CONSTRUCTION STORM WATER GENERAL PERMIT

BRUIN POINT MINE
CARBON COUNTY, UTAH

April, 2015

PREPARED FOR:
Green River Resources, Inc.
201 South Main Street, Suite 1800
Salt Lake City, Utah 84111

PREPARED BY:
URS
756 East Winchester Street, Suite 400
Salt Lake City, UT 84107
URS Job No. 24585638

STATE OF UTAH, DEPARTMENT OF ENVIRONMENTAL QUALITY, DIVISION OF WATER QUALITY
195 North 1950 West, P.O. Box 144870, Salt Lake City, Utah 84114-4870 (801) 536-4300

NOI

Notice of Intent (NOI) for Storm Water Discharges Associated with Construction Activity Under the UPDES General Permit No. UTR300000. **SEE REVERSE FOR INSTRUCTIONS**

Submission of this Notice of Intent constitutes notice that the party(s) identified in Section I of this form intends to be authorized by UPDES General Permit No. UTR300000 issued for storm water discharges associated with construction activity in the State of Utah. Becoming a permittee obligates such discharger to comply with the terms and conditions of the permit. ALL NECESSARY INFORMATION MUST BE PROVIDED ON THIS FORM.

Is this NOI seeking continuation for previously expired permit coverage at the same site? Y ☐ N ☒
If yes, what is the number of the previous permit coverage? Permit No. UTR____________________

Permit Registration Date __(automatic)___ **Permit Start Date:** ___(specified)___ (by permittee) **Permit Expiration Date:** ___(automatic)_____

I. OPERATOR INFORMATION

Name (Main operator): Green River Resources Inc. **Phone:** 801-536-6140
Address: 201 South Main Street, Suite 1800 **Status of Owner/Operator:** Owner Private
City: Salt Lake City **State:** UT **Zip:** 84111
Contact Person: William Gibbs **Phone:** 801-536-6140

Name (1st Co-permittee): Green River Resources Inc. **Phone:** 801-536-6140
Address: 201 South Main Street, Suite 1800 **Status of Owner/Operator:** Owner Private
City: Salt Lake City **State:** UT **Zip:** 84111
Contact Person: Robin Gereluk **Phone:** 403-650-5384

Name (2nd Co-permittee): ____________ **Phone:** ____________
Address: ____________ **Status of Owner/Operator:** ____________
City: ____________ **State:** ____ **Zip:** ____________
Contact Person: ____________ **Phone:** ____________

Name (3rd Co-permittee): ____________ **Phone:** ____________
Address: ____________ **Status of Owner/Operator:** ____________
City: ____________ **State:** ____ **Zip:** ____________
Contact Person: ____________ **Phone:** ____________

Please copy this form if you have more co-permittees than what is allowed on this form.

II. FACILITY SITE / LOCATION INFORMATION

Is the facility located in Indian Country? Y ☐ N ☒

Name: Bruin Point Mine
Project No. (if any): ____________
Address: Portions of Section 2, 3, and 10, T14S, R14E, SLBM **County:** Carbon
City: Sunnyside **State:** UT **Zip:** ____________
Latitude: 39 deg 37' 44.39"N **Longitude:** 110 deg 19' 33.59"W
Method (check one): USGS Topo Map, Scale 1:24000 EPA Web site GPS Other ____________

INSTRUCTIONS

Notice Of Intent (NOI) For Permit Coverage Under the UPDES General Permit For Storm Water Discharges From Construction Activities

Who Must File A Notice Of Intent (NOI) Form State law at UAC R317-8-3.9 prohibits point source discharges of storm water from construction activities to a water body(ies) of the State without a Utah Pollutant Discharge Elimination System (UPDES) permit. The operator of a construction activity that has such a storm water discharge must submit a NOI to obtain coverage under the UPDES Storm Water General Permit. If you have questions about whether you need a permit under the UPDES Storm Water program, or if you need information as to whether a particular program is administered by EPA or a state agency, contact the storm water coordinator at (801) 536-4300.

Where To File NOI Form NOIs, with fee payment(s), must be sent to the following address:

Department of Environmental Quality
Division of Water Quality
P.O. Box 144870
Salt Lake City, UT 84114-4870

The NOI can also be completed on line at:
http://www.waterquality.utah.gov/UPDES/stormwatercon.htm)

Beginning of Coverage Storm Water General Permits are issued immediately after submitting an NOI with the permit fee. The permittee should be aware that though you may not have a permit in hand, if you have submitted a completed NOI with the permit fee you are covered by the conditions in the permit and will be expected to comply with permit conditions. If you wish, contact the Division of Water Quality at (801) 536-4300 to receive a copy of the permit or you can print a copy from the DWQ web site.

Permit Fees (MAKE CHECKS PAYABLE TO: DIVISION OF WATER QUALITY) The permit fee is $110.00 per year. This fee is prorated on a yearly basis. For example if construction is scheduled for one year and one day the fee would be $220.00 because construction went into a second year. The minimum fee is $110.00 which gives one year of coverage. The fee must be received with the NOI before permit coverage is activated.

Length of Coverage: Construction Storm Water Permits start on the day that the NOI and fee payment is received at DWQ (on line if that is the case) and expire on the date that the fee is paid up to. The minimum fee is $110, therefore all permits where the minimum fee is paid will automatically receive coverage for one year. When a project is completed and the permittee wishes to discontinue permit coverage, wants to be released from accountability for permit conditions, and has stabilized the site according to permit requirements the permittee must submit the a notice of termination (NOT). The site must be clean and all temporary storm water control measures must be removed. In most cases the DWQ or municipal (for the municipality of jurisdiction) storm water coordinator will perform a final inspection. If the site passes the final inspection the permit is terminated.

The Storm Water General Permit for Construction Activities UTR300000 will expire on June 30, 2013. The Clean Water Act requires that all UPDES permits be renewed every 5 years. If a project extends beyond the expiration date of the Permit it must continue coverage under the renewed permit that will subsequently be developed to continue the same or similar permit service for construction activity.

SECTION I - FACILITY OPERATOR INFORMATION Give the legal name(s) of the person(s), firm(s), public organization(s), or any other entity(ies) that conducts the construction operation at the facility or site described in this application. The name of the operator(s) may be the developer, the owner, the general contractor, the design firm, the excavation contractor and/or others (e.g. anyone that fits the definition of operator). Most often it is the general contractor. An operator is anyone that has control over site/project specifications and/or control of day to day operational activities. Do not use a colloquial name.

Enter the complete address and telephone number of the operator(s). Enter the appropriate letter to indicate the legal status of the operator of the facility.
F = Federal M = Public (other than Fed or State) S = State P = Private

SECTION II - FACILITY/SITE LOCATION INFORMATION Enter the facility name or legal name and project number (if any) of the site and complete street address, including city, state and ZIP code. The latitude and longitude of the facility must be included to the approximate centroid of the site, and the method of how the Lat/Long was obtained (USGS maps, GPS, Internet Map sites [such as Google Earth], other). The township and range is desirable but not necessary.

Indicate whether the facility is located in Indian Country. If the facility is located in Indian Country, do not complete this NOI, instead complete form 3510-6 and submit to EPA Region VIII except for facilities on the Navajo Reservation or on the Goshute Reservation which should submit EPA form 3510-6 to Region IX.

SECTION III - SITE ACTIVITY INFORMATION If the storm water discharges to a municipal separate storm sewer system (MS4), enter the name of the operator of the MS4 (e.g., municipality name, county name) and the receiving water of the discharge from the MS4 if it is known (if it is not known please estimate or guess and indicate so). (An MS4 is defined as a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains) that is owned or operated by a state, city, town, county, district, association or other public body which is designed or used for collecting or conveying storm water).

SECTION IV - TYPE OF CONSTRUCTION Check each type of construction that applies to this application.

SECTION V – BEST MANAGEMENT PRACTICES Check each type of best management practice that will be used to control storm water runoff at the job site.

SECTION VI – ADDITIONAL Provide an estimate of the total number of acres of the site on which soil will be disturbed (round to the nearest acre). Indicate whether the storm water pollution prevention plan for the site is in compliance with approved state and/or local sediment and erosion plans, permits, or storm water management plans. An email address is required of the best contact associated with the project for the communication needs of DWQ.

SECTION VII – CERTIFICATION State statutes provide for severe penalties for submitting false information on this application form. State regulations require this application to be signed as follows:

For a corporation: by a responsible corporate officer, which means: (i) president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision making functions, or (ii) the manager of one or more manufacturing, production, or operating facilities employing more than 250 persons or having gross annual sales or expenditures exceeding $25 million (in second quarter 1980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures;

For a partnership or sole proprietorship: by a general partner or the proprietor; or

For a municipality, state, Federal, or other public facility: by either a principal executive officer or ranking elected official.

POLLUTION PREVENTION PLAN A storm water pollution prevention plan (SWP3) is required to be in hand before the NOI can be submitted. It is important to know SWP3 requirements (contained in the permit) even during the design portion of the project. A copy of the permit can be obtained from the Division of Water Quality's storm water construction web site. Guidance material for developing a SWP3 can be obtained from EPA (NTIS) or from the Division of Water Quality's storm water construction web site.

III. SITE ACTIVITY INFORMATION

Municipal Separate Storm Sewer System (MS4) Operator Name: ___NA___________________________

Receiving Water Body: ______________________________ **(this is known ☐ this is a guess ☐)**

Estimate of distance to the nearest water body? ______________________ **ft. miles. (circle one)**

List the Number of any other UPDES permits at the site: _____________ ______________

IV. TYPE OF CONSTRUCTION (Check all that apply)

1. ☐ Residential 2. ☐ Commercial 3. ☒ Industrial 4. ☐ Road 5. ☐ Bridge 6. ☐ Utility

7. ☐ Contouring, Landscaping 8. ☐ Other (Please list) ___________________________

V. BEST MANAGEMENT PRACTICES

Identify proposed Best Management Practices (BMPs) to reduce pollutants in storm water discharges: (Check all that apply)

1. ☒ Silt Fences 2. ☐ Sediment Pond 3. ☒ Seeding/Preservation of Vegetation 4. ☒ Mulching/Geotextiles

5. ☒ Check Dams 6. ☒ Structural Controls (Berms, Ditches, etc.)

7. ☐ Other (Please list) ____________________________

VI. ADDITIONAL

Estimated Area to be Disturbed (in Acres): _________160_____________ **Total Area (in Acres):**_____160__________________

A storm water pollution prevention plan has been prepared for this site and is to the best of my knowledge in Compliance with State and/or Local Sediment and Erosion Plans and Requirements. Y ☒ N ☐
(A pollution prevention plan is required to be on hand before submittal of the NOI.)

Enter the best e-mail address to contact the permittee: __wgibbs@americansandsenergy.com__________________________

VI. CERTIFICATION: I certify under penalty of law that I have read and understand the *Part 1* eligibility requirements for coverage under the general permit for storm water discharges from construction activities. I further certify that to the best of my knowledge, all discharges and BMPs that have been scheduled and detailed in a storm water pollution prevention plan will satisfy requirements of Part 1, and Part 3 of this permit. I understand that continued coverage under this storm water general permit is contingent upon maintaining eligibility as provided for in Part 1.

