AIR DISPERSION MODELING PROTOCOL
WESTMORELAND SANITY LANDFILL LEACHATE EVAPORATOR

CEC PROJECT 313-688

PREPARED BY

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.
333 BALDWIN ROAD
PITTSBURGH, PA 15202

PREPARED FOR
NOBLE ENVIRONMENTAL, INC.
901 TYROL BLVD
BELLE VERNON PA 15012

JUNE 25, 2021

TABLE OF CONTENTS

1.0 INTRODUCTION.....3

2.0 PROJECT SUMMARY.....4

2.1 Project Location..... 4
2.2 Model SelectioN..... 5
2.2.1 Urban / Rural Classification.....5
2.3 Project Source and Stack Parameters..... 6
2.4 Good Engineering Practice (GEP) Stack height and Building Downwash 7
2.5 Terrain and Receptor Data..... 7
2.6 Meteorological Data..... 8
2.7 Emissions Data and Model Results..... 8

APPENDICES

Appendix A – Site Plan and Receptor Grid

Appendix B – Stack Parameters

Appendix C – Stack Diagram

1.0 INTRODUCTION

Noble Environmental, Inc. (Noble) submitted a Plan Approval to the Pennsylvania Department of Environmental Protection (PADEP) in 2020 for the installation of a leachate evaporator at the Westmoreland Sanitary Landfill located in Belle Vernon, Westmoreland County, PA. In correspondence dated May 7, 2021, PADEP requested additional information regarding the selection of monitoring locations and potential effects of the elevated landfill cell(s) topography on monitoring radionuclide emissions. Subsequently, Noble proposed an air dispersion modeling analysis to estimate ambient air concentrations of radionuclides. A telephone conference was held with PADEP on June 8, 2021 to discuss the proposed air dispersion modeling.

This air dispersion modeling analysis will be conducted in accordance with US EPA's Guidelines on Air Quality Models (40 CFR 51 Appendix W) and PADEP's recommendations from our discussions.

2.0 PROJECT SUMMARY

Perma-Fix Environmental Services, Inc. (Perma-Fix) has provided Noble with the maximum radium-226 (Ra-226) and radium-228 (Ra-228) in the evaporator sludge material and emitted through the evaporation process. These calculations assume the influent radium is emitted as a particulate during the evaporation process. The calculations assume a total dissolved solids (TDS) reduction of 99%. This reduction occurs at the HRT system upstream of the evaporator. Assuming radium is emitted as particulate, the TSS removal reduces radium that would otherwise enter the evaporator.

While radium is in the form of particulate matter (PM), this dispersion modeling analysis will not include special model processing for PM (i.e. PM10 or PM2.5) as this is not intended to be a National Ambient Air Quality (NAAQS) analysis. Since this is not a NAAQS analysis, the following have been excluded from consideration and/or analysis:

- PM10 and PM2.5 NAAQS standards;
- PM10 and PM2.5 Significant Impact Levels;
- Nearby Sources;
- Background Concentrations; and
- Secondary Formation of PM 2.5.

2.1 PROJECT LOCATION

The location of emission sources, structures, and receptors are represented in the Universal Transverse Mercator (UTM) coordinate system. The datum for the Westmoreland Sanitary Landfill modeling analysis is based on World Geodic System (WGS84). UTM coordinates for this analysis are all located within UTM Zone 17. A map of the surrounding area and property boundary Appendix A.

The evaporator is located at the Westmoreland Sanitary Landfill, on an approximate 300-acre parcel.

The approximate UTM coordinates of the evaporator are 597,393 meters Easting and 4,444,662 meters Northing. The project will be located at a base elevation of about 290 meters above mean sea level. The evaporator is located at an active landfill. Landfill elevations range from about 290 meters to 335 meters.

2.2 MODEL SELECTION

CEC proposes to use the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD, version 19191) for this dispersion modeling analysis. AERMOD is an EPA-approved and required dispersion model for evaluating impacts of land-based stationary sources as outlined in EPA's "Guideline on Air Quality Models" (40 CFR 51, Appendix W).

