APPENDIX E-2

ONSITE DRAINAGE CALCULATIONS

Drainage Calculations for Proposed Travel Station
Yermo, San Bernardino County, CA

January 26th, 2021

This drainage study has been prepared for a proposed travel station in Yermo, sometimes referred to hereafter as the "Project". The project proposes several improvements to contain and capture the runoff generated "on-site".

The Project is located on the southwest corner of Calico Road and Telstar Court Yermo, California. The APN for the site is 0637-162-06. The proposed Project is a 13,000 square foot travel plaza that will include a food store/convenience market, a food court, restrooms and showers. Specifically, the travel center includes a 11,000 square foot convenience market, restrooms, a food court, 10 vehicle fueling stations for cars and 4 fueling stations for trucks. The Project site improvements will include truck and vehicle parking, a storm drain system, and terminal storm drain sump.

"Off-Site" Hydrology

As a condition of the project, the "off-site" hydrology was evaluated in addition to the "on-site" hydrology. The purpose of the calculations is to quantify the impact "off-site" runoff would have on the improved site. A separate report for the "off-site" hydrology was prepared and is considered supplementary to this report.

The report finds that, for the area tributary to the site, the 100-year storm water runoff would yield an instantaneous flow of 27.9 cubic feet per second. When the flow is distributed over the entire length of the western property line, the depth of flow is calculated as 1.2 inches. Additionally, the velocity of water along the western property line is calculated as 0.34 feet per second. The report concludes that, due to the low depth of flow and low velocity, 100-year storm event will have less than significant impact on the Project.

Additionally, as discussed further below, the terminal sump for the project is oversized compared to the generated "on-site" runoff. Thus, the terminal sump will be able to capture a portion of the

100-year storm event the flows onto the site. Furthermore, in the event that the sump is filled and overflows, the stormwater will continue on its historic route.

“On-Site” Improvements

The proposed storm drain improvements include concrete vee-gutters, eight storm drain inlets, and RCP or PVC pipes, which route storm water to the terminal sump at the southeast corner of the property. Exhibit “A” herein shows the project site and proposed drainage tributary to the catch basins and terminal sump. Considering that this report is preliminary, the amount and location of improvements, especially the vee-gutters and catch basins, may differ from the final design and report. The terminal drainage sump volume has been sized as per the San Bernardino County (SBC) Standards, which is described below.

Table 1 herein shows the runoff volume generated for the entirety of “on-site”. The calculations are based on the equation provided in the SBC Standards. The site is evaluated twice, once for pre-construction and once for post-construction, in order to evaluate the difference between the generated runoff. The Curve Number is a lookup from SBC Standards. The Storm Runoff Fraction is provided by the National Oceanic and Atmospheric Administration (NOAA) Precipitation Frequency Data. The calculations indicate the differential between the pre- and post-construction conditions is 12,624 cubic feet of runoff.

Table 2 herein shows the capacity of the proposed retention basin. Based on the SBC Standards, the retention basin has a water depth of 4 feet with 1-foot of freeboard. The retention basin capacity is calculated as 33,383 cubic feet, which is adequate to contain the runoff generated “on-site”. Shown by the calculations, the current sump design has a capacity roughly twice the amount of the “on-site” generated runoff. As discussed before, improvements may be different in the final design. Therefore, the sump’s capacity may be reduced to an amount closer to the generated “on-site” runoff.

These calculations have shown that the proposed storm drain system is adequate to collect, convey, and dispose of storm water for the proposed travel station. Additionally, building finished floor elevations will be elevated to ensure no stormwater will impact the proposed building.

