SDG&E TL 6975 Escondido to San Marcos 69kV Project
(A.17-11-010) Energy Division Data Request #6 Date November 7, 2018
SDG&E Response #6 Date November 21, 2018

REPORT OVERVIEW

On March 16, 2018the CPUC deemed the application and PEA for the TL 6975 Escondido to San Marcos 69 kV Project (A.17-11-010) incomplete. The Energy Division has required additional data to prepare a complete and adequate analysis of the potential environmental effects of the Project, in accordance with the requirements of CEQA.

SDG&E TL 6975 Escondido to San Marcos 69kV Project (A.17-11-010) Data Request #6		
Request No.	**DATA REQUEST**	**SDG&E RESPONSE**
1	Provide GIS shapefiles for the locations of all AC mitigation components (i.e., deep wells, coupon test station sites, additional staging areas [if any], etc.).	As requested, SDG&E has included a KMZ (Google Earth) and GIS shapefiles of the AC mitigation components (e.g., AC mitigation wells and coupon test stations) as separate file attachments to this Data Request #6 response.
2	Provide information describing the installation of a coupon test station. Describe the components and function of a coupon test station.	Please refer to **Attachment A**, *Description of Anticipated AC Mitigation Well Installation, San Diego Gas & Electric – TL 6975,* Corrpro, November 2018. **Section 2, pages 1-3,** provides a complete description of the AC mitigation wells, and **Section 3, pages 3-4,** provides a description of the coupon test stations (including components and functionality).
3	Per each well site, provide the estimated depth of the well.	The average AC mitigation well depth will be approximately 100 feet and the average diameter of the well will be 6 inches (for all well locations). See **Table 1**, AC Mitigation Well Details, in the **Attachment A, page 1,** for additional details. Coupon test stations will require an approximately 10' x 10' excavation area at a depth of approximately 5 feet.
4	Provide a description of the work area required at each deep well and coupon test station site. This should include, but not be limited to, work area dimensions, space requirements, etc. Describe potential lane closures.	The standard construction work area for an AC mitigation well and coupon test station is 15 feet by 120 feet, or approximately 1,800 square feet for both mitigation techniques. All installations are planned in the public right of way. As such, construction will require submittal and approval of encroachment and traffic control plans, as single lane closures and no-parking areas will be necessary. During construction, traffic control field personnel will be positioned to direct traffic in accordance with approved plans. See **Attachment A, Section 5, page 5.**

SDG&E TL 6975 Escondido to San Marcos 69kV Project (A.17-11-010) Data Request #6

<table>
<tr><th>Request No.</th><th>DATA REQUEST</th><th>SDG&E RESPONSE</th></tr>
<tr><td>5</td><td>Equipment Data: Type and number of construction equipment that would be used. While equipment was identified in the AC mitigation summary provide by SDG&E on October 30, 2018, more detailed information is necessary for input into CalEEMOD modeling for air quality and greenhouse gas analyses. The CalEEMOD input tables provided by SDG&E in response to Data Request #1 are good examples.</td><td>
ESTIMATED CONSTRUCTION EQUIPMENT AND PERSONNEL - AC MITIGATION
<table>
<tr><th>Activity</th><th>People</th><th># of Days per site</th><th>Equipment</th><th>Quantity</th><th>Horsepower Rating</th><th>Hours of Use per Day</th></tr>
<tr><td rowspan="8">AC Mitigation Well Construction (approx. 11 locations)</td><td rowspan="8">1 crew of 3 - 4</td><td rowspan="8">7</td><td>Mud Rotary Drill Rig</td><td>1</td><td>500</td><td>8</td></tr>
<tr><td>Support Truck</td><td>1</td><td>430</td><td>4</td></tr>
<tr><td>Desander</td><td>1</td><td>74</td><td>6</td></tr>
<tr><td>Hydro Vacuum</td><td>1</td><td>300</td><td>2</td></tr>
<tr><td>Water Truck</td><td>1</td><td>550</td><td>6</td></tr>
<tr><td>Vacuum Truck</td><td>1</td><td>550</td><td>8</td></tr>
<tr><td>Service Truck</td><td>1</td><td>310</td><td>4</td></tr>
<tr><td rowspan="4">Coupon Test Station Construction (approx. 3 locations)</td><td rowspan="4">1 crew of 2 – 3</td><td rowspan="4">4</td><td>Hydro Vacuum</td><td>1</td><td>300</td><td>2</td></tr>
<tr><td>Service Truck</td><td>1</td><td>310</td><td>4</td></tr>
<tr><td>Support Truck</td><td>1</td><td>430</td><td>4</td></tr>
<tr><td>Backhoe</td><td>1</td><td>95</td><td>6</td></tr>
</table>
</td></tr>
<tr><td>6</td><td>Scheduling: Provide information on when this work activity would occur relative to the rest of Project construction. Will these components be installed individually or would multiple components be installed simultaneously [using multiple work crews]? What would the total construction duration be? Alternatively, provide a start and end date. Will drilling occur continuously (i.e., overnight), or during work hours? Provide information on drill rate (e.g., X feet per hour, X days per well, etc.).</td><td>SDG&E intends to install the AC mitigation in the early phases of Project construction, with completion of the mitigation scheduled prior to the energization of the new transmission line. Drilling operations normally take between two to three days per site to complete at a standard drill rate of 20 feet per hour in this region. It is anticipated that the structure connection and SSD/ coupon installation will take another three to four days per site. Drilling work hours are usually from 7am to 4 pm, Monday through Friday (overnight work is not anticipated). Wells are typically sequenced with a drill team completing a well, transitioning to the next well site, while a tie-in team follows closely behind and completes the installation of the structure connection and SSD/ coupon. Fourteen sites will take approximately eight weeks to complete with one drill team.</td></tr>
<tr><td>7</td><td>Number of daily trips and approximate one-way trip lengths.</td><td>The average number of daily trips generated by AC mitigation well and coupon test station construction is approximately 4, as the majority of equipment will be staged onsite during construction. The average</td></tr>
</table>

SDG&E TL 6975 Escondido to San Marcos 69kV Project (A.17-11-010) Data Request #6		
Request No.	**DATA REQUEST**	**SDG&E RESPONSE**
		one-way distance to the AC mitigation wells and coupon test station work sites is approximately 23 miles.
8	How much dewatering may occur and how much discharge is it estimated to create?	Dewatering is not anticipated to be necessary for AC mitigation well construction because the drilling fluids, which stabilize the AC mitigation well hole, also mitigate against groundwater penetration. Dewatering is also not anticipated to be necessary for coupon test station construction because the excavation depth is relatively shallow. However, if dewatering is required it would be conducted pursuant to SDG&E's General Construction Permit from the State Water Resources Control Board and associated Storm Water Pollution Prevention Plan (SWPPP). The SWPPP would detail proposed Project information, dewatering procedures, stormwater runoff prevention control procedures, monitoring and reporting procedures, and Best Management Practices. See **Attachment A, Section 2, page 2** for additional information.
9	Estimate the volume of drill spoils and describe disposal.	Per the Corrpro report (**Attachment A, Section 2, page 2**), AC mitigation wells of this size and depth would generate approximately 3,000 gallons of drill spoils. The spoils will be funneled to a contained desander that will sieve out soil and recycle the drilling mud back into the hole. From the desander the soil is either picked up by a vacuum truck or dropped into a bin for disposal pursuant to SDG&E's General Construction Permit. The soil will be taken to an SDG&E facility for sampling. Upon approval of the sampling, the cuttings are disposed of at an approved SDG&E disposal facility.
10	Provide estimates of water use for installation and operation of this mitigation.	Per the Corrpro report (**Attachment A, Section 2, page 2**), deep wells of this size and depth require the use of approximately 2,000 gallons of water during the drilling process. The water is brought in via a water truck, or by connecting a hose to an approved fire hydrant with a backflow preventer and water meter.
11	Provide copies of reports for previous cultural resource investigations or other such information conducted within ¼-mile of the coupon test station 3 site.	The proposed location of coupon test station 3 is within a fully disturbed and developed area (e.g., sidewalk) and is outside of the ½ mile records search completed for the proposed Project. SDG&E is not aware of any cultural resources investigations completed by SDG&E within ¼ mile of coupon test station 3 and therefore does not have any cultural resources investigation reports. SDG&E does not have copies of reports for additional cultural resources investigations conducted within ¼-mile of coupon test

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		station 3. These confidential reports must be requested directly from the South Coastal Information Center (SCIC) by the CPUC's qualified consultant.
12	For illustration to the public, provide a typical or schematic drawing of a well drill that may be used for this project.	Please refer to **Attachment A**, **Figure 1**, which depicts a typical well drill that would likely be used for this Project.