I also certify under penalty of law that this document and all attachments were prepared under the direction or supervision of those who have placed their signature below, in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Print Name (of responsible person for the main operator from first page): **Date:**

______________________________________ ____________

Signature:

Print Name (of responsible person for the 1st co-permittee from first page): **Date:**

______________________________________ ____________

Signature:

Print Name (of responsible person for the 2nd co-permittee from first page): **Date:**

______________________________________ ____________

Signature:

Print Name (of responsible person for 3rd co-permittee from first page): **Date:**

______________________________________ ____________

Signature:

Amount of Permit Fee Enclosed: $_______________

ATTACHMENT 1

Utah Groundwater Discharge General Construction Permit Application Information for Green River Resources, Inc. Bruin Point Mine Project

Utah Ground Water Discharge Construction Storm Water General Permit

for

Green River Resources, Inc.

Bruin Point Mine Project

1. Background

American Sands Energy Corporation (ASEC) has applied for a Ground Water Discharge Permit (GWDP), from the Utah Division of Water Quality (DWQ). This application for construction relates to that GWDP for the dry tailings impoundment and includes typical engineering design plans and specifications that are submitted for approval by DWQ. To facilitate the public comment period, graphics and public review versions of specification and documents are being provided.

2. Construction Drawings and Specification

2.1 Drawings

- Map 1 Plant Site-Grading Plan
- Map 2 Dry Tailings Impoundment
- Map 3 Typical Cross Section Dry Tailings Impoundment (Cover and Base)
- Map 4 Portal Topo
- Map 5 Portal Closure
- Map 6 Typical Geologic Cross Section
- Map 7 Top Soil-Grading Plan
- Map 8 Dry Tailings Typical Sections xx
- Map 9 Typical Cross Section Dry Tailings Impoundment (Weeping Tile)
- Map 10 Typical Sections (Retention Basin)
- Topsoil Removal – Replacement Year 2 through 6

2.2 Specifications

- Embankment Liner Tailings Cover
- Earthwork Construction Quality Control Plan
- Retention Basin
- Weeping Tile
- Synthetic Liner Installation

2.3 Graphics

- Figure 1 Location Map
- Figure 2 Mine Plan Map
- Figure 3 Material Handling Plan
- Figure 4 Conceptual Surface Water Control Plan

2.4 Appendix A

- Preliminary Stability and Hydrology Analyses

3. Discussion

American Sands Energy Corporation (ASCE) is a Delaware Company with primary operations in Utah. The Company has acquired rights to oil sands ore covering approximately 1,760 acres (Lease Boundary) of prime oil sands resources (known as the Sunnyside deposit) in the Bruin Point area in the Book Cliffs of Utah. The Company has licensed proprietary extraction technology for bitumen and hydrocarbon extraction process that separates oil and other hydrocarbons from sand, dirt and other substances on a 99% efficiency basis, without creating environmental hazards. Based upon prototype trials and feasibility studies, American Sands is proposing to produce and deliver 5,000-10,000 barrels per day of bitumen extracted from the Green River Formation oil sands.

American Sands acquired Green River Resources (GRR), a privately-held company that controls the oil sands ore property in Carbon County, Utah. Through the Green River acquisition, the Company also acquired exclusive use in Utah of the proprietary process mentioned above. GRR will be using this new technology to extract bitumen from ore mined from the deposit. The extraction plant will be located within the Lease Boundary, in eastern Carbon County, Utah as shown in **Figure 1**.

During the first 5 years of bitumen extraction sand tailings (clean, dry sand) will be placed in a permanent surface tailings disposal area. There is no tailing pond associated with either the process or the surface tailings disposal area. The tailings pile will be equipped with a retention basin designed to collect and store meteoric water that penetrates the pile during its construction. As mining activities advance, sorted tailings will be used as underground mine backfill. There is no anticipated impact to surface or groundwater resources either during the period where tailings are being disposed of on surface or during the underground tailings disposal period of mine operation. Underground disposal of tailings will commence in the sixth year of mining activities.

It is anticipated that there will be no impact to surface or groundwater because the mining and processing activities are designed to be zero discharge. Furthermore, all storm water runoff will be captured and will either be left to evaporate, used for dust control or will be hauled off site by a licensed contractor. The *de minimis* use of water on site will not impact groundwater or surface water. GRR proposes ongoing monitoring of certain seeps and springs to provide additional evidence supporting the lack of impacts to water.

3.1 Operation Description

3.1.1 Site Development

The development of full-scale mining operations will begin with preparation of surface facilities and portal development. Vegetation will be cleared and topsoil will be stockpiled for use in reclamation. The site will only be leveled in areas required for operations and equipment. Areas that will be used for truck traffic within the Lease Boundary on 160 acres will be paved using some of the oil sands mixed with road base. Equipment and utility access will be developed from the plant site to the portal. Crushed rock mined from the face of the portal will be used to develop a pad to accommodate mine surface facilities. The pad will be large enough to contain the support facilities including a parts trailer, portable office, substation, fan house, two fuel tanks and two water tanks. All liquid stored on-site including fuel, oil, and lubricants, water, solvent and bitumen will be stored in tanks. The tanks will be constructed with secondary containment consistent with the Spill Prevention, Control and Countermeasure (SPCC) Plan. The total contained volume of the bermed area will be at least 110% of the volume of the largest tank contained in the farm. Tanks will be underlain by impermeable liners, such as HDPE, to prevent migration of spilled or leaked hydrocarbons into the soil. The impermeable liners will be integrated with secondary containment berms and sealed against them. If any spills occur during mining or processing these will be managed as outlined in the SPCC Plan.

Following the initial underground mine development the parts trailer, portable office, substation and fan house will be the only facilities left outside of the mine and they will be located directly outside of the portal. As mining advances, the balance of the support facilities and equipment will be moved to permanent locations underground. After portal development, underground mining will commence using a room and pillar method. **Figure 2** illustrates the locations of mine and processing plant features.

3.1.2 Overall Operation Description

The extraction process employed by GRR will use a proprietary solvent to separate bitumen from crushed ore. Mining, maintenance, and processing facilities will be located on-site and mining and processing operations will occur simultaneously. Development of the mine site will follow these general steps:

- Land clearing (where appropriate)
- Soil removal and stockpiling
- Work area preparation (leveling and placement of gravel)
- Portal development
- Entry development

The general mining sequence will consist of the following unit operations:

- Ore extraction (drilling, blasting, and hauling to processing pad)
- Ore crushing and stockpiling
- Solvent treatment/bitumen extraction and solvent recovery
- Placement of sand tailings on surface (and eventually, as backfill underground)

The mine development plan includes clearing and grubbing operations, installation of storm water controls, and salvaging of soil prior to mining the oil sands. Topsoil will be salvaged and stockpiled to be used during the reclamation phase. The mine opening will be developed at approximately 9,100 feet elevation along the cliff face. The road to the portal from the plant site will need to be in place in order for equipment to gain access to the portal location. Once the portal is developed mining will proceed underground. The initial underground mining will involve the development of four entries. Mining will continue with the development of rooms and pillars shown on the underground mine Materials Handling Plan, **Figure 3**.

The ore will be drilled and blasted to advance an upper bench and an underlying bench. Once the ore has been blasted it will be loaded with front end loaders and hauled using 25- to 40-ton haul trucks. Initially the sizing and sorting equipment and operations will be located at the portal bench. Ore mined during the first year of mining activities will be hauled to the material handling and sizing equipment located near the portal area. After the first year, sizing and sorting operations will be relocated from the portal area to a mined out area underground. Ore mined will be hauled to the plant site via the mine access road. The material handling system at the mine will consist of: screens, crushers, sorter, conveyor belt line, and ore stockpiles.

Crushed, sorted, and mined ore will be transported in haul trucks via the main haul road to the process area and discharged into the material handling equipment at the plant feed stockpile. This plant site stockpile will contain 30,000 tons of ore and will be available to provide feed in the event of disruption of ore supply from the mine.

The processing facilities will be located on the upper bench near Bruin Point. These facilities will be designed to extract bitumen from the ore producing clean, dry sand (tailings) and a liquid bitumen product. The major structures located in this area include the office and associated parking area, warehouse and maintenance shop, process equipment, tank farm, electrical building, and stockpiles of crushed ore and tailings.

The process produces tailings that consist of dry, clean sand as a byproduct. Based on pilot testing results, the sand tailings will contain between 2 and 25 parts per million (ppm) of the proprietary solvent. The consistency of the tailings is coarse grained sand with a very low organic carbon content after processing. The dry sand tailings disposal area will be developed in an area north of the plant site. The area is designed to hold 14 million cubic yards or five years of dry sand tailings production. The stockpile will feature a compacted base and cover constructed of 4 feet of impermeable clay material at $1x10^{-7}$cm/s. The system will include a capillary barrier on top of the clay cover with 18 inches of growth media above the capillary barrier. A sloped weeping tile will be installed above the clay base and will run downhill from the highest point in sand pile to a lined retention basin. A barrier consisting of a berm will be constructed across the interface between the working and capped sections of the pile in order to separate meteoric water deposited on the working portion of the pile from that deposited on the capped section of the pile. Water deposited on the working part of the pile will be collected to the retention basin through the above mentioned weeping tile system. Water deposited on the capped section of the pile will be returned to the North Spring and Range Creek recharge systems through the capillary break feature.

This system will serve the following purposes:

1. The clay cap and liner systems will seal the tailings pile from the environment and prevent the infiltration of meteoric water into the pile.
2. The weeping tile system and lower clay liner will contain any meteoric water, should it infiltrate the pile, collect it and deliver it to a lined retention basin for analysis and ultimate disposal.
3. The capillary system will direct meteoric water deposited on the tailings pile off to the side of the pile and back into the North Spring and Range Creek Recharge system.
4. The berm dividing the working and capped sections of the pile will serve to prevent meteoric water deposited on the working section of the pile from entering the environment.

The sand tailings will be placed in controlled lifts. As the material is placed from the bottom of the site upwards, when final slopes can be reclaimed, a clay cap consisting of approximately four feet of $1x10^{-7}$ cm/s permeability of will be used to cover the sand tailings. Topsoil which has been removed from the site and stored in a designated area will be used to cover the clay cap to enhance successful revegetation and final reclamation activities. The capillary barrier system will ensure that water collected on the cap will flow off the cap and be available to recharge the groundwater system, described further in

Section 8.4 of the Groundwater Discharge Permit Application (GRR, 2015b). A more detailed description of the mine and reclamation plans are in the Notice of Intention to Commence Large Mining Operations, M/007/0040, submitted to the Division of Oil, Gas and Mining (DOGM) (GRR, 2015a).

The system in its entirety will be designed to exclude water from the tailings while collecting water that does enter the tailings, and delivering it to the collection basin, thereby excluding it from the environment. An analysis was conducted to evaluate the behavior of residual solvent remaining in the tailings impoundment. The evaluation consisted of: (1) performing quantitative calculations to estimate the mass of solvent contained in the tailings in the impoundment, (2) estimating the retention capacity of the sand tailings to evaluate how much solvent can be held immobile in the pore space of the sands, (3) comparing the mass of solvent to the retention capacity to estimate whether sufficient mass of solvent will be present to allow downward vertical migration of free phase solvent, and (4) qualitatively evaluating the fate of any free phase solvent that may exist in the impoundment. For more information see Fate and Transport Evaluation of Residual Solvent in Sand Tailings (URS, 2015) located in Appendix D of the Groundwater Discharge Permit Application (GRR, 2015).