AERMOD is capable of modeling receptors both in the near-building wake (cavity) region as well as far-building wake regions. AERMOD incorporates the Plume Rise Model Enhancement (PRIME) downwash algorithm. The PRIME algorithm accounts for the distance from each structure to potentially affected sources in that structure's region of influence.

Default AERMOD control options are proposed. Consistent with EPA recommendations, these include the following:

- Stack-tip downwash; and
- Effects of elevated terrain (simple and complex).

2.2.1 Urban / Rural Classification

In accordance with Section 7.2.1.1 of EPA's Guideline on Air Quality Models, Appendix W, for any dispersion modeling exercise the "urban" or "rural" determination of the location surrounding the subject source is important in determining the applicable boundary layer characteristics that affect the modeled calculation of ambient concentrations. The land use methodology in Section 7.2.1.1(b)(i) of Appendix W was used to determine the urban or rural status of the area around the Westmoreland Sanitary Landfill. This methodology examines the various land uses within 3 km of the source and quantifies the percentage of area in various land use categories. Following this

guidance, 2016 National Land Cover Data was used to determine land use categories within a 3-km radius circle inscribed electronically around the landfill. The land use analysis shows the area is ~80% rural. Therefore, no urban model option was selected.

2016 NLCD Land Cover Classification		Auer Land-Use Classification			
Category ID	Category Description	Category ID	Category Description	Urban / Rural	Percent
11	Open Water	A5	Water Surfaces	Rural	4.36%
21	Developed, Open Space	A1	Metropolitan Natural	Rural	11.30%
22	Developed, Low Intensity	R1	Common Residential	Rural	18.49%
23	Developed, Medium Intensity	R2, R3, C1, I1, I2	Compact Residential / Commercial / Industrial	Urban	14.77%
24	Developed, High Intensity	R2, R3, C1, I1, I2	Compact Residential / Commercial / Industrial	Urban	5.31%
31	Barren Land (Rock/Sand/Clay)	A3	Undeveloped (uncultivated, wasteland)	Rural	2.16%
41	Deciduous Forest	A4	Undeveloped (rural)	Rural	19.09%
42	Evergreen Forest	A4	Undeveloped (rural)	Rural	0.04%
43	Mixed Forest	A4	Undeveloped (rural)	Rural	14.46%
52	Shrub/Scrub	A3	Undeveloped (uncultivated, wasteland)	Rural	0.02%
71	Grasslands/Herbaceous	A3	Undeveloped (uncultivated, wasteland)	Rural	0.78%
81	Pasture/Hay	A2	Agricultural (rural)	Rural	7.60%
82	Cultivated Crops	A2	Agricultural (rural)	Rural	1.61%
95	Emergent Herbaceous Wetland	A3	Undeveloped (uncultivated, wasteland)	Rural	0.00%
					100.0%
				Urban	20.08%
				Rural	79.92%

2.3 PROJECT SOURCE AND STACK PARAMETERS

This dispersion modeling analysis will estimate ambient air concentrations from the evaporator stack. A unit emission rate (1 g/s) is proposed to be used in this modeling analysis.

The stack parameters provided in engineering drawings and previous emission calculations (attached) are as follows:

Stack Height: 39 feet
Stack Diameter: 48 inches
Stack Exhaust Flow Rate: 30,400 scfm (22% moisture)

Stack Exhaust Flow Rate: 30,812 acfm

2.4 GOOD ENGINEERING PRACTICE (GEP) STACK HEIGHT AND BUILDING DOWNWASH

The roof elevation of the one significant building was provided by Noble. Building dimensions were estimated from the most recent landfill drawing, also provided by Nobel. The UTM coordinates for the building were determined by overlaying the site plan on Google Earth satellite imagery, ensuring that the surrounding landmarks were adequately aligned. The building was processed using the EPA Building Profile Input Program (BPIP-PRIME version 04274) to determine the Good Engineering Practice (GEP) stack heights, direction-specific building heights, and widths for each 10- degree direction for the emission source included in this air dispersion analysis.