ATTACHMENT A:

Description of Anticipated AC Mitigation Well Installation, San Diego Gas & Electric – TL 6975, Corrpro, November 2018

Description of Anticipated AC Mitigation Well Installation

SAN DIEGO GAS & ELECTRIC - TL 6975

1. INTRODUCTION

Induced alternating current (AC) is commonly experienced along buried pipelines routed in close proximity to high-voltage electrical transmission lines. The intent of AC mitigation wells is to reduce the risk of AC step and touch voltages along a pipeline, as well as provide a dedicated return path for any induced AC current, in an effort to eliminate pipeline corrosion caused by AC. The recommended field activities are proposed to support the installation of eleven AC mitigation deep wells, and three Coupon Test Stations, located in San Marcos, CA.

Appendices include:

A. AC Mitigation Design Drawings (Drawings created by ARK Engineering 9/19/18)
B. Aerial view of well and coupon locations

2. AC MITIGATION WELLS

An AC mitigation well system consists of three key components: The AC mitigation well, the structure connection to the pipeline(s), and the Solid State Decoupler (SSD) device. The eleven AC mitigation wells are designed to be 6 inches in diameter and 100 feet deep. The top 30 feet will be incased in an 8 inch polyvinyl chloride (PVC) casing. The wells will consist of a bare copper ground rod connected to a bare 2/0 AWG copper wire and backfilled from the bottom up with conductive concrete.

The construction crew will mark the well sites per the designated GPS coordinates and request a utility service alert to identify all known utilities within the construction area. Upon approval of well permits and other regulatory agencies, construction will commence.

Table 1 – AC Mitigation Well Details

Deepwell No.	GPS Location	Diameter (in)	Depth (ft)
1	33.129613, -117.235330	6	100
2	33.130814, -117.231467	6	100
3	33.130969, -117. 230981	6	100
4	33.131100, -117.230326	6	100
5	33.131471, -117.228436	6	100
6	33.131507, -117.227641	6	100
7	33.131505, -117.226591	6	100
8	33.131516, -117.225548	6	100
9	33.131529, -117.224624	6	100
10	33.131360, -117.202627	6	100
11	33.131424, -117.200824	6	100

Task 1 - Pothole

Equipment Used: Hydrovac Truck

Method: The first ten feet of each well will be excavated using a Hydrovac Truck. The hydrovac method utilizes high pressure water or air to breakup compacted soil, while incorporating a 6-inch air vacuum to transfer the spoils from the hole to the vehicle storage tank. This is a non-invasive excavation methodology that ensures unidentified utilities are located without damage. As a safety precaution, the soil will be fragmented in one-foot segments and evaluated for resources prior to using the vacuum suction.

Task 2 - Drill

Equipment Used: Mud Rotary Drilling Truck

Method: Mud rotary drilling uses an impact hammer and a drill bit to rotate and crush soil formations. The formation cuttings are removed from the hole by the circulation of water from water jets in the drill bit head. Particular additives are used to improve the cutting fluid's consistency in effort to stabilize the well walls. This process allows the drill bit and stems to be removed from the well and loading to occur while maintaining wall integrity. A secondary effect, is it temporarily mitigates the penetration of groundwater into the well. At the chosen locations and elevations of the designated AC mitigations wells, dewatering is not believed to be anticipated or necessary. The cuttings are funneled to a contained desander that will sieve out soil and recycle the drilling mud back into the hole. From the desander the soil is either picked up by a vacuum truck or dropped into a bin for disposal. For wells of this size and depth, approximately 2,000 gallons of water will be used during the drilling process. The water is brought in via a water truck, or by connecting a hose to an approved fire hydrant with a backflow preventer and water meter. The combined volume of soil and water removed is approximately 3,000 gallons.

The cuttings are taken by vacuum truck to an SDG&E facility for sampling. Upon approval of the sampling, the cuttings are disposed of at an approved SDG&E disposal facility.

Figure 1 – Drill rig towered up for mud rotary drilling

Task 3 - Load

Once the desired well depth has been achieved, the well will be loaded per the design specifications. A bare copper ground rod will be fastened to bare stranded 2/0 AWG copper wire on a spool. The rod and wire will be lowered into the hole until the ground rod makes contact with the bottom of the hole. Once the grounding is positioned in place, conductive concrete will be mixed with the appropriate ratio of water and pumped into the hole. The well will be backfilled from bottom to the top. From the AC mitigation well, a #2 AWG copper cable with HMWPE insulation will be spliced to the bare copper cable and routed to the proposed SSD location.

Task 4 - Structure Connection the Pipeline(s)

Equipment Used: Hydrovac, Shoring Equipment, Backhoes, Exothermic Welding Equipment
Method: After the completion of the AC mitigation well installation, a structure connection needs to be made to the pipe and routed to the SSD.

Type of shoring necessary for the excavation will be determined based on the depth of pipeline. The standard pipeline depth is approximately five feet. Prior to trench excavation with a backhoe, the hydrovac will be used to determine pipeline depth and identify the exact location. Once the depth is determined, excavation will be completed using a standard backhoe to expose the surface of the pipe. Once the pipe has been made accessible, a 2-inch by 3-inch portion of the pipe coating will be removed to expose the metal surface of the pipe. The metal surface will be cleaned and evaluated with ultrasonic thickness equipment to ensure the pipe thickness is adequate for exothermic welding. Two #6 AWG stranded copper wires with HMWPE insulation will be exothermically welded to the surface of the pipe, utilizing exothermic welding equipment, per SDG&E's standard specifications. The weld area will be recoated, and the wires will be routed to the proposed location of the SSD. The excavation site will be backfilled with a slurry, and the ground cover will be repaved to original conditions.

Task 5 - Installation of Solid State Decoupler (SSD)

The SSD device allows AC current to flow from the pipe to the AC mitigation well, while eliminating the transfer of Direct Current (DC) from the pipe. This prevents the AC mitigation well from diminishing the cathodic protection system's performance. SSD devices are typically floor-mounted in discrete areas. The pipeline structure leads and the cable from the AC mitigation well will be routed and connected to the SSD terminals to complete the circuit.

3. Coupon Test Station

A coupon test station consists of three key components: The coupon and reference cell combination, the structure connection to the pipeline(s), and the test station. A coupon is a piece of bare carbon steel of a known size and shape. The coupon is to be placed 6 to 12 inches from the pipeline at the midpoint of the pipeline depth. This bare piece of metal is intended to replicate the characteristics of a coating holiday on the existing pipeline. The reference cell allows for evaluation of cathodic protection structure-to-

electrolyte potentials on the coupon and pipe. Additionally, the coupon improves monitoring of AC and DC current density, and AC and DC current direction and magnitude.

The construction crew will mark the site per the GPS coordinates and request a utility service alert to identify all known utilities within the construction site.

Table 2 – Coupon Test Station Locations

Coupon No.	GPS Location
1	33.131860, -117.222208
2	33.131358, -117.202898
3	33.134843, -117.188313

The installation will use similar equipment and procedures as the installation of the AC mitigation well.

Task 1 - Structure Connection the Pipeline(s) and coupon installation

Equipment Used: Hydrovac, Shoring Equipment, Backhoes, Electric-Arc or Exothermic Welding Equipment

Method: Prior to trench excavation with a backhoe, the hydrovac will be used to determine pipeline depth and identify the exact location. Once the depth is determined, excavation will be completed using a standard backhoe to expose the surface of the pipe. After installing the structure connections, the coupon will be placed 6 – 12 inches from the pipeline, at the midpoint of the pipeline depth in a vertical position. The excavation site will be backfilled with native soil and the ground cover will be repaved to original conditions.