3.1.3 Extraction Process

Extraction of bitumen from oil sands ore will take place on-site. Crushed ore from the underground mine will be transported to a crushed ore storage area near the processing area. Storage of crushed ore near the process area allows for volumes of ore to be constantly available as feedstock for the bitumen extraction process. Prior to being fed into the process, recovered ore will be crushed to a size no greater than ¼-inch and fed into a hopper to be mixed with extraction solvent. The material safety data sheet (MSDS) and properties of the proprietary solvent are located in Appendix E of the Groundwater Discharge Permit Application (GRR, 2015b).

Solvent-wetted sand will then be mixed with additional solvent in an auger system. The wet sand/solvent mixture will flow from the auger to a closed settling tank. In this tank, sand will settle to the bottom and solvent bitumen (bitsol) mixture will rise to the top. The liquid will be decanted off the vessel through a filter to remove any fines not separated from it in the decanter tank. Wet sand will be augured from the bottom of the settling tank to a system of drying augers.

The heated drying augers will serve to dry the sand in a sealed system, thus removing the solvent by application of heat. The solvent will be evaporated from the sand, and the solvent vapors thus generated will be condensed by cross exchange with chilled heat transfer fluid. Condensed solvent will be filtered and sent to a sealed holding tank. Clean, dry sand will be produced from the drying augers to sand tailings storage as detailed elsewhere in this document.

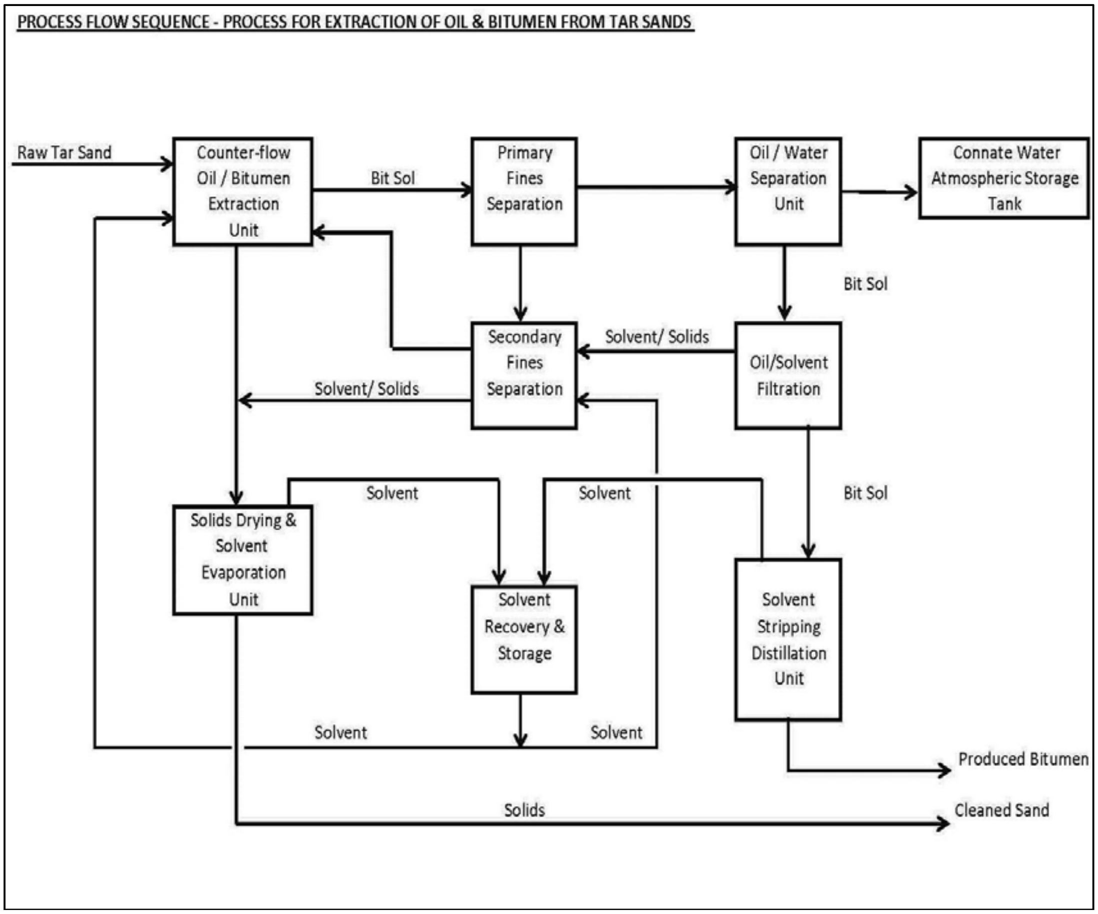
The bitsol stream from the sand washing system will be sent to a water separator. Connate (formation or naturally occurring) water will be separated from bitsol by gravity separation. This water will be sent to a water storage tank for subsequent use as underground dust control. Dry bitsol from the water separator will be heated and sent to a distillation unit.

The hot bitsol will be separated into its bitumen and solvent components under vacuum distillation. The distillation system will produce hot liquid bitumen to storage and solvent vapors. The solvent vapors will be condensed to liquid by cross exchange with cool heat transfer medium. The clean, dry solvent will be sent to storage along with the solvent recovered off the sand. Solvent will be drawn from storage and used in the sand washing portion of the plant as described above. Bitumen will be stored on-site in tanks and held for transportation to the market.

Solvent used in the operation will be recovered from both the sand and the bitumen. During the pilot testing of the process 2 ppm of solvent remained in the dry sand tailings. Operation of the plant will produce a sand product with no more than 25 ppm of solvent weight to weight (w/w) in the dry sand tailings. Bitumen produced from the process will contain a maximum of 0.5% volume percent (v/v) of solvent. This solvent will be shipped from site with the bitumen product and delivered to a refinery. These two streams (dry sand to storage with a maximum solvent content of 25 ppm and the bitumen product with a solvent content of 0.5%) represent the two streams to which solvent will be lost. All other solvent will be recovered and reused in the process. For more information see Fate and Transport Evaluation of Residual Solvent in Sand Tailings (URS, 2015) located in Appendix D of the Groundwater Discharge Permit Application (GRR, 2015).

Clean, dry sand or "tailings" will be stored in the above-referenced sand tailings area for the first 5 years of operation and will be returned to the underground workings as backfill after the 5^{th} year of operation. **Exhibit 3.1.3** below illustrates the process flow sequence for the bitumen extraction from the oil sands.

EXHIBIT 3.1.3 Process Flow Diagram



All liquid stored on site including fuel, oil, lubricants, water, solvent, and bitumen will be stored in aboveground tanks. The tanks will be constructed with secondary containment consistent with the Spill Prevention, Control and Countermeasure Plan (SPCC Plan). The total contained volume of the bermed area will be at least 110% of the volume of the largest tank contained in the farm. Tanks will be underlain by impermeable liners, such as high-density polyethylene (HDPE), to prevent migration of spilled or leaked hydrocarbons into the soil. The impermeable liners will be integrated with secondary containment berms and sealed against them. If any spills occur during mining or processing these will be managed as outlined in the SPCC Plan.

All tank connections that have a potential to be open to the atmosphere will be contained inside the tank dykes. Therefore, all load lines and drains will terminate inside the dyke. All load stations will also be equipped with spill boxes. These boxes will be connected to the end of the load connections and will be sealed around them. The boxes will come equipped with a sealed lid designed to keep out rain and snow, and will be designed to contain small leaks and drips associated with the normal use of the load connections. The boxes will be inspected on a schedule and cleaned as required. All materials removed from the boxes will be returned to their source tanks or disposed of in a manner in keeping with their identity and condition.

Any spills from the tanks to the bermed areas will be contained by these structures. Liquid collected in the berm areas will be identified and quantified. Material will be returned to the appropriate source tank or disposed of off site by a licensed contractor.

The tanks will be installed in the berms on piles with the bottoms of the tanks elevated off the ground. The aforementioned tank liner material will be continuous under the tanks and around the piles, and will be sealed against the piles by rubber seals. In this way, the underside of the tanks will be kept out of any accumulated precipitation, and can be subject to periodic inspection for corrosion or damage.

If meteoric water that accumulates inside berms and other such structures is contaminated by spills, the water will be disposed of by a licensed contractor off site. If is it not contained it will be allowed to evaporate or be recovered and used for dust control. See **Figure 4** showing the Conceptual Surface Water Control Plan.

4. Reclamation and Closure Evaluation

Upon completion of mining activities, the mine and processing facility sites will be reclaimed with the goal of creating open space and wildlife habitat, consistent with current land use. Equipment and facilities will be removed from the site and the site will be regraded, topsoiled, and reseeded to create a safe, stable, and environmentally functioning site.

As part of the reclamation process, all buildings and facilities will be removed from the site. The office, maintenance building, warehouse, change house, substation, fan house, materials handling equipment, support and mining equipment, and tanks will be hauled away to a licensed disposal facility. The mine office and power center are modular pieces of equipment and will be hauled off as intact structures. Approximately 67% of the underground mine workings will be backfilled with the material from the sand tailings temporary storage area, including reserve and reject ore and sand and fine tails. The permanent dry sand tailings storage area will be regraded to at least a 2.5-3H:1V slope to achieve a natural-looking landscape. Maintenance and haul roads will be deep-ripped to relieve compaction, regraded to match site topography, then topsoiled and seeded.

After equipment and facilities have been removed and the site has been regraded, stockpiled topsoil will be redistributed around the site, except in those areas where armored drainage channels have been installed, and beyond a practical distance on the upper slope. The newly placed topsoil will be ripped on the contour to provide a roughened surface to retain seeds and enable root penetration. Vegetative matter that was salvaged during topsoil storage will be spread with topsoil to provide additional organic matter and aid in water retention. Seeds will be broadcast as soon as possible following seedbed preparation. Fertilizer and mulch are not anticipated for use in reclamation efforts.

Visual inspections will be performed during the course of reclamation activities to ensure that reclamation goals are being met. Additional visual inspections will be performed by DOGM personnel to ensure that GRR is meeting reclamation obligations under the Utah Mined Land Reclamation Act and associated rules.

After reclamation construction and until the bond is released, GRR will monitor for noxious weeds and provide weed control measures according to Carbon County directives should noxious weeds pose a problem. Weed monitoring will consist of visual surveys of the site during early summer months by a biologist familiar with noxious weeds. In addition, GRR will qualitatively and visually monitor revegetation success during the growing season for the first two years after reclamation construction. During the third year, a quantitative vegetation survey will be conducted to assess revegetation success and to determine if revegetation has achieved 70% of pre-mining cover as required by R647-4-111.13.11.

