Remediaton and Reclamation Plan
PRODUCED WATER LINE RELEASE – INCIDENT ID NO. nAPP2107849827
RANA SALADA PAD-A TO SAN MATEO
EDDY COUNTY, NEW MEXICO

May 27, 2021

Prepared for:
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ALTAMIRA

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1.0 INTRODUCTION

1.1 General

Novo Oil & Gas Northern Delaware, LLC (Novo Oil & Gas) (Operator No. 372920) lease (Lease Number: NMNM91078) and operate facilities known as the "Rana Salada Pad A to San Mateo" located in Field Name Purple Sage – Wolfcamp, T23S, R28E, Section 1NE, in Eddy County, New Mexico. As part of production operations, Novo Oil & Gas filed and obtained a permit for an above ground temporary produced water line with the Bureau of Land Management (BLM). On March 3, 2021, field personnel for Novo Oil & Gas discovered a broken connection associated with the permitted temporary produced water line located northeast of County Road 605 (Refinery Road) at latitude 32.340822 N, longitude -104.038850 W (Figure 1). This document presents the plans and methodology for execution and completion of remediation of chloride affected soils and site reclamation.

1.2 Release Details

The release from the temporary produce water line connection was identified quickly by Novo Oil & Gas personnel and the flow of water was immediately shut down. Novo Oil & Gas has estimated that approximately 200 barrels of produce water was released and approximately 175 barrels of the produced water was recovered using vacuum trucks. The justification for the quantity release is based on the following:

- Transfer rate at the time of release was 14,000 bbls/day;
- The release occurred for 20 minutes prior to shut off;
- 14,000 bbls/day = 583.33 bbls/hour = 9.72 bbls/minute
- 9.72 bbls/minute x 20 minutes = 194.44 bbls
- Chloride concentration is assumed to be greater than 10,000 mg/L

Based on the location of the point of release, produced water generally flowed towards the north along each side of the heavy haul road. A small amount of produced water was release to the south of the road. The roadway consists of tightly compacted caliche material that has formed a dense surface for heavy equipment and large truck traffic. Much of the produce water flowed along the sides of the road as depicted on Figure 2. Following the release, Novo Oil & Gas personnel marked the perimeter of the release area with wooden stakes based on the observation of wet verses dry soil. This area is depicted on Figure 2.

It should be noted that the produced water release did occur outside of a lined containment area in an area where depth to groundwater is greater than 55 feet below ground surface. For the purpose of this assessment, chlorides were vertically delineated to 600 mg/kg. Per 19.15.29.11 (A) (5) (c) the produced water release is assumed to be greater than 10,000 mg/L; However, the quantity of produced water is known (provided above) and did not result in greater than 200 barrels of unrecovered produced water. The release resulted in approximately 25 barrels of unrecovered produced water.

2.0 ASSESSMENT RESULTS SUMMARY

Atlamira-US, LLC (Altamira) on behalf of Novo Oil & Gas conducted soil assessment activities April 12-15, 2021 in the area of the produced water release to determine the degree of impact to soil. A total of 22 soil

borings were installed to properly delineate the vertical and lateral extent of potential constituents of concern. Soil borings and soil samples from SB-1 through SB-8 were installed and collected in the known release area (along the axis of the release flow path). Soil borings and associated soil samples from SB-9 through SB-21 were installed and collected to provide lateral delineation of constituents of concern. A summary of all analytical results is provided on Table 1.

The initial soil sample interval 0-1 foot at each soil boring was analyzed for chlorides, TPH, and BTEX. If a constituent exceeded the allowable assessment/cleanup level, that constituent was analyzed in the next deeper sample interval. This analysis methodology was utilized to ensure vertical delineation of each constituent was achieved to below the applicable assessment level.

2.1 Chloride Results Discussion

Analytical results for chlorides within the known release flow path ranged from 12.6 mg/kg to 4,800 mg/kg (Figure 3). Chloride concentrations exceeded 600 mg/kg in soil samples at soil borings SB-1, SB-3, SB-7 and SB-8. Chloride concentrations in soil samples collected at soil boring SB-1 and SB-3 exceeded 600 mg/kg in the 0-1 foot sample interval, but attenuated to less than 600 mg/kg in the 3-4 foot sample interval, indicating vertical delineation was achieved at three feet below ground surface at these two locations. Subsequent step-out soil borings installed to provide lateral delineation at the SB-1 and SB-3 locations exhibited chloride concentrations less than 600 mg/kg, indicating lateral delineation has been achieved.

Chloride concentrations in soil samples collected at soil boring SB-7 exceeded 600 mg/kg in the 0-1 foot, 3-4 foot, and 4-6 foot sample intervals and attenuated to less than 600 mg/kg in the 6-8 foot sample interval, indicating vertical delineation was achieved at six feet below ground surface at soil boring SB-7. Subsequent step-out soil borings installed to provide lateral delineation at the SB-7 location exhibited chloride concentrations less than 600 mg/kg, indicating lateral delineation has been achieved.

Chloride concentrations in soil samples collected at soil boring SB-8 exceeded 600 mg/kg in the 0-1 foot, and 3-4 foot sample intervals and attenuated to less than 600 mg/kg in the 4-6 foot sample interval, indicating vertical delineation was achieved at four feet below ground surface at soil boring SB-8. Subsequent step-out soil borings installed to provide lateral delineation at the SB-8 location exhibited chloride concentrations less than 600 mg/kg, indicating lateral delineation has been achieved.

Chloride concentrations in all other source area soil borings and lateral delineation soil borings are less than 600 mg/kg.

2.2 TPH Results Discussion

TPH was analyzed on the 0-1 foot soil sample from each soil boring. TPH was fractionated into the GRO/DRO/MRO ranges. For the purpose of assessment and in accordance with regulatory guidance, TPH concentrations were compared to an assessment level of 100 mg/kg. Analytical results show low level concentrations of TPH were detected; however, concentrations of TPH are below 100 mg/kg in all soil samples submitted for laboratory analysis. Since TPH concentrations were below the applicable assessment level in all soil samples, analysis of TPH on deeper soil samples was not necessary.

