

# INITIAL STORMWATER LID SUBMITTAL

FOR

## 7-ELEVEN STORE #14141

43 Middle Rincon Road  
Santa Rosa, CA 94945

*Prepared for:*

**7-Eleven, Inc.**

3200 Hackberry Road  
Irving, TX 75063

*Prepared by:*



**TAIT & ASSOCIATES, INC.**

11280 Trade Center Drive  
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September 2, 2020

## **I. INTRODUCTION**

This Stormwater LID Submittal has been prepared for the proposed construction of a convenience store and fuel station located at 43 Middle Rincon Road, Santa Rosa, California. The proposed project is the redevelopment of an existing commercial lot with two buildings and a residential lot with multiple buildings. The proposed design follows the City of Santa Rosa 2017 Storm Water Low Impact Development Technical Design Manual.

## **II. EXISTING SITE CONDITIONS**

The existing project site consists of an existing convenience store, martial arts center, and residential property on the northwest corner of Middle Rincon Road and Highway 12. The project site is adjacent to residential use to the west, commercial use to the east and south, and residential use north of an adjacent vacant area. The project site is relatively flat, averaging 3-6% across the site, with a majority of the site sloping north towards the vacant land north of the project site.

Drainage Management areas are depicted in the attached Drainage Shed Maps. Drainage management area, DMA-A, consists of the residential structures, a portion of the martial arts center roof, and the dirt road between them. The drainage in management area DMA-A surface flows north around the residential structures and across unmaintained dirt and vegetation. Runoff surface flows north off-site onto the adjacent undeveloped area. The drainage in management area DMA-B contains a portion of the martial arts center roof and the convenience store roof along with the parking lot serving the buildings. Drainage surface flows north towards the martial arts building where it is directed east towards Middle Rincon Road. Drainage flows into the curb and gutter along Middle Rincon Road and flows north to a public storm drain catch basin.

The project site is located in the Santa Rosa Creek watershed. The Santa Rosa Creek flows into the Russian River and ultimately the Pacific Ocean. There are no known historic sources of contamination at the site. No natural features are present on the project site.

## **III. PROPOSED SITE CONDITIONS**

The project consists of the demolition of an existing convenience store, martial arts studio, and residential buildings and the construction of a new convenience store, fuel station, and associated site improvements. Project grading will occur on approximately 1.17± acres of the project, which comprises approximately 100 percent of the total site area. The project will adjoin the surrounding improvements on all sides. The project creates or replaces less than 1 acre of impervious surface and reduces the amount of impervious surface on the project site. The project is subject to treatment requirements with a treatment factor of 1.5. See the attached Storm Water LID Determination Worksheet and Storm Water Calculator.

The proposed drainage management area, DMA 1, comprises the western portion of the project site. See the attached Drainage Shed Maps for area limits. The runoff from the paving and sidewalk is conveyed by surface flow to a curb cut at the west side of the parking drive aisle

where it is further conveyed by a landscape swale. The proposed convenience store roof is directed west to the landscape swale and conveyed to the treatment area. Stormwater runoff from DMA-1 is directed towards a bioretention treatment area, BIO-1, by surface flow and landscape swale.

The proposed drainage management area, DMA-2, comprises the eastern portion of the project site. See the attached Drainage Shed Maps for area limits. The stormwater runoff is conveyed by surface flow, valley gutter, and curb and gutter, around the fueling area slab and fuel tank slab towards a curb cut. Stormwater enters the bioretention treatment area, BIO-2, through the proposed curb cut. The fuel canopy roof drains are piped to a bubble up drain located in the bioretention area.

Stormwater runoff is conveyed to two bioretention planters for water quality treatment and infiltration. The proposed bioretention planter is sized using the City of Santa Rosa Storm Water Calculator. No off-site stormwater run-on is expected on this development. The overflow inlet with bioretention underdrain connections will be connected to the public storm drain system through a new storm drain connection and extension of the public storm drain system.

#### IV. BIORETENTION PLANTER CALCULATIONS

The bioretention planters have been sized to meet the requirements of the Storm Water LID Development Technical Design Manual using the Storm Water Calculator provided by the City. The required bioretention treatment area for BIO-1 is 1,020 SF. The provided bioretention treatment area for BIO-1 is 1,312 SF. The required bioretention treatment area for BIO-2 is 1,900 SF. The provided bioretention treatment area for BIO-2 is 1,980 SF. The bioretention calculations are based on a design storm of 0.2 in/hr, a bioretention treatment rate of 5 in/hr, and a Treatment Factor of 1.5 See the attached Storm Water Calculator – City of Santa Rosa.

#### V. STORM DRAIN PIPE SIZING CALCULATIONS

The County of Sonoma uses the Rational Method for the analysis of the storm drain pipes. Below are the pipe size information and necessary capacities for open channel flow through the pipes. See the Proposed Drainage Shed Map for storm drain pipe and structure layout and the Pipe Calculations below. The on-site storm drain system adequately conveys the Q20 and Q100 flows.