Task 2 - Installation of the Coupon Test Station

Coupon Test Stations are typically floor-mounted in discrete areas. The test station consists of a 2-inch PVC pipe, a plastic terminal board, and lockable lid. Lead wires from the coupon, reference cell, and pipeline structure connections are routed and terminated at the test station to complete the installation. An illustration of the test station assembly is shown in Figure 2.

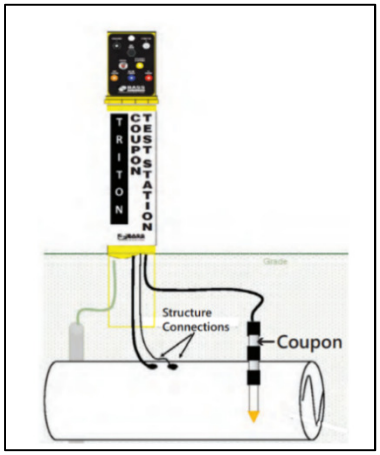

Figure 2 -Typical coupon installation (Image from American Innovation manufacturer website)

4. EQUIPMENT

The below list includes all necessary vehicles to support the installations. The service truck and support trucks will be the only vehicles mobilizing daily. The vacuum truck will demobilize for disposal once per well. All other equipment will be mobilized to the staging areas and stay in the area for daily use until the completion of the project. An average one-way distance to the site is 23 miles.

Table 3 – Vehicle average hours of operation per activity

Vehicle	Average Hours Per Day Drilling	Average Hours Per Day (Tie-in or Coupon Test Station)
Mud Rotary Drill Rig – GEFCO 30K, 550 HP Diesel Engine	8	0
Hydro Vacuum - RAM VAC HX-6, 300 HP Diesel Engine	2	2
Water Truck – 2,000-gallon Peterbilt Rig, 550 HP Diesel Engine	6	0
Vacuum Truck – 3,500-gallon Commercial Truck, 550 HP Diesel Engine	8	0
Service Truck - Ford F550 310 HP Diesel Engine	4	4
Support Truck - Ford F350 430 HP Diesel Engine	4	4
Desander – Mudpuppy MP 170-2sc 74 HP Diesel Engine	6	0
Backhoe – CAT 420 4 X 4 95 HP diesel engine	0	6

5. STANDARD WORK AREA AND DURATION

The standard work area will vary considerably based on well location. A typical construction area is 15feet by 120 feet, or approximately 1,800 square feet. The installations will involve submittal and approval of traffic controls plans, as single lane closures and no-parking areas will be necessary. Traffic control teams will be positioned to direct traffic in accordance with approved plans.

AC mitigation wells and coupons can be installed at various stages in the overall project construction timeline but must be completed prior to energizing new high voltage power lines.

Drilling operations normally take between two to three days per site to complete at a standard drill rate of 20 feet per hour in this region. It is anticipated that the structure connection and SSD/ coupon installation will take another three to four days per site. Drilling work hours are usually from 7am to 4pm, Monday through Friday. Wells are typically sequenced with a drill team completing a well, transitioning to the next well site, while a tie-in team follows closely behind and completes the installation of the structure connection and SSD/ coupon. Fourteen sites will take approximately eight weeks with one drill team. Two drill teams can be coordinated if an expedited schedule is requested.

APPENDIX A
AC MITIGATION WELL PLANS

(Drawings Created by ARK Engineering 2018)

REV	DESCRIPTION	DATE	APPROVED
0	PRELIMINARY AC MITIGATION SYSTEM DESIGN	9/19/18	BW

SAN DIEGO GAS & ELECTRIC

PROPOSED TL 6975

AC MITIGATION SYSTEM DESIGN
DEEPWELL INSTALLATION DRAWINGS
SAN DIEGO COUNTY, CALIFORNIA

PROJECT DRAWING LISTING

DRAWING NO.	SHEETS	REV	TITLE
16138-120	1	0	COVER SHEET
16138-220	1	0	DEEPWELL INSTALLATION LOCATIONS AND REQUIRED MATERIALS
16138-320	1	0	CABLE TO PIPELINE CONNECTION DETAILS
16138-321	1	0	SOLID STATE DECOUPLER (SSD) DEVICE CONNECTION DETAILS
16138-322	1	0	DEEPWELL INSTALLATION DETAILS
16138-323	1	0	EXOTHERMIC WELD CONNECTION DETAILS
16138-324	1	0	COUPON TEST STATION LOCATIONS & INSTALLATION DETAILS
16138-420	1	0	MATERIALS LIST

- PRELIMINARY -
FOR CLIENT REVIEW ONLY
NOT FOR CONSTRUCTION
ENGR:
DATE: 9/19/18

CLIENT
SAN DIEGO GAS & ELECTRIC

SITE
PROPOSED TL 6975
DEEPWELL SYSTEM

PROJECT NO.
16-E-138-AC

ARK ENGINEERING & TECHNICAL SERVICES, INC.
ARK ENGINEERING & TECH. SERVICES, INC.
639 GRANITE STREET
SUITE 200
BRAINTREE, MA
02184 U.S.A.

TITLE
COVER SHEET

DRAWN BY	DATE	SIZE	DWG. NO.	REV
SRM	9/19/18	B	16138-120	0
APPROVED BY	DATE	SCALE	CAD FILE NAME	SHEET
BW		NTS	16138-120-1-R0	1 OF 1

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REV	DESCRIPTION	DATE	APPROVED
0	PRELIMINARY AC MITIGATION SYSTEM DESIGN	9/19/18	BW

DEEPWELL INSTALLATION LOCATIONS AND REQUIRED MATERIALS

DEEPWELL NO.	GPS LOCATION	DEEPWELL DEPTH (FT)	NUMBER OF DEEPWELLS	NUMBER OF SSDs	2/0 COPPER (FT)	#6 AWG COPPER CABLE SSD TO PIPE (FT)	#6 AWG COPPER CABLE TO PIPELINE EXOTHERMIC WELD CONNECTIONS	30'x8'' I.D. PVC CASING, TYPE 80	CONDUCRETE BACKFILL (BAGS)	#2 COPPER CABLE TO 2/0 COPPER EXOTHERMIC WELD CONNECTIONS	SSD PEDESTALS	#2 AWG COPPER CABLE SSD TO 2/0 COPPER (FT)	3/4'' x 10' COPPER GROUND ROD
1	33.129613, -117.235330	100	1	1	110	100	2	1	33	1	1	25	1
2	33.130814, -117.231467	100	1	1	110	100	2	1	33	1	1	25	1
3	33.130969, -117.230981	100	1	1	110	100	2	1	33	1	1	25	1
4	33.131100, -117.230326	100	1	1	110	100	2	1	33	1	1	25	1
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8	33.131516, -117.225548	100	1	1	110	100	2	1	33	1	1	25	1
9	33.131529, -117.224624	100	1	1	110	100	2	1	33	1	1	25	1
10	33.131360, -117.202627	100	1	1	110	100	2	1	33	1	1	25	1
11	33.131424, -117.200824	100	1	1	110	100	2	1	33	1	1	25	1
TOTAL:			**11**	**11**	**1,210**	**1,100**	**22**	**11**	**363**	**11**	**11**	**275**	**11**

- PRELIMINARY -
FOR CLIENT REVIEW ONLY
NOT FOR CONSTRUCTION
ENGR:
DATE: 9/19/18

CLIENT
SAN DIEGO GAS & ELECTRIC

SITE
PROPOSED TL 6975
DEEPWELL SYSTEM

PROJECT NO.
16-E-138-AC

ARK ENGINEERING & TECHNICAL SERVICES, INC.

ARK ENGINEERING & TECH. SERVICES, INC.
639 GRANITE STREET
SUITE 200
BRAINTREE, MA
02184 U.S.A.