2.3 BTEX Results Discussion

BTEX was analyzed on the 0-1 foot soil sample from each soil boring. For the purpose of assessment and in accordance with regulatory guidance, benzene and total BTEX concentrations were compared to an

assessment level of 10 mg/kg and 50 mg/kg, respectively. Analytical results show a very low concentration of benzene was detected only in soil sample SB-3 (0-1') of 0.00407 mg/kg, which is below the 10 mg/kg assessment level. Benzene was not detected in any of the other soil samples submitted for laboratory analysis. Total BTEX concentrations were detected in soil samples from soil boring SB-1, SB-2 and SB-3; however, detected concentrations were below the applicable assessment level of 50 mg/kg. Total BTEX was not detected in any of the other soil samples submitted for laboratory analysis. Since benzene and total BTEX concentrations were below the applicable assessment level in all soil samples, analysis of benzene and total BTEX on deeper soil samples was not necessary.

2.4 Assessment Summary

Analytical results do indicate chloride concentrations exceed the 600 mg/kg assessment level in shallow soils at SB-1, SB-3, SB-7, and SB-8. Vertical and lateral delineation of chlorides has been defined. Based on the analytical results for TPH, benzene and total BTEX, no further evaluation of TPH, benzene or total BTEX is necessary.

Based on the analytical results, it appears that shallow soils in the upper 3-4 feet in the area of soil borings SB-1, SB-3, SB-7 and SB-8 will require remediation due to elevated chloride concentrations over 600 mg/kg. Concentrations of chlorides below four feet are below 10,000 mg/kg and do not require remediation.

3.0 REMEDIATION PLAN

Remediation of shallow soils in the area of soil borings SB-1, SB-3, SB-7 and SB-8 is necessary due to chloride concentrations that are greater than 600 mg/kg in the upper four feet of the soil profile. Affected soil in the area of SB-1 and SB-3 will be excavated and treated to a depth of three feet below ground surface. Affected soil in the area of SB-7 and SB-8 will be excavated and treated to a depth of four feet below ground surface. The areas of proposed remediation are depicted on Figure 4. It should be noted that remediation efforts will work around the established haul road in the native soil. The haul roads in the area of the release are constructed with hard compacted caliche based material and serve as major haul roads for heavy equipment, tank trucks, and normal vehicular travel.

Novo Oil & Gas will provide verbal and written notification to the OCD district office and BLM prior to start of field activities and two business days prior to confirmation soil sampling.

3.1 Estimated Affected Area Soil Volume

The estimated affected soil volume is based on analytical data results showing vertical delineation of chloride in soil at each of the four areas. The lateral extent is estimated based on lateral delineation data and will be verified during remediation by the use of confirmation soil sampling along excavated side-walls (refer to Figure 4). If chloride concentrations along side-walls exceed 600 mg/kg, the excavation along that side-wall will be further excavated and treated until confirmation soil sample results are below the cleanup criteria.

- SB-1 Area: approximately 160 cubic yards
- SB-3 Area: approximately 156 cubic yards
- SB-7 & SB-8 Area: approximately 268 cubic yards

3.2 Remediation Methodology

Novo Oil & Gas will utilize Altamira as their environmental consultant and will contract Ameripex Services Group LLC (Ameripex) for onsite insitu remediation activities.

The primary objective for this process is to treat chloride impacted soil onsite for beneficial reuse. The process is to excavate chloride impacted soil; treat the soil, collect confirmation soil samples of the treated soil; determine if treated soils are below the established cleanup levels; and, if so, replace the treated native soil. If soil treatment does not achieve cleanup levels, soils will be re-treated. The process uses oxidation (aeration and chemical ionization) to reduce the concentration of chlorides.

AMERAPEX and Altamira personnel will mobilize equipment and personnel to the site to excavate each affected soil area depicted on Figure 4. Once portions of the affected soil have been excavated and stockpiled, the soil shredding and reagent application machine will be set up on site. AMERAPEX utilizes a Screen Machine* 621ST, 612T or ART Extreme 4240 unit to accomplish soil shredding remediation. As material is loaded into the 5-yard hopper, a set of conveyors directs the soil to a series of rotating hardened hammers which are used to pulverize/shred and break-up the soil to small particle size pieces. Depending on the soil conditions (dry versus wet and amount of gravel/rock), the shredder can process and treat up to 300 cubic yards of material per hour depending on size of machine & material being processed.

The soil shredder will be equipped with an internal spray system capable of delivering remedial additives/chemicals to assist with the remediation. During soil shredding soil particles will be treated with a reagent called Bio-Regen SA1000. 3Tier Technologies SA-1000 is an applicable reagent tool for remediation of high sodium and metal contaminated soils. SA-1000 is an advanced treatment product that combines two, next generation, Polyelectrolyte Enhanced Organic Bio-Polymers (PEB) with bio-available calcium.

PEB possess the following properties and functions; optimal molecular mass, active functional groups, hydrophilic and hydrophobic sites, positively and negatively charged sites, non-ionic sites, and specific interactions between molecules themselves and organic/mineral compounds. The combination of these diverse properties and functions provide a product that utilizes multiple functions and mechanisms to detoxify, neutralize and bind, salts and chlorides with the added ability to convert a myriad of toxic metals to benign residual metals.

PEB naturally binds, adsorbs, and coordinates sodium cations and chlorine anions. Any sodium/chloride residue creates a new mineral formation resulting in sodium, chloride, cation and anion conversion into physically and mechanically bound status, thus eliminating salt toxicity resulting in desalination and chloride/salt toxicity reduction/elimination. This process also improves the growing profile by reversing negative osmotic pressure, reducing electrical conductivity, increasing soluble organic matter allowing proper nutrient and moisture retention, percolation, and uptake, therefore allowing new plants to establish and regenerate soil back to a healthy and productive state.

Shredding results in smaller particle sizes and greater surface area for the ions to chemically react with the released chemicals or substances. Once the product is applied, the treated material can be further aerated/screened, backfilled or can be stockpiled. Soil samples will be collected from the treated soil and submitted to an analytical laboratory for testing to ensure applicable regulatory levels are met on the 10th

day following application. Upon notification that the analytical data is below regulatory levels, AMERAPEX will conduct backfill and reclamation activities to meet regulatory requirements.