2.5 TERRAIN AND RECEPTOR DATA

A discrete Cartesian receptor grid will be generated in AERMOD. Receptor spacing is proposed as follows:

- 25-meter spacing along property boundary;
- 50-meter spacing from the property boundary to a distance of 2,000 meters;
- 100-meter spacing from the property boundary to a distance of 5,000 meters;
- Special receptors to be located at residences identified nearby; and
- 10-meter spacing in the area of identified “hot spots”.

U.S. Geologic Survey (USGS) National Elevation Dataset (NED) elevations will be imported into AERMOD’s terrain processor AERMAP in GeoTIFF format. The GeoTIFF files will have a 1-arc second (30-meter) resolution. Elevations within the landfill property boundary will be considered with regard to assigning hill heights to boundary and nearby ambient receptors.

2.6 METEOROLOGICAL DATA

PADEP has concurred with the selection of, and provided, an AERMOD ready five year meteorological data set for the years 2016 through 2020. Both upper air and surface data were collected from the Pittsburg International Airport (elevation 366 meters).

We propose to use meteorological data processed with the adjust u* option. Receptor concentrations have the potential to be overestimated in low wind conditions, as the evaporator stack is fairly short (39 feet) and close to ambient temperature.

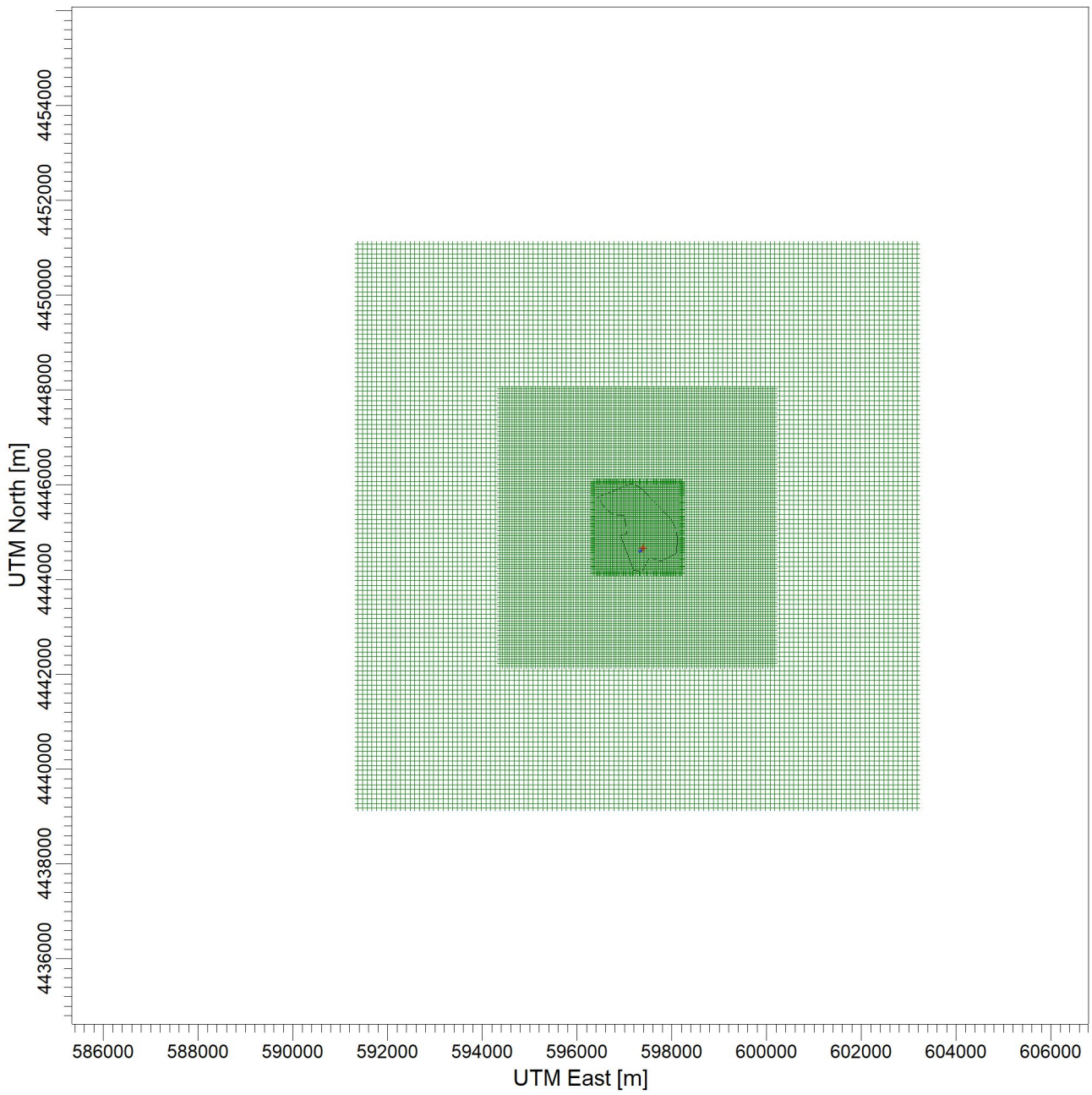
2.7 EMISSIONS DATA AND MODEL RESULTS

Radium is assumed to be emitted in particulate form. A unit emission rate (1 g/s) will be used in the air dispersion model. Model output concentration contours will be used to assist in locating potentially impacted areas. This information will be used to select air monitoring locations and update, as needed, the monitoring plan previously submitted by Noble.