TITLE
DEEPWELL INSTALLATION LOCATIONS AND REQUIRED MATERIALS

DRAWN BY	DATE	SIZE	DWG. NO.	REV
SRM	9/19/18	B	16138-220	0
APPROVED BY	DATE	SCALE	CAD FILE NAME	SHEET
BW		NTS	16138-220-1-R0	1 OF 1

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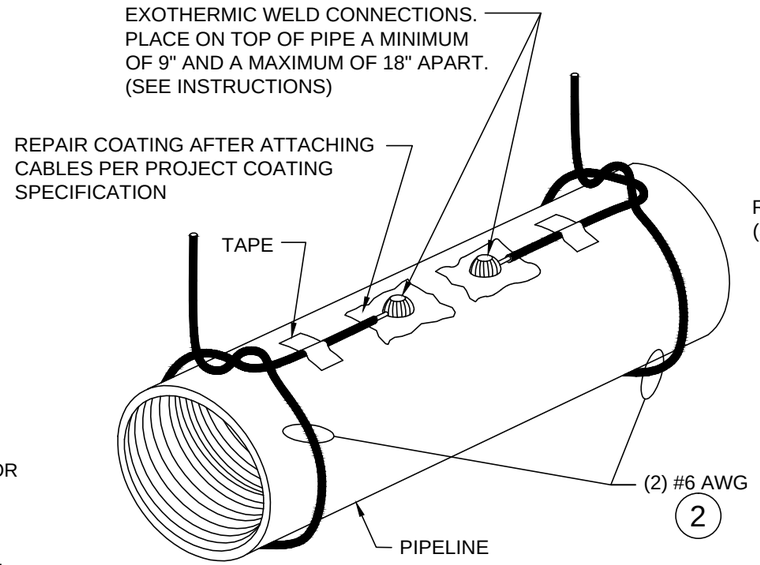
REV	DESCRIPTION	DATE	APPROVED
0	PRELIMINARY AC MITIGATION SYSTEM DESIGN	9/19/18	BW

EXOTHERMIC WELD INSTRUCTIONS:

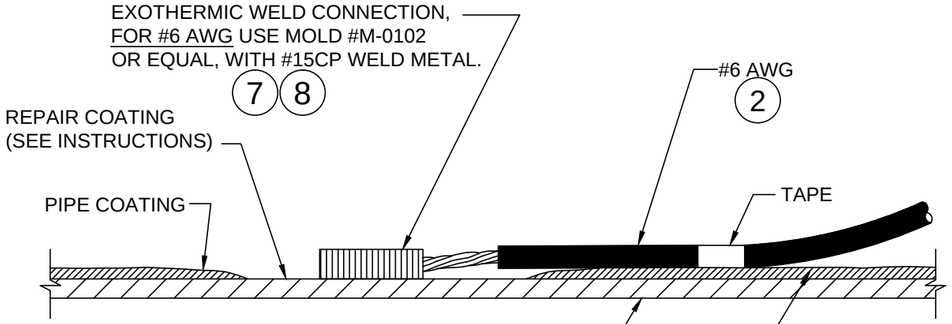
1. FIRST DETERMINE IF THE PIPELINE IS SUITABLE FOR EXOTHERMIC WELDING BY CONDUCTING THE FOLLOWING TESTS:
   - A) DETERMINE THAT THE PIPELINE SMYS (SPECIFIED MINIMUM YIELD STRENGTH) IS <80,000 PSI.
   - B) DETERMINE THAT PIPELINE WALL THICKNESS IS ⅛" (0.125") OR GREATER.
   - C) PERFORM ULTRASONIC TESTING TO PIPELINE TO DETERMINE THAT NO SURFACE OR INTERNAL DEFECTS EXIST.
2. FOR EACH CABLE TO PIPELINE CONNECTION (EXOTHERMIC WELD), REMOVE A 3"X3" MAX AREA OF PIPELINE COATING AT THE 12:00 O'CLOCK POSITION ON THE PIPELINE AND BRUSH UNTIL SHINY. ANY ADJACENT CABLE CONNECTIONS SHALL BE NO CLOSER THAN 9" AND NO FURTHER THAN 18".
3. PREPARE PIPELINE SURFACE AS SPECIFIED BY PIPELINE COATING MANUFACTURER.
4. DETAIL "A" SHOWS POSSIBLE METHOD OF CABLE STRAIN RELIEF FOR NEW PIPE INSTALLATIONS. THIS METHOD IS NOT A REQUIREMENT. OTHER MEANS OF STRAIN RELIEF MAY BE USED.
5. STRIP BACK ANY CABLE INSULATION 1"-2" AND TAPE CABLE TO PIPE.
6. ENSURE THAT THE PIPELINE WELD AREA AND CABLE ARE CLEAN AND DRY PRIOR TO WELDING.
7. USE SPECIFIC WELD MOLD AND WELD METAL AS INDICATED IN DRAWING MATERIALS LIST.
8. IF INDICATED, USE COPPER HEAT SLEEVE ON CABLE END TO BE WELDED.
9. USE ONLY A 15 GRAM WELDING CHARGE. DO NOT EXCEED.
10. PLACE THE METAL RETAINER DISK IN THE SPECIFIED WELD MOLD AND DUMP (DO NOT POUR) WELD METAL POWDER ONTO THE DISK. MAKE SURE THAT ALL OF THE FINE STARTING POWDER IS IN THE MOLD. IF ANY POWDER REMAINS IN THE CARTRIDGE BOTTOM, SQUEEZE OUT INTO MOLD AND BREAK UP.
11. CLOSE MOLD LID.
12. REPLACE CAP ON EMPTY WELD METAL CARTRIDGE AND PLACE BACK INTO CARTRIDGE PACK BOX UPSIDE DOWN TO KEEP THE REMAINING CARTRIDGES UPRIGHT.
13. LAY THE CABLE END ON THE PREPARED PIPE SURFACE USING A SPRING LOADED CHAIN CLAMP TO HOLD CRUCIBLE TIGHT TO PIPELINE.
14. USING EYE AND HAND PROTECTION, STAND ON THE OPPOSITE SIDE OF THE CRUCIBLE FROM THE TOUCH HOLE AND IGNITE POWDER WITH SPARK FROM FLINT GUN. *CAUTION: POWDER WILL FLASH WHEN IGNITED*



DETAIL 'A'

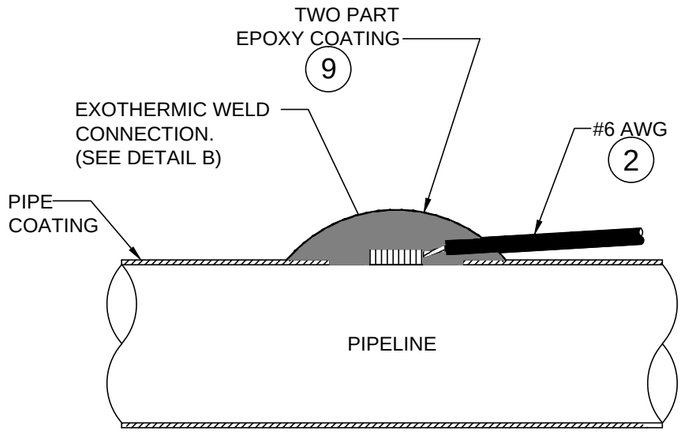
CABLE TO PIPELINE ATTACHMENT DETAIL

15. WHEN WELD HAS SET, REMOVE WELD MOLD AND TEST CONNECTION BY RAPPING SHARPLY WITH A SLAG HAMMER. IF THERE IS ANY INDICATION THAT A COMPLETE WELD HAS NOT BEEN ACHIEVED, REMOVE THE WELD AND RE-APPLY.
16. IF WELD IS GOOD, REMOVE ANY SLAG WITH HAMMER AND CLEAN USING A WIRE BRUSH.
17. AFTER COMPLETING THE EXOTHERMIC WELD CONNECTION TO THE PIPELINE, ALL COATING DAMAGE IS TO BE CLEANED AND COATED WITH 20 MILS MINIMUM OF SPC SP-2888, TWO PART EPOXY COATING OR SAN DIEGO GAS & ELECTRIC APPROVED EQUAL.
18. REFER TO SAN DIEGO GAS & ELECTRIC REPAIR SPECIFICATIONS AND PRODUCT DATA SHEET TO DETERMINE IF REPAIR IS ACCEPTABLE.
19. AFTER REPAIR COATING HAS CURED ACCORDING TO MANUFACTURER'S SPECIFICATIONS, HOLIDAY DETECTION MUST BE PERFORMED.



