Final Stormwater Management Study

FOR

The Grove at Lee's Summit

City of Lee's Summit
Jackson County, Missouri

May 3, 2018

Prepared for:

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Prepared by:

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GBA

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Introduction:

George Butler Associates, Inc. (GBA) has been hired to complete planning and construction submittals for The Grove development located in Lee's Summit, Missouri. The purpose of this report is to serve as a Final Master Stormwater Drainage Study for The Grove development and analyze how the development will fit into the surrounding watershed.

The Grove development encompasses 84 acres of development near the southwest corner of the intersection of Missouri Highway 291 and U.S. Highway 50 in Lee's Summit Missouri. The project area is bisected by SE Bailey Road and is currently undeveloped. The full build out of the development includes approximately 1.7 million square feet of mixed use development, in addition to required public improvements. The first phase of development includes an approximate 200,000 square foot light manufacturing facility, mass grading, regional stormwater retention, and construction of SE Summit Street and SE Decker Street.

Methodology:

The Study methodology is based on allowable methods and procedures specified by the City of Lee's Summit codes and guidelines. A summary of each component of the report is provided below.

- The 2011 Version of APWA Section 5600
- HEC-HMS version 4.2 and TR-55 were used for basin modeling and routing

Existing Conditions:

The Grove development encompasses 84 acres of development near the southwest corner of the intersection of Missouri Highway 291 and U.S. Highway 50 in Lee's Summit Missouri. The project area is bisected by SE Bailey Road and is currently undeveloped. The site consist of hydrologic type C soils per the NRCS soil report. See Appendix A for soil report. The site lies within Flood Zone X, areas determined to be outside the 0.2% annual chance flood, per FEMA FIRM 29095C0438G, dated January 20, 2017, and FIRM 29095C0419G, dated January 20, 2017.

Approximately 52.73 acres north of SE Bailey Road drain south through the future Phase 1 Grove development, of which 36.89 acres is future Grove development, and 15.84 acres is offsite. Three RCP culverts convey water from north to south under SE Bailey Street to the southern part of The Grove development.

South of SE Bailey Road, which includes phase 1 of development, approximately 54.16 acres drain through The Grove development , of which 42.94 acres is future Gove development, and 11.22 is offsite area. The offsite area flows to a pond east of the railroad tracks adjacent to the property, where it is conveyed under the railroad tracks onto The Grove development. Natural drainage channels on The Grove property convey water to the southern property line, where a 36" CMP conveys water to the south. The 36" CMP is offsite and located between a series of commercial buildings along SE 16th Street. The 36" CMP daylights near the SE 16th Street right-of-way where a 30" RCP culvert conveys water south under SE 16th Street. See Table 1 below for Sub-Basin Summary. An composite curve number of 76.35 was calculated for all drainage areas (includes offsite). A composite curve number of 74.76 was calculated for the proposed site (does not include offsite).

	Sub-Basin	Area	Existing CN	Existing Tc (min.)
North of SE Bailey Rd	1	17.82	74	16.67
	2	19.07	74	24.55
South of SE Bailey Rd	3	19.38	74	37.08
	4	8.69	81	26.46
	5	14.87	74	28.41
Offsite	Off 1	15.84	86	12.78
	Off 2	11.22	74	11.28

Table 1 – Existing Sub-Basin Summary

HEC-HMS was used to model the existing site to acquire existing flows for the offsite drainage areas. See Figure 1 below for existing site HEC-HMS model. See Appendix A for existing HEC-HMS data and summary.

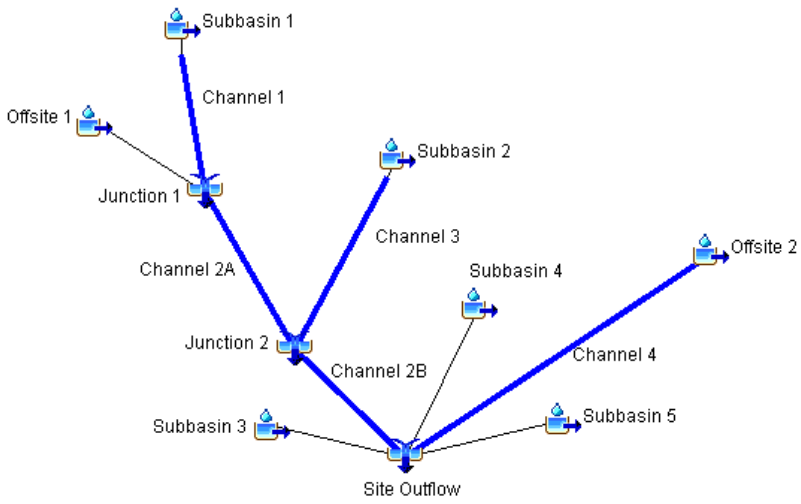


Figure 1 – Existing Site HEC-HMS Model

Stormwater Detention:

Stormwater detention is required per City of Lee's Summit Design Standards and the 2011 version of APWA Section 5600. The comprehensive control strategy is to be used for site allowable release rates. The allowable peak release rates are as follows:

- 50% Storm (2 Year) – Less than or equal to 0.5 CFS per Acre
- 10% Storm (10 year) – Less than or equal to 2.0 CFS per Acre
- 1% Storm (100 year) – Less than or equal to 3.0 CFS per Acre

40 hour extended detention of the 90% mean annual rainfall event is also included under the comprehensive control strategy. The 90% mean annual rainfall event equates to a 1.37 inch, 24 hour rainfall event.

Two offsite drainage areas flow through the proposed development. These areas are not included within this development, and therefore stormwater detention will not be provided for the offsite drainage areas. The offsite drainage areas will be allowed to "pass through" at their existing flow rates. All proposed drainage areas within The Grove development will be detained to comprehensive control strategy release rates. Tables 2 through 4 below illustrate the allowable release rates for the 2, 10, and 100 year storms.

	2 Year Storm			
	BHC Watershed	Area (AC)	Allowable Release Rate (CFS/AC)	Allowable Release Rate (CFS)
Project Site	1	17.82	0.5	8.91
	2	19.07	0.5	9.535
	4	19.38	0.5	9.69
	5	8.69	0.5	4.345
	6	14.87	0.5	7.435
Offsite	Off 1	15.84	Same as Existing	39.97
	Off 2	11.22	Same as Existing	16.94
			Total	**96.83**

Table 2 – 2 Year Storm (50% annual chance) Allowable Release Rate

	10 Year Storm			
	BHC Watershed	Area (AC)	Allowable Release Rate (CFS/AC)	Allowable Release Rate (CFS)
Project Site	1	17.82	2	35.64
	2	19.07	2	38.14
	4	19.38	2	38.76
	5	8.69	2	17.38
	6	14.87	2	29.74
Offsite	Off 1	15.84	Same as Existing	70.43
	Off 2	11.22	Same as Existing	36.69
			Total	**266.78**

Table 3 – 10 Year Storm (10% annual chance) Allowable Release Rate

	100 Year Storm			
	BHC Watershed	Area (AC)	Allowable Release Rate (CFS/AC)	Allowable Release Rate (CFS)
Project Site	1	17.82	3	53.46
	2	19.07	3	57.21
	4	19.38	3	58.14
	5	8.69	3	26.07
	6	14.87	3	44.61
Offsite	Off 1	15.84	Same as Existing	111.2
	Off 2	11.22	Same as Existing	65.44
			Total	**416.13**

Table 4 – 100 Year Storm (1% annual chance) Allowable Release Rate

Proposed Conditions:

The proposed development will predominately drain via enclosed storm sewer. The existing drainage areas will remain the same under proposed conditions as they do under existing conditions. See Table 5 below for Existing vs. Proposed Sub-Basin Summary. A time of concentration of 5 minutes was selected as a conservative value as design values could change with future expansions. A composite curve number of 87.44 was calculated for all drainage areas (including offsite). A composite curve number of 89.61 was calculated for the proposed site (does not include offsite) The 7 sub-basins will drain to a proposed stormwater retention basin. See Appendix B for storm sewer plan and calculations.

	Sub-Basin	Area	Existing CN	Existing Tc (min.)	Proposed CN	Proposed Tc (min.)
North of SE Bailey Rd	1	17.82	74	16.67	94	5
	2	19.07	74	24.55	88	5
South of SE Bailey Rd	3	19.38	74	37.08	89	5
	4	8.69	81	26.46	90	5
	5	14.87	74	28.41	87	5
Offsite	Off 1	15.84	86	12.78	86	5
	Off 2	11.22	74	11.28	74	5

Table 5 – Existing and Proposed Sub-Basin Summary

The proposed site was modeled in HEC-HMS 4.2. See Figure 2 below for proposed model. See Appendix B for HEC-HMS model data and summaries.

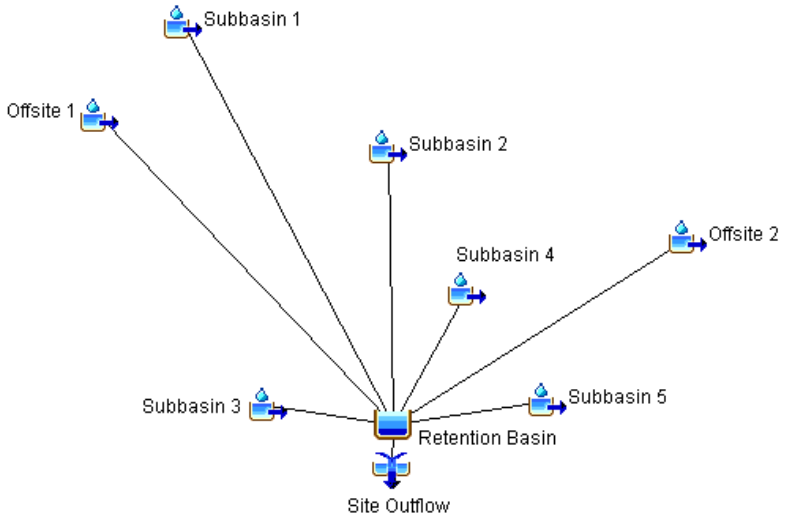


Figure 2 – Proposed HEC-HMS Model

Offsite drainage area 1 currently discharges through multiple culverts under SE Bailey Road. Enclosed storm sewer will be constructed along SE Bailey Road to covey the Offsite 1 drainage to the south. The drainage from Offsite 2 will be rerouted in a proposed drainage swale to allows for construction of the first phase of development. The proposed drainage swale will be conveyed under SE Summit Street via 4'x5' RCB to the proposed retention basin.

A stormwater retention basin is to be constructed near the south end of the proposed site. The proposed retention basin will provide approximately 22.14 AC-FT of stormwater storage. A 15'x10' concrete outflow structure is to be constructed to regulate outflows for the 2, 10, and 100 year storms, as well as the water quality storm. See plan sheet C7.8 for outflow structure construction details. See Table 6 below for stormwater retention basin summary. See Appendix B for basin elevation-storage-discharge values.

Storm	Allowable Peak Release Rate (CFS)	Proposed Peak Release Rate (CFS)	Peak Water Elevation (FT)
2	96.83	49.11	1003.65
10	266.78	137.18	1005.4
100	416.13	381.65	1007.07
100 Yr Low Flow Bypass	N/A	432.34	1007.38

Table 6 – Proposed Retention Basin Summary

As shown in Table 6, the proposed basin outflows are less than the calculated allowable release rates, ensuring the downstream storm system will function as designed.

The water quality volume for the proposed retention basin was calculated to be 3.74 AC-FT. The proposed retention basin is designed to store the water quality volume and release it over 40 hours, per APWA Section 5600. An 8 inch low flow orifice is to be constructed on the basin outflow structure to facilitate water quality volume drainage. See Appendix B for water quality

volume calculations. The water quality volume storage is achieved at elevation 1001.39 FT in the basin.

In the event the 8 inch low flow orifice is blocked, the basin is able to pass the 100 year storm through the other outflow structure openings without over-topping of the basin. The peak water elevation during a 100-year storm bypass event was modeled to be 1007.38 FT.

The downstream storm sewer currently consists of a 36 inch CMP which flows from north to south through the commercial development to the south. This 36" CMP is to be replaced with a triple 42" HDPE pipe culvert, extending from the retention basin outflow structure to the creek south of SE 16th Street. The triple 42 inch culvert will be approximately 434 feet in length. See attached plan sheets for details.

Summary and Recommendations:

Construction of the proposed development per the recommendations of this report will meet or exceed the stormwater quality and quantity requirements of the City of Lee's Summit, Missouri. The designed stormwater management plan will reduce the risk of flooding for residents and businesses downstream of the project, and provide stormwater management and water quality benefits for the proposed development.

APPENDIX A – EXISTING CONDITIONS

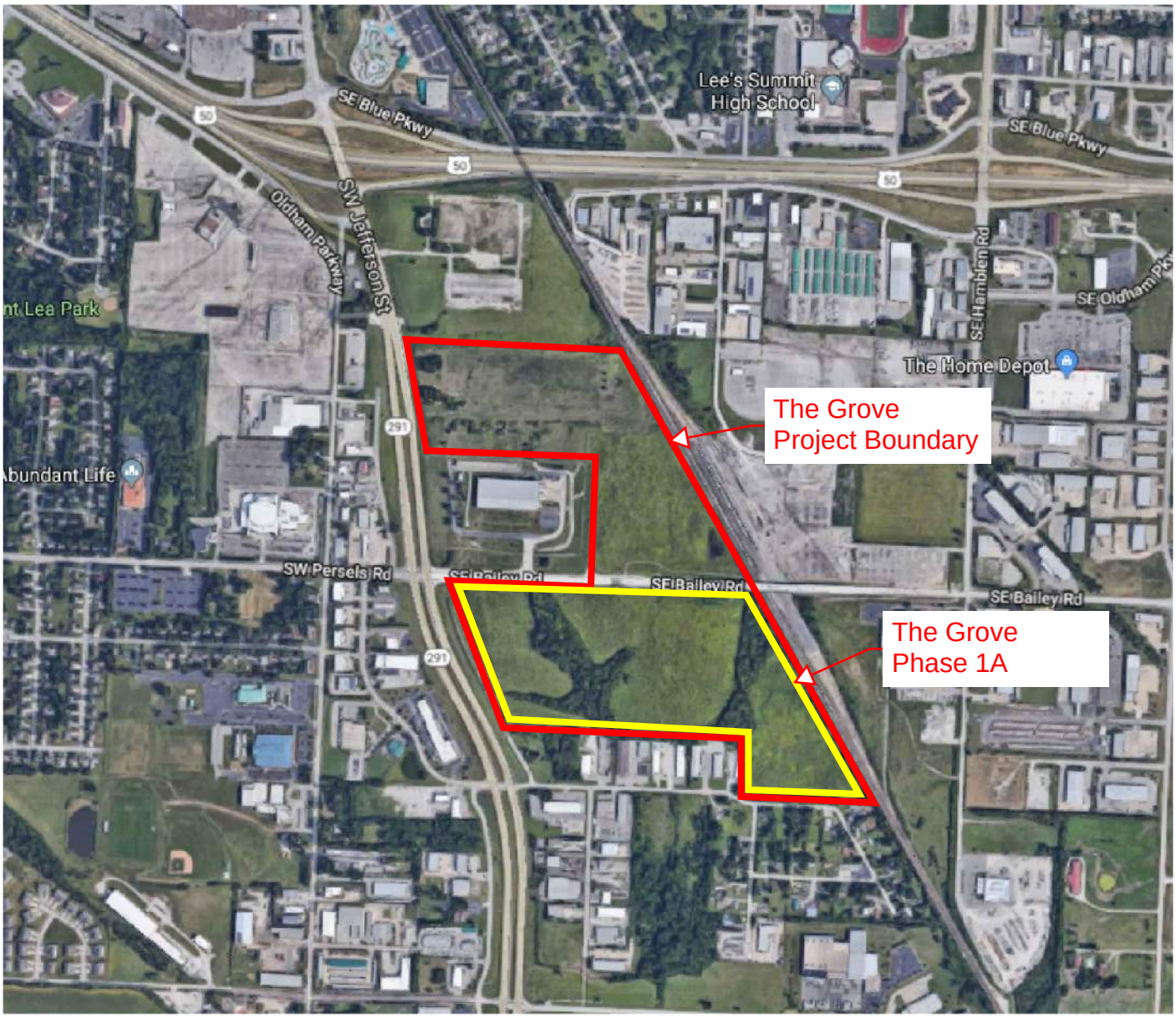
Exhibit 1 – Location Map

Exhibit 2 – FEMA Flood Insurance Rate Map, FIRMette

Exhibit 3 – USDA/NRCS Soil Resource Report

Exhibit 4 – Existing Drainage Map

Exhibit 5 – Existing Conditions HEC-HMS Model Summary



1000' 0' 1000' 2000'

SCALE : 1 INCH = 1000 FEET

GBA architects engineers

PROJECT NUMBER		EXHIBIT
13958	THE GROVE LEE'S SUMMIT, MISSOURI PROJECT LOCATION	1
DATE 4/3/18		

NOTES TO USERS

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

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

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

The **projection** used in the preparation of this map was Missouri State Plane West Zone (FIPS zone 2403). The **horizontal datum** was NAD 83, GRS 1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

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NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713- 3242**, or visit its website at http://www.ngs.noaa.gov.

Base map information shown on this FIRM was derived from the U.S.D.A Farm Service National Agriculture ImageryProgram (NAIP) dated 2014. Produced at scale of 1:24,000.

The **profile baselines** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the **profile baseline**, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

Based on updated topographic information, this map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. As a result, the Flood Profiles and Floodway Data tables for multiple streams in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on the map. Also, the road to floodplain relationships for unrevised streams may differ from what is shown on previous maps.

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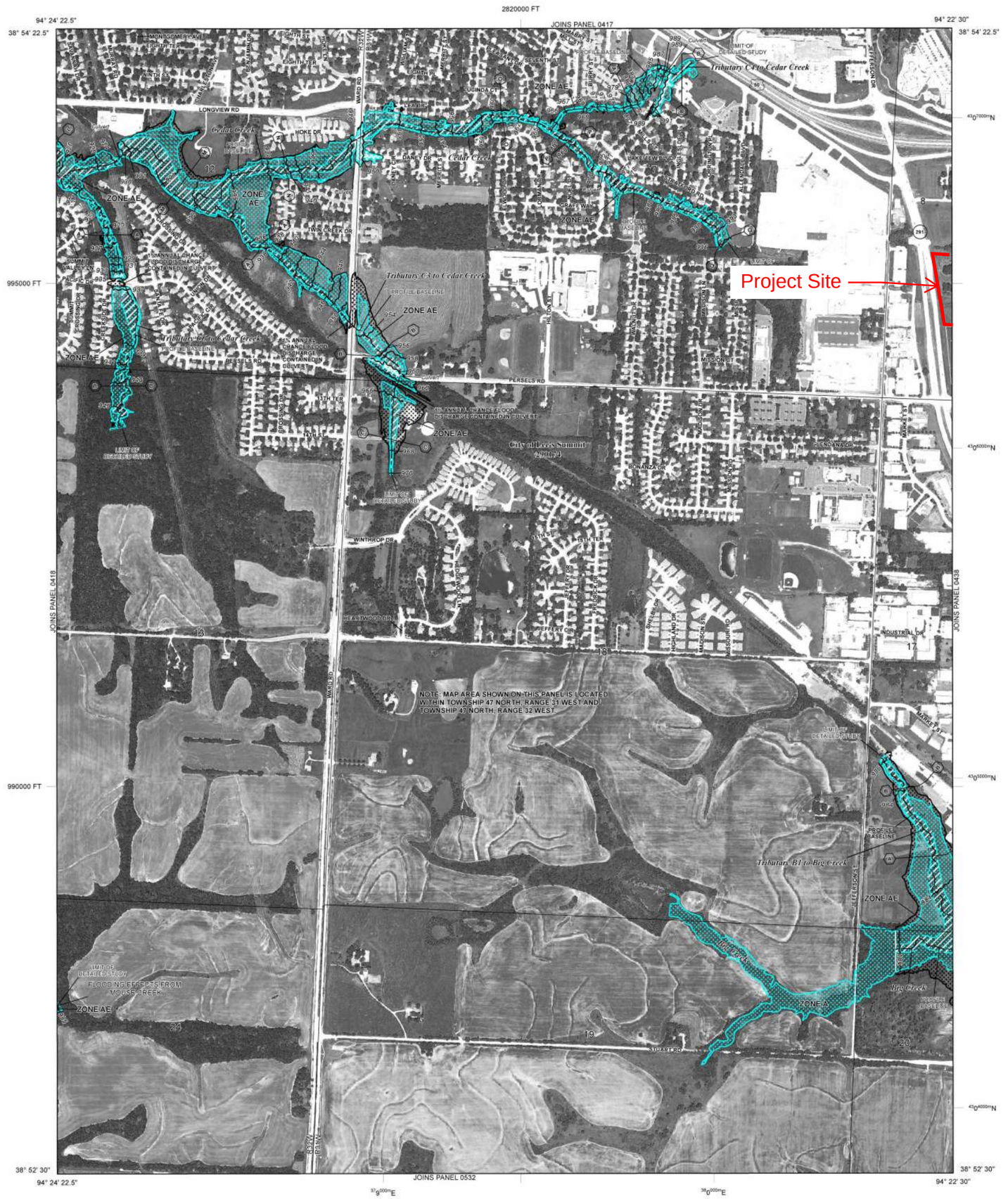

LEGEND

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

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

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

FLOODWAY AREAS IN ZONE AE

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

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

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

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

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

- 1% Annual Chance Floodplain Boundary
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- M1.5 — River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
September 29, 2006

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
January 20, 2017 - to change Special Flood Hazard Areas.