APPENDIX A
SITE PLAN AND RECEPTOR GRID

PROJECT TITLE:

Appendix A Receptor Grid
Leachate Evaporator



COMMENTS:	**1**	COMPANY NAME: **Civil & Environmental Consultants, Inc.**	
	RECEPTORS: **27535**		
		SCALE: 1:134,977 0 5 km	
		DATE: **6/23/2021**	PROJECT NO.: **313-688**

PROJECT TITLE:

Appendix A Site Layout
Leachate Evaporator

Terrain Contours — meters

222 240 250 260 270 280 290 300 310 320 340 350 360 370 380 390 400 410 420 429

COMMENTS:	1	COMPANY NAME: Civil & Environmental Consultants, Inc.	
	RECEPTORS: 27535		
		SCALE: 1:26,557 (0 — 1 km)	
		DATE: 6/23/2021	PROJECT NO.: 313-688

APPENDIX B
STACK PARAMETERS

APPENDIX B - STACK PARAMETERS

Modeling Parameters			Referance	1 ft =	0.3048	m
Stack height	39	ft	Stack Drawing.pdf	1 cf =	0.028317	m3
	11.89	m		1 min =	60	sec
Stack diameter	4	ft	Stack Drawing.pdf	F =	[(F-32) x (5/9) +273.15]	K
	1.22	m				
Exit flow rate	30,400	scfm 22% H2O	WSL-Air-Plan-Approval-RTC-1.pdf	Ps =	14.5	psia
	30,653	acfm		Pb =	14.5	psia
	14.47	m3/sec		Pa =	14.5	psia
Exit temperature	72	°F		RHs =	22%	
	295.4	K		RHa =	22%	
				PVs =	0.3391	psi
				PVa =	0.3887	psi
				Ts =	528	R
				Ta =	532	R

$$ACFM = SCFM \cdot \frac{P_S - (RH_S \cdot PV_S)}{P_B - (RH_A \cdot PV_A)} \cdot \frac{T_A}{T_S} \cdot \frac{P_B}{P_A}$$

where:

P_S = Standard pressure (PSIA)

P_B = Atmospheric pressure – barometer (PSIA)

P_A = Actual pressure (PSIA)

RH_S = Standard relative humidity

RH_A = Actual relative humidity

PV_S = Saturated vapor pressure of water at standard temperature (PSI)1

PV_A = Saturated vapor pressure of water at actual temperature (PSI)1

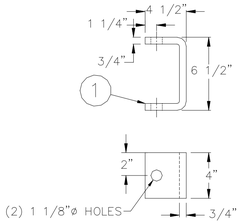
T_S = Standard temperature (°R) NOTE: °R =°F+460