5. References

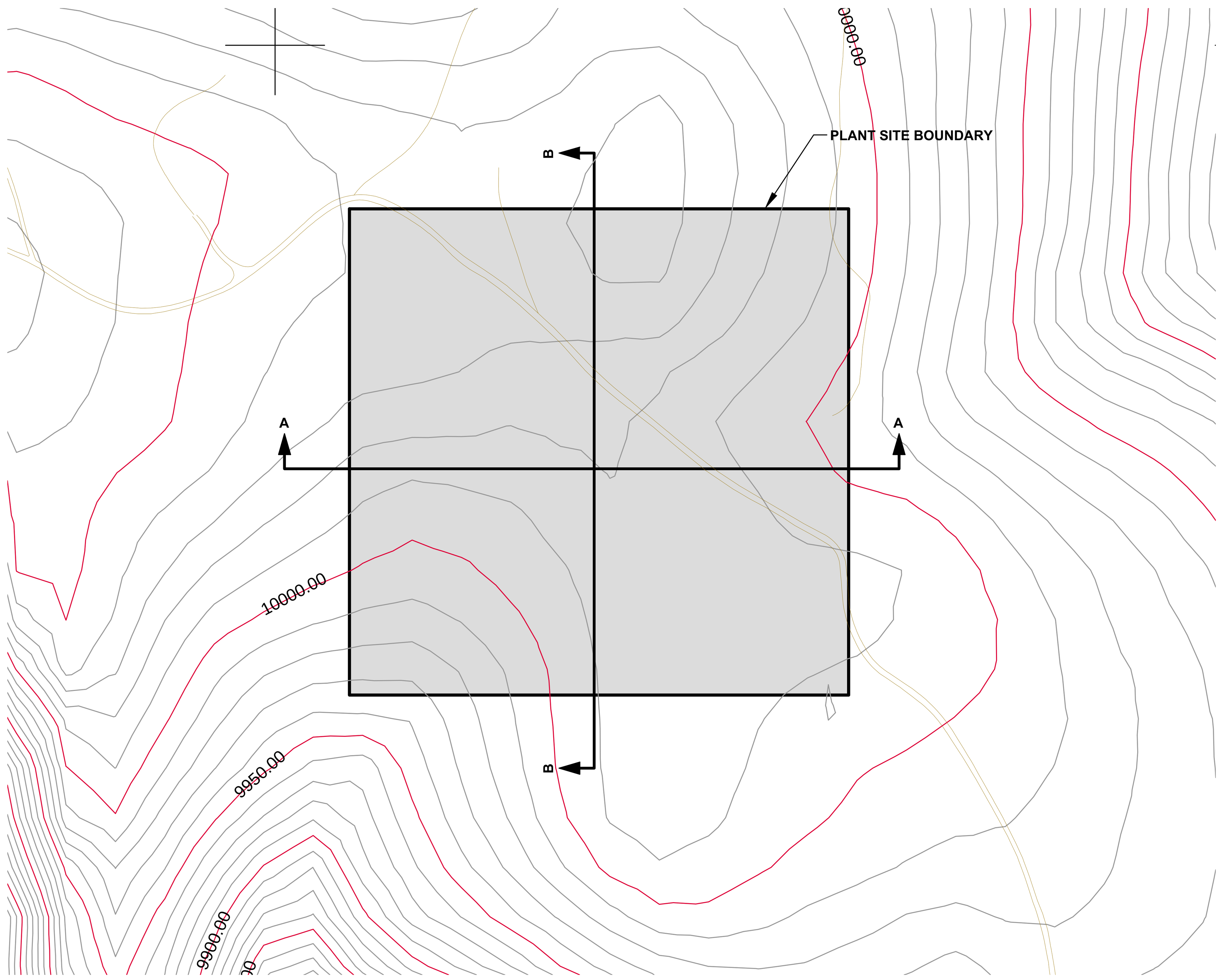
Green River Resources (GRR), 2015a. Notice of Intention to Commence Large Mining Operations, Green River Resources, Inc., Bruin Point Mine, M/007/0040. March 2015.

GRR, 2015b. Utah Groundwater Discharge Permit Application, Green River Resources, Inc., Bruin Point Mine. April 2015.

URS, 2015. American Sands Energy Corporation Fate and Transport Evaluation of Residual Solvent in Sand Tailings. Located in Appendix I of the Groundwater Discharge Permit Application (GRR, 2015c). March 2015.

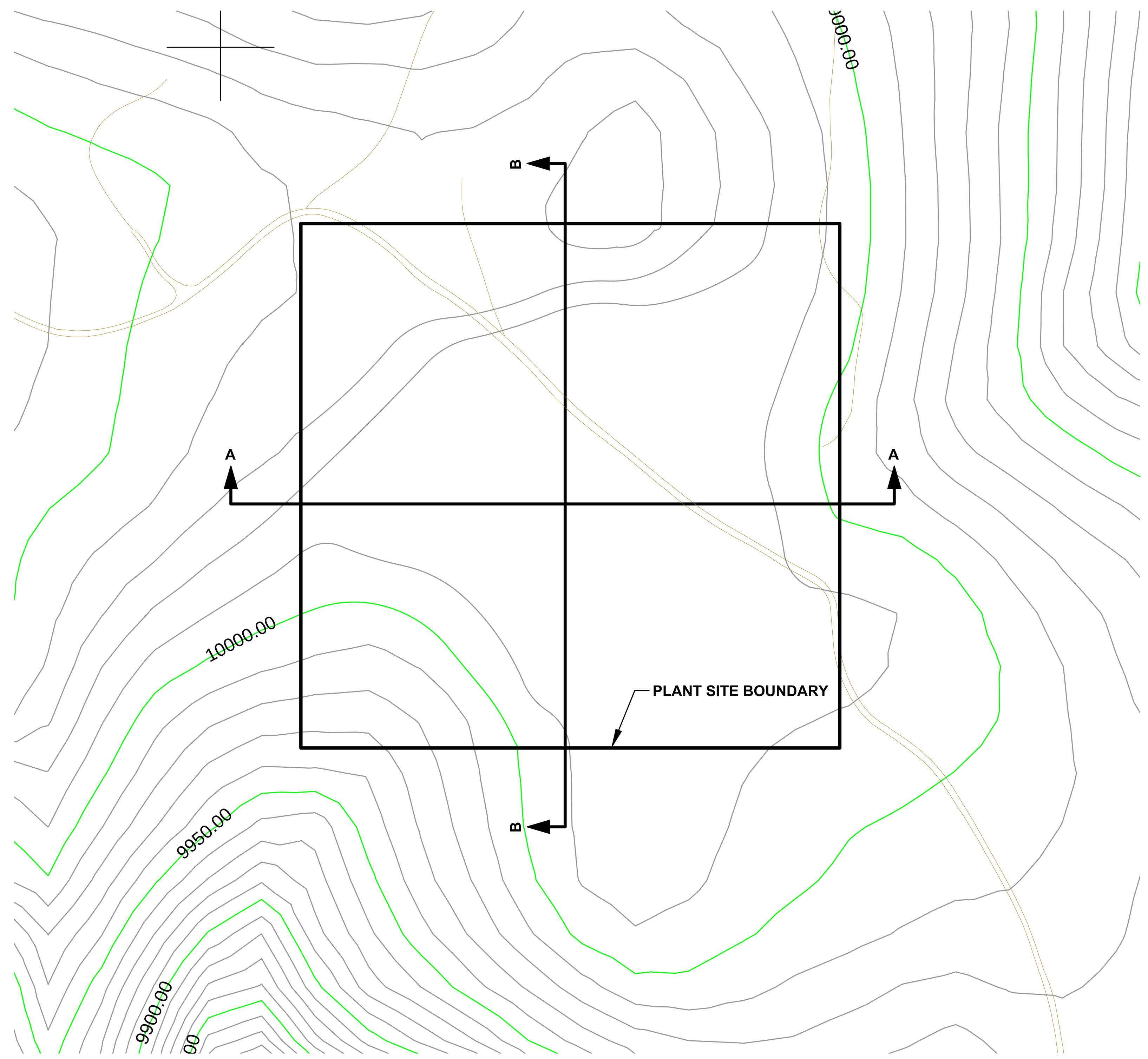
DRAWINGS

Map 1 Plant Site Grading Plan
Map 2 Dry Tailings Impoundment
Map 3 Typical Cross Section Dry Tailings Impoundment (Cover and Base)
Map 4 Portal
Map 5 Portal Closure
Map 6 Typical Geologic Cross Section
Map 7 Top Soil Grading Plan
Map 8 Dry Tailings Typical Sections
Map 9 Typical Cross Section Dry Tailings Impoundment (Weeping Tile)
Map 10 Typical Section (Retention Basin)
Topsoil Removal – Replacement Yr2 through 6



PLANT SITE
PRE-PLANT TOPO

200 FT 0 200 FT 1,000 FT



PLANT SITE
POST TOPO

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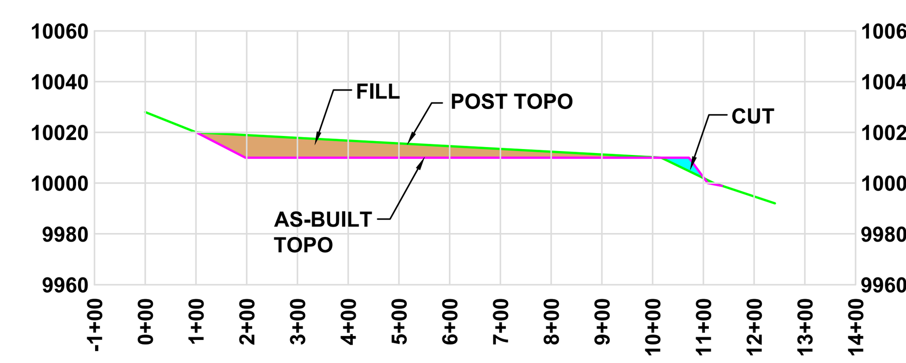
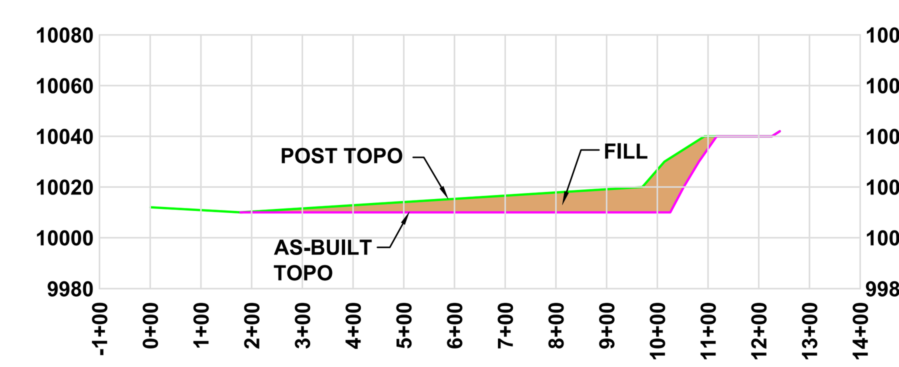