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

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MAP SCALE 1" = 500'
250 0 500 1000 FEET
150 0 150 300 METERS

NFIP — NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0419G

FIRM

FLOOD INSURANCE RATE MAP

JACKSON COUNTY, MISSOURI
AND INCORPORATED AREAS

PANEL 419 OF 625
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
LEE'S SUMMIT, CITY OF	290174	0419	G

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

MAP NUMBER
29095C0419G
MAP REVISED
JANUARY 20, 2017

Federal Emergency Management Agency

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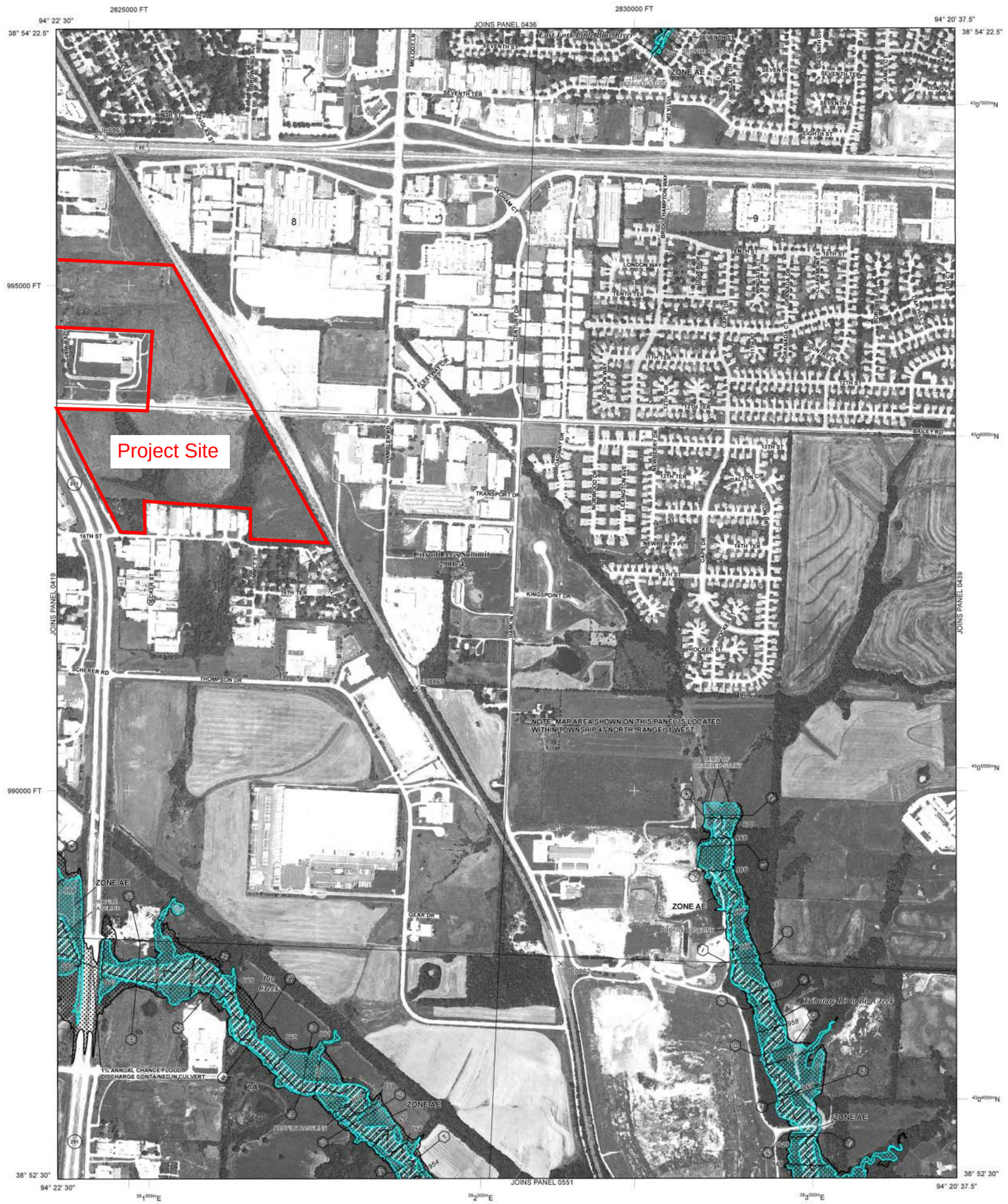

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PANEL 0438G

FIRM

FLOOD INSURANCE RATE MAP

JACKSON COUNTY, MISSOURI AND INCORPORATED AREAS

PANEL 438 OF 625
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
LEE'S SUMMIT, CITY OF	290174	0438	G

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

MAP NUMBER
29095C0438G

MAP REVISED
JANUARY 20, 2017

Federal Emergency Management Agency

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

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

Custom Soil Resource Report for Jackson County, Missouri

The Grove- Lee's Summit

April 2, 2018

Preface

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

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

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

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

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

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

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Contents

How Soil Surveys Are Made

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

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

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

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

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

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

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

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

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

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

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

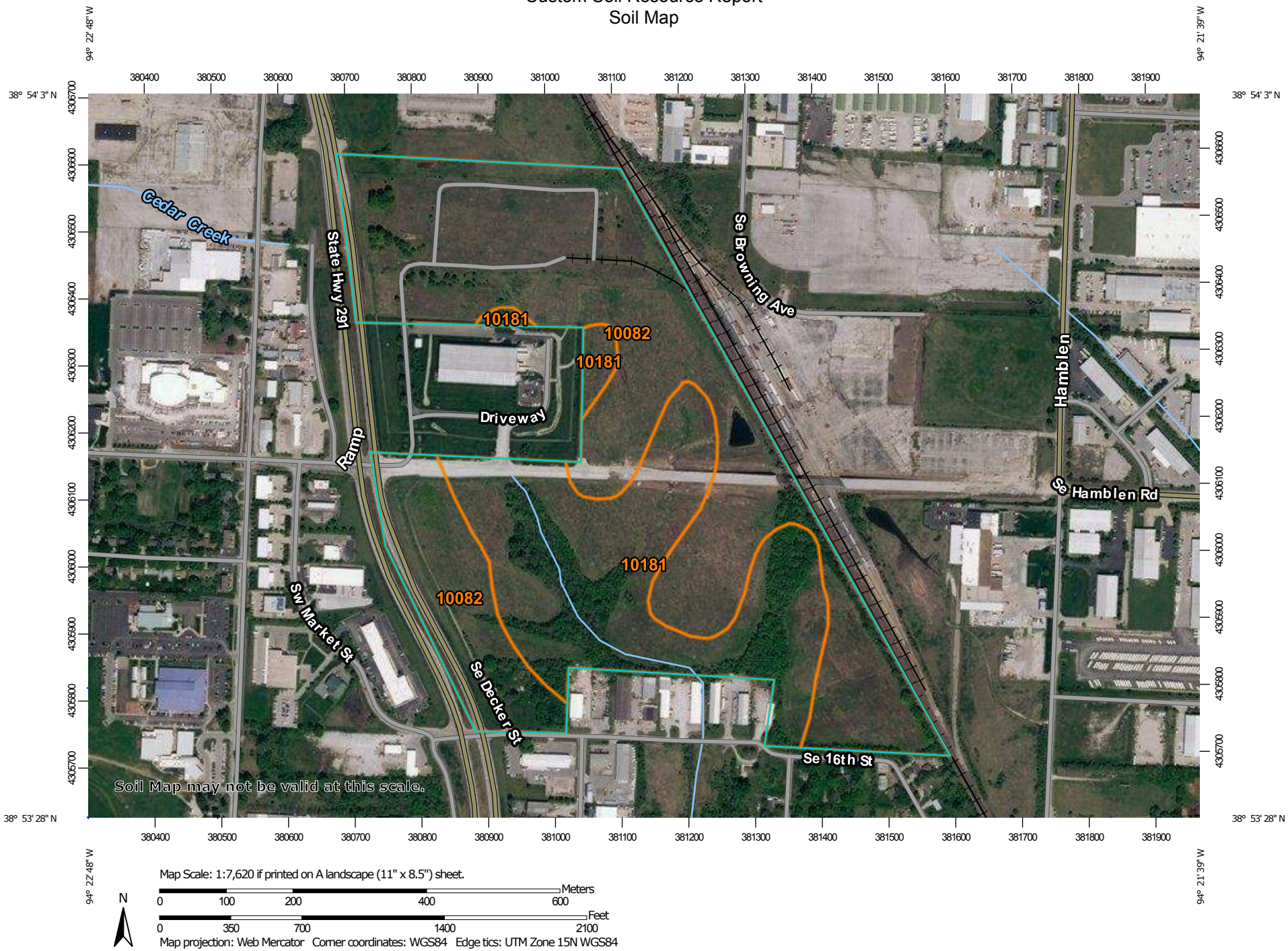
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

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

Soil Map

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

Custom Soil Resource Report
Soil Map



MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Jackson County, Missouri
Survey Area Data: Version 18, Sep 16, 2017

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

Date(s) aerial images were photographed: Oct 14, 2014—Oct 10, 2016

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
10082	Arisburg-Urban land complex, 1 to 5 percent slopes	68.6	66.0%
10181	Udarents-Urban land-Sampsel complex, 5 to 9 percent slopes	35.4	34.0%
Totals for Area of Interest		**104.0**	**100.0%**

Map Unit Descriptions

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

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

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

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

development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

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

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

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

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

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

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

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

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

Jackson County, Missouri

10082—Arisburg-Urban land complex, 1 to 5 percent slopes

Map Unit Setting

National map unit symbol: 2w7ld
Elevation: 750 to 1,130 feet
Mean annual precipitation: 39 to 45 inches
Mean annual air temperature: 50 to 55 degrees F
Frost-free period: 177 to 220 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Arisburg and similar soils: 61 percent
Urban land: 30 percent
Minor components: 9 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Arisburg

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loess

Typical profile

Ap - 0 to 6 inches: silt loam
A - 6 to 13 inches: silt loam
Bt - 13 to 19 inches: silty clay loam
Btg - 19 to 56 inches: silty clay loam
BCg - 56 to 79 inches: silty clay loam

Properties and qualities

Slope: 1 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 11.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: Loess Upland Prairie (R107BY007MO)
Hydric soil rating: No

Description of Urban Land

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

Minor Components

Sharpsburg

Percent of map unit: 3 percent
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Loess Upland Prairie (R109XY002MO)
Hydric soil rating: No

Sampsel

Percent of map unit: 3 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Concave
Ecological site: Interbedded Sedimentary Upland Savanna (R109XY010MO)
Hydric soil rating: Yes

Greenton

Percent of map unit: 3 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Loess Upland Prairie (R109XY002MO)
Hydric soil rating: No

10181—Udarents-Urban land-Sampsel complex, 5 to 9 percent slopes

Map Unit Setting

National map unit symbol: 1n85g
Elevation: 600 to 900 feet
Mean annual precipitation: 33 to 43 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 175 to 220 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Udarents and similar soils: 41 percent
Urban land: 39 percent
Sampsel and similar soils: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udarents

Setting

Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Mine spoil or earthy fill

Typical profile

C1 - 0 to 5 inches: silt loam
C2 - 5 to 80 inches: silty clay loam

Properties and qualities

Slope: 5 to 9 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.14 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 9.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: Deep Loess Upland Prairie (R107BY002MO)
Other vegetative classification: Mixed/Transitional (Mixed Native Vegetation)
Hydric soil rating: No

Description of Urban Land

Setting

Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Across-slope shape: Convex

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

Description of Sampsel

Setting

Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Residuum weathered from shale

Typical profile

Ap - 0 to 13 inches: silty clay loam
Bt - 13 to 80 inches: silty clay

Properties and qualities

Slope: 5 to 9 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 8.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C/D
Ecological site: Interbedded Sedimentary Upland Savanna (R109XY010MO)
Other vegetative classification: Grass/Prairie (Herbaceous Vegetation)
Hydric soil rating: No

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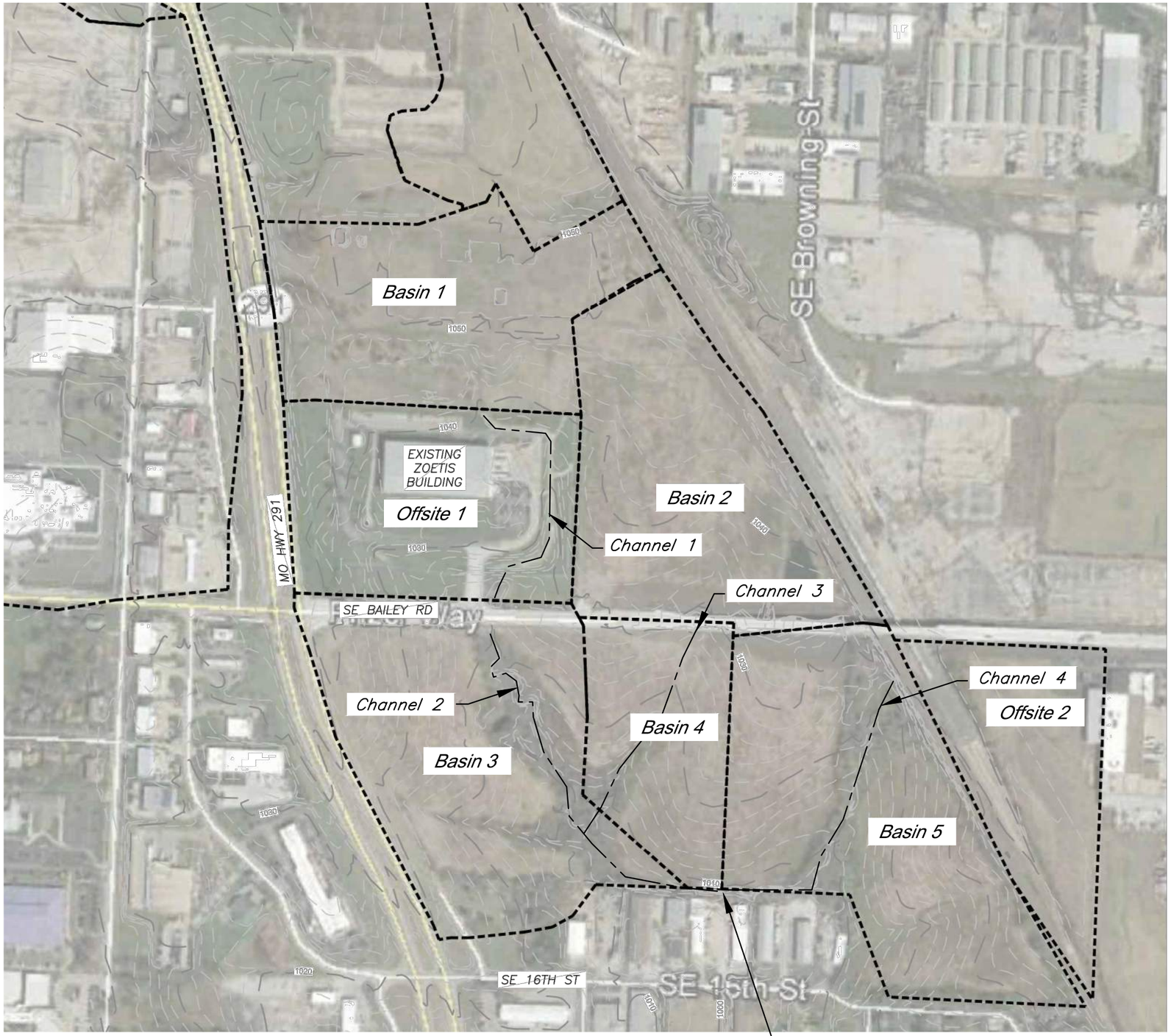


400' 0' 400' 800'

SCALE : 1 INCH = 400 FEET

GBA architects engineers

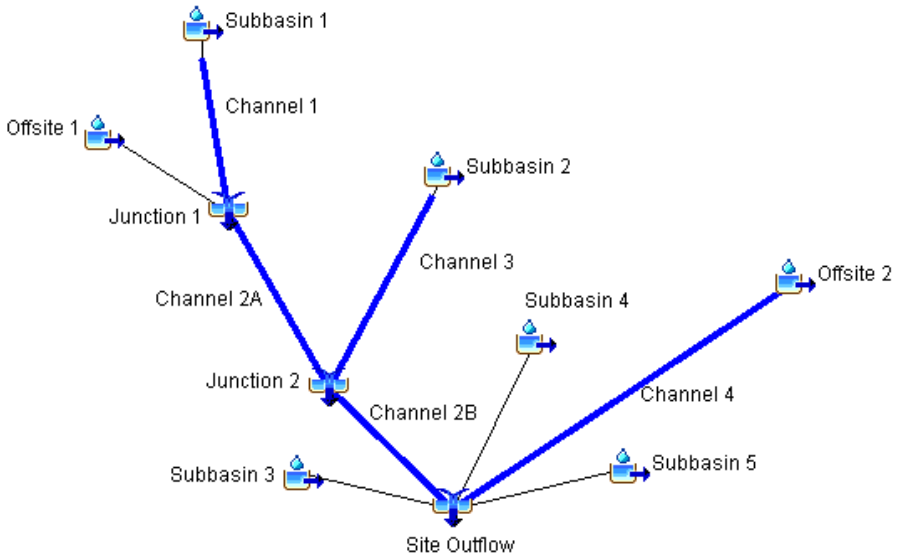
THE GROVE
LEE'S SUMMIT, MISSOURI
EXISTING DRAINAGE MAP

PROJECT NUMBER
13958

DATE
4/3/18

EXHIBIT
4

Exhibit 5 – Existing Conditions HEC-HMS Model Summary



	Sub-Basin	Area	Existing CN	Existing Tc (min.)
North of SE Bailey Rd	1	17.82	74	16.67
	2	19.07	74	24.55
South of SE Bailey Rd	3	19.38	74	37.08
	4	8.69	81	26.46
	5	14.87	74	28.41
Offsite	Off 1	15.84	86	12.78
	Off 2	11.22	74	11.28

Channel 1 Travel Time = 8.83 minutes
Channel 2A Travel Time = 10.69 minutes
Channel 2B Travel Time = 6.77 minutes
Channel 3 Travel Time = 5.4 minutes
Channel 4 Travel Time = 12.08 minutes

Project: The Grove 13958 Simulation Run: Existing 2 Yr

Start of Run: 03Mar2018, 10:00 Basin Model: Existing
End of Run: 04Mar2018, 10:06 Meteorologic Model: 2 Year
Compute Time: 03May2018, 08:51:38 Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Subbasin 1	0.0278440	23.08	03Mar2018, 22:06	1.84
Channel 1	0.0278440	22.02	03Mar2018, 22:12	1.83
Offsite 1	0.0247500	39.97	03Mar2018, 22:00	2.77
Junction 1	0.0525940	54.50	03Mar2018, 22:06	4.60
Channel 2A	0.0525940	54.50	03Mar2018, 22:12	4.59
Subbasin 2	0.0297969	20.50	03Mar2018, 22:06	1.96
Channel 3	0.0297969	20.27	03Mar2018, 22:12	1.96
Junction 2	0.0823909	74.76	03Mar2018, 22:12	6.55
Channel 2B	0.0823909	72.41	03Mar2018, 22:12	6.54
Subbasin 3	0.0302812	16.70	03Mar2018, 22:18	1.99
Subbasin 5	0.0232344	15.01	03Mar2018, 22:12	1.53
Offsite 2	0.0175313	16.94	03Mar2018, 22:00	1.16
Channel 4	0.0175313	16.02	03Mar2018, 22:06	1.15
Subbasin 4	0.0135781	12.79	03Mar2018, 22:06	1.23
Site Outflow	0.1670159	130.40	03Mar2018, 22:12	12.44

Project: The Grove 13958 Simulation Run: Existing 10 Yr

Start of Run: 03Mar2018, 10:00 Basin Model: Existing
End of Run: 04Mar2018, 10:06 Meteorologic Model: 10 Year
Compute Time: 03May2018, 08:51:24 Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Subbasin 1	0.0278440	49.44	03Mar2018, 22:06	3.86
Channel 1	0.0278440	47.75	03Mar2018, 22:06	3.85
Offsite 1	0.0247500	70.43	03Mar2018, 22:00	4.94
Junction 1	0.0525940	104.99	03Mar2018, 22:06	8.79
Channel 2A	0.0525940	104.99	03Mar2018, 22:12	8.78
Subbasin 2	0.0297969	45.48	03Mar2018, 22:06	4.12
Channel 3	0.0297969	44.27	03Mar2018, 22:12	4.12
Junction 2	0.0823909	149.26	03Mar2018, 22:12	12.90
Channel 2B	0.0823909	145.16	03Mar2018, 22:12	12.89
Subbasin 3	0.0302812	36.54	03Mar2018, 22:18	4.18
Subbasin 5	0.0232344	32.75	03Mar2018, 22:12	3.21
Offsite 2	0.0175313	36.69	03Mar2018, 22:00	2.43
Channel 4	0.0175313	35.04	03Mar2018, 22:06	2.43
Subbasin 4	0.0135781	24.75	03Mar2018, 22:06	2.35
Site Outflow	0.1670159	267.96	03Mar2018, 22:12	25.05

Project: The Grove 13958 Simulation Run: Existing 100 Yr

Start of Run: 03Mar2018, 10:00 Basin Model: Existing
End of Run: 04Mar2018, 10:06 Meteorologic Model: 100 Year
Compute Time: 03May2018, 08:51:30 Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Subbasin 1	0.0278440	87.63	03Mar2018, 22:06	6.90
Channel 1	0.0278440	86.48	03Mar2018, 22:06	6.89
Offsite 1	0.0247500	111.20	03Mar2018, 22:00	7.96
Junction 1	0.0525940	175.89	03Mar2018, 22:06	14.86
Channel 2A	0.0525940	175.89	03Mar2018, 22:12	14.84
Subbasin 2	0.0297969	82.21	03Mar2018, 22:06	7.37
Channel 3	0.0297969	79.37	03Mar2018, 22:12	7.37
Junction 2	0.0823909	255.26	03Mar2018, 22:12	22.21
Channel 2B	0.0823909	249.01	03Mar2018, 22:12	22.18
Subbasin 3	0.0302812	66.02	03Mar2018, 22:12	7.47
Subbasin 5	0.0232344	58.66	03Mar2018, 22:12	5.75
Offsite 2	0.0175313	65.44	03Mar2018, 22:00	4.35
Channel 4	0.0175313	62.82	03Mar2018, 22:06	4.34
Subbasin 4	0.0135781	41.38	03Mar2018, 22:06	3.94
Site Outflow	0.1670159	465.52	03Mar2018, 22:12	43.68