3.3 Confirmation Soil Sampling for Treated Soil

Following treatment of chloride affected soil on the 10th day, a five point composite will be collected for every 50 cubic yards of treated soil. The composite soil sample will be submitted to Pace Analytical Laboratories for analysis of chloride using EPA Method 300.0. As mentioned above, if chloride concentrations are detected above 600 mg/kg, the treated soil will be rehydrated and allowed to work/sit for an additional 5-10 days and then resampled to determine effectiveness of the remediation/reduction of chlorides in soil. If necessary, soil may be re-treated, but based on the relatively low concentration of chlorides in soil and proven technology, it is unlikely that soils will require re-treatment.

3.4 Confirmation Soil Sampling Methodology

Following excavation of each area, confirmation soil sampling will be conducted per 19.15.29.12 (D)(1). A five-point composite soil sample will be collected every 200 square feet for each sidewall and floor of the excavation. Representative soil from each of the five points (per composite) will be mixed and placed into laboratory provided containers, labeled, and maintained on ice in an insulated cooler. Confirmation soil samples will be submitted to Pace Analytical Laboratories for analysis of chloride using EPA Method 300.0. Since TPH, benzene and total BTEX concentrations were well below the Assessment and Closure Criteria for soils, these constituents will not be considered for analysis for confirmation of remediation effectiveness.

- SB-1 Area: Estimated 48’ x 30’ x 3’ – 7 floor samples, 1 sample per wall – Total of 11 soil samples
- SB-3 Area: Estimated 70’ x 20’ x 3’ – 7 floor samples, 1 sample per wall – Total of 11 soil samples
- SB-7 & SB-8 Area: Estimated 113’ x 16’ x 3’ – 9 floor samples, 3 sample per long wall, 1 sample per short wall – Total of 17 soil samples

The established closure criteria for chlorides in soil (upper 4-feet) is 600 mg/kg since the area is not on a well pad area. Closure criteria for chlorides in soil below four feet, based on depth to water greater than 55 feet at the site, is 10,000 mg/kg. Confirmation soil sample results with a concentration less than 600 mg/kg will indicate remediation of chlorides in soil is complete. If the concentration of chlorides in a particular soil sample is greater than 600 mg/kg, the area will be further excavated and then re-sampled. This methodology will be implemented until affected soil is removed to concentrations less than 600 mg/kg.

3.5 Proposed Remediation Schedule/Timeline

Upon NMOCD and BLM approval of this remediation and reclamation work plan, Novo Oil & Gas anticipates the following schedule:

- 45 days following approval – finalize work plan and mobilize to site area
- 48 hours prior to start of field activities, notify NMOCD and BLM
- 48 hours prior to confirmation soil sampling, notify NMOCD and BLM
- 10 days following remediation – collect composite samples of treated soil (1 per 100 cubic yards)
- 15 days following remediation – collect additional samples of treated soil if necessary
- 15-20 days following remediation – backfill, compact and conduct reclamation activities, re-seed area, water area

- 20-30 days following mobilization – remediation and reclamation complete, observe vegetation growth to meet state criteria
- Submit final closure once established vegetation growth meets regulated criteria

4.0 RESTORATION, RECLAMATION & RE-VEGETATION

Following completion of affected soil remediation and confirmation soil sampling, Novo Oil & Gas will restore the excavated areas to the condition that existed prior to the release. This will include the replacement of removed and treated soil, reclamation to original grade, and re-vegetation with native species.

4.1 Restoration and Reclamation

Following treatment of chloride affected soils and obtaining confirmation soil sample results for chlorides in treated soil below 600 mg/kg, treated soil will be placed back into the respective excavation areas and compacted on 6-inch to 9-inch lifts. The upper 1-foot top layer of soil will be separated from deeper soil and used as the final top layer during final reclamation. Final soil cover will be placed to match the sites existing grade to prevent ponding of water and erosion. Site personnel will inspect the area on a weekly basis to monitoring the final cover/grade.

As previously mentioned, the treated native soil (chlorides <600 mg/kg) will be placed back into the original excavation area. Based on this, the upper 3-4 feet will be reclaimed with the minimum required depth of non-waste containing earthen material.

4.2 Re-Vegetation

Currently, pre-disturbed areas within the immediate area consists of spars vegetation including weeds and low brush forming plants. Approximately 70-75% of the ground surface consists of native soil and broken rock.

Following placement of the top layer, native seed mixtures will be spread and watered to support growth. Per NMOCD 19.15.29.13 (D)(3) reclamation of disturbed areas will be considered complete when the uniform vegetation cover has been established that reflects a life-form ration of plus or minus fifty percent of pre-disturbed levels and a total percent plant cover of at least seventy percent of pre-disturbed levels. This results in an approximate established re-growth of 25-30% of the ground surface (based on best estimate of site observations).

Novo Oil & Gas will notify the NMOCD when reclamation and re-vegetation is complete and submit the final closure report and request.

TABLES

Table 1
Analytical Data Results Summary - Soil Samples (mg/kg)
Novo Oil Gas - Rana Salada Produced Water Release Leak
Near Loving, New Mexico