SECTION A-A
POST - PLANT SITE TOPOGRAPHY

300 FT 0 300 FT 600 FT

2H:1V MAXIMUM



SECTION B-B
POST - PLANT SITE TOPOGRAPHY

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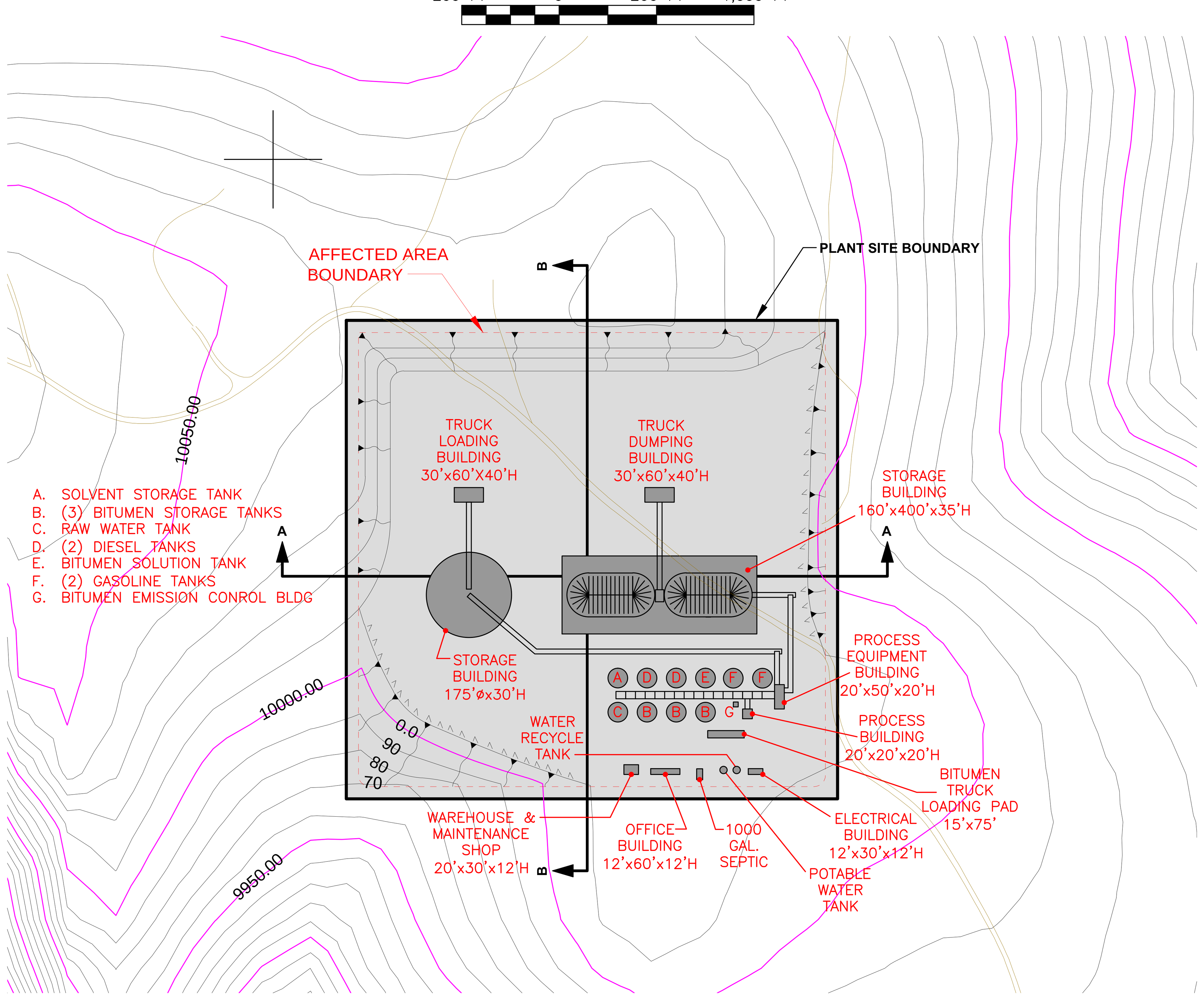
2H:1V MAXIMUM



PLANT SITE
AS-BUILT TOPO

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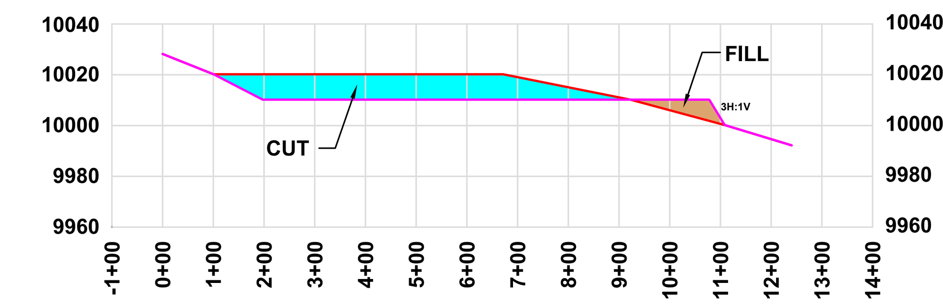

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PRE - PLANT SITE TOPOGRAPHY

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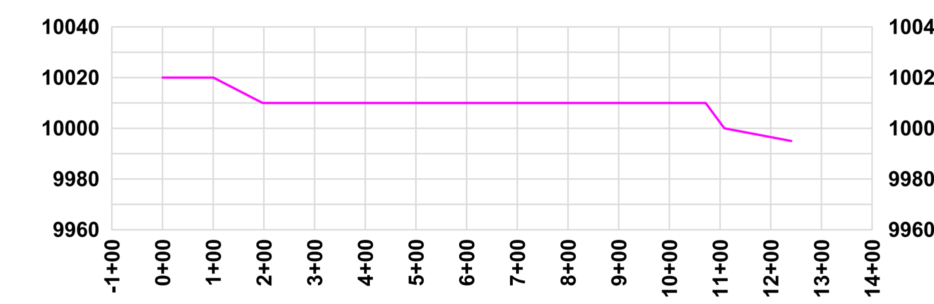
2H:1V MAXIMUM



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AS-BUILT SITE TOPOGRAPHY

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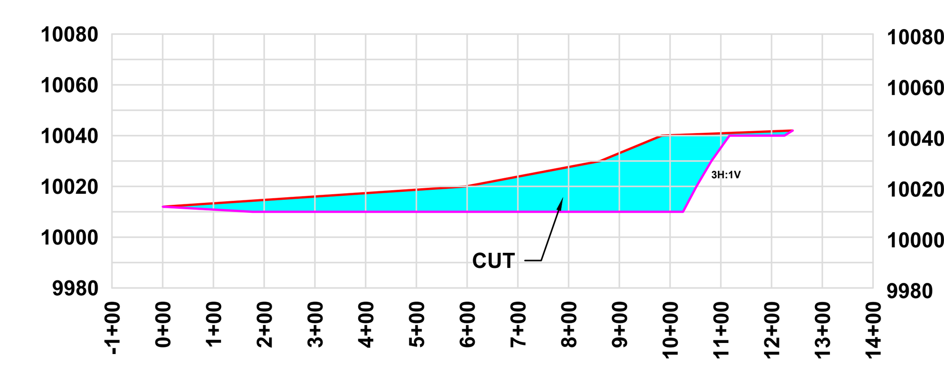
2H:1V MAXIMUM



SECTION B-B
PRE - PLANT SITE TOPOGRAPHY

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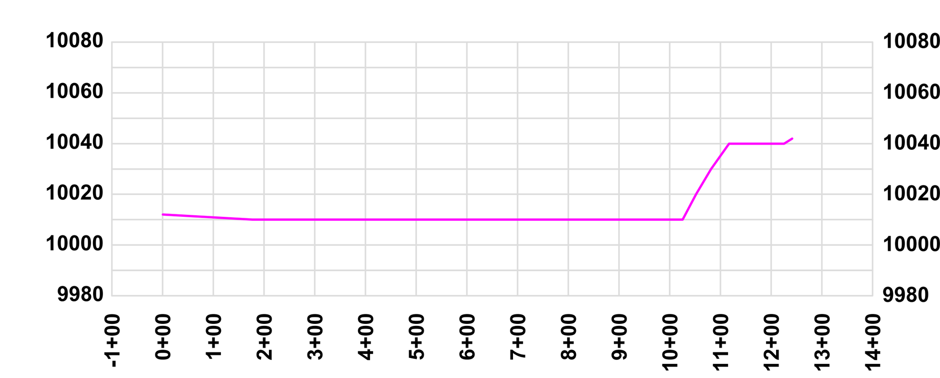
2H:1V MAXIMUM



SECTION B-B
AS-BUILT SITE TOPOGRAPHY

300 FT 0 300 FT 600 FT

2H:1V MAXIMUM

LEGEND

EXISTING ROADS

CONTAINMENT BERM

AFFECTED AREA BOUNDARY

MAJOR CONTOUR SPACING 50 FT

PRELIMINARY FEATURES LAYOUT FOR DESIGN AND ENGINEERING.

"NOT FOR CONSTRUCTION"

COORDINATE SYSTEM:

UT83-CF
UTAH STATE PLANES: NAD 83 DATUM, CENTRAL ZONE, US FOOT.

SCALE ACCURATE WHEN PRINTED AT 24"x36"

Professional Certification

No.	REVISION	DATE	BY	CHKD
6	GENERAL MODIFICATIONS	05/16/15	J&L	EDS
5	SHOW FIRE WATER TANKS	01/30/15	J&L	EDS
4	UPDATED LEGEND / POST MAP	01/09/15	J&L	EDS
3	LABEL CORRECTIONS	12/23/14	J&L	EDS
2	ADDED LABELS	12/05/14	J&L	EDS
1	DESIGN	06/06/14	J&L	EDS

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201 South Main Street
Ste.#1800
Salt Lake City, UT 84111