APPENDIX B – PROPOSED CONDITIONS

Mass Grading Plan Sheet C4.0 – Grading Plan

Mass Grading Plan Sheet C5.1 – C5.5 – Storm Plan and Profile

Summit and Decker Sheets C9.1 – C9.5 – Storm Plan and Profiles

Summit and Decker Sheet C10.1 – Drainage Map

Phase 1A FDP Plan Sheet C4.0 – Drainage Map

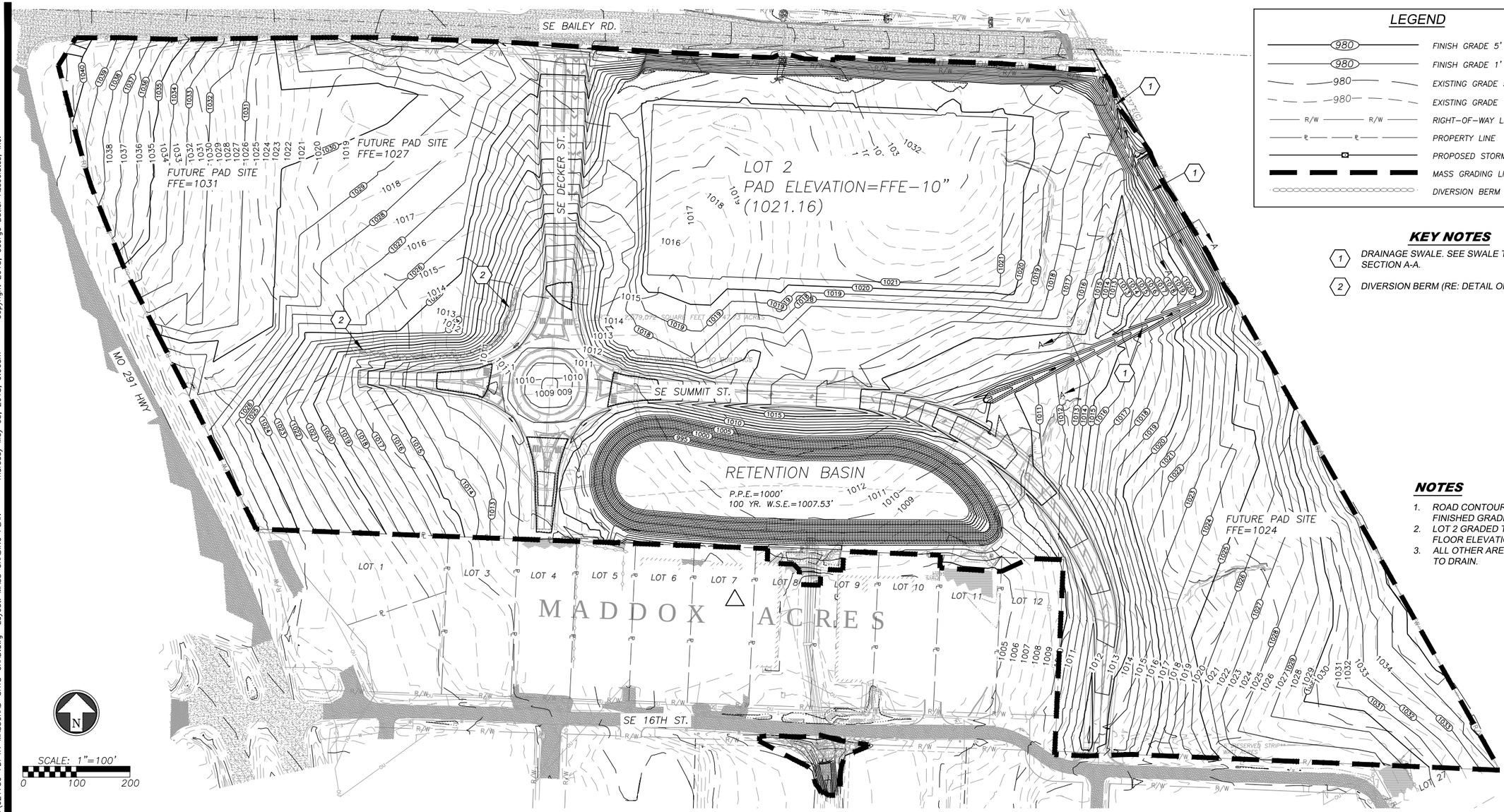
Phase 1A FDP Plan Sheet C5.0 – Storm Plan

Phase 1A FDP – Plan Sheet C5.1 – C5.2 Storm Plan and Profile

Exhibit 6 – Storm Sewer Calculations

Exhibit 7 – Proposed Conditions HEC-HMS Model Summary

Exhibit 8 – Water Quality Volume Calculations



LEGEND

- 980 — FINISH GRADE 5' CONTOURS
- 980 — FINISH GRADE 1' CONTOURS
- 980 — EXISTING GRADE 5' CONTOURS
- 980 — EXISTING GRADE 1' CONTOURS
- R/W — R/W — RIGHT-OF-WAY LINE
- ℄ — ℄ — PROPERTY LINE
- PROPOSED STORM SEWER MAIN
- MASS GRADING LIMITS
- DIVERSION BERM

KEY NOTES

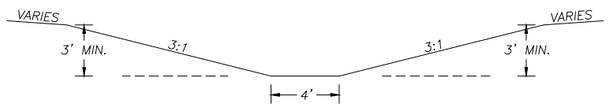
1. DRAINAGE SWALE. SEE SWALE TYPICAL SECTION A-A.
2. DIVERSION BERM (RE: DETAIL ON SHEET C7.3)

NOTES

1. ROAD CONTOURS SHOWN AT FINISHED GRADE MINUS 15.5".
2. LOT 2 GRADED TO FINISH FLOOR ELEVATION MINUS 10".
3. ALL OTHER AREAS GRADED TO DRAIN.

GRADING NOTES

1. CONTRACTOR SHALL OBTAIN A COPY OF THE PRELIMINARY SUBSURFACE EXPLORATION – PROPOSED INDUSTRIAL DEVELOPMENT – THE GROVE – LEE'S SUMMIT, MISSOURI, DATED MARCH 10, 2017 PREPARED BY GEOTECHNOLOGY INC. AND SATISFY HIMSELF AS TO THE EXISTING CONDITIONS AND RECOMMENDATIONS CONTAINED IN THE REPORT.
2. AS DISCUSSED IN THE GEOTECHNICAL REPORT, OVER EXCAVATION OF EXISTING UNSUITABLE SOILS WILL BE REQUIRED UNDER BUILDING AND PAVEMENT AREAS. CONTRACTOR SHALL PERFORM OVER EXCAVATION OF UNSUITABLE SOILS AS A PART OF THIS WORK.
3. ALL MATERIAL UNDER PAVEMENT SURFACES AND BUILDING SLABS SHALL BE REMEDIATED IN ACCORDANCE WITH THE GEOTECHNICAL REPORT.
4. ALL TOPSOIL, VEGETATION, ROOT STRUCTURES, AND DELETERIOUS MATERIALS SHALL BE STRIPPED FROM THE GROUND SURFACE PRIOR TO THE PLACEMENT OF EMBANKMENTS.
5. ALL DISTURBED AREAS THAT ARE NOT TO BE PAVED (GREEN SPACES) SHALL BE FINISH GRADED WITH A MINIMUM OF SIX INCHES OF TOPSOIL.
6. ALL EXCAVATION AND EMBANKMENTS SHALL COMPLY WITH THE RECOMMENDATIONS PROVIDED BY THE GEOTECHNICAL ENGINEER.
7. PRIOR TO PLACING ANY CONCRETE OR ASPHALT PAVEMENT THE CONTRACTOR SHALL PERFORM A PROOF ROLL OF THE PAVEMENT SUB-GRADE WITH A FULLY LOADED TANDEM AXLE DUMP TRUCK. THE PROOF ROLL SHALL BE CONDUCTED IN THE PRESENCE OF THE ENGINEER AND THE ON-SITE GEOTECHNICAL REPRESENTATIVE. AREAS THAT DISPLAY RUTTING OR PUMPING THAT ARE UNSATISFACTORY TO THE ENGINEER SHALL BE RE-WORKED AND A FOLLOW-UP PROOF ROLL SHALL BE CONDUCTED PRIOR TO ACCEPTANCE OF THE SUB-GRADE FOR PAVING. THE CONTRACTOR MAY, AT ITS OWN EXPENSE, STABILIZE THE SUB-GRADE USING CLASS C FLY ASH OR QUICKLIME.
8. FINISHED GRADES SHALL NOT BE STEEPER THAN 3:1.
9. ALL GRADING WORK SHALL BE CONSIDERED UNCLASSIFIED. NO ADDITIONAL PAYMENTS SHALL BE MADE FOR ROCK EXCAVATION. CONTRACTOR SHALL SATISFY HIMSELF AS TO ANY ROCK EXCAVATION REQUIRED TO ACCOMPLISH THE IMPROVEMENTS SHOWN HEREON.



SWALE SECTION A-A
(NTS)

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Professional Engineer
License No. PE-2011009651

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MASS GRADING PLAN

SHEET NUMBER
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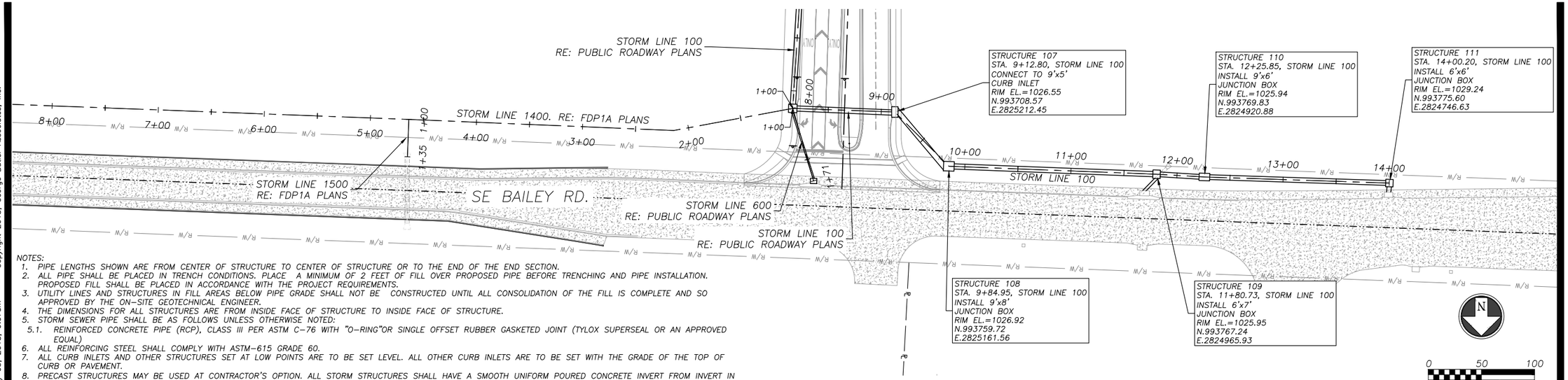

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3. UTILITY LINES AND STRUCTURES IN FILL AREAS BELOW PIPE GRADE SHALL NOT BE CONSTRUCTED UNTIL ALL CONSOLIDATION OF THE FILL IS COMPLETE AND SO APPROVED BY THE ON-SITE GEOTECHNICAL ENGINEER.
4. THE DIMENSIONS FOR ALL STRUCTURES ARE FROM INSIDE FACE OF STRUCTURE TO INSIDE FACE OF STRUCTURE.
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6. ALL REINFORCING STEEL SHALL COMPLY WITH ASTM-615 GRADE 60.
7. ALL CURB INLETS AND OTHER STRUCTURES SET AT LOW POINTS ARE TO BE SET LEVEL. ALL OTHER CURB INLETS ARE TO BE SET WITH THE GRADE OF THE TOP OF CURB OR PAVEMENT.
8. PRECAST STRUCTURES MAY BE USED AT CONTRACTOR'S OPTION. ALL STORM STRUCTURES SHALL HAVE A SMOOTH UNIFORM POURED CONCRETE INVERT FROM INVERT IN TO INVERT OUT.
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12. ALL HDPE PIPE SHALL BE ADS N-12 OR APPROVED EQUAL, MEETING AASHTO M284, TYPE S OR ASTM F2306. THE PIPE SHALL HAVE A SMOOTH INTERIOR AND ANNULAR EXTERIOR CORRUGATIONS. PIPE JOINTS SHALL BE JOINTED USING BELL & SPIGOT JOINT MEETING AASHTO M252, AASHTO M294, OR ASTM F2306. THE JOINT SHALL BE WATERTIGHT, ACCORDING TO THE REQUIREMENTS OF ASTM D3212, AND GASKETS SHALL MEET THE REQUIREMENTS OF ASTM F477. GASKETS SHALL BE INSTALLED BY THE PIPE MANUFACTURER AND COVERED WITH A REMOVABLE WRAP TO ENSURE THE GASKET IS FREE FROM DEBRIS. A JOINT LUBRICANT SUPPLIED BY THE MANUFACTURER SHALL BE USED ON THE GASKET AND BELL DURING ASSEMBLY.
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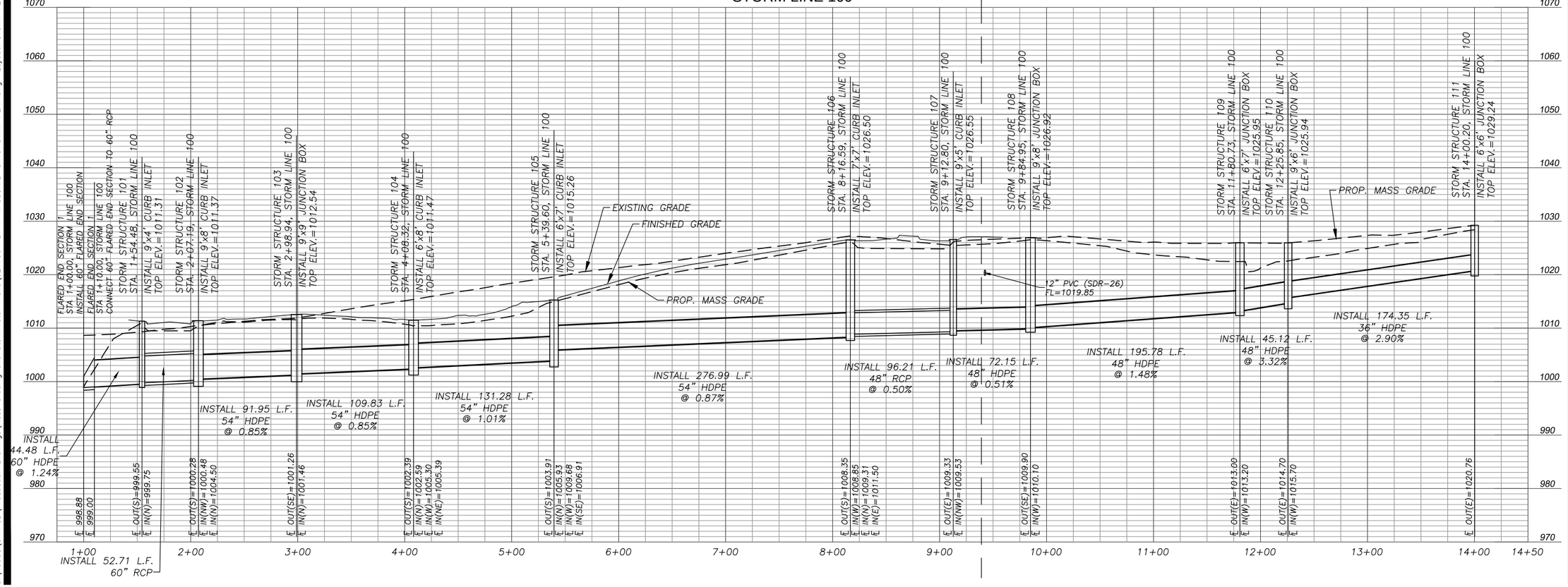
REFER TO PUBLIC ROAD PLAN SET FOR STRUCTURES 100-107, LINE 100

REFER TO THIS PLAN FOR STRUCTURES 108-111, LINE 100

STORM LINE 100



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LEE'S SUMMIT, MISSOURI

Clint Loumaster
Professional Engineer
License No. PE-2011009651

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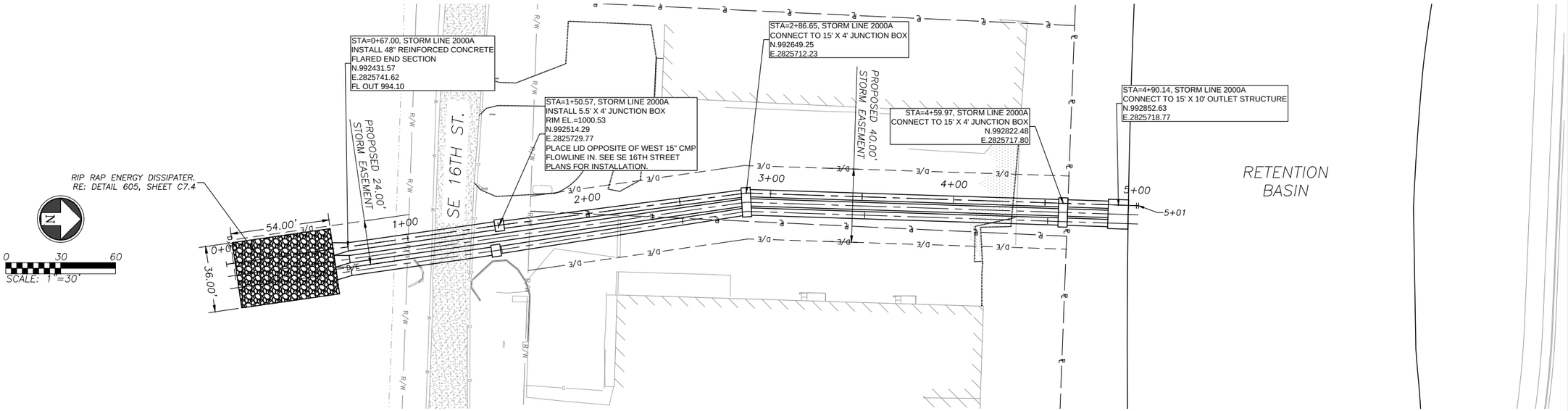

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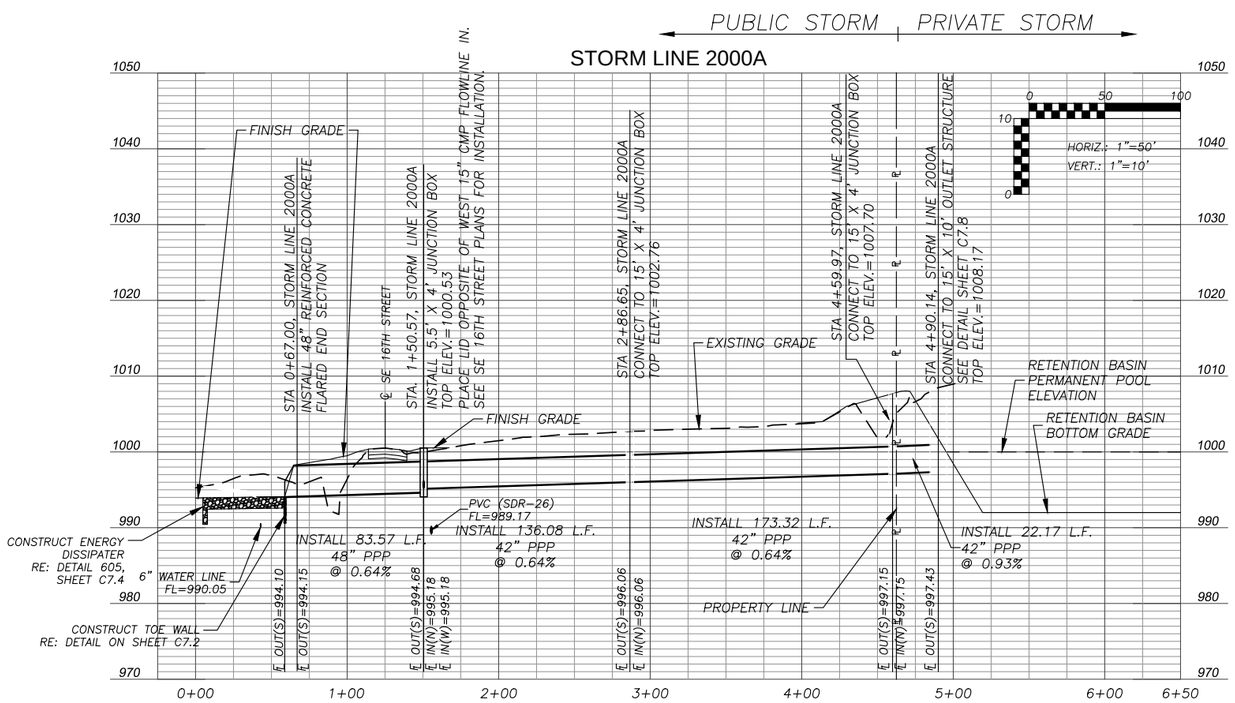

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SHEET NUMBER
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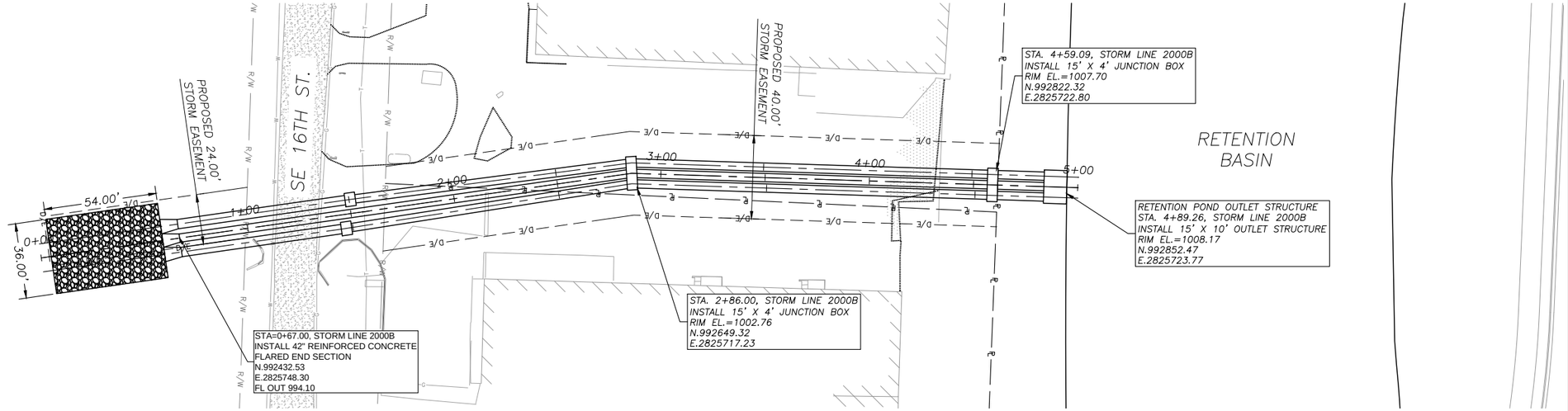