DETAIL 'B'

EXOTHERMIC WELD CONNECTION



DETAIL 'C'

CORROSION PROTECTION SEAL

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ENGR: BW
DATE: 9/19/18

CLIENT: SAN DIEGO GAS & ELECTRIC SITE: PROPOSED TL 6975 DEEPWELL SYSTEM	ARK ENGINEERING & TECHNICAL SERVICES, INC. ARK ENGINEERING & TECH. SERVICES, INC. 639 GRANITE STREET SUITE 200 BRAINTREE, MA 02184 U.S.A.	TITLE: CABLE TO PIPELINE CONNECTION DETAILS		
	DRAWN BY: SRM	DATE: 9/19/18	SIZE: B	DWG. NO.: 16138-320
PROJECT NO.: 16-E-138-AC	APPROVED BY: BW	DATE:	SCALE: NTS	CAD FILE NAME: 16138-320-1-R0
				SHEET: 1 OF 1

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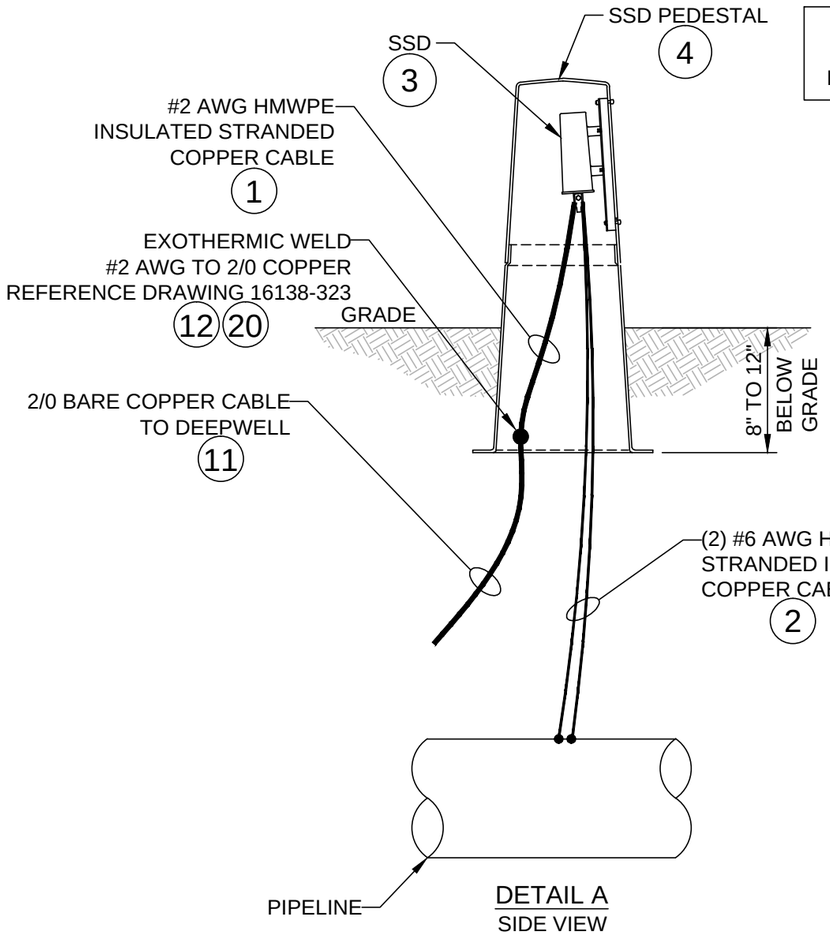
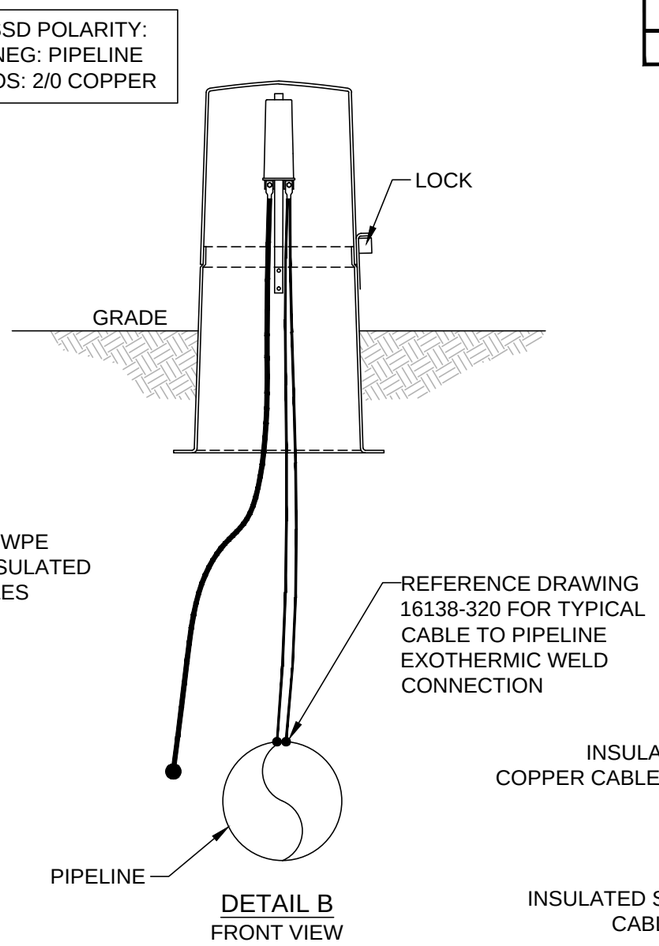
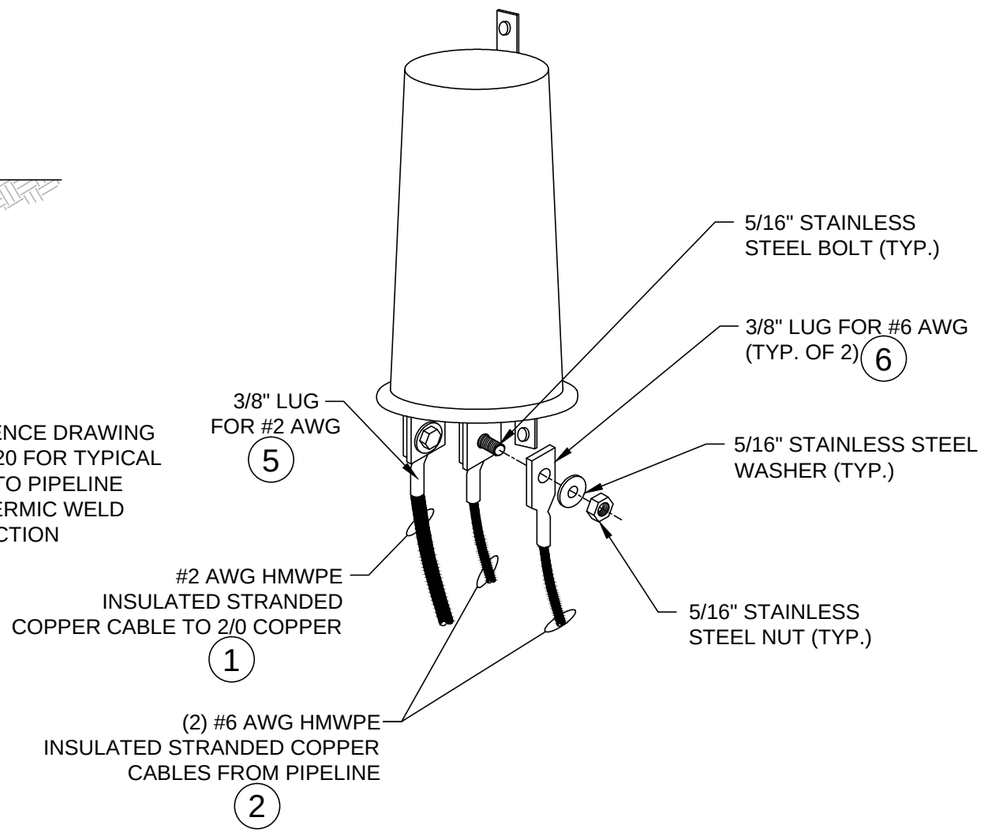
REV: 0