**Q10 and Q100 Flow Rate Calculation Table**

| Flow Rate | Runoff Coefficient | Intensity (in/hr) * | Area (AC) | Calculated Flow Rate (cfs) |
|-----------|--------------------|---------------------|-----------|----------------------------|
| Q10       | 0.8                | 2.29                | 1.17      | 2.14                       |
| Q100      | 0.8                | 3.40                | 1.17      | 3.18                       |

\*See attached NOAA Precipitation Data. Tc = 10 minutes

**Pipe Information Table**

| Pipe Section  | Watershed Area (acres) | Cumulative Area (acres) | Q20 (cfs)** | Q100 (cfs)** | Pipe Size | Pipe Slope (%) | *Pipe Capacity Qcap (cfs) |
|---------------|------------------------|-------------------------|-------------|--------------|-----------|----------------|---------------------------|
| A – Full Site | 1.17                   | 1.17                    | 2.14        | 3.18         | 12"       | 1.0            | 3.8                       |

\*See attached nomograph chart with pipe capacities. \*\*See Q10 Calculations Above

## **VI. NPDES COMPLIANCE**

The project is in compliance with the NPDES Permit, the City of Santa Rosa 2017 Storm Water Low Impact Development Technical Design Manual and the California Stormwater Quality Association (CASQA) BMP Handbooks. The project is less than 1 acre and therefore not required to submit a Notice of Intent (NOI) and Stormwater Pollution Prevention Plan (SWPPP) to the State Water Resource Control Board (SWRCB).

## **VII. BMP MAINTENANCE**

Ongoing BMP maintenance of the bioretention planter system will be assured with a covenant maintenance agreement that will be recorded with the county prior to issuance of building permits.

## **VIII. CONCLUSION**

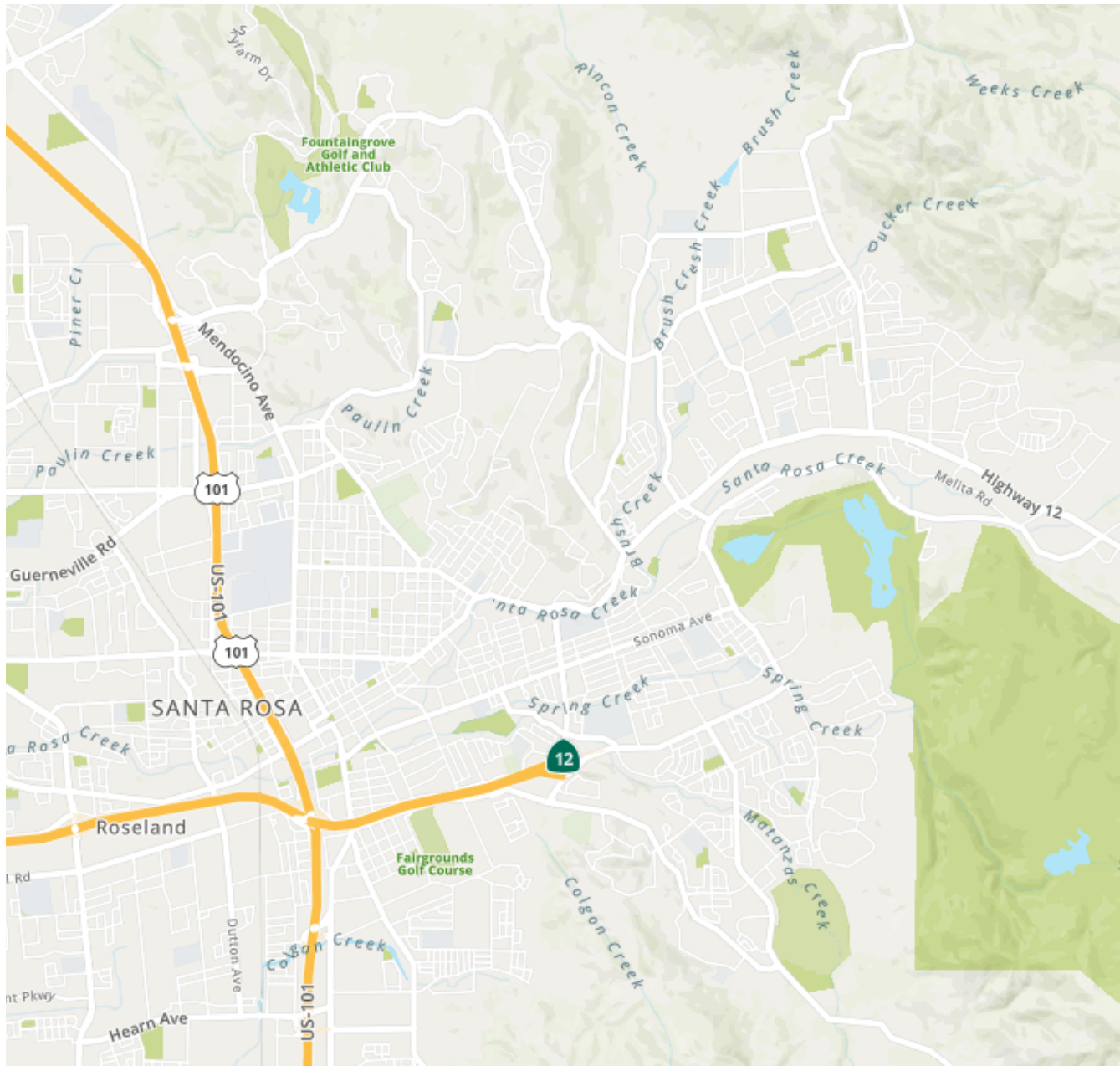
The hydrology and water quality calculations demonstrate that the proposed site is designed to meet stormwater treatment and flow requirements. The existing commercial and residential buildings will be replaced with a new convenience store and fueling station. The site improvements include the construction of a storm drain system designed to meet the 10-yr storm event, and adequately conveys the 100-yr storm event. The proposed project includes stormwater quality treatment and infiltration through the construction of a bioretention planter with underdrains.