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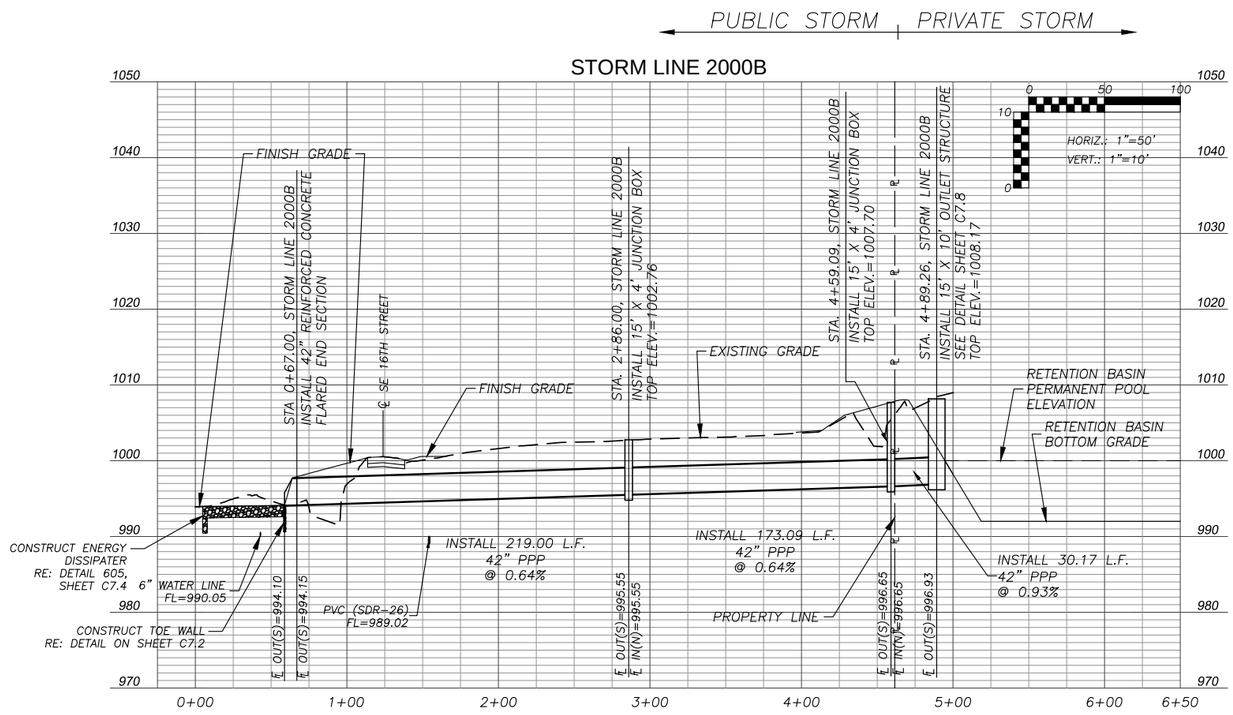

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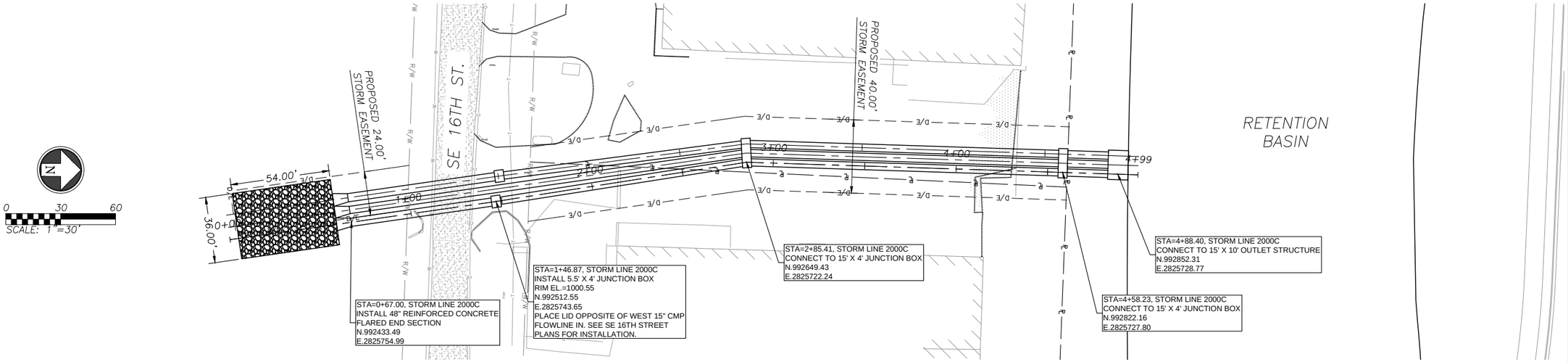

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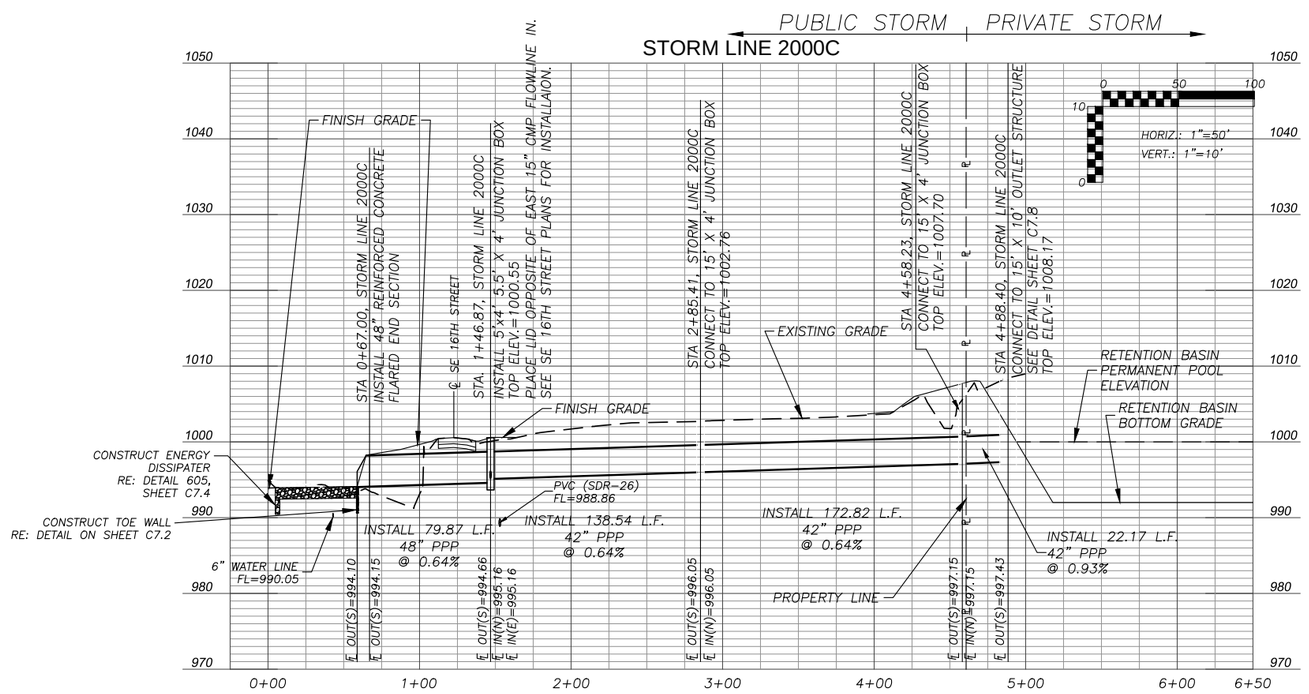

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Lenexa, Kansas 66219
913.492.0400
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PROPOSED FACILITY FOR:

THE GROVE AT LEE'S SUMMIT

MASS GRADING AND STORMWATER
MISSOURI HWY 291 & 16TH STREET
LEE'S SUMMIT, MISSOURI

Clint Loumaster
Professional Engineer
License No. PE-2011009651

REVISION

PROJECT NUMBER
13958.00

DATE
4/XX/18

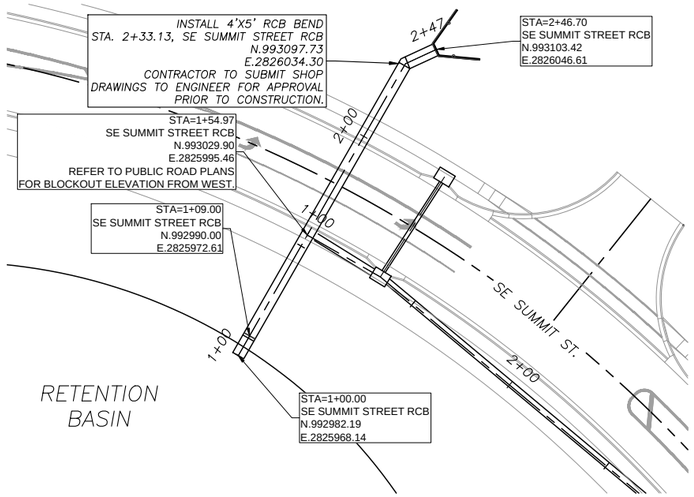
DESIGNED

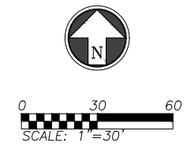
DRAWN

REVIEWED

SHEET TITLE
STORM PLAN AND PROFILE (4)

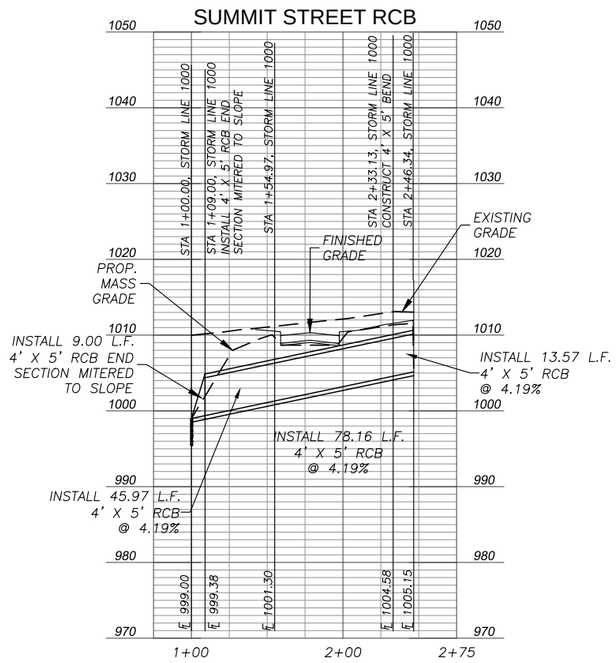
SHEET NUMBER
C5.4

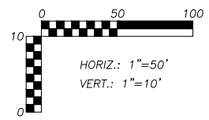




NOTES:

1. PIPE LENGTHS SHOWN ARE FROM CENTER OF STRUCTURE TO CENTER OF STRUCTURE OR TO THE END OF THE END SECTION. ALL PIPES SHALL BE FIELD STAKED TO THE INSIDE WALL FACE OF THE STRUCTURE.
2. ALL PIPE SHALL BE PLACED IN TRENCH CONDITIONS. PLACE A MINIMUM OF 2 FEET OF FILL OVER PROPOSED PIPE BEFORE TRENCHING AND PIPE INSTALLATION. PROPOSED FILL SHALL BE PLACED IN ACCORDANCE WITH THE PROJECT REQUIREMENTS.
3. UTILITY LINES AND STRUCTURES IN FILL AREAS BELOW PIPE GRADE SHALL NOT BE CONSTRUCTED UNTIL ALL CONSOLIDATION OF THE FILL IS COMPLETE AND SO APPROVED BY THE ON-SITE GEOTECHNICAL ENGINEER.
4. THE DIMENSIONS FOR ALL STRUCTURES ARE FROM INSIDE FACE OF STRUCTURE TO INSIDE FACE OF STRUCTURE.
5. STORM SEWER PIPE SHALL BE AS FOLLOWS UNLESS OTHERWISE NOTED:
   - 5.1. REINFORCED CONCRETE PIPE (RCP), CLASS III PER ASTM C-76 WITH "O-RING"OR SINGLE OFFSET RUBBER GASKETED JOINT (TYLOX SUPERSEAL OR AN APPROVED EQUAL)
6. ALL REINFORCING STEEL SHALL COMPLY WITH ASTM-615 GRADE 60.
7. ALL CURB INLETS AND OTHER STRUCTURES SET AT LOW POINTS ARE TO BE SET LEVEL. ALL OTHER CURB INLETS ARE TO BE SET WITH THE GRADE OF THE TOP OF CURB OR PAVEMENT.
8. PRECAST STRUCTURES MAY BE USED AT CONTRACTOR'S OPTION. ALL STORM STRUCTURES SHALL HAVE A SMOOTH UNIFORM POURED CONCRETE INVERT FROM INVERT IN TO INVERT OUT.
9. THE LIDS OF ALL PRECAST STRUCTURES SHALL BE GROUTED TO THE TOP OF THE WALLS.
10. NORTHINGS AND EASTINGS ARE SHOWN TO THE CENTER OF THE STRUCTURE.
11. THE FIRST DIMENSION SHOWN IS THE "L" DIMENSION AND THE SECOND IS THE "W" DIMENSION, SEE DETAILS.
12. ALL HDPE PIPE SHALL BE ADS N-12 OR APPROVED EQUAL, MEETING AASHTO M284, TYPE S OR ASTM F2306. THE PIPE SHALL HAVE A SMOOTH INTERIOR AND ANNULAR EXTERIOR CORRUGATIONS. PIPE JOINTS SHALL BE JOINTED USING BELL & SPIGOT JOINT MEETING AASHTO M252, AASHTO M294, OR ASTM F2306. THE JOINT SHALL BE WATERTIGHT, ACCORDING TO THE REQUIREMENTS OF ASTM D3212, AND GASKETS SHALL MEET THE REQUIREMENTS OF ASTM F477. GASKETS SHALL BE INSTALLED BY THE PIPE MANUFACTURER AND COVERED WITH A REMOVABLE WRAP TO ENSURE THE GASKET IS FREE FROM DEBRIS. A JOINT LUBRICANT SUPPLIED BY THE MANUFACTURER SHALL BE USED ON THE GASKET AND BELL DURING ASSEMBLY.
13. FITTINGS FOR PLASTIC PIPE SHALL CONFORM TO AASHTO M252, AASHTO M294, OR ASTM F2306. ALL TEES SHALL BE DUAL WALL REDUCING TEES CONSISTENT WITH THE ADS N-12 PIPE WATERTIGHT CONNECTIONS.
14. ALL PIPE DESIGNATED AS PPP SHAL BE POLYPROPYLENE PIPE MEETING THE FOLLOWING SPECIFICATIONS:
   - 14.1. PIPE STIFFNESS AND JOINTS SHALL MEET ASTM F2881 AND AASHTO M330 FOR DIAMETER.
   - 14.2. ALL PIPE JOINTS SHALL BE BELL AND SPIGOT JOINTS WHICH MEET THE REQUIREMENTS OF ASTM D3212.





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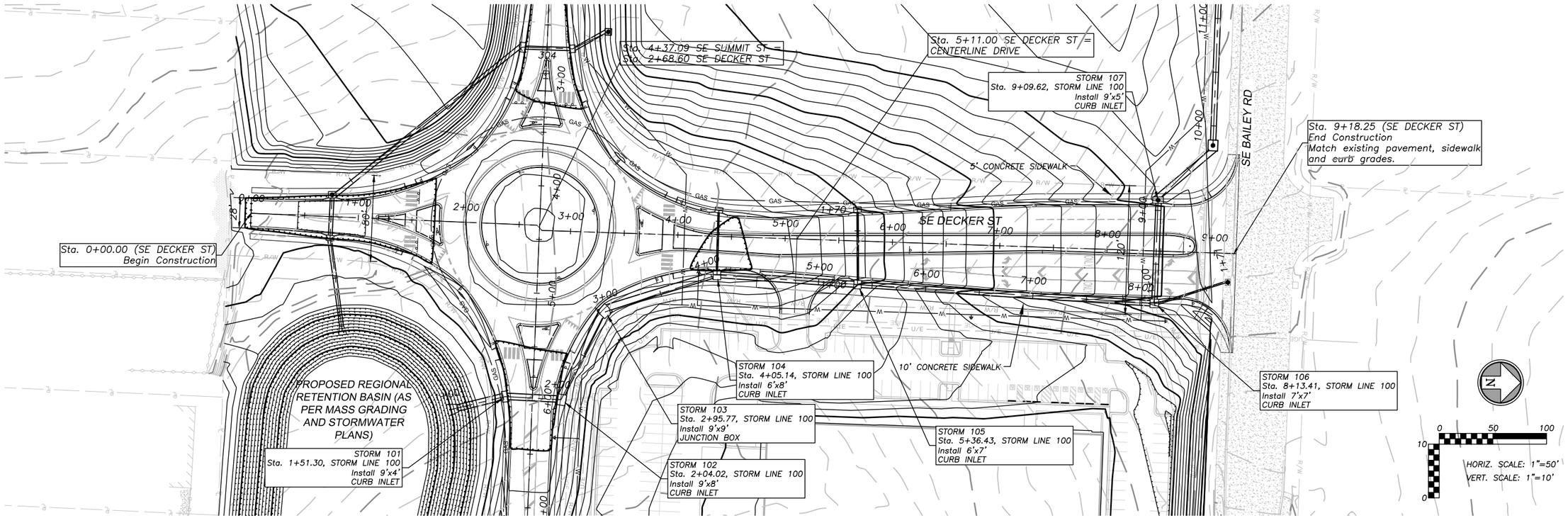
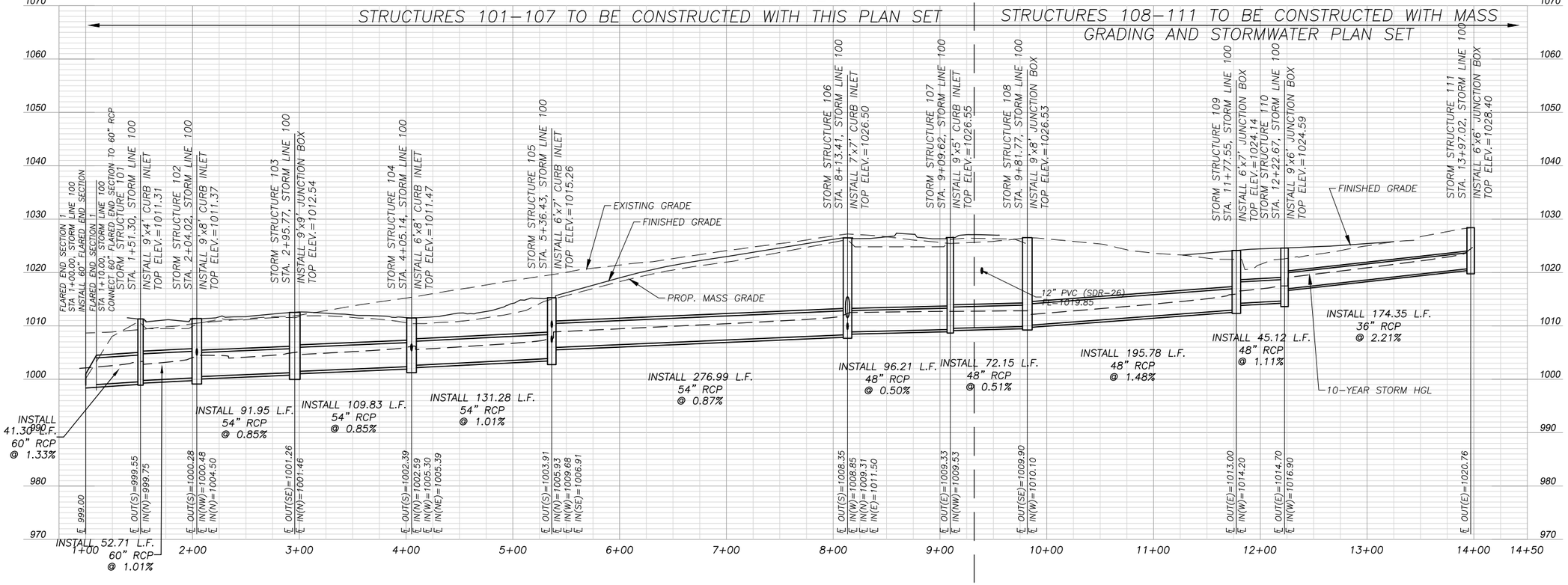
STORM PLAN AND PROFILE (5)

SHEET NUMBER

C5.5



STORM LINE 100



Rev.	Date	Description	By	App.

STATE OF MISSOURI
PATRICK J. JOYCE
NUMBER PE-2009030082
PROFESSIONAL ENGINEER
6-8-17

BHC RHODES
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BHC RHODES is a trademark of Bungardt, Hammack & Company, P.A.

