
44' TYPICAL PAVEMENT SECTION

SHEET 3 OF 3

CONTRACT NO. | DRAWING NO. | REV.




EXISTING SIGHT DISTANCE
(DRIVEWAY 1)




PROPOSED SIGHT DISTANCE
(DRIVEWAY 1)

LEGEND

- PROPOSED CENTERLINE
- PROPOSED ROADWAY
- SIGHT DISTANCE TRIANGLE
- EXIST ROW (6' ≥ S < 8')
- EXIST ROW (8' ≤ S < 9')
- EXIST ROW (S ≥ 9')
- (X) DRIVEWAY NUMBERS
- TRAFFIC FLOW DIRECTION

N

0 30 60 120
(IN FEET)
1 INCH = 60 FEET

| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
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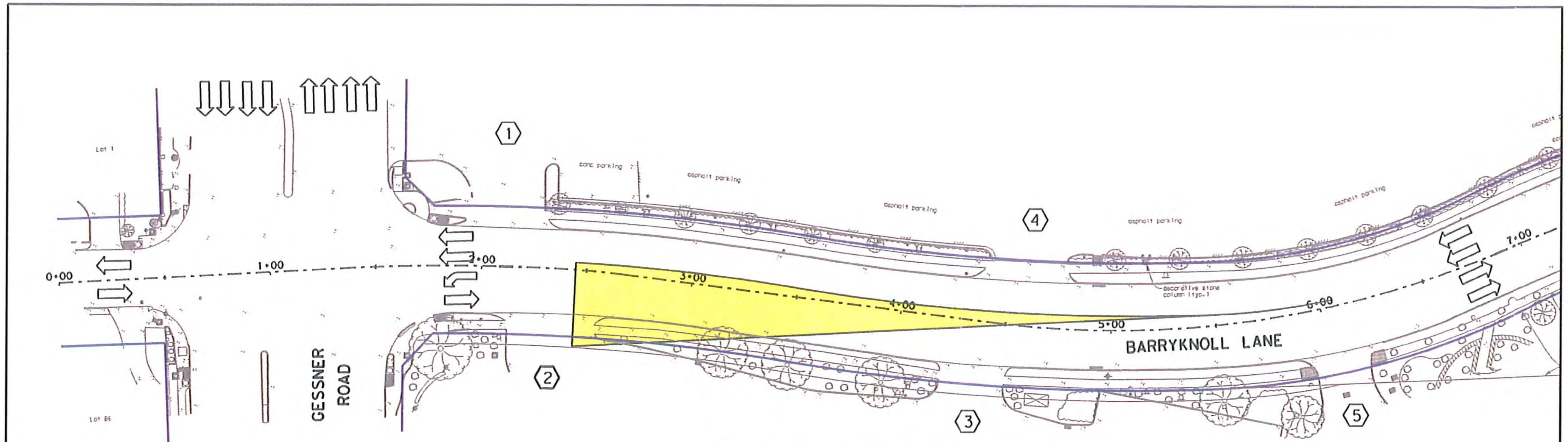
| SCALE: AS SHOWN | |

BARRYKNOLL LANE

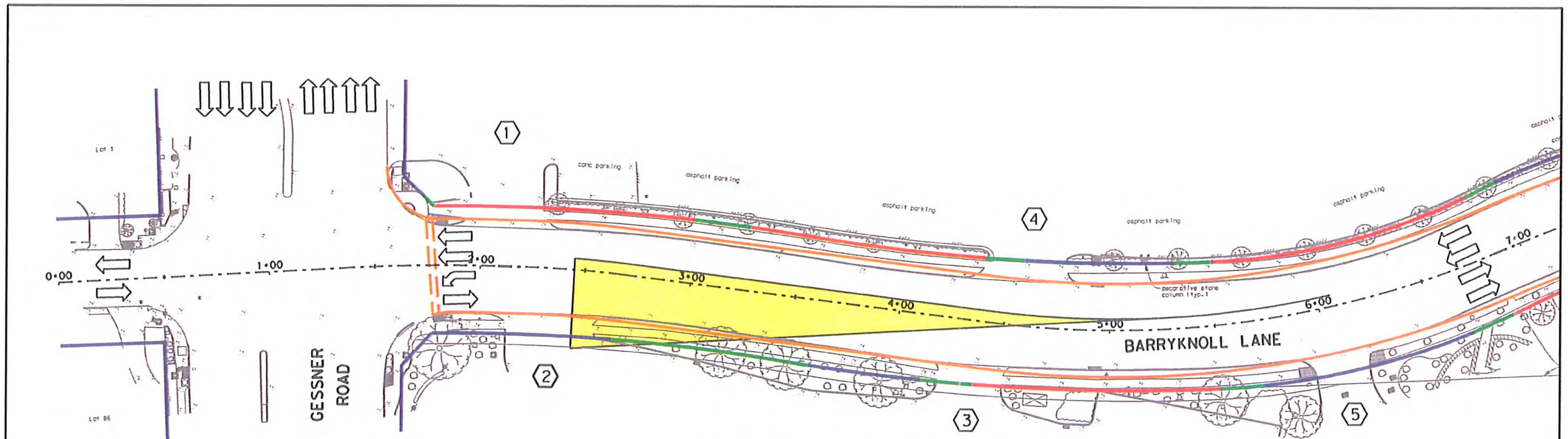
EXHIBIT 3
DRIVEWAY 1
SIGHT DISTANCE TRIANGLE

SHEET 1 OF 14

CONTRACT NO. | DRAWING NO. | REV.




EXISTING SIGHT DISTANCE
(DRIVEWAY 2)




PROPOSED SIGHT DISTANCE
(DRIVEWAY 2)

LEGEND

N

- PROPOSED CENTERLINE
- PROPOSED ROADWAY
- SIGHT DISTANCE TRIANGLE
- EXIST ROW (6' ≥ S < 8')
- EXIST ROW (8' ≤ S < 9')
- EXIST ROW (S ≥ 9')
- (X) DRIVEWAY NUMBERS
- TRAFFIC FLOW DIRECTION

0 30 60 120
(IN FEET)
1 INCH = 60 FEET

| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
|---|---|---|---|---|---|---|---|---|---|

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TIRZ 17 REDEVELOPMENT AUTHORITY

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Firm: Lockwood, Andrews & Newnam Inc.
Firm No.: F-2614
Date: AUG 2011

| | |
|---|---|
| M. J. G. DRN BY | AUG 2011 DATE |
| T. G. B. DRN CKD BY | AUG 2011 DATE |
| M. J. G. DES BY | AUG 2011 DATE |
| T. G. B. DES CKD BY | AUG 2011 DATE |
| APPROVED BY | DATE |
| SCALE: AS SHOWN | |

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EXHIBIT 3
DRIVEWAY 2
SIGHT DISTANCE TRIANGLE

SHEET 2 OF 14

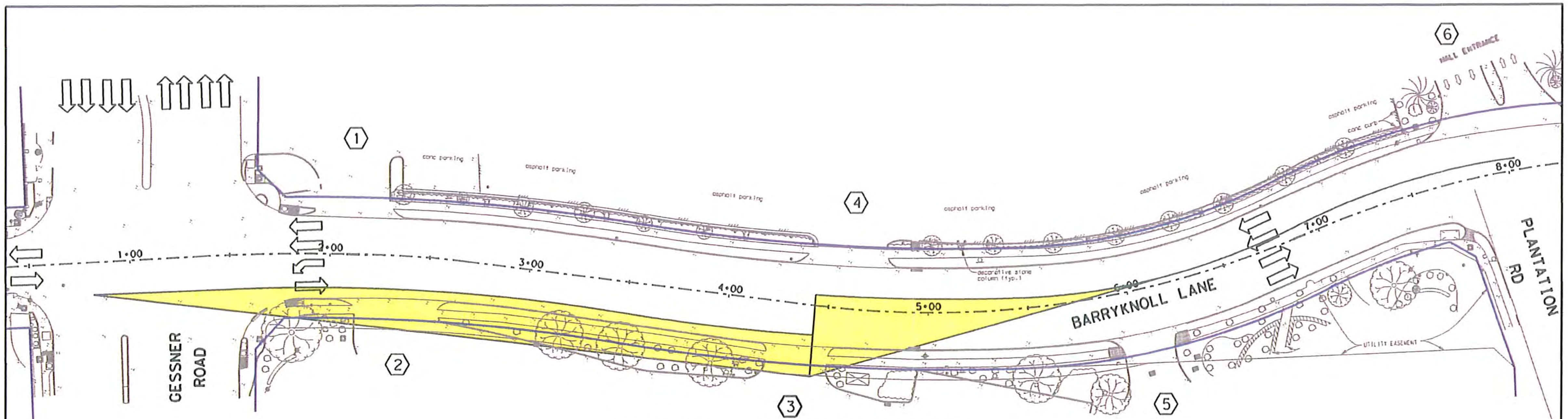
CONTRACT NO. | DRAWING NO. | REV.

LEGEND

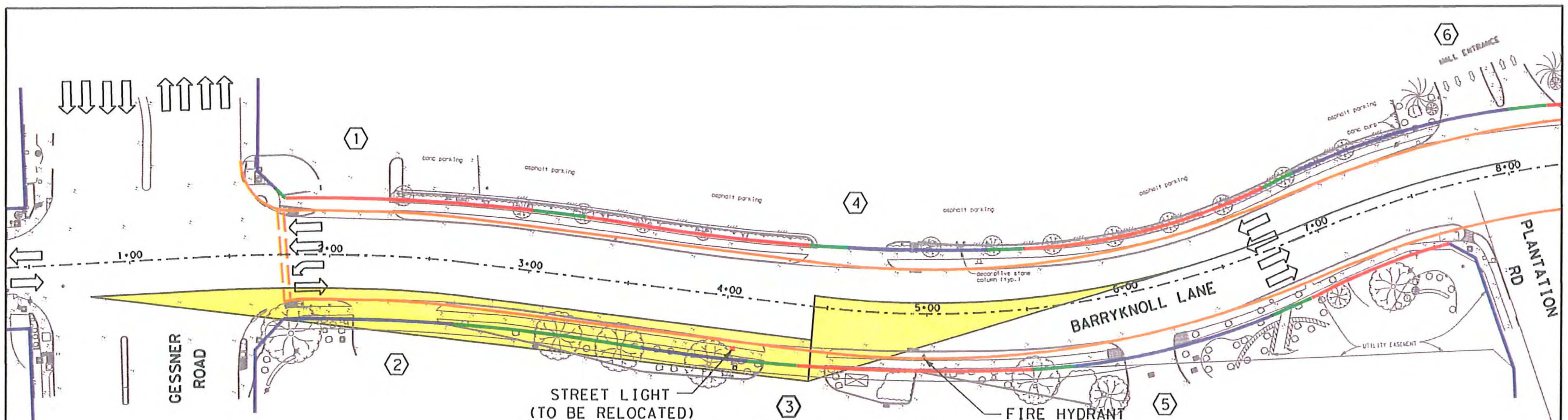
- PROPOSED CENTERLINE
- PROPOSED ROADWAY
- SIGHT DISTANCE TRIANGLE
- EXIST ROW (6' ≥ S < 8')
- EXIST ROW (8' ≤ S < 9')
- EXIST ROW (S ≥ 9')
- DRIVEWAY NUMBERS
- TRAFFIC FLOW DIRECTION

N

0 30 60 120
(IN FEET)
1 INCH = 60 FEET




EXISTING SIGHT DISTANCE
(DRIVEWAY 3)




PROPOSED SIGHT DISTANCE
(DRIVEWAY 3)

| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
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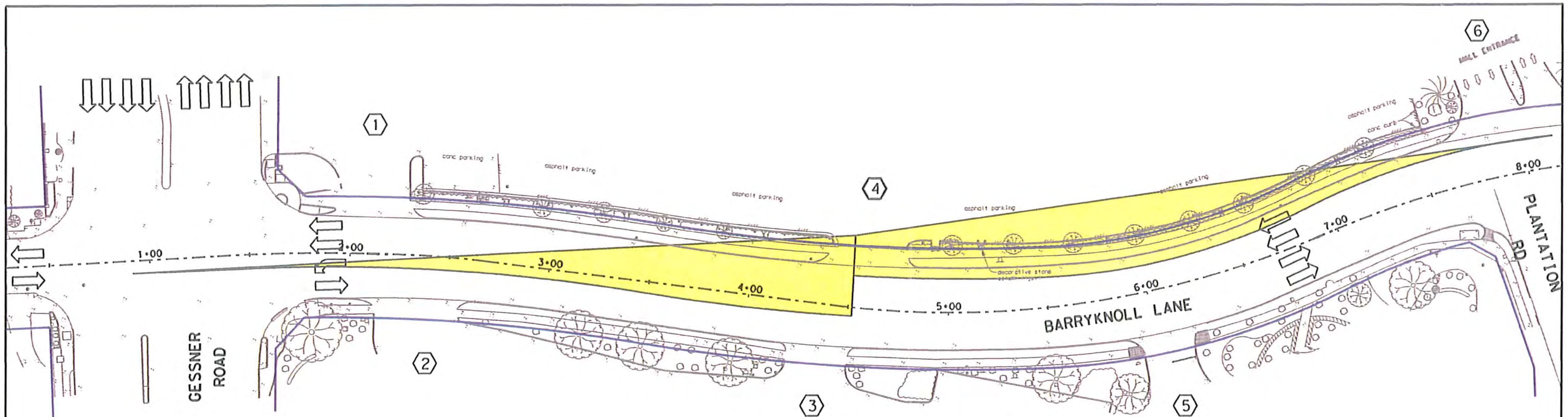
| T. G. B. (DRN CKD BY) | AUG 2011 (DATE) |
| M. J. G. (DES BY) | AUG 2011 (DATE) |
| T. G. B. (DES CKD BY) | AUG 2011 (DATE) |
| APPROVED BY | DATE |
| SCALE: AS SHOWN | |

BARRYKNOLL LANE

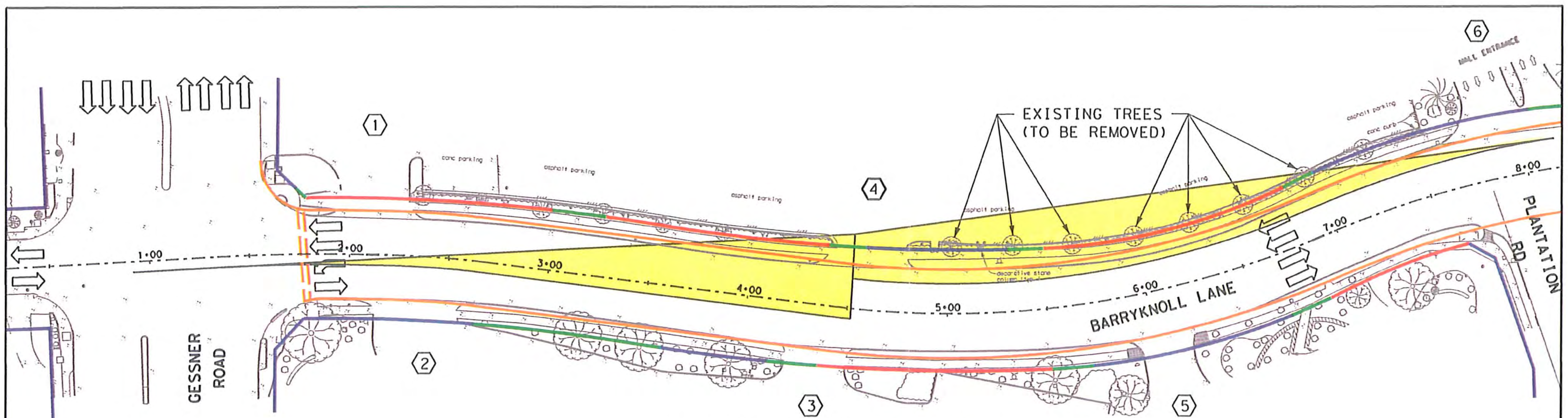
EXHIBIT 3
DRIVEWAY 3
SIGHT DISTANCE TRIANGLE

SHEET 3 OF 14

CONTRACT NO. | DRAWING NO. | REV.




## EXISTING SIGHT DISTANCE
(DRIVEWAY 4)




## PROPOSED SIGHT DISTANCE
(DRIVEWAY 4)

**LEGEND**

- PROPOSED CENTERLINE
- PROPOSED ROADWAY
- SIGHT DISTANCE TRIANGLE
- EXIST ROW (6' ≥ S < 8')
- EXIST ROW (8' ≤ S < 9')
- EXIST ROW (S ≥ 9')
- DRIVEWAY NUMBERS
- TRAFFIC FLOW DIRECTION

N

0 30 60 120
(IN FEET)
1 INCH = 60 FEET

| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
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| T. G. B. — DRN CKD BY | AUG 2011 — DATE |
| M. J. G. — DES BY | AUG 2011 — DATE |
| T. G. B. — DES CKD BY | AUG 2011 — DATE |
| APPROVED BY | DATE |
| SCALE: AS SHOWN | |

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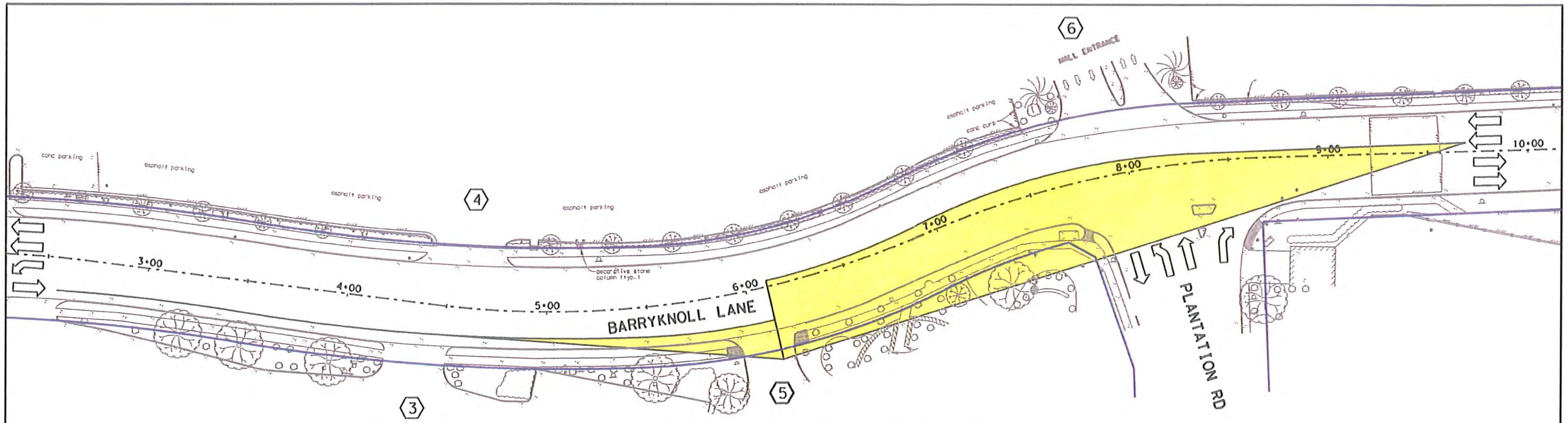
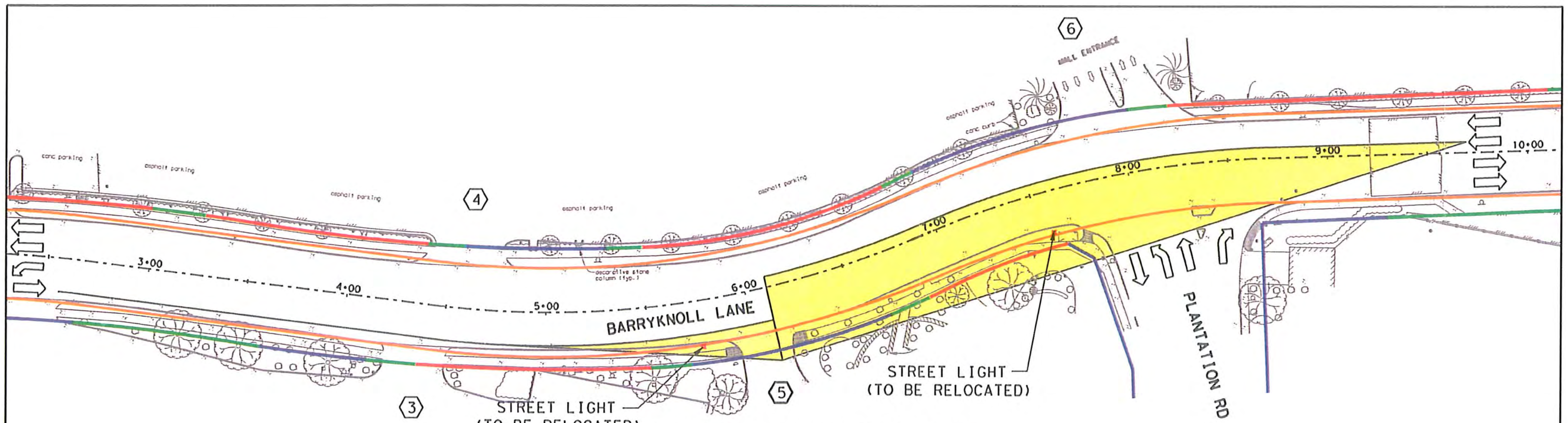
EXHIBIT 3
DRIVEWAY 4
SIGHT DISTANCE TRIANGLE

SHEET 4 OF 14

CONTRACT NO. | DRAWING NO. | REV.




## EXISTING SIGHT DISTANCE
(DRIVEWAY 5)




## PROPOSED SIGHT DISTANCE
(DRIVEWAY 5)

**LEGEND**

- PROPOSED CENTERLINE
- PROPOSED ROADWAY
- SIGHT DISTANCE TRIANGLE
- EXIST ROW (6' ≥ S < 8')
- EXIST ROW (8' ≤ S < 9')
- EXIST ROW (S ≥ 9')
- ⓧ DRIVEWAY NUMBERS
- TRAFFIC FLOW DIRECTION

N

0 30 60 120
(IN FEET)
1 INCH = 60 FEET

| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
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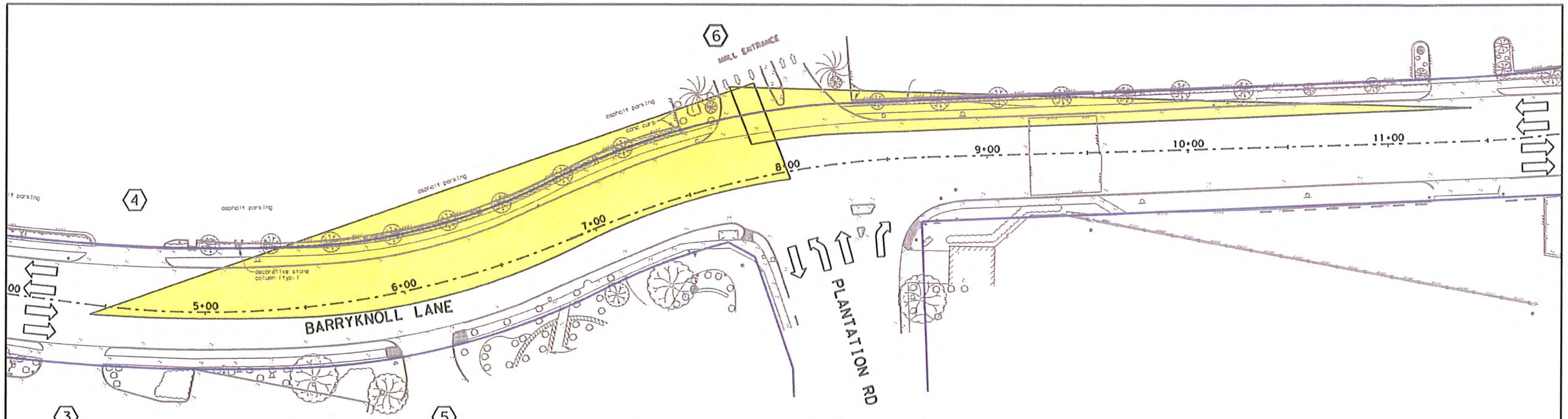
| T. G. B. (DRN CKD BY) | AUG 2011 (DATE) |
| M. J. G. (DES BY) | AUG 2011 (DATE) |
| T. G. B. (DES CKD BY) | AUG 2011 (DATE) |
| APPROVED BY | DATE |
| SCALE: AS SHOWN | |

BARRYKNOLL LANE

EXHIBIT 3
DRIVEWAY 5
SIGHT DISTANCE TRIANGLE

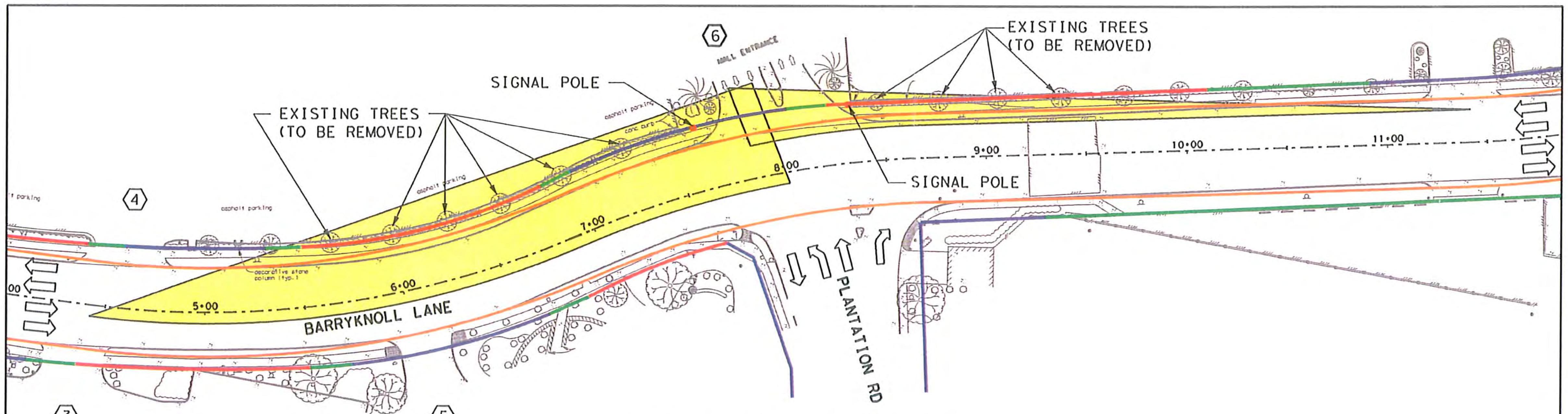
SHEET 5 OF 14

CONTRACT NO. | DRAWING NO. | REV.




EXISTING SIGHT DISTANCE

(DRIVEWAY 6)




PROPOSED SIGHT DISTANCE

(DRIVEWAY 6)

LEGEND

- PROPOSED CENTERLINE
- PROPOSED ROADWAY
- SIGHT DISTANCE TRIANGLE
- EXIST ROW (6' ≥ S < 8')
- EXIST ROW (8' ≤ S < 9')
- EXIST ROW (S ≥ 9')
- DRIVEWAY NUMBERS
- TRAFFIC FLOW DIRECTION

N

0 30 60 120

(IN FEET)
1 INCH = 60 FEET

| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
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| M.J.G. DES BY | AUG 2011 DATE |
| T.G.B. DES CKD BY | AUG 2011 DATE |
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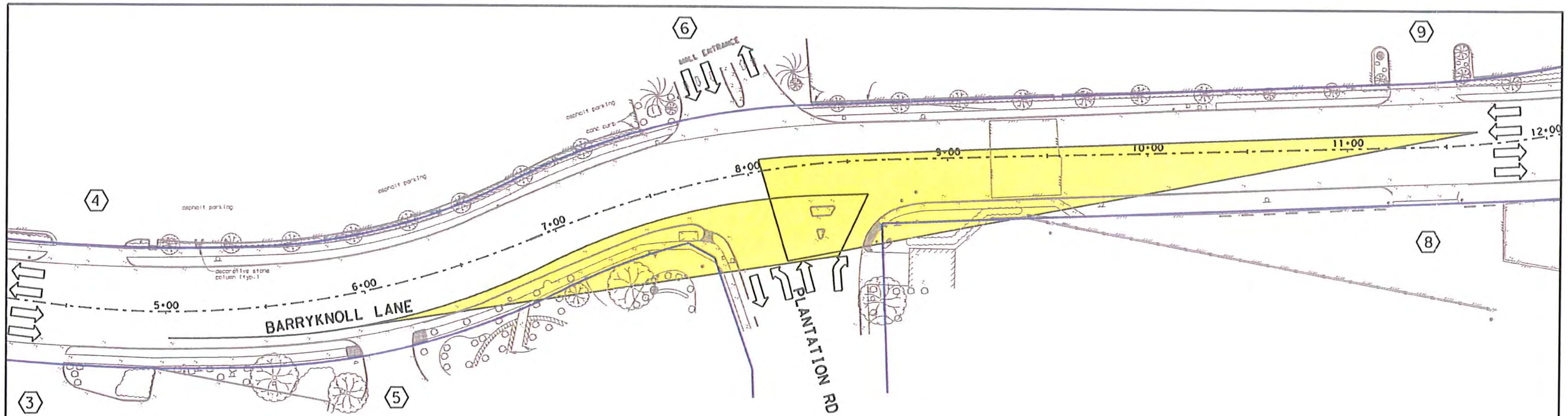
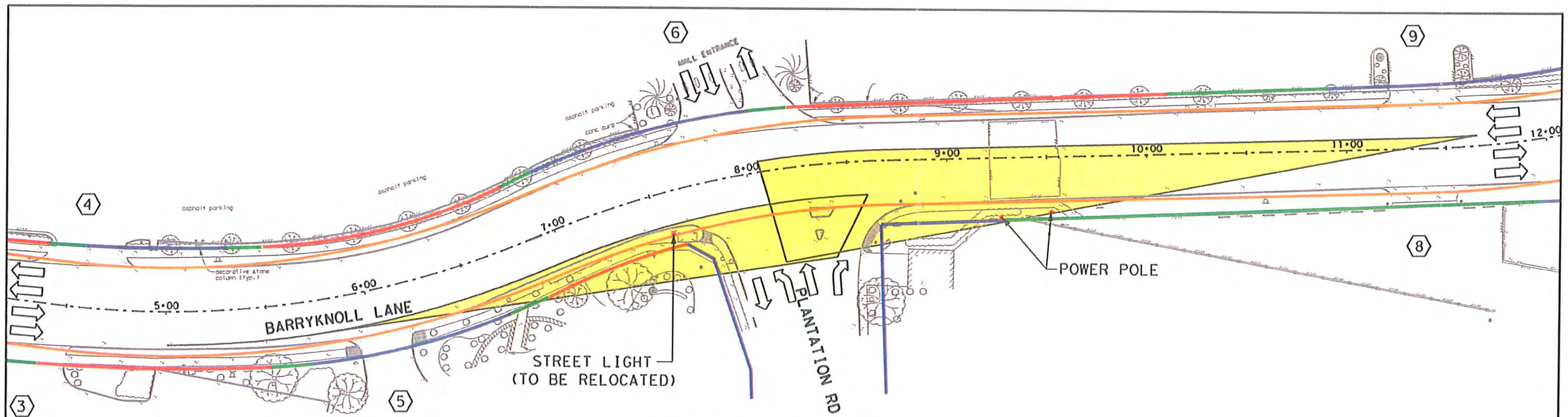
EXHIBIT 3
DRIVEWAY 6
SIGHT DISTANCE TRIANGLE

SHEET 6 OF 14

CONTRACT NO. | DRAWING NO. | REV.




EXISTING SIGHT DISTANCE
(PLANTATION ROAD)




PROPOSED SIGHT DISTANCE
(PLANTATION ROAD)

LEGEND

- PROPOSED CENTERLINE
- PROPOSED ROADWAY
- SIGHT DISTANCE TRIANGLE
- EXIST ROW (6' ≥ S < 8')
- EXIST ROW (8' ≤ S < 9')
- EXIST ROW (S ≥ 9')
- (X) DRIVEWAY NUMBERS
- TRAFFIC FLOW DIRECTION

N

0 30 60 120
(IN FEET)
1 INCH = 60 FEET

| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
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| T. G. B. DRN CKD BY | AUG 2011 DATE |
| M. J. G. DES BY | AUG 2011 DATE |
| T. G. B. DES CKD BY | AUG 2011 DATE |
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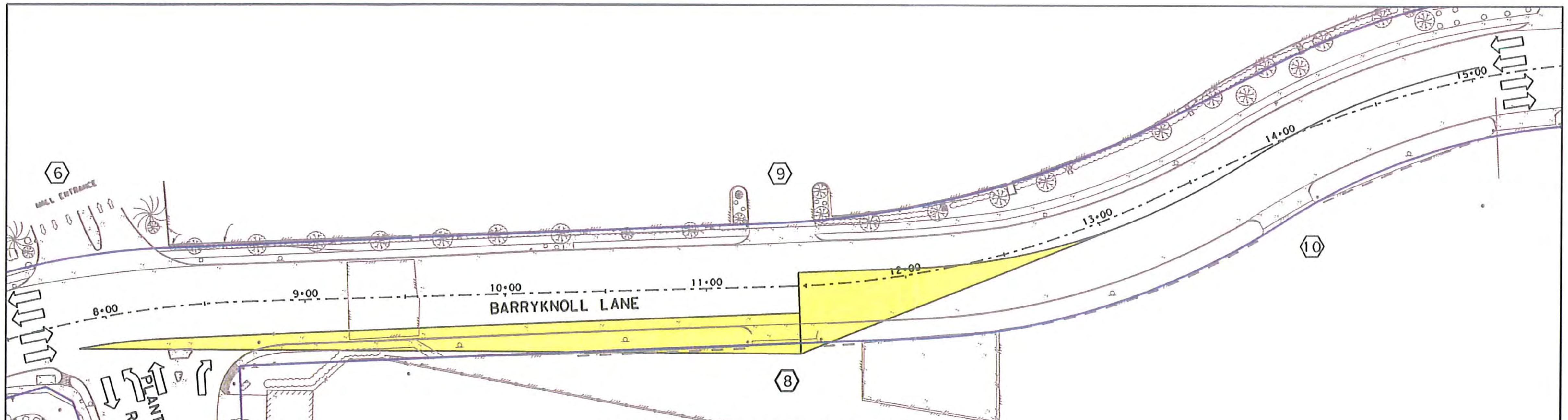
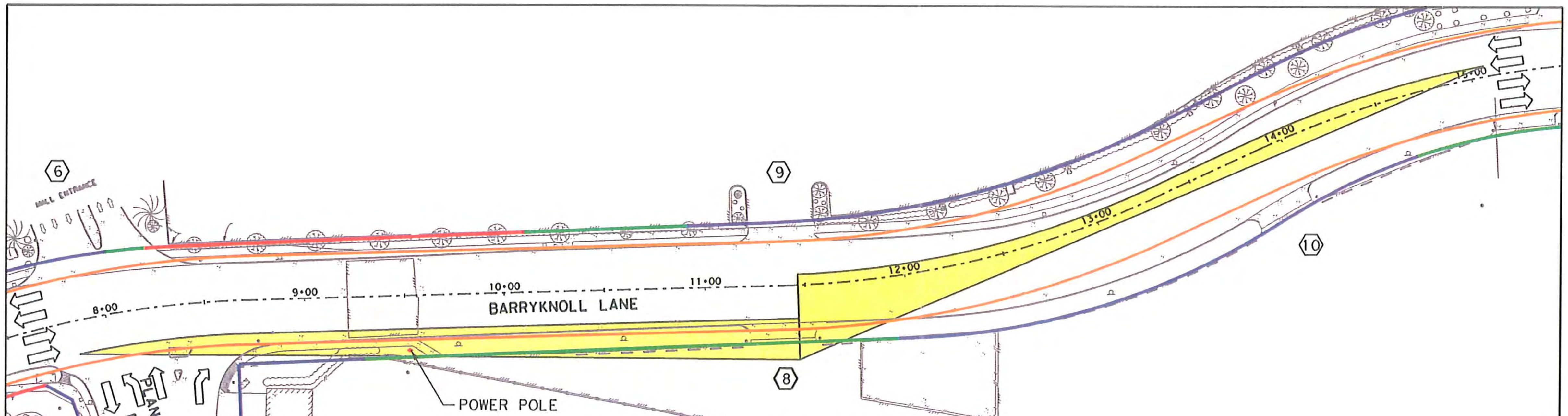
EXHIBIT 3
PLANTATION ROAD
SIGHT DISTANCE TRIANGLE

SHEET 7 OF 14

CONTRACT NO. | DRAWING NO. | REV.




EXISTING SIGHT DISTANCE
(DRIVEWAY 8)




PROPOSED SIGHT DISTANCE
(DRIVEWAY 8)

LEGEND

- PROPOSED CENTERLINE
- PROPOSED ROADWAY
- SIGHT DISTANCE TRIANGLE
- EXIST ROW (6' ≥ S < 8')
- EXIST ROW (8' ≤ S < 9')
- EXIST ROW (S ≥ 9')
- (X) DRIVEWAY NUMBERS
- TRAFFIC FLOW DIRECTION

N

0 30 60 120
(IN FEET)
1 INCH = 60 FEET

| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
|---|---|---|---|---|---|---|---|---|---|

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Date: AUG 2011

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|---|---|
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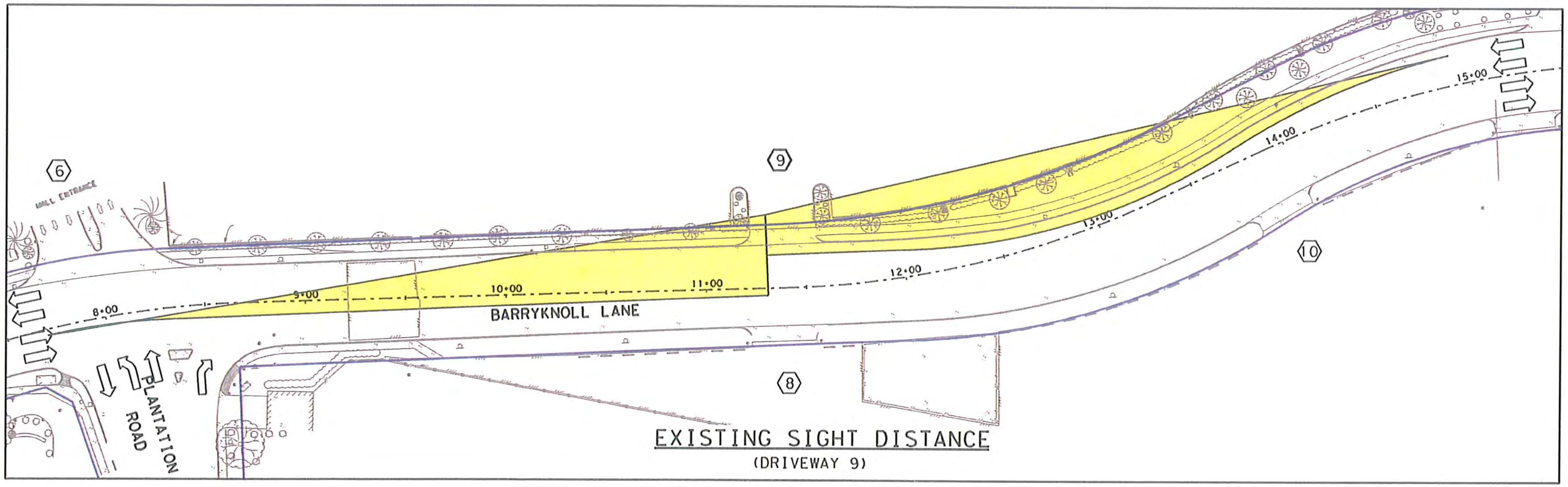
| T. G. B. DRN CKD BY | AUG 2011 DATE |
| M. J. G. DES BY | AUG 2011 DATE |
| T. G. B. DES CKD BY | AUG 2011 DATE |
| APPROVED BY | DATE |
| SCALE: AS SHOWN | |

BARRYKNOLL LANE

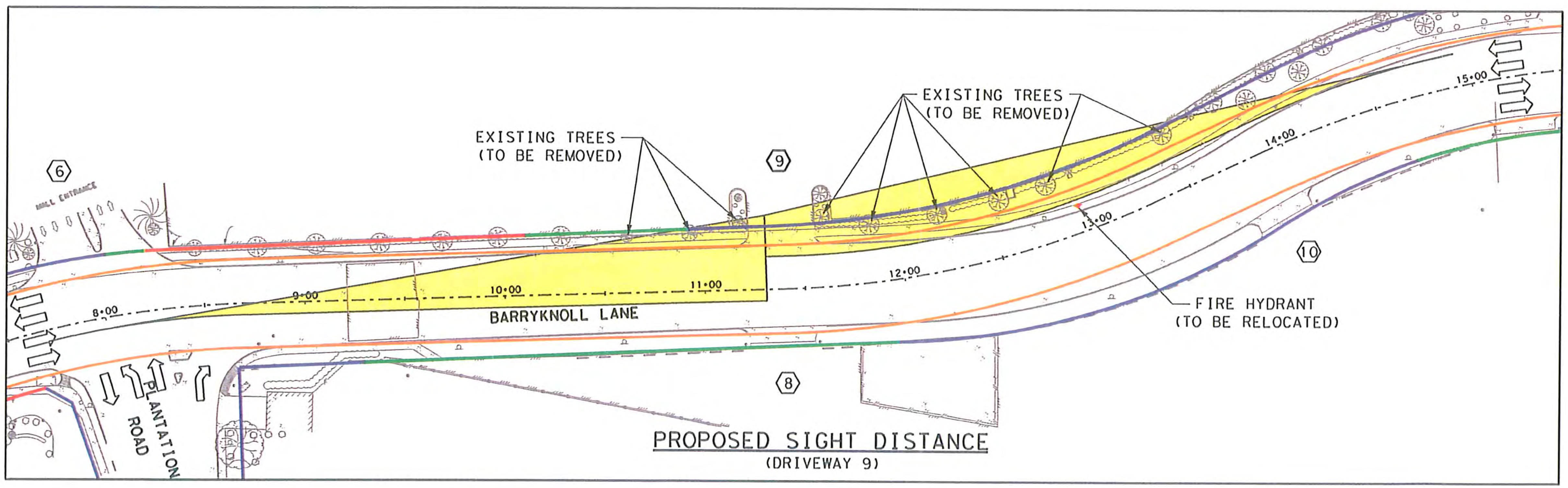
EXHIBIT 3
DRIVEWAY 8
SIGHT DISTANCE TRIANGLE

SHEET 8 OF 14

CONTRACT NO. | DRAWING NO. | REV.




EXISTING SIGHT DISTANCE
(DRIVEWAY 9)




PROPOSED SIGHT DISTANCE
(DRIVEWAY 9)

LEGEND

- PROPOSED CENTERLINE
- PROPOSED ROADWAY
- SIGHT DISTANCE TRIANGLE
- EXIST ROW (6' ≥ S < 8')
- EXIST ROW (8' ≤ S < 9')
- EXIST ROW (S ≥ 9')
- DRIVEWAY NUMBERS
- TRAFFIC FLOW DIRECTION

N

0 30 60 120
(IN FEET)
1 INCH = 60 FEET

| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
|---|---|---|---|---|---|---|---|---|---|

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| T. G. B. DRN CKD BY | AUG 2011 DATE |
| M. J. G. DES BY | AUG 2011 DATE |
| T. G. B. DES CKD BY | AUG 2011 DATE |
| APPROVED BY | DATE |
| SCALE: AS SHOWN | |

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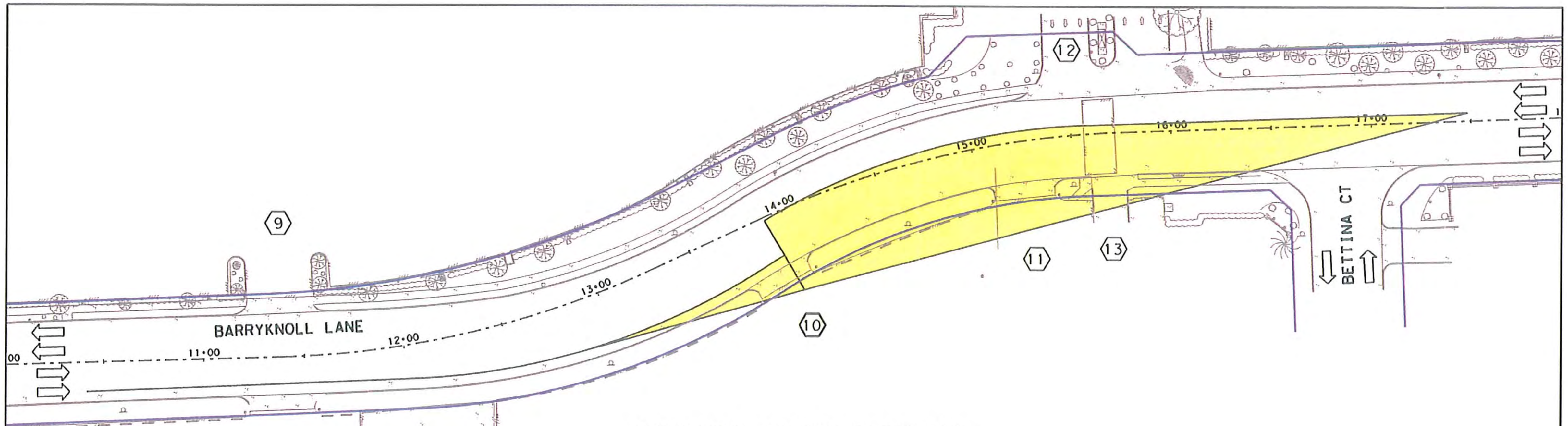
EXHIBIT 3
DRIVEWAY 9
SIGHT DISTANCE TRIANGLE

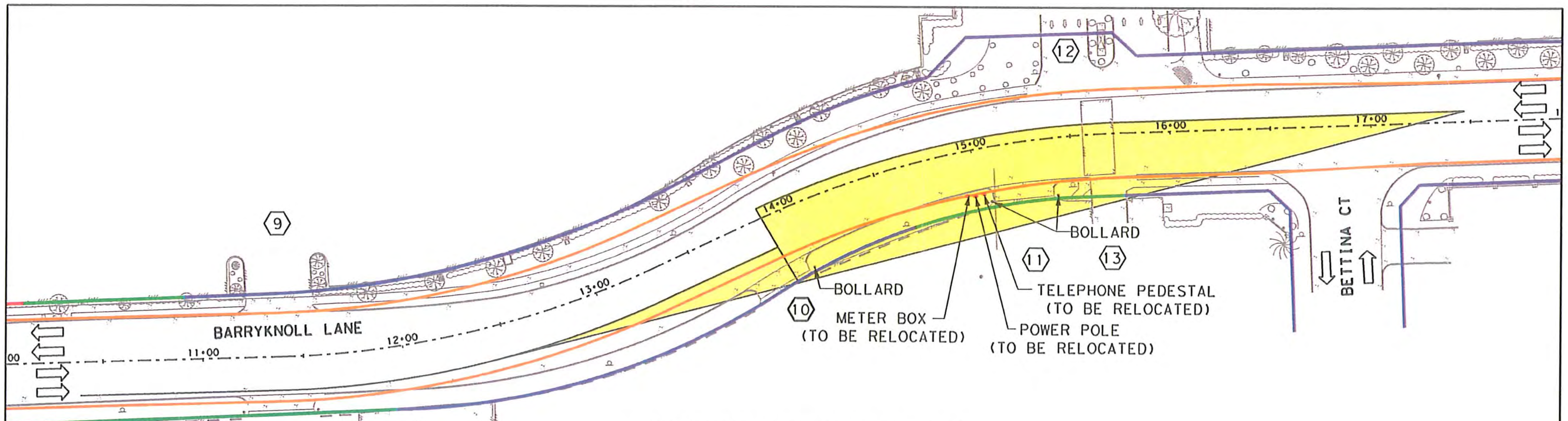
SHEET 9 OF 14

CONTRACT NO. | DRAWING NO. | REV.