REV	DESCRIPTION	DATE	APPROVED
0	PRELIMINARY AC MITIGATION SYSTEM DESIGN	9/19/18	BW

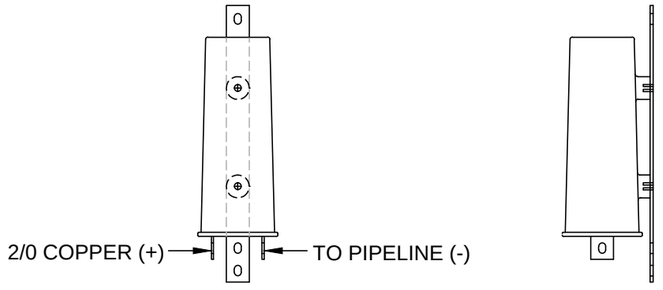




SSD INSTALLATION DETAILS



CABLE TO SSD TERMINAL CONNECTION DETAIL



SOLID STATE DECOUPLER DEVICE (SSD)

NOTES:

1. SSD IS TO BE MOUNTED INSIDE THE FIBERGLASS PEDESTAL. ALL COPPER CABLES ARE TO PASS THROUGH BOTTOM OF PEDESTAL.
2. INSTALL PEDESTAL AS CLOSE AS POSSIBLE TO PIPING CONNECTIONS TO REDUCE LEAD LENGTHS.

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ENGR:
DATE: 9/19/18

CLIENT: SAN DIEGO GAS & ELECTRIC

SITE: PROPOSED TL 6975 DEEPWELL SYSTEM

ARK ENGINEERING & TECHNICAL SERVICES, INC.
ARK ENGINEERING & TECH. SERVICES, INC.
639 GRANITE STREET
SUITE 200
BRAINTREE, MA
02184 U.S.A.

TITLE: SOLID STATE DECOUPLER (SSD) DEVICE CONNECTION DETAILS

DRAWN BY	DATE	SIZE	DWG. NO.	REV
SRM	9/19/18	B	16138-321	0

PROJECT NO.	APPROVED BY	DATE	SCALE	CAD FILE NAME	SHEET
16-E-138-AC	BW		NTS	16138-321-1-R0	1 OF 1

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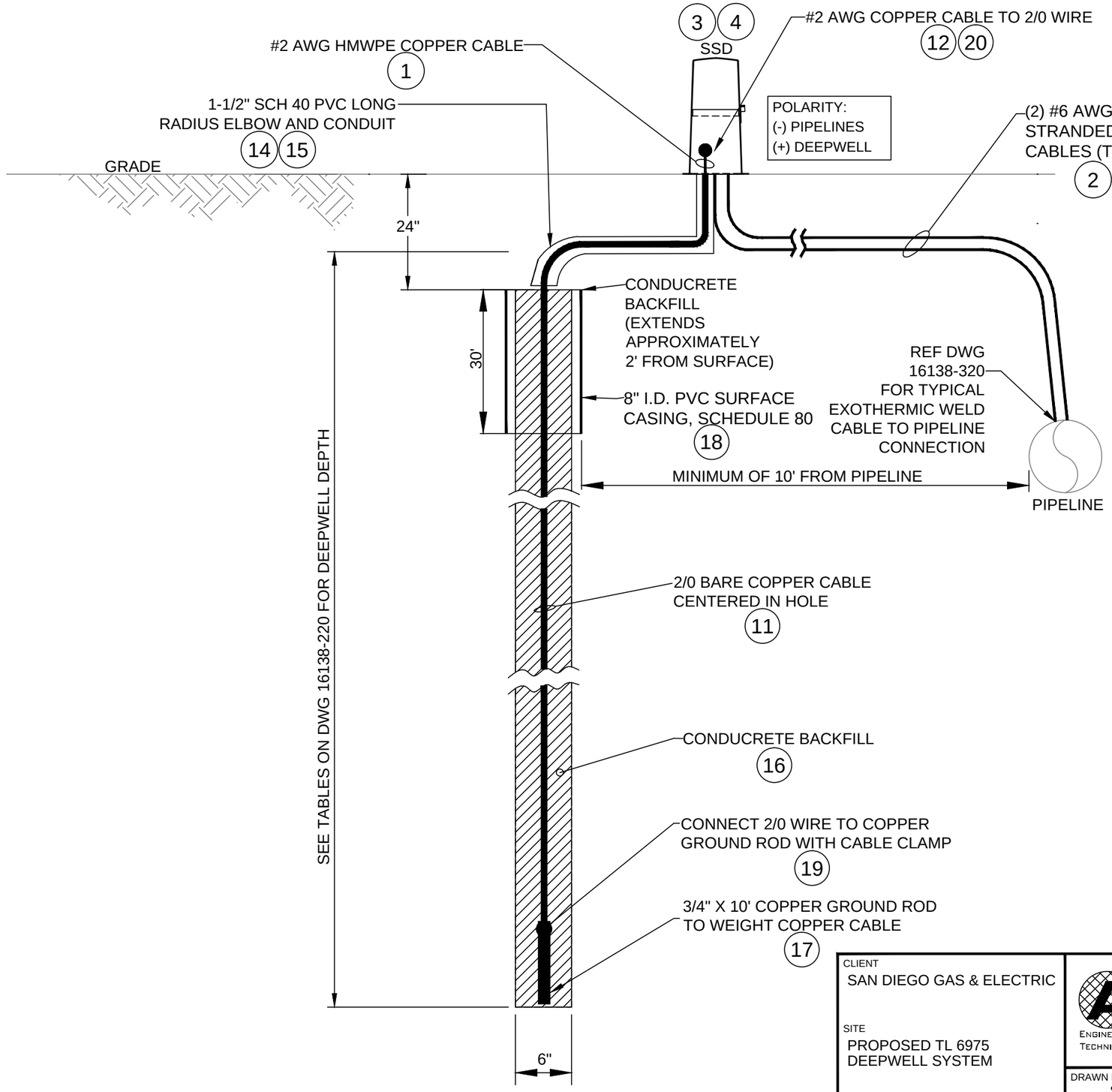
REV	DESCRIPTION	DATE	APPROVED
0	PRELIMINARY AC MITIGATION SYSTEM DESIGN	9/19/18	BW



DEEPWELL ANODE INSTALLATION

NOTES:

1. SURFACE CASING WITH MINIMUM 8" I.D. SHOULD BE INSTALLED TO A DEPTH OF 32'. THE HOLE FOR THE DEEP ANODE SYSTEM CAN THEN BE DRILLED THROUGH THE OPENING OF THE SURFACE CASING.
2. DRILL HOLE TO DESIGNED DEPTH AND DIAMETER.
3. PLACE WEIGHTED, 2/0 BARE COPPER CABLE IN CENTER OF HOLE, LEAVING A MINIMUM OF 10' OF CABLE EXTENDING OUT OF THE TOP OF THE HOLE FOR CONNECTION TO #2 WIRE.
4. MIX CONDUCRETE (ITEM 16) INTO A SLURRY AT A RATIO OF 4.2 GALLONS OF WATER TO EACH 55 POUND BAG OF CONDUCRETE.
5. PUMP SLURRIED CONDUCRETE INTO THE HOLE FROM THE BOTTOM OF THE HOLE TO THE TOP OF THE PVC PIPE USING A TREMMY TUBE OR EQUIVALENT.

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ENGR:
DATE: 9/19/18

CLIENT: SAN DIEGO GAS & ELECTRIC

SITE: PROPOSED TL 6975 DEEPWELL SYSTEM

ARK ENGINEERING & TECHNICAL SERVICES, INC.
ARK ENGINEERING & TECH. SERVICES, INC.
639 GRANITE STREET
SUITE 200
BRAINTREE, MA
02184 U.S.A.