T_A = Actual temperature (°R)1: See vapor pressure chart >

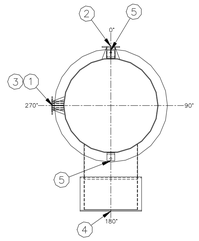
https://www.pdblowers.com/tech-talk/scfm-standard-cfm-vs-acfm-actual-cfm/

APPENDIX C
STACK DIAGRAM

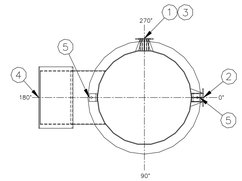
ITEM	QTY	DESCRIPTION	REF.			
1	1	4"ø FRP FLANGED NOZZLE W/GUSSETS				
2	1	4"ø FRP FLANGED NOZZLE W/GUSSETS				
3	1	2"ø FRP FLANGED NOZZLE W/GUSSETS				
4	1	27" x 40 1/4" RECTANGULAR FLANGED FITTING				
5	2	LIFTING LUGS – #304 STAINLESS STEEL				



LIFT LUG DETAIL



TOP VIEW



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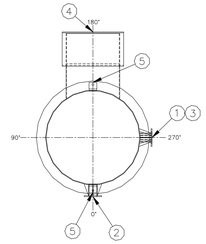
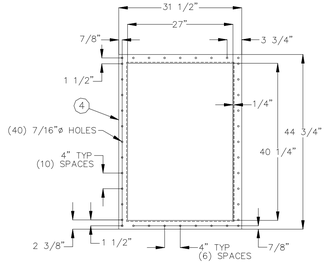
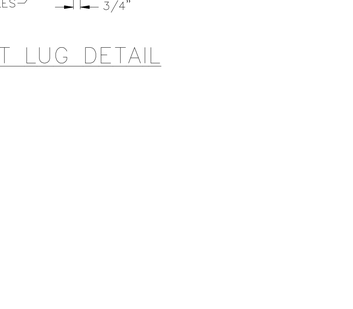