Analyte			Chloride	BTEX	Benzene	TPH (low)	TPH (C10-28)	TPH (C28-36)	TPH
Method			300.0	8260B	8260B	8015D	8015M	8015M	8015M
Table I - Closure Criteria (0-4')			600	50	10	-	-	-	100
Sample ID	Sample Date								
SB-1 (0-1')	4/13/2021		**6140**	**0.00724 (J)**	<0.000612	**1.97 (J)**	**30.8**	**34.5**	**67.27**
SB-1 (3-4')	4/13/2021		**170**	**0.0017 (J)**	<0.000567	<0.657	<1.67	**0.495 (J)**	**0.495 (J)**
SB-2 (0-1')	4/13/2021		**23.2**	<0.00157	<0.000565	**0.758 (J)**	**2.8 (J)**	**11**	**14.558**
SB-2 (3-4')	4/13/2021		**260**	**0.00134 (J)**	<0.000677	<0.788	<1.82	**0.456 (J)**	**0.465 (J)**
SB-3 (0-1')	4/14/2021		**1270**	**0.00559**	**0.00407**	**1.66 (J)**	**4.91**	**16.1**	**22.67**
SB-3 (3-4')	4/14/2021		**210**	-	**-**	**-**	**-**	**-**	**-**
SB-4 (0-1')	4/14/2021		**30.2**	<0.00156	<0.00056	<0.649	**11.7**	**27.6**	**39.3**
SB-4 (3-4')	4/14/2021		**246**	-	-	-	-	-	-
SB-5 (0-1')	4/14/2021		**87.3**	<0.00142	<0.000509	**1.15 (J)**	**5.47**	**14.2**	**20.82**
SB-5 (3-4')	4/14/2021		**107**	-	-	-	-	-	-
SB-6 (0-1')	4/15/2021		**194**	<0.00159	<0.000572	<0.665	<1.79	**2.36 (J)**	**2.36 (J)**
SB-6 (3-4')	4/15/2021		**12.6 (J)**	-	-	-	-	-	-
SB-7 (0-1')	4/15/2021		**2610**	<0.00147	<0.000526	<0.611	**4.32**	**9.83**	**14.15**
SB-7 (3-4')	4/15/2021		**2200**	-	-	<0.681	<1.70	**2.59 (J)**	**2.59 (J)**
SB-7 (4-6')	4/15/2021		**1870**	-	-	-	-	-	-
SB-7 (6-8')	4/15/2021		**88**	-	-	-	-	-	-
SB-7 (8-10')	4/15/2021		**29.8**	-	-	-	-	-	-
SB-8 (0-1')	4/15/2021		**3300**	<0.0016	<0.000576	<0.671	**1.9 (J)**	**6.32**	**8.22**
SB-8 (3-4')	4/15/2021		**4800**	-	-	<0.819	<1.91	**0.446 (J)**	**0.446 (J)**
SB-8 (4-6')	4/15/2021		**323**	-	-	-	-	-	-
SB-9 (0-1')	4/14/2021		**63.2**	<0.00151	<0.000543	**2.76 (J)**	**8.74**	**23.2**	**34.7**
SB-9 (3-4')	4/14/2021		**72.6**	-	-	-	-	-	-
SB-10 (0-1')	4/14/2021		**210**	<0.00162	<0.000584	**2.52 (J)**	**4.35**	**9.82**	**16.69**

Table 1
Analytical Data Results Summary - Soil Samples (mg/kg)
Novo Oil Gas - Rana Salada Produced Water Release Leak
Near Loving, New Mexico

SB-10 (3-4')	4/14/2021		**229**	-	-	-	-	-	-
SB-11 (0-1')	4/14/2021		**26.1**	<0.0017	<0.00061	<0.71	<1.85	**6.81**	**6.81**
SB-11 (3-4')	4/14/2021		**448**	-	-	-	-	-	-
SB-12 (0-1')	4/13/2021		**31.3**	<0.00137	<0.000492	<0.572	<1.62	**6.97**	**6.97**
SB-12 (3-4')	4/13/2021								
SB-13 (0-1')	4/14/2021		**319**	<0.00157	<0.000565	**2.17 (J)**	<1.69	**6.71**	**8.88**
SB-14 (0-1')	4/14/2021		**12.3 (J)**	<0.00154	<0.000554	**1.73 (J)**	<1.64	**1.32 (J)**	**3.05**
SB-14 (3-4')	4/14/2021		**68.4**	-	-	-	-	-	-
SB-15 (0-1')	4/14/2021		**56.7**	<0.00161	<0.000578	<0.672	**17.9**	**40.3**	**58.2**
SB-15 (3-4')	4/14/2021		**142**	-	-	-	-	-	-
SB-16 (0-1')	4/15/2021		**23.5**	<0.00159	<0.00057	**2.27 (J)**	**2.95 (J)**	**13.1**	**18.32**
SB-16 (3-4')	4/15/2021		**238**	-	-	-	-	-	-
SB-17 (0-1')	4/15/2021		**202**	<0.00155	<0.000556	<0.647	**14.9**	**42.2**	**57.1**
SB-17 (3-4')	4/15/2021		**393**	-	-	-	-	-	-
SB-18 (0-1')	4/15/2021		<9.46	<0.00143	<0.000513	**1.17 (J)**	**1.99 (J)**	**18.6**	**21.76**
SB-18 (3-4')	4/15/2021		**18.8 (J)**	-	-	-	-	-	-
SB-19 (0-1')	4/15/2021		**17.1 (J)**	<0.00203	<0.000729	<0.847	**2.99 (J)**	**16.2**	**19.19**
SB-19 (3-4')	4/15/2021		**116**	-	-	-	-	-	-
SB-20 (0-1')	4/15/2021		**10.5**	<0.00152	<0.000546	<0.636	**4.48**	**15.2**	**19.68**
SB-20 (3-4')	4/15/2021		**12 (J)**	-	-	-	-	-	-
SB-21 (0-1')	4/14/2021		**20.9**	<0.00145	<0.00052	**1.33 (J)**	**1.72 (J)**	**9.13**	**12.18**
SB-21 (3-4')	4/14/2021		**13.3 (J)**	-	-	-	-	-	-

Notes:

All results are in mg/kg

Closure Criteria Soils - Table I of 19.15.29.12 NMAC

TPH - Total Petroleum Hydrocarbons - includes GRO, DRO, MRO

Table 1
Analytical Data Results Summary - Soil Samples (mg/kg)
Novo Oil Gas - Rana Salada Produced Water Release Leak
Near Loving, New Mexico