## EXISTING SIGHT DISTANCE

(DRIVEWAY 10)




## PROPOSED SIGHT DISTANCE

(DRIVEWAY 10)

LEGEND

- PROPOSED CENTERLINE
- PROPOSED ROADWAY
- SIGHT DISTANCE TRIANGLE
- EXIST ROW (6' ≥ S < 8')
- EXIST ROW (8' ≤ S < 9')
- EXIST ROW (S ≥ 9')
- (X) DRIVEWAY NUMBERS
- TRAFFIC FLOW DIRECTION

0 30 60 120
(IN FEET)
1 INCH = 60 FEET

| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
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| T. G. B. (DRN CKD BY) | AUG 2011 (DATE) |
| M. J. G. (DES BY) | AUG 2011 (DATE) |
| T. G. B. (DES CKD BY) | AUG 2011 (DATE) |
| APPROVED BY | DATE |
| SCALE: AS SHOWN | |

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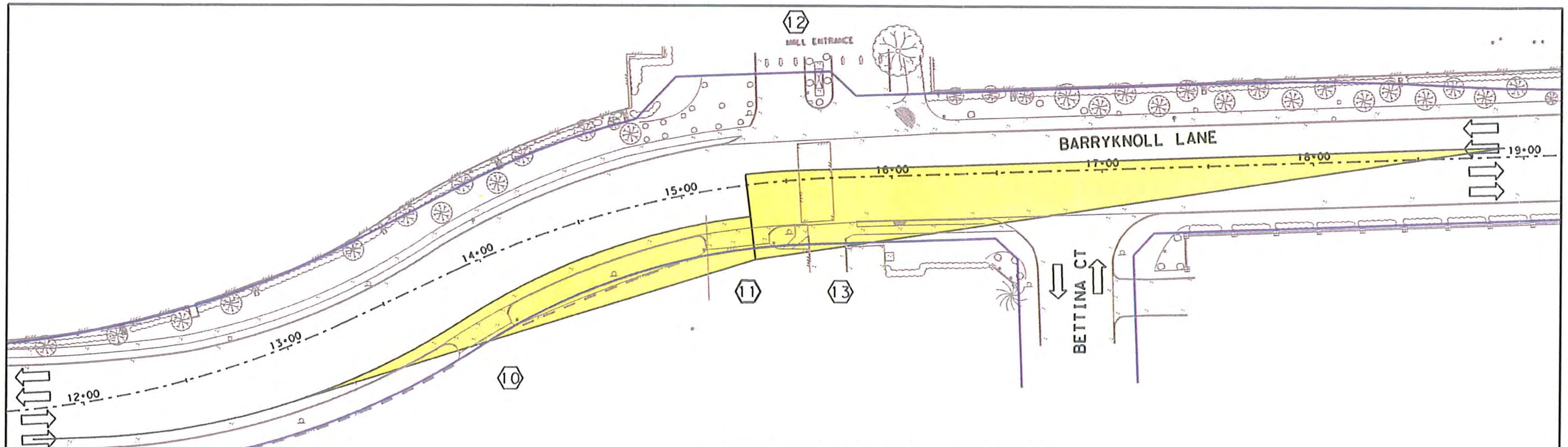
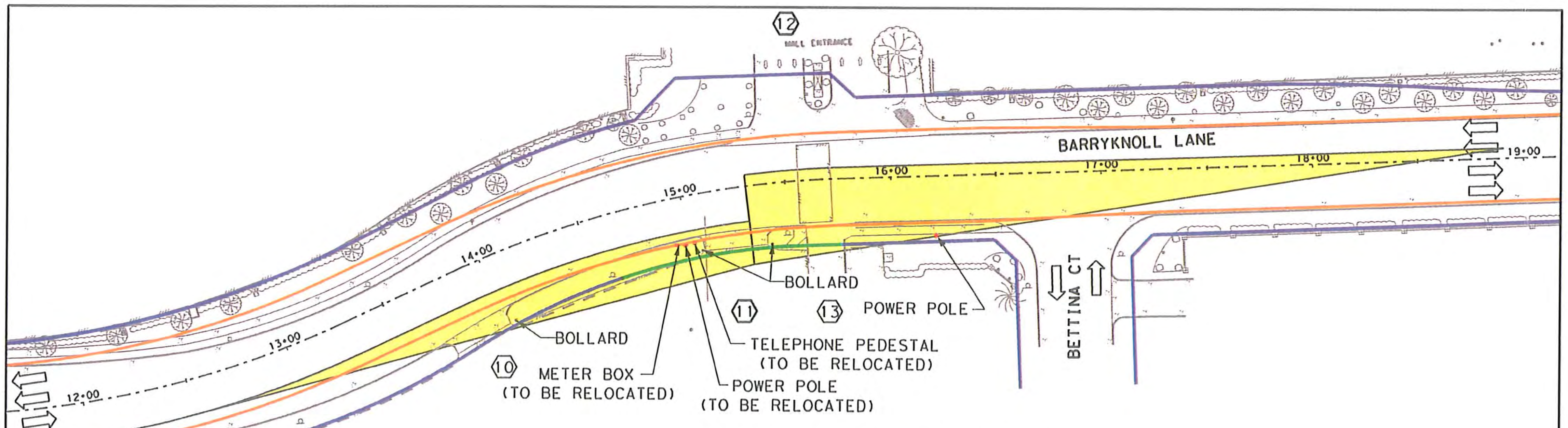
EXHIBIT 3
DRIVEWAY 10
SIGHT DISTANCE TRIANGLE

SHEET 10 OF 14

CONTRACT NO. | DRAWING NO. | REV.




EXISTING SIGHT DISTANCE
(DRIVEWAY 11)




PROPOSED SIGHT DISTANCE
(DRIVEWAY 11)

LEGEND

- PROPOSED CENTERLINE
- PROPOSED ROADWAY
- SIGHT DISTANCE TRIANGLE
- EXIST ROW (6' ≥ S < 8')
- EXIST ROW (8' ≤ S < 9')
- EXIST ROW (S ≥ 9')
- DRIVEWAY NUMBERS
- TRAFFIC FLOW DIRECTION

N

0 30 60 120
(IN FEET)
1 INCH = 60 FEET

| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
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| T. G. B. (DES CKD BY) | AUG 2011 (DATE) |
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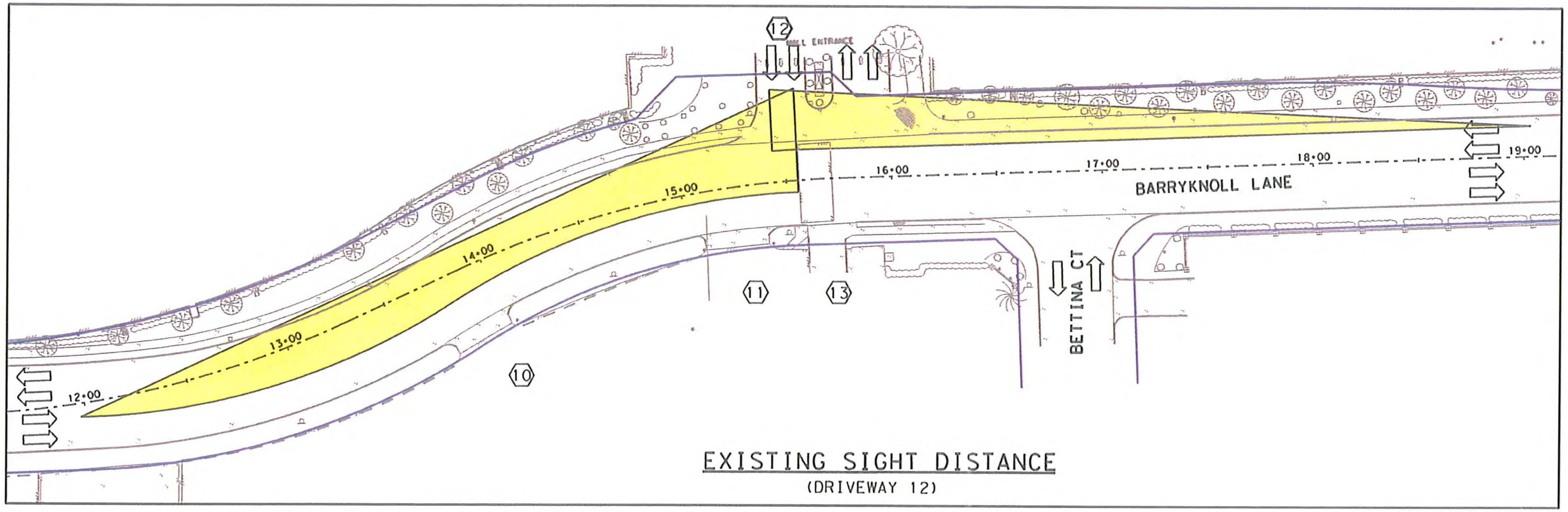
| SCALE: AS SHOWN | |

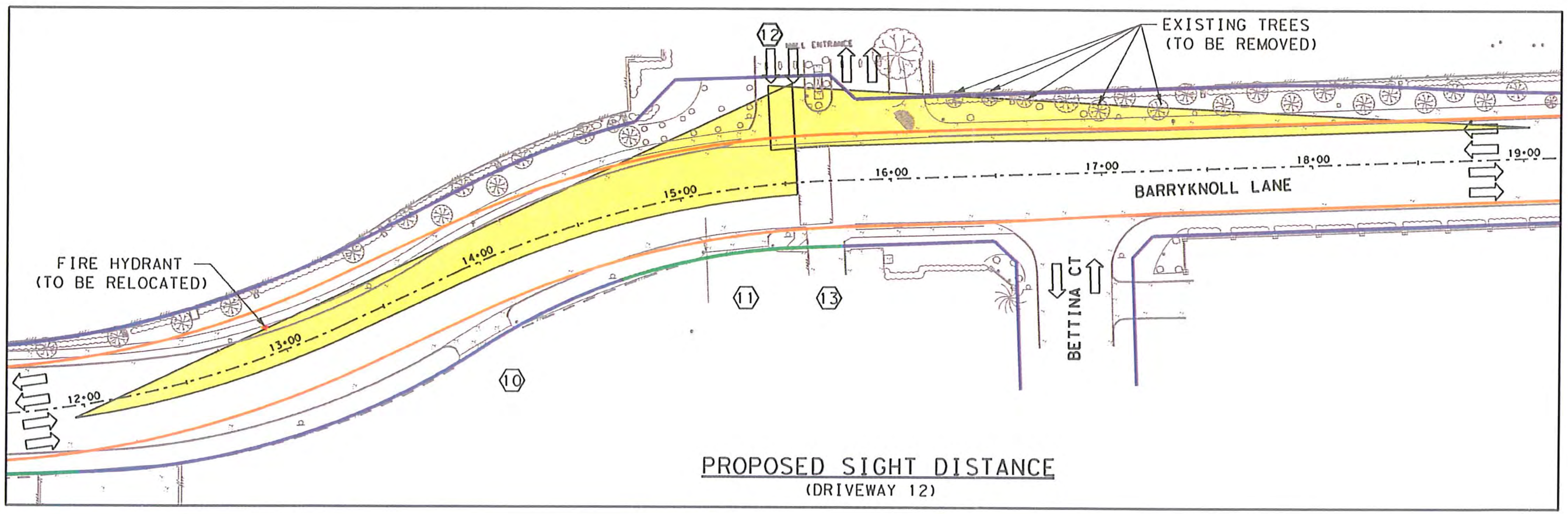
BARRYKNOLL LANE

EXHIBIT 3
DRIVEWAY 11
SIGHT DISTANCE TRIANGLE

SHEET 11 OF 14

CONTRACT NO. | DRAWING NO. | REV.




**LEGEND**

- PROPOSED CENTERLINE
- PROPOSED ROADWAY
- SIGHT DISTANCE TRIANGLE
- EXIST ROW (6' ≥ S < 8')
- EXIST ROW (8' ≤ S < 9')
- EXIST ROW (S ≥ 9')
- (X) DRIVEWAY NUMBERS
- TRAFFIC FLOW DIRECTION

N

0 30 60 120
(IN FEET)
1 INCH = 60 FEET

| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
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| M. J. G. (DES BY) | AUG 2011 (DATE) |
| T. G. B. (DES CKD BY) | AUG 2011 (DATE) |
| APPROVED BY | DATE |
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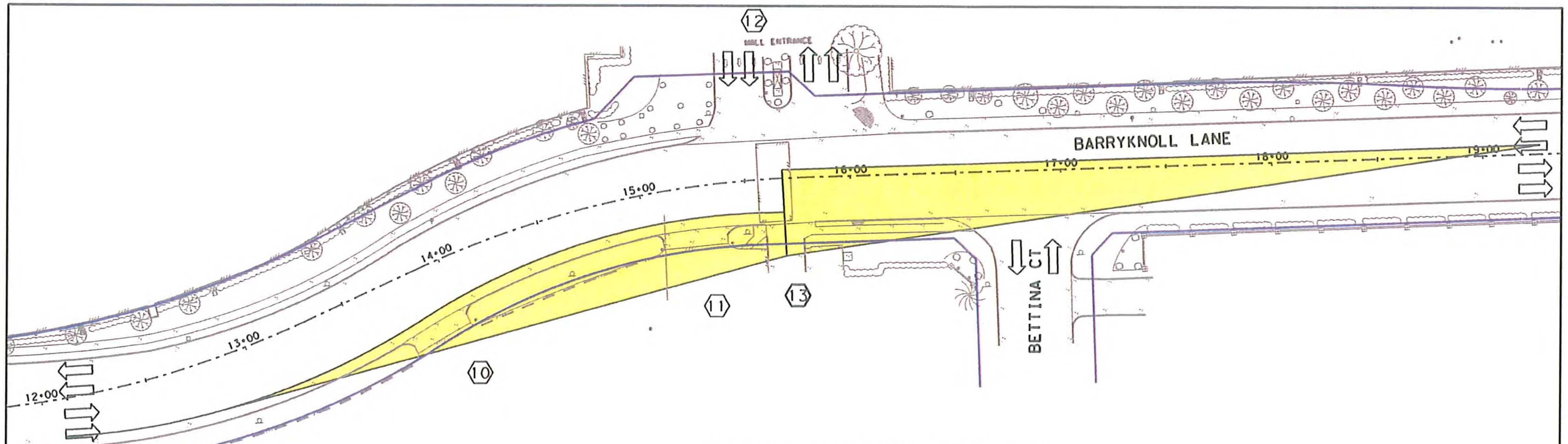
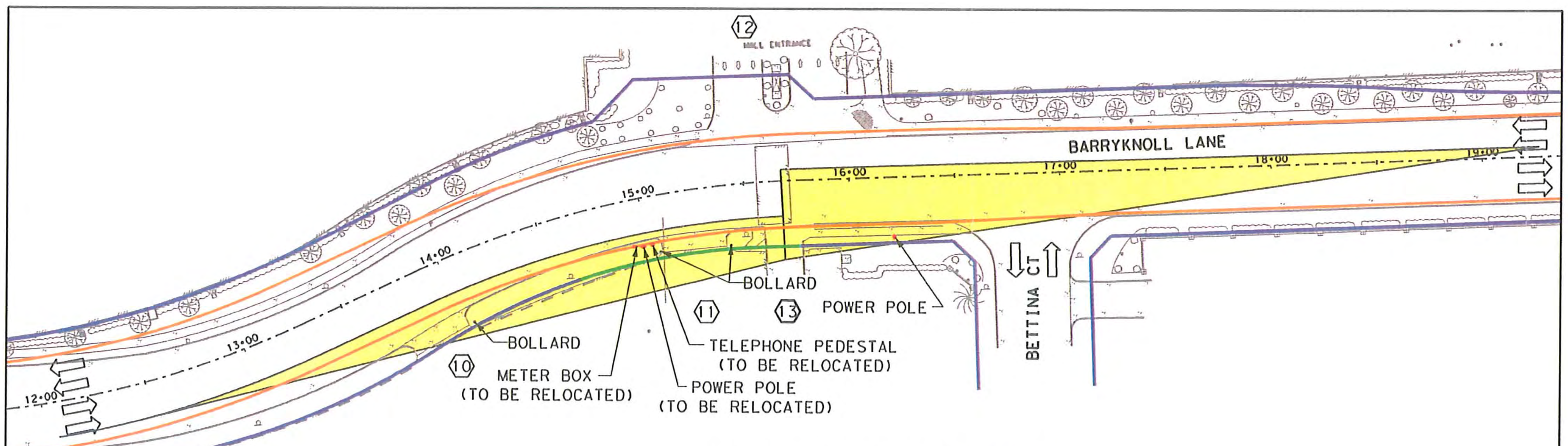
EXHIBIT 3
DRIVEWAY 12
SIGHT DISTANCE TRIANGLE

SHEET 12 OF 14

CONTRACT NO. | DRAWING NO. | REV.




EXISTING SIGHT DISTANCE
(DRIVEWAY 13)




PROPOSED SIGHT DISTANCE
(DRIVEWAY 13)

LEGEND

- PROPOSED CENTERLINE
- PROPOSED ROADWAY
- SIGHT DISTANCE TRIANGLE
- EXIST ROW (6' ≥ S < 8')
- EXIST ROW (8' ≤ S < 9')
- EXIST ROW (S ≥ 9')
- (X) DRIVEWAY NUMBERS
- TRAFFIC FLOW DIRECTION

N

0 30 60 120
(IN FEET)
1 INCH = 60 FEET

| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
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P.E. Serial No.: 99997
Firm: Lockwood, Andrews & Newnam Inc.
Firm No.: F-2614
Date: AUG 2011

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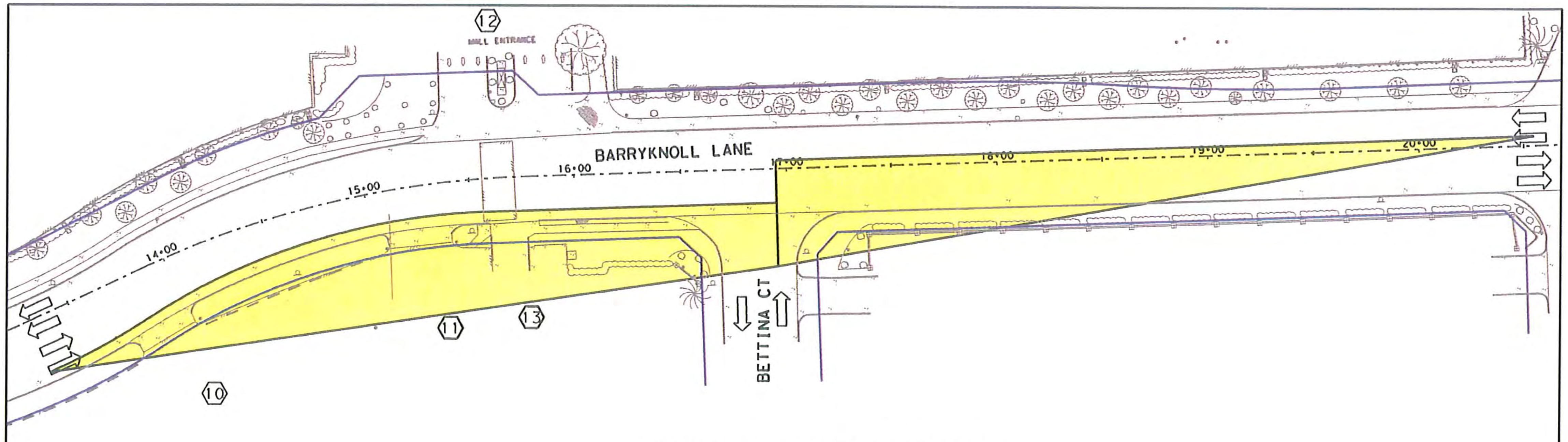
| M. J. G. (DRN BY) | AUG 2011 (DATE) |
| T. G. B. (DRN CKD BY) | AUG 2011 (DATE) |
| M. J. G. (DES BY) | AUG 2011 (DATE) |
| T. G. B. (DES CKD BY) | AUG 2011 (DATE) |
| APPROVED BY | DATE |
| SCALE: AS SHOWN | |

BARRYKNOLL LANE

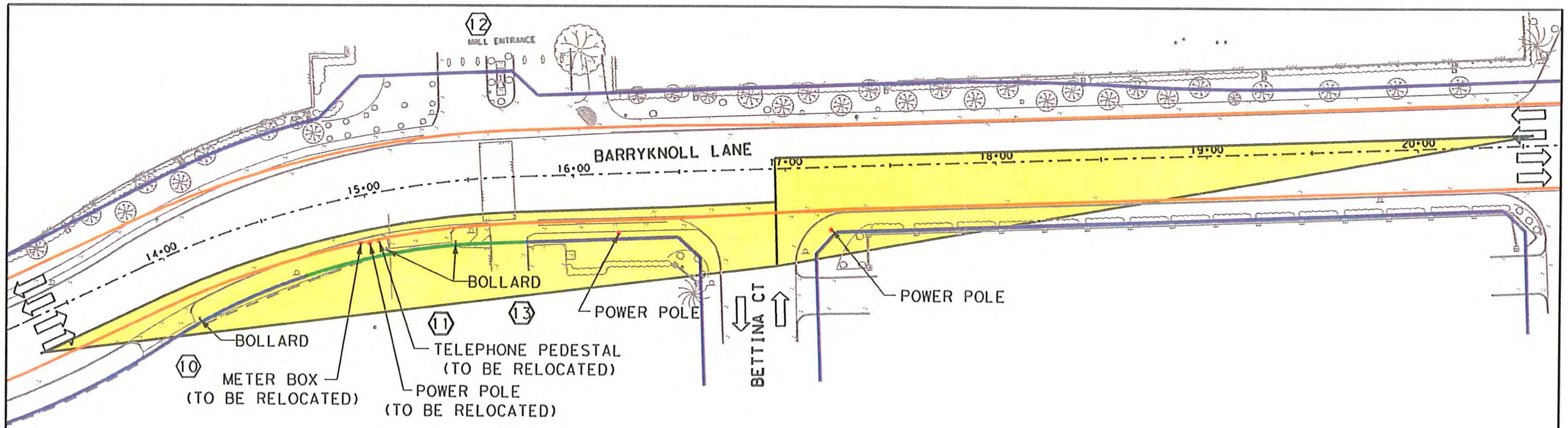
EXHIBIT 3
DRIVEWAY 13
SIGHT DISTANCE TRIANGLE

SHEET 13 OF 14

CONTRACT NO. | DRAWING NO. | REV.




EXISTING SIGHT DISTANCE
(BETTINA CT)




PROPOSED SIGHT DISTANCE
(BETTINA CT)

LEGEND
- PROPOSED CENTERLINE
- PROPOSED ROADWAY
- SIGHT DISTANCE TRIANGLE
- EXIST ROW (6' ≥ S < 8')
- EXIST ROW (8' ≤ S < 9')
- EXIST ROW (S ≥ 9')
- DRIVEWAY NUMBERS
- TRAFFIC FLOW DIRECTION

N

0 30 60 120
(IN FEET)
1 INCH = 60 FEET

| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
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Lockwood, Andrews & Newnam, Inc.
A LEO A DALY COMPANY

TIRZ 17 REDEVELOPMENT AUTHORITY

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Engineer: Tara G. Burrer, P.E.
P.E. Serial No.: 99997
Firm: Lockwood, Andrews & Newnam Inc.
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| M. J. G. DRN BY | AUG 2011 DATE |
| T. G. B. DRN CKD BY | AUG 2011 DATE |
| M. J. G. DES BY | AUG 2011 DATE |
| T. G. B. DES CKD BY | AUG 2011 DATE |
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BARRYKNOLL LANE

EXHIBIT 3
BETTINA CT
SIGHT DISTANCE TRIANGLE

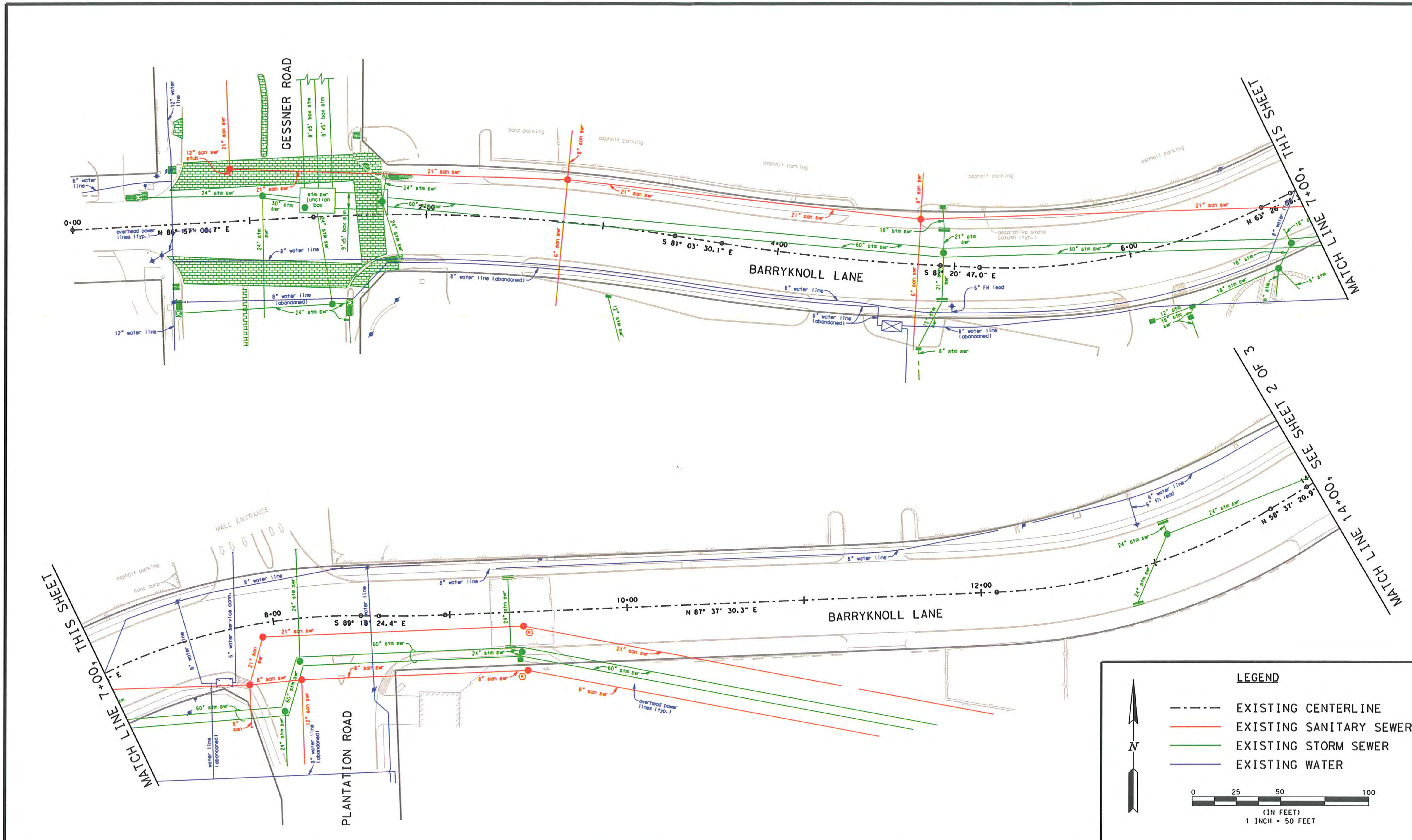
SHEET 14 OF 14

CONTRACT NO. | DRAWING NO. | REV.

# APPENDIX F

# PUBLIC/PRIVATE UTILITIES

# Appendix F.1
# Existing Public Utilities

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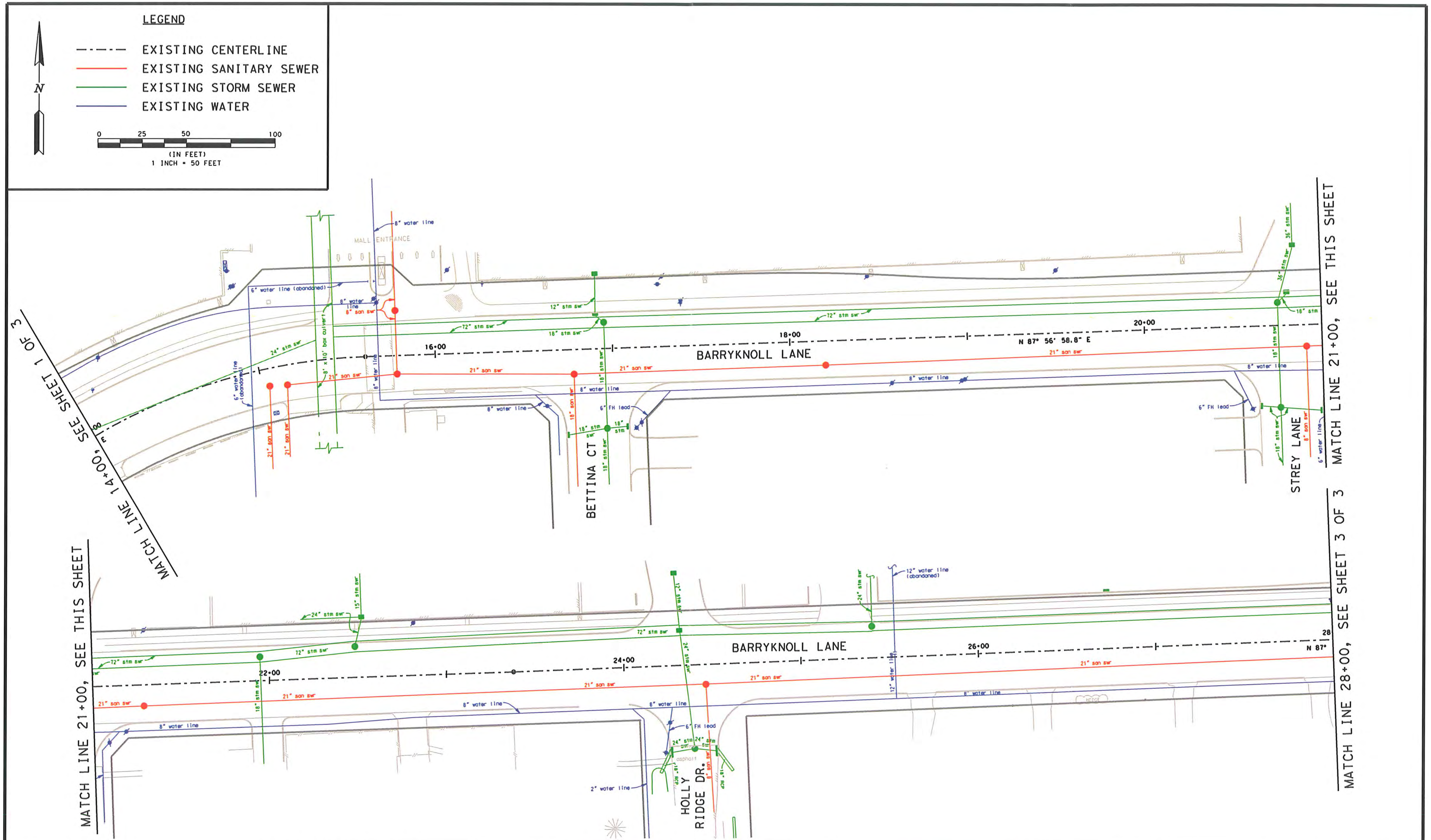
| M. J. G. DES BY | AUG 2011 DATE |
| T. G. B. DES CKD BY | AUG 2011 DATE |
| APPROVED BY | DATE |
| SCALE: AS SHOWN | |

APPENDIX F.1

BARRYKNOLL LANE
EXISTING PUBLIC UTILITIES
SHEET 1 OF 3

CONTRACT NO. | DRAWING NO. | REV.

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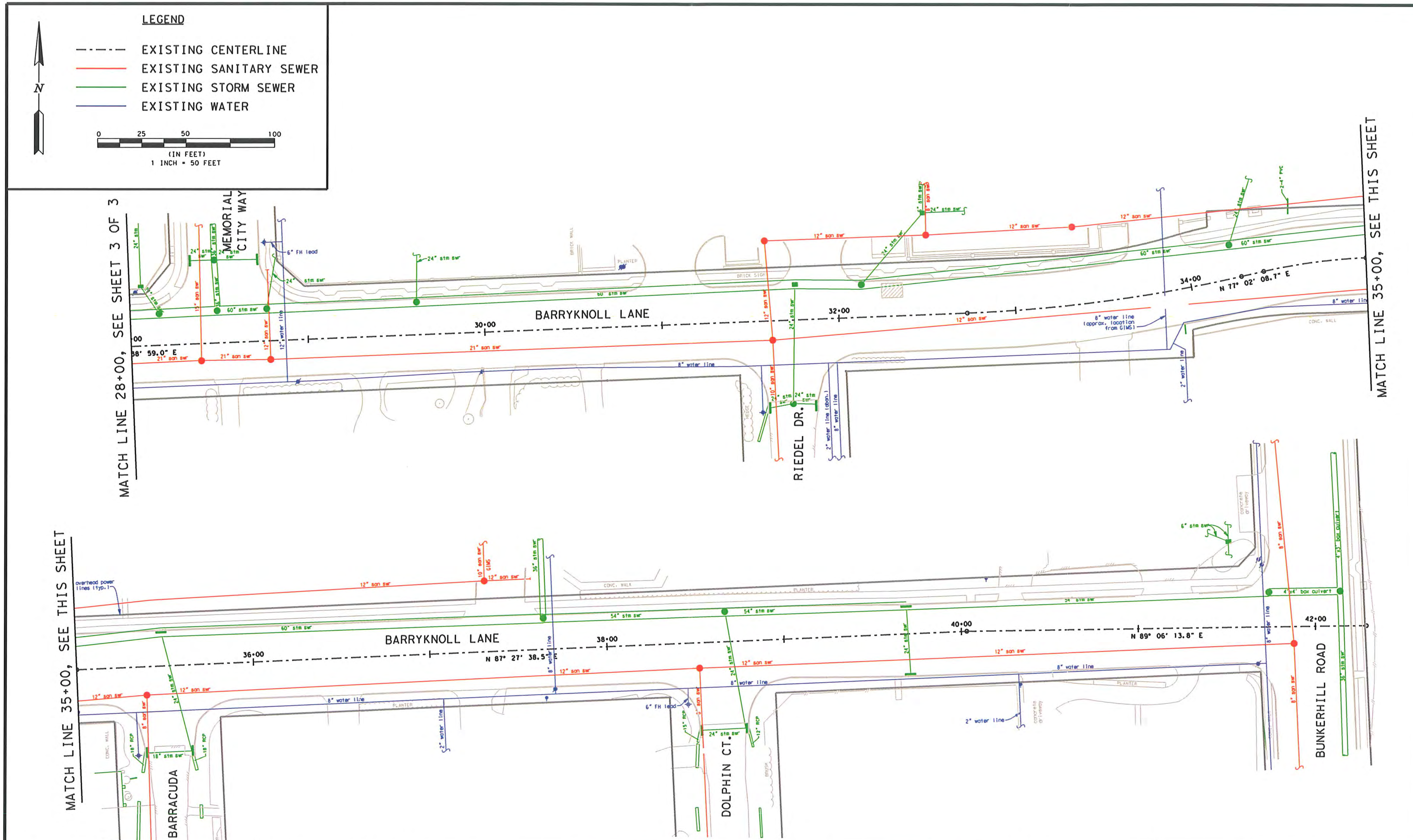
| DRN CKD BY | T. G. B. | AUG 2011 |
| DES BY | M. J. G. | AUG 2011 |
| DES CKD BY | T. G. B. | AUG 2011 |
| APPROVED BY | | |
| SCALE: | AS SHOWN | |

APPENDIX F.1

BARRYKNOLL LANE
EXISTING PUBLIC UTILITIES
SHEET 2 OF 3

CONTRACT NO. | DRAWING NO. | REV.

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| M. J. G. | DES BY | AUG 2011 DATE |
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| | APPROVED BY | DATE |

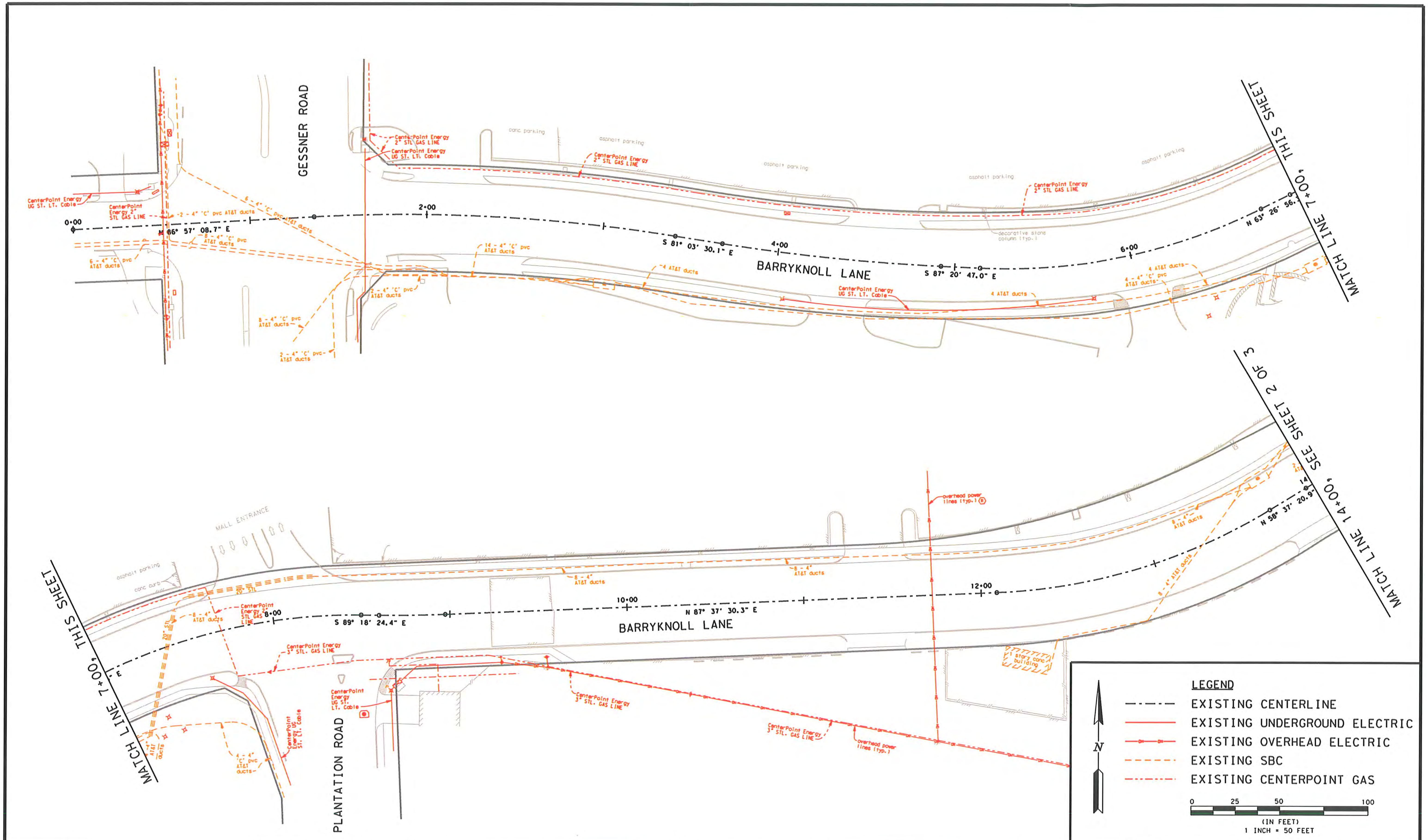
SCALE: AS SHOWN

APPENDIX F.1

BARRYKNOLL LANE
EXISTING PUBLIC UTILITIES
SHEET 3 OF 3

CONTRACT NO. | DRAWING NO. | REV.

# Appendix F.2
# Existing Private Utilities

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P.E. Serial No.: 99997
Firm: Lockwood, Andrews & Newnam Inc.
Firm No.: F-2614
Date: AUG 2011

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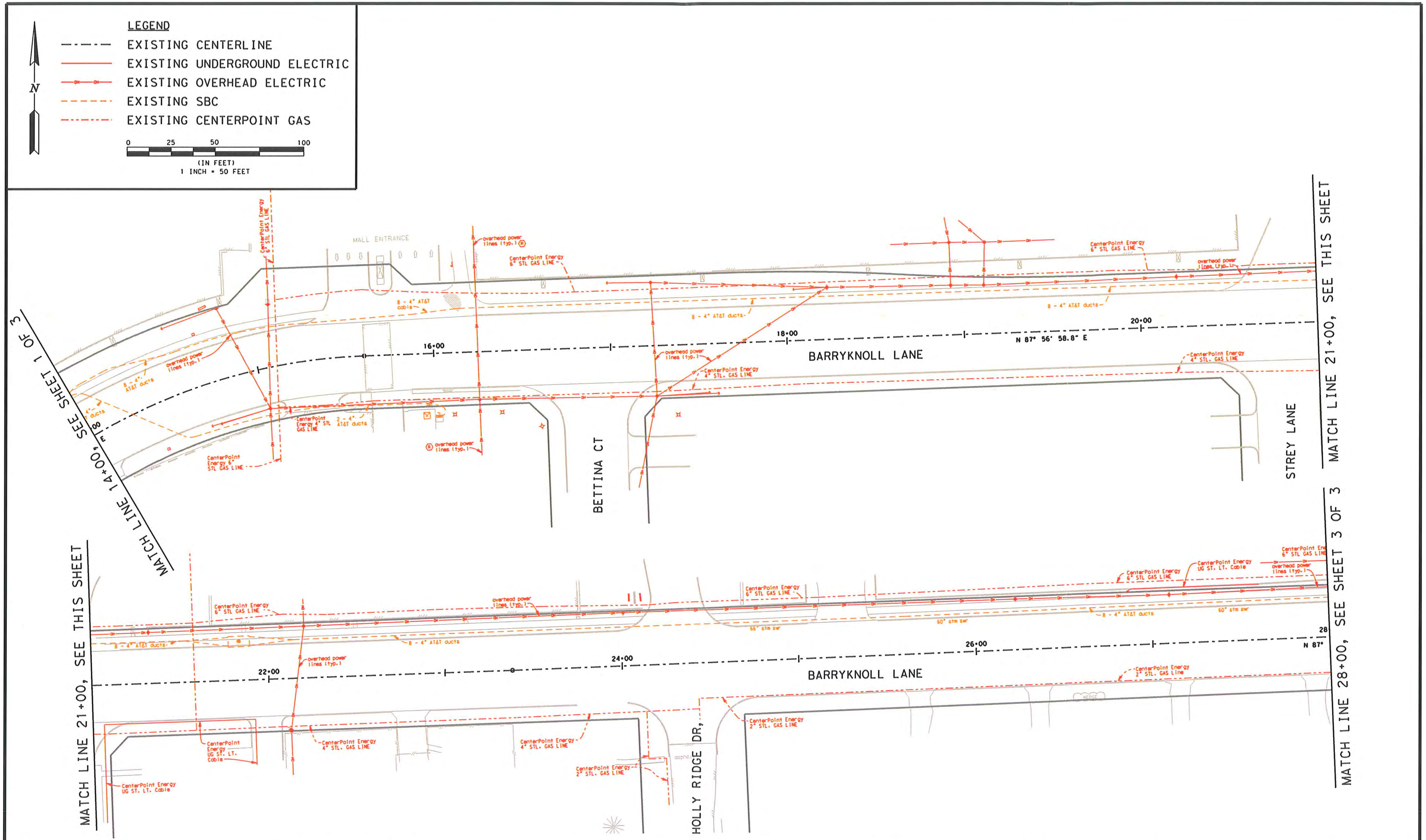
| T. G. B. — DRN CKD BY | AUG 2011 — DATE |
| M. J. G. — DES BY | AUG 2011 — DATE |
| T. G. B. — DES CKD BY | AUG 2011 — DATE |
| APPROVED BY | DATE |
| SCALE: AS SHOWN | |

APPENDIX F.2

BARRYKNOLL LANE
EXISTING PRIVATE UTILITIES
SHEET 1 OF 3

CONTRACT NO. | DRAWING NO. | REV.