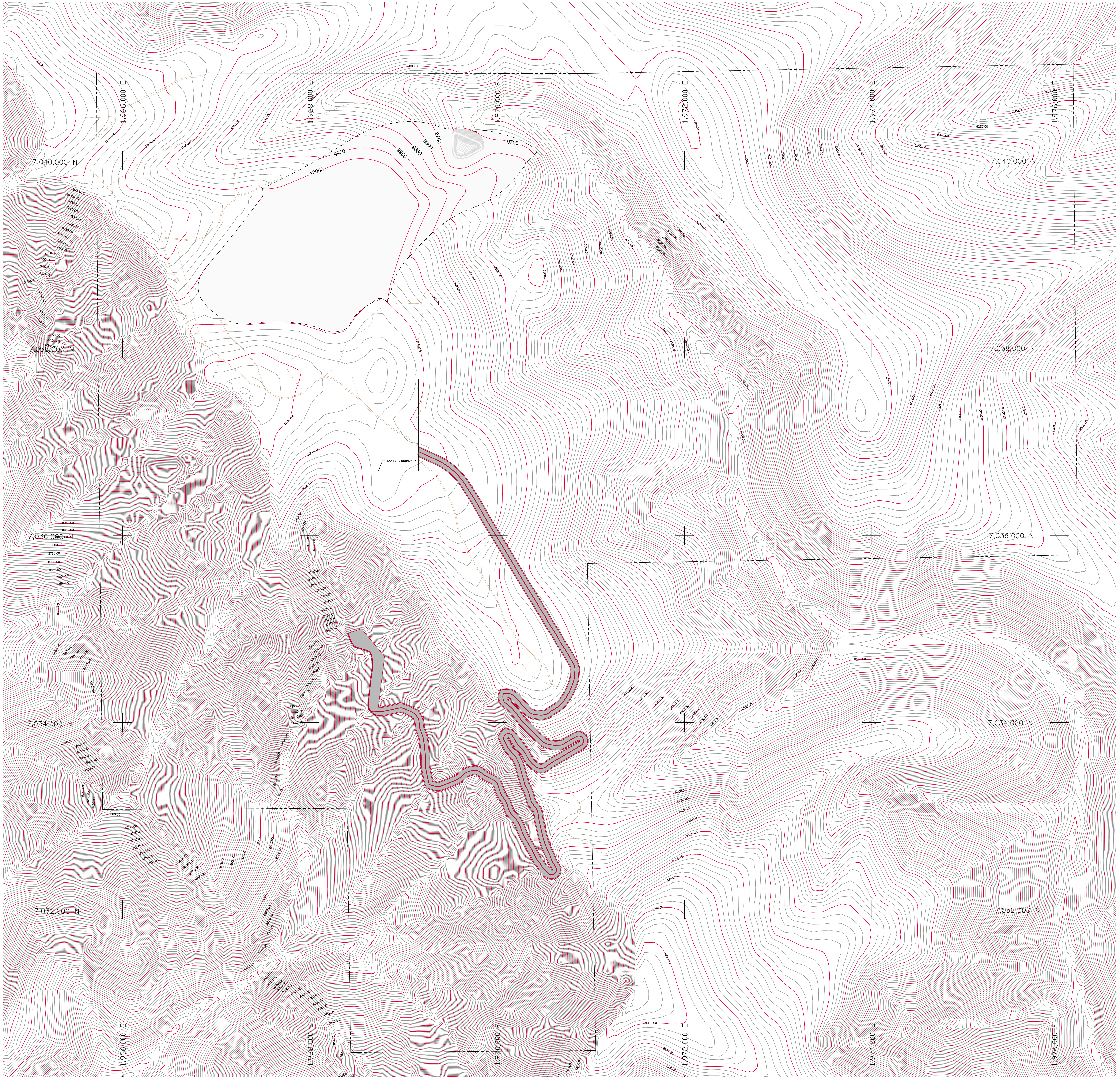
Title:

PLANT SITE–GRADING PLAN

Scale:	Date:	Design By:	Drawn By:	Approved By:
1"=200'	04/04/14	MEI	J&L	

MINE ENGINEERS, INC.
3901 South Industrial Road
Cheyenne, Wyoming 82007 USA
Phone: 307-638-8833 Fax: 307-638-0578

MAP 1



LEGEND

- LAND AFFECTED BOUNDARY
- EXISTING ROADS
- DRY TAILINGS IMPOUNDMENT
- MINE ROAD
- MAJOR CONTOUR SPACING 50 FT

PRELIMINARY FEATURES LAYOUT FOR DESIGN AND ENGINEERING.

"NOT FOR CONSTRUCTION"

COORDINATE SYSTEM:

UT83-CF
UTAH STATE PLANES: NAD 83 DATUM, CENTRAL ZONE, US FOOT.

N

400 FT 0 400 FT 800 FT

SCALE ACCURATE WHEN PRINTED AT 24"x36"

Professional Certification

No.	REVISION	DATE	BY	CHKD
5	SHOWED RETENTION BASIN	04/17/15	J&L	EDS
4	UPDATE TAILINGS STOCKPILE	01/09/15	J&L	EDS
3	FINAL	10/02/14	J&L	EDS
2	GENERAL REVISION	09/02/14	J&L	EDS
1	PRLIMINARY	02/19/14	J&L	EDS

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Title: DRY TAILINGS IMPOUNDMENT

Scale:	Date:	Design By:	Drawn By:	Approved By:
1"=400'	02/19/14	MEI	J&L	EDS

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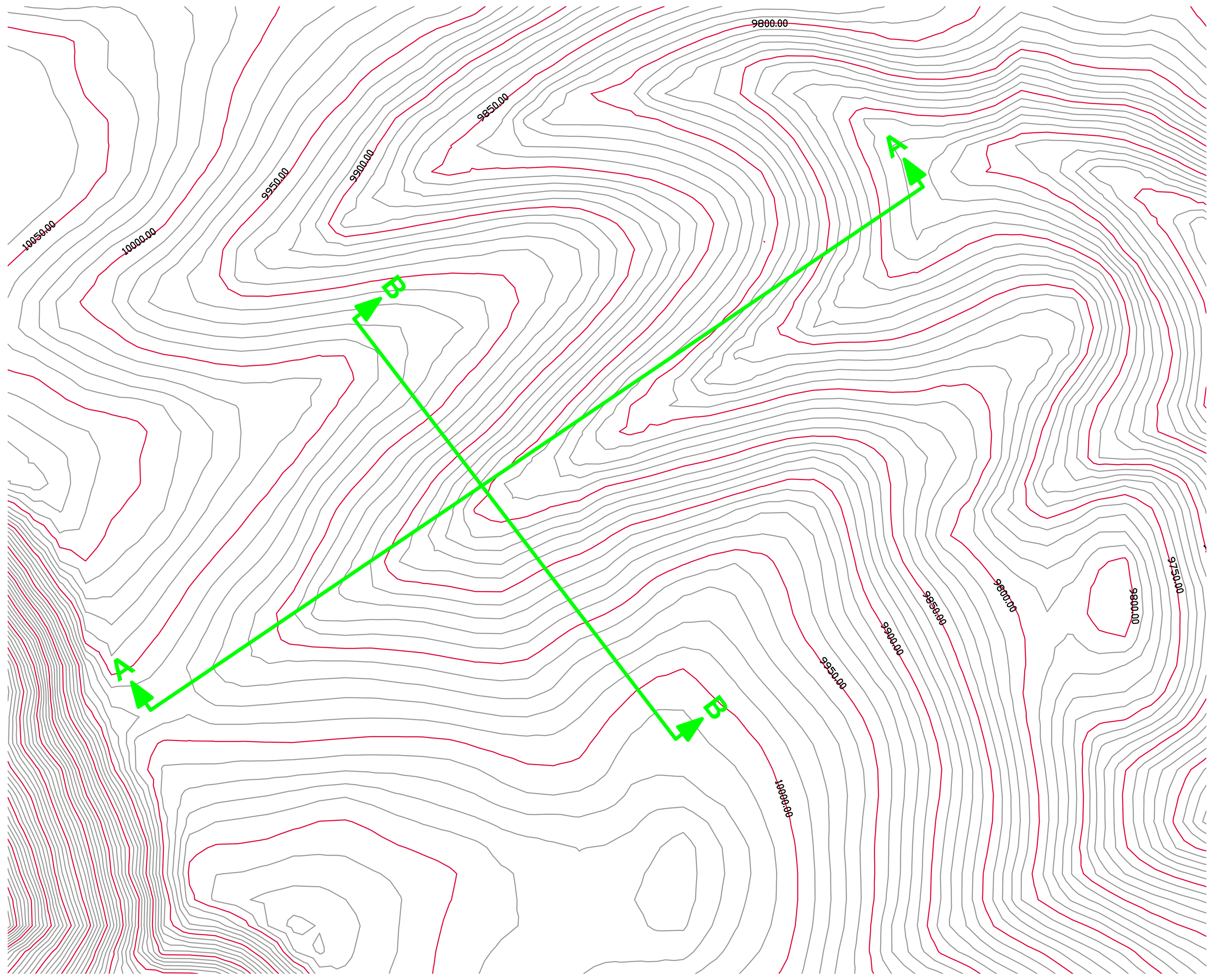
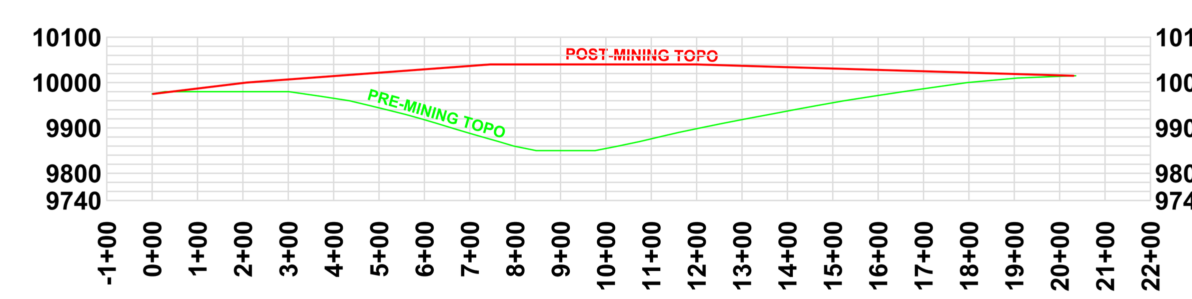
MAP 2

Y:\MEI Projects\MEI Client Files\Amercian Sands Energy_5-12\Drawings\10-12-12\DRAWINGS\PRELIMINARY DWGS 4-16-15\MAP-2.dwg, 4/17/2015 10:30:36 AM