Prepared For:
THE GROVE AT LEE'S SUMMIT, LLC
P.O. BOX 57
LEE'S SUMMIT, MISSOURI 64063

THE GROVE AT LEE'S SUMMIT
CITY OF LEE'S SUMMIT
JACKSON COUNTY, MISSOURI

PUBLIC ROAD IMPROVEMENTS FOR SE DECKER ST. & SE SUMMIT ST.
STORM SEWER PLAN & PROFILE

Design:	DRS
Drawn:	SKE
Checked:	PJJ
Issue Date:	04/21/17
Project Number:	021730

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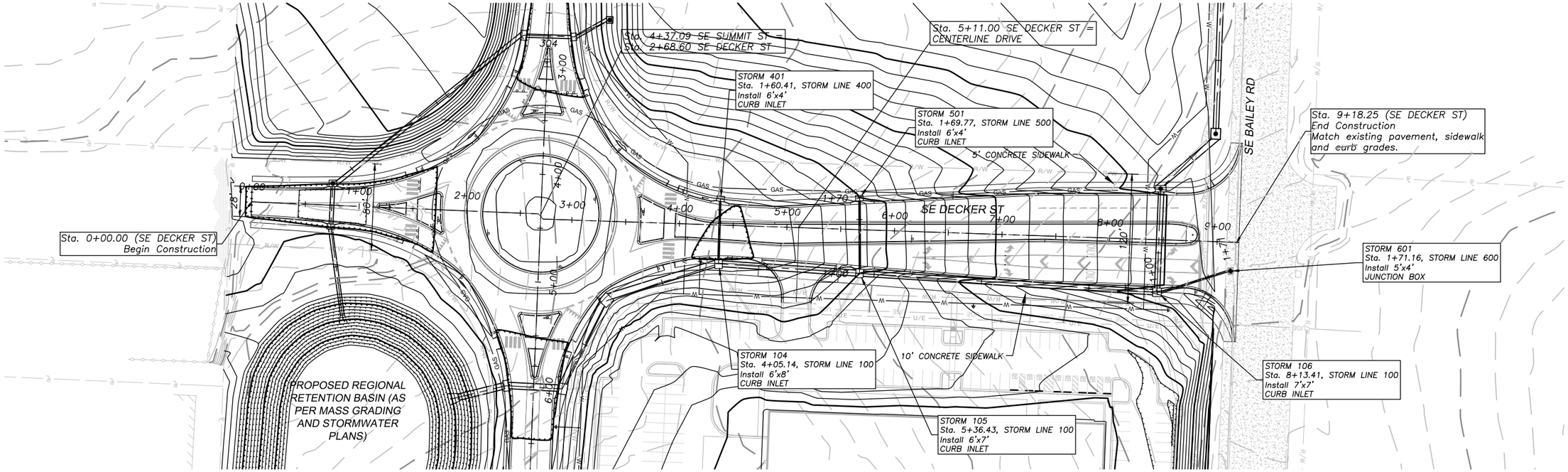
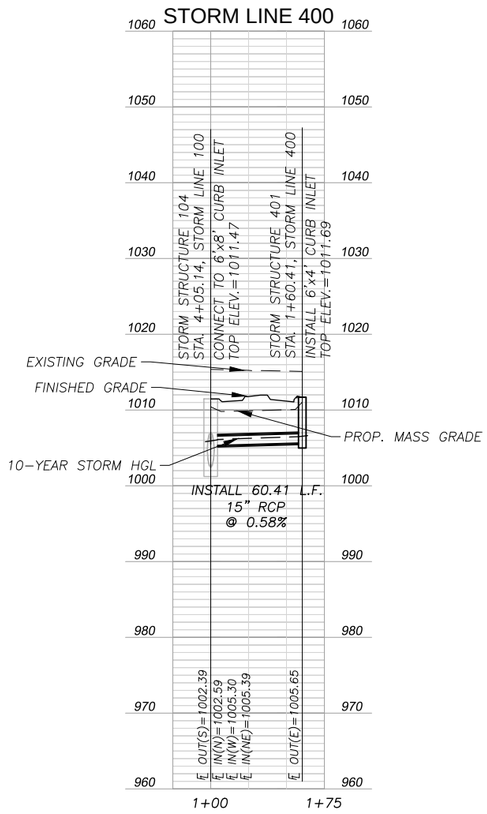
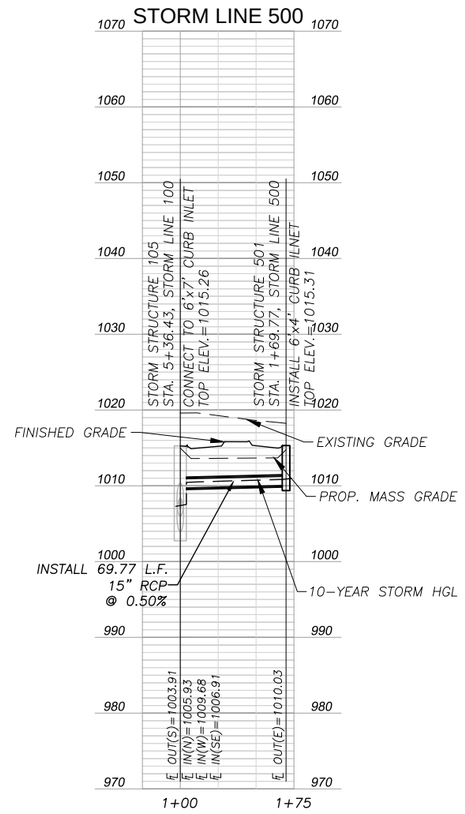
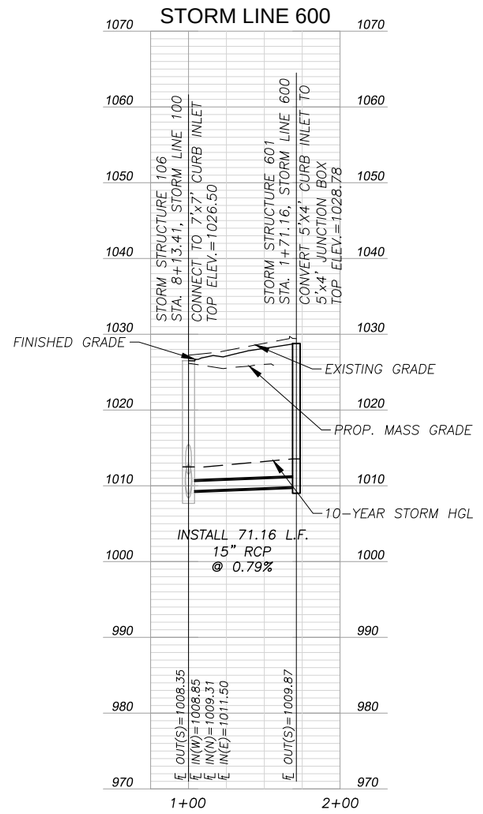
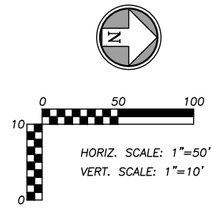
C9.1











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CITY OF LEE'S SUMMIT
JACKSON COUNTY, MISSOURI
PUBLIC ROAD IMPROVEMENTS FOR
SE DECKER ST. & SE SUMMIT ST.
STORM SEWER PLAN & PROFILE

Design: DRS	Drawn: SKE
Checked:	PJJ
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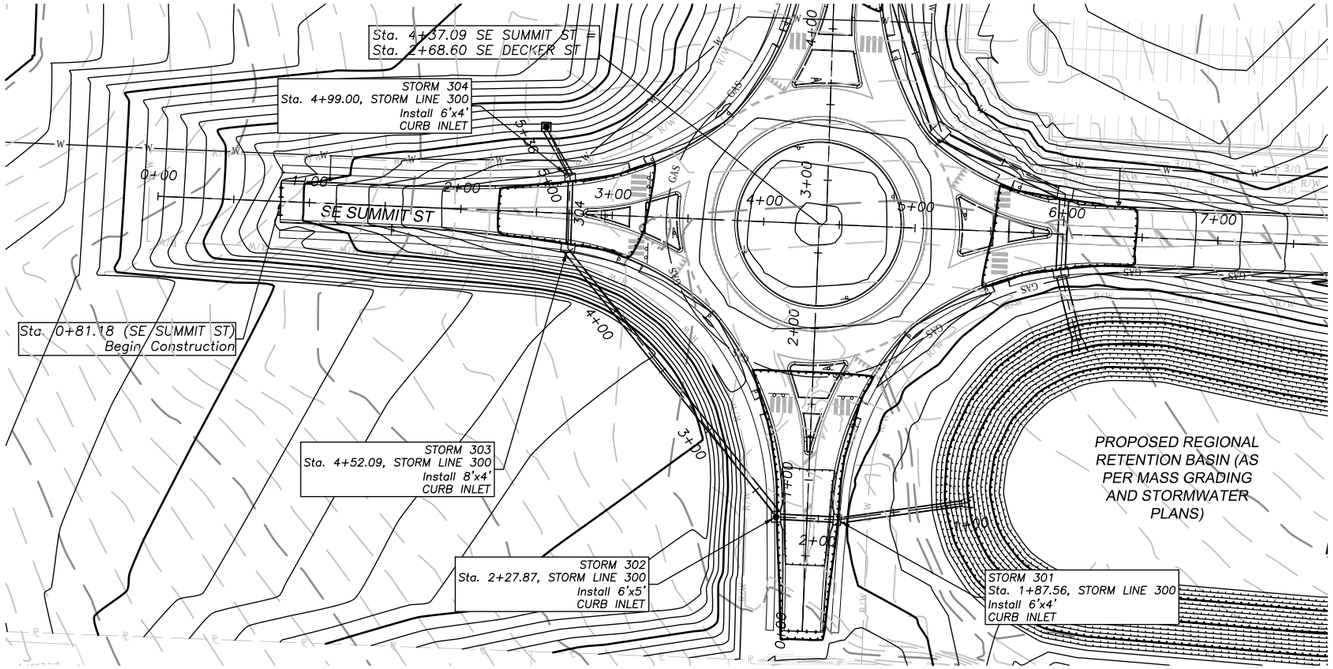
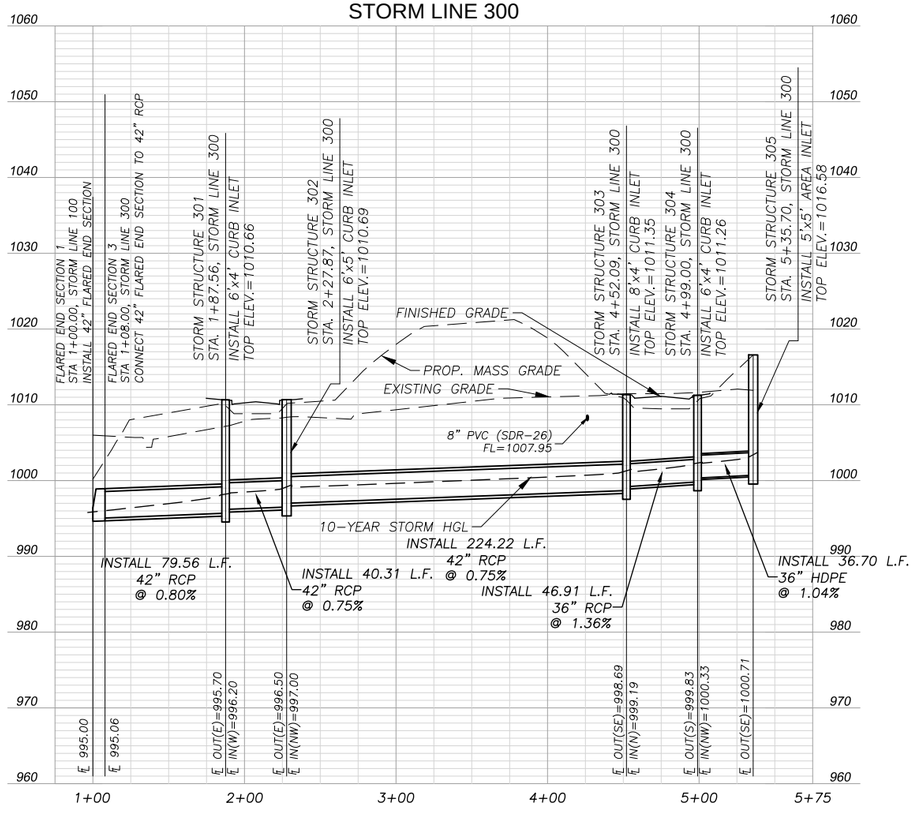
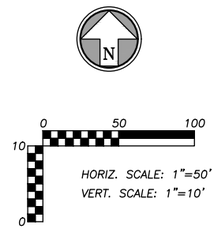
C9.2







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CITY OF LEE'S SUMMIT
JACKSON COUNTY, MISSOURI
PUBLIC ROAD IMPROVEMENTS FOR SE DECKER ST. & SE SUMMIT ST.
STORM SEWER PLAN & PROFILE

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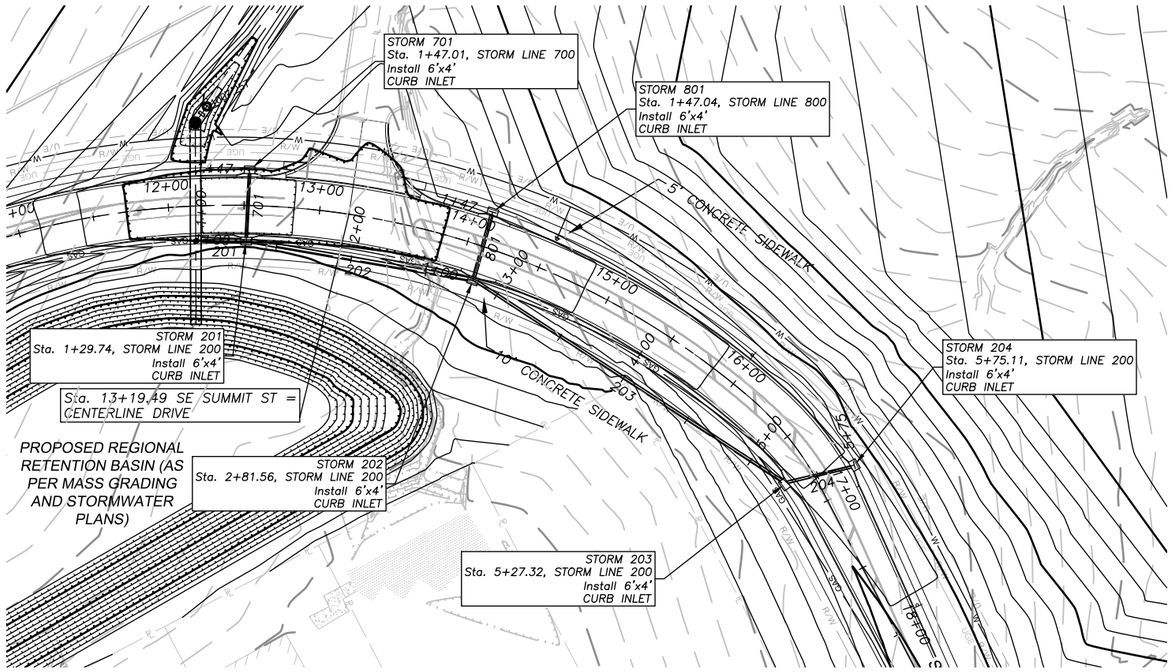
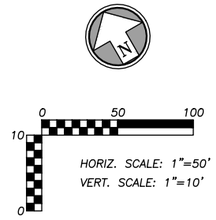
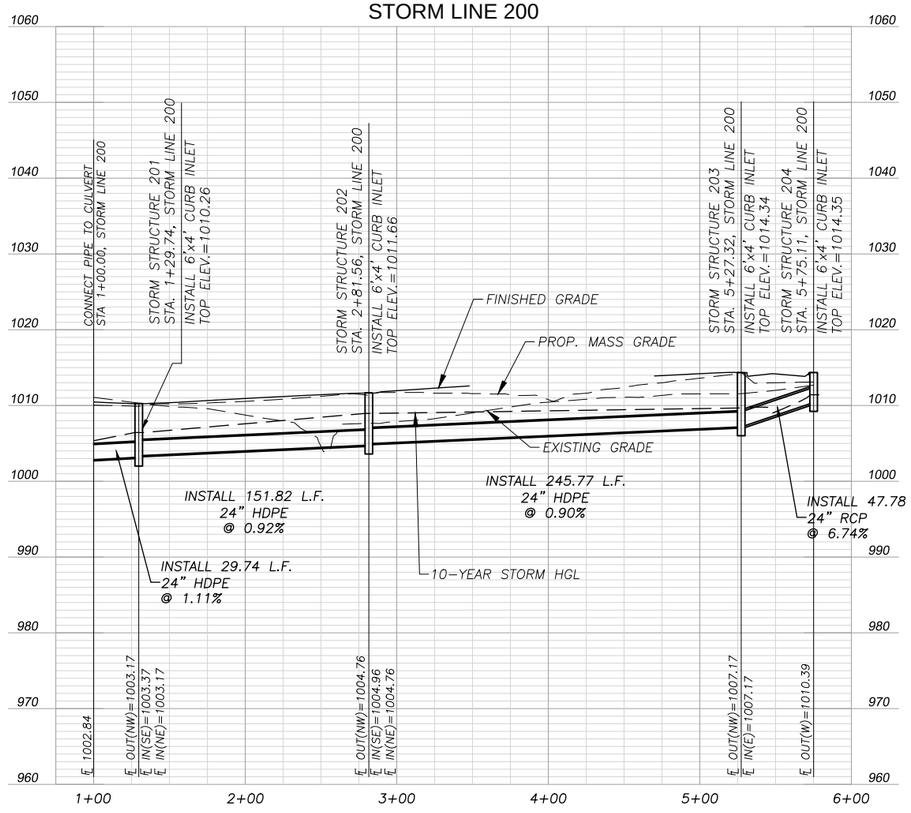
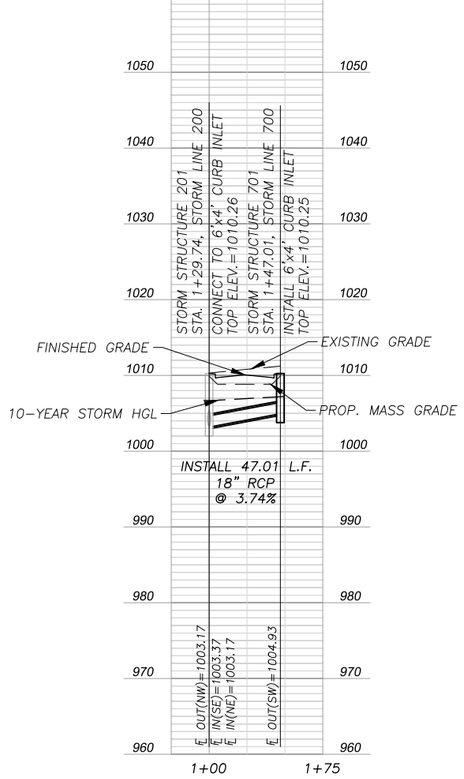
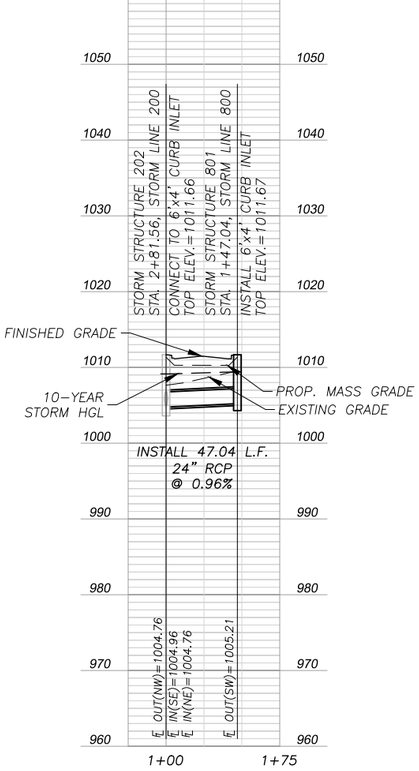
C9.3











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STATE OF MISSOURI
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JACKSON COUNTY, MISSOURI
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STORM SEWER PLAN & PROFILE

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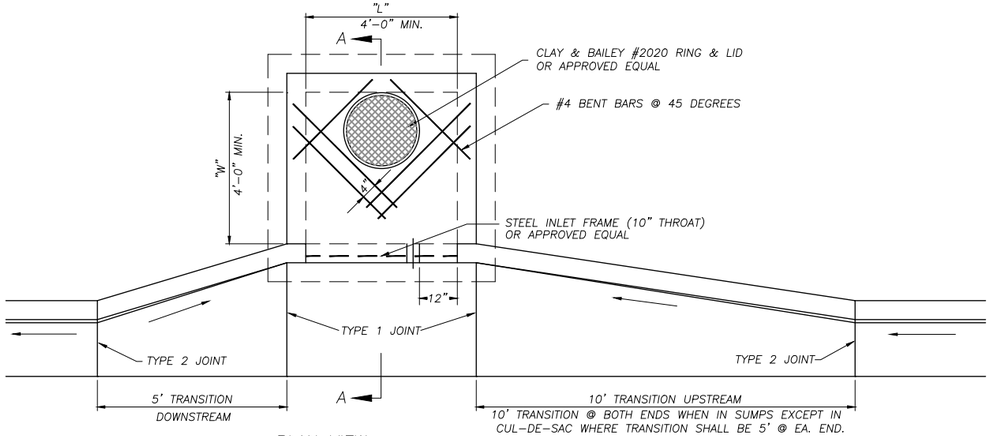
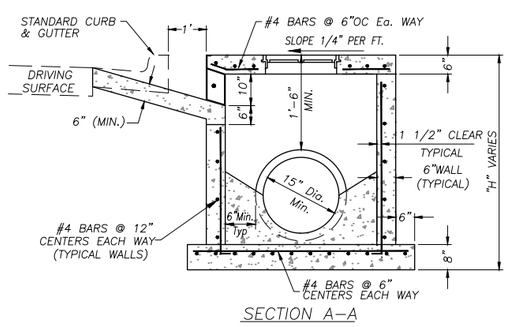


PLAN VIEW

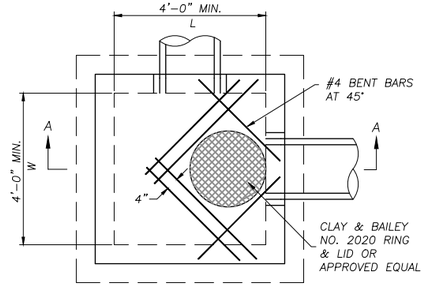


SECTION A–A

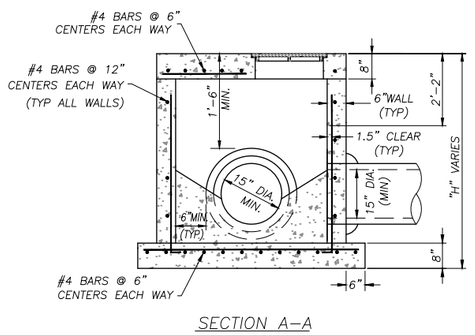
NOTES:

1. ALL CONCRETE SHALL BE 4000 psi.
2. INLET CONSTRUCTION NOTES SHALL LIST THE "L" DIMENSION FIRST, THE "W" DIMENSION SECOND, AND THE "H" DIMENSION THIRD.
3. FLOOR OF INLET SHALL HAVE A SHAPED CONCRETE INVERT TO PROVIDE FOR SMOOTH FLOW.
4. THE MINIMUM DIMENSION BETWEEN TOP OF PIPE AND TOP OF BOX SHALL BE 1'–6" (TYPICAL ALL WALLS)
5. ALL INGRADE INLETS SHALL CONFORM TO STREET GRADE. ALL INLETS IN SUMP SHALL BE LEVEL. BEVEL ALL EXPOSED EDGES WITH 3/4" TRIANGULAR MOLDING.
6. THE THROAT AND TRANSITION ARE SUBSIDIARY TO THE STRUCTURE.

001 CURB INLET



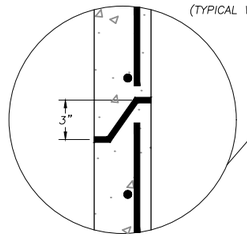
PLAN VIEW



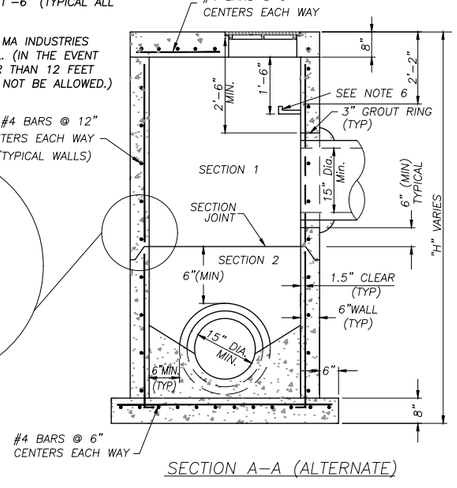
SECTION A–A

NOTES:

1. ALL CONCRETE SHALL BE 4000 psi.
2. JUNCTION BOX CONSTRUCTION NOTES SHALL LIST THE "L" DIMENSION FIRST, THE "W" DIMENSION SECOND, AND THE "H" DIMENSION THIRD.
3. FLOOR OF JUNCTION BOX SHALL HAVE A SHAPED CONCRETE INVERT TO PROVIDE FOR SMOOTH FLOW.
4. THE MINIMUM DIMENSION BETWEEN TOP OF PIPE AND TOP OF BOX SHALL BE 1'–6" (TYPICAL ALL WALLS)
5. STEPS SHALL BE C&B 2102, MA INDUSTRIES PS2–PF OR APPROVED EQUAL. (IN THE EVENT "H" IS EQUAL TO OR GREATER THAN 12 FEET MA INDUSTRIES PS2–PF WILL NOT BE ALLOWED.)