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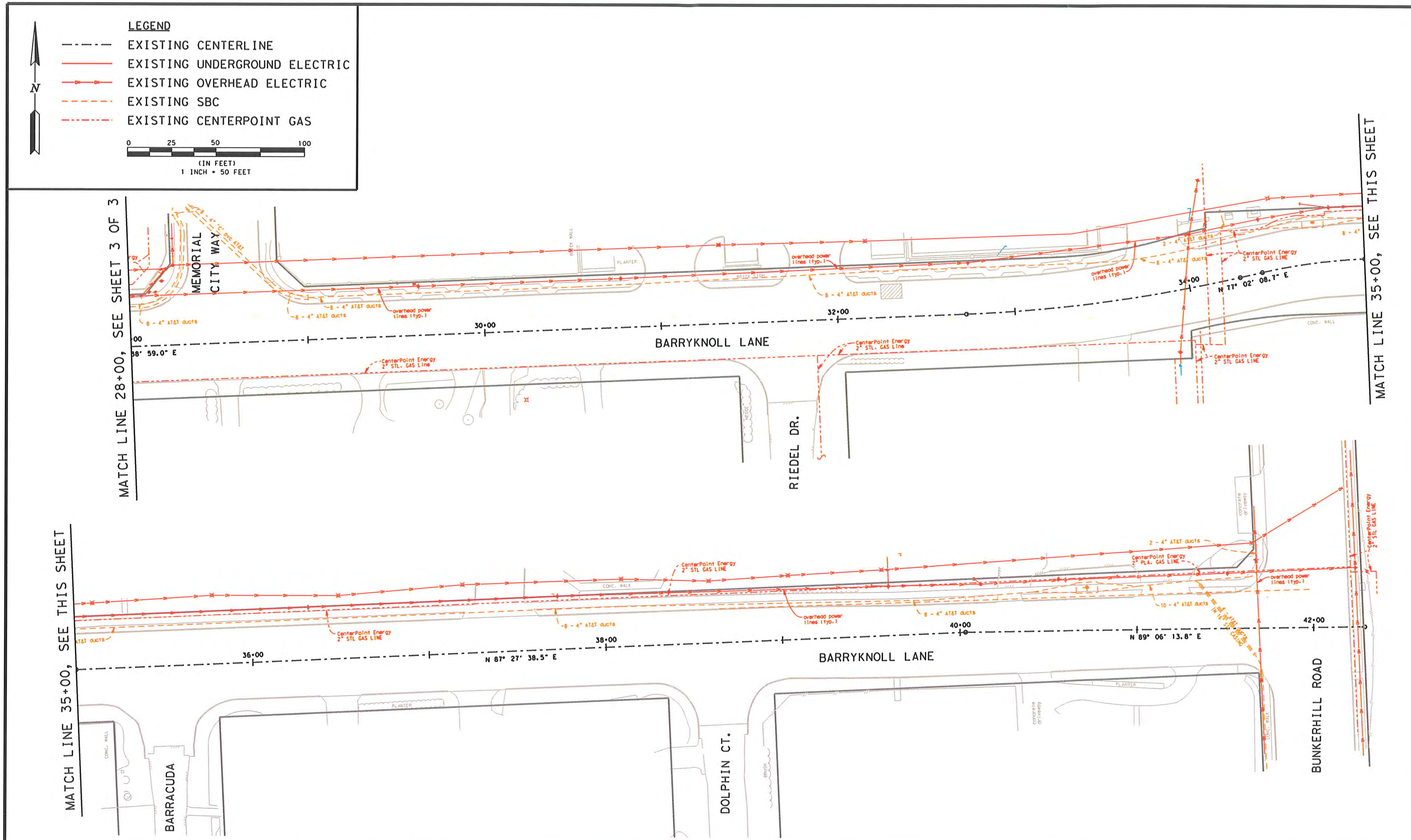
| M. J. G. DES BY | AUG 2011 DATE |
| T. G. B. DES CKD BY | AUG 2011 DATE |
| APPROVED BY | DATE |
| SCALE: AS SHOWN | |

APPENDIX F.2

BARRYKNOLL LANE
EXISTING PRIVATE UTILITIES
SHEET 2 OF 3

CONTRACT NO. | DRAWING NO. | REV.

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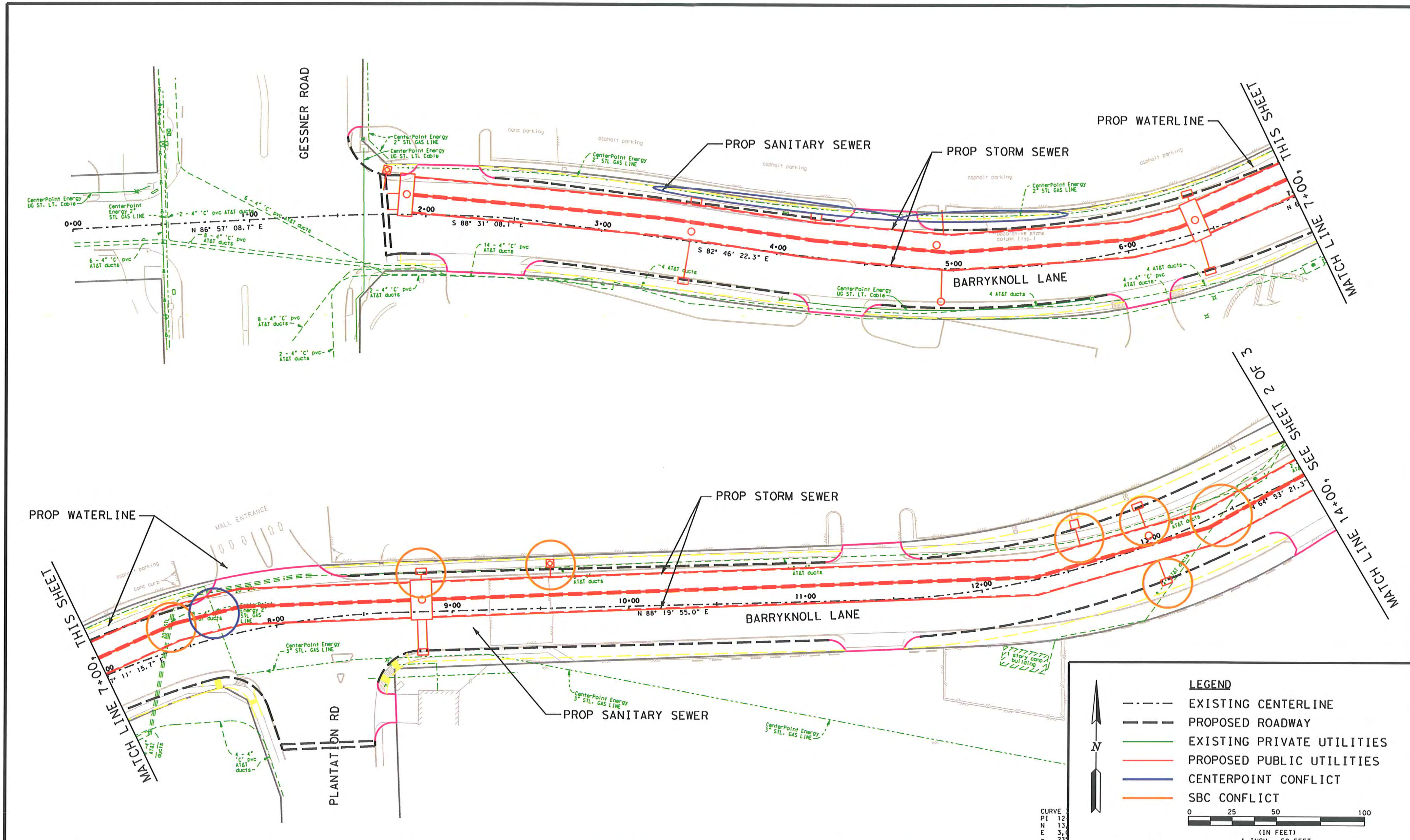
APPENDIX F.2

BARRYKNOLL LANE
EXISTING PRIVATE UTILITIES
SHEET 3 OF 3

CONTRACT NO. | DRAWING NO. | REV.

# Appendix F.3
# Potential Utility Conflicts

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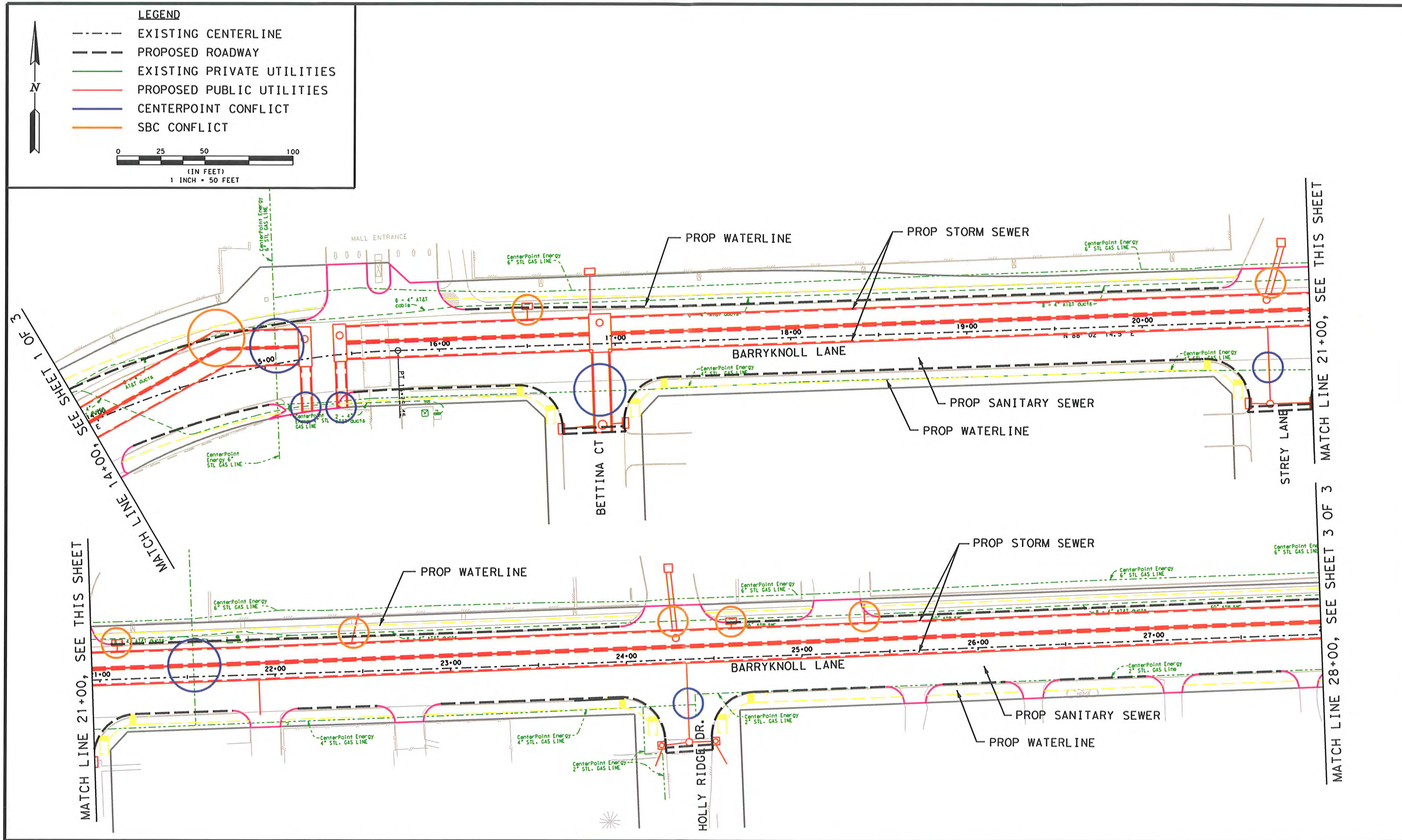
| M. J. G. — DRN BY | AUG 2011 — DATE |
| T. G. B. — DRN CKD BY | AUG 2011 — DATE |
| M. J. G. — DES BY | AUG 2011 — DATE |
| T. G. B. — DES CKD BY | AUG 2011 — DATE |
| APPROVED BY | DATE |
| SCALE: AS SHOWN | |

APPENDIX F.3
BARRYKNOLL LANE
POTENTIAL UTILITY CONFLICTS
SHEET 1 OF 3

CONTRACT NO. | DRAWING NO. | REV.

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Lockwood, Andrews & Newnam, Inc.
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TIRZ 17 REDEVELOPMENT AUTHORITY

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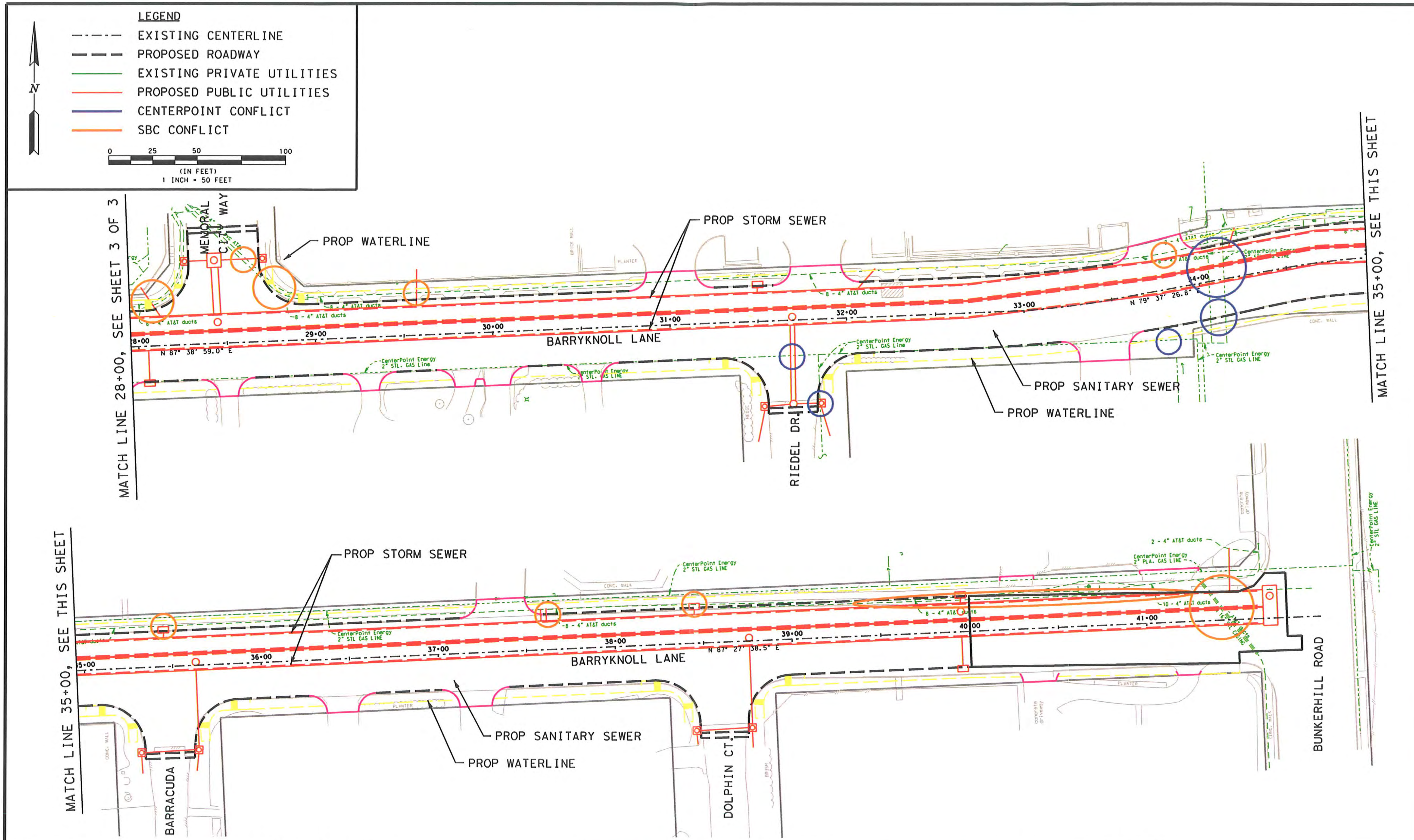
APPENDIX F.3
BARRYKNOLL LANE
UTILITY CONFLICTS
SHEET 2 OF 3

CONTRACT NO. | DRAWING NO. | REV.

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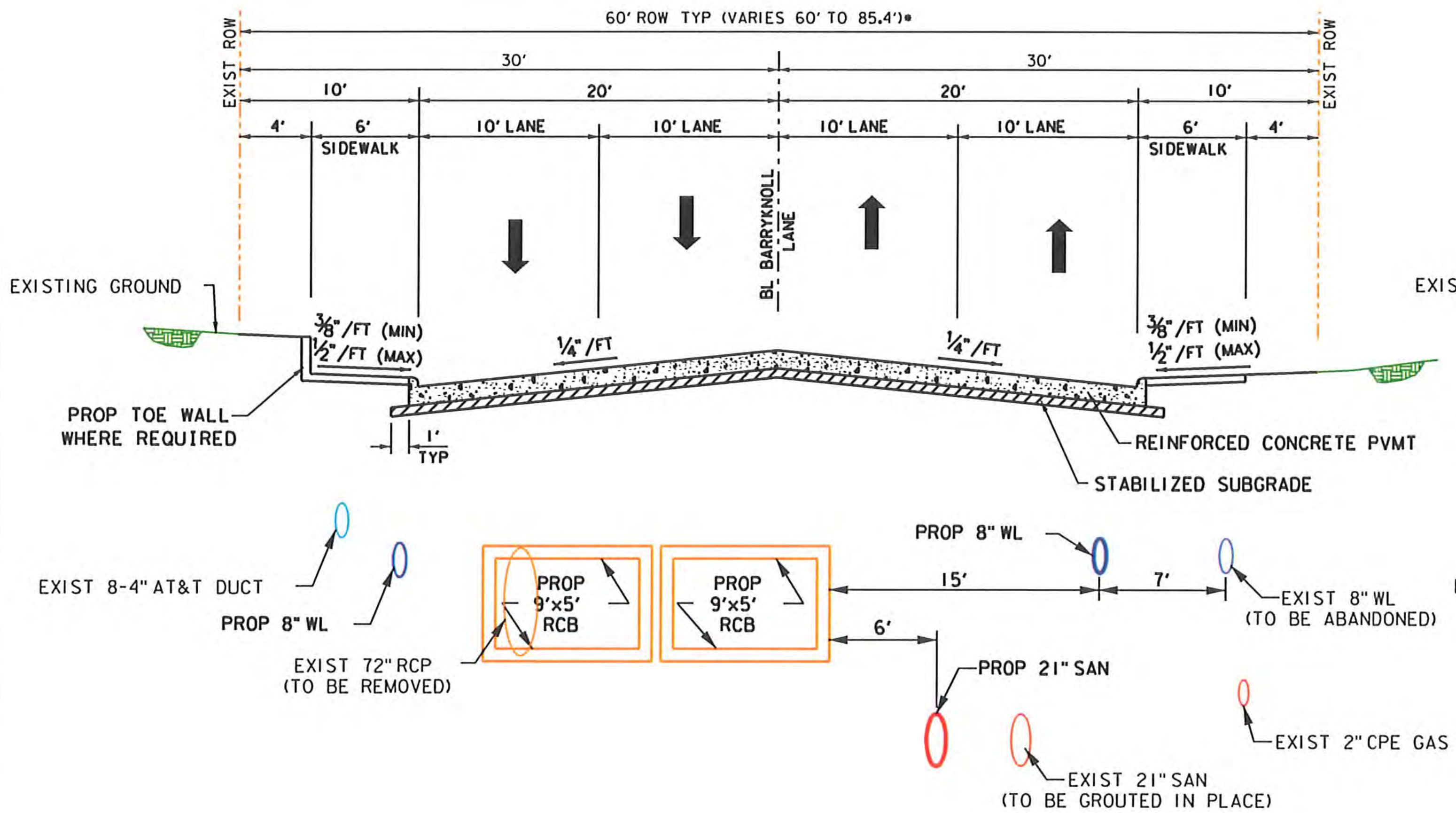
| T. G. B. DES CKD BY | AUG 2011 DATE |
| APPROVED BY | DATE |
| SCALE: AS SHOWN | |

APPENDIX F.3
BARRYKNOLL LANE
UTILITY CONFLICTS
SHEET 3 OF 3

CONTRACT NO. | DRAWING NO. | REV.

# Appendix F.4
# Existing Utility Typical Sections

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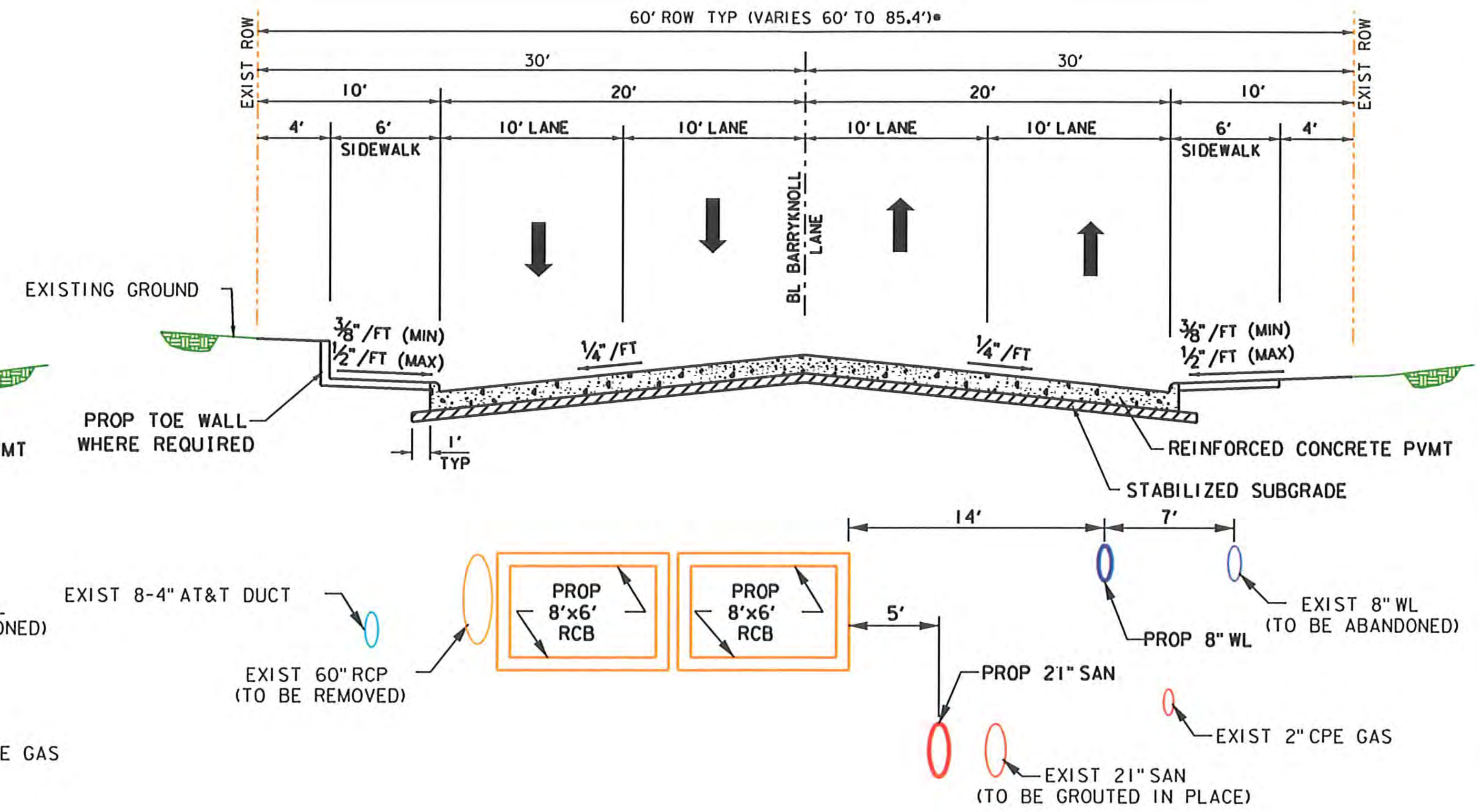


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P.E. Serial No.: 99997
Firm: Lockwood, Andrews & Newnam Inc.
Firm No.: F-2614
Date: NOV. 2011

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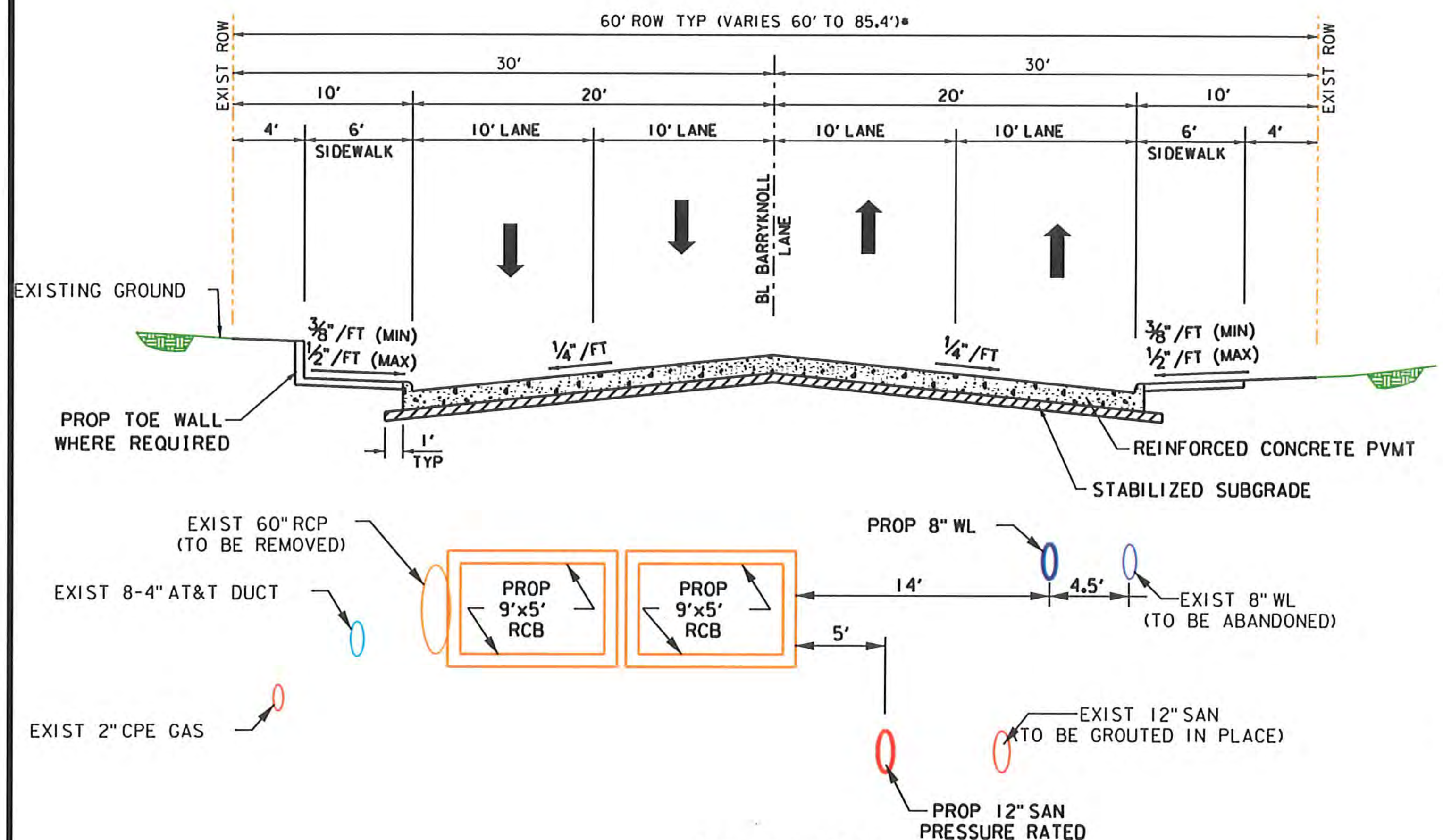
| T.G.B. DES CKD BY | NOV 2011 DATE |
| APPROVED BY | DATE |
| SCALE: AS SHOWN | |

APPENDIX F.4

BARRYKNOLL LANE
EXISTING UTILITY TYPICAL SECTIONS
SHEET 1 OF 2

CONTRACT NO. | DRAWING NO. | REV.

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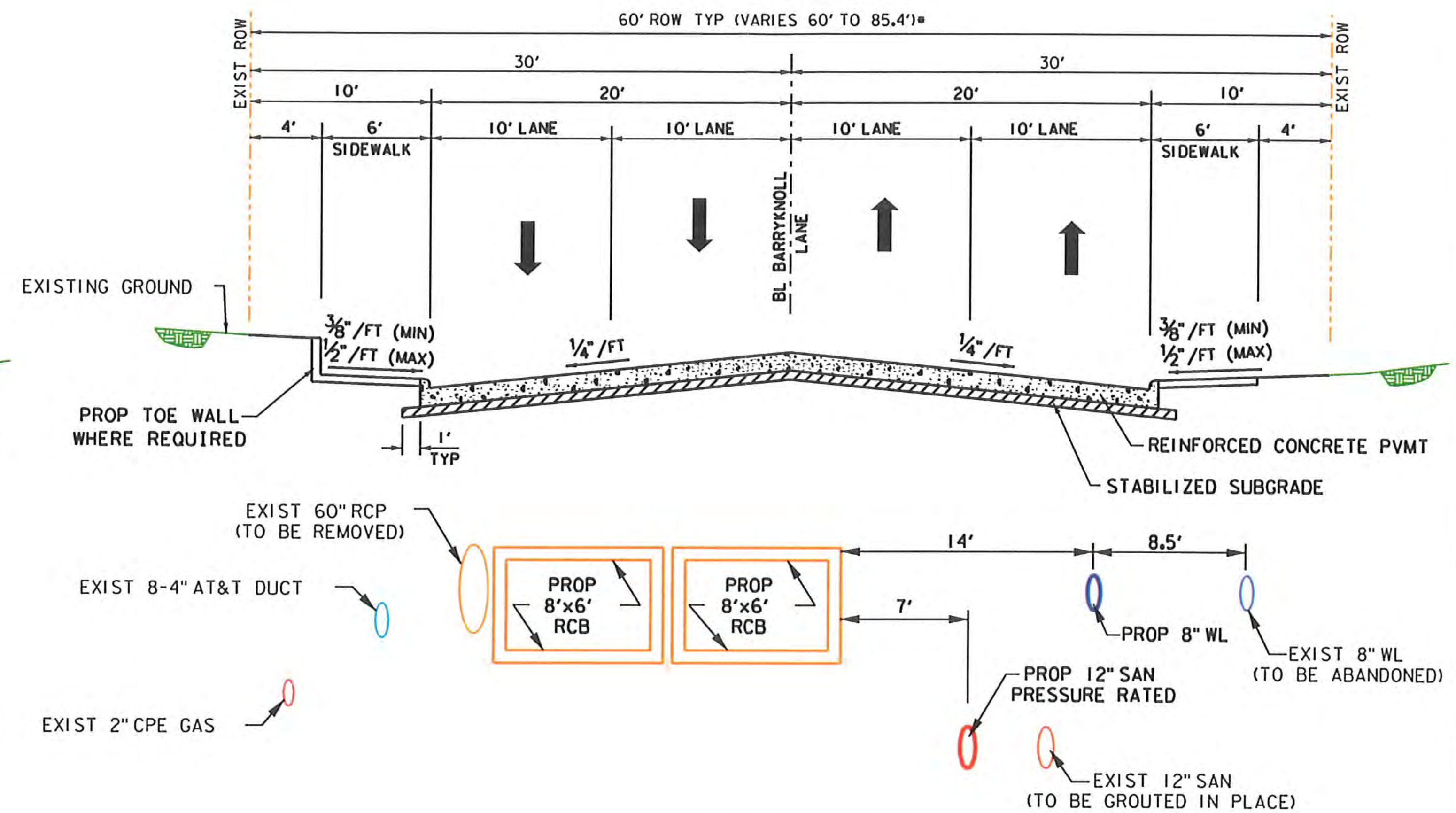


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| DRN CKD BY | T.G.B. | NOV 2011 |
| DES BY | M.J.G. | NOV 2011 |
| DES CKD BY | T.G.B. | NOV 2011 |
| APPROVED BY | | |
| SCALE: | AS SHOWN | |

APPENDIX F.4

BARRYKNOLL LANE
EXISTING UTILITY TYPICAL SECTIONS
SHEET 2 OF 2

CONTRACT NO. | DRAWING NO. | REV.

# Appendix F.5
# City of Houston Sanitary Sewer Recommendations

CITY OF HOUSTON WASTEWATER OPERATIONS
REVISED SANITARY SEWER RECOMMENDATIONS (MODIFIED)
T-1715 BARRYKNOLL EAST DRAINAGE IMPROVEMENTS; T-1724 GESSNER AT BARRYKNOLL INTERSECTIO

| UPSTREAM MANHOLE | DOWNSTREAM MANHOLE | LENGTH (Feet) | SIZE (Inches) | LOCATION | BASIN | TCEQ Agreed Order FY Basin | KEY MAP | CTV DATE | RECOMMENDATION |
|---|---|---|---|---|---|---|---|---|---|
| WDP06076 | WDP06074 | 41 | 21 | Along Gessner ROW | WDP06 | NA | 490A | 1/7/1992 | RR to 24_inch |
| WDP06077 | WDP06076 | 298 | 21 | Along Gessner ROW | WDP06 | NA | 490A | 1/7/1992 | RR to 24_inch |
| WDP06078 | WDP06077 | 194 | 21 | Along Gessner ROW | WDP06 | NA | 490A | 8/13/1998 | RR to 24_inch |
| WD042001 | WDP06078 | 223 | 21 | Barryknoll Ln. ROW | WD042 | NA | 490A | 8/13/1998 | RR to 24_inch |
| WD042002 | WD042001 | 288 | 21 | Barryknoll Ln. ROW | WD042 | NA | 490A | NONE | RR |
| WD042003 | WD042002 | 32 | 21 | Barryknoll Ln. ROW | WD042 | NA | 490A | NONE | RR |
| WD042004 | WD042003 | 149 | 21 | Barryknoll Ln. ROW | WD042 | NA | 490A | NONE | RR |
| WD042005 | WD042004 | 288 | 21 | Barryknoll Ln. ROW | WD042 | NA | 490A | NONE | RR |
| WD042006 | WD042005 | 280 | 21 | Barryknoll Ln. ESMT | WD042 | NA | 490A | NONE | RR |
| WD042007 | WD042006 | 221 | 21 | Barryknoll Ln. ROW | WD042 | NA | 490A | NONE | RR |
| WD042008 | WD042007 | 49 | 21 | Barryknoll Ln. ROW | WD042 | NA | 490A | NONE | RR |
| WD042019 | WD042008 | 101 | 21 | Barryknoll Ln. ROW | WD042 | NA | 490A | NONE | RR |
| WD042009 | WD042008 | 29 | 8 | Barryknoll Ln. ROW | WD042 | NA | 490A | NONE | RR |
| WD042023 | WD042019 | 145 | 21 | Barryknoll Ln. ROW | WD042 | NA | 490A | NONE | RR |
| WD042024 | WD042023 | 278 | 21 | Baryknoll Ln. ROW | WD042 | NA | 490A | NONE | RR |
| WD042030 | WD042024 | 45 | 21 | Baryknoll Ln. ROW | WD042 | NA | 490A | NONE | RR |
| WD042031 | WD042030 | 302 | 21 | Baryknoll Ln. ROW | WD042 | NA | 490A | NONE | RR |
| WD043001 | WD042031 | 425 | 21 | Baryknoll Ln. ROW | WD043 | NA | 490B | NONE | RR |
| WD043002 | WD043001 | 286 | 21 | Barryknoll Ln. ROW | WD043 | NA | 490B | NONE | RR |
| WD043003 | WD043002 | 56 | 12 | Barryknoll Ln. ROW | WD043 | NA | 490B | 10/27/2004 | NA |
| WD043004 | WD043003 | 62 | 12 | Barryknoll Ln. ESMT | WD043 | NA | 490B | NONE | CTV |
| WD043005 | WD043004 | 103 | 12 | Barryknoll Ln. ESMT | WD043 | NA | 490B | 7/30/2005 | NA |
| WD043006 | WD043005 | 124 | 12 | Barryknoll Ln. ESMT | WD043 | NA | 490B | 7/30/2005 | NA |
| WD043007 | WD043006 | 270 | 12 | Barryknoll Ln. ESMT | WD043 | NA | 490B | 7/30/2005 | NA |
| WD043032 | WD043002 | 386 | 12 | Barryknoll Ln. ROW | WD043 | NA | 490B | NONE | RR |
| WD043034 | WD043032 | 310 | 12 | Barryknoll Ln. ROW | WD043 | NA | 490B | NONE | RR |
| WD043036 | WD043034 | 335 | 12 | Barryknoll Ln. ROW | WD043 | NA | 490B | NONE | RR |
| | | 5321 | | | | | | | |
| | | | | | | | | | |

**General Guidelines:**

1. All work shall meet TCEQ Rules and Regulations, and conform to the latest City of Houston Guidelines.
2. Sanitary Sewer Service connections shall not be damaged during construction.
3. All Sanitary Sewer Services shall be reconnected.
4. Identify any additional work to ensure a complete in place working system.
5. TV older than five (5) years does not reflect the current conditions. Clean and televise lines in this category to determine their current state.

PREPARED BY OGADINMA ONYEBUCHI
REVIEWED BY RAGHAVENDER NEDNUR

# APPENDIX G

# TREE INVENTORY

# Appendix G.1
# Preliminary Tree Inventory- Findings and Recommendations

# Memorial City Redevelopment Authority
# Barryknoll Lane Street & Drainage Improvements

## Preliminary Tree Inventory-Findings and Recommendations


C.N. Koehl

Urban Forestry, Inc.

Tree numbers and locations included on attached redline of plan drawings.

Tree no. 1

31" Live Oak on private property. Existing ramp, walk, and retaining wall installed as part of the Gessner project. Tree will be preserved if the retaining wall remains in place

Trees no. 2-4

21" Live Oak, 24" Live Oak, and 18" Live Oak on private property. The three trees are growing between back of curb and parking/drive area on private property. The distance from back of curb to edge of parking is approximately 15 feet. Given the large size of the three trees, any southward shift of curb will jeopardize long term tree survival. If existing back of curb can be maintained the trees can be preserved in place with zero curb cutback street construction and forming proposed sidewalk over tree roots 1" diameter and larger. The sidewalk widening would need to occur on north side of existing sidewalk location.


**Figure 1: Proximity of trees 2-4 to existing sidewalk**

Tree no. 5

21" Live Oak on private property. The tree can tolerate shifting of curb approximately 18-24 inches to south. Street construction would require root pruning and zero curb cutback to minimize construction impacts. Sidewalk construction would need to be completed without cutting or otherwise damaging large trees roots.


**Figure 2: Proximity of tree 5 to edge of existing sidewalk**

Tree no. 6

17" Live Oak on private property. The tree is far enough from existing sidewalk to tolerate shifting of curb to south and shifting of sidewalk to edge of right of way.

Trees no. 7-21, 26-34, & 39

(24)9-12" Holly trees on private property. Trunk of trees is just outside street right of way on private property. Some of the bases of the trees flare over the right of way line and most of the large exposed roots grow across right of way line and immediately against existing sidewalk. Any northward movement of existing sidewalk will significantly jeopardize long term tree survival. Construction of sidewalk in same location as existing will require contractor to use plywood form on north side to avoid excavation and root cutting that would be needed to install steel or 2" wide wooden forms.


**Figure 3: Iron rod at right of way and root mass at north side of walk at tree 11.**


**Figure 4: Proximity of tree 19 to north edge of walk relative to 6" long scale and 9" wide portfolio**

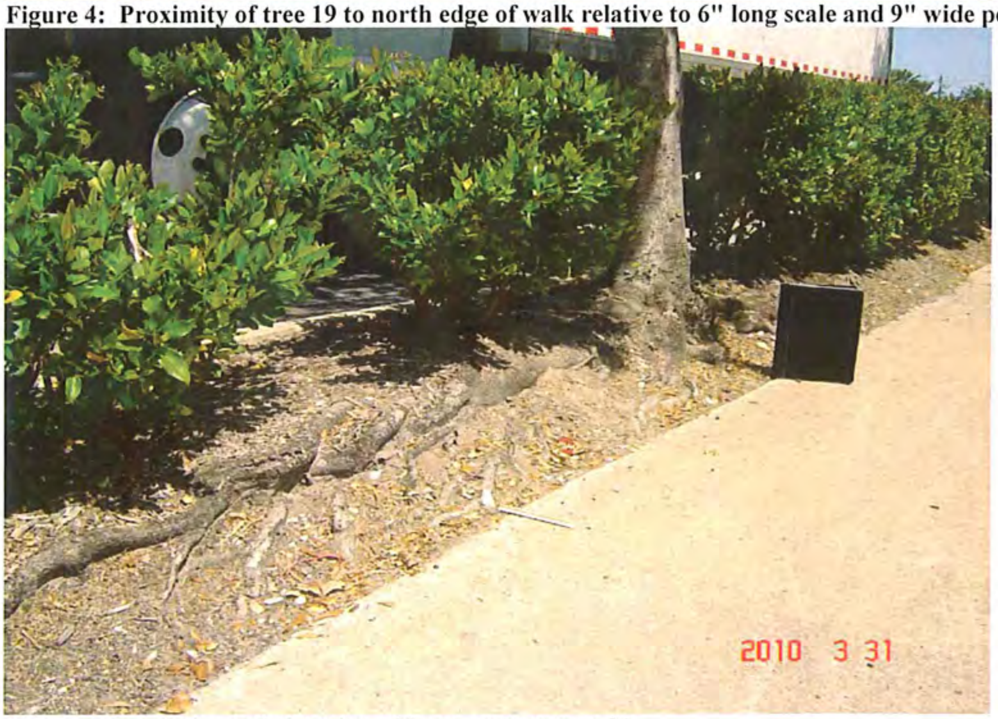



**Figure 5: Proximity and elevation of large roots at tree 31**

Trees no. 22&24

40' Palm trees located on private property. Will not be impacted by construction.

Trees no. 23 & 35-38

3" & 4" diameter Crepe Myrtles on private property. Will not be impacted by construction.

Tree no. 40

4' Sago Palm on private property. Will not be impacted by construction.

Trees no. 41

18" Live Oak on private property. Root pruning will be necessary at edge of proposed sidewalk to minimize tree impact from grading. Construction in right of way will not impact long term tree survival or structural integrity.

Tree no. 42

27" Live Oak that appears to be on the limits of right of way. Could not determine if more than 50% of the base of the tree is in the street right of way. If existing driveway on Plantation Road is to be removed and replaced it will need to be reconstructed in same location at same elevation to avoid disturbing tree roots beneath.

Trees no. 42A & 43

15" Pine & 18" Pine on private property. No existing sidewalk along west side of Betina Court. If sidewalk is to be installed we recommend keeping alignment immediately back of curb to minimize impact on long term tree survival.

Trees no. 44, 45, 49, 51, 55, 61, 63, 65, & 67

9" to 12" Hollies in street right of way and protected by Street Tree Ordinance. Base of the trees are approximately 4-5 feet north of existing sidewalk. Shifting walk location 18" north would not cause significant impact to the tree. Root pruning and root stimulation will be necessary to minimize construction impacts. A short curb wall will need to be formed with the north side of proposed sidewalk to avoid need to grade soil and roots to meet lower sidewalk elevation.

Trees no. 46, 47, 60, 62, 64, 66, 68, 70

9" to 12" Hollies in street right of way and protected by Street Tree Ordinance. Base of trees are approximately 10 to 12' from north edge of existing sidewalk. Shifting proposed sidewalk 2 to 4' north will have no impact on long term tree survival. Tree protection fencing and root pruning trench can be used to minimize construction impacts on trees.

Trees no. 48, 50, 52, 53, 72, & 74

9" to 12" Hollies that appear to be on the limits of right of way. Could not determine if more than 50% of the base of the trees are in the street right of way. Base of trees are approximately 6 to 10' from north edge of existing sidewalk. Shifting proposed sidewalk 2 to 4' north will have no impact on long term tree survival. Tree protection fencing and root pruning trench can be used to minimize construction impacts on trees.