## **IX. ATTACHMENTS**

Attached are following documents and exhibits to support the statements and calculations in the above Hydrology Study:

- Location Map
- Storm Water LID Determination Worksheet.
- Storm Water Calculator – City of Santa Rosa
- Percolation Results Section – Geotechnical Report
- Pipe Design Manual Nomograph
- NOAA Precipitation Data
- Sonoma County Mean Seasonal Precipitation map
- Drainage Shed Map – Existing
- Drainage Shed Map – Proposed

## Location Map



**FOR OFFICE USE ONLY:**

Does this project require permanent storm water BMP's?

Y N

Date Submitted: \_\_\_\_\_



|                     |          |
|---------------------|----------|
| File No:            | Quadrant |
| Related Files:      |          |
| Set:                |          |
| Department Use Only |          |

## 2017 Storm Water LID Determination Worksheet

**PURPOSE AND APPLICABILITY:** This determination worksheet is intended to satisfy the specific requirements of "ORDER NO. R1-2015-0030, NPDES NO. CA0025054 NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT AND WASTE DISCHARGE REQUIREMENTS FOR DISCHARGES FROM THE MUNICIPAL SEPARATE STORM SEWER SYSTEMS." Additional design requirements imposed by Governing Agencies, such as local grading ordinances, CAL Green, CEQA, 401 permitting, and hydraulic design for flood control still apply as appropriate. Additionally, coverage under another regulation may trigger the requirement to design in accordance with the Storm Water LID Technical Design Manual.

### Part 1: Project Information

Project Name Applicant (owner or developer) Name

Project Site Address Applicant Mailing Address

Project City/State/Zip Applicant City/State/Zip

Permit Number(s) - (if applicable) Applicant Phone/Email/Fax

Designer Name Designer Mailing Address

Designer City/State/Zip Designer Phone/Email

### **Type of Application/Project:**

Subdivision Grading Permit Building Permit Hillside Development  
 Design Review Use Permit Encroachment Time Extensions Other : Lot Line Adjustment

### PART 2: Project Exemptions

1. Is this a project that creates or replaces *less than* 10,000 square feet of impervious surface<sup>1</sup>, including all project phases and off-site improvements?

Yes No

<sup>1</sup> Impervious surface replacement, such as the reconstruction of parking lots or excavation to roadway subgrades, is not a routine maintenance activity. Reconstruction is defined as work that replaces surfaces down to the subgrade. Overlays, resurfacing, trenching and patching are defined as maintenance activities per section VI.D.2.b.

## 2017 Storm Water LID Determination Worksheet

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2. Is this project a routine maintenance activity<sup>2</sup> that is being conducted to maintain original line and grade, hydraulic capacity, and original purpose of facility such as resurfacing existing roads and parking lots?

Yes                  No

3. Is this project a stand alone pedestrian pathway, trail or off-street bike lane?

Yes                  No

4. **Did you answer "YES" to any of the questions in Part 2?**

**YES:** This project will *not* need to incorporate permanent Storm Water BMP's as required by the NPDES MS4 Permit. **Please complete the "Exemption Signature Section" on Page 4.**

**NO:** Please complete the remainder of this worksheet.

### **Part 3: Project Triggers**

#### **Projects that Trigger Requirements:**

Please answer the following questions to determine whether this project requires permanent Storm Water BMP's and the submittal of a SW LIDs as required by the NPDES MS4 Permit order No. R1-2015-0030.

1. Does this project create or replace a combined total of 10,000 square feet or more of impervious surface<sup>1</sup> including all project phases and off-site improvements?

Yes                  No

2. Does this project create or replace a combined total or 10,000 square feet or more of impervious streets, roads, highways, or freeway construction or reconstruction<sup>3</sup>?                  Yes                  No

3. Does this project create or replace a combined total of 1.0 acre or more of impervious surface<sup>1</sup> including all project phases and off-site improvements?                  Yes                  No

4. **Did you answer "YES" to any of the above questions in Part 3?**

**YES:** This project will need to incorporate permanent Storm Water BMP's as required by the NPDES MS4 Permit. **Please complete remainder of worksheet and sign the "Acknowledgement Signature Section" on Page 4.**

**NO:** This project will *not* need to incorporate permanent Storm Water BMP's as required by the NPDES MS4 permit. **Please complete the "Exemption Signature Section" on Page 4.**

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<sup>1</sup> Impervious surface replacement, such as the reconstruction of parking lots or excavation to roadway subgrades, is not a routine maintenance activity. Reconstruction is defined as work that replaces surfaces down to the subgrade. Overlays, resurfacing, trenching and patching are defined as maintenance activities per section VI.D.2.b.

<sup>2</sup> "Routine Maintenance Activity" includes activities such as overlays and/or resurfacing of existing roads or parking lots as well as trenching and patching activities and reroofing activities per section VI.D.2.b.

<sup>3</sup> "Reconstruction" is defined as work that extends into the subgrade of a pavement per section VI.D.2.b.