JOINT DETAIL

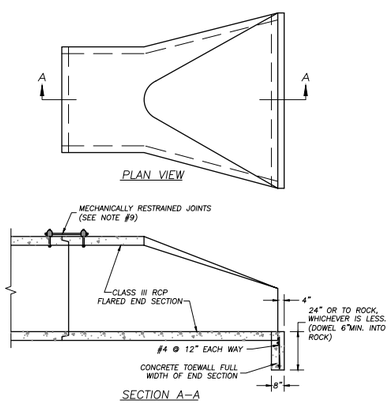


SECTION A–A (ALTERNATE)

002 JUNCTION BOX

NOTES:

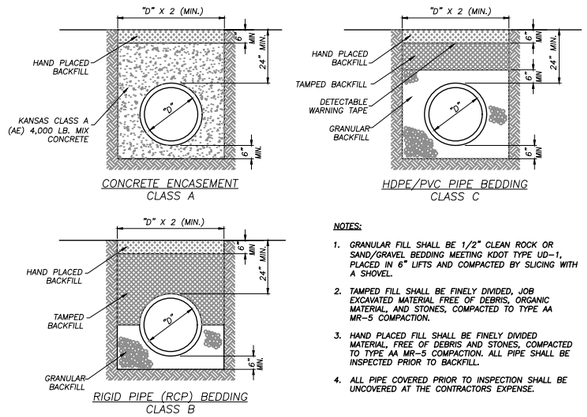
1. ALL CONCRETE SHALL BE 4000 psi.
2. REINFORCING STEEL SHALL BE NEW BILLET, MINIMUM GRADE 60 AS PER ASTM A615, AND SHALL BE BENT COLD.
3. ALL DIMENSIONS RELATIVE TO REINFORCING STEEL ARE TO CENTERLINE OF BARS. 2" CLEARANCE SHALL BE PROVIDED THROUGHOUT UNLESS NOTED OTHERWISE. TOLERANCE OF +/– 1/8" SHALL BE PERMITTED.
4. ALL LAP SPLICES NOT SHOWN SHALL BE A MINIMUM OF 40 BAR DIAMETERS IN LENGTH.
5. ALL CONCRETE CONSTRUCTION SHALL MEET THE APPLICABLE REQUIREMENTS OF STANDARD SPECIFICATIONS FOR STATE ROAD AND BRIDGE CONSTRUCTION, KANSAS DEPARTMENT OF TRANSPORTATION, LATEST EDITION, AND SPECIAL PROVISIONS.
6. ALL DOWELS SHALL BE ACCURATELY PLACED AND SECURELY TIED IN PLACE PRIOR TO PLACEMENT OF BOTTOM SLAB CONCRETE. STICKING OF DOWELS INTO FRESH OR PARTIALLY HARDENED CONCRETE WILL NOT BE ACCEPTABLE.
7. ALL REINFORCING STEEL SHALL BE SUPPORTED ON FABRICATED STEEL BAR SUPPORTS @ 3'–0" MAXIMUM SPACING.
8. DO NOT SCALE THESE DRAWINGS FOR DIMENSIONS OR CLEARANCES. ANY QUESTIONS REGARDING DIMENSIONS SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER AND CONTRACTING OFFICER PRIOR TO CONSTRUCTION.
9. THE LAST THREE JOINTS OF RCP, INCLUDING THE END SECTION, SHALL BE MECHANICALLY RESTRAINED WHERE DISCHARGING INTO UNIMPROVED SYSTEMS.



PLAN VIEW

SECTION A–A

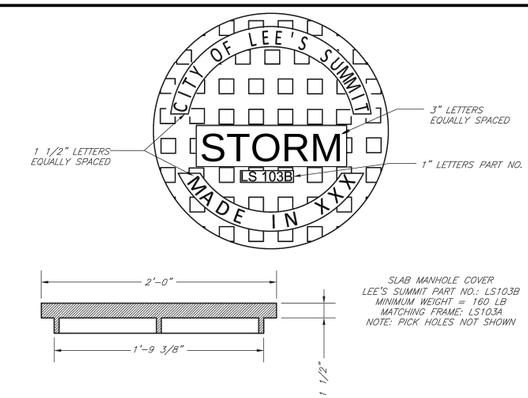
003 END SECTION WITH TOE WALL



NOTES:

1. GRANULAR FILL SHALL BE 1/2" CLEAN ROCK OR SAND/GRAVEL BEDDING MEETING KDOT TYPE UD–1, PLACED IN 6" LIFTS AND COMPACTED BY SLICING WITH A SHOVEL.
2. TAMPED FILL SHALL BE FINELY DIVIDED, JOB EXCAVATED MATERIAL FREE OF DEBRIS, ORGANIC MATERIAL, AND STONES, COMPACTED TO TYPE AA MR–5 COMPACTION.
3. HAND PLACED FILL SHALL BE FINELY DIVIDED MATERIAL, FREE OF DEBRIS AND STONES, COMPACTED TO TYPE AA MR–5 COMPACTION. ALL PIPE SHALL BE INSPECTED PRIOR TO BACKFILL.
4. ALL PIPE COVERED PRIOR TO INSPECTION SHALL BE UNCOVERED AT THE CONTRACTORS EXPENSE.

004 PIPE BEDDING



005 MANHOLE FRAME AND LID

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STATE OF MISSOURI
PATRICK J. JOYCE
NUMBER PE-2009030032
PROFESSIONAL ENGINEER
6-8-17

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PUBLIC ROAD IMPROVEMENTS FOR SE DECKER ST. & SE SUMMIT ST.
STORM SEWER DETAILS

Design: DRS	Drawn: SKE
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Issue Date:	04/21/17
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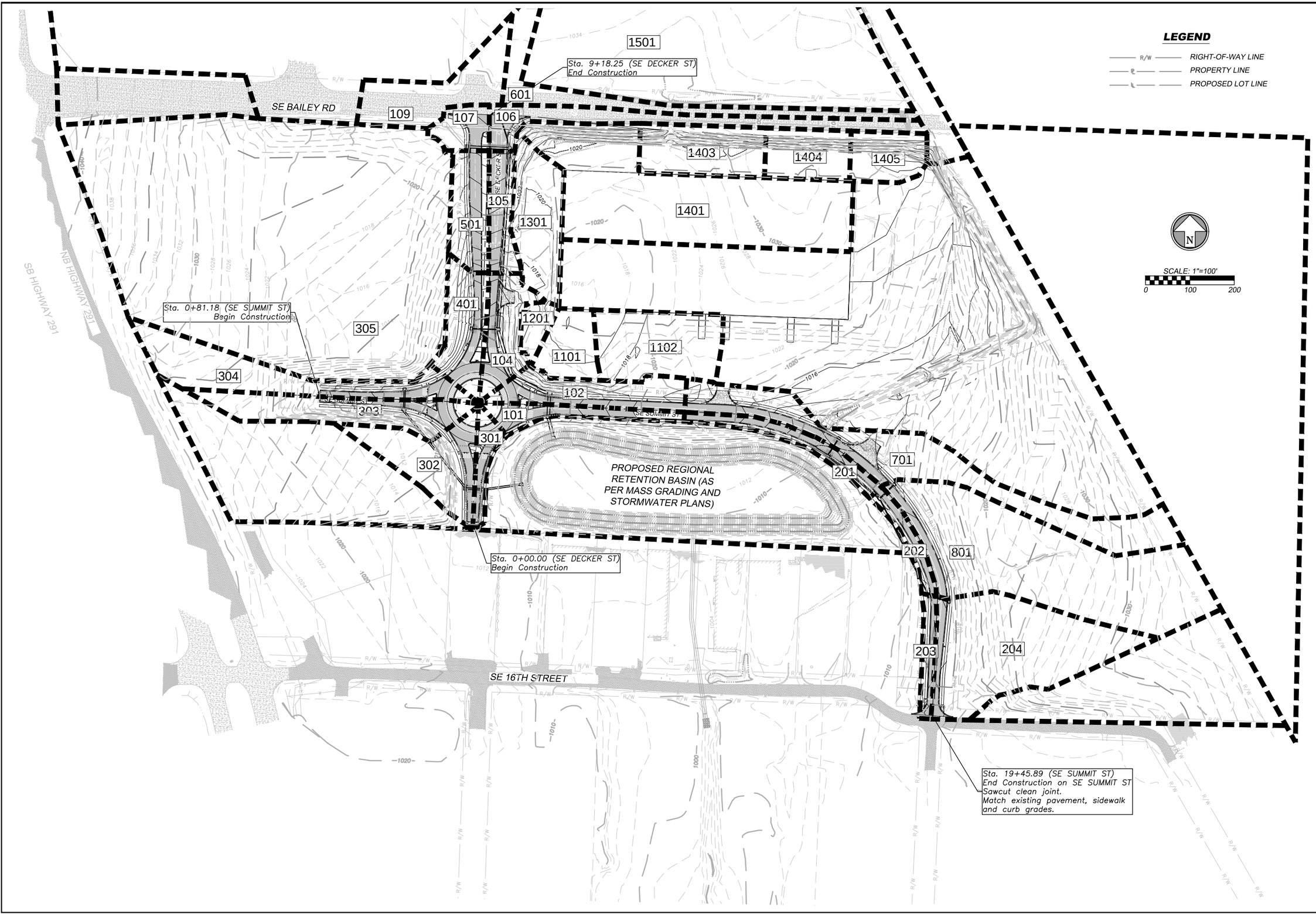
C9.5

Jun 08, 2017 – 10:55pm Plotted By: dalton.signer V:\021730-The Grove\04-DWG\Eng\Sheet\Public Improvements FDP1A\Summit & Decker\021730-SHTS-PUBL-ROAD-DTLS.dwg Layout: STORM SEWER DETAILS



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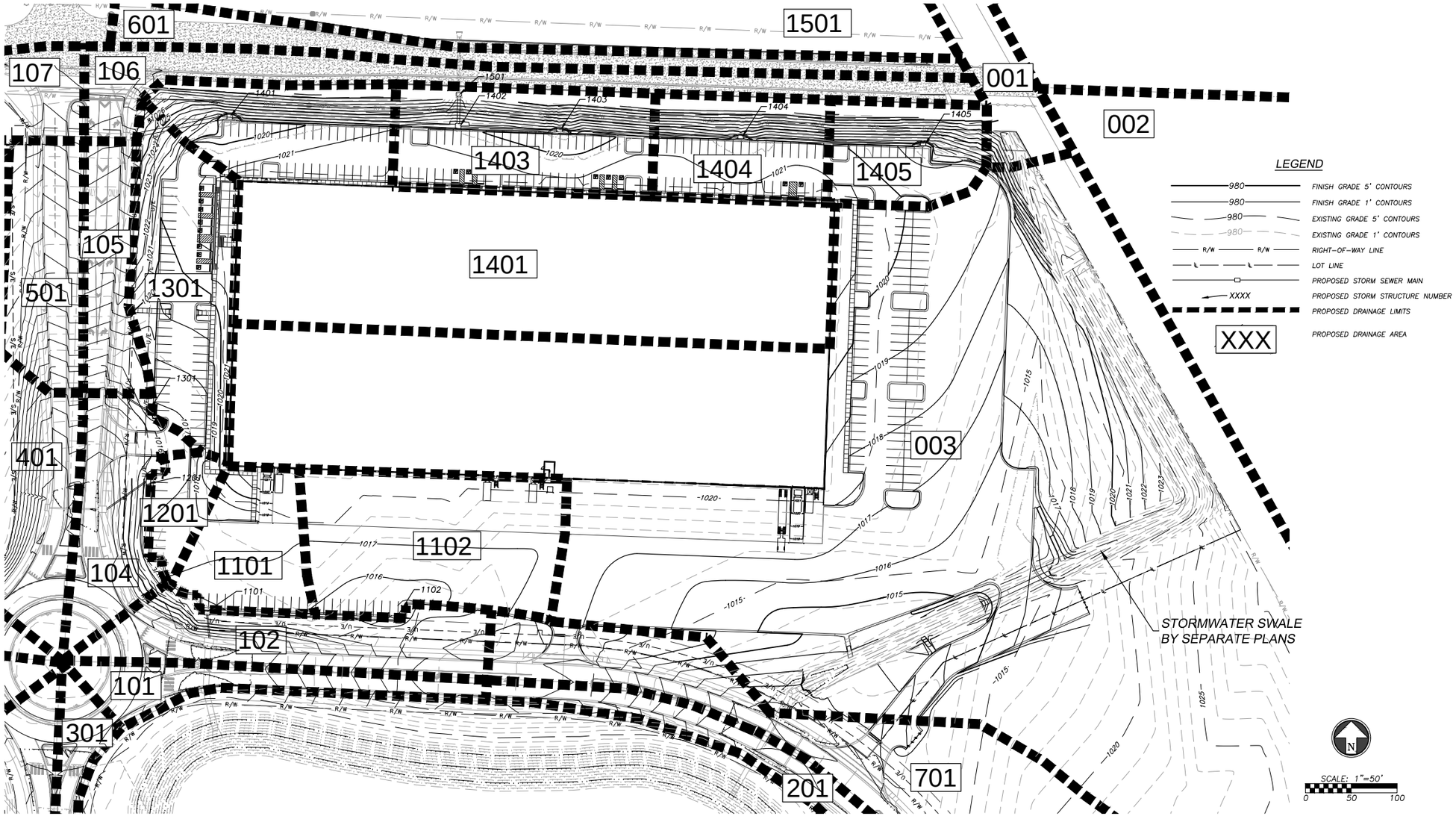
PUBLIC ROAD IMPROVEMENTS FOR SE DECKER ST. & SE SUMMIT ST.
DRAINAGE MAP

Design: DRS	Drawn: SKE
Checked:	PJJ
Issue Date:	04/21/17
Project Number:	021730

30 of 39

C10.1



STORM NOTES

1. PROJECT IS A PART OF A LARGER DEVELOPMENT WITH REGIONAL WATER QUALITY TREATMENT AND REGIONAL DETENTION, THUS ON-SITE CONTROLS ARE NOT REQUIRED.
2. STORM LINES 1100, 1200, 1300, 1400, 1500, AND 1600 TO BE CONSTRUCTED PER PLAN SET. ALL OTHER STORM LINES SHOWN FOR REFERENCE ONLY.
3. UNDERGROUND PRIVATE STORM PIPE SYSTEM DESIGNED TO CARRY MINIMUM 10 YEAR STORM EVENT PER CITY OF LEE'S SUMMIT 5600. STORM PIPE CALCULATIONS SHOWN ON SHEET C4.1.
4. ALL STORM CONSTRUCTION TO BE DONE IN ACCORDANCE WITH CITY OF LEE'S SUMMIT SPECIFICATIONS.
5. RUNOFF FROM AREAS 001-003 DRAIN DIRECTLY TO STORMWATER SWALE SHOWN IN PLAN. STORMWATER SWALE TO BE CONSTRUCTED PER MASS GRADING PLAN SET.
6. RUNOFF FROM NORTH PORTION OF ROOF ADDED TO AREA 1401 FOR CALCULATIONS. NORTH ROOF DRAINS TO BE PIPED INTO STORM LINE 1400 BY ROOF DRAIN HEADER SYSTEM. RUNOFF FROM SOUTH PORTION OF ROOF ADDED TO AREA 003. SOUTH ROOF DRAINS TO BE PIPED VIA ROOF DRAIN HEADER SYSTEM AND DAYLIGHTED TO PROPOSED STORMWATER SWALE SHOWN IN PLAN. STORMWATER SWALE TO BE CONSTRUCTED PER MASS GRADING PLAN SET.
7. PIPE LENGTHS SHOWN ON SHEET C5.1 ARE MEASURED FROM CENTER OF STRUCTURE OR TO THE END OF END SECTION. ALL PIPES SHALL BE FIELD STAKED TO THE INSIDE WALL FACE OF THE STRUCTURE.
8. ALL PIPE SHALL BE PLACED IN TRENCH CONDITIONS. PLACE A MINIMUM OF 2 FEET OF FILL OVER PROPOSED PIPE BEFORE TRENCHING AND PIPE INSTALLATION. PROPOSED FILL SHALL BE PLACED IN ACCORDANCE WITH PROJECT REQUIREMENTS.
9. UTILITY LINES AND STRUCTURES IN FILL AREAS BELOW PIPE GRADE SHALL NOT BE CONSTRUCTED UNTIL ALL CONSOLIDATION OF THE FILL IS COMPLETE AND SO APPROVED BY THE ON-SITE GEOTECHNICAL ENGINEER.
10. THE DIMENSIONS FOR ALL STRUCTURES SHOWN ON C5.1 ARE FROM INSIDE FACE OF STRUCTURE TO INSIDE FACE OF STRUCTURE. STORM SEWER PIPE SHALL BE AS FOLLOWS UNLESS OTHERWISE NOTED.
11. THE FIRST DIMENSION SHOWN IS THE "L" DIMENSION AND THE SECOND IS THE "W" DIMENSION ON RECTANGULAR STRUCTURES.
12. ALL CURB INLETS AND OTHER STRUCTURE SET AT LOW POINTS ARE TO BE SET LEVEL. ALL OTHER CURB INLETS ARE TO BE SET WITH THE GRADE OF THE TOP OF CURB OR PAVEMENT.
13. PRECAST STRUCTURES MAY BE USED AT CONTRACTOR'S OPTION. ALL STORM STRUCTURES SHALL HAVE A SMOOTH UNIFORM POURED CONCRETE INVERT FROM INVERT IN TO INVERT OUT.
14. THE LIDS OF ALL PRECAST STRUCTURES SHALL BE GROUTED TO THE TOP OF THE WALLS.
15. NORTHING AND EASTINGS SHOWN ON SHEET C5.1 ARE TO CENTER OF STRUCTURE OR TO END OF END SECTION.
16. ALL HDPE PIPE SHALL BE ADS N-12, OR APPROVED EQUAL, MEETING AASHTO M294, TYPE S OR ASTM F2306. THE PIPE SHALL HAVE A SMOOTH INTERIOR AND ANNULAR EXTERIOR CORRUGATIONS. PIPE JOINTS SHALL BE JOINTED USING A BELL & SPIGOT JOINT MEETING AASHTO M252, AASHTO M294 OR ASTM F2306. THE JOINT SHALL BE WATERTIGHT ACCORDING THE THE REQUIREMENTS OF ASTM D3212 AND GASKETS SHALL MEET THE REQUIREMENTS OF ASTM F477. GASKETS SHALL BE INSTALLED BY THE PIPE MANUFACTURER AND COVERED WITH A REMOVABLE WRAP TO ENSURE THE GASKET IS FREE FROM DEBRIS. A JOINT LUBRICANT SUPPLIED BY THE MANUFACTURER SHALL BE USED ON THE GASKET AND BELL DURING ASSEMBLY.
17. FITTINGS FOR PLASTIC PIPE SHALL CONFORM TO AASHTO M252, AASHTO M294, OR ASTM F2306 ALL WYES SHALL BE DUAL WALL WYES CONSISTENT WITH THE ADS N-12 PIPE WATERTIGHT CONNECTIONS.

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project title

SHELL WAREHOUSE B

1407 SE Decker
Lees Summit, MO

key plan

project number
17105.002

drawing issuance
PERMIT

drawing revisions

No.	Description:	Date:

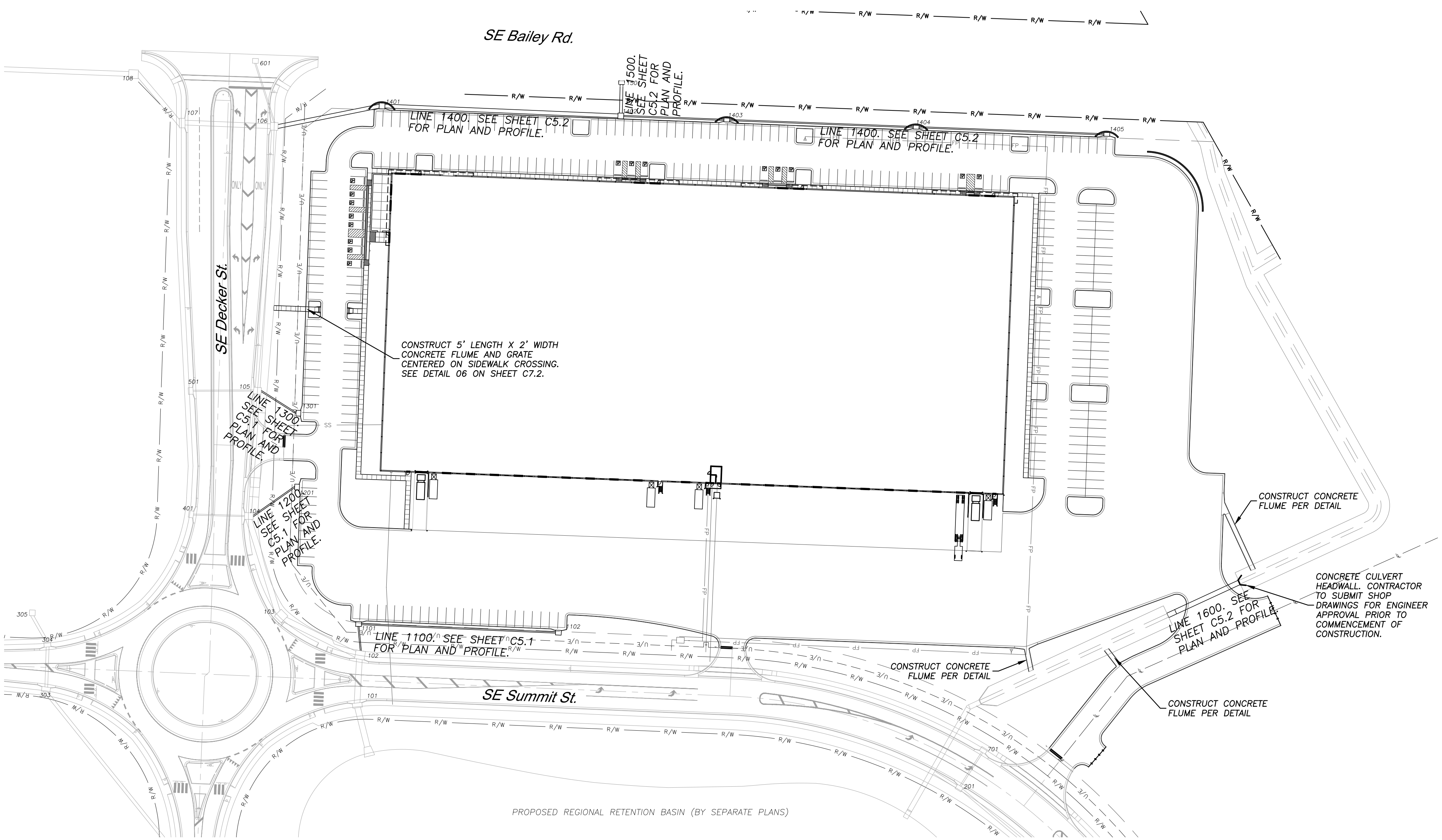
professional seal

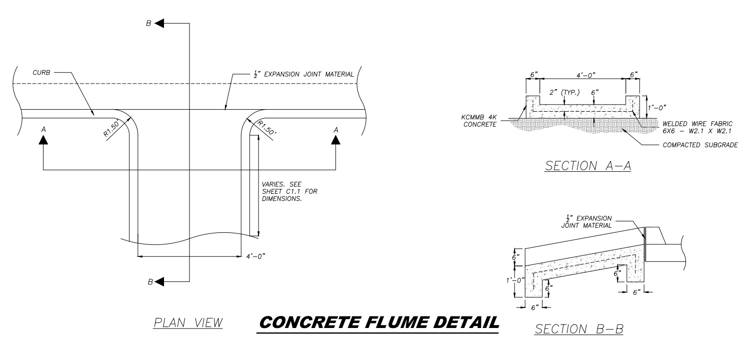
PRELIMINARY
DRAWINGS IN PROGRESS
NOT FOR CONSTRUCTION

drawing title
DRAINAGE MAP

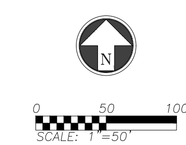
drawing number
C4.0

May 03, 2018 - 9:04am G:\1730\TOP\A-SHTS-DWG\P.dwg





CONCRETE FLUME DETAIL



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THE ARCHITECT DISCLAIMS responsibility for the existing building structure, site conditions, existing construction elements, or any documents, drawings or other instruments used for any part of this Project which do not bear the Architect's seal. The Architect's services are undertaken only in the interest of the Project Owner. No obligation is assumed by the Architect for the benefit of any other entity.