TITLE: DEEPWELL INSTALLATION DETAILS

DRAWN BY	DATE	SIZE	DWG. NO.	REV
SRM	9/19/18	B	16138-322	0

PROJECT NO.	APPROVED BY	DATE	SCALE	CAD FILE NAME	SHEET
16-E-138-AC	BW		NTS	16138-322-1-R0	1 OF 1

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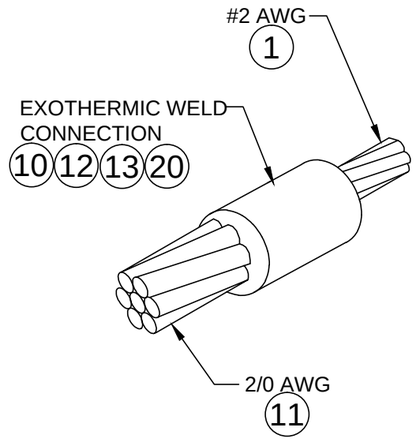
REV	DESCRIPTION	DATE	APPROVED
0	PRELIMINARY AC MITIGATION SYSTEM DESIGN	9/19/18	BW



DETAIL 'A'

2/0 AWG COPPER CABLE TO #2 AWG COPPER CABLE
IN-LINE EXOTHERMIC WELD INSTALLATION

DETAIL	MOLD	WELD METAL
'A'	M-5166	#45CP

NOTES:

1. ALL EXOTHERMIC WELD CONNECTIONS ARE TO BE SEALED WITH ROYSTON "SPLICE RIGHT" SPLICE KIT (ITEM 10), OR SAN DIEGO GAS & ELECTRIC APPROVED ALTERNATIVE.

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ENGR:
DATE: 9/19/18

CLIENT
SAN DIEGO GAS & ELECTRIC

SITE
PROPOSED TL 6975
DEEPWELL SYSTEM

PROJECT NO.
16-E-138-AC

ARK ENGINEERING & TECHNICAL SERVICES, INC.

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SUITE 200
BRAINTREE, MA
02184 U.S.A.

TITLE
EXOTHERMIC WELD
CONNECTION DETAILS

DRAWN BY	DATE	SIZE	DWG. NO.	REV
SRM	9/19/18	B	16138-323	0
APPROVED BY	DATE	SCALE	CAD FILE NAME	SHEET
BW		NTS	16138-323-1-R0	1 OF 1

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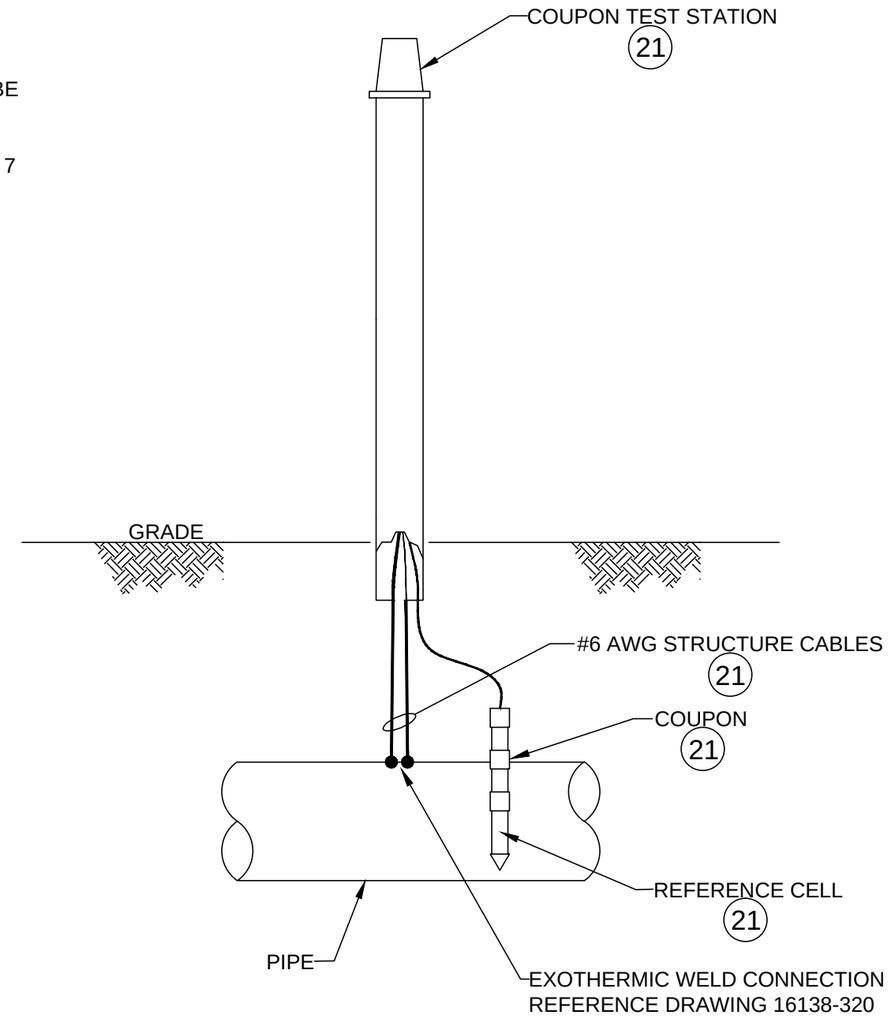
REV	DESCRIPTION	DATE	APPROVED
0	PRELIMINARY AC MITIGATION SYSTEM DESIGN	9/19/18	BW

NOTES:

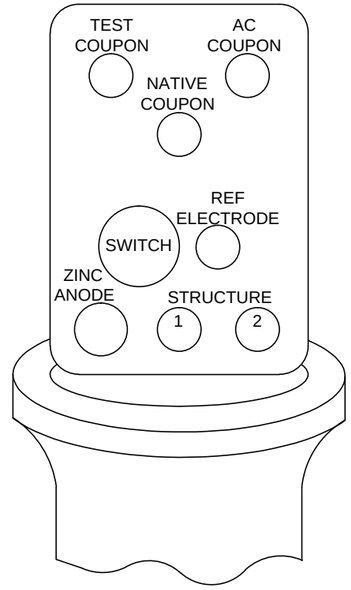
1. TEST STATION TO BE INSTALLED DIRECTLY ABOVE BURIED PIPE WHEN ALLOWED.
2. COUPON TEST STATION TO BE PROVIDED AS A KIT WITH STEEL COUPONS, WIRING, AND TEST HEAD INCLUDED (ITEM 21).
3. COUPON TO BE INSTALLED 4-12" LATERALLY FROM THE PIPE AND TO BE INSTALLED AT THE BOTTOM 1/3 OF THE PIPE (0"-8"). THE ASSEMBLY MUST BE INSTALLED IN A VERTICAL POSITION WITH THE MIDPOINT OF THE REFERENCE CELL AT A DEPTH RELATIVE TO THE PIPELINE'S 5 OR 7 O'CLOCK POSITION.
4. THE CU/CUSO4 REFERENCE CELL SHOULD BE INSTALLED AT THE 9 O'CLOCK POSITION ON THE PIPE.
5. PACK NATIVE SOIL INSIDE TEST STATION TUBE 1' ABOVE GRADE.
6. LEAVE TEST STATION SWITCH IN "OFF" POSITION UNTIL COUPONS ARE POLARIZED.
7. REFERENCE TABLE BELOW FOR COUPON TEST STATION LOCATIONS.

COUPON TEST STATION LOCATIONS

LOCATION NO.	GPS LOCATION
1	33.131860, -117.222208
2	33.131358, -117.202898
3	33.134843, -117.188313



COUPON TEST STATION
WIRING DETAILS



COUPON TEST STATION - TERMINAL BOARD
(COVER REMOVED)

CONNECTIONS TO:		QUANTITY	WIRE SIZE & TYPE	TAPE OR WIRE COLOR
TEST STATION	PIPE/DEVICE			
STRUCTURE 1	PIPELINE	1	#6 AWG THHN	RED
STRUCTURE 2	PIPELINE	1	#6 AWG THHN	WHITE
REFERENCE ELECTRODE	CP COUPON	1	#14 AWG THHN	YELLOW
NATIVE COUPON	COUPON ASSEMBLY	NOT USED	-	-
TEST COUPON	COUPON ASSEMBLY	1	#14 AWG THHN	BLUE
AC COUPON	COUPON ASSEMBLY	1	#14 AWG THHN	ORANGE

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ENGR:
DATE: 9/19/18

CLIENT
SAN DIEGO GAS & ELECTRIC

SITE
PROPOSED TL 6975
DEEPWELL SYSTEM

PROJECT NO.
16-E-138-AC

ARK ENGINEERING & TECHNICAL SERVICES, INC.
ARK ENGINEERING & TECH. SERVICES, INC.
639 GRANITE STREET
SUITE 200
BRAINTREE, MA
02184 U.S.A.