BTEX - Benzene, Toluene, Ethylbenzene, Xylenes

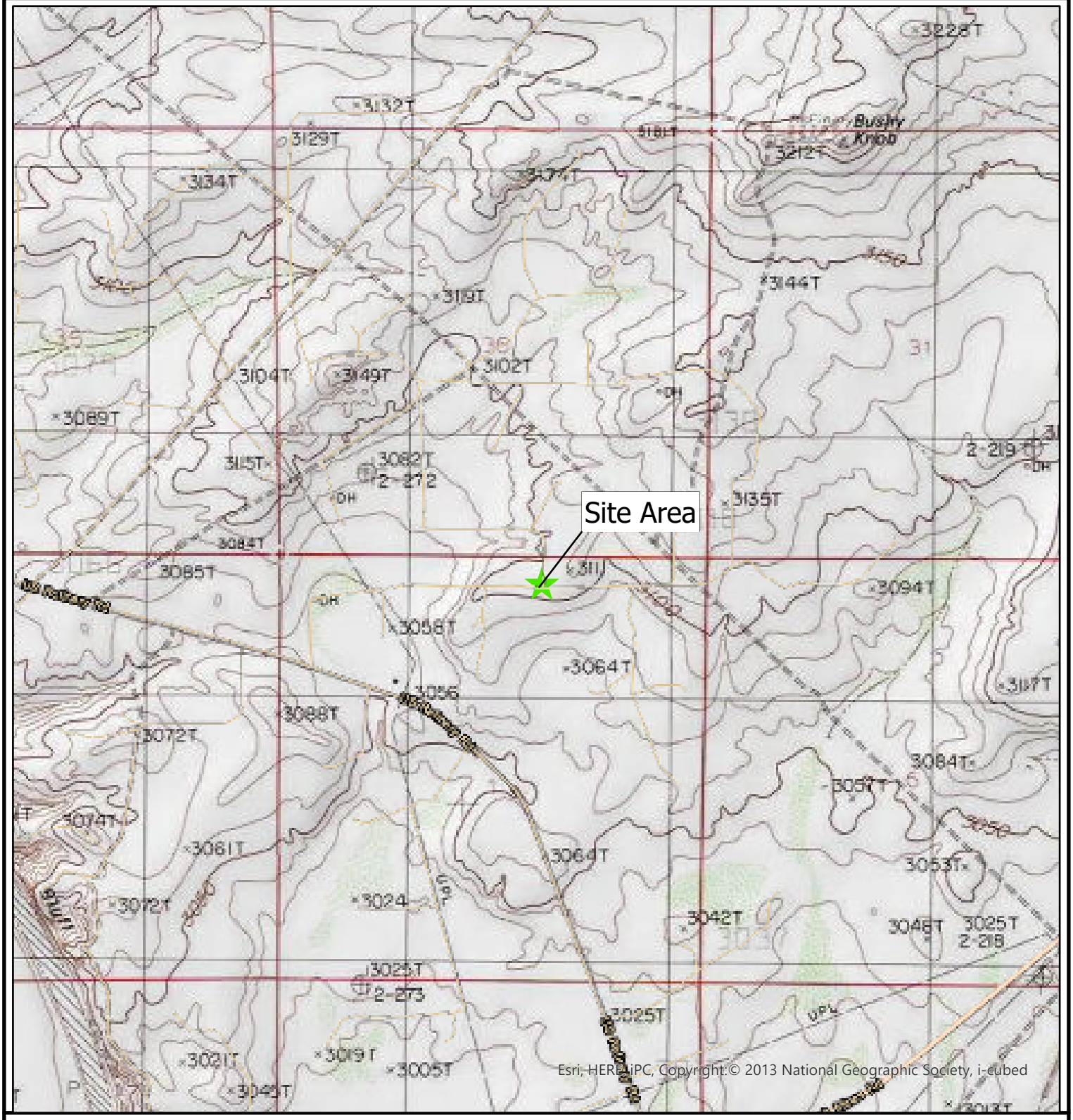
< number is the SDL (not detected above the sample detection limit)

J - result is less than the MQL but greater than or equal to the SDL and the concentration is an estimated value

Bold indicates that a COC was detected

Shading indicates that a detected result exceeded the RRC Screeing levels

FIGURES



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Folder: D:\GIS_Projects\NVONM2102\