Trees no. 54, 57, 58, &59

3" to 4" Crepe Myrtles that appear to be on the limits of right of way. Could not determine if more than 50% of the base of the trees are in the street right of way. Base of trees are approximately 8 to 10' from north edge of existing sidewalk. Shifting proposed sidewalk 2 to 4' north will have no impact on long term tree survival.

Trees no. 69, 71, & 73

9" to 12" Hollies in street right of way and protected by Street Tree Ordinance. Base of the trees are approximately 3 feet north of existing sidewalk. Shifting walk location 12" north would not cause significant impact to the tree. Root pruning and root stimulation will be necessary to minimize construction impacts. A short curb wall will need to be formed with the north side of proposed sidewalk to avoid need to grade soil and roots to meet lower sidewalk elevation.


**Figure 6: Proximity of tree 73 to north edge of existing sidewalk with 12" portfolio for reference.**

Tree no. 75

9" Holly in street right of way. The base of the tree is approximately 12" north of existing sidewalk. Any northward movement of existing sidewalk will significantly jeopardize long term tree survival. Construction of sidewalk in same location as existing will require contractor to use plywood form on north side to avoid excavation and root cutting that would be needed to install steel or 2" wide wooden forms.

Trees no. 76 - 79

9" to 12" Hollies that appear to be on the limits of right of way. Could not determine if more than 50% of the base of the trees are in the street right of way. Base of trees are approximately 3' from north edge of existing sidewalk. Shifting proposed sidewalk 12" north will have no impact on long term tree survival. Tree protection fencing and root pruning trench can be used to minimize construction impacts on trees. A short curb wall will need to be formed with the north side of proposed sidewalk to avoid need to grade soil and roots to meet lower sidewalk elevation.

Trees no. 80 & 81

40' Palm trees located on private property. Will not be impacted by construction.

Trees no. 82-90

9" to 12" Hollies in street right of way. The bases of the trees are approximately 6 to 10" north of existing sidewalk. Any northward movement of existing sidewalk will significantly jeopardize long term tree survival. Construction of sidewalk in same location as existing will require contractor to use plywood form on north side to avoid excavation and root cutting that would be needed to install steel or 2" wide wooden forms. A short curb wall will need to be formed with the north side of proposed sidewalk to avoid need to grade soil and roots to meet lower sidewalk elevation.


**Figure 7: Conditions at base of tree 82 with 12" portfolio and 6" scale for reference**


**Figure 8: Conditions at base of tree 88 with 12" portfolio and 6" scale for reference**

Tree no. 91 & 92

15" Tallow & 8" Ligustrum on private property. Construction in street right of way will not impact long term tree survival or structural integrity.

Trees 93 & 94

25" Lacebark Elm & 12" Lacebark Elm growing just behind wooden fence on private property. Base of tree is approximately 10' south of existing back of curb. Construction of 6' side sidewalk immediately back of existing curb will not jeopardize long term tree survival, provided excavation for sidewalk is limited to 6" depth to avoid damage to large tree roots. If proposed curb is shifted 12-24" south, excavation for sidewalk would more than likely cut into the base of the trees, thus significantly impacting long term tree survival and structural integrity.

Trees no. 95-97

10" Tallow, 8" Tallow, and 9" Tallow growing on private property and in poor condition. Construction in street right of way will not impact long term tree survival or structural integrity.

Tree no. 98

29" Water Oak growing on private property, approximately 20' south of existing back of curb. Construction of new sidewalk, wheelchair ramps, and landing immediately back of proposed curb will not impact long term tree survival or structural integrity. A short retaining wall will be needed on the south edge of proposed walk, ramp, and landing to minimize soil and root disturbance adjacent to tree. Root pruning trench will also be necessary to minimize construction impact on the tree.

Trees no. 99 & 100

9" Tallow & 11" Tallow growing in street right of way at south west corner of Holly Ridge Drive. The trees will need to be removed to construct wheel chair ramps and landing. The trees are not protected by the Street Tree Ordinance and will not require any replacement planting to comply with ordinance.


**Figure 9: Tree 98(background) and trees 99&100 (foreground)**

Trees no. 101-103

24" Pecan, 26" Pecan, & 36" Water Oak on private property. Trees will not be impacted by construction in street right of way.

Tree no. 104

17" Pine on private property. The tree is approximate 15' from existing back of curb. Construction of 6' wide sidewalk immediately back of curb will not impact long term tree survival or structural integrity. Root pruning will be needed for sidewalk excavation to minimize construction impacts.

Tree no. 105

21" Pine tree on private property. Tree is dead. Construction in street right of way will have no impact on tree.

Tree no. 106

46" Water Oak on private property. Shifting proposed back of curb south of existing back of curb will have significant impact on long term tree survival and structural integrity. Construction of new street in same location as existing will require use of zero curb cutback to avoid damage to large structural roots. Construction of 6' wide sidewalk will require excavation and forming of walk without cutting or otherwise damaging tree roots 2" diameter or larger. Keeping proposed gutter at or above existing gutter elevation will assist contractor in meeting adjacent driveway with compliant sloped sidewalk while avoiding large tree roots. Depending on elevation of final curb gutter and drive, a section of checkerplate sidewalk may be necessary to avoid the large tree roots. The existing drive does not have lip at the gutter line. Forming new drive with 1.5" lip will also provide additional elevation to assist contractor in forming sidewalk over tree roots.


**Figure 10: Conditions at tree no. 106 with 12" portfolio for reference**

Tree no. 107

48" Live Oak on private property. The tree is approximately 20-25' south of existing back of curb. Construction of proposed 6' wide sidewalk immediately back of curb will not impact long term tree survival or structural integrity. Root pruning will be necessary for proposed street construction to minimize impacts from excavation for stabilization back of curb. Existing elevations in right of way and onto private property appear to have created a drainage issue. It appears sidewalk construction will require filling of low area rather than excavation down into root zone area. Any fill applied in this area should be bank sand, and not a heavy clay soil.


**Figure 11: Low area between Tree no. 107 and back of curb.**

Tree no. 108

23" Pine on private property, approximately 20-25' from back of existing curb. Construction of 6' wide sidewalk immediately back of curb will not impact long term tree survival or structural integrity. Root pruning will be needed for sidewalk excavation to minimize construction impacts. The canopy of the tree will also need to be pruned to provide construction clearance over street.

Tree no. 109

20" Live Oak growing on right of way line. Could not determine if more than 50% of the base of the tree is in the street right of way. Shifting proposed back of curb south of existing back of curb will have significant impact on long term tree survival and structural integrity. Construction of new street in same location as existing will require use of zero curb cutback to avoid damage to large structural roots. Construction of 6' wide sidewalk will require excavation and forming of walk without cutting or otherwise damaging tree roots 2" diameter or larger. Keeping proposed gutter at or above existing gutter elevation will assist contractor in meeting adjacent driveway with compliant sloped sidewalk while avoiding large tree roots. Depending on elevation of final curb gutter and drive, a section of checkerplate sidewalk may be necessary to avoid the large tree roots. The existing drive does not have lip at the gutter line. Forming new drive with 1.5" lip will also provide additional elevation to assist contractor in forming sidewalk over tree roots.


**Figure 12: Conditions at tree no. 109 with 12" portfolio for reference**

Trees no. 110, 111, & 112

20" Pine, 14" Live Oak, & 19" Pine located on private property. Shifting proposed back of curb south of existing back of curb will impact long term tree survival and structural integrity. Root pruning will be necessary to minimize impact from stabilization back of curb in street construction. Excavation for proposed sidewalk will need to be completed without cutting or otherwise damaging tree roots 2" diameter and larger. Keeping proposed curb gutter at or above elevation of existing will minimize conflicts between proposed sidewalk and root elevations.

Trees no. 113 & 116-123

(9)9-11" Holly trees in street right of way. The base of the trunks of the trees is approximately 12-18" north of existing sidewalk with large roots growing immediately against the sidewalk. Any northward movement of existing sidewalk will significantly jeopardize long term tree survival. Construction of sidewalk in same location as existing will require contractor to use plywood form on north side to avoid excavation and root cutting that would be needed to install steel or 2" wide wooden forms. A short curb wall will need to be formed with the north side of proposed sidewalk to avoid need to grade soil and roots to meet lower sidewalk elevation.

Trees no. 124-129 & 134-138

(11)9-11" Holly trees in street right of way. The base of the trunks of the trees is approximately 12-18" north of existing sidewalk with large roots growing immediately against the sidewalk. Any northward movement of existing sidewalk will significantly jeopardize long term tree survival. Construction of sidewalk in same location as existing will require contractor to use plywood form on north side to avoid excavation and root cutting that would be needed to install steel or 2" wide wooden forms. Existing cross slope of sidewalk appears to be greater than 2% - A taller curb will be necessary to allow contractor to form new sidewalk as same elevation as existing to avoid large roots in area adjacent to sidewalk.

Trees no. 114 & 115

(2) 5" Crepe Myrtle on private property. Construction in street right of way will not impact long term tree survival.

Trees no. 130-133, 139, & 140

(6) 8-12" Holly on private property. The trees will not be impacted by construction in street right of way.

Trees no. 141-145, 175-177, & 179

18" Lacebark Elm, 21" Lacebark Elm, 17" Pine, 19" Lacebark Elm, 19" Pine, 19" Pine, 16" Pine, 14" Pine, 15" Live Oak growing on private property approximately 3-5' north of existing sidewalk. Any northward movement of existing sidewalk will significantly jeopardize long term tree survival and structural integrity. Demolition and excavation for proposed sidewalk will need to be completed without damaging tree roots 2" diameter or larger. Proposed street will need to be constructed with zero curb cutback to avoid disturbance back of curb for stabilization. The trees will need to be pruned to provide clearance for street construction.

**Figure 13: Conditions at tree no. 145 with 12" portfolio for reference**

Tree no. 146 & 147

20" Pine & 11" Pine growing in street right of way and protected by Street Tree Ordinance. Any southward shifting of back of curb will significantly impact long term tree survival and structural integrity. Elevation of proposed curb gutter should be kept at or above existing elevation to minimize excavation requirements for new sidewalk construction. New street will need to be constructed with zero curb cutback to avoid root loss in stabilization back of curb. Excavation and forming of new sidewalk will need to be completed without cutting or otherwise damaging tree roots 2" diameter or larger. Depending on elevation of tree roots, a section of decomposed granite or checkerplate sidewalk may be needed to install compliant slope walk over tree roots. The trees will need to be pruned to provide clearance for street construction.

**Figure 14: Conditions adjacent to trees 146 & 147 with 12" portfolio for reference**

<u>Trees no. 148</u>

36" Live Oak on private property, approximately 15' south of existing back of curb. Root pruning will be necessary to minimize impact from excavation for stabilization back of curb and sidewalk construction. The tree has been impacted by recent home construction on site.

<u>Tree no. 149</u>

21" Pine tree growing at the limits of right of way. Could not determine if more than 50% of the trunk is growing in the street right of way. The tree is approximately 9' back of existing curb and elevation at base of tree is approximately 16" higher than elevation of existing curb gutter. Construction of ramp and landing around corner and then south on Riedel will significantly impact long term tree survival and structural integrity. Is it possible to install east bound ramp only, and keep ramp and landing immediately back of south curb on Barryknoll to avoid tree impacts?

**Figure 15: Proximity of tree no. 149 to back of curb with 12" portfolio for reference**

<u>Tree no. 150</u>

20" Pine that appears to be growing in street right of way that is protected by Street Tree Ordinance. Tree will not be impacted provided all sidewalk and pavement transition work is completed north of existing fire hydrant location.

<u>Tree no. 151</u>

21" Pecan in street right of way that is protected by Street Tree Ordinance. Tree will not be impacted provided all sidewalk and pavement transition work is completed north of existing storm inlet location.


**Figure 16: Proximity of tree no. 151 to existing inlet with 12" portfolio for reference**

Trees no. 152 & 153

15" Pine, in street right of way and protected by Street Tree Ordinance, & 14" Pine, on private property. Trees will not be significantly impacted provided ramp and landing stops before north side of existing storm inlet. Root pruning will be needed for ramp and landing excavation and a curb wall will be needed on back side of sidewalk to minimize amount of grading needed to meet elevation of new sidewalk.

Tree no. 154

22" Live Oak growing at limits of right of way-it appears that more than 50% of the base of the trunk is growing in street right of way. The tree is protected by Street Tree Ordinance. The tree is approximately 7-8' back of existing curb. There is no existing sidewalk and the tree is approximately 4-5' west of driveway. Installation of a compliant cross slope walk through driveway and then meeting driveway with compliant sloped sidewalk would require approximately 8-10" of excavation at the base of the tree, which would significantly impact long term tree survival and structural integrity. Is it possible to raise the curb gutter elevation a couple of inches, insert a 1.5" lip on driveway at gutter, and use 8% slope sidewalk to meet drive in attempt to get new sidewalk over tree roots? Zero curb cutback will be needed for street construction to avoid impacting large roots in stabilization back of curb. Narrowing drive slightly will provide contractor additional run area to construct compliant slope sidewalk.


**Figure 17: Conditions at tree 154 with 12" portfolio for reference**

Tree no. 155

12" Live Oak growing at limits of right of way-it appears that more than 50% of the base of the trunk is growing in street right of way. The tree is protected by Street Tree Ordinance. The tree is approximately 7-8' back of existing curb. There is no existing sidewalk and the tree is approximately 10' east of driveway. Installation of a compliant cross slope walk through driveway and then meeting driveway with compliant sloped sidewalk would require approximately 6" of excavation at the base of the tree, which would significantly impact long term tree survival and structural integrity. Is it possible to raise the curb gutter elevation a couple of inches, insert a 1.5" lip on driveway at gutter, and use 8% slope sidewalk to meet drive in attempt to get new sidewalk over tree roots? Zero curb cutback will be needed for street construction to avoid impacting large roots in stabilization back of curb. Narrowing drive slightly will provide contractor additional run area to construct compliant slope sidewalk

Tree no. 156 & 157

34" Water Oak & 12" Live Oak on private property. Shifting proposed back of curb south of existing back of curb will have significant impact on long term tree survival and structural integrity. Construction of new street in same location as existing will require use of zero curb cutback to avoid damage to large structural roots. Construction of 6' wide sidewalk will require excavation and forming of walk without cutting or otherwise damaging tree roots 2" diameter or larger. Keeping proposed gutter at or above existing gutter elevation will assist contractor in avoiding large tree roots. Depending on elevation of final curb gutter and top of curb, a section of checkerplate sidewalk may be necessary to avoid the large tree roots. An additional section of 8% slope may be necessary west of wheel chair ramp to get sidewalk over roots. Tree canopy will need to be pruned to provide clearance for street construction.


**Figure 18: Low hanging branches over street at tree no. 156**

Tree no. 158

8" Redbud in street right of way and not protected by Street Tree Ordinance. Tree is growing in landscape planting and will not be significantly impacted by sidewalk and street construction. Edge of sidewalk will need to be root pruned to minimize impact and outside edge of ramps, landing, and sidewalk will need a short curb wall to avoid need for grading at base of tree if tree is to be preserved.

Tree no. 159

18" Tallow growing in street right of way and in poor condition. The tree is not protected by Street Tree Ordinance and will need to be removed for construction of ramps, landing and sidewalk. No replacement planting is required to comply with ordinance.

Tree no. 160

15" Water Oak at right of way limits-could not determine if 50% of trunk is located in street right of way. Keep proposed ramps, landing, and sidewalks immediately back of curb. Root pruning will be needed at edge of proposed sidewalk to minimize construction impacts on tree. A short curb wall will be needed on outside edge of sidewalk to avoid grading back to base of tree.

Tree no. 161

5" Chinaberry on private property. The tree is dead. Construction will have no impact on tree.

Tree no. 162

10' tall Ligustrum hedge growing on private property. Construction will have no impact on hedge. The hedge is growing over fence and hanging low over area of proposed sidewalk. Hedge will need to be pruned to provide 80" of vertical clearance over sidewalk.

**Figure 19: Low hanging limbs at Ligustrum hedge - tree no. 162**

Tree no. 163

20" Tallow on private property. Tree will not be impacted by construction in street right of way.

Tree no. 164

8" American Elm in street right of way, approximately 7' back of existing curb. The tree will need to be removed to construct 6' wide sidewalk. The tree is not protected by Street Tree Ordinance and does not require replacement planting to comply with ordinance.


**Figure 20: Location of tree 164 relative to back of curb**

Tree no. 165

8" Water Oak on private property. Root pruning for sidewalk construction will be necessary to minimize impact from excavation.

Trees no. 166 & 168

(2) 3' Sago Palms on private property. Construction in street right of way will not impact long term tree survival or structural integrity.

Tree no. 167

(18) 4" Italian Cypress on private property. Root pruning for sidewalk construction will be necessary to minimize impact from excavation.

Tree no. 169 & 170

(2) 2" Crepe Myrtles growing in street right of way and not protected by Street Tree Ordinance. Both trees will need to be removed to construct 6' wide sidewalk. No replacement planting will be required to comply with ordinance.


**Figure 21: Conditions adjacent to trees 166-169 with 12" portfolio for reference.**

Tree 171

20" Pecan on private property with twig dieback – not in best overall condition. Root pruning for sidewalk construction will be necessary to minimize impact from excavation.

Tree 172, 173, & 174

10" Cedar, 11" Pine, & 13" Pine on private property. Root pruning for sidewalk construction will be necessary to minimize impact from excavation. Tree canopies will need to be pruned to provide clearance for street and sidewalk construction.

Tree no. 178

13" Pine on private property and in poor condition. The tree is chlorotic with approximately 40% canopy dieback. Construction in street right of way will not impact long term tree survival or structural integrity.

Trees no. 180 & 181

20" Arizona Ash & 19" Arizona Ash growing on private property. Construction in street right of way will not impact long term tree survival or structural integrity. Canopy of trees will need to be pruned to provide clearance for street construction.

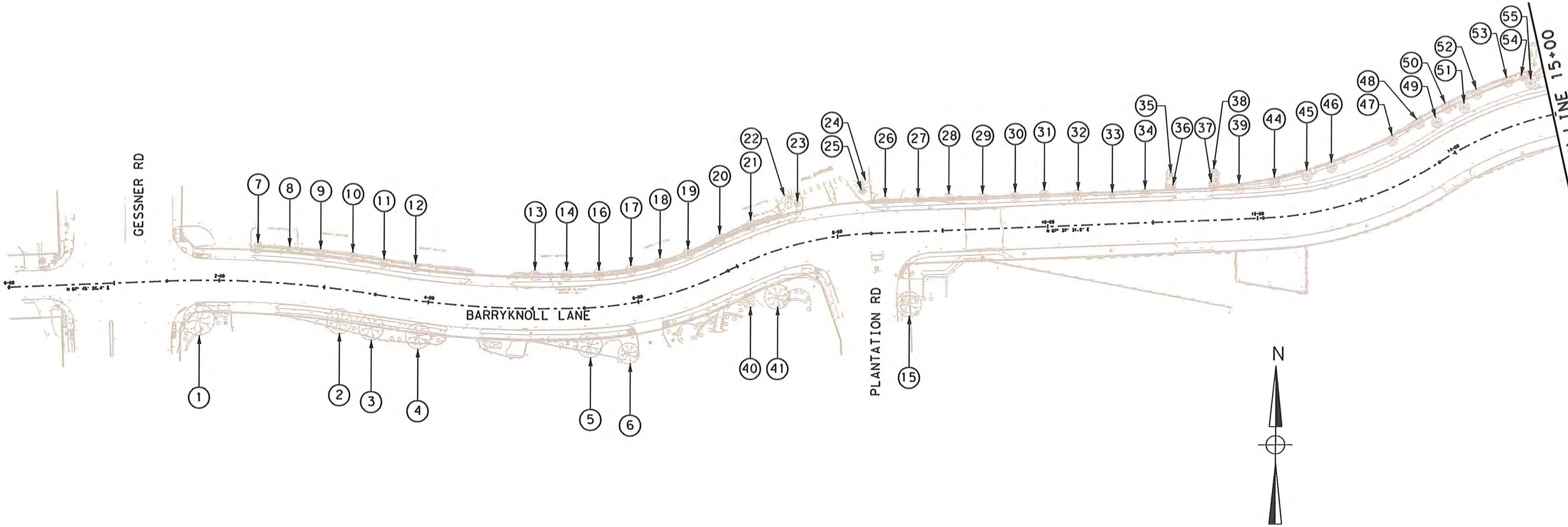
Trees no. 182-184

(3) 8" Live Oaks growing in street right of way and protected by Street Tree Ordinance. Base of tree trunks is approximately 24" north of existing sidewalk. Any northward shifting of existing sidewalk will require removal and replacement of the 3 trees and require 24" in replacement plantings. If the proposed sidewalk is no closer than existing sidewalk the trees can be preserved by forming proposed sidewalk over tree roots 2" diameter and larger and using root pruning trench to minimize impact from excavation for stabilization back of curb. The canopy of the trees will need to be pruned to provide clearance for street and sidewalk construction.

Trees 185 & 186

(2) 4" Crepe Myrtles growing on private property and topped to 6' tall. Construction in street right of way will not impact long term tree survival or structural integrity.

# Appendix G.2
# Tree Exhibit




| TREE NUMBER | TREE TYPE | ROADWAY ALTERNATIVE 2 | ROADWAY ALTERNATIVE 3 | ROADWAY ALTERNATIVE 4 |
|---|---|---|---|---|
| 1 | 31" LIVE OAK | | | |
| 2 | 21" LIVE OAK | | | |
| 3 | 24" LIVE OAK | | | |
| 4 | 18" LIVE OAK | | | |
| 5 | 21" LIVE OAK | | | |
| 6 | 17" LIVE OAK | | | |
| 7 | 9-12" HOLLY | REMOVE | REMOVE | REMOVE |
| 8 | 9-12" HOLLY | REMOVE | REMOVE | REMOVE |
| 9 | 9-12" HOLLY | REMOVE | REMOVE | REMOVE |
| 10 | 9-12" HOLLY | REMOVE | REMOVE | REMOVE |
| 11 | 9-12" HOLLY | REMOVE | REMOVE | REMOVE |
| 12 | 9-12" HOLLY | REMOVE | REMOVE | REMOVE |
| 13 | 9-12" HOLLY | REMOVE | REMOVE | REMOVE |
| 14 | 9-12" HOLLY | REMOVE | REMOVE | REMOVE |
| 15 | 27" LIVE OAK | | | |
| 16 | 9-12" HOLLY | REMOVE | REMOVE | REMOVE |
| 17 | 9-12" HOLLY | REMOVE | REMOVE | REMOVE |
| 18 | 9-12" HOLLY | REMOVE | REMOVE | REMOVE |
| 19 | 9-12" HOLLY | REMOVE | REMOVE | REMOVE |
| 20 | 9-12" HOLLY | | REMOVE | REMOVE |
| 21 | 9-12" HOLLY | | REMOVE | REMOVE |
| 22 | 40' PALM | | | |
| 23 | 3-4" CREPE MYRTLE | | | |
| 24 | 40' PALM | | | |
| 25 | 3-4" CREPE MYRTLE | | | |
| 26 | 9-12" HOLLY | REMOVE | REMOVE | REMOVE |
| 27 | 9-12" HOLLY | REMOVE | REMOVE | REMOVE |

| TREE NUMBER | TREE TYPE | ROADWAY ALTERNATIVE 2 | ROADWAY ALTERNATIVE 3 | ROADWAY ALTERNATIVE 4 |
|---|---|---|---|---|
| 28 | 9-12" HOLLY | REMOVE | REMOVE | REMOVE |
| 29 | 9-12" HOLLY | REMOVE | REMOVE | REMOVE |
| 30 | 9-12" HOLLY | REMOVE | REMOVE | REMOVE |
| 31 | 9-12" HOLLY | | REMOVE | REMOVE |
| 32 | 9-12" HOLLY | | REMOVE | REMOVE |
| 33 | 9-12" HOLLY | | REMOVE | REMOVE |
| 34 | 9-12" HOLLY | | REMOVE | REMOVE |
| 35 | 3-4" CREPE MYRTLE | | | |
| 36 | 3-4" CREPE MYRTLE | | | |
| 37 | 3-4" CREPE MYRTLE | | | |
| 38 | 3-4" CREPE MYRTLE | | | |
| 39 | 9-12" HOLLY | REMOVE | REMOVE | REMOVE |
| 40 | 4' SAGO PALM | | | |
| 41 | 18" LIVE OAK | | | |
| 44 | 9-12" HOLLY | REMOVE | REMOVE | REMOVE |
| 45 | 9-12" HOLLY | REMOVE | REMOVE | REMOVE |
| 46 | 9-12" HOLLY | REMOVE | REMOVE | REMOVE |
| 47 | 9-12" HOLLY | REMOVE | REMOVE | REMOVE |
| 48 | 9-12" HOLLY | REMOVE | REMOVE | REMOVE |
| 49 | 9-12" HOLLY | REMOVE | REMOVE | REMOVE |
| 50 | 9-12" HOLLY | | | |
| 51 | 9-12" HOLLY | REMOVE | REMOVE | REMOVE |
| 52 | 9-12" HOLLY | | | |
| 53 | 9-12" HOLLY | | | |
| 54 | 3-4" CREPE MYRTLE | | | |
| 55 | 9-12" HOLLY | REMOVE | REMOVE | REMOVE |

0 50 100 200
(IN FEET)
1 INCH = 100 FEET

| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
|---|---|---|---|---|---|---|---|---|---|

Lockwood, Andrews & Newnam, Inc.
A LEO A DALY COMPANY

TIRZ 17 REDEVELOPMENT AUTHORITY

DRAFT

INTERIM REVIEW ONLY
Document incomplete: not intended for permit, bidding or construction.
Engineer: Tara G. Burrer, P.E.
P.E. Serial No.: 99997
Firm: Lockwood, Andrews & Newnam Inc.
Firm No.: F-2614
Date: NOV. 2011

| | |
|---|---|
| M. J. G. (DRN BY) | NOV 2011 (DATE) |
| T. G. B. (DRN CKD BY) | NOV 2011 (DATE) |
| M. J. G. (DES BY) | NOV 2011 (DATE) |
| T. G. B. (DES CKD BY) | NOV 2011 (DATE) |
| APPROVED BY | DATE |

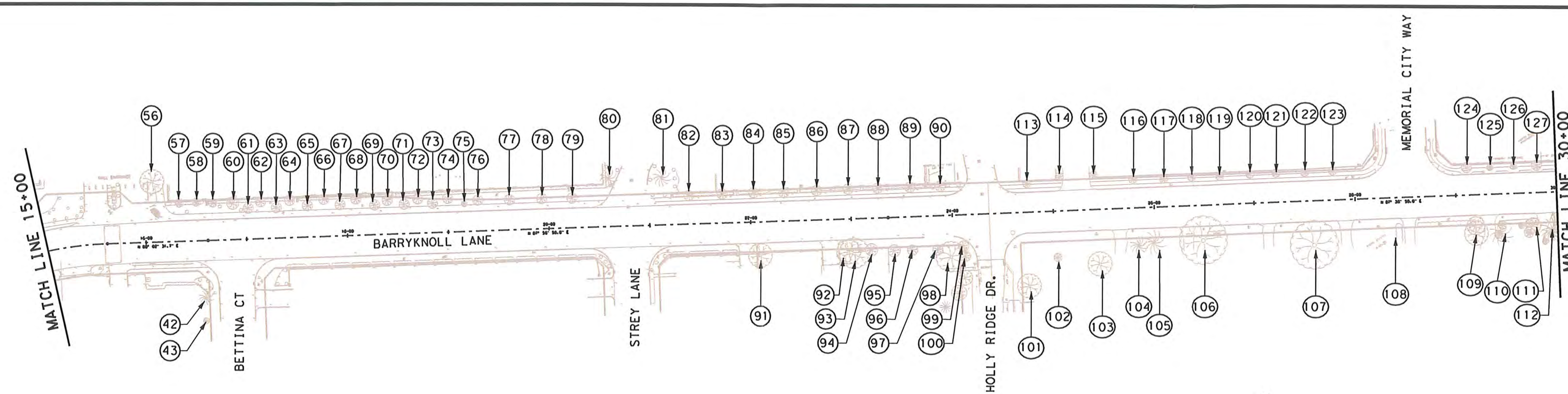
SCALE: AS SHOWN

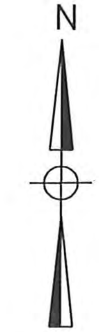
BARRYKNOLL LANE

BARRYKNOLL LANE
TREE EXHIBIT

SHEET 1 OF 3

CONTRACT NO. | DRAWING NO. | REV.




| TREE NUMBER | TREE TYPE | ROADWAY ALTERNATIVE 2 | ROADWAY ALTERNATIVE 3 | ROADWAY ALTERNATIVE 4 |
|---|---|---|---|---|
| 42 | 15" PINE | | | |
| 43 | 18" PINE | | | |
| 56 | | | | |
| 57 | 3-4" CREPE MYRTLE | | | |
| 58 | 3-4" CREPE MYRTLE | | | |
| 59 | 3-4" CREPE MYRTLE | | | |
| 60 | 9-12" HOLLY | | | |
| 61 | 9-12" HOLLY | | | |
| 62 | 9-12" HOLLY | | | |
| 63 | 9-12" HOLLY | | | |
| 64 | 9-12" HOLLY | | | |
| 65 | 9-12" HOLLY | | | |
| 66 | 9-12" HOLLY | | | |
| 67 | 9-12" HOLLY | | | |
| 68 | 9-12" HOLLY | | | |
| 69 | 9-12" HOLLY | | | |
| 70 | 9-12" HOLLY | | | |
| 71 | 9-12" HOLLY | | | |
| 72 | 9-12" HOLLY | | | |
| 73 | 9-12" HOLLY | | | |
| 74 | 9-12" HOLLY | | | |
| 75 | 9" HOLLY | | | |
| 76 | 9-12" HOLLY | | | |
| 77 | 9-12" HOLLY | | | |
| 78 | 9-12" HOLLY | | | |
| 79 | 9-12" HOLLY | | | |
| 80 | 40' PALM | | | |
| 81 | 40' PALM | | | |
| 82 | 9-12" HOLLY | | | |
| 83 | 9-12" HOLLY | | | |
| 84 | 9-12" HOLLY | | | |
| 85 | 9-12" HOLLY | | | |
| 86 | 9-12" HOLLY | | | |
| 87 | 9-12" HOLLY | | | |
| 88 | 9-12" HOLLY | | | |
| 89 | 9-12" HOLLY | | | |
| 90 | 9-12" HOLLY | | | |
| 91 | 15" TALLOW | | | |

| TREE NUMBER | TREE TYPE | ROADWAY ALTERNATIVE 2 | ROADWAY ALTERNATIVE 3 | ROADWAY ALTERNATIVE 4 |
|---|---|---|---|---|
| 92 | 8" LIGUSTRUM | | | |
| 93 | 25" LACEBARK ELM | | | |
| 94 | 12" LACEBARK ELM | | | |
| 95 | 10" TALLOW | | | |
| 96 | 8" TALLOW | | | |
| 97 | 9" TALLOW | | | |
| 98 | 29" WATER OAK | | | |
| 99 | 9" TALLOW | REMOVE | REMOVE | REMOVE |
| 100 | 11" TALLOW | REMOVE | REMOVE | REMOVE |
| 101 | 24" PECAN | | | |
| 102 | 26" PECAN | | | |
| 103 | 36" WATER OAK | | | |
| 104 | 17" PINE | | | |
| 105 | 21" PINE | | | |
| 106 | 46" WATER OAK | | | |
| 107 | 48" LIVE OAK | | | |
| 108 | 23" PINE | | | |
| 109 | 20' LIVE OAK | | | |
| 110 | 20" PINE | | | |
| 111 | 14" LIVE OAK | | | |
| 112 | 19" PINE | | | |
| 113 | 9-11" HOLLY | | | |
| 114 | 5" CREPE MYRTLE | | | |
| 115 | 5" CREPE MYRTLE | | | |
| 116 | 9-11" HOLLY | | | |
| 117 | 9-11" HOLLY | | | |
| 118 | 9-11" HOLLY | | | |
| 119 | 9-11" HOLLY | | | |
| 120 | 9-11" HOLLY | | | |
| 121 | 9-11" HOLLY | | | |
| 122 | 9-11" HOLLY | | | |
| 123 | 9-11" HOLLY | | | |
| 124 | 9-11" HOLLY | | | |
| 125 | 9-11" HOLLY | | | |
| 126 | 9-11" HOLLY | | | |
| 127 | 9-11" HOLLY | | | |

0 50 100 200
(IN FEET)
1 INCH = 100 FEET

| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
|---|---|---|---|---|---|---|---|---|---|

Lockwood, Andrews & Newnam, Inc.
A LEO A DALY COMPANY

TIRZ 17 REDEVELOPMENT AUTHORITY

DRAFT

INTERIM REVIEW ONLY
Document incomplete: not intended for permit, bidding or construction.

Engineer: Tara G. Burrer, P.E.
P.E. Serial No.: 99997
Firm: Lockwood, Andrews & Newnam Inc.
Firm No.: F-2614
Date: NOV. 2011

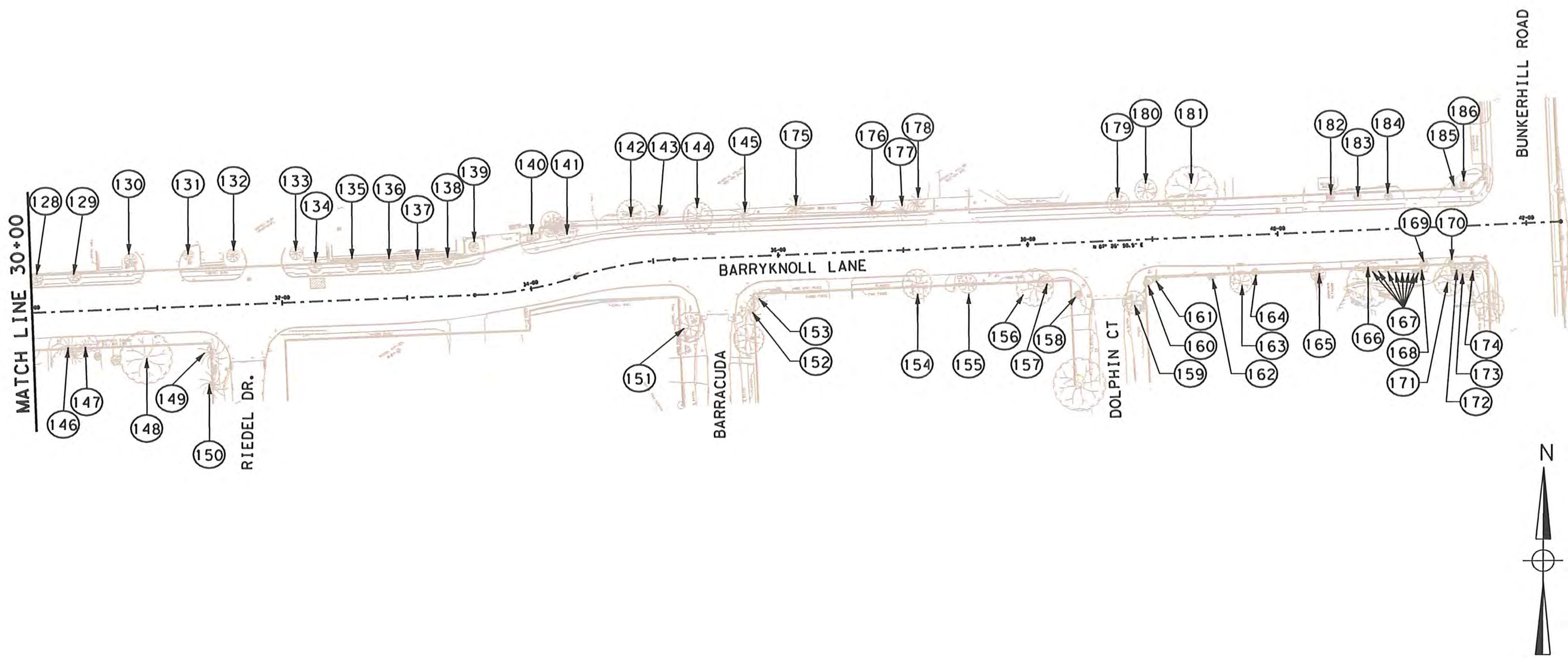
| | |
|---|---|
| M. J. G. DRN BY | NOV 2011 DATE |
| T. G. B. DRN CKD BY | NOV 2011 DATE |
| M. J. G. DES BY | NOV 2011 DATE |
| T. G. B. DES CKD BY | NOV 2011 DATE |
| APPROVED BY | DATE |
| SCALE: AS SHOWN | |

BARRYKNOLL LANE

BARRYKNOLL LANE
TREE EXHIBIT

SHEET 2 OF 3

CONTRACT NO. | DRAWING NO. | REV.




| TREE NUMBER | TREE TYPE | ROADWAY ALTERNATIVE 2 | ROADWAY ALTERNATIVE 3 | ROADWAY ALTERNATIVE 4 |
|---|---|---|---|---|
| 128 | 9-11" HOLLY | | | |
| 129 | 9-11" HOLLY | | | |
| 130 | 8-12" HOLLY | | | |
| 131 | 8-12" HOLLY | | | |
| 132 | 8-12" HOLLY | | | |
| 133 | 8-12" HOLLY | | | |
| 134 | 9-11" HOLLY | | | |
| 135 | 9-11" HOLLY | | | |
| 136 | 9-11" HOLLY | | | |
| 137 | 9-11" HOLLY | | | |
| 138 | 9-11" HOLLY | | | |
| 139 | 8-12" HOLLY | | | |
| 140 | 8-12" HOLLY | | | |
| 141 | 18" LACEBARK ELM | | | |
| 142 | 21" LACEBARK ELM | | | |
| 143 | 17" PINE | | | |
| 144 | 19" LACEBARK ELM | | | |
| 145 | 19" PINE | | | |
| 146 | 20" PINE | | | |
| 147 | 11" PINE | | | |
| 148 | 36" LIVE OAK | | | |
| 149 | 21" PINE | | | |
| 150 | 20" PINE | | | |
| 151 | 21" PECAN | | | |
| 152 | 15" PINE | | | |
| 153 | 14" PINE | | | |
| 154 | 22" LIVE OAK | | | |
| 155 | 12" LIVE OAK | | | |
| 156 | 34" WATER OAK | | | |

| TREE NUMBER | TREE TYPE | ROADWAY ALTERNATIVE 2 | ROADWAY ALTERNATIVE 3 | ROADWAY ALTERNATIVE 4 |
|---|---|---|---|---|
| 157 | 12" LIVE OAK | | | |
| 158 | 8" REDBUD | | | |
| 159 | 18" TALLOW | | | |
| 160 | 15" WATER OAK | | | |
| 161 | 5" CHINABERRY | | | |
| 162 | 10' LIGUSTRUM HEDGE | | | |
| 163 | 20" TALLOW | | | |
| 164 | 8" AMERICAN ELM | REMOVE | REMOVE | REMOVE |
| 165 | 8" WATER OAK | | | |
| 166 | 3' SAGO PALM | | | |
| 167 | 4" ITALIAN CYPRESS | | | |
| 168 | 3' SAGO PALM | | | |
| 169 | 2" CREPE MYRTLE | REMOVE | REMOVE | REMOVE |
| 170 | 2" CREPE MYRTLE | REMOVE | REMOVE | REMOVE |
| 171 | 20" PECAN | | | |
| 172 | 10" CEDAR | | | |
| 173 | 11" PINE | | | |
| 174 | 13" PINE | | | |
| 175 | 19" PINE | | | |
| 176 | 16" PINE | | | |
| 177 | 14" PINE | | | |
| 178 | 13" PINE | | | |
| 179 | 15" LIVE OAK | | | |
| 180 | 10" ARIZONA ASH | | | |
| 181 | 19" ARIZONA ASH | | | |
| 182 | 8" LIVE OAK | | | |
| 183 | 8" LIVE OAK | | | |
| 184 | 8" LIVE OAK | | | |
| 185 | 4" CREPE MYRTLE | | | |
| 186 | 4" CREPE MYRTLE | | | |

0 50 100 200
(IN FEET)
1 INCH = 100 FEET

| REV | DATE | DESCRIPTION | ADD | AMD | CCR | BY | ENG | CHK | APP |
|---|---|---|---|---|---|---|---|---|---|

Lockwood, Andrews & Newnam, Inc.
A LEO A DALY COMPANY

TIRZ 17 REDEVELOPMENT AUTHORITY

DRAFT

INTERIM REVIEW ONLY
Document incomplete: not intended for permit, bidding or construction.

Engineer: Tara G. Burrer, P.E.
P.E. Serial No.: 99997
Firm: Lockwood, Andrews & Newnam Inc.
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| | |
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| M. J. G. DRN BY | NOV 2011 DATE |
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| M. J. G. DES BY | NOV 2011 DATE |
| T. G. B. DES CKD BY | NOV 2011 DATE |
| APPROVED BY | DATE |
| SCALE: AS SHOWN | |

BARRYKNOLL LANE

BARRYKNOLL LANE
TREE EXHIBIT

SHEET 3 OF 3

CONTRACT NO. | DRAWING NO. | REV.

# APPENDIX H

# GEOTECHNICAL INVESTIGATION

# REVISED
# GEOTECHNICAL EXPLORATION STUDY
# PROPOSED BARRYKNOLL DRAINAGE IMPROVEMENTS
# FROM DITCH W151 TO BUNKER HILL (2700-FT±)
# AND FROM DITCH W151 TO GESSNER ROAD (1400-FT±)
# HOUSTON, TEXAS
# MEMORIAL CITY REDEVELOPMENT AUTHORITY
# TIRZ CIP NO. T-1715
# LAN PROJECT NUMBER 120-10308-000-555
# REVISION I

**REPORT NO. 09-544E-1**

**TO**

**LOCKWOOD, ANDREWS & NEWNAM, INC**
**HOUSTON, TEXAS**

**BY**

**GEOTECH ENGINEERING AND TESTING**

**SERVICING**

**TEXAS, LOUISIANA, NEW MEXICO, OKLAHOMA**

*www.geotecheng.com*

**FEBRUARY 2010**

**TEXAS BOARD OF PROFESSIONAL ENGINEERS**
**REGISTRATION NUMBER F-001183**

**GEOTECH ENGINEERING and TESTING**

ACCREDITED

*Geotechnical, Environmental, Construction Materials, and Forensic Engineering*

Lockwood, Andrews & Newnam, Inc.
2925 Briarpark Drive, Suite 400
Houston, Texas 77042

Report No. 09-544E-1
Report Type: ST/U
February 26, 2010

Attention: Ms. Tara G. Godwin, P.E.

**REVISED**
**GEOTECHNICAL EXPLORATION STUDY**
**PROPOSED BARRYKNOLL DRAINAGE IMPROVEMENTS**
**FROM DITCH W151 TO BUNKER HILL (2700-FT±)**
**AND FROM DITCH W151 TO GESSNER ROAD (1400-FT±)**
**HOUSTON, TEXAS**
**MEMORIAL CITY REDEVELOPMENT AUTHORITY**
**TIRZ CIP NO. T-1715**
**LAN PROJECT NUMBER 120-10308-000-555**
**REVISION I**

Dear Madam:

Submitted here is Geotech Engineering and Testing (GET) soils report on the exploration of subsurface condition for the above referenced project. This study was conducted in general accordance with our Proposal No. P09-150, Revision I, dated August 19, 2009 and was authorized by Mr. Rafael Ortega, P.E., Vice President on December 21, 2009 and subsequently by Ms. Veda Montalbano, P.E., Project Manager on December 31, 2009.

This report presents the results of our field exploration and laboratory testing together with design recommendations for the construction of waterlines, storm sewers and paving for the proposed Barryknoll Drainage Improvements from Ditch W151 to Bunker Hill and from Ditch W151 to Gessner Road in Houston, Texas.

We appreciate the opportunity to be of service. Should you have any questions or need additional assistance, please call.

Very truly yours,

GEOTECH ENGINEERING AND TESTING

Dave Sikdar, Ph.D.
Project Manager

Al Dutta, Ph.D.
Engineering Manager

David A. Eastwood, P.E., C.A.P.M.
Principal Engineer

STATE OF TEXAS
D. A. EASTWOOD
51419
REGISTERED
PROFESSIONAL ENGINEER

David A. Eastwood
02/26/10

Copies Submitted: (2)

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## ILLUSTRATIONS



## APPENDICES

## 1.0 EXECUTIVE SUMMARY

It is planned to construct approximately 4100± lineal feet of waterlines, storm sewers and concrete roadway at the Barryknoll Drainage Improvement in Houston, Texas. The project alignment spans along Berryknoll Lane from Ditch W151 to Bunker Hill with approximate length of 2700-ft and from Ditch W151 to Gessner with approximate length of 1400-ft. We understand that the existing paving will be removed and replaced in order to construct the new waterlines and storm sewers. Furthermore, the depth of the storm sewers will be about 10-ft below the existing grade. We understand that box culverts will be used for the construction of storm sewers in this project. Open excavations will be used for box culverts installations. This report contains a description of our field and laboratory testing results together with engineering analysis and recommendations for the construction of the proposed facilities along the project alignment.