DRAWN BY: SRM
DATE: 9/19/18
APPROVED BY: BW
DATE:

TITLE
COUPON TEST STATION
LOCATIONS & WIRING DETAILS

SIZE: B
SCALE: NTS
DWG. NO.: 16138-324
REV: 0
CAD FILE NAME: 16138-324-1-R0
SHEET: 1 OF 1

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REV	DESCRIPTION	DATE	APPROVED
0	PRELIMINARY AC MITIGATION SYSTEM DESIGN	9/19/18	BW

ITEM	QUANTITY	DESCRIPTION
1	275'	COPPER CABLE, #2 AWG HMWPE (BLACK) INSULATED, STRANDED, SOFT-DRAWN, COMMERCIALLY PURE COPPER, ASTM B8, CLASS B STD. USED FOR CONNECTIONS OF 2/0 COPPER CABLE TO SOLID-STATE DECOUPLING DEVICES.
2	1,100'	COPPER CABLE, #6 AWG (BLACK) HMWPE INSULATED, STRANDED, SOFT-DRAWN, COMMERCIALLY PURE COPPER, ASTM B8, CLASS B STD. USED FOR CONNECTIONS OF SOLID-STATE DECOUPLING DEVICES TO PIPE.
3	11	SOLID-STATE DECOUPLING DEVICE (SSD), DAIRYLAND ELECTRICAL INDUSTRIES P/N SSD-2/2-5.0-100-R. EQUIPPED WITH STANDARD CONNECTORS. -2V/+2V BLOCKING VOLTAGE. 100KA LIGHTNING SURGE CURRENT RATING (4 X 10 WAVEFORM). 45 AMP STEADY-STATE CURRENT RATING AT 50/60 HZ. 5KA FAULT CURRENT RATING AT 30 CYCLES.
4	11	SSD PEDESTAL, DAIRYLAND ELECTRICAL INDUSTRIES P/N MTP-36. FIBERGLASS CASE: 9" X 14" X 36" HIGH, 22-1/2" BASE, 13-1/2" TOP WITH 2 FLANGES STAINLESS STEEL BACK-PLATES FOR MOUNTING THE SOLID-STATE DECOUPLING DEVICE.
5	11	ONE HOLE, LONG BARREL COMPRESSION LUG, 3/8" HOLE, BURNDY P/N YAZ2C-TC38. USED WITH #2 AWG STRANDED COPPER CABLE. FOR 2/0 COPPER TO SSD CONNECTIONS
6	22	ONE HOLE, LONG BARREL COMPRESSION LUG, 3/8" HOLE, BURNDY P/N YAZ6C-TC38. USED WITH #6 AWG STRANDED COPPER CABLE. FOR SSD CONNECTION TO PIPE.
7	1	EXOTHERMIC WELD MOLD, THERMOWELD P/N M-0102. HANDLE CLAMP AND FLINT IGNITOR ARE INCLUDED. USED FOR EXOTHERMIC WELD CONNECTION OF #6 AWG COPPER CABLE TO PIPE. USE #15CP WELD METAL.
8	2 BOXES	EXOTHERMIC WELD METAL, THERMOWELD P/N #15CP. BONDS #6 AWG CABLE TO PIPELINE. 20 SHOTS PER BOX.
9	14 CARTRIDGES	TWO PART EPOXY: SPECIALTY POLYMER COATINGS, INC SP-2888, TWO PART EPOXY. FOR REPAIRING PIPE COATING AT #6 AWG CONNECTIONS TO PIPE. APPLY 20 MILS THICK MIN., 50 ML TUBE WILL REPAIR TWO EXOTHERMIC CONNECTIONS TO PIPELINE. INCLUDES TWO MINI STATIC MIXING TIPS PER 50ML CARTRIDGE.
10	11 KITS	ROYSTON SPLICERIGHT KIT (OR APPROVED EQUAL). INSULATION KIT FOR EXOTHERMIC WELD SPLICE CONNECTIONS.
11	1,210'	2/0 STRANDED, BARE, SOFT-DRAWN COPPER CABLE. TO RUN DEEPWELLS.
12	1	EXOTHERMIC WELD MOLD, THERMOWELD P/N M-5166. USED FOR IN-LINE SPLICE OF 2/0 COPPER TO #2 AWG CABLE. USE #45CP WELD METAL.
13	1	HANDLE CLAMP AND FLINT IGNITOR, THERMOWELD P/N 40-0106-00. USED FOR 2/0 COPPER TO TO #2 AWG CABLE IN-LINE SPLICE CONNECTIONS.
14	11	1-1/2" SCHEDULE 40 PVC CONDUIT: 10' SECTION, CUT TO PROPER LENGTH IN FIELD. CONTAINS 2/0 COPPER AND #2 AWG CABLE FROM DEEPWELL TO SSD.
15	11	1-1/2" SCHEDULE 40 PVC ELBOW. CONTAINS 2/0 COPPER FROM DEEPWELL TO SSD.
16	363 BAGS	DM100 CONDUCRETE, CONDUCTIVE CONCRETE BACKFILL. 55 POUND BAGS. SAE, INC.
17	11	3/4" DIAMETER, 10 FOOT LONG COPPER COATED GROUND ROD, GALVAN INDUSTRIES P/N 7510. USED TO WEIGHT 2/0 COPPER IN DEEPWELL.
18	11	30' X 8" ID. PIPE FOR DEEPWELL CASING (SCHEDULE 80).
19	11	GROUND ROD CLAMP, GALVAN INDUSTRIES P/N SRC.
20	2 BOXES	EXOTHERMIC WELD METAL, THERMOWELD P/N #45CP. USED FOR #2 AWG CABLE TO 2/0 COPPER CABLE CONNECTIONS. 10 SHOTS PER BOX.
21	3	COUPON TEST STATION: AMERICAN INNOVATIONS TRITON, INCLUDES CU/CUS04 REFERENCE ELECTRODE, (2) 100 SQUARE CENTIMETER STEEL COUPONS, & (1) 1 SQUARE CENTIMETER STEEL COUPON. ALSO INCLUDES 30 FEET OF #6 AWG THHN & 30 FEET OF #14 AWG THHN (5 CONDUCTOR) WIRE.

NOTE:

ARK ENGINEERING CAN PROVIDE ALL MATERIALS LISTED ABOVE AND INSTALLATION SERVICES. PLEASE CALL 1-800-469-3436 FOR A MATERIAL OR INSTALLATION QUOTATION.

- PRELIMINARY -
FOR CLIENT REVIEW ONLY
NOT FOR CONSTRUCTION
ENGR:
DATE: 9/19/18

CLIENT: SAN DIEGO GAS & ELECTRIC

SITE: PROPOSED TL 6975 DEEPWELL SYSTEM

ARK ENGINEERING & TECHNICAL SERVICES, INC.
ARK ENGINEERING & TECH. SERVICES, INC.
639 GRANITE STREET
SUITE 200
BRAINTREE, MA
02184 U.S.A.

TITLE: MATERIALS LIST

DRAWN BY	DATE	SIZE	DWG. NO.	REV
SRM	9/19/18	B	16138-420	0

PROJECT NO.	APPROVED BY	DATE	SCALE	CAD FILE NAME	SHEET
16-E-138-AC	BW		NTS	16138-420-1-R0	1 OF 1

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APPENDIX B
AERIAL VIEW OF THE WELL AND COUPON LOCATIONS

Deep Well Locations 1 to 9 and Coupon Test Station 1

Deep Well Locations 10 to 11 and Coupon Test Stations 2 & 3