FIGURE TITLE
Site Area Topo Map

DOCUMENT TITLE
Site Location Topo Map

CLIENT
CLIENT: NOVO Oil & Gas - Rana Salada

LOCATION
Loving, New Mexico

DATE	4/26/2021
SCALE	1:1000
DESIGNED BY	BH
APPROVED BY	BH
DRAWN BY	KLT
PROJECT NUMBER	NVONM2102
FIGURE NUMBER	1

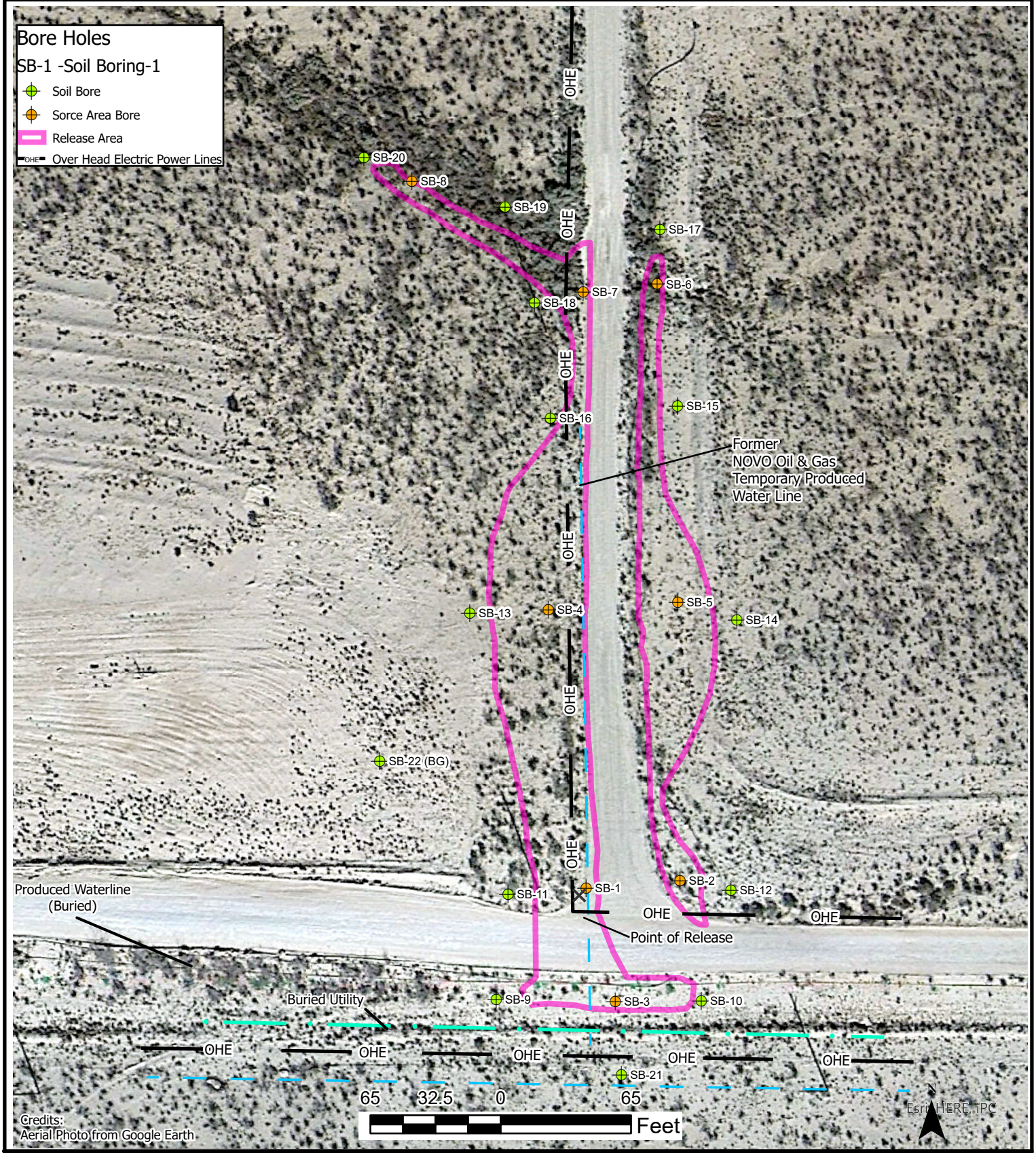

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FIGURE TITLE
Site Plan – Soil Boring Location Map Produced Water Release

DOCUMENT TITLE
Soil Sample locations and Release Area

CLIENT
CLIENT: NOVO Oil & Gas - Rana Salada

LOCATION
Loving, New Mexico

DATE	5/18/2021
SCALE	1:65
DESIGNED BY	BH
APPROVED BY	BH
DRAWN BY	KLT
PROJECT NUMBER	NVONM2102
FIGURE NUMBER	2

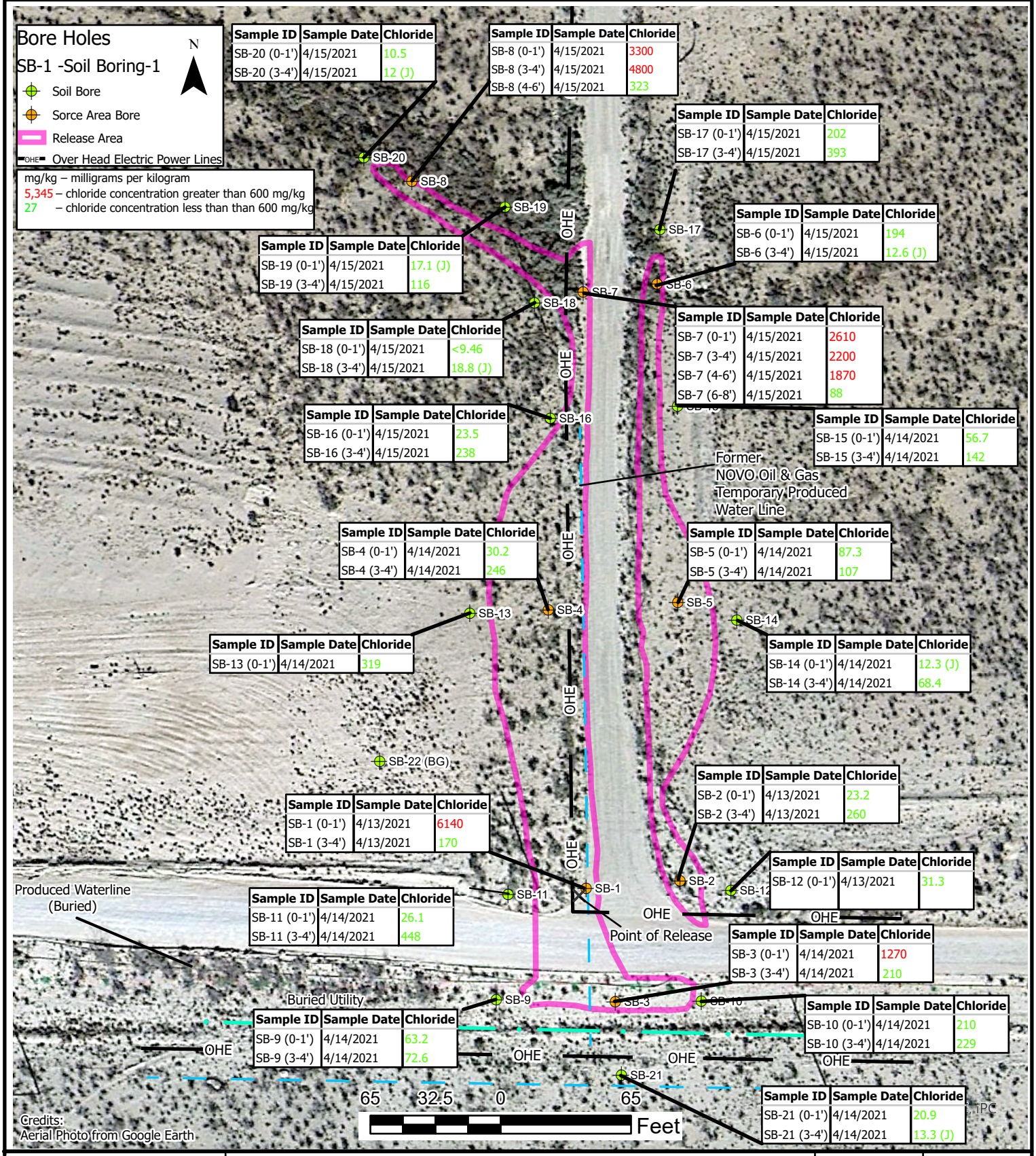

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FIGURE TITLE
Chloride Concentration Map (mg/kg)