The soil stratigraphy and groundwater condition along the project alignment were evaluated by conducting nine (9) soil testing borings (Borings B-1 through B-9). A summary of our findings is presented below:

1. The soil stratigraphy were explored by conducting nine (9) soil test borings (Borings B-1 through B-9). The soil borings were drilled to depths of 20-ft below the existing grade. The soil stratigraphy for the project alignment is summarized below:

| Stratum No. | Range of Depth, ft. | Soil Description |
|---|---|---|
| | | CONCRETE PAVEMENT (6.7" to 9.1" in Thickness) |
| I | 0 – 2 | FILL: SANDY LEAN CLAY (CL) |
| II | 0 – 2 | FILL: LEAN CLAY WITH SAND (CL), In Boring B-4 only |
| III | 0 – 2 | FILL: SILTY SAND (SM) |
| IV | 2 – 13 | SANDY LEAN CLAY (CL) |
| V | 2 – 20 | SILTY SAND (SM) |
| VI | 8 – 10 | LEAN CLAY WITH SAND (CL), In Boring B-9 only |

2. Depth to groundwater will be important for design and construction of the proposed facilities. Water level observations were made during and at 24-hours after drilling. Our field exploration indicated that free water was encountered at depths ranging from 11- to 19-ft during drilling along the project alignment. Groundwater level rose to depths ranging from 6- to 14-ft after 24 hours of drilling.

3. Borings B-1, B-4 and B-8 were converted to piezometer P-1, P-2 and P-3, respectively after completion of the field exploration. The results of piezometer observation indicated that stabilized groundwater level in piezometer P-1 exists at depths ranging from 7.3- to 7.5-feet below the existing ground surface. The range of stabilized groundwater level in piezometer P-2 is observed at depths ranging from 9.0- to 10.0-feet. The range of stabilized groundwater level in piezometer P-3 is observed at approximately 4.5- to 5.5-feet below the existing ground surface.

4. We understand that concrete pavement will be used on this project. The concrete pavement was designed on the basis of "1993 AASHTO Guide for Design of Pavement Structures." We also understand that there is no accurate traffic information available for the project alignment. However, considering the pavement structure will be subjected to major thoroughfare traffic loading and based on our experience on similar projects, a design ESAL of $10.0 \times 10^6$ is considered for the design of the proposed pavement structure. The results of the pavement component thicknesses are summarized as follows:

| Design, ESAL $\times 10^6$ | Concrete Pavement Thickness, inch(es) | Subgrade Stabilization Thickness, inch(es) |
|---|---|---|
| 10.0 | 10.0 | 8.0 |

5. The type of subgrade stabilization will depend on the final grade elevation and the type of soil at the elevation. Furthermore, the type and amount of stabilization should be evaluated once the final grade is reached. Subgrade preparation in pavement areas should specify compaction of the upper eight-inches to at least 95% of maximum standard density (ASTM D 698) at a moisture content between optimum and +3% of optimum. Since most of the subgrade soils consists of clays, lime stabilization of the surficial soils should most likely be performed for the project alignment. The upper eight-inches of the soils should be lime stabilized, using 4% lime by dry weight. The application rate corresponding to this additive amount would be 24 pounds of lime per square yard for eight-inches of compacted thickness. City of Houston Standard Specification 02336 should be used as a procedural guide for placing, mixing and compacting the lime stabilizer and the soils.

6. We understand that waterlines and storm sewers will be constructed along the project alignment. The depths of the storm sewers will be approximately 10-ft deep. The design recommendations for the construction of the proposed waterlines and storm sewers are presented in this report.

## 2.0 INTRODUCTION

It is planned to construct approximately 4100± lineal feet of waterlines, storm sewers and concrete roadway at the Barryknoll Drainage Improvement in Houston, Texas. The project alignment spans along Berryknoll Lane from Ditch W151 to Bunker Hill with approximate length of 2700-ft and from Ditch W151 to Gessner with approximate length of 1400-ft. The project alignment is shown on Plate 1. We understand that the existing paving will be removed and replaced in order to construct the new waterlines and storm sewers. Furthermore, the depth of the storm sewers will be about 10-ft below the existing grade. We understand that box culverts will be used for the construction of storm sewers in this project. Open excavations will be used for box sewer installations.

This report contains a description of our field and laboratory testing results together with engineering analysis and recommendations for construction of the waterlines, storm sewers and paving along the proposed project alignment. Our recommendations on waterlines, storm sewers, site preparation and soil stabilization are in general accordance with the City of Houston, Chapter 11 Design Manual, and dated October 2002 and July 2009 (Ref. 1 and Ref. 2). Furthermore, the pavement design in this study is in general accordance with ASSHTO 1993 Guide of Design of Pavement Structure (Ref. 3).

## 3.0 FIELD EXPLORATION

### 3.1 Drilling and Sampling

At the request of the client, the soil conditions were explored by conducting nine (9) soil test borings (Borings B-1 through B-9) along the project alignment. The boring locations were discussed with Ms. Tara G. Godwin, P.E. of Lockwood, Andrews & Newnam, Inc. prior to drilling. The soil borings were drilled to depths of 20-ft below the existing grade. Approximate boring locations are presented on Plate 2. The coordinates and elevations of the boring locations were not available at the time of this report. A summary of our boring schedule was as follows:

| Facility | Borings | Depth, ft. | Remarks |
|---|---|---|---|
| Waterlines, Strom Sewers and Paving from Ditch W151 to Gessner Road (1400-ft Segment) | B-1 through B-3 | 20 | Boring B-1 was converted to Piezometer P-1. |
| Waterlines, Strom Sewers and Paving from Ditch W151 to Bunker Hill Road (2700-ft Segment) | B-4 through B-9 | 20 | Borings B-4 and B-8 were converted to Piezometers P-2 and P-3, respectively. |

Nine (9) pavement corings (Corings C-1 through C-9) at Borings B-1 through B-9 were conducted prior to drilling and sampling. The core thicknesses are shown on Plate 3. Undisturbed samples were obtained continuously at each boring locations from the ground surface to 10-ft and at five-ft intervals thereafter to the completion depth of the borings at 20-ft. The cohesive soils were sampled in general accordance with ASTM D 1587.

Cohesionless soils were generally sampled with a split-spoon sampler driven in general accordance with the Standard Penetration Test (SPT), ASTM D 1586. This test is conducted by recording the number of blows required for a 140-pound weight falling 30-inches to drive the sampler 12-inches into the soil. Driving resistance for the SPT, expressed as blows per foot of sampler resistance (N), is tabulated on the boring logs.

Soil samples were examined and classified in the field, and cohesive soil strengths were estimated using a calibrated hand penetrometer. This data, together with a classification of the soils encountered and strata limits, is presented on the logs of borings, Plates 4 through 12. A key to the log terms and symbols is given on Plate 13.

Borings were drilled dry, without the aid of drilling fluids, to more accurately estimate the depth to groundwater. Water level observations made during and at 24 hours after drilling are indicated at the bottom portion of each individual boring log. The boreholes were grouted using tremie method after the completion of the field work.

## 3.2 Piezometer Installation

Piezometers P-1 through P-3 were installed to the depth of 20-ft in Borings B-1, B-4 and B-8, respectively after completion of the field work. Each piezometer consisted of two-inch diameter PVC riser pipe connected to a 5-ft long section of 0.01-inch slotted well screen. The riser pipe for each piezometer extends to the ground surface and is capped at the top with a water tight flush mounted locking cap. The holes were covered with steel plates to prevent piezometer pipes from being damaged by heavy traffic. After the borings were drilled, the riser pipe and well screen assembly were installed in the borings, filter sand was placed in the bottom of the borings and in the annulus between the boring wall and the PVC pipe/screen, and subsequently the borings were sealed with bentonite from the top of the filter sands to the ground surface. The piezometers were developed by using a bailer to purge several volumes of water from the piezometer riser pipe. The piezometer installation diagram is shown on Plate 14. A summary of the piezometer readings is presented in the "Piezometer Reading Table" on Plate 15. The piezometers were abandoned, per TCEQ requirements in accordance with the City of Houston Design Manual, Item 11.07-Site Restoration.

## 4.0 LABORATORY TESTS

### 4.1 General

Soil classifications and shear strengths were further evaluated by laboratory tests on representative samples of the major strata. The laboratory tests were performed in general accordance with ASTM Standards. Specifically, ASTM D 2487 is used for classification of soils for engineering purposes.

### 4.2 Classification Tests

As an aid to visual soil classifications, physical properties of the soils were evaluated by classification tests. The tests were conducted in general accordance with ASTM standards. These tests consisted of natural moisture content tests (ASTM D 4643), percent finer than the No. 200 sieve tests (ASTM D 1140), Atterberg limit determinations (ASTM D 4318) and dry unit weights. Similarity of these properties is indicative of uniform strength and compressibility characteristics for soils of essentially the same geological origin. Results of these tests are tabulated on the boring logs at respective sample depths.

### 4.3 Strength Tests

Undrained shear strengths of the cohesive soils measured in the field were verified by calibrated hand penetrometer, unconfined compressive strength tests (ASTM D 2166) and torvane tests. The test results are also presented on the boring logs.

### 4.4 Soil Sample Storage

Soil samples tested or not tested in the laboratory will be stored for a period of seven days subsequent to submittal of this report. The samples will be discarded after this period, unless we are instructed otherwise.

## 5.0 SITE GEOLOGY

According to the soil survey of Harris County, Texas (prepared by the U.S. Department of Agriculture Soil and Conservation Service,1976) the project alignment is geologically located within Addicks-Urban land complex (Ak), Gessner-Urban land complex (Gu), and Urban land (Ur). The geologic character of each soil type is described in the following section.

**Addicks-Urban Land Complex (Ak)** – This is a nearly level complex in urban areas and in the surrounding rural areas where the population is increasing. Encroachment of trees has occurred in some areas. The older urban areas are generally wooded, as a result of tree planting to provide shade. The areas of this unit are irregular in shape and generally range in size from 30 to 850 acres. A few areas are larger than a thousand acres. The boundaries commonly coincide with the outer limits of subdivisions and other built-up areas. The surface is plane to slightly convex. The slope ranges from 0 to 1 percent and averages about 0.3 percent. Addicks loam makes up 20 to 85 percent of the complex, Urban land 10 to 60 percent, and other soils 5 to 20 percent. The areas are so intricately mixed that it was not practical to separate them at the scale for this survey.

The Addicks soil has a surface layer of friable, neutral, black loam about 11 inches thick. The layer below that is friable, neutral, dark gray loam about 12 inches thick. The next layer is about 26 inches thick and consists of friable, moderately alkaline, light gray loam that is about 20 percent, by volume, visible calcium carbonate. The layer at a depth of about 49 inches is firm, moderately alkaline, light gray loam that has distinct yellow and yellowish brown mottles and is about 5 percent visible calcium carbonate.

Urban land consists of soils that support buildings and other urban structures that have covered or altered the soils so that classification is not practical. Typical structures are single and multiple- unit dwellings, streets, schools, churches, parking lots, office buildings, and shopping centers less than 40 acres in size. In places Urban land consists of small areas of Addicks loam that has been altered by cutting, filling, and grading. Fill material has altered the soil in places. In some areas the entire profile is covered with 6 to 24 inches of fill material. Soils in the older areas that are drained by road ditches show less evidence of alteration. Included with this unit in area few areas of Clodine, Gessner, Bernard, and Midland soils. These soils are unaltered in places.

This unit has moderate to severe limitations for urban development. Poor drainage is the greatest limitation. There are no imitations for landscaping or for gardening. Chlorosis is common in areas where cuts have been made. Most of the acreage was formerly in cropland or native pasture.

**Gessmer-Urban Complex (Gu)** – This soils is in broad, nearly level areas and in depression. It consists of built-up areas and areas where the population is increasing. The areas range from 15 to 180 acres, but a few areas several hundred acres in size. Slopes are mainly 0 to 1 percent. Water stands on the surface in the depressions for long periods after rains. There are pimple mounds in a few areas. These are leveled in urban development. Water oak, willow oak, hackberry, sweetgum, and elm have encroached in some areas.

Gessner soils make up 20 to 80 percent of this unit, Urban land, 10 to 75 percent, and other soils, 10 to 20 percent. The areas making up this complex are so intricately mixed.

The surface layer of the Gessner soils is friable, slightly acid, dark grayish brown loam about 7 inches thick. The layer below that is about 9 inches thick and consists of friable, slightly acid, grayish brown loam. It tongues into the next layer, which is friable, neutral, dark gray loam, about 18 inches thick that is more clayey. The layer below that is about 19 inches thick and consists of friable, moderately alkaline, brown, gray loam. The next layer, to depth of 84 inches, is firm, moderately alkaline, light gray sandy clay loam that has distinct mottles of yellowish brown and brownish yellow.

Urban land consists of soils that have been altered or covered by buildings or other urban structures and of other disturbed areas. Classifying these soils is not practical. Other areas might have been disturbed by cutting, filling, or grading. In some areas 6 to 24 inches of fill material covers the entire soil profile.

Gessner soils have sever limitations for streets and low-cost roads and urban development in general and use as septic tank filter fields. The main limitation is poor drainage. Water stands on the surface for long periods after rains, and the soils remains wet long after water on the surface has evaporated. The risk of corrosion to uncoated steel is high. Most areas are muddy and boggy when wet.

**Urban Land (Ur)** – This unit is mainly in the central part of the country, the hub of the Houston metropolitan area. It is made up of the extensively built-up areas where 75 to 100 percent of each area is either covered by structures or disturbed by cutting, filing, or grading. The areas also include shopping centers 40 to 120 acres in size.

Included are small areas of moderately built-up areas where buildings and other structures cover only 40 to 60 percent of the surface. Also included are remnants of undisturbed soils and areas where the natural soil is covered by fill material. These inclusions make up as much as 25 percent of Urban land. The soil making up Urban Land have been so altered and obscured that they can not be classified.

## 6.0 GENERAL SOILS AND DESIGN CONDITIONS

### 6.1 Site Conditions

The project alignment is along Barryknoll Lane from Bunker Hill Road to Gessner Road from east to west. Barryknoll Lane along the project alignment is an undivided four lane concrete paved roadway. Commercial buildings and residences are located along this alignment at both sides of the road. The ditch W151 crosses the project alignment near the intersection of Bettina Court. Project site pictures were taken during our site visit. These pictures are presented on cover page and in Appendix A.

### 6.2 Soil Stratigraphy

Based on field and laboratory test data, the subsurface soils appear to be variable. Details of subsoil conditions at each boring location along the project alignment are presented on the respective boring logs. In general, the soils can be grouped into six (6) major strata with depth limits and characteristics as follows:

| Stratum No. | Range of Depth, ft. | Soil Description* |
|---|---|---|
| | | CONCRETE PAVEMENT (6.7" to 9.1" in Thickness) |
| I | 0 – 2 | FILL: SANDY LEAN CLAY, very soft to stiff, gray, light gray, dark gray, greenish gray, brown, brownish yellow, with root fibers, calcareous nodules, moist (CL) |
| II | 0 – 2 | FILL: LEAN CLAY WITH SAND, soft, light brown, dark gray, with root fibers, shells, moist (CL); In Boring B-4 only |
| III | 0 – 2 | FILL: SILTY SAND, brown, gray, with root fibers, moist (SM) |
| IV | 2 – 13 | SANDY LEAN CLAY, soft to very stiff, brown, light brown, dark brown, brownish yellow, gray, light gray, dark gray, greenish gray, with root fibers to 6', ferrous and calcareous nodules, shells, fissured, sands, moist (CL) |

| Stratum No. | Range of Depth, ft. | Soil Description* |
|---|---|---|
| V | 2 – 20 | SILTY SAND, loose to dense, brown, light brown, brownish yellow, gray, light gray, greenish gray, moist to wet (SM) |
| VI | 8 – 10 | LEAN CLAY WITH SAND, soft, gray, moist (CL); In Boring B-9 only |

* Classification in accordance with the Unified Soil Classification System (ASTM D 2487)

## 6.3 Design Conditions

Soil strength and plasticity conditions pertinent to waterlines, storm sewers, and paving designs can be summarized as follows:

| Stratum No. | Soil Type | PI(s) | SPT | Soil Expansivity | Soil Strength, tsf | Remarks |
|---|---|---|---|---|---|---|
| I | Fill: Sandy Lean Clay (CL) | 9 – 14 | – | Non-Expansive | 0.07 – 0.62 | – |
| II | Fill: Lean Clay with Sand (CL) | 9 | – | Non-Expansive | 0.23 | – |
| III | Fill: Silty Sand (SM) | – | – | Non-Expansive | – | Moisture Sensitive |
| IV | Sandy Lean Clay (CL) | 11 – 23 | – | Non- to Moderately Expansive | 0.15 – 1.41 | – |
| V | Silty Sand (SM) | – | 10 – 35 | Non-Expansive | – | Moisture Sensitive |
| VI | Lean Clay with Sand (CL) | 16 | – | Non-Expansive | 0.23 | – |

Legend: PI = Plasticity Index
SPT = Standard Penetration Test

## 6.4 Water-Level Measurements

The soil borings were drilled dry to evaluate the presence of perched or free-water conditions. The levels where free water was first encountered in the open boreholes during our field exploration and 24 hours after drilling are shown on the boring logs. Our groundwater measurements are as follows:

| Boring No. | Groundwater Depth, ft. at the Time of Drilling | Groundwater Depth, ft. After 24 Hours | Caved-In, ft. After 24 Hours |
|---|---|---|---|
| B-1 | 17 | 6 | 16 |
| B-2 | 15 | 8 | 15 |
| B-3 | 12 | 8 | 17 |
| B-4 | 19 | 9 | – |
| B-5 | 15 | 8 | 16 |
| B-6 | 16 | 7 | 17 |

| Boring No. | Groundwater Depth, ft. at the Time of Drilling | Groundwater Depth, ft. After 24 Hours | Caved-In, ft. After 24 Hours |
|---|---|---|---|
| B-7 | 18 | 14 | – |
| B-8 | 18 | 9 | – |
| B-9 | 11 | 6 | 12 |

Fluctuations in groundwater generally occur as a function of seasonal moisture variation, temperature, groundwater withdrawal and future construction activities that may alter the surface drainage and subdrainage characteristics of this site.

An accurate evaluation of the hydrostatic water table in the relatively impermeable clay and low permeability silts/sands requires long term observation of monitoring wells and/or piezometers. It is not possible to accurately predict the pressure and/or level of groundwater that might occur based upon short-term site exploration. Borings B-1, B-4 and B-8 were converted to Piezometers P-1, P-2 and P-3, respectively, after completion of field work. The results of piezometer observation are presented in Plate 15.

We recommend that GET be immediately notified if a noticeable change in groundwater occurs from that mentioned in our report. We would be pleased to evaluate the effect of any groundwater changes on our design and construction sections of this report.

## 7.0 STORM SEWERS AND WATERLINES

### 7.1 General

It is planned to construct approximately 4100± lineal feet of waterlines, storm sewers and concrete roadway at the Barryknoll Drainage Improvement in Houston, Texas. The project alignment spans along Berryknoll Lane from Ditch W151 to Bunker Hill with approximate length of 2700-ft and from Ditch W151 to Gessner with approximate length of 1400-ft. The depth of storm sewers will be about 10-ft below the existing grade. We understand that box culverts will be used for the construction of storm sewers for this project. Furthermore, open excavations will be used for box culverts installations. In addition, we also understand that the proposed storm sewers will be constructed in accordance with the City of Houston Specifications (Ref. 1 and 2).

### 7.2 Storm Sewers

The box culverts should be constructed in accordance with the City of Houston Specifications, section 02612 – Precast Reinforced Concrete Box Sewers. The proposed box culvert sizes were not available at the time of our study. The box culverts may be designed in accordance with the parameters presented on Plate 16. In general, where dry stable trench conditions exist, bedding and backfill for the storm sewers should be in accordance with the City of Houston Specification Drawing No. 02317-05. Bedding for the storm sewers, where wet stable trench conditions exist (where excavations below groundwater table are required), should be in accordance with the City of Houston Specification Drawing No. 02317-06.

**The results of our field exploration and laboratory testing indicate that unsatisfactory soils for excavation, such as soft sandy lean clay (CL), lean clay with sand (CL) and silty sand (SM) soils exist at various depths in the borings along storm sewers. A summary of the unsatisfactory soils locations and depths are as follows:**

| Boring(s) | Depth Range, ft. |
|---|---|
| B-1 | 2 to 4 and 6 to 20 |
| B-2 | 6 to 20 |
| B-3 | 0 to 2, 6 to 8 and 13 to 20 |
| B-4 | 0 to 2 and 6 to 20 |
| B-5 | 0 to 2, 6 to 8 and 13 to 20 |
| B-6 | 4 to 20 |
| B-7 | 0 to 8 and 10 to 20 |
| B-8 | 6 to 8 and 12 to 20 |
| B-9 | 0 to 2 and 4 to 20 |

If these conditions are encountered during the time of construction, suitable groundwater control measures should be implemented in accordance with the City of Houston Specification 01578 – Control of Groundwater and Surface Water. Furthermore, the contractor may have to over excavate an additional 6 inches and remove unstable or unsuitable materials with approval by geotechnical engineer, then place an equal depth of cement stabilization sand.

Due to potential variability of the on-site soils, unstable trench conditions may still exist in the areas where we did not conduct our borings. If these conditions are encountered during the time of construction, a stable trench should be provided to allow proper bedding and installation.

Sand backfill used in the cement-stabilized sand and sand backfill sections should be free of clay lumps, organic materials, or other deleterious substances, and should have a PI less than 4 for the cement-stabilized sand and less than 7 for the sand backfill section, and not more than 15% passing the No. 200 sieve. Cement stabilized sand should conform to the City of Houston Specification 02321-Cement Stabilized Sand.

### 7.3 Waterlines

For open-trench construction, bedding and backfill for the proposed waterlines should be constructed in accordance with the City of Houston Specifications drawing No. 02317-04. Trenches for the proposed waterlines must have a width below the top of the pipe of not less than the outside diameter of the pipe plus 24 inches and shall be wide enough to permit making up the joints but shall not be wider than the outside diameter of the pipe plus 36 inches.

In general, 12-inches of bank sand should be placed above the waterlines. Twelve-inch lifts of bank sand should be placed below the waterlines for dry excavation bottom. In case of wet excavation bottom, geotextile fabrics should be placed at the excavation bottom and along the excavation sides to a height of at least 24 inches.

## 7.4 Groundwater Control

### 7.4.1 General

We understand that the depths of the storm sewers will be about 10-ft below existing grade. Our short-term field exploration indicates that groundwater was encountered at depths ranging from 11- to 19-ft during drilling. After 24-hours, groundwater level along the alignment rose to depths ranging from 6- to 14-ft. Our short-term field exploration also indicated that the some of the holes were caved-in at depths ranging from 12- to 15-ft after 24 hours of drilling. Hence, groundwater dewatering will be required. Fluctuations in groundwater can occur as a function of seasonal moisture variation. Groundwater control recommendations are presented in the following report sections.

### 7.4.2 Dewatering Technique

In the event that groundwater is encountered during construction, it is our opinion that groundwater should be lowered to a depth of at least three-ft below the deepest excavation grade in order to provide dry working conditions and firm bedding. Any minor water inflow in cohesive soil layers can probably be removed using a sump-pump or trench sump-pump. Wellpoint system can be used in the area where silty sands soils are present. The selection and proper implementation of an effective groundwater control system is the responsibility of the contractor.

Design of a wellpoint system should consider the amount of groundwater to be lowered and the permeability of the affected soils. The selection and proper implementation of an effective groundwater control system is the responsibility of the contractor. The design of groundwater and surface water should be in accordance with the City of Houston Specifications, Section 01578 – Control of Ground Water and Surface Water.

## 7.5 Bedding and Backfilling

Box culverts sections should be placed on a well prepared, properly compacted working surface. Cast-in-place culverts can be supported on the natural soils provided subgrade is protected from subgrade disturbances and surface water is not allowed to pond within the excavation. We recommend the exposed subgrade be uniformly proofrolled to at least 95 percent of Standard Proctor (ASTM D698) maximum dry density at a moisture content between optimum and +3% of optimum. The excavation, embedment and backfilling for the proposed box culverts shall be in accordance with City of Houston Specifications, Section 02317 – Excavation and Backfill for Utilities.

## 7.6 OSHA Soil Classifications

The subsoils can be classified in accordance with Occupational Safety and Health Administration (OSHA) Standards, dated October 31, 1989 of the Federal Register. OSHA classification system categorizes the soil and rock in four types based on shear strength and stability. The description of four (4) types of classification system is summarized in the Appendix B.

Based on our geotechnical exploration and laboratory test results, details of soil classifications at each boring together with trench safety report are presented in Appendix B.

## 7.7 Open Trenched Excavations

Open trenched excavations may be used in open space above the alignment. Based on soil strength data, temporary (less than 24 hours) open-trenched, non-surcharged, and unsupported excavations should be made on slopes of flatter than 1.5 (h):1 (v). Vertical cuts can be constructed, provided shoring and bracing are used for the excavation wall stability. In all cases, excavations should conform to OSHA guidelines. Flatter slopes may have to be used if large amounts of sand need to be excavated for deep utility installations. Specifications should require that no water be allowed to pond in the excavations. The surface slopes should be protected from deterioration and weathering if they are to be left open for more than 24 hours.

Excavations should be performed with equipment capable of providing a relatively clean bearing area. Excavation equipment should not disturb the soil beneath the design excavation bottom and should not leave large amounts of loose soil in the excavation.

The bearing surface should be protected against disturbance and deterioration by completing the box culverts installation and backfilling operations as quickly as possible. The excavation bottom should be properly sloped to allow any water to infiltrate into the convenient location along the edge of the excavation. Water should not be allowed to stand on the bearing areas.

## 7.8 Lateral Earth Pressures

In the event that open excavations are not used, the proposed box culverts and waterlines can be installed using trench sheeting. The sheeting can be constructed in the form of cantilever sheeting or with bracing. Lateral earth pressures for each method used are summarized on Plate 17. The trenching and shoring operations should follow OSHA Standards. We recommend a geotechnical engineer monitor all phases of trench excavation and bracing to assure trench safety.

## 7.9 Buoyancy

The structure will experience uplift loads from the groundwater during flood conditions. The box culverts should perform satisfactorily if a design factor of safety against uplift loads of 2.0 is used. In general, the hydrostatic pressure will be resisted by the dead weight of the structure, weight of the overburden soils above the top of the box culverts and the friction or adhesion between the walls and natural soils or fill. A submerged unit weight of 60 pounds per cubic foot (pcf) and 85 pcf can be used for soils and concrete, respectively, to compute the resistance to uplift loads. An adhesion value of 200 psf can be used between the backfill and the box culverts to resist the uplift loads. A factor of safety of 2.0 is included in the adhesion value.

# 8.0 PAVEMENT RECOMMENDATIONS

## 8.1 General

It is planned to construct approximately 4100± lineal feet of pavement at the Barryknoll Drainage Improvement in Houston, Texas. We also understand that the new road structures will consist of rigid pavement. The new pavement design is in accordance with the "1993 ASSHTO Guide for Design of Pavement Structures" (Ref. 3). Furthermore, our site preparation and soil stabilization recommendations are generally developed on the basis of the "City of Houston Standard Construction Specifications" (Ref. 1 and 2).

## 8.2 Traffic Information

We understand that there is no accurate traffic information available for the project alignment at this point. However, considering the pavement structure will be subjected to major thoroughfare traffic loading and based on our experience on similar projects, a design ESAL of $10.0 \times 10^6$ is considered for the design of the proposed pavement structures.

## 8.3 Subgrade Stabilization

The type of subgrade stabilization will depend on the final grade elevation and the type of soil at the elevations. Furthermore, the type and amount of stabilization should be evaluated once the final grade is reached. Subgrade preparation in pavement areas should specify compaction of the upper eight-inches to at least 95% of maximum standard density (ASTM D 698) at a moisture content between optimum and +3% of optimum. Since most of the subgrade soils consists of clays, lime stabilization of the surficial soils should most likely be performed for the project area. The upper eight-inches of the soils should be lime stabilized, using 4% lime by dry weight. The application rate corresponding to this additive amount would be 24 pounds of lime per square yard for eight-inches of compacted thickness. City of Houston Standard Specification 02336 should be used as a procedural guide for placing, mixing and compacting the lime stabilizer and the soils.

**Our recommendations on subgrade stabilization are preliminary. The actual depth and type of stabilization should be determined in the field at the time of construction just after site stripping and proofrolling. Furthermore, the type and amount of the stabilizer may vary depending on the final grade elevation and the soil type encountered.**

### 8.4 Recommended Subgrade Design Values

Results of the soils test indicated that subgrade soils are lean clay with sand (CL), sandy lean clay (CL) and silty sand (SM) fill soils based on unified soils classification system (ASTM D 2487). We estimated the subgrade California Bearing Ratio (CBR) on the basis of subgrade soil classification and our experience in the area. The recommended design parameters for CBR and $M_R$ values are 5 and 7,500 psi, respectively.

### 8.5 Concrete Pavement

The following design parameters (based on 1993 AASHTO Guide for Design of Pavement Structures, Ref. 1) were used in the concrete pavement design for the proposed project alignment in the City of Houston.

| AASHTO Design Parameter | Pavement Design Value |
|---|---|
| ESAL $\times 10^6$ for 20-year design life | 10.0 |
| Reliability, R | 95% |
| Overall Standard Deviation, $S_0$ | 0.35 |
| Load Transfer Coefficient, J | 3.2 |
| Loss of Support, LS | 1.0 |
| Drainage Coefficient, $C_d$ | 1.2 |
| Design Serviceability Loss, $\Delta$ psi | 2.0 |
| Concrete Modules of Rupture (28 days) in psi, $S_c$' | 620 |
| Concrete Compressive Strength at 28 days in psi, $f_c$' | 3,500 |
| Effective Modulus of Subgrade Reaction k, in pci | 130 |

Based on the above design parameters, the recommendations for the minimum concrete pavement section thickness are as follows:

| Design, ESAL $\times 10^6$ | Concrete Pavement Thickness, inch(es) | Subgrade Stabilization Thickness, inch(es) |
|---|---|---|
| 10.0 | 10.0 | 8.0 |

Detailed design computations are presented in Appendix C. Our design recommendations also consider excellent drainage is provided near the pavement structures, assuming the pavement are exposed to moisture levels approaching saturation from 1 to 5 percent of the time. Concrete should meet the requirements of the City of Houston design paving specification as well as AASHTO "Guide Specifications for Highway Construction and the Structural Specifications for Transportation Materials." The construction of rigid pavement should be in accordance with the City of Houston Specification Drawing No. 02751-01.

Our recommendations for the steel reinforcement placement are in general accordance with the City of Houston Standard Specification (Ref. 1 and 2) for the jointed reinforced concrete pavements. The reinforcement steel bar sized and spacing are summarized as follows:

| | | Longitudinal Steel # 4 Bars | | | Transverse Steel # 4 Bars |
|---|---|---|---|---|---|
| Pavement Thickness, in. | Pavement Width, ft. | No. of Bars | Spacing, in. | End Bar Spacing, in. | Spacing, in. |
| 10.0 | 44 | 44 | 12.0 | 4.0 | 24.0 |

The reinforcement steel should be Grade 60. We recommend a lap length of 22-inches for the No. 4 bars.

## 9.0 CONSTRUCTION CONSIDERATIONS

### 9.1 Fill Requirement

Fill requirements should be in accordance with the City of Houston Standard Specifications 02316 –Excavation and Backfill for Structures, 02317 – Excavation and Backfill for Utilities and 02320 – Utility Backfill Materials.

### 9.2 Surface Water Drainage

In order to minimize ponding of surface water, site drainage should be established early in the project construction so that this condition will be controlled.

### 9.3 Site Preparation

**Portion of the project site has the potential for construction problems related to the surficial layer of silty sand soils. These permeable surficial soils are underlain by relatively impermeable lean clay soils. Thus, due to poor site drainage, wet season or site geohydrology, water ponds on the clays and creates a "perched water table condition." The surficial silty sand soils become extremely soft when wet, and must be stabilized, aerated, or replaced.** Site preparation should be conducted in accordance with the City of Houston Standard Construction Specifications Sections 02221 and 02233. In general, subgrade preparation should be as follows:

1. The requirement for removal of any existing paving, and subsoil materials will depend on final grades and other alignment information. In general, remove all vegetation, tree roots, organic topsoil, existing foundations, paved areas and any undesirable materials from the construction area. Tree trucks under the pavement should be removed to a root size of less than 0.5-inches. We recommend that the stripping depth be evaluated at the time of construction by a soil technician.

2. The subgrade areas should then be proofrolled with a loaded dump truck or similar pneumatic-tired equipment with loads ranging from 25- to 50-tons. The proofrolling serves to compact surficial soils and to detect any soft or loose zones. The proofrolling should be conducted in accordance with TxDOT Standard Specification Item 216. Any soils deflecting excessively under moving loads should be undercut to firm soils and recompacted. Any subgrade stabilization should be conducted after site proofrolling is completed and approved by the geotechnical engineer. The proofrolling operations should be observed by an experienced geotechnician.

3. Portions of the surficial soils at the project site are moisture sensitive, compressible and are difficult to compact in a wet condition (they may pump). These soils can be modified, using 5% to 10% Fly-ash. The Fly-ash stabilization should be in accordance with the City of Houston Standard Specifications 02337.

4. Off-site borrow for fill should consist of lean clays with a liquid limit not exceeding 40 and a PI between 12 and 20. These soils should be placed in loose lifts not exceeding eight-inches and compacted to at least 95% of maximum standard density (ASTM D 698) at a moisture content between optimum and 3%. Bank sands should not be used as select structural fill. On-site soils, free of organics, (with the exception of sands and silts) are also suitable for use as structural fill.

5. In cut areas, the soil should be excavated to grade and the surficial soil proofrolled and scarified to a minimum depth of six-inches and recompacted to the previously mentioned density and moisture content.

6. Positive site drainage should be developed at the beginning of the project to limit construction difficulties with wet surface soils.

## 9.4 Earthwork

### 9.4.1 General

**Difficult access and workability problems can occur in the surficial soils due to poor site drainage, wet season, or site geohydrology.** Based on the laboratory test results, the subsurface soils at the project site consists of lean clay with sand (CL), sandy lean clay (CL) and silty sand (SM) fill soils. Considering the soils stratigraphy, the construction of this project should be conducted during the dry season to avoid major earthwork problems. Our recommendations for earthwork activity for areas with cohesive and cohessionless soils are provided separately.

### 9.4.2 Earthwork for Cohesive Soils

Difficult access and workability problems can occur in the surficial clay soils due to poor site drainage, wet season, or site geohydrology. Should this condition develop, drying of the soils for support of pavement may be improved by the addition of 4% lime by dry weight. The application rate corresponding to this additive amount would be 24 pounds of lime per square yard for eight-inch of compacted thickness.

City of Houston Standard Specifications 02336 shall be used as procedural guides for placing, mixing, and compacting lime stabilizer and the soils.

**Our recommendations on subgrade stabilization are preliminary. The actual depth and type of stabilization should be determined in the field at the time of construction just after site stripping and proofrolling. Furthermore, the type and amount of the stabilizer may vary depending on the final grade elevation and the soil type encountered.**

Provided the site work is performed during dry weather and/or project schedules permit aeration of wet soils, the subgrade will be suitable for pavement support.

9.4.3 Earthwork for Cohesionless Soils

In the event the subgrade soils become wet and experience pumping problems, they can be (a) opened up to dry up, (b) removed and replaced with dry cohesive soils or (c) chemically modified or stabilized. These alternatives are discussed in the following report sections.

9.4.3.1 Subgrade Drying

The on-site wet soils can be opened up so that it would dry up. However, opening up the surficial cohesionless soils for drying purposes may not be practical, due to cyclic rainfall in the Gulf-Coast area.

9.4.3.2 Removal and Replacement

The surficial cohesionless soils can be removed and replaced with select structural fill. The actual depth of removal and replacement should be evaluated in the field, but it can be whole thickness of surficial cohesionless soils. This procedure will include removal of the surficial cohesionless soils, proofrolling and compacting the subgrade cohesive soils to a minimum of 95 percent standard proctor density (ASTM D 698). The site can then be backfilled with select structural fill, compacted to a minimum of 95 percent of standard proctor density. The proofrolling should be in accordance with the site preparation section of this report. All of the fill soils should be placed and tested in accordance with the site preparation section of this report.

9.4.3.3 Modification/Stabilization

We recommend that the on-site cohesionless soils be modified (to dry up), using 5 to 10 percent fly ash by dry weight. City of Houston Standard Specifications 02337, shall be used as a procedural guide for placing, mixing and compacting the fly-ash stabilizer. The estimated amount of fly ash per depth of modification are as follows:

| Modification Depth, in. | Fly Ash Weight Range, lbs. per Square Yard |
|---|---|
| 6 | 23 – 45 |
| 12 | 46 – 90 |
| 18 | 69 – 135 |
| 24 | 92 – 180 |

We recommend that five percent fly ash be used if the surficial soils are relatively moist at the time of application. Higher levels (10 percent) of fly ash should be used if wet and soggy subgrade soils are encountered.

The subgrade soils should be removed to a depth of 24-inch (or more) below existing grade. These soils should be stockpiled. The soils below a depth of 24-inch should be modified to a depth of 12-inch. These soils should be compacted to a minimum of 95 percent of standard proctor density (ASTM D 698). The stockpiled soils should then be modified and replaced in six-inch lifts and compacted to 95 percent of maximum dry density as determined by ASTM D 698 at moisture contents within ±2 percent of optimum.

Due to poor drainage and the depth of the cohesionless soils, the depth of stabilization may be as deep as depth of cohesionless soils. A test section can be implemented for this purpose. The subgrade soils should be modified in six-inch lifts and compacted within four hours of mixing and placement. All of the subgrade soils should be compacted to a minimum of 95 percent of the standard proctor density at the moisture content with optimum. The degree of compaction for the lifts, below a depth of 24-inch can be relaxed to 90 percent of maximum dry density to ease the construction procedures.

The subcontractor who will be doing the subgrade modification or stabilization should be experienced with stabilization procedures and methods. Furthermore, all of the earthwork at this project should be monitored by our geotechnician to assured compliance with the project specifications.

Once the subgrade is constructed, the soils at the top of subgrade should be slicked and the subgrade needs to be crowned such that the all surface water would drain away. No low areas should be left within the subgrade areas, since these areas would hold water and destroy the subgrade structure.

### 9.5 Construction Surveillance

Construction surveillance and quality control tests should be planned to verify materials and placement in accordance with the specifications. The recommendations presented in this report were based on a discrete number of soil test borings. Soil type and properties may vary across the site. As a part of quality control, if this condition is noted during the construction, we can then evaluate and revise the design and construction to minimize construction delays. We recommend the following quality control procedures be followed by a qualified engineer or technician during the construction of the facility:

- Observe the site stripping and proofrolling.
- Verify the compaction of subgrade soils.
- Verify the type, depth and amount stabilizer.
- Evaluate the quality of fill and monitor the fill compaction for all lifts.
- Observe all phases of trench safety.

- Observe all excavation operations.
- Monitor concrete placement, conduct slump tests and make concrete cylinders.

It is the responsibility of the client to notify GET of when each phase of the construction is taking place so that proper quality control and procedures are implemented.

## 10.0 RECOMMENDED ADDITIONAL STUDIES

This report has been based on assumed conditions/characteristics of the proposed project area where specific information was not available. It is recommended that the civil engineer along with any other design professionals involved in this project carefully review these assumptions to ensure they are consistent with the actual planned development. When discrepancies exist, they should be brought to our attention to ensure they do not affect the conclusions and recommendations provided herein. We recommend that GET be retained to review the plans and specifications to ensure that the geotechnical related conclusions and recommendations provided herein have been correctly interpreted as intended.

## 11.0 STANDARD OF CARE

The recommendations described herein were conducted in a manner consistent with the level of care and skill ordinarily exercised by members of the geotechnical engineering profession practicing contemporaneously under similar conditions in the locality of the project. No other warranty or guarantee, expressed or implied, is made other than the work was performed in a proper and workmanlike manner.

## 12.0 REPORT DISTRIBUTION

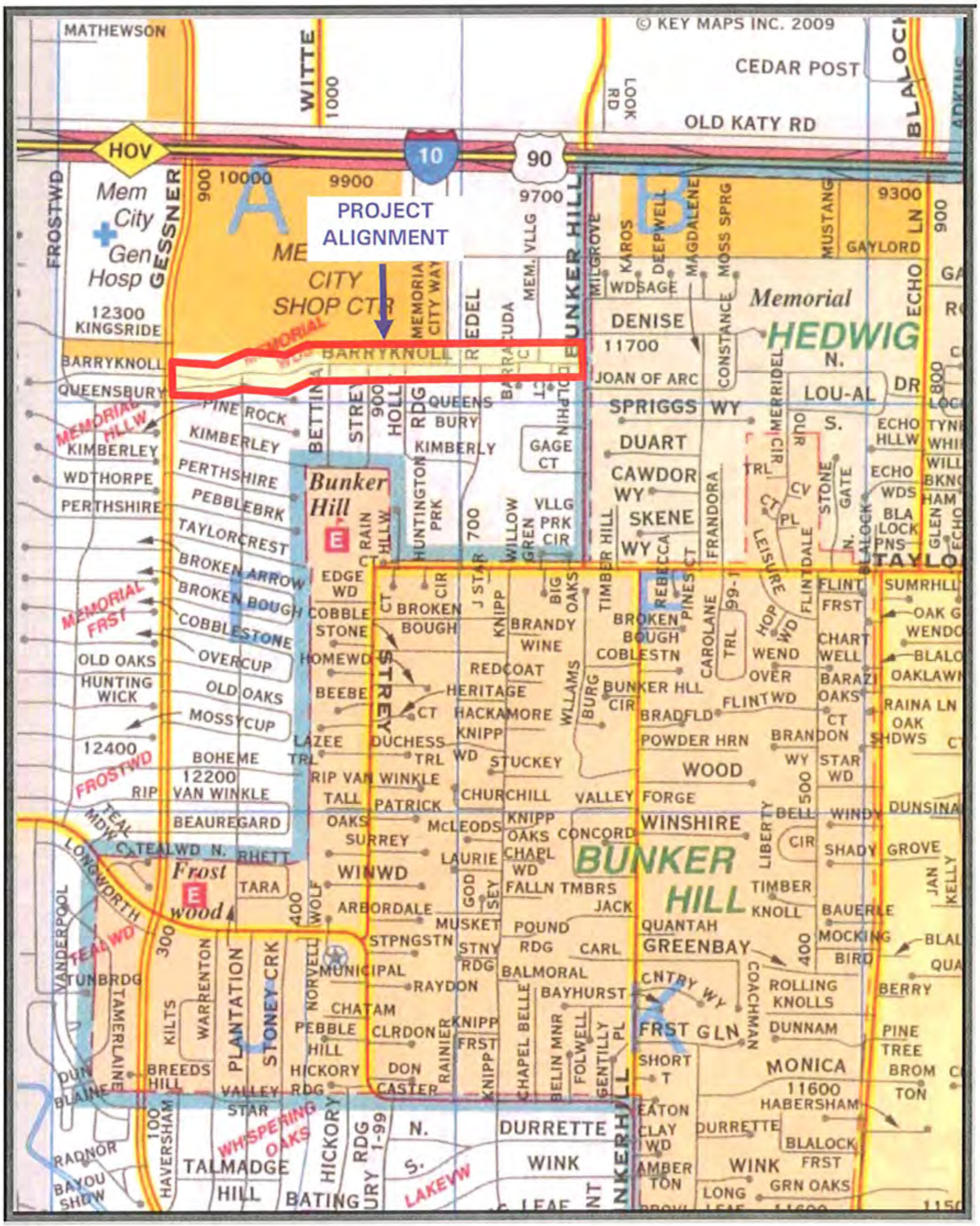
This report was prepared for the sole and exclusive use by our client (Lockwood, Andres & Newnam, Inc.) and owner (City of Houston), based on specific and limited objectives. All reports, boring logs, field data, laboratory test results, maps and other documents prepared by GET as instruments of service shall remain the property of GET. Reuse of these documents is not permitted without written approval by GET. GET assumes no responsibility or obligation for the unauthorized use of this report by other parties and for purposes beyond the stated project objectives and work limitations.