Submitted by: Matthew K. VoVilla 2-19-24

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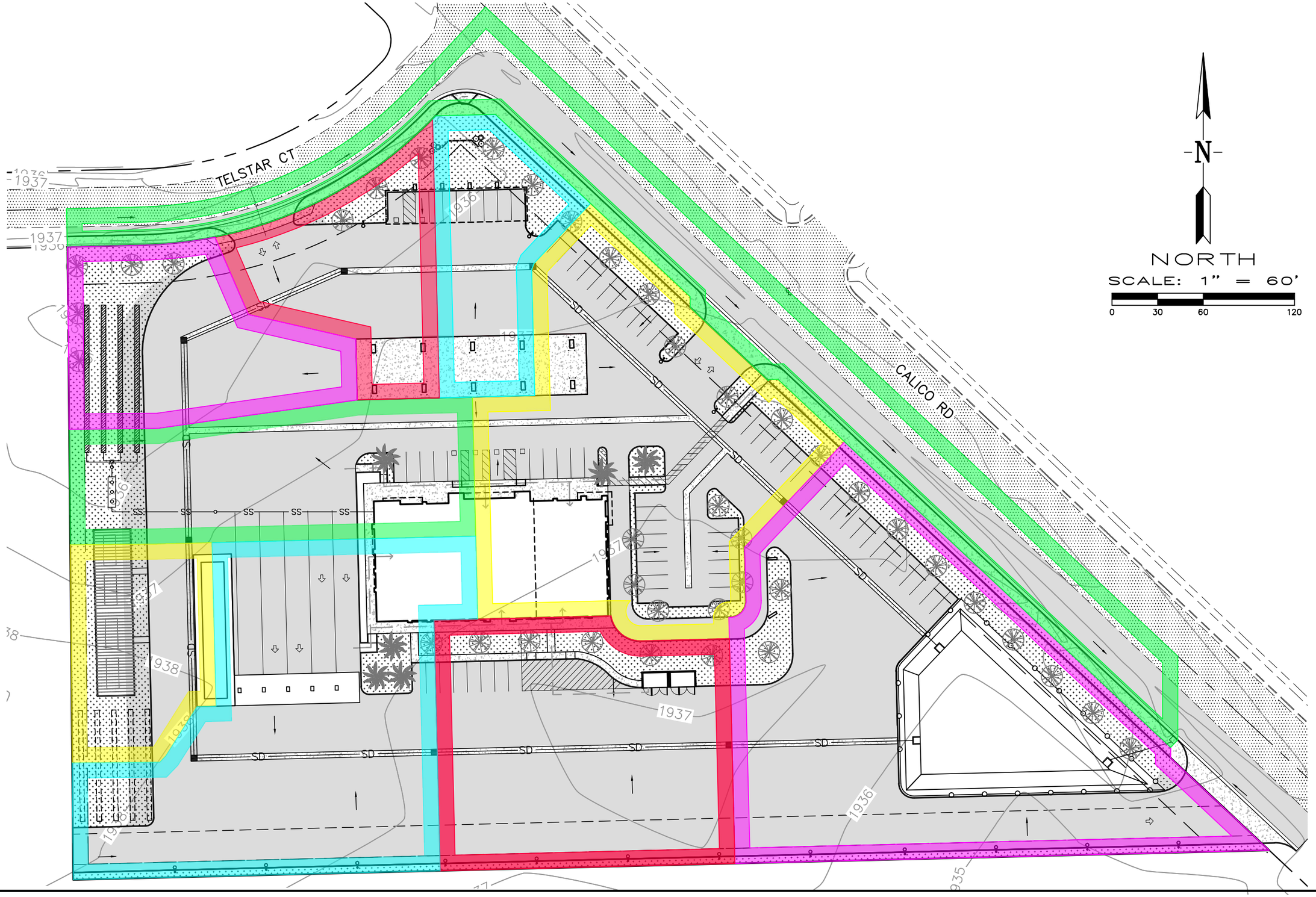
EXHIBIT "A" - DRAINAGE AREAS



NORTH

SCALE: 1" = 60'

0 30 60 120

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EXHIBIT "A" - DRAINAGE AREAS
PRELIMINARY DRAINAGE STUDY
TRAVEL CENTER
YERMO, CALIFORNIA

JOB No.:	18-858
DWG NO.:	EXHIBIT
DATE:	01/26/2021
DRAWN BY:	BMB
CHECKED BY:	MKV
SHEET	1
OF	1 SHEETS

Table 1

Sump Volume Calculator
Travel Center, Yermo CA

Job No: 18-858
Date: 10/5/2020
Created by: BMB

Volume Required							
Description	**Curve Number (CN)**	**Soil Capacity (S)**	**Initial Obstruction (I_a)**	**Storm Runoff Fraction (P_{24})**	**Storm Runoff Yield Fraction (Y_j)**	**Runoff Area (sq. ft)**	**Runoff Volume (cu. ft)**
Pre-Development	46	11.74	2.35	2.47	0.00051	248,967	11
Post-Development	90	1.11	0.22	2.47	0.61	248,967	12,635
Stormwater Differential							12,624

Note:
Sump volume calculated using San Bernardino Standards:
Runoff Volume = Y_j*A, or;
Runoff Volume = $(1/12)*[(P_{24}-I_a)^2/ (P_{24}-I_a+S)P_{24}]*A$, where;

A = Runoff Area (sq. ft)
P_{24} = 24-hour storm rainfall (Per NOAA)
Ia = Initial Abstraction (I_a = 0.2S)
S = Soil Capacity (S = 1000/CN-10)
CN = Curve Number (From SBCHM Figure C-3)

P_{24} collected from: http://hdsc.nws.noaa.gov/hdsc/pfds/
Site Soil is Hydrologic Group "A"

Table 2

Required Sump Volume
Travel Center, Yermo CA

Job #: 18-858
Date: 10/5/2020
Created by: BMB

Side Slope (H to V):	2	1
Freeboard:	1	ft
Depth-$_{\text{water surface:}}$	4	ft
Depth-$_{\text{total:}}$	5	ft
Area-$_{\text{floor:}}$	6,779	sf
Area-$_{\text{1/2 water surface:}}$	8,321	sf
Area-$_{\text{water surface:}}$	10,012	sf
Volume-$_{\text{provided-trial:}}$	**33,383**	**cubic ft**
Volume-$_{\text{provided-trial:}}$	**0.77**	**acre ft**

Conclusions:
The volume provided by the dimensions of the sump shown above (33,383 cu ft) is greater than the volume of runoff generated on site (12,624 acre-ft). Therefore, the sump is sufficient for storing runoff.