1. Total Project area:                      square feet  
acres

Commercial      Industrial      Residential      Public      Other

3. Existing impervious surface area: \_\_\_\_\_ square feet  
\_\_\_\_\_ acres

Commercial      Industrial      Residential      Public      Other

5. Proposed impervious surface area: \_\_\_\_\_ square feet  
\_\_\_\_\_ acres

2017 Storm Water LID Determination Worksheet

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**Acknowledgment Signature Section:**

As the property owner or developer, I understand that this project is required to implement permanent Storm Water Best Management Practices and provide a Storm Water Low Impact Development Submittal (SW LIDS) as required by the City's National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer Systems (MS4) Permit Order No. R1-2015-0030. \*Any unknown responses must be resolved to determine if the project is subject to these requirements.

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Applicant Signature

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Date**Exemption Signature Section:**

As the property owner or developer, I understand that this project as currently designed does not require permanent Storm Water BMP's nor the submittal of a Storm Water Low Impact Development Submittal (SW LIDS) as required by the City's National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer Systems (MS4) Permit\*. I understand that redesign may require submittal of a new Determination Worksheet and may require permanent Storm Water BMP's.

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Applicant Signature

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Date

\* This determination worksheet is intended to satisfy the specific requirements of "ORDER NO. R1-2015-0030, NPDES NO. CA0025054 NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT AND WASTE DISCHARGE REQUIREMENTS FOR DISCHARGES FROM THE MUNICIPAL SEPARATE STORM SEWER SYSTEMS." Additional design requirements imposed by Governing Agencies, such as local grading ordinances, CAL Green, CEQA, 401 permitting, and hydraulic design for flood control still apply as appropriate. Additionally, coverage under another regulation may trigger the requirement to design in accordance with the Storm Water LID Technical Design Manual.

**Implementation Requirements:** All calculations shall be completed using the "Storm Water Calculator" available at: [www.srcity.org/stormwaterLID](http://www.srcity.org/stormwaterLID)

**Hydromodification Control/100% Volume Capture:** Capture (infiltration and/or reuse) of 100% of the volume of runoff generated by a 1.0" 24-hour storm event, as calculated using the "Urban Hydrology for Small Watersheds" TR-55 Manual method. This is a retention requirement.

**Treatment Requirement:** Treatment of 100% of the flow calculated using the modified Rational Method and a known intensity of 0.20 inches per hour.

**Delta Volume Capture Requirement:** Capture (infiltration and/or reuse) of the increase in volume of storm water due to development generated by a 1.0" 24-hour storm event, as calculated using the "Urban Hydrology for Small Watersheds" TR-55 Manual method. This is a retention requirement.



## STORM WATER CALCULATOR

### LID BMP Summary Page & Site Global Values

|   |   |   |
|---|---|---|
| <b>Project Information:</b><br>Project Name: <u>7-Eleven Store #14141</u><br>Address/Location: <u>43 Middle Rincon Road, Santa Rosa, CA 94945</u><br>Designer: <u>JLV</u><br>Date: <u>5/11/2020</u> | <b>Site Information:</b><br>Mean Seasonal Precipitation (MSP) of Project Site: <u>35.00</u> (inches)<br>K=MSP/3(      K= <u>1.17</u><br><br>Impervious area - pre development: <u>37,700.0</u> ft <sup>2</sup><br>Impervious area - post development: <u>32,326.0</u> ft <sup>2</sup> | Based upon the pre and post development impervious area, the post construction BMP requirement is:<br><br><b>Treatment Only</b> |
|---|---|---|