## 13.0 REFERENCES

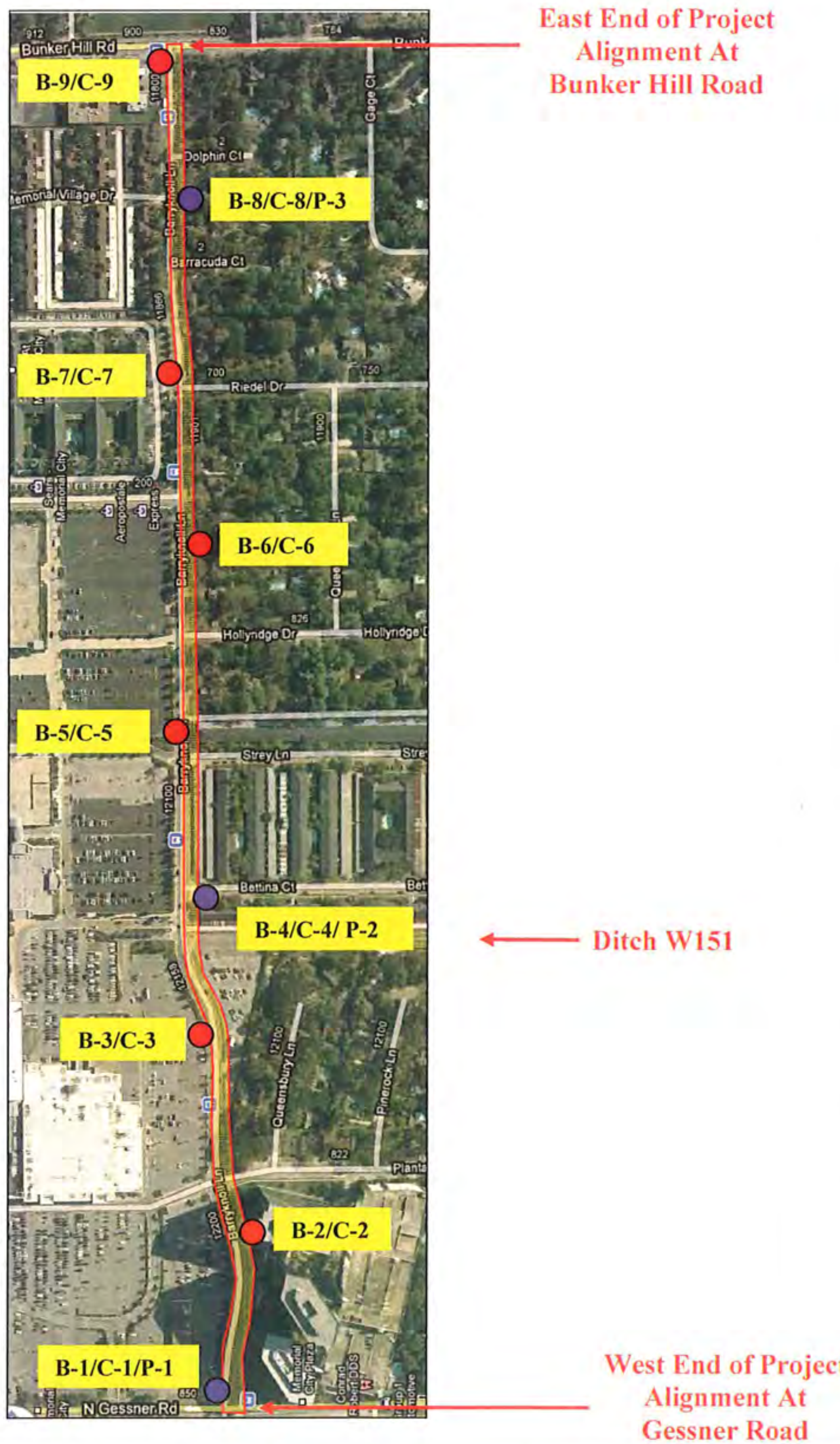
1. "City of Houston Standard Construction Specifications", Department of Pubic Works and Engineering, City of Houston, October 2002.

2. "City of Houston Standard Construction Specifications", Department of Pubic Works and Engineering, City of Houston, July 2009.

3. AASHTO Specifications, "Guide for Design of Pavement Structures", American Association of State Highway and Transportation Officials, 1993.




| SITE VICINITY MAP | | | NORTH |
|---|---|---|---|
| PROJECT: Limited Phase I Geologic Fault Study, Barryknoll Drainage Improvements from Bunker Hill Road to Gessner Road<br>Houston, Texas | | | |
| SCALE: NOT TO SCALE | DATE: FEBRUARY 2010 | REPORT NO.: 09-544E | |




**Legend:**

- (red circle) **B-1/C-1/P-1–Boring No. 1/ Coring No. 1/ Piezometer No. 1**
- (purple circle) **B-2/C-2–Boring No. 2/ Coring No. 2**

| | | | |
|---|---|---|---|
| **SITE PLAN** | | | NORTH |
| PROJECT: Berryknoll Drainage Improvements from Bunker Hill Road to Gessner Road<br>Houston, Texas | | | |
| SCALE: NOT TO SCALE | DATE: FEBRUARY 2010 | REPORT NO.: 09-544E | |

## EXISTING CONCRETE PAVEMENT THICKNESS

| Location | Concrete Pavement Thickness, inches |
|---|---|
| C-1 | 7.2 |
| C-2 | 6.9 |
| C-3 | 7.9 |
| C-4 | 6.7 |
| C-5 | 8.0 |
| C-6 | 9.1 |
| C-7 | 7.3 |
| C-8 | 8.2 |
| C-9 | 7.6 |

# LOG OF BORING NO. B-1

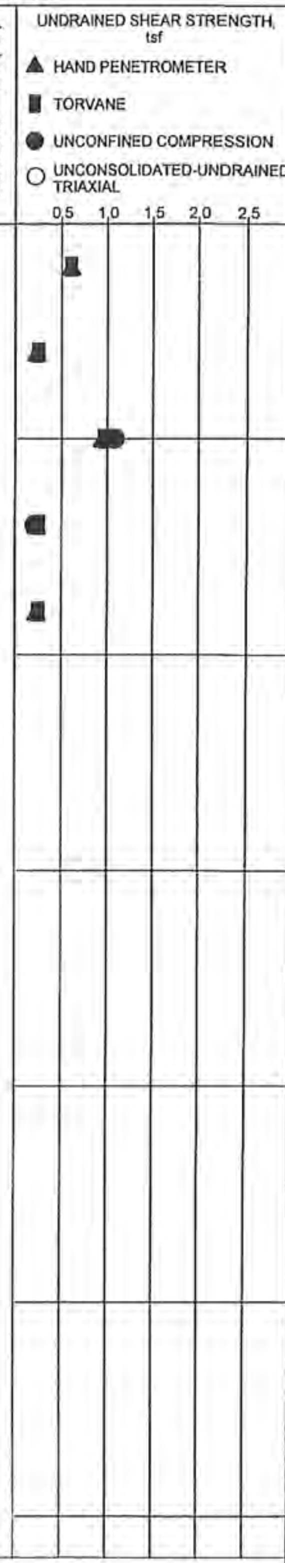
Sheet 1 of 1

Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022
Phone: 713-699-400 Fax: 713-699-9200

PROJECT: Barryknoll Drainage Improvements From Bunker Hill Road to Gessner Road
LOCATION: Houston, Texas
PROJECT NO.: 09-544E STATION NO.:
DATE: 1-24-10 COMPLETION DEPTH: 20.0 ft.

ELEVATION: Existing Grade

| DEPTH, ft | SPT N-VALUE blows per foot | OVM, ppm | DESCRIPTION | NATURAL MOISTURE CONTENT, % | LIQUID LIMIT, % | PLASTIC LIMIT, % | PLASTICITY INDEX, % | PERCENT PASSING NO. 200 SIEVE | SUCTION (pF) | DRY UNIT WEIGHT, pcf | PERCENT COMPACTION | PASSING/FAILING (P/F) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | CONCRETE PAVEMENT (7.2") | | | | | | | | | |
| | | | FILL: SANDY LEAN CLAY (CL), stiff, gray, light gray, with root fibers, calcareous nodules, moist | 16 | 29 | 15 | 14 | 67 | | | | |
| | | | SANDY LEAN CLAY (CL), soft, gray, light gray, with root fibers to 6', calcareous nodules, sands, moist - very stiff, brownish yellow 4' to 6' - with ferrous nodules 4' to 10' | | | | | | | | | |
| 5 | | | | 17 | | | | | | 112 | | |
| | | | | 17 | 32 | 16 | 16 | 66 | | 108 | | |
| | | | SILTY SAND (SM), medium dense, gray, wet | | | | | | | | | |
| | 26 | | | | | | | | | | | |
| 20 | | | | | | | | | | | | |




WATER OBSERVATIONS:
▽: WATER ENCOUNTERED AT 17.0 ft. DURING DRILLING.
▼: WATER DEPTH AT 6.0 ft. AFTER 24 HOURS. THE HOLE CAVED IN AT 16.0 ft. AFTER 24 HOURS.

DRY AUGER: 0 TO 20 ft.
WET ROTARY: ___ TO ___ ft.

DRILLED BY: GET
LOGGED BY: Abraham

OVM2 09-544E.GPJ OVM.GDT 3/2/10

# LOG OF BORING NO. B-2



Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022
Phone: 713-699-400 Fax: 713-699-9200

PROJECT: Barryknoll Drainage Improvements From Bunker Hill Road to Gessner Road
LOCATION: Houston, Texas
PROJECT NO.: 09-544E STATION NO.:
DATE: 1-24-10 COMPLETION DEPTH: 20.0 ft.

UNDRAINED SHEAR STRENGTH, tsf: ▲ HAND PENETROMETER; ■ TORVANE; ● UNCONFINED COMPRESSION; ○ UNCONSOLIDATED-UNDRAINED TRIAXIAL (scale 0.5, 1.0, 1.5, 2.0, 2.5)

| DEPTH, ft | SPT N-VALUE blows per foot | OVM, ppm | DESCRIPTION | NATURAL MOISTURE CONTENT, % | LIQUID LIMIT, % | PLASTIC LIMIT, % | PLASTICITY INDEX, % | PERCENT PASSING NO. 200 SIEVE | SUCTION (pF) | DRY UNIT WEIGHT, pcf | PERCENT COMPACTION | PASSING/FAILING (P/F) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ELEVATION: Existing Grade | | | | | | | | | |
| 0 | | | CONCRETE PAVEMENT (6.9") | | | | | | | | | |
| | | | FILL: SANDY LEAN CLAY (CL), firm, brown, dark gray, with root fibers, moist | | | | | | | | | |
| | | | SANDY LEAN CLAY (CL), stiff, light gray, with root fibers to 4', ferrous nodules, moist | 16 | 33 | 16 | 17 | 65 | | 114 | | |
| 5 | | | - soft, with calcareous nodules 6' to 10' | | | | | | | | | |
| | | | | 17 | 33 | 16 | 17 | 65 | | 107 | | |
| 10 | | | SILTY SAND (SM), medium dense, gray, wet | | | | | | | | | |
| 15 | 23 | | | | | | | | | | | |
| 20 | | | | | | | | | | | | |
| 25 | | | | | | | | | | | | |
| 30 | | | | | | | | | | | | |

WATER OBSERVATIONS:
▽: WATER ENCOUNTERED AT 15.0 ft. DURING DRILLING.
▼: WATER DEPTH AT 8.0 ft. AFTER 24 HOURS. THE HOLE CAVED IN AT 15.0 ft. AFTER 24 HOURS.

DRY AUGER: 0 TO 20 ft.
WET ROTARY: ___ TO ___ ft.

DRILLED BY: GET
LOGGED BY: Abraham

OVM2 09-544E.GPJ OVM.GDT 3/2/10

# LOG OF BORING NO. B-3



Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022
Phone: 713-699-400 Fax: 713-699-9200

PROJECT: Barryknoll Drainage Improvements From Bunker Hill Road to Gessner Road
LOCATION: Houston, Texas
PROJECT NO.: 09-544E STATION NO.:
DATE: 1-24-10 COMPLETION DEPTH: 20.0 ft.

UNDRAINED SHEAR STRENGTH, tsf: ▲ HAND PENETROMETER; ■ TORVANE; ● UNCONFINED COMPRESSION; ○ UNCONSOLIDATED-UNDRAINED TRIAXIAL (scale 0.5, 1.0, 1.5, 2.0, 2.5)

| DEPTH, ft | SPT N-VALUE blows per foot | OVM, ppm | DESCRIPTION | NATURAL MOISTURE CONTENT, % | LIQUID LIMIT, % | PLASTIC LIMIT, % | PLASTICITY INDEX, % | PERCENT PASSING NO. 200 SIEVE | SUCTION (pF) | DRY UNIT WEIGHT, pcf | PERCENT COMPACTION | PASSING/FAILING (P/F) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | ELEVATION: Existing Grade<br>CONCRETE PAVEMENT (7.9") | | | | | | | | | |
| | | | FILL: SANDY LEAN CLAY (CL), soft, gray, greenish gray, with root fibers, moist | | | | | | | | | |
| | | | SANDY LEAN CLAY (CL), stiff, dark gray, brown, with root fibers to 6', moist<br>- firm, 4' to 6' | | | | | | | | | |
| 5 | | | - with ferrous nodules 4' to 10' | 17 | 26 | 15 | 11 | 67 | | 109 | | |
| | | | - soft 6' to 8' | | | | | | | | | |
| | | | - very stiff 8' to 10' | 16 | 38 | 17 | 21 | | | 110 | | |
| 10 | | | | | | | | | | | | |
| | 21 | | SILTY SAND (SM), medium dense, gray, wet | 21 | | | | 27 | | | | |
| 15 | | | | | | | | | | | | |
| 20 | | | | | | | | | | | | |
| 25 | | | | | | | | | | | | |
| 30 | | | | | | | | | | | | |

WATER OBSERVATIONS:
▽: WATER ENCOUNTERED AT 12.0 ft. DURING DRILLING.
▼: WATER DEPTH AT 8.0 ft. AFTER 24 HOURS. THE HOLE CAVED IN AT 17.0 ft. AFTER 24 HOURS.

DRY AUGER: 0 TO 20 ft.
WET ROTARY: ____ TO ____ ft.

DRILLED BY: GET
LOGGED BY: Abraham

OVM2 09-544E.GPJ OVM.GDT 3/2/10

# LOG OF BORING NO. B-4

Sheet 1 of 1

Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022
Phone: 713-699-400 Fax: 713-699-9200

PROJECT: Barryknoll Drainage Improvements From Bunker Hill Road to Gessner Road
LOCATION: Houston, Texas
PROJECT NO.: 09-544E STATION NO.:
DATE: 1-24-10 COMPLETION DEPTH: 20.0 ft.

ELEVATION: Existing Grade

| DEPTH, ft | SPT N-VALUE blows per foot | OVM, ppm | DESCRIPTION | NATURAL MOISTURE CONTENT, % | LIQUID LIMIT, % | PLASTIC LIMIT, % | PLASTICITY INDEX, % | PERCENT PASSING NO. 200 SIEVE | SUCTION (pF) | DRY UNIT WEIGHT, pcf | PERCENT COMPACTION | PASSING/FAILING (P/F) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | CONCRETE PAVEMENT (6.7") | | | | | | | | | |
| | | | FILL: LEAN CLAY WITH SAND (CL), soft, light brown, dark gray, with root fibers, shells, moist | 7 | 24 | 15 | 9 | 71 | | | | |
| | | | SANDY LEAN CLAY (CL), stiff, light gray, brownish yellow, with ferrous and calcareous nodules, sands, moist | 13 | | | | | | 119 | | |
| | | | - firm, greenish gray 4' to 6' | | | | | | | | | |
| 5 | | | | | | | | | | | | |
| | | | - soft 6' to 10' | 14 | 35 | 16 | 19 | 56 | | 105 | | |
| 10 | | | | | | | | | | | | |
| | | | SILTY SAND (SM), medium dense, light gray, brownish yellow, wet | | | | | | | | | |
| | 25 | | | | | | | | | | | |
| 15 | | | | | | | | | | | | |
| | 27 | | | | | | | | | | | |
| 20 | | | | | | | | | | | | |
| 25 | | | | | | | | | | | | |
| 30 | | | | | | | | | | | | |

UNDRAINED SHEAR STRENGTH, tsf
▲ HAND PENETROMETER
■ TORVANE
● UNCONFINED COMPRESSION
○ UNCONSOLIDATED-UNDRAINED TRIAXIAL

0.5 1.0 1.5 2.0 2.5

WATER OBSERVATIONS:
▽: WATER ENCOUNTERED AT 19.0 ft. DURING DRILLING.
▼: WATER DEPTH AT 9.0 ft. AFTER 24 HOURS.

DRY AUGER: 0 TO 20 ft.
WET ROTARY: ___ TO ___ ft.

DRILLED BY: GET
LOGGED BY: Abraham

OVM2 09-544E.GPJ OVM.GDT 3/2/10

# LOG OF BORING NO. B-5



Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022
Phone: 713-699-400 Fax: 713-699-9200

PROJECT: Barryknoll Drainage Improvements From Bunker Hill Road to Gessner Road
LOCATION: Houston, Texas
PROJECT NO.: 09-544E STATION NO.:
DATE: 1-24-10 COMPLETION DEPTH: 20.0 ft.

ELEVATION: Existing Grade

| DEPTH, ft | SPT N-VALUE blows per foot | DESCRIPTION | NATURAL MOISTURE CONTENT, % | LIQUID LIMIT, % | PLASTIC LIMIT, % | PLASTICITY INDEX, % | PERCENT PASSING NO. 200 SIEVE | SUCTION (pF) | DRY UNIT WEIGHT, pcf | PERCENT COMPACTION | PASSING/FAILING (P/F) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | CONCRETE PAVEMENT (8.0") | | | | | | | | | |
| | | FILL: SANDY LEAN CLAY (CL), very soft, gray, brownish yellow, with root fibers, moist | | | | | | | | | |
| | | SANDY LEAN CLAY (CL), stiff, dark gray, brownish yellow, fissured, moist | | | | | | | | | |
| | | - firm 4' to 6' | | | | | | | | | |
| 5 | | | 13 | 33 | 16 | 17 | 68 | | 108 | | |
| | | - soft 6' to 8'<br>- light gray 6' to 10' | | | | | | | | | |
| | | - very stiff 8' to 10' | | | | | | | | | |
| | | | 13 | 40 | 17 | 23 | 57 | | 119 | | |
| 10 | | | | | | | | | | | |
| | | SILTY SAND (SM), medium dense, light gray, greenish gray, wet | | | | | | | | | |
| | 22 | | | | | | | | | | |
| 15 | | | | | | | | | | | |
| 20 | | | | | | | | | | | |
| 25 | | | | | | | | | | | |
| 30 | | | | | | | | | | | |

UNDRAINED SHEAR STRENGTH, tsf
▲ HAND PENETROMETER
▮ TORVANE
● UNCONFINED COMPRESSION
○ UNCONSOLIDATED-UNDRAINED TRIAXIAL
0.5 1.0 1.5 2.0 2.5

WATER OBSERVATIONS:
▽: WATER ENCOUNTERED AT 15.0 ft. DURING DRILLING.
▼: WATER DEPTH AT 8.0 ft. AFTER 24 HOURS. THE HOLE CAVED IN AT 16.0 ft. AFTER 24 HOURS.

DRY AUGER: 0 TO 20 ft.
WET ROTARY: ___ TO ___ ft.

DRILLED BY: GET
LOGGED BY: Abraham

OVM2 09-544E.GPJ OVM.GDT 3/2/10

# LOG OF BORING NO. B-6



Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022
Phone: 713-699-400 Fax: 713-699-9200

PROJECT: Drainage Improvements From Bunker Hill Road to Gessner Road
LOCATION: Houston, Texas
PROJECT NO.: 09-544E STATION NO.:
DATE: 1-21-10 COMPLETION DEPTH: 20.0 ft.

UNDRAINED SHEAR STRENGTH, tsf: ▲ HAND PENETROMETER; ▮ TORVANE; ● UNCONFINED COMPRESSION; ○ UNCONSOLIDATED-UNDRAINED TRIAXIAL (scale 0.5, 1.0, 1.5, 2.0, 2.5)

ELEVATION: Existing Grade

| DEPTH, ft | SPT N-VALUE blows per foot | OVM, ppm | DESCRIPTION | NATURAL MOISTURE CONTENT, % | LIQUID LIMIT, % | PLASTIC LIMIT, % | PLASTICITY INDEX, % | PERCENT PASSING NO. 200 SIEVE | SUCTION (pF) | DRY UNIT WEIGHT, pcf | PERCENT COMPACTION | PASSING/FAILING (P/F) | UNDRAINED SHEAR STRENGTH, tsf |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | CONCRETE PAVEMENT (9.1") | | | | | | | | | | |
| | | | FILL: SANDY LEAN CLAY (CL), stiff, dark brown, brownish yellow, with root fibers, moist | | | | | | | | | | ▲ ▮ |
| | | | SANDY LEAN CLAY (CL), firm, light gray, brownish yellow, with ferrous and calcareous nodules, fissured, moist | 17 | 34 | 16 | 18 | | | 115 | | | ● ▲ |
| 5 | | | | 14 | 30 | 16 | 14 | 57 | | 111 | | | ● |
| | | | SILTY SAND (SM), medium dense, light brown, gray, wet | | | | | | | | | | |
| | 12 | | | | | | | | | | | | |
| | 16 | | | 23 | | | | 31 | | | | | |
| 10 | | | | | | | | | | | | | |
| | 22 | | | | | | | | | | | | |
| 15 | | | | | | | | | | | | | |
| 20 | | | | | | | | | | | | | |
| 25 | | | | | | | | | | | | | |
| 30 | | | | | | | | | | | | | |

WATER OBSERVATIONS:
▽: WATER ENCOUNTERED AT 16.0 ft. DURING DRILLING.
▼: WATER DEPTH AT 7.0 ft. AFTER 24 HOURS. THE HOLE CAVED IN AT 17.0 ft. AFTER 24 HOURS.

DRY AUGER: 0 TO 20 ft.
WET ROTARY: ___ TO ___ ft.

DRILLED BY: GET
LOGGED BY: Abraham

OVM2 09-544E.GPJ OVM.GDT 3/2/10

# LOG OF BORING NO. B-7



Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022
Phone: 713-699-400 Fax: 713-699-9200

PROJECT: Barryknoll Drainage Improvements From Bunker Hill Road to Gessner Road
LOCATION: Houston, Texas
PROJECT NO.: 09-544E STATION NO.:
DATE: 1-24-10 COMPLETION DEPTH: 20.0 ft.

UNDRAINED SHEAR STRENGTH, tsf: ▲ HAND PENETROMETER; ■ TORVANE; ● UNCONFINED COMPRESSION; ○ UNCONSOLIDATED-UNDRAINED TRIAXIAL (scale 0.5, 1.0, 1.5, 2.0, 2.5)

| DEPTH, ft | SPT N-VALUE blows per foot | OVM, ppm | DESCRIPTION | NATURAL MOISTURE CONTENT, % | LIQUID LIMIT, % | PLASTIC LIMIT, % | PLASTICITY INDEX, % | PERCENT PASSING NO. 200 SIEVE | SUCTION (pF) | DRY UNIT WEIGHT, pcf | PERCENT COMPACTION | PASSING/FAILING (P/F) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ELEVATION: Existing Grade | | | | | | | | | |
| 0 | | | CONCRETE PAVEMENT (7.3") | | | | | | | | | |
| | | | FILL: SILTY SAND (SM), brown, with root fibers, moist | 11 | | | | 23 | | | | |
| | 13 | | SILTY SAND (SM), medium dense, brown, moist | | | | | | | | | |
| 5 | 14 | | | | | | | | | | | |
| | | | SANDY LEAN CLAY (CL), stiff, gray, greenish gray, moist | 17 | 30 | 16 | 14 | 57 | | 111 | | |
| 10 | | | SILTY SAND (SM), brown, light gray, moist | | | | | | | | | |
| | | | - medium dense, wet 13' to 20' | | | | | | | | | |
| | 21 | | | | | | | | | | | |
| 15 | | | | | | | | | | | | |
| | 22 | | | | | | | | | | | |
| 20 | | | | | | | | | | | | |
| 25 | | | | | | | | | | | | |
| 30 | | | | | | | | | | | | |

WATER OBSERVATIONS:
▽: WATER ENCOUNTERED AT 18.0 ft. DURING DRILLING.
▼: WATER DEPTH AT 14.0 ft. AFTER 24 HOURS.

DRY AUGER: 0 TO 20 ft.
WET ROTARY: ___ TO ___ ft.

DRILLED BY: GET
LOGGED BY: Abraham

OVM2 09-544E.GPJ OVM.GDT 3/2/10

# LOG OF BORING NO. B-8



Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022
Phone: 713-699-400 Fax: 713-699-9200

PROJECT: Barryknoll Drainage Improvements From Bunker Hill Road to Gessner Road
LOCATION: Houston, Texas
PROJECT NO.: 09-544E STATION NO.:
DATE: 1-24-10 COMPLETION DEPTH: 20.0 ft.

ELEVATION: Existing Grade

| DEPTH, ft | SPT N-VALUE blows per foot | DESCRIPTION | NATURAL MOISTURE CONTENT, % | LIQUID LIMIT, % | PLASTIC LIMIT, % | PLASTICITY INDEX, % | PERCENT PASSING NO. 200 SIEVE | SUCTION (pF) | DRY UNIT WEIGHT, pcf | PERCENT COMPACTION | PASSING/FAILING (P/F) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | CONCRETE PAVEMENT (8.2") | | | | | | | | | |
| | | FILL: SANDY LEAN CLAY (CL), stiff, gray, dark gray, with root fibers, moist | 15 | 24 | 15 | 9 | 65 | | | | |
| | | SANDY LEAN CLAY (CL), firm, gray, light gray, moist | 17 | | | | | | 110 | | |
| 5 | | | 17 | 27 | 15 | 12 | | | 111 | | |
| | 14 | SILTY SAND (SM), medium dense, brown, moist | | | | | | | | | |
| | | SANDY LEAN CLAY (CL), stiff, brownish yellow, gray, with ferrous nodules, moist | 16 | 32 | 16 | 16 | 66 | | 110 | | |
| 10 | | | | | | | | | | | |
| | 32 | SILTY SAND (SM), dense, brown, gray, wet | | | | | | | | | |
| 15 | | | | | | | | | | | |
| 20 | 35 | | | | | | | | | | |

UNDRAINED SHEAR STRENGTH, tsf: ▲ HAND PENETROMETER; ▮ TORVANE; ● UNCONFINED COMPRESSION; ○ UNCONSOLIDATED-UNDRAINED TRIAXIAL (scale 0.5, 1.0, 1.5, 2.0, 2.5)

WATER OBSERVATIONS:
▽: WATER ENCOUNTERED AT 18.0 ft. DURING DRILLING.
▼: WATER DEPTH AT 9.0 ft. AFTER 24 HOURS.

DRY AUGER: 0 TO 20 ft.
WET ROTARY: ___ TO ___ ft.

DRILLED BY: GET
LOGGED BY: Abraham

OVM2 09-544E.GPJ OVM.GDT 3/2/10

# LOG OF BORING NO. B-9



Geotech Engineering and Testing
800 Victoria Drive
Houston, Texas 77022
Phone: 713-699-400 Fax: 713-699-9200

PROJECT: Barryknoll Drainage Improvements From Bunker Hill Road to Gessner Road
LOCATION: Houston, Texas
PROJECT NO.: 09-544E STATION NO.:
DATE: 1-24-10 COMPLETION DEPTH: 20.0 ft.

ELEVATION: Existing Grade

| DEPTH, ft | SPT N-VALUE blows per foot | DESCRIPTION | NATURAL MOISTURE CONTENT, % | LIQUID LIMIT, % | PLASTIC LIMIT, % | PLASTICITY INDEX, % | PERCENT PASSING NO. 200 SIEVE | SUCTION (pF) | DRY UNIT WEIGHT, pcf | PERCENT COMPACTION | PASSING/FAILING (P/F) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | CONCRETE PAVEMENT (7.6") | | | | | | | | | |
| | | FILL: SILTY SAND (SM), gray, brown, with root fibers, moist | | | | | | | | | |
| | | SANDY LEAN CLAY (CL), stiff, brownish yellow, gray, with ferrous nodules, moist | 17 | 28 | 15 | 13 | 59 | | 111 | | |
| 5 | 11 | SILTY SAND (SM), medium dense, gray, moist | | | | | | | | | |
| | 10 | - loose, wet 6' to 8' | | | | | | | | | |
| | | LEAN CLAY WITH SAND (CL), soft, gray, moist | 21 | 32 | 16 | 16 | 76 | | 110 | | |
| 10 | | SILTY SAND (SM), gray, wet | | | | | | | | | |
| 20 | | | | | | | | | | | |

UNDRAINED SHEAR STRENGTH, tsf: ▲ HAND PENETROMETER; ▮ TORVANE; ● UNCONFINED COMPRESSION; ○ UNCONSOLIDATED-UNDRAINED TRIAXIAL (scale 0.5, 1.0, 1.5, 2.0, 2.5)

WATER OBSERVATIONS:
▽: WATER ENCOUNTERED AT 11.0 ft. DURING DRILLING.
▼: WATER DEPTH AT 6.0 ft. AFTER 24 HOURS. THE HOLE CAVED IN AT 12.0 ft. AFTER 24 HOURS.

DRY AUGER: 0 TO 20 ft.
WET ROTARY: ___ TO ___ ft.

DRILLED BY: GET
LOGGED BY: Abraham

# KEY TO LOG TERMS AND SYMBOLS

## UNIFIED SOIL CLASSIFICATIONS

| Symbol | | Material Descriptions |
|---|---|---|
| GW | | WELL GRADED-GRAVELS, GRAVEL-SAND MIXTURES LITTLE OR NO FINES |
| GP | | POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES |
| GM | | SILTY GRAVELS, GRAVEL-SAND SILT MIXTURES |
| GC | | CLAY GRAVELS, GRAVEL-SAND CLAY MIXTURES |
| SW | | WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES |
| SP | | POORLY GRADED SANDS, OR GRAVELLY SANDS, LITTLE OR NO FINES |
| SM | | SILTY SANDS, SAND-SILT MIXTURES a |
| SC | | CLAYEY SANDS, SAND-SILT MIXTURES b |
| ML | | INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY |
| CL | | INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY GRAVELLY CLAYS, SANDY CLAYS, LEAN CLAYS |
| OL | | ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY |
| MH | | INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS |
| CH | | INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS |
| OH | | ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS |
| PT | | PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENT |
| | | FILL SOILS |

## TERMS CHARACTERIZING SOIL STRUCTURE

| | | |
|---|---|---|
| Slickensided | - | Having incline planes of weakness that are slick and glossy in appearance. |
| Fissured | - | Containing shrinkage cracks frequently filled with fine sand or silt: usually vertical. |
| Laminated | - | Composed of thin layers of varying colors and soil sample texture. |
| Interbedded | - | Composed of alternate layers of different soil types. |
| Calcareous | - | Containing appreciable quantities of calcium carbonate. |
| Well Graded | - | Having wide range in grain sizes and substantial amounts of all intermediate particle sizes. |
| Poorly Graded | - | Predominantly of one grain size, or having a range of sizes with some intermediate sizes missing. |
| Pocket | - | Inclusion of material of different texture that is smaller than the diameter of the sample. |
| Parting | - | Inclusion less than ⅛-inch thick extending through the sample. |
| Seam | - | Inclusion ⅛- to 3-inches thick extending through the sample. |
| Layer | - | Inclusion greater than 3-inches thick extending through the sample. |
| Interlayered | - | Soils sample composed of alternating layers of different soil types. |
| Intermixed | - | Soil samples composed of pockets of different soil type and layered or laminated structure is not evident. |

COARSE GRAINED SOILS (major portion retained on No. 200 Sieve): Includes (1) clean gravels and sands, and (2) silty or clayey gravels and sands. Conditions rated according to standard penetration test (SPT)* as performed in the field.

| Descriptive Terms | Blows Per Foot* |
|---|---|
| Very Loose | 0 – 4 |
| Loose | 5 – 10 |
| Medium Dense | 11 – 30 |
| Dense | 31 – 50 |
| Very Dense | over 50 |

* 140 pound weight having a free fall of 30-inches

FINE GRAINED SOILS (major portion passing No. 200 Sieve): Include (1) inorganic or organic silts and clays, (2) gravelly, sandy, or silty clays, and (3) clayey silts. Consistency is rated according to shearing strength as indicated by hand penetrometer readings or by unconfined compression tests.

| Descriptive Term | Undrained Shear Strength Ton/Sq. Ft. |
|---|---|
| Very Soft | Less than 0.13 |
| Soft | 0.13 to 0.25 |
| Firm | 0.25 to 0.50 |
| Stiff | 0.50 to 1.00 |
| Very Stiff | 1.00 to 2.00 |
| Hard | 2.00 or higher |

**NOTE:** Slickensided and fissured clays may have lower unconfined compressive strengths than shown above because of weakness or cracks in the soil. The consistency ratings of such soils are based on hand penetrometer readings.

### SOIL SAMPLERS

- SHELBY TUBE SAMPLER
- STANDARD PENETRATION TEST
- AUGER SAMPLING

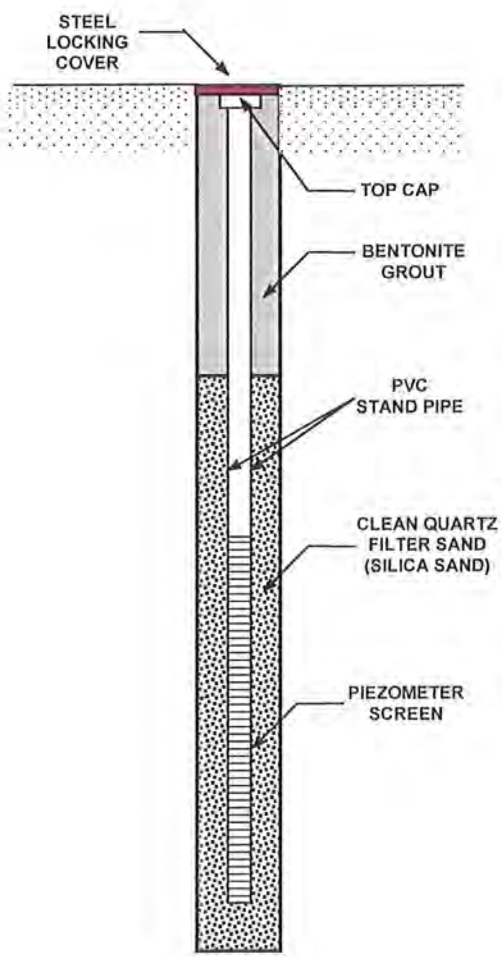
### TERMS CHARACTERIZING ROCK PROPERTIES

| | |
|---|---|
| VERY SOFT OR PLASTIC | Can be remolded in hand: corresponds in consistency up to very stiff in soils. |
| SOFT | Can be scratched with fingernail. |
| MODERATELY HARD | Can be scratched easily with knife; cannot be scratched with fingernail. |
| | Difficult to scratch with knife. |
| VERY HARD | Cannot be scratched with knife. |
| POORLY CEMENTED OR FRIABLE | Easily crumbled. |
| CEMENTED | Bounded Together by chemically precipitated materials. |
| UNWEATHERED | Rock in its natural state before being exposed to atmospheric agents. |
| SLIGHTLY WEATHERED | Noted predominantly by color change with no disintegrated zones. |
| WEATHERED | Complete color change with zones of slightly decomposed rock. |
| EXTREMELY WEATHERED | Complete color change with consistency, texture, and general appearance or soil. |

## PIEZOMETER INSTALLATION DATA

| Piezometer No. | Boring No. | Top of Riser-Height, ft | Piezometer Tip | | Depth to Filter Sand, ft. | | Bentonite Grout, ft. | |
|---|---|---|---|---|---|---|---|---|
| | | | Depth, ft. | Screen Length, ft. | Top | Bottom | Top | Bottom |
| P-1 | B-1 | 0.00 | 20.00 | 5.00 | 8.00 | 20.00 | 0.00 | 8.00 |
| P-2 | B-4 | 0.00 | 20.00 | 5.00 | 8.00 | 20.00 | 0.00 | 8.00 |
| P-3 | B-8 | 0.00 | 20.00 | 5.00 | 8.00 | 20.00 | 0.00 | 8.00 |

Notes: (1) Depth is referenced to ground surface.

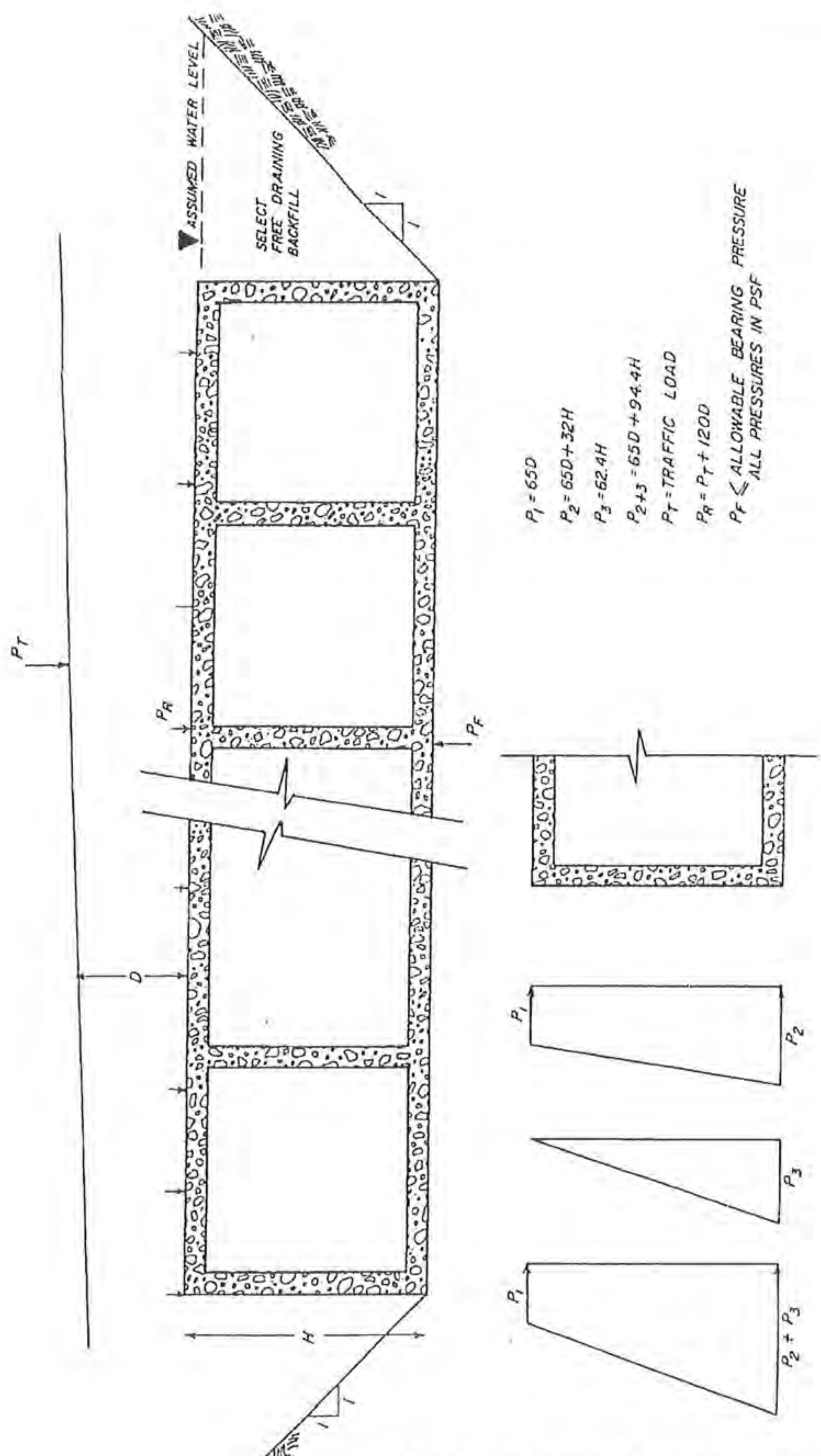



Note: Drawing is not to scale.

# PIEZOMETER READING TABLE (09-544)
# BERRYKNOLL DRAINAGE IMPROVEMENTS

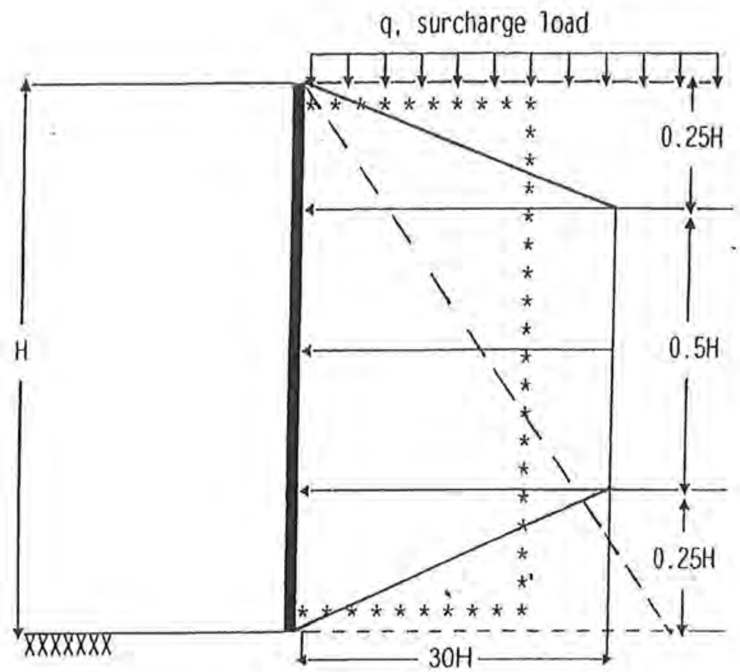
| Piezometer No. | Groundwater Depths During Drilling from Ground Surface, ft. | Piezometric Level, ft. | | | | | |
|---|---|---|---|---|---|---|---|
| | | February 07, 2010 | | | February 16, 2010 | | |
| | | Before Bailing | After Bailing | | Before Bailing | After Bailing | |
| | | | Time (Min.) | Depth | | Time, (Min.) | Depth |
| P-1 (20') | 17' 0" | 7' 6" | 1 | 9' 6" | 7' 4" | 1 | 8' 5" |
| | | | 2 | 8' 11" | | 2 | 7' 10" |
| | | | 5 | 8' 6" | | 5 | 7' 6" |
| | | | 10 | 7' 10" | | 10 | 7' 4" |
| | | | 20 | 7' 8" | | 20 | 7' 4" |
| | | | 30 | 7' 6" | | 30 | 7' 4" |
| | | | 60 | 7' 6" | | 60 | 7' 4" |
| P-2 (20') | 19' 0" | 10' 0" | 1 | 14' 0" | 9' 0" | 1 | 14' 0" |
| | | | 2 | 13' 5" | | 2 | 13' 10" |
| | | | 5 | 12' 10" | | 5 | 13' 5" |
| | | | 10 | 10' 11" | | 10 | 13' 2" |
| | | | 20 | 10' 6" | | 20 | 11' 8" |
| | | | 30 | 10' 0" | | 30 | 11' 8" |
| | | | 60 | 10' 0" | | 60 | 11' 8" |
| P-3 (20') | 18' 0" | 5' 6" | 1 | 14' 5" | 4' 6" | 1 | 13' 3" |
| | | | 2 | 14' 1" | | 2 | 12' 11" |
| | | | 5 | 13' 6" | | 5 | 12' 4" |
| | | | 10 | 12' 9" | | 10 | 12' 0" |
| | | | 20 | 12' 7" | | 20 | 11' 10" |
| | | | 30 | 12' 0" | | 30 | 11' 10" |
| | | | 60 | 12' 0" | | 60 | 11' 10" |

Note: Borings B-1, B-4 and B-8 were turned into Piezometers P-1, P-2 and P-3, respectively. The piezometer depths are shown in parenthesis.




## BOX CULVERT DESIGN PARAMETERS

## LATERAL EARTH PRESSURE DIAGRAM




Legend:

———————— Braced Excavation (stiff clays)

* * * * * * * * * * * * * Braced Excavation (sands)

- - - - - - - - - - - - - - - Cantilivered sheeting

Active Pressure:

(a) Braced Excavation (stiff clays) = 0.5q + 30H + 62.4H

(b) Braced Excavation (sands) = 0.4q + 18H + 62.4H

(c) Cantilivered sheeting = 0.7q + 42H + 62.4H

where: q = surcharge load, psf
H = wall height, ft.

Notes:

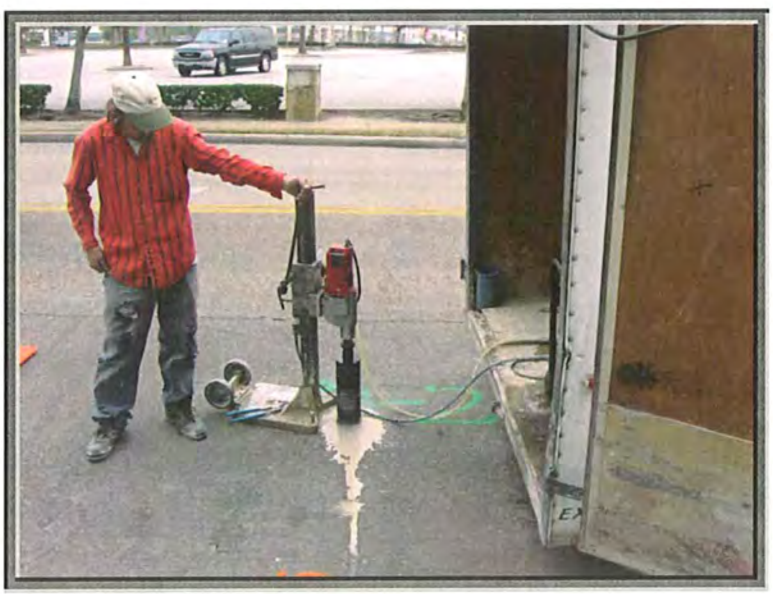
1. The above Active Pressure Equations account for the groundwater at the surface.
2. The final lateral pressures should be reviewed prior to construction.
3. Trench excavation and construction should be observed by a geotechnical engineer.
4. The means and methods for a safe excavation is the responsibility of the contractor.