PRE-MINING TOPO

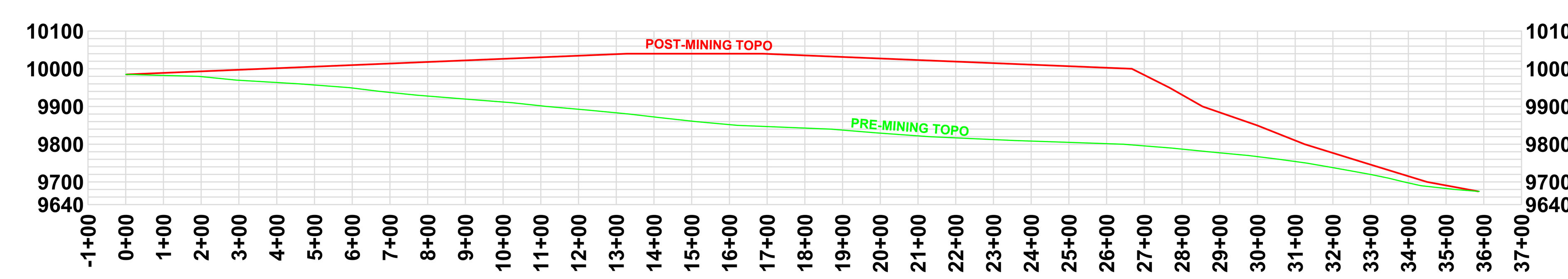
400 FT 0 400 FT 800 FT



SECTION B-B

300 FT 0 300 FT 600 FT

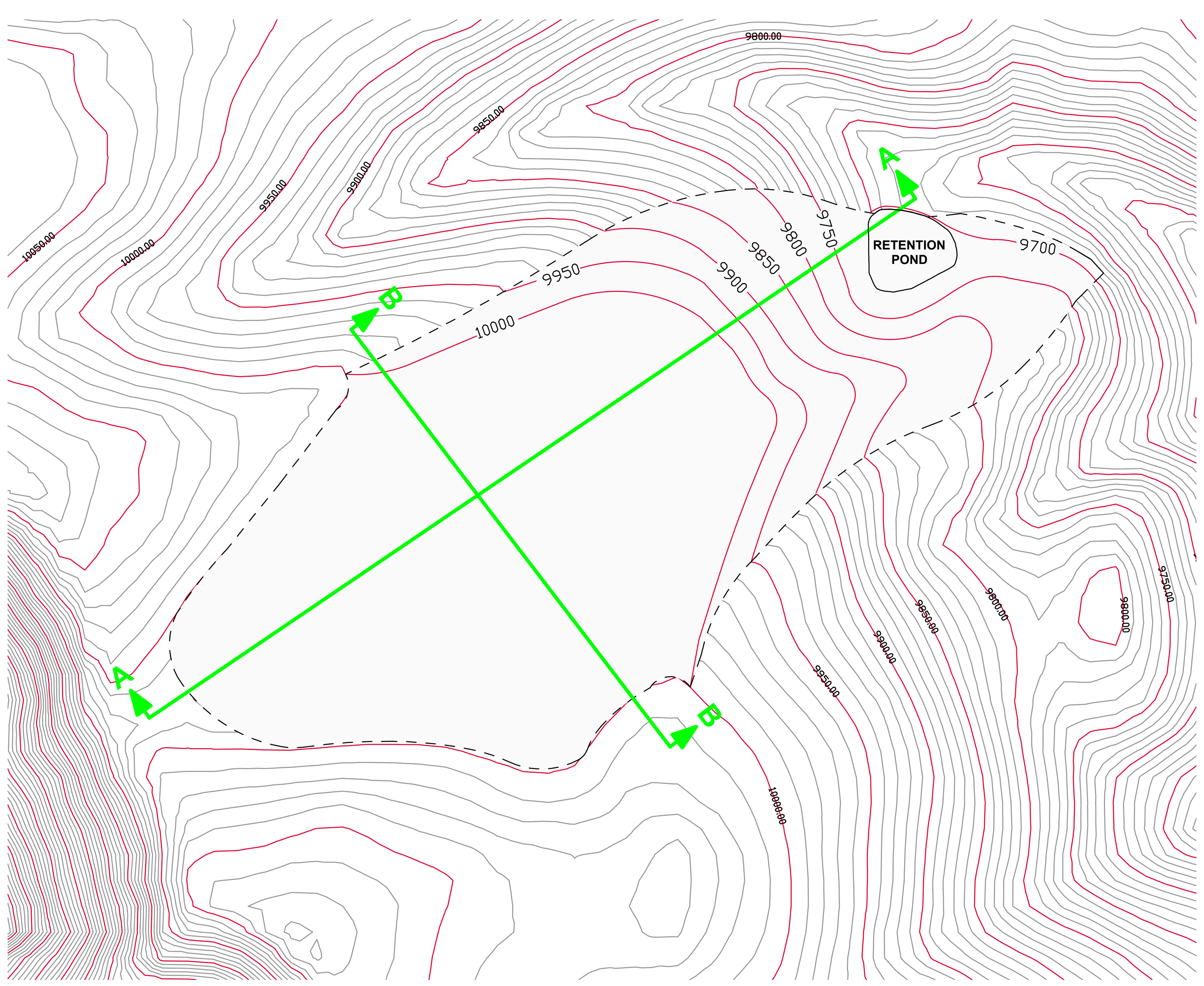
2H:1V MAXIMUM



SECTION A-A

300 FT 0 300 FT 600 FT

2H:1V MAXIMUM



POST MINING TOPO

400 FT 0 400 FT 800 FT

LEGEND

EXISTING TRAILS
DRY TAILINGS IMPOUNDMENT
MAJOR CONTOUR SPACING 50 FT

NOTE: Base to be constructed at 4 feet thick and cover to be constructed at 4 feet thick with compacted clay material to specified permeability. Cover system includes 18 inches of topsoil/plant growth medium placed on the clay cover. Reference "Summary of Preliminary HELP Model Results, American Sands Energy - Bruin Point Mine" by URS, September, 2014.

PRELIMINARY FEATURES LAYOUT
FOR DESIGN AND ENGINEERING
"NOT FOR CONSTRUCTION"

COORDINATE SYSTEM:

UT83-CF
UTAH STATE PLANES: NAD 83 DATUM, CENTRAL ZONE, US FOOT.

N

SCALE ACCURATE WHEN PRINTED AT 24"x36"

Professional Certification

No.	REVISION	DATE	BY	CHKD
6	GENERAL UPDATES	04/17/15	J&L	EDS
5	MODIFIED CONTOURS AND X-SECTIONS	01/27/15	J&L	EDS
4	MINOR GENERAL UPDATES	01/23/15	J&L	EDS
3	FINAL	10/16/14	J&L	EDS
2	MODIFIED X-SECTIONS	09/16/14	J&L	EDS
1	PRLIMINARY	02/19/14	J&L	EDS

American Sands Energy Corp
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201 South Main Street
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Salt Lake City, UT 84111

Title: TYPICAL CROSS SECTION DRY TAILINGS IMPOUNDMENT (COVER AND BASE)

Scale:	Date:	Design By:	Drawn By:	Approved By:
1"=400'	02/19/14	MEI	J&L	EDS

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3901 South Industrial Road
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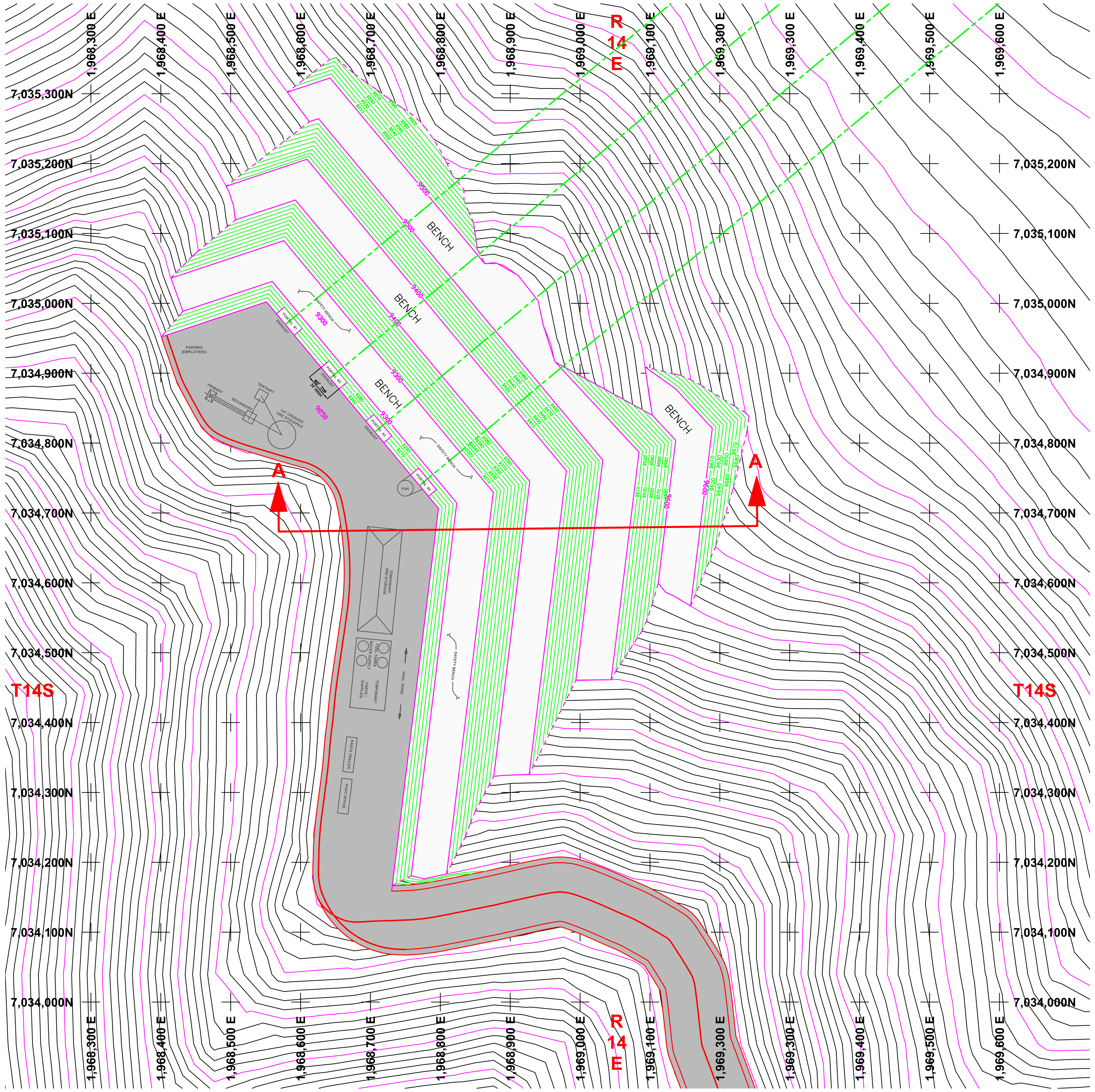
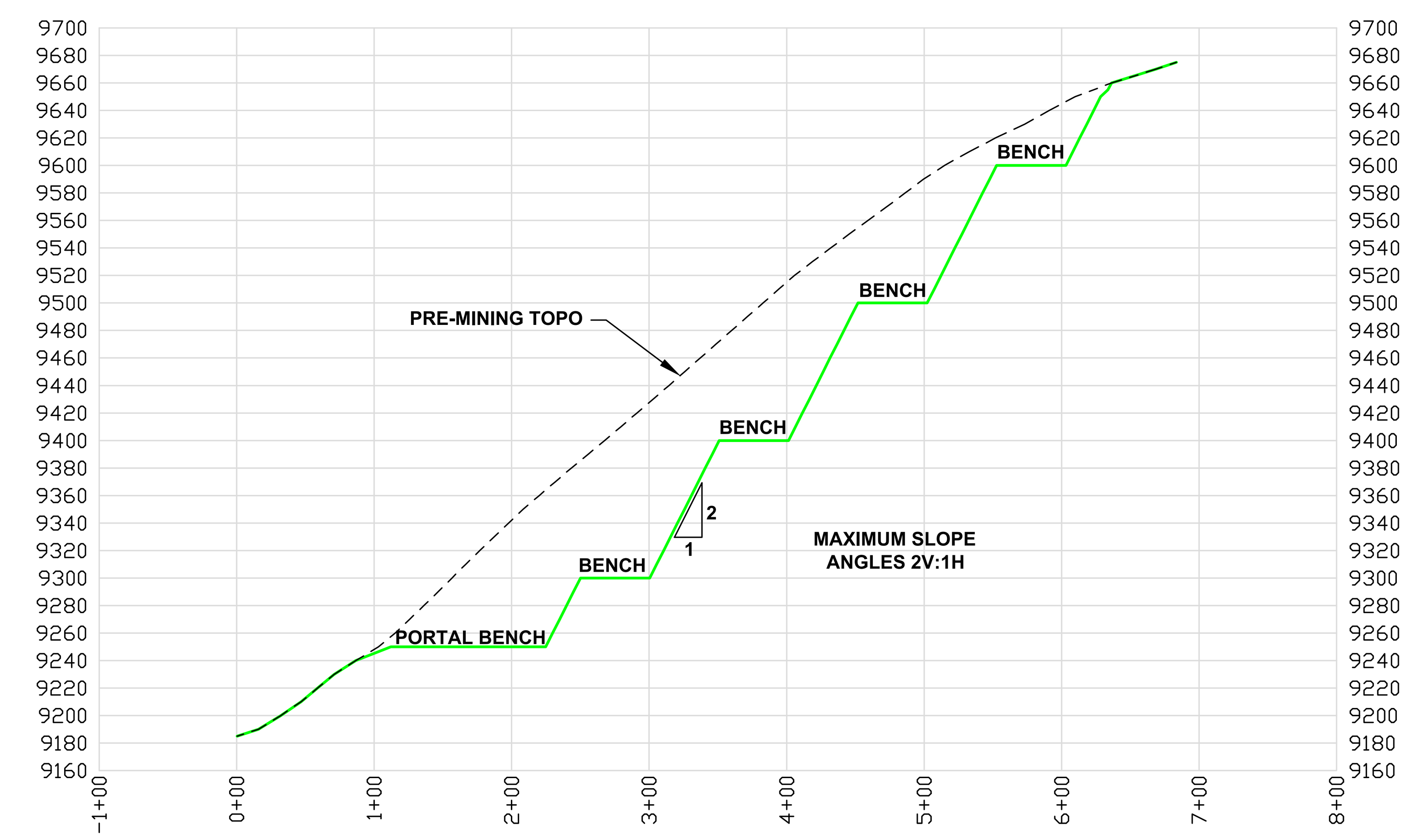
MAP 3