RELATED DOCUMENTS: This Drawing is a single component of an integrated set of Construction Documents. General and Supplementary Conditions of the Contract, General Requirements, Specifications and other Drawings may affect the Work described. Failure to review and integrate the design intent of the whole of the Construction Documents does not relieve the Contractor from providing a complete Project.

COMPLY WITH all laws, codes, ordinances and regulations with authorities having jurisdiction and with requirements of the Landlord, if applicable. Do not start Work until all permits and required approvals are obtained.

VERIFY ACTUAL CONDITIONS and dimensions prior to construction. Commencement of work constitutes verification and acceptance of all existing conditions. Application of a material or equipment item to Work installed by others constitutes acceptance of that Work, and assumption of responsibility for satisfactory installation.

DIMENSIONS SHOWN are to finish face of a material unless otherwise indicated.

CALCULATE & MEASURE dimensions – DO NOT SCALE drawings unless otherwise directed.

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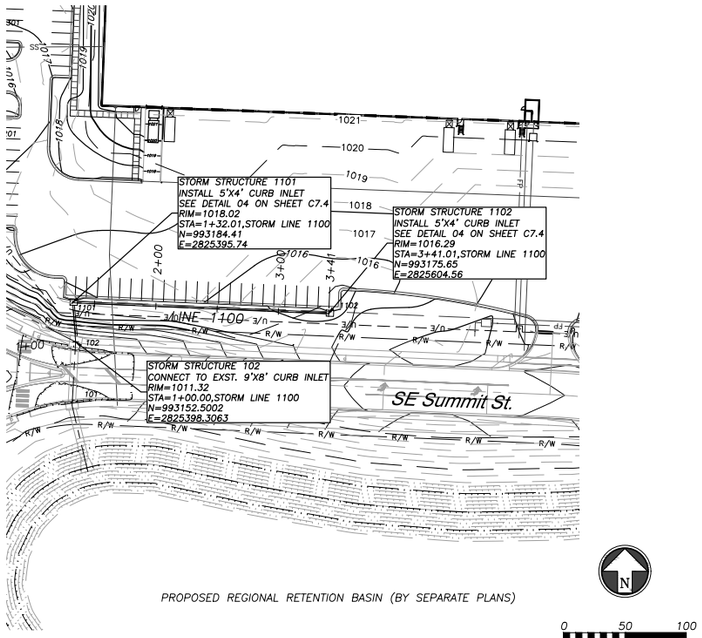
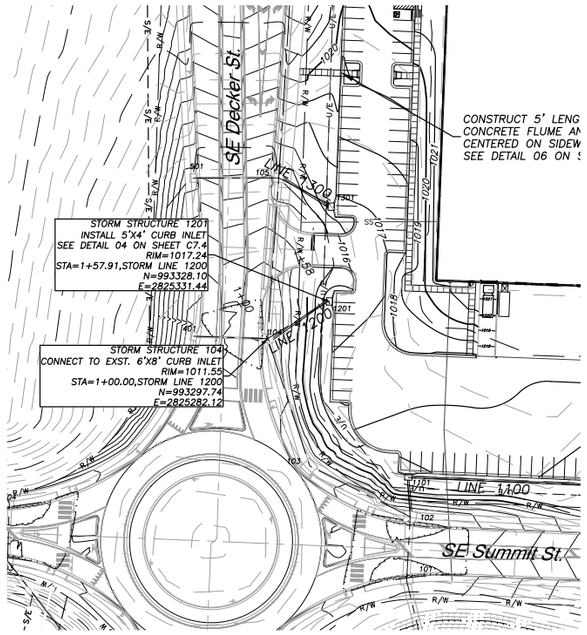
drawing title

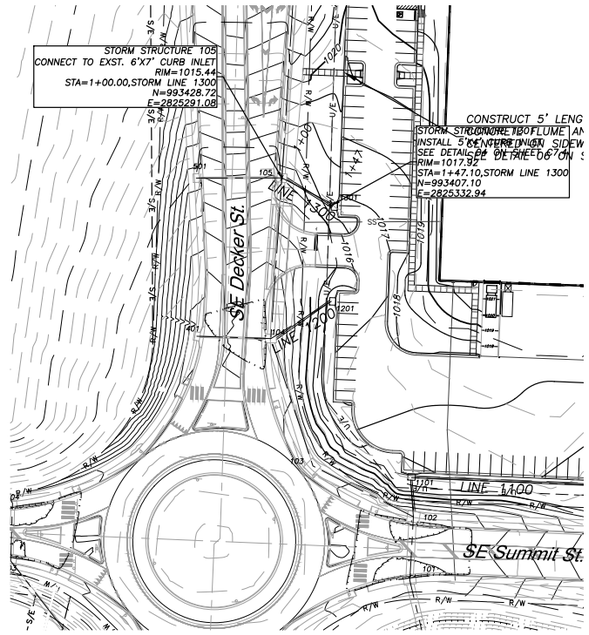
STORM PLAN

drawing number

C5.0

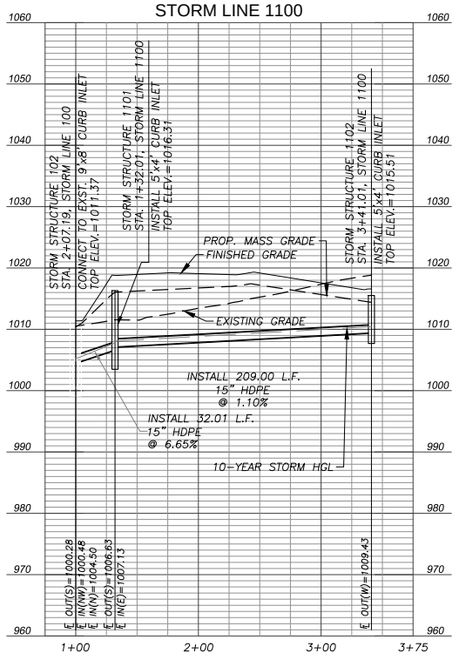






SCALE: 1"=50'

STORM LINE 1100



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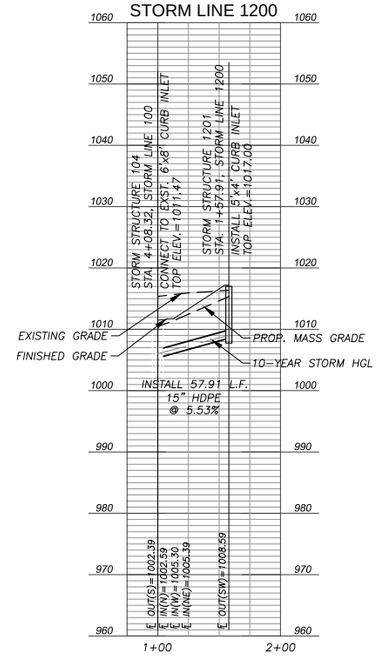

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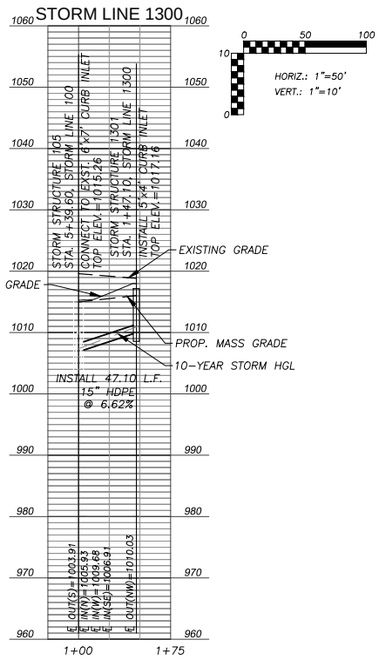

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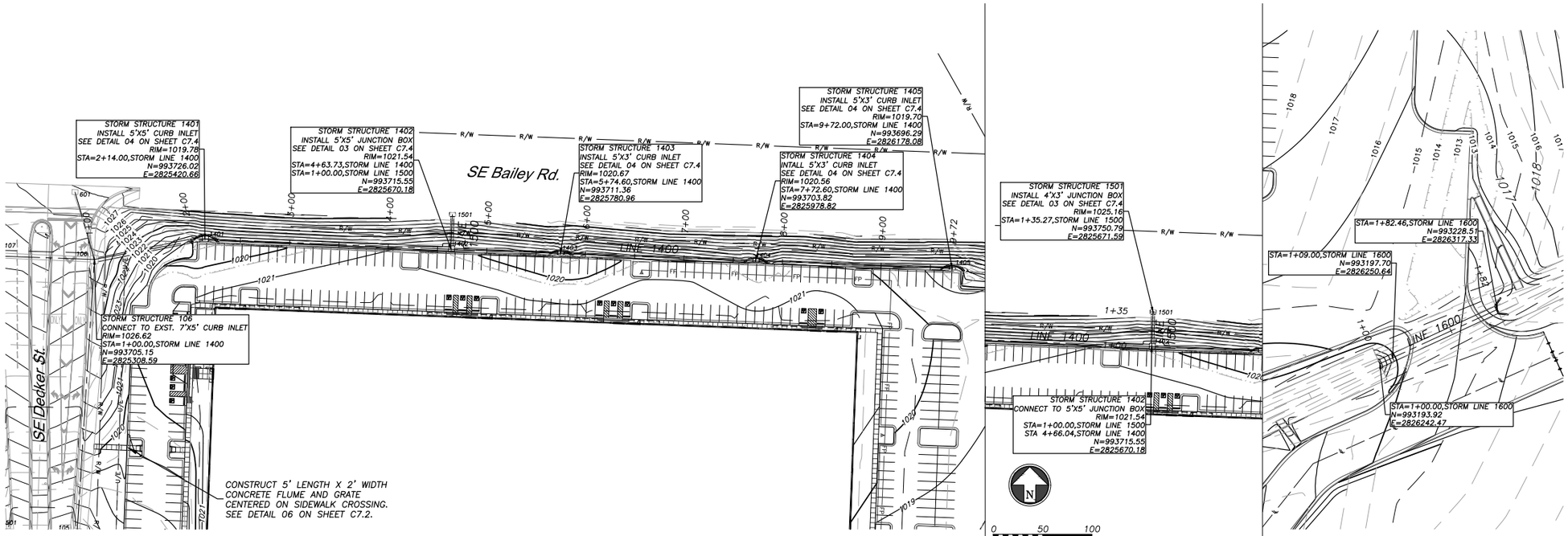
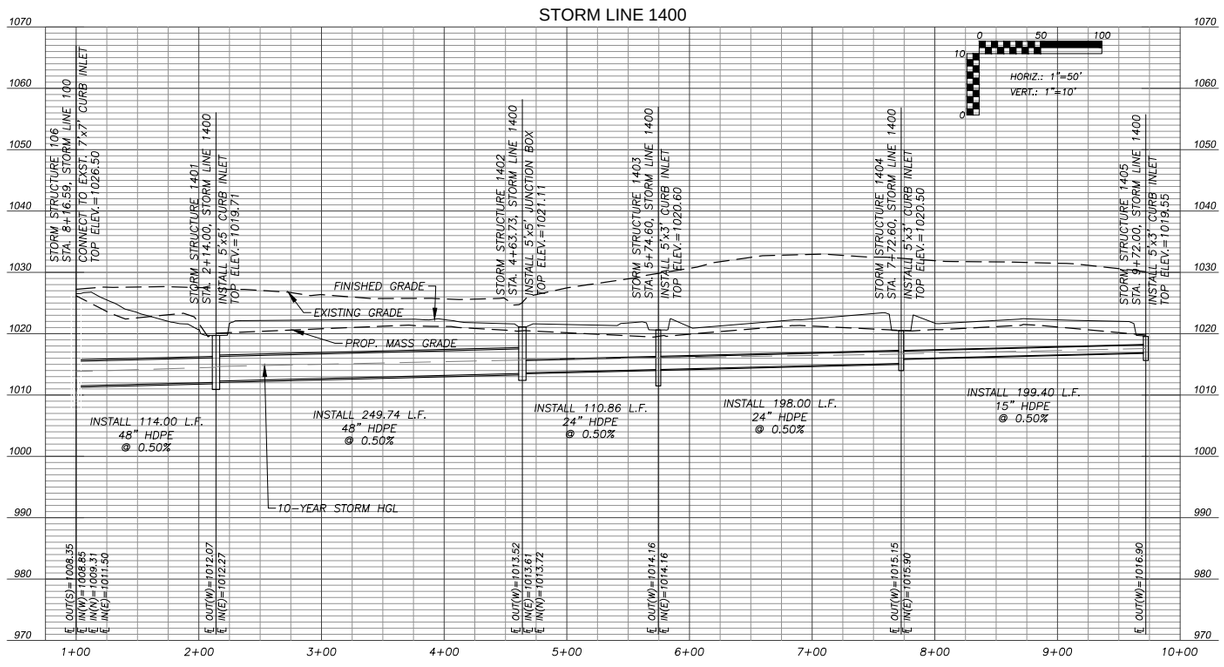
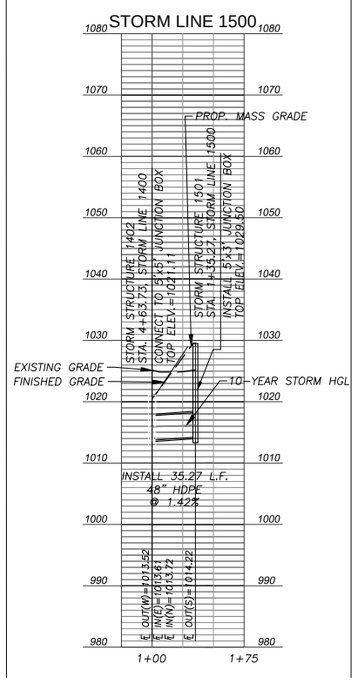
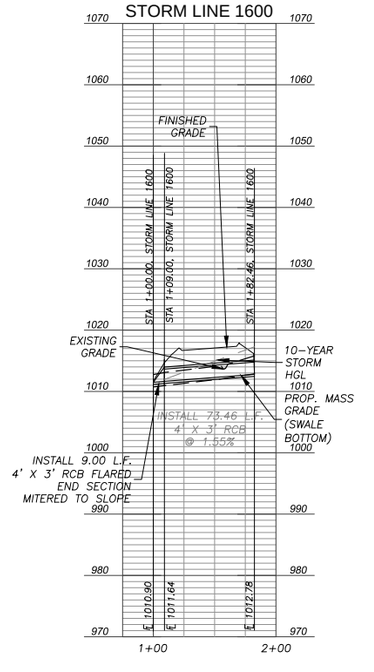
drawing title
STORM PLAN AND PROFILE (1)

drawing number
C5.1









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drawing issuance
PERMIT

drawing revisions

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drawing title
STORM PLAN AND PROFILE (2)