## APPENDIX A

**Project Site Pictures**

**PROJECT PICTURES**
Report No. 09-544e

**A-1**



**A-2**

## PROJECT PICTURES

Report No. 09-544e

**A-3**


**A-4**

**PROJECT PICTURES**
Report No. 09-544e

**A-5**

**A-6**

**PROJECT PICTURES**
Report No. 09-544e


**A-7**

**A-8**

## APPENDIX B

**Trench Safety Report**

GEOTECH ENGINEERING and TESTING

ACCREDITED

*Geotechnical, Environmental, Construction Materials, and Forensic Engineering*

Lockwood, Andrews & Newnam, Inc.
2925 Briarpark Drive, Suite 400
Houston, Texas 77042

Report No. 09-544E-1
Report Type: ST/U
February 26, 2010

Attention: Ms. Tara G. Godwin, P.E.

Subject: Trench Safety Recommendations
Proposed Barryknoll Drainage Improvements
From Ditch W151 to Bunker Hill (2700-ft±)
And From Ditch W151 to Gessner Road (1400-ft±)
Houston, Texas
Memorial City Redevelopment Authority
TIRZ CIP No. T-1715
LAN Project No. 120-10308-000-555

Dear Madam:

Submitted here is Geotech Engineering and Testing (GET) recommendations on trench safety for the proposed Barryknoll Drainage Improvements project. The following is our trench safety recommendations together with the earth pressure diagram for the braced excavations.

General

Occupational Safety and Health Administration (OSHA) has required a trench protective system for trenches deeper than five-ft. Trenches that are deeper than five-ft, should be shored, sheeted, braced or laid back to a stable slope, or some other appropriate means of protection should be provided where workers might be exposed to moving ground or caving. OSHA developed a soil classification system to be used as a guideline in determining protective requirements for trench excavations.

OSHA classification system categorizes the soil and rock in four types based on shear strength and stability. These classifications are summarized in the following report sections.

Stable Rock

means natural solid mineral matter that can be excavated with vertical sides and remain intact while exposed.

Type A Soil

means cohesive soils with an unconfined compressive strength of 1.5-ton per square foot (tsf) or greater. Examples of cohesive soils are: clay, silty clay, sandy clay, clay loam, silty clay loam, sandy clay loam, caliche and hardpan. No soil is Type A if:

- o The soil is fissured; or
- o The soil is subject to vibration from heavy traffic, pile driving or similar effects; or

- The soil has been previously disturbed; or
- The soil is part of a slope, layered system where the layers dip into the excavation on a slope of 4(h): 1(v) or greater; or
- The material is subject to other factors that would require it to be classified as a less stable material.

Type B Soil

- Cohesive soil with an unconfined compressive strength greater than 0.5 tsf but less than 1.5 tsf; or
- Granular cohesionless soils including: angular gravel, silt, silt loam, sandy loam, and in some case, silty clay loam and sandy clay loam; or
- Previously disturbed soils except those which would otherwise be classified as Type C soil; or
- Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subject to vibration; or
- Dry rock that is not stable; or
- Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than 4(h): 1(v), but only if the material would otherwise be classified as Type B.

Type C Soil

- Cohesive soil with an unconfined compressive strength of 0.5 tsf or less; or
- Granular soils including gravel, sand, and loamy sand; or
- Submerged soil or soil from which water is freely seeping; or
- Submerged rock that is not stable; or
- Materials in a sloped, layered system where the layers dip into the excavation on a slope 4 (h) : 1(v) or steeper.

Under the assumption that appropriate groundwater control measures are carried out, and the groundwater table, if present, is lowered and maintained at least 3 feet below the excavation depths, the stable cohesive soils (CL) & (CH), with unconfined compressive strength greater than 0.5 tsf, are classified as OSHA soil Type "B". The granular soils, which are less stable, are classified as OSHA soil Type "C".

Based on our geotechnical exploration and laboratory test results details of soil classifications at each boring are summarized below:

## OSHA SOIL TYPE

| Boring No. | Depth Range [1], ft | Soil Type | OSHA Soil Classification |
|---|---|---|---|
| B-1 | 0 – 2 | Fill: Sandy Lean Clay (CL) | B |
| | 2 – 4 | Sandy Lean Clay (CL) | C |
| | 4 – 6 | Sandy Lean Clay (CL) | B |
| | 6 – 12 | Sandy Lean Clay (CL) | C |
| | 12 – 20 | Silty Sand (SM) | C |
| B-2 | 0 – 2 | Fill: Sandy Lean Clay (CL) | C |
| | 2 – 6 | Sandy Lean Clay (CL) | B |
| | 6 – 11 | Sandy Lean Clay (CL) | C |
| | 11 – 20 | Silty Sand (SM) | C |
| B-3 | 0 – 2 | Fill: Sandy Lean Clay (CL) | C |
| | 2 – 4 | Sandy Lean Clay (CL) | B |
| | 4 – 13 | Sandy Lean Clay (CL) | C |
| | 13 – 20 | Silty Sand (SM) | C |
| B-4 | 0 – 2 | Fill: Lean Clay with Sand (CL) | C |
| | 2 – 4 | Sandy Lean Clay (CL) | B |
| | 4 – 12 | Sandy Lean Clay (CL) | C |
| | 12 – 20 | Silty Sand (SM) | C |
| B-5 | 0 – 2 | Fill: Sandy Lean Clay (CL) | C |
| | 2 – 4 | Sandy Lean Clay (CL) | B |
| | 4 – 13 | Sandy Lean Clay (CL) | C |
| | 13 – 20 | Silty Sand (SM) | C |
| B-6 | 0 – 2 | Fill: Sandy Lean Clay (CL) | B |
| | 2 – 6 | Sandy Lean Clay (CL) | C |
| | 6 – 20 | Silty Sand (SM) | C |
| B-7 | 0 – 2 | Fill: Silty Sand (SM) | C |
| | 2 – 8 | Silty Sand (SM) | C |
| | 8 – 10 | Sandy Lean Clay (CL) | B |
| | 10 – 20 | Silty Sand (SM) | C |

| Boring No. | Depth Range (1), ft | Soil Type | OSHA Soil Classification |
|---|---|---|---|
| B-8 | 0 – 2 | Fill: Sandy Lean Clay (CL) | B |
| | 2 – 6 | Sandy Lean Clay (CL) | C |
| | 6 – 8 | Silty Sand (SM) | C |
| | 8 – 12 | Sandy Lean Clay (CL) | C |
| | 12 – 20 | Silty Sand (SM) | C |
| B-9 | 0 – 2 | Fill: Silty Sand (SM) | C |
| | 2 – 4 | Sandy Lean Clay (CL) | B |
| | 4 – 8 | Silty Sand (SM) | C |
| | 8 – 10 | Lean Clay with Sand (CL) | C |
| | 10 – 20 | Silty Sand (SM) | C |

Note: 1. Refer to each boring log of soils stratigraphy

Stockpiling of excavated materials may not be allowed near the banks of excavated areas. Generally, a distance of one-half the excavation depth on both sides of the trench should be kept clear of any excavated material.

In the event that open excavation is not in use, the excavation for the facility should be provided with proper trench support system. The trench should be provided with a temporary shoring system on excavations deeper than five-ft. The trenches can be made using shored, sheeted and braced, laid back stable slope or other means of appropriate protection system should be provided where workers are exposed to moving ground or caving. The slopes may be constructed in accordance with Table B-1 and shoring may be constructed in accordance with Table C-1.1, Table C-1.2 and Table C-1.3 of 29 CFR Part 1926 of OSHA.

In the event that a trench sheeting is used, the sheeting can be constructed in the form of cantilever sheeting or with bracing. Lateral earth pressures for each method used are summarized on Plate 1. The trenching and shoring operations should follow OSHA Standards. We recommend that a geotechnical engineer monitor all phases of trench excavation and bracing to assure trench safety.

Timber shoring as outlined in 29 CFR Part 1926 of OSHA recommendation may be used in the construction of trench supporting system.

Groundwater Conditions

We understand that the depths of the storm sewers will not be greater than 10-ft below existing grade. Our short-term field exploration indicates that groundwater was encountered at depths ranging from 11- to 19-ft during drilling. After 24-hours, groundwater level along the alignments rose to depths ranging from 6- to 14-ft. Our short-term field exploration also indicated that the some of the holes were caved-in at depths ranging from 12- to 15-ft after 24 hours of drilling. Hence, groundwater dewatering may be required. Fluctuations in groundwater can occur as a function of seasonal moisture variation. Groundwater control recommendations are presented in the following report sections.

In the event that groundwater is encountered during construction, it is our opinion that groundwater should be lowered to a depth of at least three-ft below the deepest excavation grade in order to provide dry working conditions and firm bedding. Any minor water inflow in cohesive soil layers can probably be removed using a sump-pump or trench sump-pump. Wellpoint system can be used in the area where silty sand soils are present. The selection and proper implementation of an effective groundwater control system is the responsibility of the contractor.

Design of a wellpoint system should consider the amount of groundwater to be lowered and the permeability of the affected soils. The selection and proper implementation of an effective groundwater control system is the responsibility of the contractor. The design of groundwater and surface water should be in accordance with the City of Houston Specifications, Section 01578 – Control of Ground Water and Surface Water.

**The results of our field exploration and laboratory testing indicate that unsatisfactory soils for excavation, such as soft sandy lean clay (CL), lean clay with sand (CL) and silty sand (SM) soils exist at various depths in the borings along storm sewer lines. A summary of the unsatisfactory soils locations and depths are as follows:**

| Boring(s) | Depth Range, ft. |
|---|---|
| B-1 | 2 to 4 and 6 to 20 |
| B-2 | 6 to 20 |
| B-3 | 0 to 2, 6 to 8 and 13 to 20 |
| B-4 | 0 to 2 and 6 to 20 |
| B-5 | 0 to 2, 6 to 8 and 13 to 20 |
| B-6 | 4 to 20 |
| B-7 | 0 to 8 and 10 to 20 |
| B-8 | 6 to 8 and 12 to 20 |
| B-9 | 0 to 2 and 4 to 20 |

If these conditions are encountered during the time of construction, suitable groundwater control measures should be implemented in accordance with the City of Houston Specification 01578 – Control of Groundwater and Surface Water. Furthermore, the contractor may have to over excavate an additional 6 inches and remove unstable or unsuitable materials with approval by geotechnical engineer, then place an equal depth of cement stabilization sand.

Due to potential variability of the on-site soils, unstable trench conditions may still exist in the areas where we did not conduct our borings. If these conditions are encountered during the time of construction, a stable trench should be provided to allow proper bedding and installation.

Our recommendation on trench safety along the subject alignment does not address the effects of excavations on existing buildings /facilities at the project site. This study was outside the scope of our work.

We appreciate the opportunity to be of service. Should you have any questions or need additional assistance, please call.

Very truly yours,

GEOTECH ENGINEERING AND TESTING

Dave Sikdar, Ph.D.
Project Manager

Al Dutta, Ph.D.
Engineering Manager

David A. Eastwood, P.E., C.A.P.M.
Principal Engineer

STATE OF TEXAS
D. A. EASTWOOD
51419
REGISTERED
PROFESSIONAL ENGINEER

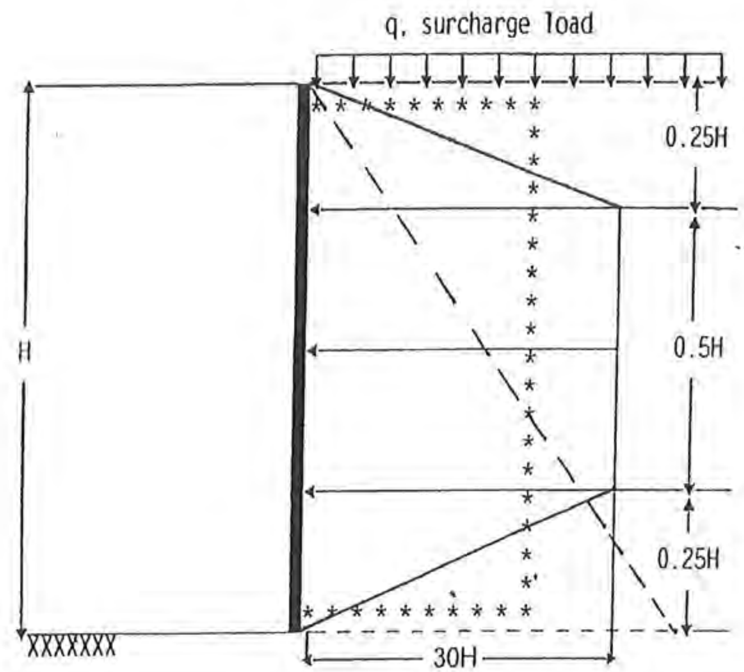
David A. Eastwood
02/26/10

BJ/AD/DAE/bj

Copies Submitted: (2)

Enclosure: Trench Lateral Earth Pressure Diagrams, Plate 1

## LATERAL EARTH PRESSURE DIAGRAM




Legend:

———————— Braced Excavation (stiff clays)
* * * * * * * * * * * * * Braced Excavation (sands)
- - - - - - - - - - - - - - - Cantilivered sheeting

Active Pressure:

(a) Braced Excavation (stiff clays) = 0.5q + 30H + 62.4H
(b) Braced Excavation (sands) = 0.4q + 18H + 62.4H
(c) Cantilivered sheeting = 0.7q + 42H + 62.4H

where: q = surcharge load, psf
H = wall height, ft.

Notes:

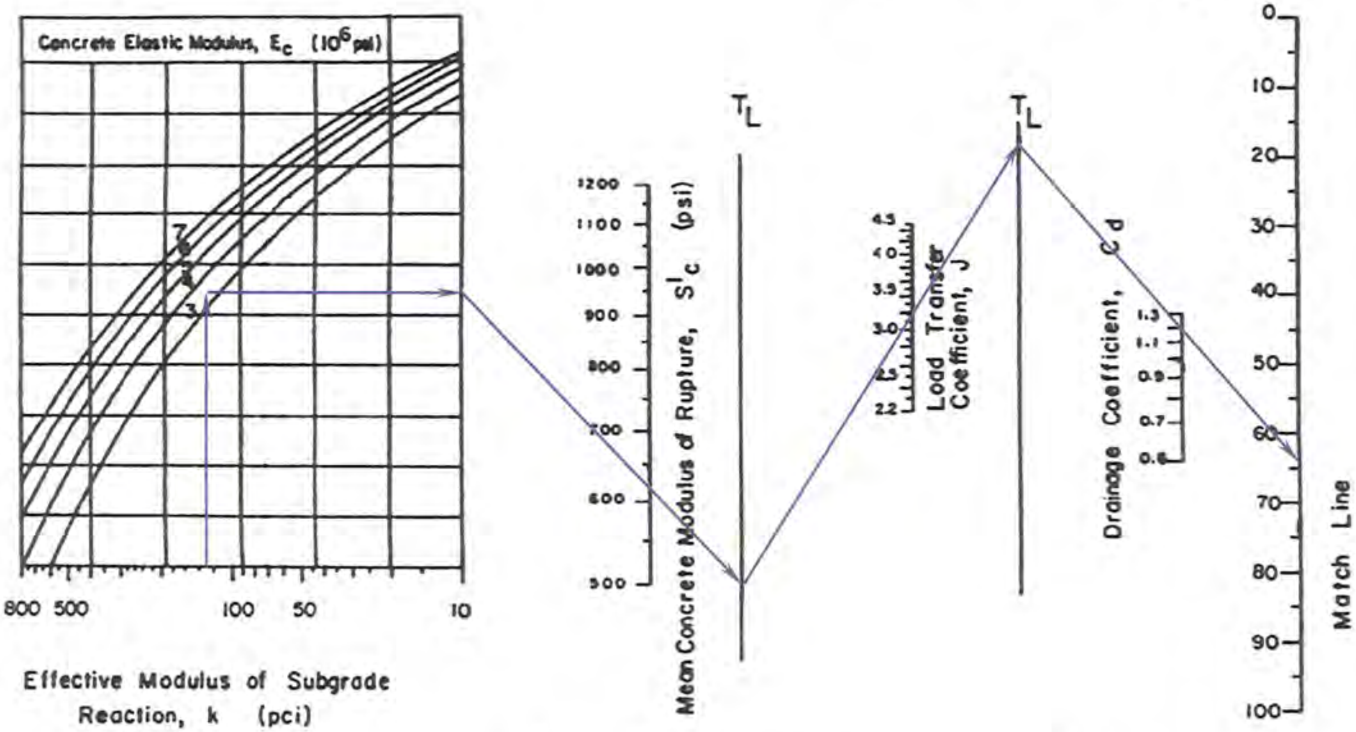
1. The above Active Pressure Equations account for the groundwater at the surface.
2. The final lateral pressures should be reviewed prior to construction.
3. Trench excavation and construction should be observed by a geotechnical engineer.
4. The means and methods for a safe excavation is the responsibility of the contractor.

# APPENDIX C

## Pavement Design Computations

NOMOGRAPH SOLVES:

$$\log_{10} W_{18} = Z_R * S_o + 7.35*\log_{10}(D+1) - 0.06 + \frac{\log_{10}\left[\frac{\Delta PSI}{4.5 - 1.5}\right]}{1 + \frac{1.624*10^7}{(D+1)^{8.46}}} + (4.22-0.32p_t)*\log_{10}\left[\frac{S_c' * C_d \left[D^{0.75} - 1.132\right]}{215.63*J\left[D^{0.75} - \frac{18.42}{(E_c/k)^{0.25}}\right]}\right]$$




Legend :

— Pavement Design for This Study

Calculation:

$K = 130$ pci

$E_c = 3.37 \times 10^6$

$S_c = 620$ psi

$J = 3.2$

$C_d = 1.2$

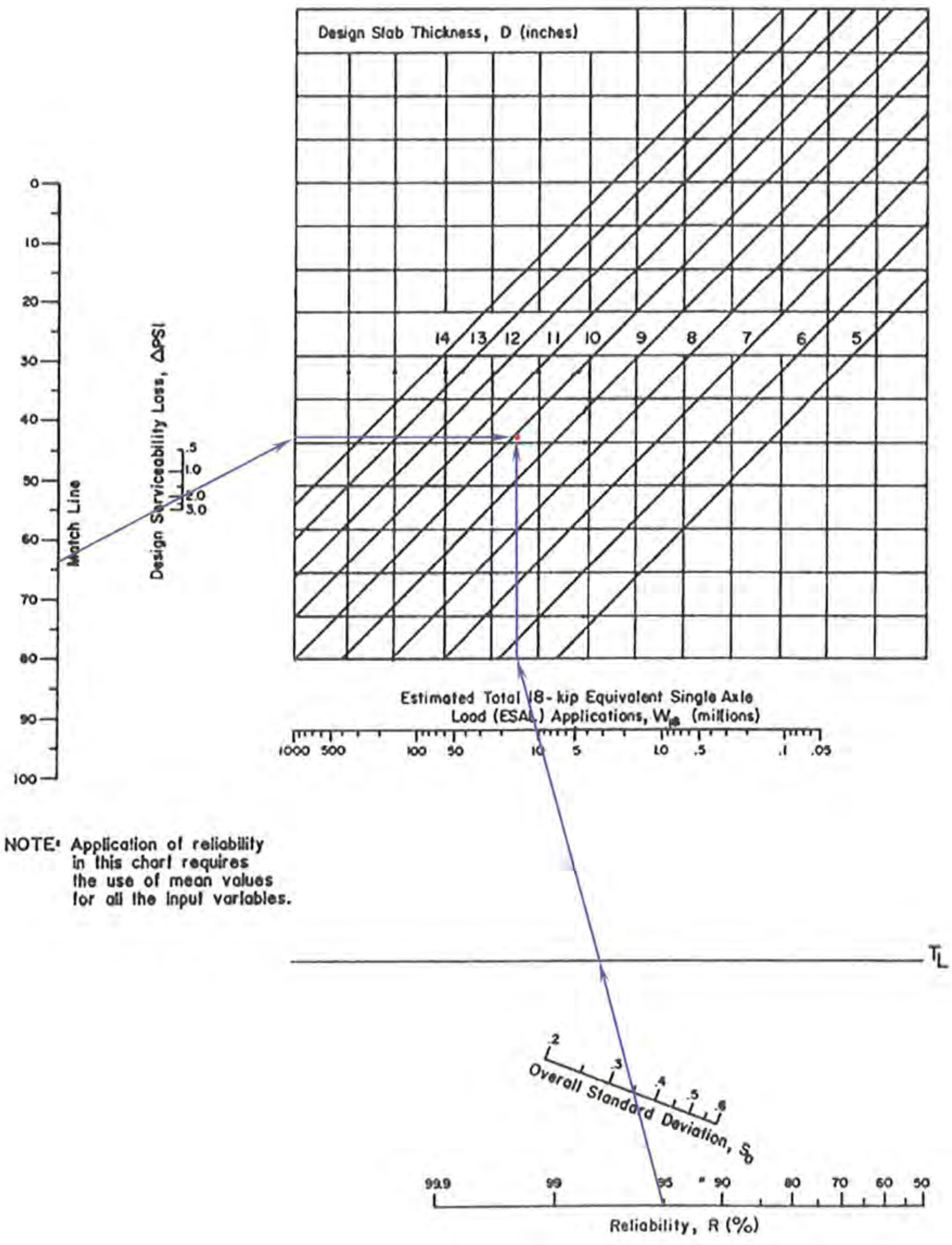
$S_o = 0.35$

$R = 95\%$

$\Delta PSI = 4.5-2.5 = 2.0$

Solution:

| $W_{18}$ (18kip ESAL x $10^6$) | Concrete Pavement Thickness, inches |
|---|---|
| 10.0 | 10.0 |



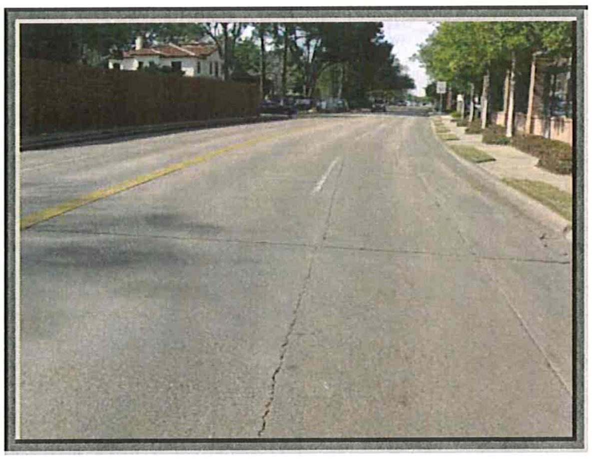

DESIGN CHART FOR RIGID PAVEMENTS BASED ON USING MEAN VALUES FOR EACH INPUT VARIABLES (SEGMENT 2)

# APPENDIX I

# GEOLOGIC FAULT STUDY

# REVISED
# LIMITED PHASE I GEOLOGIC FAULT STUDY
# PROPOSED BARRYKNOLL DRAINAGE IMPROVEMENTS
# FROM DITCH W151 TO BUNKER HILL (2700-FT±)
# AND FROM DITCH W151 TO GESSNER ROAD (1400-FT±)
# HOUSTON, TEXAS
# MEMORIAL CITY REDEVELOPMENT AUTHORITY
# TIRZ CIP NO. T-1715
# LAN PROJECT NUMBER 120-10308-000-555
# REVISION I

**REPORT NO. 09-544E**



**TO**

**LOCKWOOD, ANDREWS & NEWNAM, INC**
**HOUSTON, TEXAS**

**BY**

**GEOTECH ENGINEERING AND TESTING**

**SERVICING**

**TEXAS, LOUISIANA, NEW MEXICO, OKLAHOMA**

*www.geotecheng.com*

**FEBRUARY 2010**

TEXAS BOARD OF PROFESSIONAL ENGINEERS
REGISTRATION NUMBER F-001183

Lockwood, Andrews & Newnam, Inc.
2925 Briarpark Drive, Suite 400
Houston, Texas 77042

Report No. 09-544E
Report Type: ST/F/G/FI
February 22, 2010

Attention: Ms. Tara G. Godwin, P.E.

**REVISED
LIMITED PHASE I GEOLOGIC FAULT STUDY
PROPOSED BARRYKNOLL DRAINAGE IMPROVEMENTS
FROM DITCH W151 TO BUNKER HILL (2700-FT±)
AND FROM DITCH W151 TO GESSNER ROAD (1400-FT±)
HOUSTON, TEXAS
MEMORIAL CITY REDEVELOPMENT AUTHORITY
TIRZ CIP NO. T-1715
LAN PROJECT NUMBER 120-10308-000-555
REVISION I**

Dear Madam:

Submitted here is our report on the Limited Phase I Geologic Fault Study for the above-referenced project. This study was conducted in accordance with our Proposal No. P09-150, Revision I, dated August 19, 2009 and was authorized by Mr. Rafael Ortega, P.E., Vice President on December 21, 2009 and subsequently by Mrs. Veda Montalbano, P.E., Project Manager on December 31, 2009.

This report presents the results of our site reconnaissance, review of site geology, aerial photographs, published fault maps, and our conclusions.

We appreciate the opportunity to be of service. Should you have any questions or need additional assistance, please call.

Very truly yours,

GEOTECH ENGINEERING AND TESTING

Dave Sikdar, Ph.D.
Project Manager

Al Dutta, Ph.D.
Engineering Manager

David A. Eastwood, P.E., C.A.P.M.
Principal Engineer

STATE OF TEXAS
D. A. EASTWOOD
51419
REGISTERED PROFESSIONAL ENGINEER

David A. Eastwood
02/22/10

DS/AD/DAE/ds

Copies Submitted: (2)

## TABLE OF CONTENTS



## ILLUSTRATIONS

## 1.0 INTRODUCTION

Berryknoll Drainage Improvements, extends along Berryknoll Lane from Ditch W151 to Bunker Hill with approximate length of 2700-ft and from Ditch W151 to Gessner with approximate length of 1400-ft. The project alignment is located along the right of way of Barryknoll Lane between Bunker Hill Road and Gessner Road in Houston, Texas from east to west.

The objective of this study was to conduct a limited phase I geologic fault study to evaluate the possibility of surface faulting along the project alignment. This objective was accomplished by (1) reviewing the existing published fault maps from Geotech Engineering and Testing (GET) Library, (2) evaluating aerial photographs available at GET Library, Positive Image Studios, Inc. and Terraserver website (www.terraserver.com), (3) performing an on-site reconnaissance with particular attention relative to features and/or topographical relief, based on our review of items (1) and (2). A site vicinity map is shown on Plate 1 and site plan is presented on Plate 2. The aerial photographs from Terraserver website (www.terraserver.com) are shown in Appendix A and pictures along the project alignment and surrounding areas are presented in Appendix B.

## 2.0 REVIEW OF PUBLISHED FAULT MAPS

### 2.1 General

Existing fault maps (Ref. 1 through Ref. 6) represent one of the screening methods used for evaluating the location of known active faults. Active faults in the Houston area are not a new discovery. Rates of movement on many of the faults in Houston exceed 1½-inches per year (Ref. 5). Despite the lack of seismicity, these faults constitute a considerable geologic hazard. Structures situated on the surface traces of these faults may suffer considerable damage. Water and sewer lines are particularly susceptible to disruption by fault movements. Deformation associated with faulting disturbs any man made structure crossing the fault. The damage is done primarily by differential movements across the fault zone itself, which generally is accompanied by tilting and other distortions that extend outward. These effects of deformations need to be allowed in the placement of street alignment, etc.

### 2.2 Review of Published Fault Maps

Our review of fault maps presented in Plates 3 through 7 indicates that there are no major active faults located along the project alignment. However, faults may be present that are absent from the published maps. The Long Point, Piney Point and Addicks faults are close to the project alignment. The Long Point Fault is a concave upward growth fault which is over 10 miles in length and spans much of the northwest and west part of the Houston metropolitan area (Ref. 7). Piney Point fault is antithetic to the Long Point Fault and dips northward at an angle of 70° to 76° towards north and spans for about 2 miles between Frandora Lane to the Katy Freeway at Voss Road (Ref. 8).

The Addicks Fault system extends from the Baker Reservoir towards Bush Continental Airport at northeast direction (Ref. 7). The closest known fault to the project alignment is Piney Point fault located approximately 0.8 miles (on Plates 3 and 4) to the south and southeast of the project alignment. Long Point fault is located approximately 0.9-mile (on Plates 3 and 4) to the north of the project alignment. Addicks fault is located approximately 8-miles (on Plates 3 and 4) to the west of the project alignment. No special study of movement rates for any of this fault was attempted. The fault maps are presented on Plates 3 through 7.

## 3.0 STUDY OF AERIAL PHOTOGRAPHS

### 3.1 General

Aerial photographs can assist in the detection of faults on grass-covered areas, provided the surface has not been disturbed excessively in recent years. Linear contrasts in tone and texture, evident on black and white photographs, result from differences in soil moisture and vegetation characteristics. Micro-drainage differences typically occur between the up-thrown and down-thrown sides of the fault and make the approximate location evident on aerial photographs taken under favorable conditions.

### 3.2 Review of Aerial Photographs

Aerial photographs from 1956 to 2008 (Ref. 9) available at Positive Image Studios, Inc. and Terraserver website (www.terraserver.com) were reviewed for this project. Selected aerial photographs are presented in Appendix A. Our review of aerial photographs from 1956 through 1961 indicated that the project alignment and its vicinity were vacant and covered with vegetation. The Berryknoll Lane and the memorial City mall located at the north of the project alignment were developed since 1965. The aerial photographs indicated that much of the developments including residences and commercial buildings around the project alignment occurred between 1967 and 1982. The drainage ditch W151 near by project alignment was constructed in 1996. Our review of the aerial photographs from 1995 to 2007 also indicates that the project alignment and the surrounding areas were mostly developed with residential and commercial buildings.

We did not observe the presence of any lineal features or tonal contrast indicative of faulting at the project area. Based on the review of the aerial photographs, no evidence of faulting was observed along the project alignment.

## 4.0 SITE RECONNAISSNACE

### 4.1 General

A site reconnaissance of the project alignment was performed to evaluate the evidence of any surface faulting, based on information obtained from existing fault maps and aerial photographs. Evidence of an active fault is often characterized by well-defined pavement breaks and building damage. Damaged features are further characterized by up-down polarity, small surface scarps and local drainage anomalies.

### 4.2 Site Visit

A site reconnaissance of the project alignment was conducted by Mr. Dave Sikdar, Ph.D. of Geotech Engineering and Testing (GET) on January 11, 2010. Our reconnaissance included observations of the streets, driveways, parking lots, creek and residences in the vicinity along the project alignment. The project alignment is approximately 4100-ft long roadway (Berryknoll Lane) in Houston, Texas between Bunker Hill Road and Gessner Road from east to west.

Currently, the project alignment is an undivided four lane concrete roadway, stretching from east to west. Bunker Hill Road, Plantation Road, Bettina Court, Strey lane, Hollyridge Drive, Riedel Drive, Barracuda Drive, Memorial Village Drive, Dolphin Court and Bunker Hill Drive pass over Berryknoll Lane through the project alignment. In general, residences including Memorial Village Town Homes, Memorial City Shopping Mall, Valero Energy Store, Paradigm Commercial Building, Sears Auto Center and many single family homes are located along the project alignment.

Our on-site reconnaissance was made at the project site to identify whether there is any clearly visible evidence of geologic faults. During our site visit, there was no evidence of faulting. Project site pictures are presented in Appendix B.

## 5.0 CONCLUSIONS

Based on our review of the existing fault maps, aerial photos, and on-site reconnaissance of the project site, it is our opinion that on-site surface faulting features are not evident at this time along the project alignment. Therefore, it is our opinion that surface faulting is not currently present along the project alignment. It is, however, possible that on-site faulting may be present below the ground surface that was not observed during our site reconnaissance or documented on published maps.

## 6.0 STANDARD OF CARE

The conclusions described herein were conducted in a manner consistent with the level of care and skill ordinarily exercised by members of the geotechnical engineering profession practicing contemporaneously under similar conditions in the locality of the project. No other warranty or guarantee, expressed or implied, is made other than the work was performed in a proper and workmanlike manner.

## 7.0 REFERENCES


1. Verbeck, E.R. and Clanton, U.S., "Map Showing Surface Faults in the Southeastern Houston Metropolitan Area", Texas, 1978.

2. O'Neill, N.W., and Van Siclen, D.C., 1983, "Activation of Gulf Coast Faults by Depressuring of Aquifers and An Engineering Approach to Sitting Structures along the Traces", Publication by the Association of Engineering Geologists.

3. Houston Area Environmental Geology: Surface Faulting, Ground Subsidence, Hazard Liability, Published by Houston Geological Society, 1981, pages 18, 20.

4. O'Neill and Van Siclen, "Gulf Coast Faults", Bulletin of the Association of Engineering Geologists", Vol. XXI, No. 1, pp. 73-87.

5. Everett, R. John, and Reid, W.M., 1981, "Active Faults in the Houston, Texas area as observed on Landsat Imagery", Houston Area Environmental Geology, pp. 13-27.

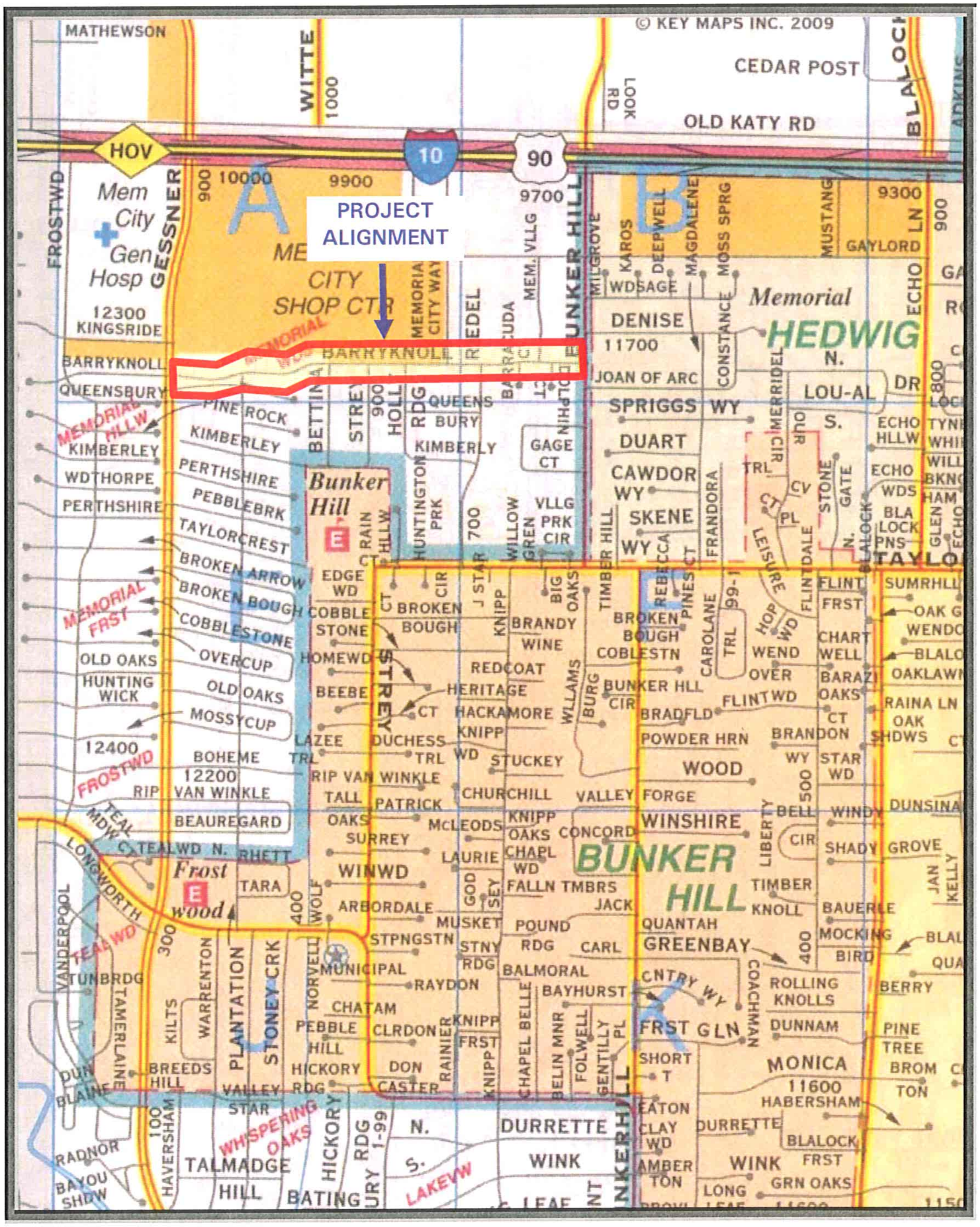
6. Verbeck, Earl R. and Clanton, Vel S., "Historically Active Faults of the Houston Metropolitan Area, Texas", no date.

7. Engelkeimer, R.M., Khan, S.D. 2008, "Lidar Mapping of Faults in Houston, Texas, USA", Geosphere, Vol. 4, No. 1, pp. 170-182.

8. Norman, C., 2005, Ground subsidence and active faults in the Houston metropolitan area: Coastal subsidence, sea level and the future of the Gulf Coast: Houston Geological Society/Engineering, Science and Technology Council of Houston Conference, Field Trip Guide.

9. Aerial Photographs

    - 1956 , February, Harper Leiper Studios, Inc., Black & White, S-554-B
    - 1959 , September, Harper Leiper Studios, Inc., Black & White, S-521-C
    - 1961 , December, Harper Leiper Studios, Inc., Black & White, K-528-A
    - 1965 , June, Harper Leiper Studios, Inc., Black & White, K-573
    - 1980 , April, Harper Leiper Studios, Inc., Black & White, K-737-B
    - 1982 , June, Harper Leiper Studios, Inc., Black & White, K-781-P
    - 1984 , November, Harper Leiper Studios, Inc., Black & White, K-822-A
    - 1996 , December, Positive Image Studios, Inc., Color, 9619.077
    - 1997 , December, Positive Image Studios, Inc., Color, 199711-103
    - 2008 , December, Positive Image Studios, Inc., Color, 200814750
    - 1995, Terraserver Website (www.terraserver.com), Black & White
    - 2000, Terraserver Website (www.terraserver.com), Color
    - 2002, Terraserver Website (www.terraserver.com), Color
    - 2004, Terraserver Website (www.terraserver.com), Color
    - 2006, Terraserver Website (www.terraserver.com), Color
    - 2007, Terraserver Website (www.terraserver.com), Color
    - 2008, Terraserver Website (www.terraserver.com), Color

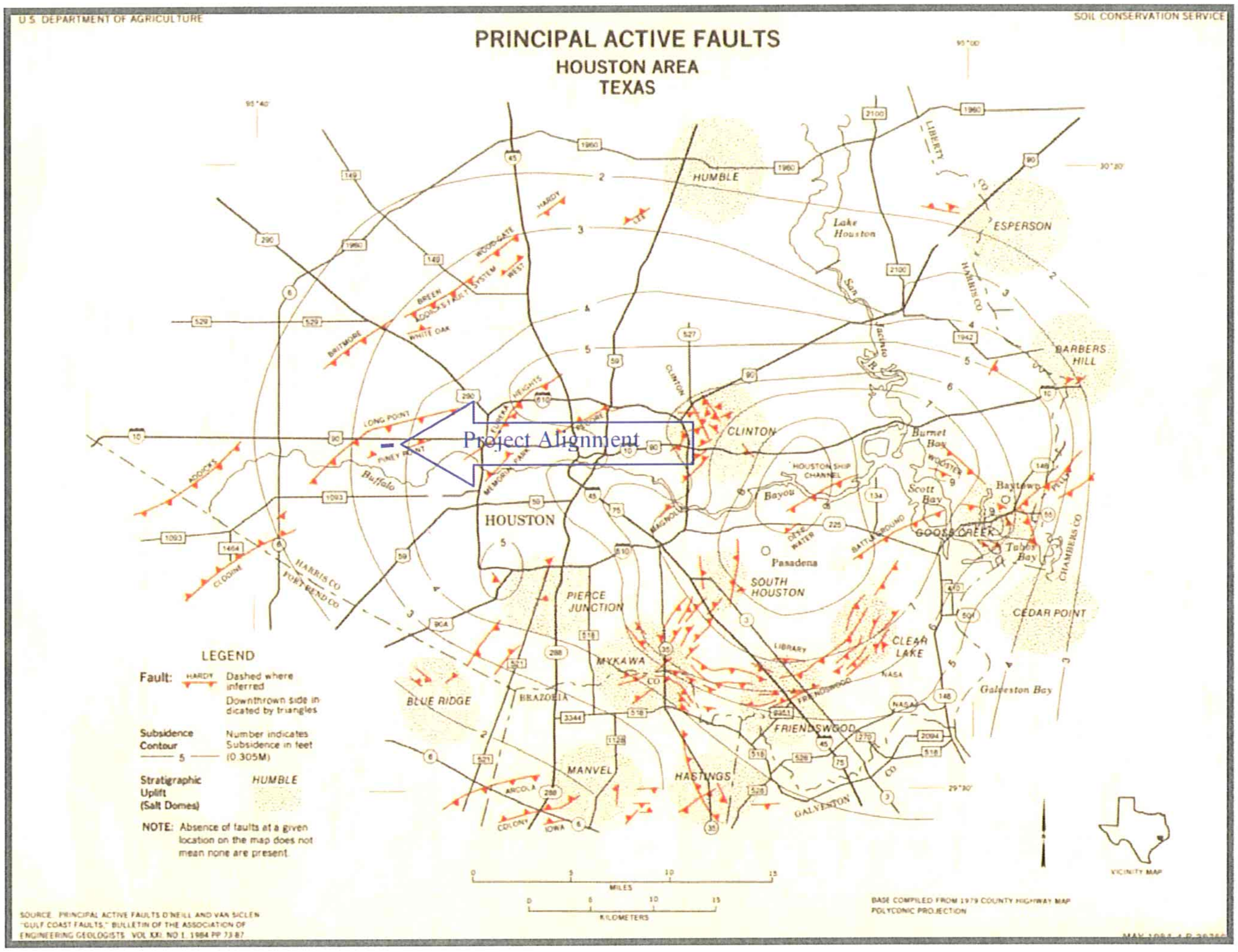



| | |
|---|---|
| **SITE VICINITY MAP** | NORTH |

PROJECT: Limited Phase I Geologic Fault Study, Barryknoll Drainage Improvements from Bunker Hill Road to Gessner Road Houston, Texas

| | | |
|---|---|---|
| SCALE: NOT TO SCALE | DATE: FEBRUARY 2010 | REPORT NO.: 09-544E |


| SITE PLAN | | | NORTH |
|---|---|---|---|
| PROJECT: Limited Phase I Geologic Fault Study, Barryknoll Drainage Improvements from Bunker Hill Road to Gessner Road<br>Houston, Texas | | | |
| SCALE: NOT TO SCALE | DATE: FEBRUARY 2010 | REPORT NO.: 09-544E | |