### Summary of Saved BMP Results:

| BMP ID: | Tributary Area        |                                 | Requirements            |                              |  | BMP Design Results                   |                |                            |                |                       |                |  |
|---------|-----------------------|---------------------------------|-------------------------|------------------------------|--|--------------------------------------|----------------|----------------------------|----------------|-----------------------|----------------|--|
|         | Tributary Area (ft².) | Runoff Reduction Measures (Y/N) | Type of Requirement Met | Type of BMP Design           | Percent Achieved   | Hydromodification Control            |                | Flow Base Treatment        |                | Delta Volume Capture  |                |  |
|         |                       |                                 |                         |                              |  | Required V <sub>Hydromod</sub> (ft³) | Achieved (ft³) | Required Q Treatment (cfs) | Achieved (ft³) | Required Vdelta (ft³) | Achieved (ft³) |  |
| 1       | BMP-1                 | 18,270                          | No                      | 100% Vertical Flow Treatment | Priority 2: P2-05 Roadside Bioretention - No Curb AND Gutter | 100.5                                |                |                            | 0.1174         | 0.1181                |                |  |
| 2       | BMP-2                 | 32,693                          | No                      | 100% Vertical Flow Treatment | Priority 2: P2-04 Roadside Bioretention - Curb Opening       | 104.6                                |                |                            | 0.2101         | 0.2199                |                |  |
| 3       |                       |                                 |                         |                              |  |                                      |                |                            |                |                       |                |  |
| 4       |                       |                                 |                         |                              |  |                                      |                |                            |                |                       |                |  |
| 5       |                       |                                 |                         |                              |  |                                      |                |                            |                |                       |                |  |
| 6       |                       |                                 |                         |                              |  |                                      |                |                            |                |                       |                |  |
| 7       |                       |                                 |                         |                              |  |                                      |                |                            |                |                       |                |  |
| 8       |                       |                                 |                         |                              |  |                                      |                |                            |                |                       |                |  |
| 9       |                       |                                 |                         |                              |  |                                      |                |                            |                |                       |                |  |
| 10      |                       |                                 |                         |                              |  |                                      |                |                            |                |                       |                |  |
| 11      |                       |                                 |                         |                              |  |                                      |                |                            |                |                       |                |  |
| 12      |                       |                                 |                         |                              |  |                                      |                |                            |                |                       |                |  |
| 13      |                       |                                 |                         |                              |  |                                      |                |                            |                |                       |                |  |
| 14      |                       |                                 |                         |                              |  |                                      |                |                            |                |                       |                |  |
| 15      |                       |                                 |                         |                              |  |                                      |                |                            |                |                       |                |  |
| 16      |                       |                                 |                         |                              |  |                                      |                |                            |                |                       |                |  |
| 17      |                       |                                 |                         |                              |  |                                      |                |                            |                |                       |                |  |
| 18      |                       |                                 |                         |                              |  |                                      |                |                            |                |                       |                |  |
| 19      |                       |                                 |                         |                              |  |                                      |                |                            |                |                       |                |  |
| 20      |                       |                                 |                         |                              |  |                                      |                |                            |                |                       |                |  |
| 21      |                       |                                 |                         |                              |  |                                      |                |                            |                |                       |                |  |
| 22      |                       |                                 |                         |                              |  |                                      |                |                            |                |                       |                |  |
| 23      |                       |                                 |                         |                              |  |                                      |                |                            |                |                       |                |  |
| 24      |                       |                                 |                         |                              |  |                                      |                |                            |                |                       |                |  |
| 25      |                       |                                 |                         |                              |  |                                      |                |                            |                |                       |                |  |
| 26      |                       |                                 |                         |                              |  |                                      |                |                            |                |                       |                |  |
| 27      |                       |                                 |                         |                              |  |                                      |                |                            |                |                       |                |  |
| 28      |                       |                                 |                         |                              |  |                                      |                |                            |                |                       |                |  |
| 29      |                       |                                 |                         |                              |  |                                      |                |                            |                |                       |                |  |
| 30      |                       |                                 |                         |                              |  |                                      |                |                            |                |                       |                |  |



## STORM WATER CALCULATOR

### BMP Tributary Parameters

Project Name: **7-Eleven Store #14141**

BMP ID: **BMP-1**  
BMP Design Criteria: **Treatment Only**  
Type of BMP Design: **Priority 2: P2-05 Roadside Bioretention - No Curb AND Gutter**  
BMP's Physical Tributary Area: **18,270.0** ft<sup>2</sup>  
Description/Notes:

### 100% Treatment

$Q_{\text{TREATMENT}} =$  **0.1174** cfs

Post surface type: **Concrete**  
 $C_{\text{POST}}$ : **0.80**  
User Composite post development  $C_{\text{POST}}$ : **0.00**  
User Input  $I_{\text{Historical}}$ : **0.00** in./hr.  
Treatment Factor (Tf): **2** Calculated  
 $I_{\text{Design Storm}}$ : **0.20** in./hr.

### BMP Sizing 100% Treatment Vertical

Percent of Goal Achieved = **100.53** %

Infiltration rate of the specified BMP soil: **5.00** in./hr.  
Depth of drainage pipe: **1.50** ft  
BMP Length: **102.00** ft  
BMP Width: **10.00** ft



## STORM WATER CALCULATOR

### BMP Tributary Parameters

Project Name: **7-Eleven Store #14141**

BMP ID: **BMP-2**  
BMP Design Criteria: **Treatment Only**  
Type of BMP Design: **Priority 2: P2-04 Roadside Bioretention - Curb Opening**  
BMP's Physical Tributary Area: **32,693.0** ft<sup>2</sup>  
Description/Notes:

### 100% Treatment

$Q_{\text{TREATMENT}} =$  **0.2101** cfs

Post surface type: **Concrete**  
 $C_{\text{POST}}$ : **0.80**  
User Composite post development  $C_{\text{POST}}$ : **0.00**  
User Input  $I_{\text{Historical}}$ : **0.00** in./hr.  
Treatment Factor (Tf): **2** Calculated  
 $I_{\text{Design Storm}}$ : **0.20** in./hr.

### BMP Sizing 100% Treatment Vertical

Percent of Goal Achieved = **104.64** %

Infiltration rate of the specified BMP soil: **5.00** in./hr.  
Depth of drainage pipe: **1.50** ft  
BMP Length: **100.00** ft  
BMP Width: **19.00** ft

# Percolation Testing Results -Geotechnical Report

**TABLE 6.3**  
**WATER SOLUBLE SULFATE EXPOSURE REQUIREMENTS**

| <b>Dissolved Sulfate (SO<sub>4</sub>) in Soil % by Weight</b> | <b>Exposure Severity</b> | <b>Exposure Class</b> | <b>Maximum w/cm Ratio</b> | <b>Minimum Concrete Compressive Strength</b> | <b>Cementitious Materials Type</b> |
|---|--------------------------|-----------------------|---------------------------|--|------------------------------------|
| 0.427   | Severe                   | S2                    | 0.45                      | 4,500 psi                                    | V                                  |

The water-soluble chloride concentration detected in saturation extract from the soil samples was 33 mg/kg. In addition, testing performed on a near surface soil resulted in a minimum resistivity value of 508 ohm-centimeters. Based on the results, these soils would be considered to have an “extremely corrosive” potential to buried metal objects (per National Association of Corrosion Engineers, Corrosion Severity Ratings).