drawing number
C5.2

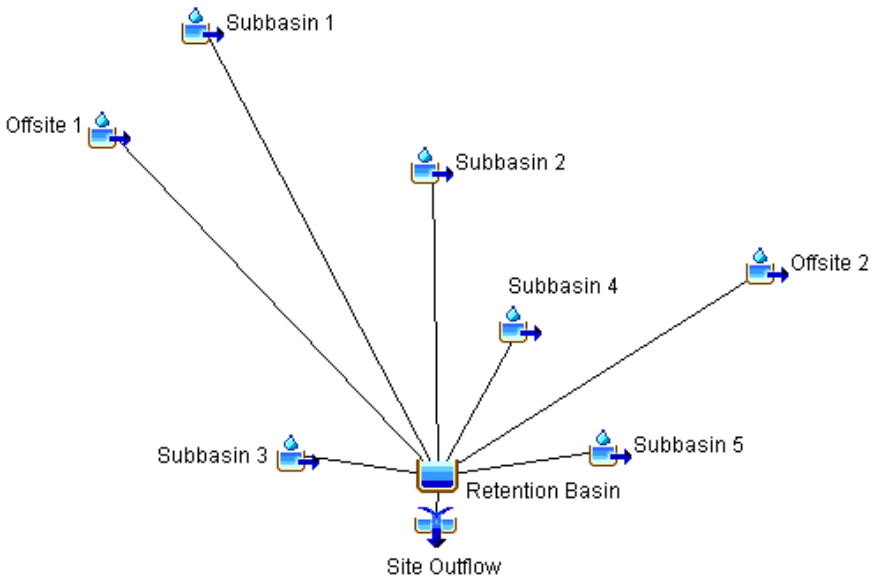
Exhibit 6

10 Year Storm

	Structures		Runoff Calculations										Pipe Design								Design Checks										
			Direct	Line	Total																							Downstream	Hydraulic	Hydraulic	
	From	To	Area	In	Area	C	K	Tc	Flow Time	Intensity	Design Q	Description	Pipe length	Pipe Slope	Pipe dia (in)	Manning's	Q full	Pipe	V full	Design V	Hw/D	outlet	HW, Inlet	HW, Outlet	Inlet Top	Upstream	Downstream	Inlet	Water	Grade Elev.	Grade	Comments
			(acre)	(acre)	(acre)			(min)	(min)	(in/hr)	(cfs)		(lin ft)	Slope, %		n Value	(cfs)	Area, sf	fps	fps		head, H	Control, (ft)	Control, (ft)	Elevation	flowline	flowline	Drop (ft)	Elevation	(Calculated)	(Allowable)	
	111		29.74			0.66	1.00	12.00		5.68	111.5	Junction Box													1028.40					1049.42	1027.90	
		110			29.74	0.66	1.00	12.00	0.13	5.68	111.5	HDPE	174.35	2.90	36	0.01	148.06	7.07	20.95	22.96	4.0	11.01	1032.68	1049.42		1020.76	1015.70		1038.41			
	110		0.00			0.78	1.00	5.00		7.35	0.0	Junction Box													1024.59			1		1038.41	1024.09	
		109			29.74	0.66	1.00	12.13	0.03	5.66	111.1	HDPE	45.12	3.32	48	0.01	341.17	12.57	27.15	24.22	1.4	1.81	1020.49	1038.41		1014.70	1013.20		1036.60			
	109		0.83			0.78	1.00	5.00		7.35	4.8	Junction Box													1024.14			0.2		1036.60	1023.64	
		108			30.57	0.66	1.00	12.16	0.18	5.65	114.6	HDPE	195.78	1.48	48	0.01	227.79	12.57	18.13	18.12	1.5	3.18	1019.00	1036.60		1013.00	1010.10		1033.42			
	108		0.00			0.78	1.00	5.00		7.35	0.0	Junction Box													1026.53			0.2		1033.42	1026.03	
		107			30.57	0.66	1.00	12.34	0.10	5.62	114.0	HDPE	72.15	0.51	48	0.01	133.72	12.57	10.64	11.92	1.5	2.13	1015.86	1033.42		1009.90	1009.54		1031.30			
	107		0.28			0.78	1.00	5.00		7.35	1.6	Curb Inlet													1026.55			0.2		1031.30	1026.05	
		106			30.85	0.66	1.00	12.44	0.14	5.60	114.8	RCP	96.21	0.50	48	0.013	101.84	12.57	8.10	11.84	1.5	2.91	1015.34	1031.30		1009.34	1008.85		1028.38			
	106		0.76	15.79		0.78	1.00	5.00		7.35	4.4	Curb Inlet													1026.50			0.5		1028.38	1026.00	Lines 600 and 1400 In
Line 100		105			47.40	0.70	1.00	12.57	0.28	5.58	186.3	HDPE	276.99	0.87	54	0.01	239.09	15.90	15.03	16.59	1.9	5.81	1016.84	1028.38		1008.35	1005.94		1022.58			
	105		0.36	1.30		0.78	1.00	5.00		7.35	2.1	Curb Inlet													1015.26			2.02		1022.58	1014.76	Lines 500 and 1300 In
		104			49.06	0.71	1.00	12.85	0.12	5.53	191.8	HDPE	131.28	1.01	54	0.01	257.61	15.90	16.20	17.71	2.0	4.34	1012.74	1022.58		1003.92	1002.60		1018.23			
	104		0.53	0.68		0.78	1.00	5.00		7.35	3.0	Curb Inlet													1011.47			0.2		1018.23	1010.97	Lines 400 and 1200 In
		103			50.27	0.71	1.00	12.98	0.11	5.51	196.3	HDPE	109.83	0.85	54	0.01	236.33	15.90	14.86	16.58	2.0	4.27	1011.48	1018.23		1002.40	1001.47		1013.97			
	103		0.00			0.78	1.00	5.00		7.35	0.0	Junction Box													1012.54			0.2		1013.97	1012.04	
		102			50.27	0.71	1.00	13.09	0.09	5.49	195.6	HDPE	91.95	0.85	54	0.01	236.33	15.90	14.86	16.56	2.0	4.01	1010.31	1013.97		1001.27	1000.48		1009.96			
	102		0.65	1.41		0.78	1.00	5.00		7.35	3.7	Curb Inlet													1011.37			0.2		1009.96	1010.87	Line 1100 In
		101			52.33	0.71	1.00	13.18	0.06	5.47	203.8	RCP	52.71	1.01	60	0.013	262.45	19.63	13.37	14.73	1.5	2.72	1007.93	1009.96		1000.28	999.75		1007.24			
	101		0.32			0.78	1.00	5.00		7.35	1.8	Curb Inlet													1011.31			0.2		1007.24	1010.81	
		100			52.65	0.71	1.00	13.24	0.04	5.46	204.8	HDPE	44.48	1.24	60	0.01	378.04	19.63	19.25	19.59	1.5	2.39	1007.24	1003.89		999.55	999.00		1001.50			
																														1001.50		
	204		1.93			0.78	1.00	5.00		7.35	11.1	Curb Inlet													1014.35					1012.24	1013.85	
		203			1.93	0.78	1.00	5.00	0.06	7.35	11.1	RCP	47.78	6.74	24	0.013	58.89	3.14	18.75	14.36	0.9	0.48	1012.24	1011.05		1010.40	1007.18		1010.56			
	203		0.18			0.78	1.00	5.00		7.35	1.0	Curb Inlet													1014.34			0		1010.56	1013.84	
		202			2.11	0.78	1.00	5.06	0.50	7.34	12.1	HDPE	245.77	0.78	24	0.01	26.04	3.14	8.29	8.12	1.0	1.19	1009.11	1010.56		1007.18	1005.27		1009.37			
Line 200	202		0.19	3.00		0.78	1.00	5.00		7.35	1.1	Curb Inlet													1011.66			0.5		1009.37	1011.16	Line 800 In
		201			5.30	0.78	1.00	5.56	0.23	7.18	29.7	HDPE	151.82	0.92	30	0.01	51.28	4.91	10.45	10.81	1.3	1.72	1007.90	1009.37		1004.77	1003.37		1007.65			
	201		0.32	1.80		0.78	1.00	5.00		7.35	1.8	Curb Inlet													1010.26			0.2		1007.65	1009.76	Line 700 In
		200			7.42	0.78	1.00	5.79	0.04	7.12	41.2	HDPE	29.74	1.11	30	0.01	56.33	4.91	11.48	12.50	1.8	1.97	1007.65	1006.06		1003.17	1002.84		1004.09			
																														1004.09		
	305		9.67			0.66	1.00	5.00		7.35	46.9	Area Inlet													1016.58					1010.11	1016.08	
		304			9.67	0.66	1.00	5.00	0.04	7.35	46.9	HDPE	36.70	1.25	36	0.01	97.20	7.07	13.75	13.60	1.3	1.06	1009.52	1010.11		1005.75	1005.29		1009.05			
	304		1.09			0.78	1.00	5.00		7.35	6.3	Curb Inlet													1011.26			0.5		1009.05	1010.76	
		303			10.76	0.67	1.00	5.04	0.04	7.34	53.1	RCP	46.91	3.97	36	0.013	133.25	7.07	18.85	17.75	1.4	1.71	1009.05	1007.93		1004.79	1002.93		1006.23			
	303		0.85			0.78	1.00	5.00		7.35	4.9	Curb Inlet													1011.35			0.5		1006.23	1010.85	
Line 300		302			11.61	0.68	1.00	5.09	0.32	7.33	57.8	HDPE	224.22	0.75	42	0.01	113.57	9.62	11.80	11.83	1.1	1.64	1006.22	1006.23		1002.43	1000.75		1004.58			
	302		0.82			0.78	1.00	5.00		7.35	4.7	Curb Inlet													1010.69			0.5		1004.58	1010.19	
		301			12.43	0.69	1.00	5.40	0.06	7.23	61.7	RCP	40.31	0.75	42	0.013	87.37	9.62	9.08	12.03	1.1	1.10	1004.23	1004.58		1000.25	999.95		1003.48			
	301		0.20			0.78	1.00	5.00		7.35	1.1	Curb Inlet													1010.66			0.5		1003.48	1010.16	
		300			12.63	0.69	1.00	5.46	0.13	7.21	62.7	HDPE	82.97	0.49	42	0.01	91.80	9.62	9.54	10.25	1.2	1.21	1003.48	1002.00		999.45	999.04		1000.79			
																														1000.79		
	401		0.59			0.78	1.00	5.00		7.35	3.4	Curb Inlet													1011.69					1006.79	1011.19	
Line 400		104			0.59	0.78	1.00	5.00	0.23	7.35	3.4	RCP	60.41	0.58	15	0.013	4.93	1.23	4.02	4.33	0.9	0.51	1006.79	1006.43		1005.65	1005.30		1005.93			Connect to Line 100
																														1005.93		
	501		0.51			0.78	1.00	5.00		7.35	2.9	Curb Inlet													1015.31					1011.09	1014.81	
Line 500		105			0.51	0.78	1.00	5.00	0.30	7.35	2.9	RCP	69.77	0.50	15	0.013	4.58	1.23	3.73	3.94	0.9	0.42	1011.09	1010.73		1010.03	1009.68		1010.31			Connect to Line 100
																														1010.31		
	601		0.80			0.78	1.00	5.00		7.35	4.6	Curb Inlet													1028.78					1011.27	1028.28	
Line 600		106			0.80	0.78	1.00	5.00	0.23	7.35	4.6	RCP	71.16	0.79	15	0.013	5.76	1.23	4.69	5.20	1.1	1.05	1011.27	1010.99		1009.87	1009.31		1009.94			Connect to Line 100
																														1009.94		
	701		1.80			0.78	1.00	5.00		7.35	10.3	Curb Inlet													1010.25					1007.20	1009.75	
Line 700		201			1.80	0.78	1.00	5.00	0.12	7.35	10.3	RCP	47.01	1.00	18	0.013	10.53	1.77	5.96	6.78	1.6	1.64	1007.20	1006.76		1004.84	1004.37		1005.12			Connect to Line 200
																														1005.12		
	801		3.00			0.78	1.00	5.00		7.35	17.2	Curb Inlet													1011.67					1008.27	1011.17	
Line 800		202			3.00	0.78	1.00	5.00	0.10	7.35	17.2	RCP	47.04	1.00	24	0.013	22.68	3.14	7.22	7.92	1.3	1.16	1008.27	1007.42		1005.73	1005.26		1006.26			Connect to Line 200
																														1006.26		
	1002		25.05			0.66	1.00	11.28		5.82	96.2	RCB Headwall																		1012.30	1012.50	
Line 1000 RCB		1001			25.05	0.66	1.00	11.28	0.01	5.82	96.2	RCP	13.57	4.19	4'x5' RCB	0.013	501.99	20.00	25.10	16.64	1.3	1.23	1014.12	1014.77		1009.10	1008.53		1013.55			
	1001		0.00			0.78	1.00	5.00		7.35	0.0	RCB Headwall													N/A			0		1013.55	N/A	
		1000			25.05	0.66	1.00	11.29	0.08	5.82	96.1	RCP	78.16	4.19	4'x5' RCB	0.013	501.99	20.00	25.10	16.64	1.3	1.86	1013.55	1009.12		1008.53	1005.26		1007.26			
																														1007.26		
	1102		0.98			0.78	1.00	5.00		7.35	5.6	Curb Inlet													1016.58					1011.59	1016.08	
		1101			0.98	0.78	1.00	5.00	0.46	7.35	5.6	HDPE	209.00	1.10	15	0.01	8.83	1.23	7.20	7.60	1.3	2.46	1011.10	1011.59		1009.43	1007.13		1009.13			
Line 1100	1101		0.43			0.78	1.00	5.00		7.35	2.5	Curb Inlet													1017.65			0.5		1009.13	1017.15	
		102			1.41	0.78	1.00	5.46	0.03	7.21	7.9	HDPE	32.01	6.65	15	0.01	21.71	1.23	17.69	16.27	2.0	1.41	1009.13	1006.53		1006.63	1004.50		1005.13			Connect to Line 100
																														1005.13		
	1201		0.09			0.78	1.00	5.00		7.35	0.5	Curb Inlet													1017.00					1009.44	1016.50	
Line 1200		104			0.09	0.78	1.00	5.00	0.14	7.35	0.5	HDPE	57.91	5.53	15	0.01	19.80	1.23	16.14	6.84	0.7	0.01	1009.44	1006.02		1008.59	1005.39		1006.02			Connect to Line 100
																														1006.02		

Line 1300	1301		0.79			0.78	1.00	5.00		7.35	4.5	Curb Inlet												1017.16					1011.41	1016.66	
		105			0.79	0.78	1.00	5.00	0.06	7.35	4.5	HDPE	47.10	6.62	15	0.01	21.66	1.23	17.65	13.91	1.1	0.56	1011.41	1008.09		1010.03	1006.91		1007.54			Connect to Line 100
																													1007.54		
Line 1400	1405		0.43			0.78	1.00	5.00		7.35	2.5	Curb Inlet												1019.55					1018.97	1019.05	
		1404			0.43	0.78	1.00	5.00	0.72	7.35	2.5	HDPE	199.40	0.50	15	0.01	5.95	1.23	4.85	4.63	0.8	0.45	1017.90	1018.97		1016.90	1015.90		1018.51			
	1404		0.49			0.78	1.00	5.00		7.35	2.8	Curb Inlet												1020.50				0.75		1018.51	1020.00	
		1403			0.92	0.78	1.00	5.72	0.60	7.14	5.1	HDPE	198.00	0.50	24	0.01	20.85	3.14	6.64	5.47	0.7	0.18	1016.60	1018.51		1015.15	1014.16		1018.33			
	1403		0.73			0.78	1.00	5.00		7.35	4.2	Curb Inlet												1020.60				0		1018.33	1020.10	
		1402			1.65	0.78	1.00	6.32	0.29	6.97	9.0	HDPE	110.86	0.50	24	0.01	20.85	3.14	6.64	6.38	0.8	0.38	1015.83	1018.33		1014.16	1013.61		1017.95			
	1402		0.00	10.40		0.78	1.00	5.00		7.35	0.0	Junction Box												1021.11				0.09		1017.95	1020.61	
		1401			12.05	0.78	1.00	6.61	0.40	6.89	64.7	RCP	249.74	0.50	48	0.013	101.84	12.57	8.10	10.45	0.9	1.61	1017.26	1017.95		1013.52	1012.27		1016.34			
	1401		2.94			0.78	1.00	5.00		7.35	16.9	Curb Inlet												1019.71				0.2		1016.34	1019.21	
		106			14.99	0.78	1.00	7.01	0.17	6.78	79.3	HDPE	114.00	0.50	48	0.01	132.40	12.57	10.54	10.99	1.1	1.20	1016.34	1014.70		1012.07	1011.50		1013.50			Connect to Line 100
																													1013.50		
Line 1500	1501		10.40			0.78	1.00	5.00		7.35	59.6	Curb Inlet												1029.50					1017.80	1029.00	
		1402			10.40	0.78	1.00	5.00	0.04	7.35	59.6	HDPE	35.27	1.42	48	0.01	223.12	12.57	17.76	15.00	0.9	0.50	1017.80	1016.22		1014.22	1013.72		1015.72			
																													1015.72		
Line 1600 RCB	1601		24.02			0.66	1.00	11.10		5.85	92.8	Curb Inlet												1018.00					1017.09	1017.50	
		1600			24.02	0.66	1.00	11.10	0.14	5.85	92.8	RCP	73.46	1.55	4'x3' RCB	0.013	154.09	12.00	12.84	8.52	3.0	6.35	1021.65	1019.49		1012.78	1011.64		1013.14			
																													1013.14		
Retention Basin Outflow	Outflow		106.89			0.66	1.00	5.00		7.35	45.7	Outflow Structure												1008.17				0		1000.36	1007.67	
		Sta 4+59			106.89	0.66	1.00	5.00	0.04	7.35	45.7	HDPE	30.17	0.93	42	0.01	126.47	9.62	13.15	12.06	0.9	0.50	1000.13	1000.36		996.89	996.61		999.85			Calculation shown for one of three pipes
	Sta 4+59		0.00	0.00		0.78	1.00	5.00		7.35	0.0	Junction Box												1007.70				0		999.85	1007.20	
		Sta 2+86			106.89	0.66	1.00	5.04	0.27	7.34	45.7	HDPE	173.09	0.64	42	0.01	104.92	9.62	10.90	10.51	0.9	0.89	999.85	999.63		996.61	995.50		998.75			Calculation shown for one of three pipes
	Sta 2+86		0.00	0.00		0.78	1.00	5.00		7.35	0.0	Junction Box												1002.76				0		998.75	1002.26	
		Sta 0+67			106.89	0.66	1.00	5.32	0.35	7.26	45.7	HDPE	219.00	0.64	42	0.01	104.92	9.62	10.90	10.51	0.9	1.01	998.75	996.86		995.50	994.10		995.85			Calculation shown for one of three pipes
																													995.85		

Exhibit 7 – Proposed HEC-HMS Model Summary



	Sub-Basin	Area	Proposed CN	Proposed Tc (min.)
North of SE Bailey Rd	1	17.82	94	5
	2	19.07	88	5
South of SE Bailey Rd	3	19.38	89	5
	4	8.69	90	5
	5	14.87	87	5
Offsite	Off 1	15.84	86	5
	Off 2	11.22	74	5

Basin Elevation-Area

Elevation (FT)	Area (AC)	Incremental Storage (AC-FT)	Cumulative Storage (AC-FT)
1000	2.6	0	0
1002	2.8	5.4	5.4
1004	3.25	6.05	11.45
1006	3.885	7.135	18.585
1007	4.625	8.51	27.095
1008	4.833	9.458	36.553

Basin Elevation-Discharge

Elevation (FT)	Depth (Ft)	Discharge (Combined) (CFS)	8" Orifice (CFS)	10'x1' Orifice (CFS)	6x'1.5' Orifice (CFS)	(3) 10' Weirs (CFS)
1000.00	0	0.00	0.00	0.00	0.00	0.00
1000.25	0.25	0.51	0.51	0.00	0.00	0.00
1000.50	0.5	2.74	2.74	0.00	0.00	0.00
1000.75	0.75	4.34	4.34	0.00	0.00	0.00
1001.00	1	5.49	5.49	0.00	0.00	0.00
1001.25	1.25	6.44	6.44	0.00	0.00	0.00
1001.50	1.5	7.26	7.26	0.00	0.00	0.00
1001.75	1.75	8.00	8.00	0.00	0.00	0.00
1002.00	2	8.68	8.68	0.00	0.00	0.00
1002.25	2.25	9.31	9.31	0.00	0.00	0.00
1002.50	2.5	9.90	9.90	0.00	0.00	0.00
1002.75	2.75	10.45	10.45	0.00	0.00	0.00
1003.00	3	10.98	10.98	0.00	0.00	0.00
1003.25	3.25	20.22	11.48	6.24	2.50	0.00
1003.50	3.5	36.68	11.96	17.66	7.06	0.00
1003.75	3.75	57.85	12.43	32.44	12.98	0.00
1004.00	4	66.90	12.87	34.05	19.98	0.00
1004.25	4.25	82.92	13.31	41.70	27.92	0.00
1004.50	4.5	99.40	13.72	48.15	37.53	0.00
1004.75	4.75	111.30	14.13	53.83	43.33	0.00
1005.00	5	121.94	14.52	58.97	48.45	0.00
1005.25	5.25	131.68	14.91	63.70	53.07	0.00
1005.50	5.5	140.70	15.28	68.09	57.33	0.00
1005.75	5.75	161.53	15.65	72.22	61.28	12.38
1006.00	6	192.14	16.00	76.13	65.00	35.00
1006.25	6.25	229.02	16.35	79.85	68.52	64.30
1006.50	6.5	270.96	16.69	83.40	71.86	99.00
1006.75	6.75	317.25	17.03	86.80	75.06	138.36
1007.00	7	367.44	17.36	90.08	78.12	181.87
1007.25	7.25	421.18	17.68	93.24	81.07	229.19
1007.50	7.5	478.23	18.00	96.30	83.92	280.01
1007.75	7.75	527.24	18.31	99.26	86.67	323.00
1008.00	8	563.92	18.62	102.14	89.34	353.83

Project: The Grove 13958 Simulation Run: Proposed 2 Yr

Start of Run: 03Mar2018, 10:00 Basin Model: Proposed
End of Run: 04Mar2018, 10:06 Meteorologic Model: 2 Year
Compute Time: 03Apr2018, 10:33:50 Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Subbasin 3	0.0302812	64.20	03Mar2018, 21:54	3.81
Subbasin 2	0.0297969	60.93	03Mar2018, 21:54	3.60
Subbasin 1	0.027844	68.87	03Mar2018, 21:54	4.21
Offsite 1	0.02475	39.97	03Mar2018, 22:00	2.77
Subbasin 5	0.0232344	45.76	03Mar2018, 21:54	2.70
Offsite 2	0.0175313	16.94	03Mar2018, 22:00	1.16
Subbasin 4	0.0135781	29.80	03Mar2018, 21:54	1.77
Retention Basin	0.1670159	49.11	03Mar2018, 22:24	14.92
Site Outflow	0.1670159	49.11	03Mar2018, 22:24	14.92

Project: The Grove 13958 Simulation Run: Proposed 2 Yr

Reservoir: Retention Basin

Start of Run:	03Mar2018, 10:00	Basin Model:	Proposed
End of Run:	04Mar2018, 10:06	Meteorologic Model:	2 Year
Compute Time:	03Apr2018, 10:33:50	Control Specifications:	Control 1

Volume Units: AC-FT

Computed Results

Peak Inflow:	309.60 (CFS)	Date/Time of Peak Inflow:	03Mar2018, 21:54
Peak Discharge:	49.11 (CFS)	Date/Time of Peak Discharge	03Mar2018, 22:24
Inflow Volume:	20.02 (AC-FT)	Peak Storage:	10.32 (AC-FT)
Discharge Volume	14.92 (AC-FT)	Peak Elevation:	1003.65 (FT)

Project: The Grove 13958 Simulation Run: Proposed 10 Yr

Start of Run: 03Mar2018, 10:00
End of Run: 04Mar2018, 10:06
Compute Time: 03Apr2018, 10:33:43

Basin Model: Proposed
Meteorologic Model: 10 Year
Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Subbasin 3	0.0302812	108.71	03Mar2018, 21:54	6.55
Subbasin 2	0.0297969	104.72	03Mar2018, 21:54	6.28
Subbasin 1	0.027844	109.07	03Mar2018, 21:54	6.84
Offsite 1	0.02475	70.43	03Mar2018, 22:00	4.94
Subbasin 5	0.0232344	79.84	03Mar2018, 21:54	4.77
Offsite 2	0.0175313	36.69	03Mar2018, 22:00	2.43
Subbasin 4	0.0135781	49.74	03Mar2018, 21:54	3.02
Retention Basin	0.1670159	137.18	03Mar2018, 22:12	28.19
Site Outflow	0.1670159	137.18	03Mar2018, 22:12	28.19

Project: The Grove 13958 Simulation Run: Proposed 10 Yr
Reservoir: Retention Basin

Start of Run:	03Mar2018, 10:00	Basin Model:	Proposed
End of Run:	04Mar2018, 10:06	Meteorologic Model:	10 Year
Compute Time:	03Apr2018, 10:33:43	Control Specifications:	Control 1

Volume Units: AC-FT

Computed Results

Peak Inflow:	530.78 (CFS)	Date/Time of Peak Inflow:	03Mar2018, 21:54
Peak Discharge:	137.18 (CFS)	Date/Time of Peak Discharge	03Mar2018, 22:12
Inflow Volume:	34.83 (AC-FT)	Peak Storage:	16.32 (AC-FT)
Discharge Volume	28.19 (AC-FT)	Peak Elevation:	1005.40 (FT)

Project: The Grove 13958 Simulation Run: Proposed 100 Yr

Start of Run: 03Mar2018, 10:00 Basin Model: Proposed
End of Run: 04Mar2018, 10:06 Meteorologic Model: 100 Year
Compute Time: 03Apr2018, 10:33:47 Control Specifications: Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Subbasin 3	0.0302812	167.57	03Mar2018, 21:54	10.32
Subbasin 2	0.0297969	162.82	03Mar2018, 21:54	9.97
Subbasin 1	0.027844	161.95	03Mar2018, 21:54	10.37
Offsite 1	0.02475	111.20	03Mar2018, 22:00	7.96
Subbasin 5	0.0232344	125.25	03Mar2018, 21:54	7.63
Offsite 2	0.0175313	65.44	03Mar2018, 22:00	4.35
Subbasin 4	0.0135781	76.03	03Mar2018, 21:54	4.71
Retention Basin	0.1670159	381.65	03Mar2018, 22:06	47.38
Site Outflow	0.1670159	381.65	03Mar2018, 22:06	47.38

Project: The Grove 13958 Simulation Run: Proposed 100 Yr
Reservoir: Retention Basin

Start of Run:	03Mar2018, 10:00	Basin Model:	Proposed
End of Run:	04Mar2018, 10:06	Meteorologic Model:	100 Year
Compute Time:	03Apr2018, 10:33:47	Control Specifications:	Control 1

Volume Units: AC-FT

Computed Results

Peak Inflow:	826.87 (CFS)	Date/Time of Peak Inflow:	03Mar2018, 21:54
Peak Discharge:	381.65 (CFS)	Date/Time of Peak Discharge	03Mar2018, 22:06
Inflow Volume:	55.32 (AC-FT)	Peak Storage:	23.15 (AC-FT)
Discharge Volume	47.38 (AC-FT)	Peak Elevation:	1007.07 (FT)

Project: The Grove 13958 Simulation Run: WQV Bypass 100 Yr
Reservoir: Retention Basin

Start of Run:	03Mar2018, 10:00	Basin Model:	WQV Bypass
End of Run:	04Mar2018, 10:06	Meteorologic Model:	100 Year
Compute Time:	03Apr2018, 10:33:53	Control Specifications:	Control 1

Volume Units: AC-FT

Computed Results

Peak Inflow:	826.87 (CFS)	Date/Time of Peak Inflow:	03Mar2018, 21:54
Peak Discharge:	432.34 (CFS)	Date/Time of Peak Discharge	03Mar2018, 22:06
Inflow Volume:	55.32 (AC-FT)	Peak Storage:	16.29 (AC-FT)
Discharge Volume	54.56 (AC-FT)	Peak Elevation:	1007.38 (FT)

Exhibit 8 – Water Quality Volume Calculations

Water Quality Volume = WQv = P x Rv
P = 1.37”
Rv = 0.05 + 0.009(% Impervious)
Rv = 0.05 + 0.009(40)
Rv = 0.41
WQv = 1.37 x 0.41 = 0.5617 inches
WQv = 0.5617 inches x 79.83 acres (development) = **3.74 AC-FT**
= **162,771 CF**

40 Hour Draw Down Calculation
WQv at elevation 1001.39’
Average Head = 0.70’
40 hours = 144,000 seconds
Average Q = WQv / 40 Hours = 162,771 CFS / 144,000 seconds = 1.13 CFS
Average Head & Average Discharge → **Requires 8” orifice**