DOCUMENT TITLE
Soil Sample locations and Release Area

CLIENT
CLIENT: NOVO Oil & Gas - Rana Salada

LOCATION
Loving, New Mexico

DATE	5/18/2021
SCALE	1:65
DESIGNED BY	BH
APPROVED BY	BH
DRAWN BY	KLT
PROJECT NUMBER	NVONM2102
FIGURE NUMBER	3

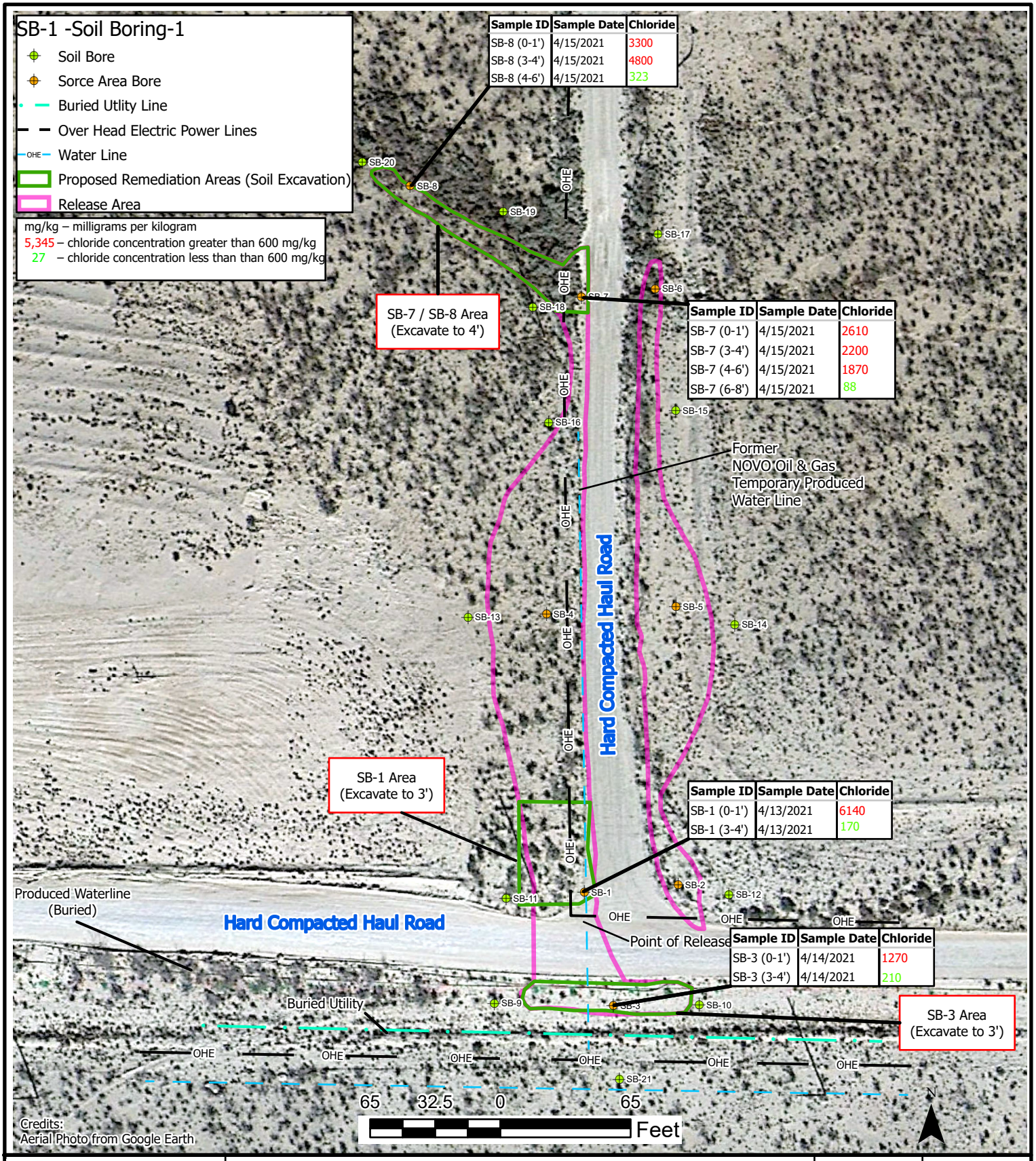

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FIGURE TITLE
Areas of Soil Remediation (Clorides)

DOCUMENT TITLE
Remediation Sites

CLIENT
CLIENT: NOVO Oil & Gas - Rana Salada

LOCATION
Loving, New Mexico

DATE	5/20/2021
SCALE	1:65
DESIGNED BY	BH
APPROVED BY	BH
DRAWN BY	KLT
PROJECT NUMBER	NVONM2102
FIGURE NUMBER	4

APPENDIX A

Ameripex Case Studies and Information

AMERAPEX
Committed to Technical Excellence

SOIL CONTAMINATED WITH CHLORIDE REMEDIATED USING ADVANCED REMEDIATION TECHNOLOGY (ART)

ZERO
WASTE GENERATION
HAULING OFF
USE OF LANDFILLS
HAULING IN

Client Challenge

An ice storm caused an electricity blackout at a client's site, resulting in their tank battery alarm system to fail when a pump busted. The amount of produced water released during this time remains unknown. The client sought an alternative, more cost-effective and limited liability option for remediation instead of digging up the contaminated soil and hauling it to landfill.

Challenge's Potential Impact

The impacts salt/chloride can have on soil and plants when spills occur can be critical. When spills occur, soil particles are dispersed, which results in destroyed aggregation. Additionally, osmotic potential reduces the plants' ability to uptake water and the ionic balance of the soil solution is impacted reducing nutrient absorption.

The Solution - Advanced Remediation Technology (ART)

To minimize the negative effects of contaminated soil, Amerapex implemented the use of Advanced Remediation Technology (ART). ART utilizes an ex-situ soil pulverization, aeration, and chemical solution to treat the contaminated soil. Amerapex excavated approximately 2,800 cubic yards of affected soil with contamination ranging from 25,000 to 62,000ppm Total Soluble Salts (TSS). All the samples met the OCC clean standards of 2640 within 12 days. This allowed the existing soil to be treated, as well as provided a solution that minimized liabilities and was cost-effective.

As a result of ART, there was zero waste generation, zero hauling off, zero use of landfills and zero need to haul in new soil.

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SOIL CONTAMINATED WITH CHLORIDE REMEDIATED USING ADVANCED REMEDIATION TECHNOLOGY (ART)

Sampling - Total Soluable Salts (TSS)

Pre-ART ppm	≤ 5 days	≤ 13 days	≤ 19 days
1A- 59,800	1--6570	1B--1070	1T--232
2A- 55,800	2--4700	2B--1050	2T--883
3A-61,500	3--2290		
	4--2570		
	5--1820		
	6--2130		

Note: The pretesting was done of excavated soil and the first sampling was done five days after ART treatment. All samples meet the OCC clean standards of 2640 except 1 & 2. As a result, both were resampled 8 days later and results show they both met the clean up standard at that time. Two additional samples were taken 5 days later to see if the remediation was continuing to work, and the results proved it was.