It is recommended that, at a minimum, applicable manufacturer’s recommendations for corrosion protection of buried metal pipe be closely followed. Corrosion is dependent upon a complex variety of conditions, which are beyond the Geotechnical practice. Consequently, a qualified corrosion engineer should be consulted if the owner desires more specific recommendations.

## **6.4 Results of Percolation Testing**

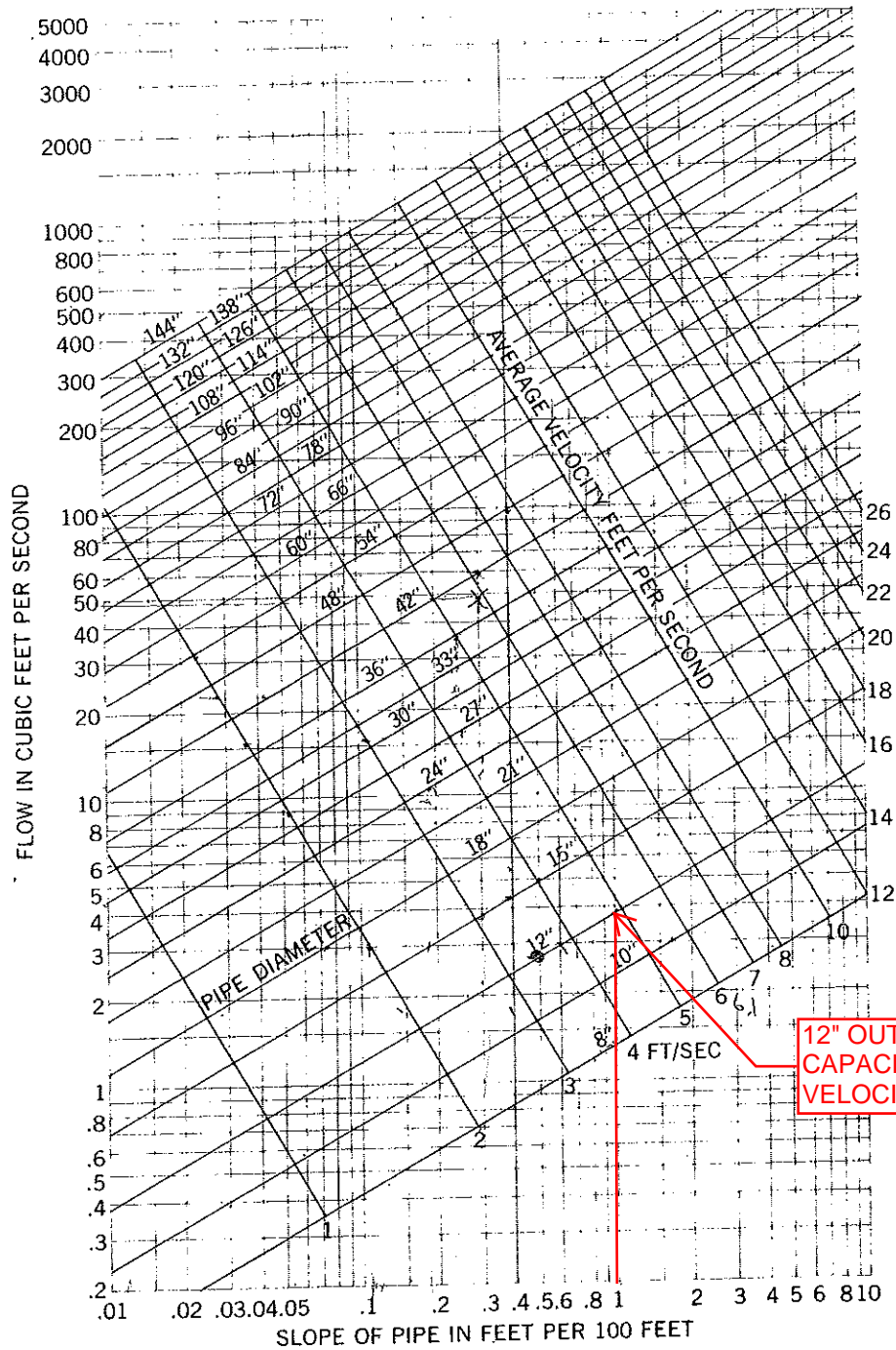
The percolation test was performed in the general area of the planned landscape. The approximate location of the percolation test is shown on the attached Figure 2. Approximately 6-inch diameter percolation boreholes were advanced using solid flight auger to the depths as illustrated in the following table. Approximately 1 to 3 inches of gravel was placed in the bottom of each hole followed by a 3-inch diameter perforated pipe. The annulus surrounding the perforated pipe was backfilled with gravel. The holes were pre-saturated a before percolation testing commenced. The following table includes a summary of the percolation tests:

| <b>Location</b> | <b>Depth, BSG (feet)</b> | <b>Unfactored Gravel Corrected Percolation Rate (minutes per inch)</b> | <b>Estimated Unfactored Infiltration Rate (inches per hour)</b> | <b>Soil Type (USCS)</b> |
|-----------------|--------------------------|--|---|-------------------------|
| P-1             | 5                        | 90.9   | 0.1   | CL                      |