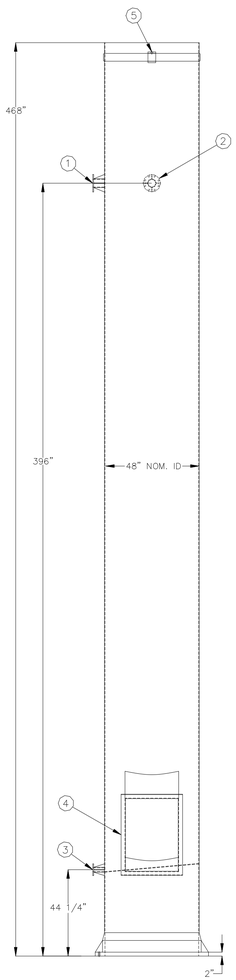
TOP VIEW



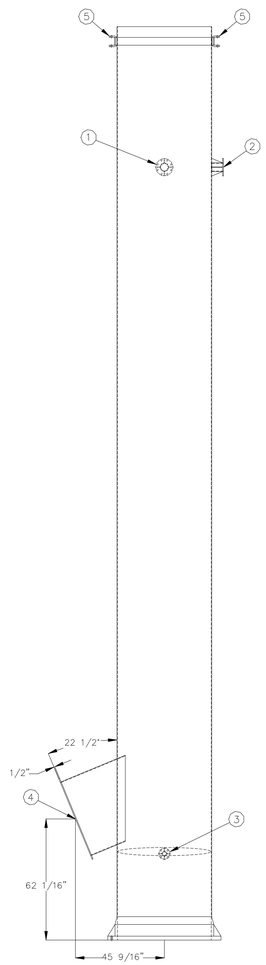
ITEM #4 FLANGE DETAIL



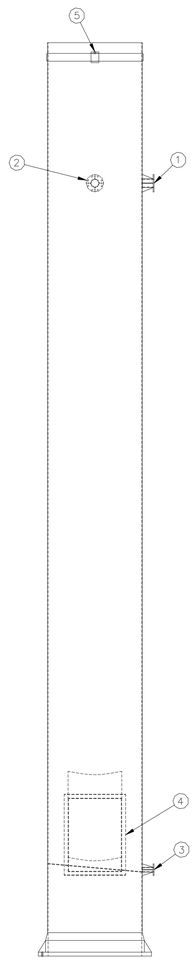
INTERNAL PLATE DETAIL



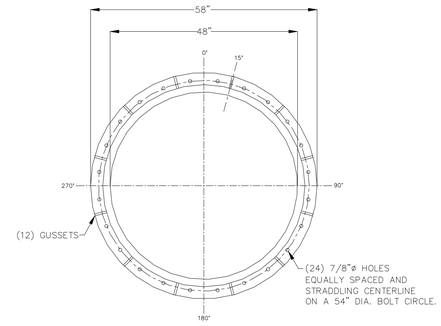
ELEVATION VIEW



ELEVATION VIEW



ELEVATION VIEW



BOTTOM FLANGE

MATERIAL & GENERAL NOTES

- RESIN: DERAKANE 441 VINYL ESTER RESIN – 100 MIL CORROSION BARRIER – MEKP CURE
  DERAKANE 441 VINYL ESTER RESIN BACKUP – MEKP CURE
- VEIL: NEXUS FILAMENT WIND 90° (90° = HOOP)
- EXTERIOR FINISH: RAL #7042 TRAFFIC GREY A GEL COAT w/U.V. INHIBITOR.
- STACK DESIGNED FOR A SPECIFIC GRAVITY OF 1.2, OUTDOORS & 20 PSF SNOW LOAD.
- WIND LOADS ARE PER ASCE 7–10 WITH 115 MPH WIND LOAD AND EXPOSURE C.
- STACK DESIGNED FOR +5"/–0" w.c. PRESSURE AT 200° F. TEMPERATURE.
- STACK DESIGNED IN ACCORDANCE WITH ASTM D 3299 WHERE APPLICABLE.
  ITEMS NOT ADDRESSED BY ASTM D 3299 ARE DESIGNED IN ACCORDANCE WITH GPI STANDARDS OR OUR SUPPLIERS STANDARDS.
- THE CHEMICAL SERVICE MUST BE COMPATIBLE WITH THE MATERIALS OF CONSTRUCTION AT THE DESIGN CONDITIONS.
- MAXIMUM FLUID LEVEL IS 3".
- STACK ESTIMATED WEIGHT EMPTY: 2,100 LB.
- ALL HARDWARE TO BE 18–8 S.S. UNLESS SPECIFIED OTHERWISE.
- ALL EXPOSED C.S. TO BE PAINTED WITH GRAY PRIMER.
- TRUE ORIENTATION SHOWN IN PLAN VIEW ONLY FOR CLARITY.
- SEE GPI HANDLING & INSTALLATION INSTRUCTIONS & GENERAL OPERATING INSTRUCTIONS.
- ALL STANDARD NOZZLES HAVE A 150# BOLT PATTERN PER ANSI B16.5, 50 PSI RATING, WITH HOLES STRADDLING THE CENTER LINES.
- ALL STANDARD FLANGED FITTINGS ARE TO EXTEND 6" FROM FLANGE FACE TO CLOSEST POINT ON TANK UNLESS SPECIFIED OTHERWISE.
- SHIPPING ORIENTATION: 90° DOWN

PART NUMBER: ST16–1

REVISIONS					HEARTLAND			
NO.	DESCRIPTION	BY DATE:	CHK'D	COPIES:	GPI Corp.			
1.	–	–			101 Northern Rd. Schofield, WI 54476 (715)–359–6123			
2.					DRAWN BY: KJZ	SCALE:	HDL'G. INST.:	# ORIG. PRINTS.
3.					CHECKER:	DATE: OCT. 15, 2019	DRAWING NO:	
4.					CHK'D:	GPI JOB# 7888	D19–10–15–01	
5.								