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FAQ – Bio-Regen SA-1000
For Salt Remediation

What is SA-1000?

3Tier Technologies **SA-1000** is a new management tool for remediation of high sodium and metal contaminated soils and wastewater streams. **SA-1000** is an advanced treatment product combing two, next generation, Polyelectrolyte Enhanced Organic Bio-Polymers (PEB) with bio-available calcium.

This uniquely blended product possess the following properties and functions; optimal molecular mass, active functional groups, hydrophilic and hydrophobic sites, positively and negatively charged sites, non-ionic sites, and specific interactions between molecules themselves and organic/mineral compounds. The combination of these diverse properties and functions provide a product that utilizes multiple functions and mechanisms to detoxify, neutralize and bind, salts and chlorides with the added ability to convert a myriad of toxic metals to benign residual metals.

What is 3 Tier's Polyelectrolyte Enhanced Biopolymer (PEB)?

The foundation of **SA-1000** is an advanced blend of two Polyelectrolyte Enhanced Biopolymer (PEB) that are derived from very stable, organic compounds found in brown and oxidized black coal. Our proprietary processing technology purifies and unleashes the vast potential of these massive molecular formulas.

PEB is a highly reactive long-chain molecule providing a purified carbon source available with various concentrations of fulvic acids, highly reaction functional groups, high CEC potential, and low ash and ballast. **SA-1000** contains a combination of negatively charged molecules for reactions with positively charged Na and a new generation of non-ionic molecules for negatively charged chlorides. This unique combination with the addition of calcium creates a complete remediation tool for salts, chlorides and metals. PEB is an all-natural, highly soluble, liquid concentrate that is safe and easy to use for both soil and aqueous application

Why is the PEB important to the salt remediation process?

PEB naturally binds, adsorbs, and coordinates sodium cations and chlorine anions which allow excessive amounts of salts/chlorides to become more mobile in terms of sodium cations and chloride anions, which eliminates the salt's/chlorides ability to bind to soil particles, especially clay. This reaction allows sodium/chlorides to be safely leached and naturally filtered through the soil profile. Any sodium/chloride residue creates a new mineral formation resulting in sodium, chloride, cation and anion conversion into physically and mechanically bound status, thus eliminating salt toxicity resulting in desalination and salt toxicity reduction/elimination. This process also improves the growing profile by reversing negative osmotic pressure, reducing electrical conductivity, increasing soluble organic matter allowing proper nutrient and moisture retention, percolation, and uptake, therefore allowing new plants to establish and regenerate soil back to a healthy and productive state. In aqueous solutions, the reactions are similar, resulting in the precipitation of most of the sodium, chlorides and metals with the remaining soluble forms being neutralized into non-toxic forms.

How does SA-1000 work?

SA-1000 possesses several beneficial characteristics that buffers the treatment environment, creates a foundation for maximum biological, geological and chemical reactions, is both hydrophobic and hydrophilic, and is designed to work effectively in both soil and aqueous environments. Through these various reactions with contaminants, **SA-1000** attracts various contaminants, reverses their negative impact in their environment and reduces/or eliminates the harmful impact through the following processes:

- **SA-1000** adsorbs and coordinates sodium cations and chlorine anions which allow excessive amounts of salt to become more mobile in terms of sodium cations and chloride anions that have a natural ability to safely filter through the soil or precipitate out of water. Any sodium residue creates a new mineral formation resulting in sodium, chlorine, cation and anion conversion into physically and mechanically bound status, thus eliminating salt toxicity resulting in desalination and salt toxicity reduction/ elimination.
- **SA-1000** with bio-available calcium is immediately soluble and active compared to gypsum applications. See results within a couple weeks.
- In soil, **SA-1000** creates fresh soil organic matter that results in increased CEC, reduced Electrical Conductivity (EC), better water holding capacity through osmotic pressure reduction, and soil porosity/structure that results in healthy, active soil for re-use.
- **SA-1000** will naturally stimulate toxic organic and mineral pollutants decomposition into neutral soil mineral compounds such as converting Chromium VI to Chromium III which is accomplished by an abundance of hydroxyl and phenol groups. These functional groups are key to the metal complexation resulting in the binding of various metals which protects the environment.

How does SA-1000 improve the soil condition?

When frack/production water or drilling muds are accidentally released onto healthy soils, the results on vegetation are immediate, with devastating results. The impact of the sodium increases compaction through interactions with clay particles, reduces the ability for moisture to naturally penetrate the soils, dramatically increases Electrical Conductivity (EC), and limits natural nutrient conversion and availability to plants resulting in certain death.

Treatment of soils with **SA-1000** creates fresh soil organic matter that results in healthy, active soil for re-use. **SA-1000** will increase CEC while reducing electrical conductivity, improve water holding capacity by reducing the osmotic pressure, and soil porosity/structure by releasing the sodium for the clay and reversing the charge of the clay particles forcing them apart. **SA-1000** helps safely regenerate soil affected by salts/chlorides/metals and promotes improved soil structure for healthy, productive use of the site.

How quickly will SA-1000 work and when can you expect desired results?

In most of our project sites, the application of **SA-1000** resulted in a reduction in excess of 75% of Total Soluble Salts and over 80% reduction in chlorides within 30 days after application. While results may vary from one project site to the next, it is important to evaluate results after a minimum of six months. At such time **SA-1000** full impact would be realized in terms of improving the soil structure.

In most cases, the speed in which the product will work is impacted by a variety of variables. The most important factor is accurate soil analysis the clearly defines the level of contamination and soil structure/type. This information will insure proper application dosage of the treatment for the desired results. Other critical factors include soil moisture after application (Limited or no rainfall will slow analytical results), proper dosing rate and application, and the establishment of accurate expectations. A reasonable expectation is to see significant results in 30 days if the recommended dosage is used.

Once SA-1000 is applied is it safe to apply seed and any other required nutrients?

Yes, the impact of **SA-1000** is almost immediate in terms of detoxifying and buffering the soil structure. If desired, you may apply seed & required nutrients to the treated soil immediately after the application of **SA-1000**. With the proper moisture level & rain fall, germination may be seen in as little as 2 weeks