The results of the percolation tests performed generally indicate the soils tested have poor infiltration characteristics. Based on the results of the percolation test performed, the infiltration capacity of the materials encountered is very low to negligible. If considered feasible, an unfactored infiltration rate of 0.1 inches per hour may be considered for design of proposed stormwater disposal systems. An appropriate factor of safety should be selected for design. At a minimum a factor of safety of 3 should be considered. The estimated infiltration rates included in this report are unfactored. SALEM Engineering should be provided plans showing the limits and calculations used for design of the proposed stormdrain system for review. During construction, the bottom of the proposed stormwater disposal system should be inspected and/or tested for infiltration to determine if the system has been design appropriately

FIGURE 4

FLOW FOR CIRCULAR PIPE FLOWING FULL  
BASED ON MANNING'S EQUATION  $n=0.012$



Circular  
Pipe  
Slope





NOAA Atlas 14, Volume 6, Version 2  
Location name: Santa Rosa, California, USA\*  
Latitude: 38.4642°, Longitude: -122.6657°  
Elevation: 274.96 ft\*\*  
\* source: ESRI Maps  
\*\* source: USGS



## POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitania, Deborah Martin,  
Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao,  
Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

[PF\\_tabular](#) | [PF\\_graphical](#) | [Maps & aerals](#)