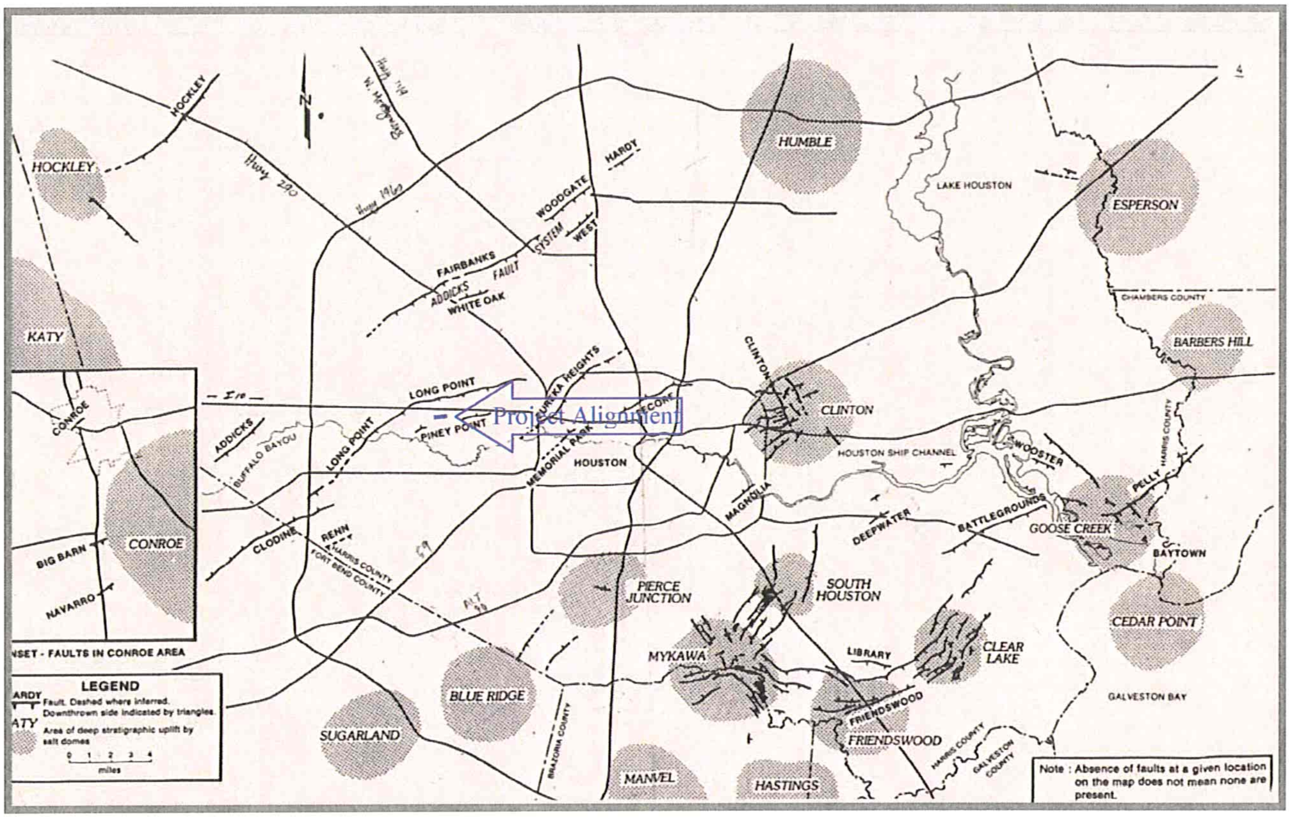



**PRINCIPAL ACTIVE FAULTS IN THE HOUSTON AREA (Project alignment location is approximate)**

PROJECT: Limited Phase I Geologic Fault Study, Barryknoll Drainage Improvements from Bunker Hill Road to Gessner Road
Houston, Texas

| SCALE: NOT TO SCALE | DATE: FEBRUARY 2010 | REPORT NO.: 09-544E |
|---|---|---|

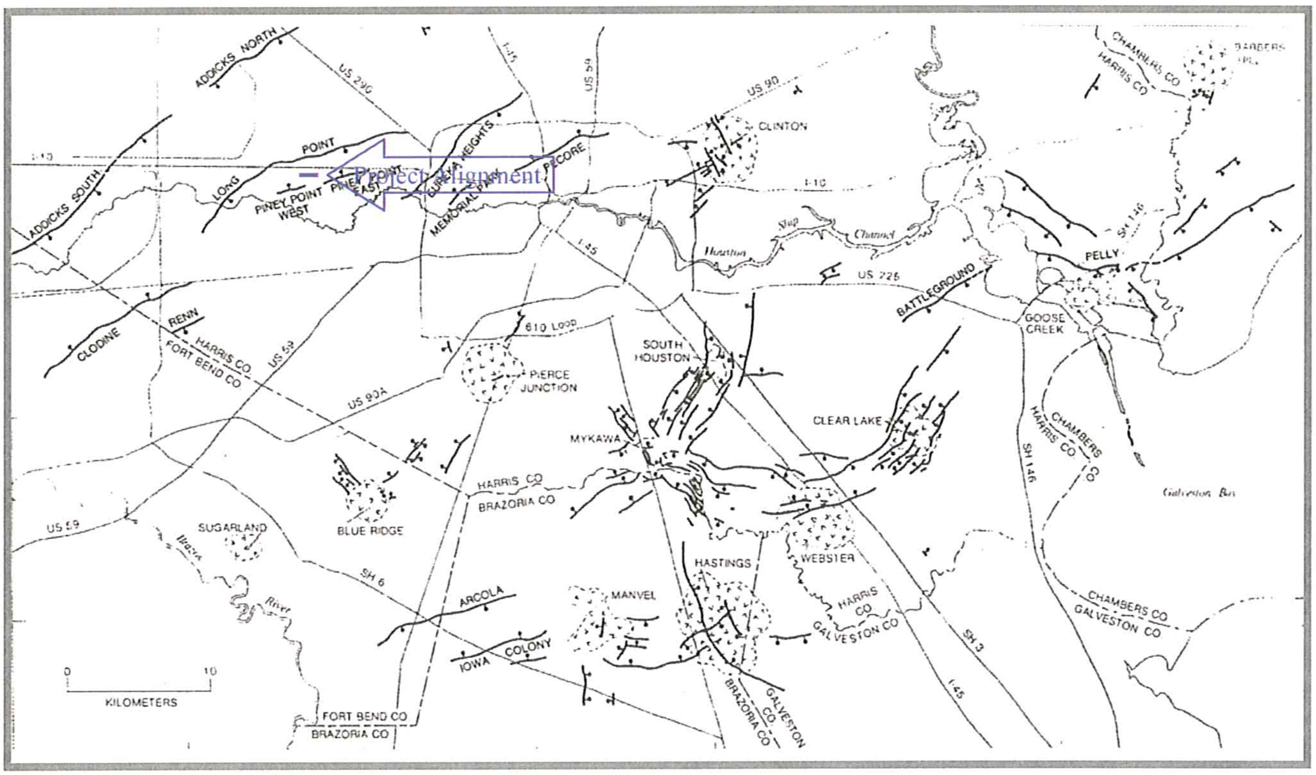
NORTH



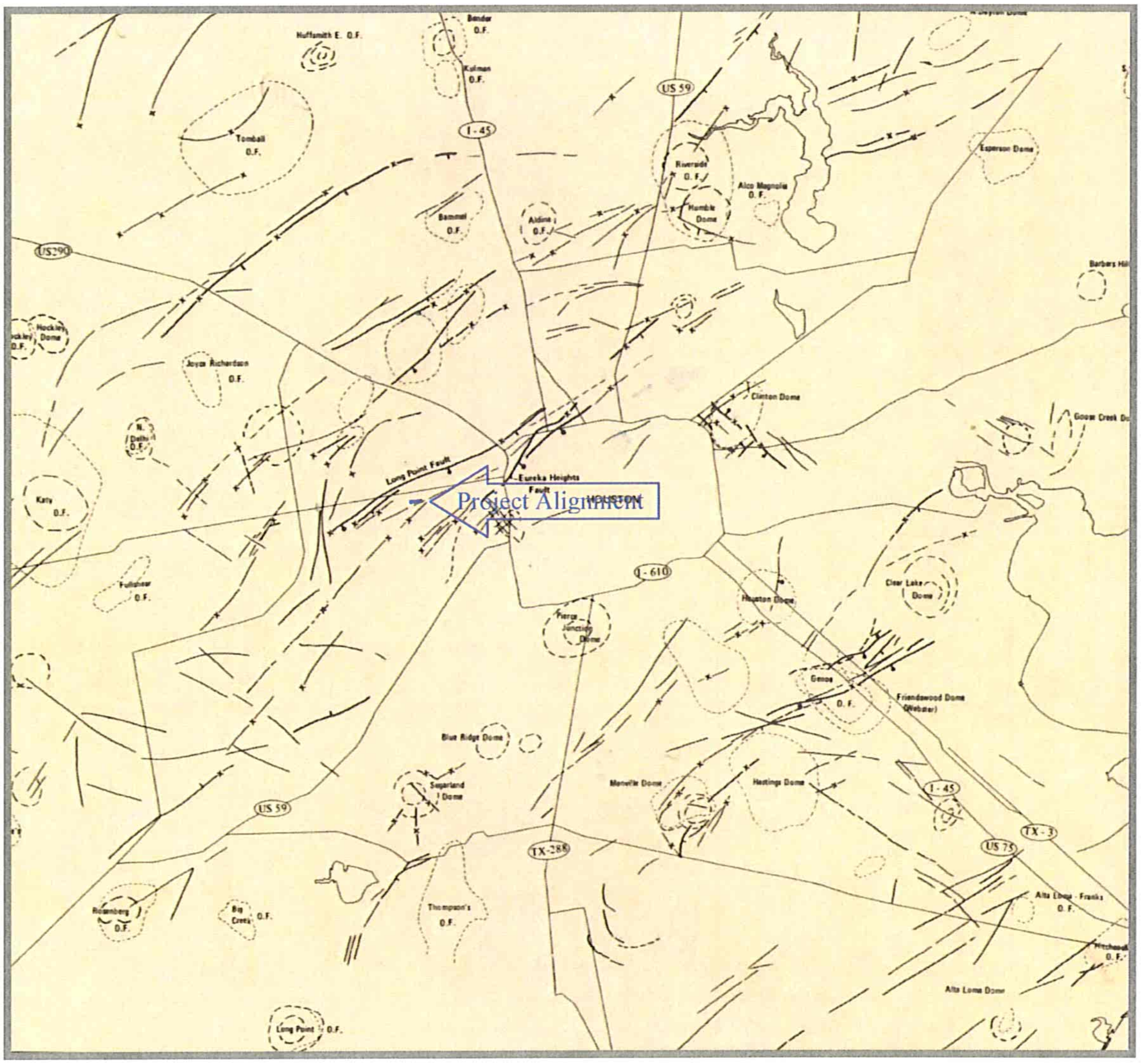

**FAULTS IN PART OF THE HOUSTON AREA (Project alignment location is approximate)**

PROJECT: Limited Phase I Geologic Fault Study, Barryknoll Drainage Improvements from Bunker Hill Road to Gessner Road
Houston, Texas

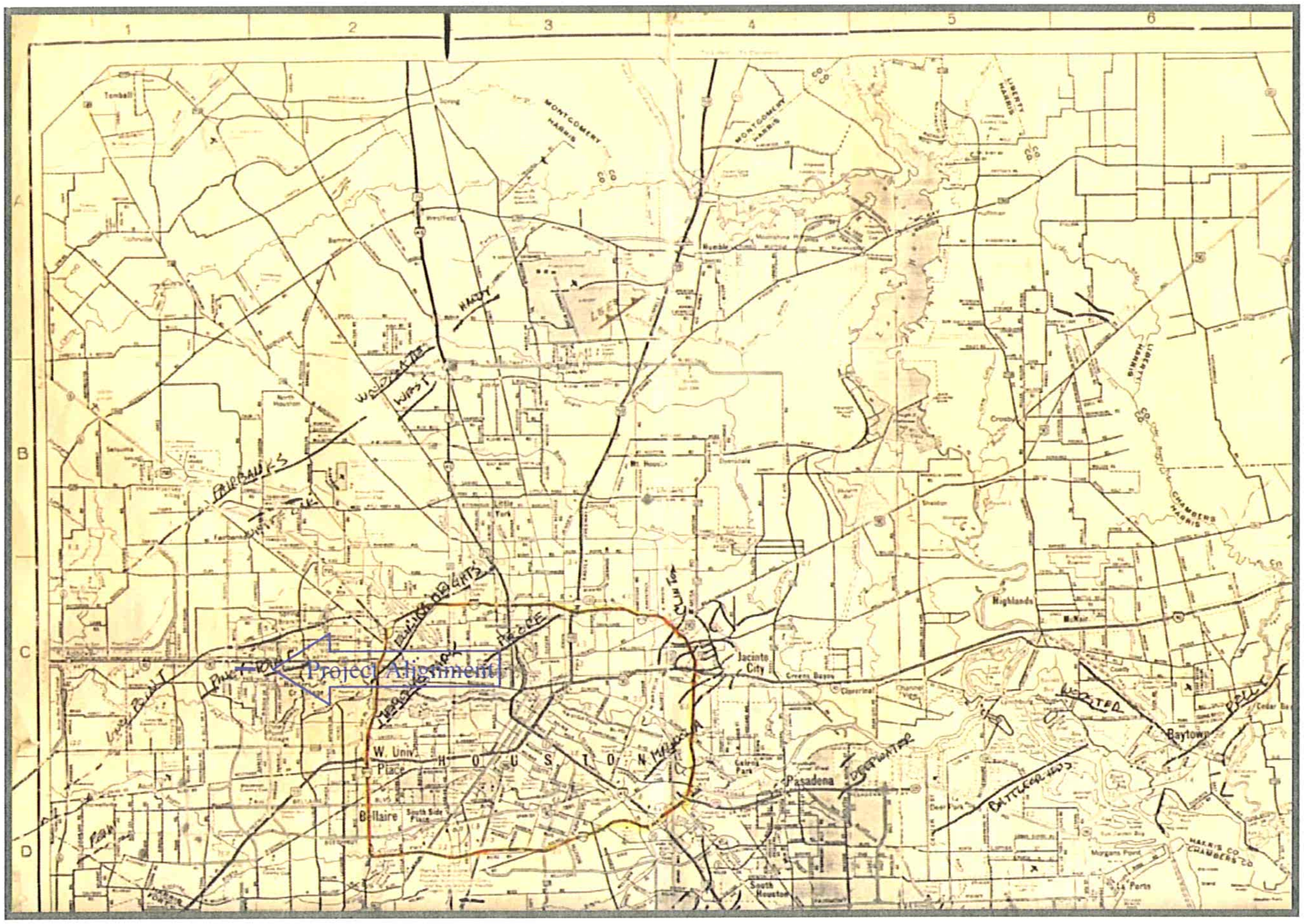
| SCALE: NOT TO SCALE | DATE: FEBRUARY 2010 | REPORT NO.: 09-544E |
|---|---|---|




| SURFACE FAULT PATTERN OF HOUSTON METROPOLITAN AREA (Project alignment location is approximate) | | | NORTH |
|---|---|---|---|
| PROJECT: Limited Phase I Geologic Fault Study, Barryknoll Drainage Improvements from Bunker Hill Road to Gessner Road<br>Houston, Texas | | | |
| SCALE: NOT TO SCALE | DATE: FEBRUARY 2010 | REPORT NO.: 09-544E | |



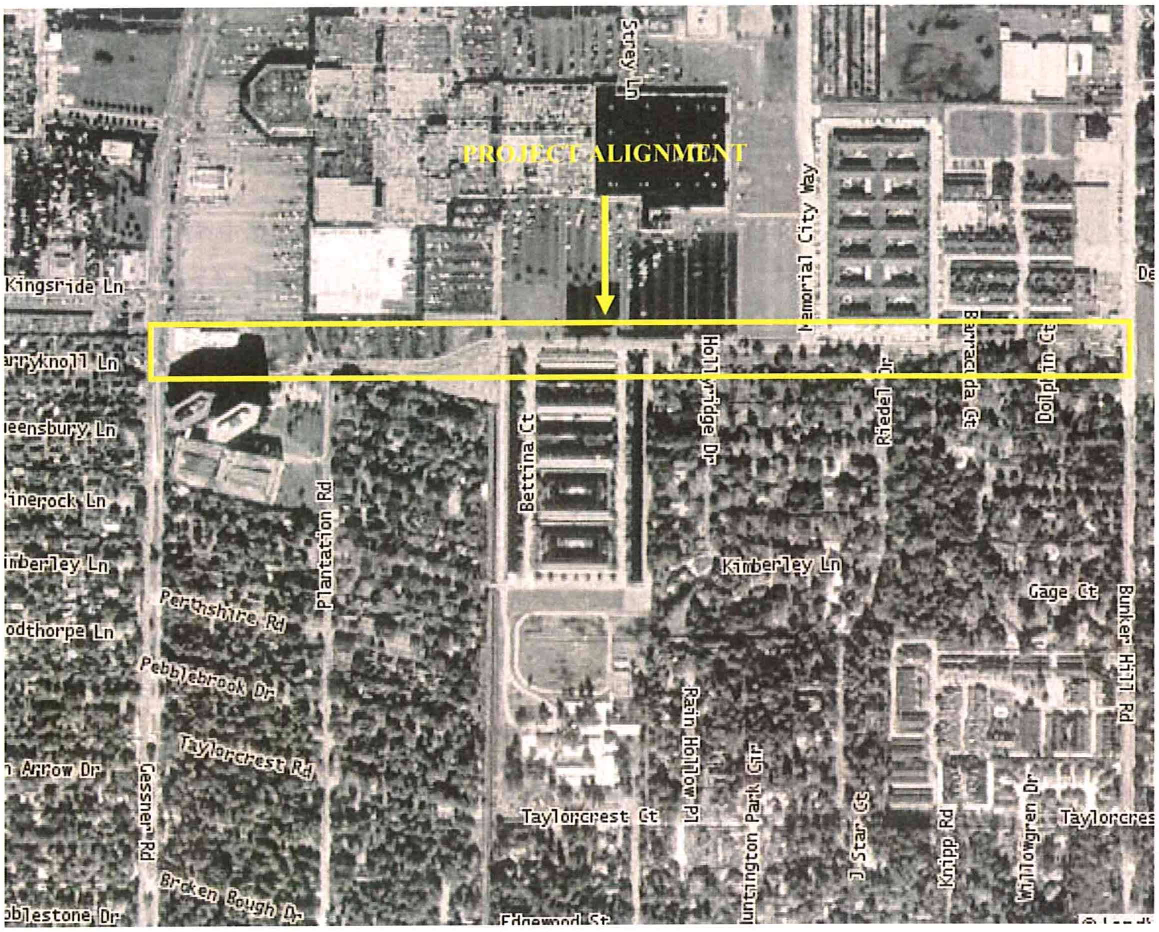

| FAULTS IN HOUSTON AREA (Project alignment location is approximate) | | | NORTH |
|---|---|---|---|
| PROJECT: Limited Phase I Geologic Fault Study, Barryknoll Drainage Improvements from Bunker Hill Road to Gessner Road<br>Houston, Texas | | | |
| SCALE: NOT TO SCALE | DATE: FEBRUARY 2010 | REPORT NO.: 09-544E | |




| FAULTS IN NORTHWEST OF THE HOUSTON AREA (Project alignment location is approximate) | | | NORTH |
|---|---|---|---|
| PROJECT: Limited Phase I Geologic Fault Study, Barryknoll Drainage Improvements from Bunker Hill Road to Gessner Road<br>Houston, Texas | | | |
| SCALE: NOT TO SCALE | DATE: FEBRUARY 2010 | REPORT NO.: 09-544E | |

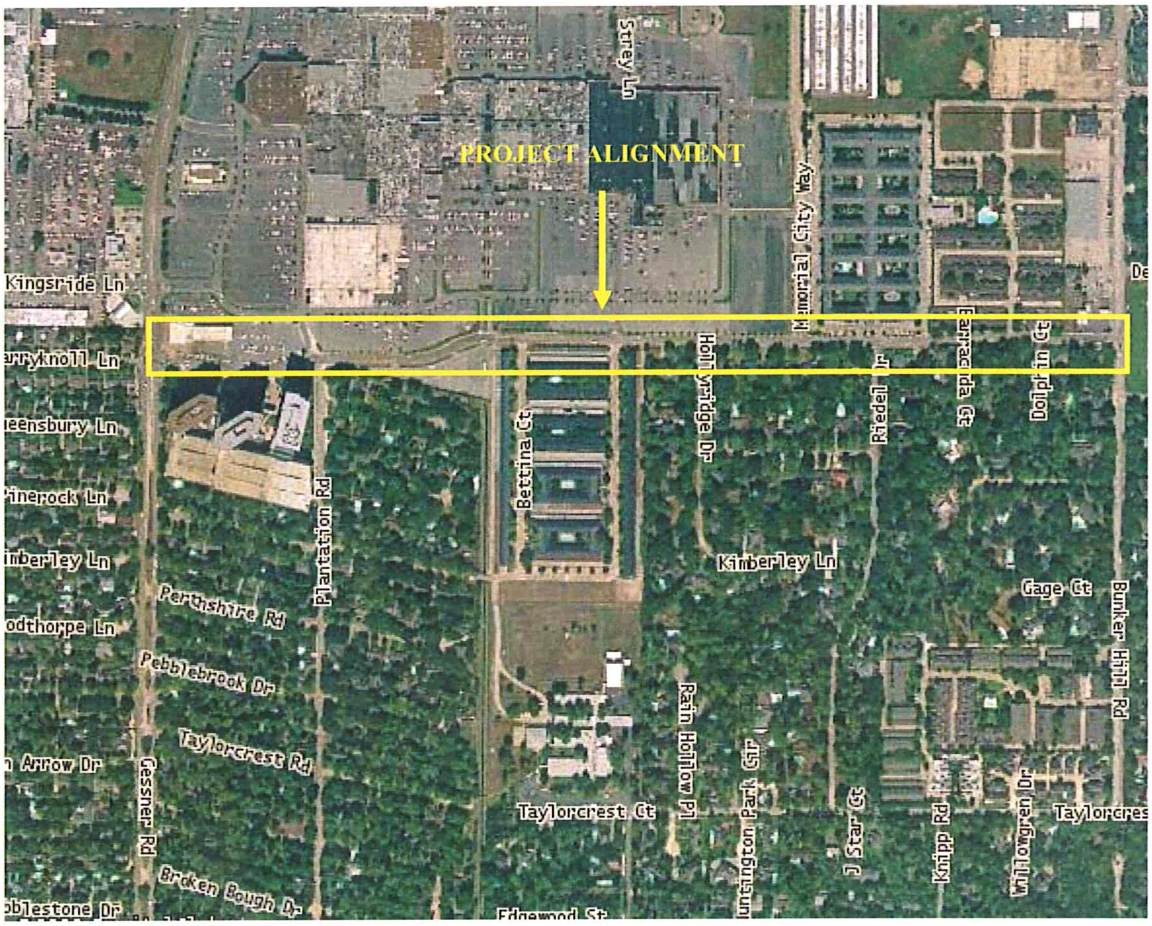
## APPENDIX A

## AEREAL PHOTOGRAPHS FROM TERRASERVER WEBSITE




| | | | |
|---|---|---|---|
| **AERIAL PHOTOGRAPH 1995** | | | NORTH |
| PROJECT: Limited Phase I Geologic Fault Study, Barryknoll Drainage Improvements from Bunker Hill Road to Gessner Road Houston, Texas | | | |
| SCALE: NOT TO SCALE | DATE: FEBRUARY 2010 | REPORT NO.: 09-544E | |

**GEOTECH ENGINEERING AND TESTING**



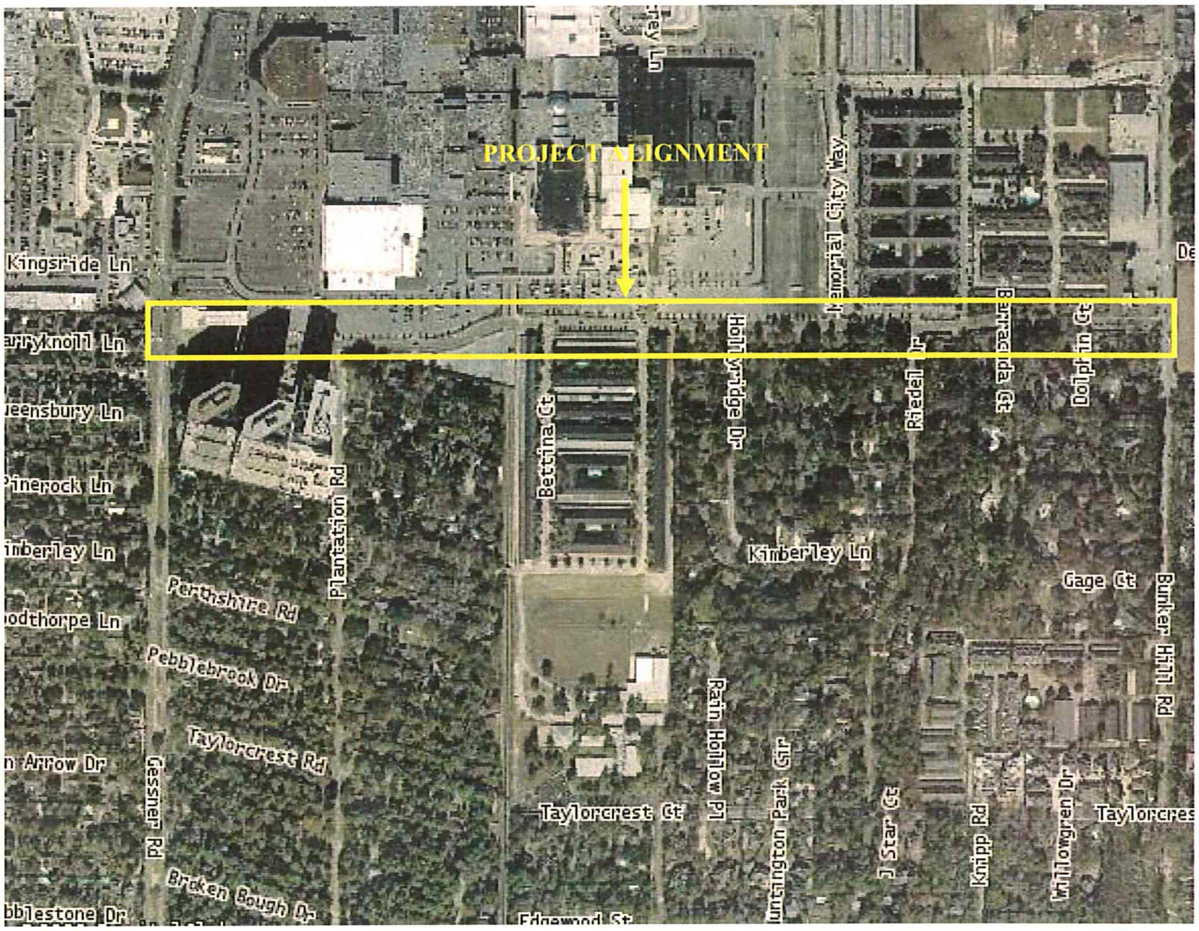

**AERIAL PHOTOGRAPH 2000**

PROJECT: Limited Phase I Geologic Fault Study, Barryknoll Drainage Improvements from Bunker Hill Road to Gessner Road
Houston, Texas

| | | |
|---|---|---|
| SCALE: NOT TO SCALE | DATE: FEBRUARY 2010 | REPORT NO.: 09-544E |

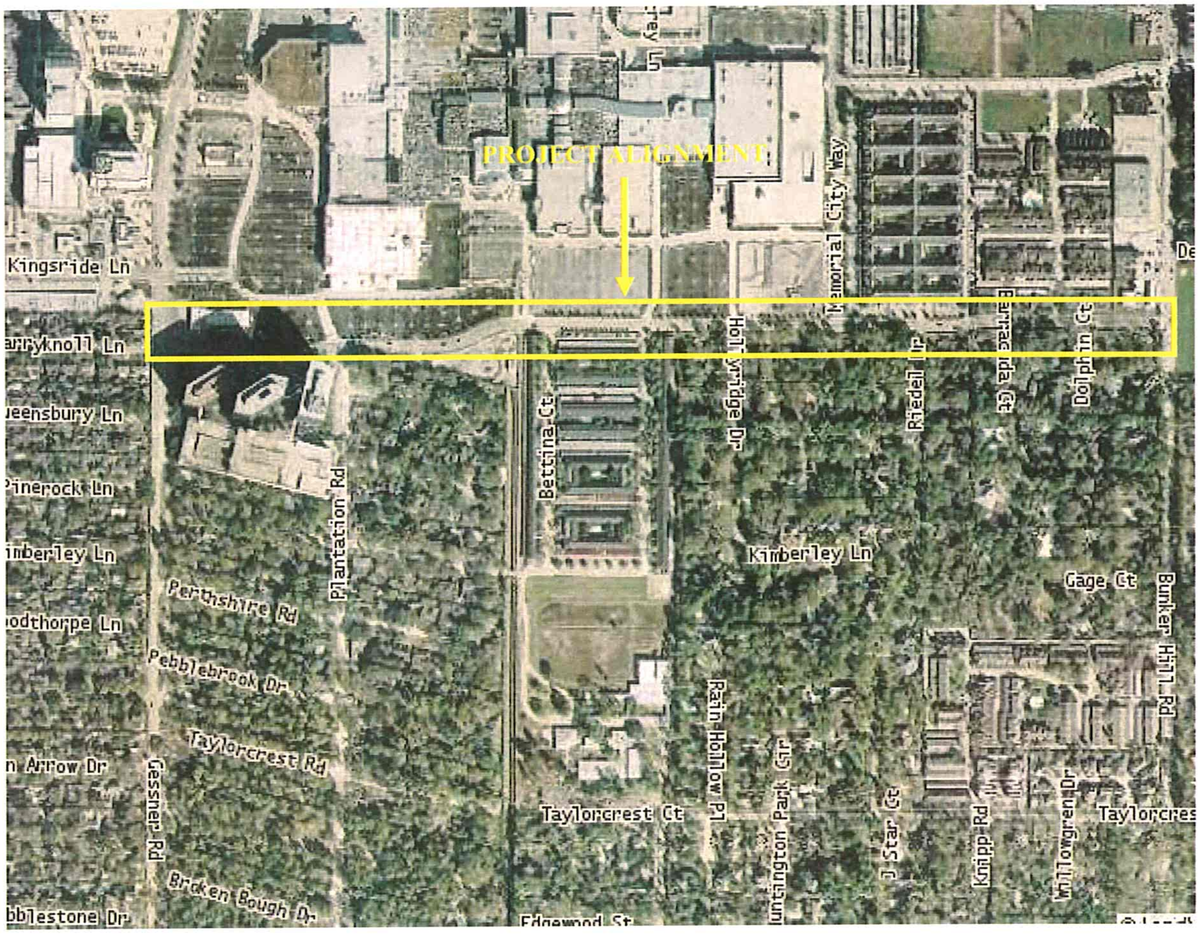
NORTH

**GEOTECH ENGINEERING AND TESTING**




| **AERIAL PHOTOGRAPH 2002** | | | NORTH |
|---|---|---|---|
| PROJECT: Limited Phase I Geologic Fault Study, Barryknoll Drainage Improvements from Bunker Hill Road to Gessner Road<br>Houston, Texas | | | |
| SCALE: NOT TO SCALE | DATE: FEBRUARY 2010 | REPORT NO.: 09-544E | |

**GEOTECH ENGINEERING AND TESTING**



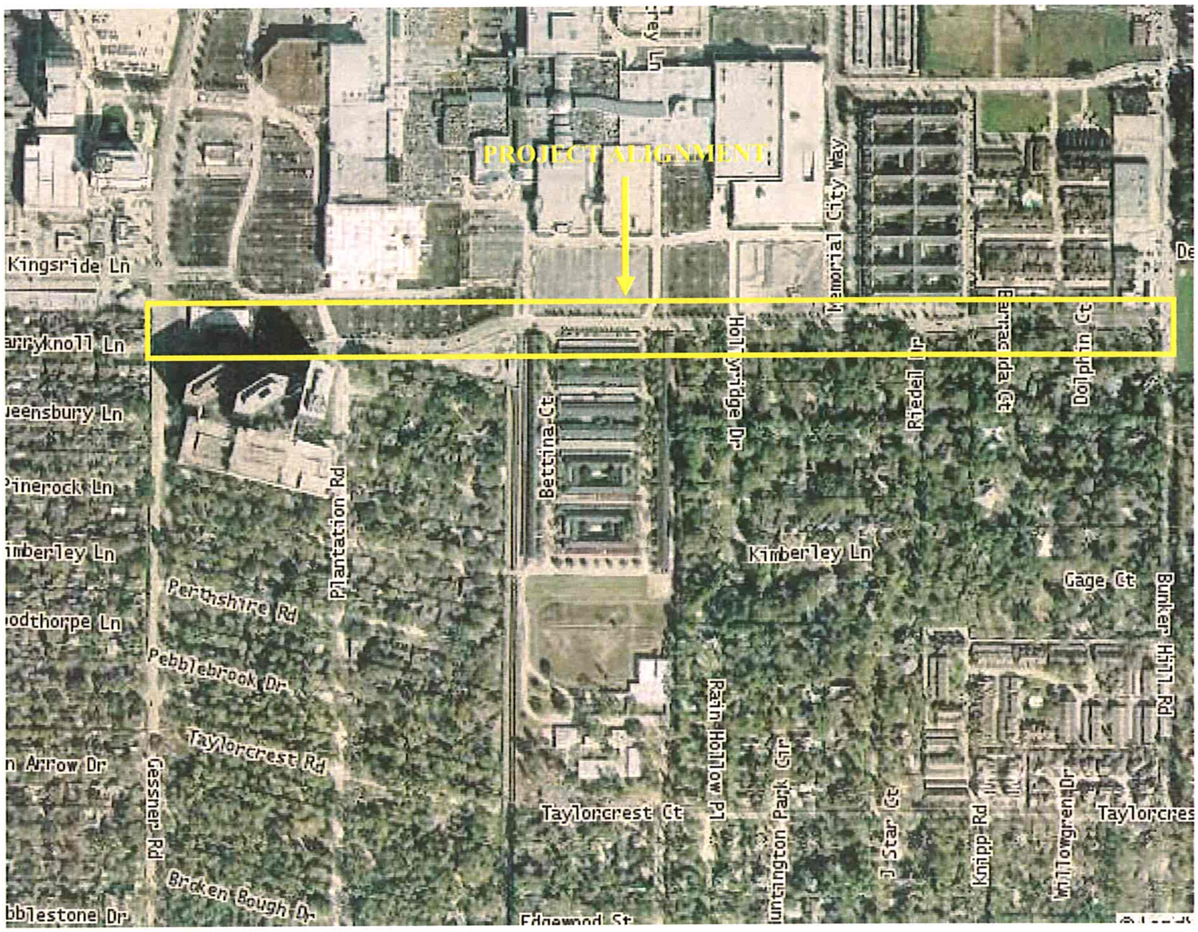

**AERIAL PHOTOGRAPH 2004**

PROJECT: Limited Phase I Geologic Fault Study, Barryknoll Drainage Improvements from Bunker Hill Road to Gessner Road
Houston, Texas

| SCALE: NOT TO SCALE | DATE: FEBRUARY 2010 | REPORT NO.: 09-544E |
|---|---|---|

NORTH

**GEOTECH ENGINEERING AND TESTING**



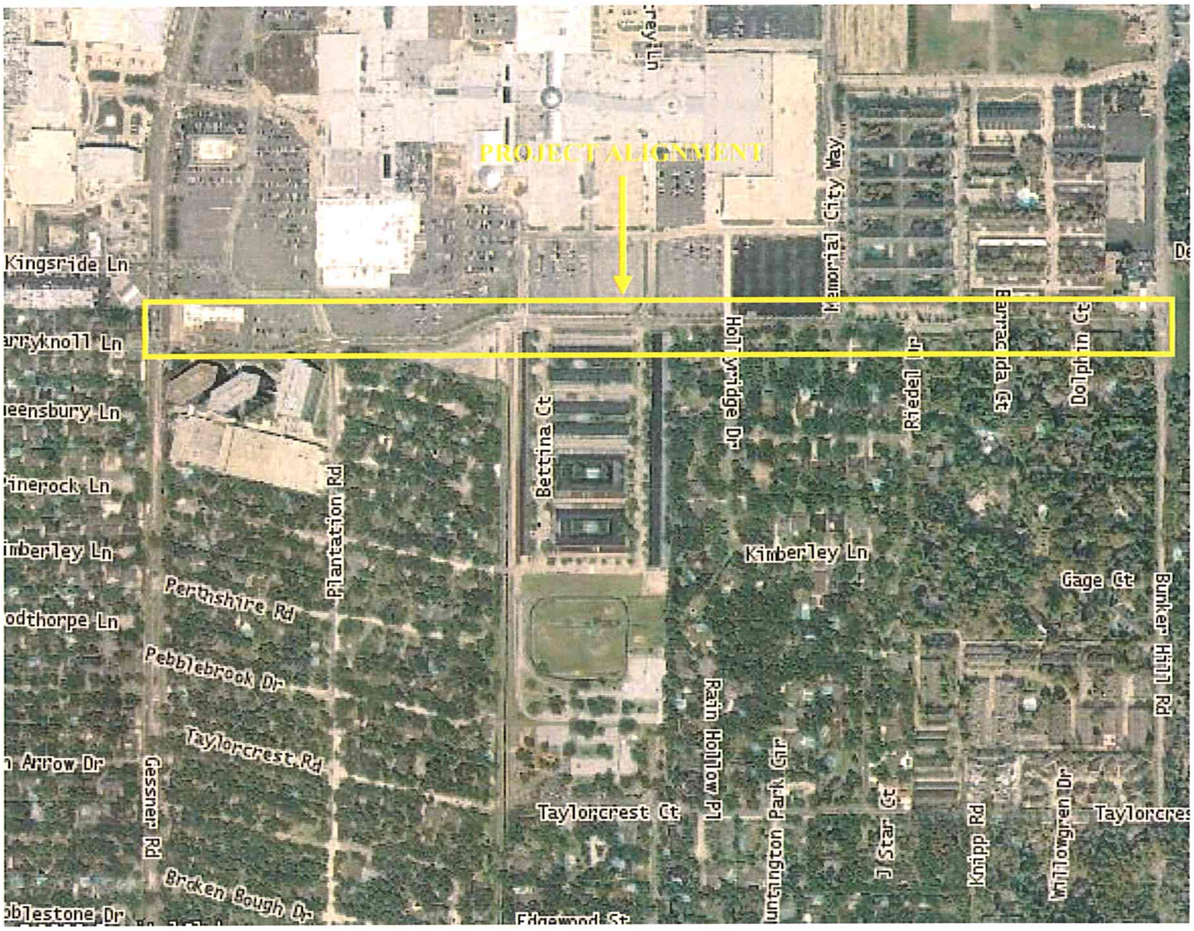

**AERIAL PHOTOGRAPH 2005**

NORTH

PROJECT: Limited Phase I Geologic Fault Study, Barryknoll Drainage Improvements from Bunker Hill Road to Gessner Road
Houston, Texas

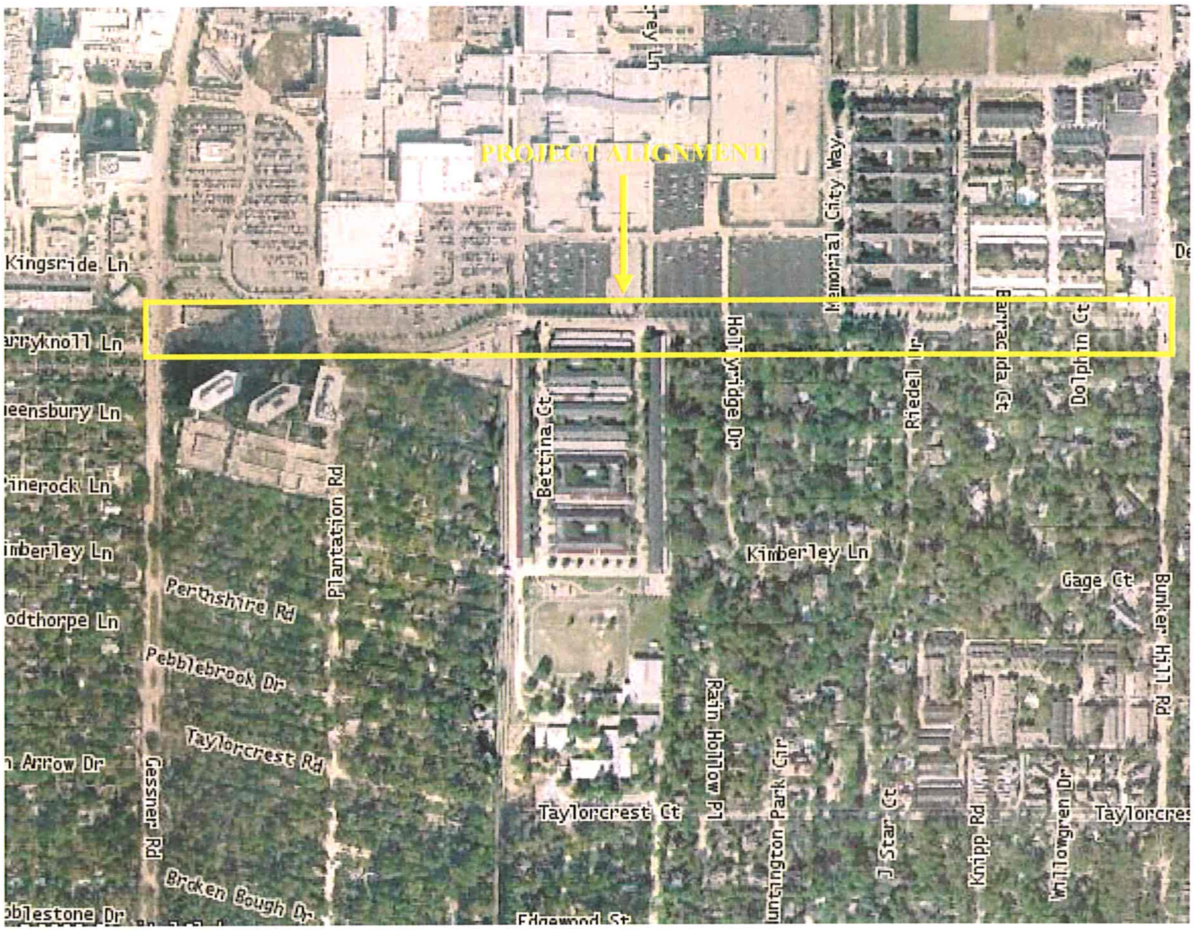
| SCALE: NOT TO SCALE | DATE: FEBRUARY 2010 | REPORT NO.: 09-544E |
|---|---|---|

GEOTECH ENGINEERING AND TESTING




| **AERIAL PHOTOGRAPH 2006** | | | NORTH |
|---|---|---|---|
| PROJECT: Limited Phase I Geologic Fault Study, Barryknoll Drainage Improvements from Bunker Hill Road to Gessner Road<br>Houston, Texas | | | |
| SCALE: NOT TO SCALE | DATE: FEBRUARY 2010 | REPORT NO.: 09-544E | |

**GEOTECH ENGINEERING AND TESTING**




| AERIAL PHOTOGRAPH 2007 | | | NORTH |
|---|---|---|---|
| PROJECT: Limited Phase I Geologic Fault Study, Barryknoll Drainage Improvements from Bunker Hill Road to Gessner Road<br>Houston, Texas | | | |
| SCALE: NOT TO SCALE | DATE: FEBRUARY 2010 | REPORT NO.: 09-544E | |

GEOTECH ENGINEERING AND TESTING

## APPENDIX B

## PROJECT SITE PICTURES

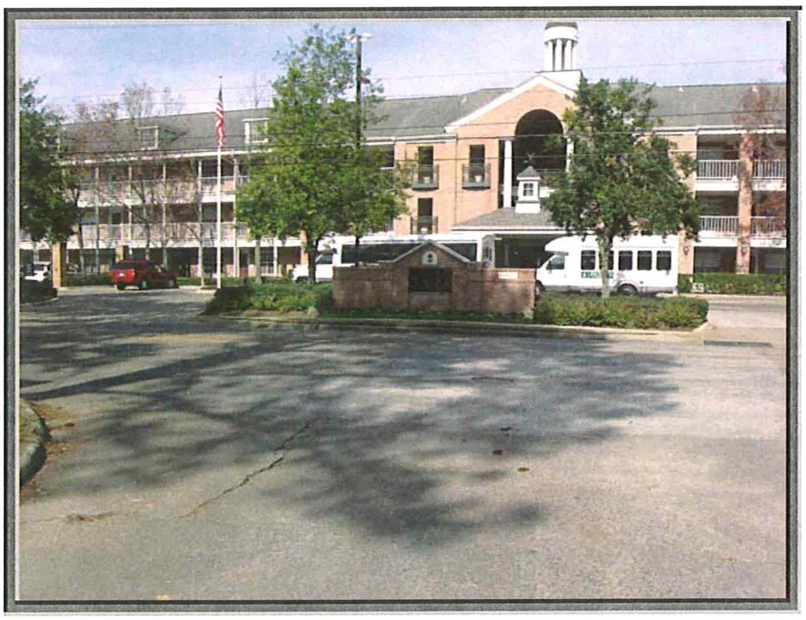
## PICTURE INDEX

| Picture No. | Description |
|---|---|
| B-1 | A view of east boundary of project alignment along Barryknoll Lane at the intersection of Bunker Hill Road |
| B-2 | A view of Barryknoll Lane at the intersection of Memorial City Lane |
| B-3 | A view of drainage ditch (W151) located near the intersection of Barryknoll Lane and Bettina Court |
| B-4 | A view of Memorial Village Townhomes located at north of project alignment along Barryknoll Lane |
| B-5 | A view of parking pot near project alignment along Barryknoll Lane |
| B-6 | A view of residences and roads located to the north of the project alignment at the intersection of Riedel Drive |
| B-7 | A view of west boundary of the project alignment along Barryknoll Lane at the intersection of Gessner Road |
| B-8 | A view of the Medical Plaza located near the northeast corner of the project alignment |
| B-9 | A view of the drainage ditch and residences located to the southwest of the project alignment near Bettina Court |
| B-10 | A view of the Valero Energy Store located to the northeast of the project alignment near Bunker Hill Road |
| B-11 | A view of Gessner Road across the west boundary of project alignment |
| B-12 | A view of vacant land at the west side of project alignment |

# B-1

# B-2

# B-3



# B-4

**# B-5**

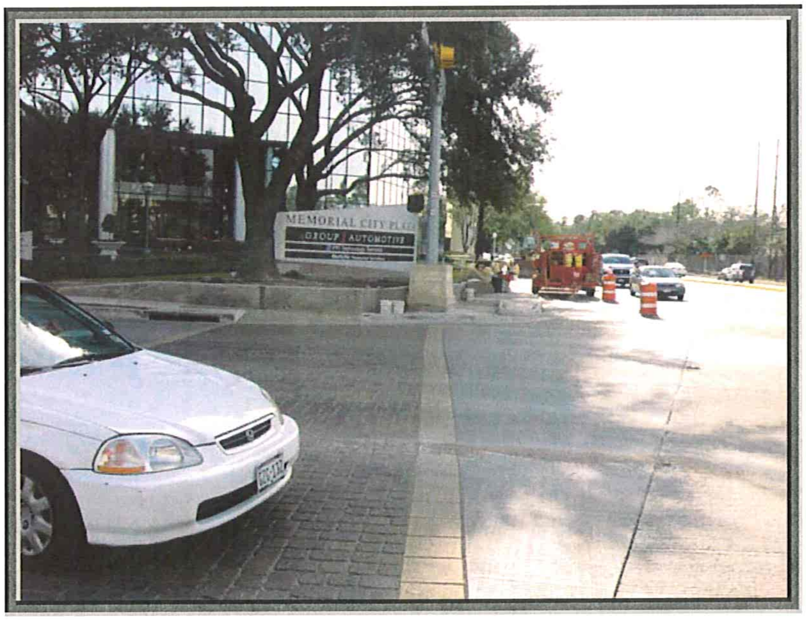
**# B-6**

# B-7

# B-8


# B-9

# B-10




# B-11

# B-12