### PF tabular

| PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour) <sup>1</sup> |                                     |                        |                        |                        |                        |                        |                        |                        |                        |                        |
|---|-------------------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| Duration  | Average recurrence interval (years) |                        |                        |                        |                        |                        |                        |                        |                        |                        |
|   | 1                                   | 2                      | 5                      | 10                     | 25                     | 50                     | 100                    | 200                    | 500                    | 1000                   |
| 5-min   | 1.90<br>(1.68-2.15)                 | 2.27<br>(2.02-2.58)    | 2.77<br>(2.46-3.17)    | 3.19<br>(2.81-3.68)    | 3.79<br>(3.19-4.54)    | 4.26<br>(3.50-5.23)    | 4.75<br>(3.79-6.00)    | 5.27<br>(4.08-6.88)    | 6.00<br>(4.43-8.21)    | 6.58<br>(4.67-9.37)    |
| 10-min  | 1.36<br>(1.21-1.54)                 | 1.63<br>(1.45-1.85)    | 1.99<br>(1.76-2.27)    | 2.29<br>(2.01-2.64)    | 2.72<br>(2.29-3.25)    | 3.05<br>(2.51-3.74)    | 3.40<br>(2.72-4.30)    | 3.77<br>(2.92-4.93)    | 4.30<br>(3.17-5.88)    | 4.72<br>(3.35-6.71)    |
| 15-min  | 1.09<br>(0.972-1.24)                | 1.31<br>(1.16-1.49)    | 1.60<br>(1.42-1.83)    | 1.85<br>(1.62-2.13)    | 2.19<br>(1.85-2.62)    | 2.46<br>(2.02-3.02)    | 2.74<br>(2.20-3.46)    | 3.04<br>(2.36-3.97)    | 3.46<br>(2.56-4.74)    | 3.80<br>(2.70-5.41)    |
| 30-min  | 0.774<br>(0.688-0.880)              | 0.928<br>(0.824-1.06)  | 1.14<br>(1.01-1.30)    | 1.31<br>(1.15-1.51)    | 1.55<br>(1.31-1.86)    | 1.74<br>(1.43-2.14)    | 1.94<br>(1.55-2.45)    | 2.16<br>(1.67-2.81)    | 2.45<br>(1.81-3.36)    | 2.69<br>(1.91-3.84)    |
| 60-min  | 0.548<br>(0.487-0.622)              | 0.657<br>(0.583-0.747) | 0.803<br>(0.711-0.916) | 0.926<br>(0.812-1.07)  | 1.10<br>(0.925-1.31)   | 1.23<br>(1.01-1.51)    | 1.38<br>(1.10-1.74)    | 1.53<br>(1.18-1.99)    | 1.74<br>(1.28-2.38)    | 1.91<br>(1.35-2.71)    |
| 2-hr  | 0.413<br>(0.368-0.470)              | 0.494<br>(0.440-0.562) | 0.600<br>(0.531-0.684) | 0.684<br>(0.600-0.788) | 0.796<br>(0.671-0.954) | 0.881<br>(0.725-1.08)  | 0.966<br>(0.773-1.22)  | 1.05<br>(0.816-1.37)   | 1.17<br>(0.863-1.60)   | 1.26<br>(0.893-1.79)   |
| 3-hr  | 0.351<br>(0.312-0.398)              | 0.419<br>(0.372-0.477) | 0.506<br>(0.448-0.577) | 0.574<br>(0.504-0.662) | 0.664<br>(0.560-0.796) | 0.731<br>(0.602-0.897) | 0.797<br>(0.638-1.01)  | 0.863<br>(0.668-1.13)  | 0.950<br>(0.702-1.30)  | 1.02<br>(0.721-1.45)   |
| 6-hr  | 0.265<br>(0.235-0.300)              | 0.316<br>(0.281-0.359) | 0.380<br>(0.336-0.433) | 0.429<br>(0.376-0.494) | 0.493<br>(0.415-0.590) | 0.539<br>(0.444-0.662) | 0.584<br>(0.467-0.738) | 0.629<br>(0.487-0.820) | 0.686<br>(0.506-0.939) | 0.729<br>(0.517-1.04)  |
| 12-hr   | 0.187<br>(0.167-0.213)              | 0.223<br>(0.198-0.254) | 0.268<br>(0.237-0.306) | 0.303<br>(0.265-0.349) | 0.347<br>(0.292-0.415) | 0.379<br>(0.312-0.465) | 0.410<br>(0.328-0.518) | 0.441<br>(0.342-0.575) | 0.481<br>(0.355-0.658) | 0.510<br>(0.362-0.726) |
| 24-hr   | 0.130<br>(0.117-0.147)              | 0.156<br>(0.140-0.177) | 0.188<br>(0.168-0.214) | 0.212<br>(0.189-0.244) | 0.244<br>(0.211-0.288) | 0.267<br>(0.227-0.321) | 0.290<br>(0.241-0.356) | 0.312<br>(0.253-0.393) | 0.341<br>(0.267-0.444) | 0.362<br>(0.275-0.486) |
| 2-day   | 0.084<br>(0.075-0.095)              | 0.103<br>(0.092-0.117) | 0.126<br>(0.113-0.144) | 0.144<br>(0.128-0.165) | 0.167<br>(0.145-0.197) | 0.184<br>(0.156-0.221) | 0.200<br>(0.166-0.245) | 0.215<br>(0.175-0.271) | 0.235<br>(0.184-0.307) | 0.250<br>(0.190-0.336) |
| 3-day   | 0.063<br>(0.057-0.072)              | 0.079<br>(0.071-0.090) | 0.099<br>(0.089-0.113) | 0.114<br>(0.101-0.131) | 0.133<br>(0.115-0.157) | 0.146<br>(0.124-0.176) | 0.159<br>(0.132-0.195) | 0.172<br>(0.139-0.216) | 0.188<br>(0.147-0.244) | 0.199<br>(0.151-0.268) |
| 4-day   | 0.053<br>(0.047-0.060)              | 0.067<br>(0.060-0.076) | 0.084<br>(0.075-0.095) | 0.096<br>(0.086-0.111) | 0.112<br>(0.097-0.133) | 0.124<br>(0.105-0.149) | 0.135<br>(0.112-0.166) | 0.146<br>(0.118-0.183) | 0.159<br>(0.125-0.207) | 0.169<br>(0.128-0.227) |
| 7-day   | 0.037<br>(0.034-0.042)              | 0.047<br>(0.043-0.054) | 0.060<br>(0.053-0.068) | 0.069<br>(0.061-0.079) | 0.080<br>(0.069-0.095) | 0.088<br>(0.075-0.106) | 0.096<br>(0.080-0.118) | 0.104<br>(0.084-0.130) | 0.113<br>(0.088-0.147) | 0.120<br>(0.091-0.161) |
| 10-day  | 0.030<br>(0.027-0.034)              | 0.038<br>(0.034-0.043) | 0.048<br>(0.043-0.054) | 0.055<br>(0.049-0.063) | 0.064<br>(0.055-0.075) | 0.070<br>(0.060-0.085) | 0.076<br>(0.064-0.094) | 0.082<br>(0.067-0.103) | 0.089<br>(0.070-0.117) | 0.095<br>(0.072-0.127) |
| 20-day  | 0.020<br>(0.018-0.022)              | 0.025<br>(0.023-0.029) | 0.031<br>(0.028-0.036) | 0.036<br>(0.032-0.041) | 0.042<br>(0.036-0.049) | 0.046<br>(0.039-0.055) | 0.050<br>(0.041-0.061) | 0.053<br>(0.043-0.067) | 0.057<br>(0.045-0.075) | 0.060<br>(0.046-0.081) |
| 30-day  | 0.016<br>(0.014-0.018)              | 0.020<br>(0.018-0.023) | 0.025<br>(0.023-0.029) | 0.029<br>(0.026-0.033) | 0.033<br>(0.029-0.039) | 0.037<br>(0.031-0.044) | 0.039<br>(0.033-0.048) | 0.042<br>(0.034-0.053) | 0.045<br>(0.035-0.059) | 0.047<br>(0.036-0.064) |
| 45-day  | 0.013<br>(0.012-0.015)              | 0.016<br>(0.015-0.019) | 0.020<br>(0.018-0.023) | 0.023<br>(0.021-0.027) | 0.027<br>(0.023-0.032) | 0.029<br>(0.025-0.035) | 0.031<br>(0.026-0.038) | 0.033<br>(0.027-0.042) | 0.036<br>(0.028-0.046) | 0.037<br>(0.028-0.050) |
| 60-day  | 0.011<br>(0.010-0.013)              | 0.015<br>(0.013-0.017) | 0.018<br>(0.016-0.021) | 0.021<br>(0.018-0.024) | 0.023<br>(0.020-0.028) | 0.025<br>(0.022-0.031) | 0.027<br>(0.023-0.033) | 0.029<br>(0.023-0.036) | 0.031<br>(0.024-0.040) | 0.032<br>(0.024-0.043) |

<sup>1</sup> Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at low er and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the low er bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.



# REFERENCE DOCUMENT A