Y:\MEI\MEI Projects\MEI Client Files\Amercian Sands Energy_5-12\Drawings\10-12-12\DRAWINGS\PRELIMINARY DWGS 4-16-15\MAP-3.dwg, 4/17/2015 10:37:19 AM



AS-BUILT TOPO

100 FT 0 100 FT 200 FT



SECTION A-A

100 FT 0 100 FT 200 FT

LEGEND

- MINE ROAD
- CUT LINE
- PORTALS
- MAJOR CONTOUR SPACING 50 FT
- CONTOUR SPACING 10 FT

PRELIMINARY FEATURES LAYOUT FOR DESIGN AND ENGINEERING.

"NOT FOR CONSTRUCTION"

COORDINATE SYSTEM:

UT83-CF
UTAH STATE PLANES: NAD 83 DATUM, CENTRAL ZONE, US FOOT.

SCALE ACCURATE WHEN PRINTED AT 24"x36"

Professional Certification

No.	REVISION	DATE	BY	CHKD
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5	GENERAL REVISIONS	01/23/15	J&L	EDS
4	ADDED CONTOURS / SECTION	01/16/15	J&L	EDS
3	ADDED NOTE	12/23/14	J&L	EDS
2	ADDED FEATURES	12/05/14	J&L	EDS
1	DESIGN	09/30/14	J&L	EDS

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Ste.#1800
Salt Lake City, UT 84111

Title:

PORTAL TOPO

Scale:	Date:	Design By:	Drawn By:	Approved By:
1"=100'	09/30/14	MEI	J&L	

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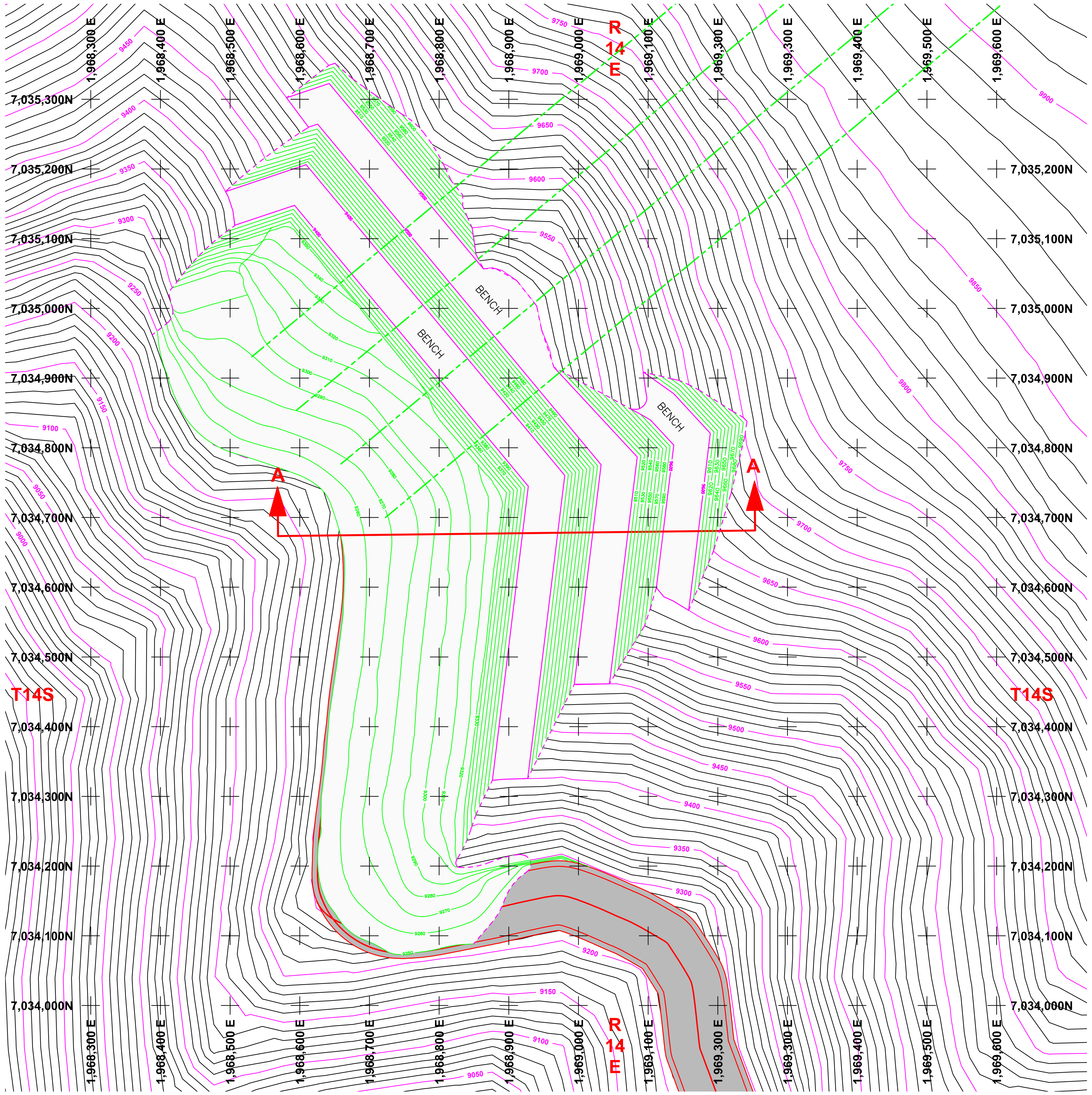
3901 South Industrial Road
Cheyenne, Wyoming 82007 USA
Phone: 307-638-8833 Fax: 307-638-0578

MAP 4



POST-MINING (PORTAL CLOSURE) TOPO

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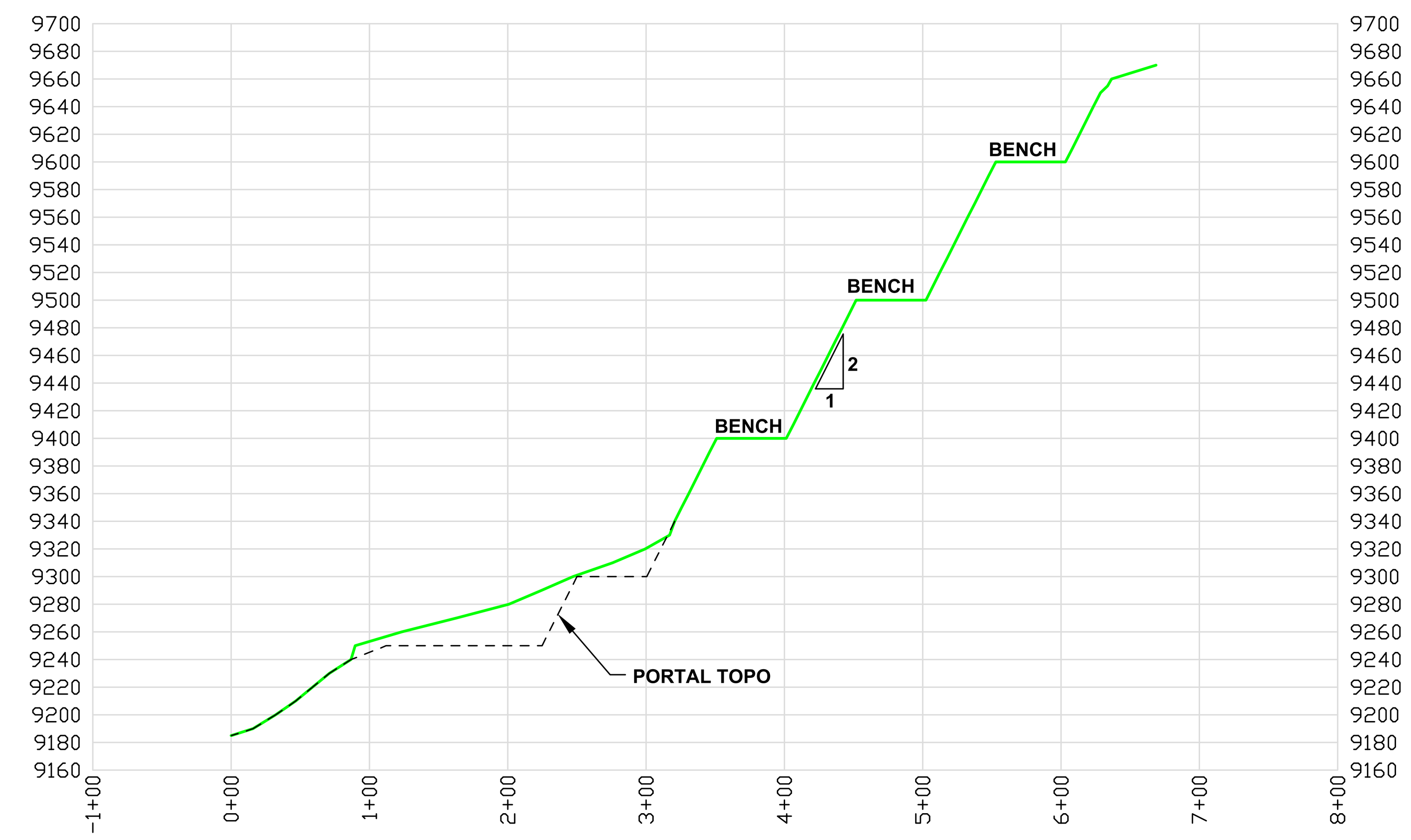

SECTION A-A

100 FT 0 100 FT 100 FT

LEGEND

MINE ROAD
CUT LINE
PORTALS
MAJOR CONTOUR SPACING 50 FT
CONTOUR SPACING 10 FT

PRELIMINARY FEATURES LAYOUT FOR DESIGN AND ENGINEERING.

"NOT FOR CONSTRUCTION"

COORDINATE SYSTEM:

UT83-CF
UTAH STATE PLANES: NAD 83 DATUM, CENTRAL ZONE, US FOOT.

N

SCALE ACCURATE WHEN PRINTED AT 24"x36"

Professional Certification

No.	REVISION	DATE	BY	CHKD
3	ADDED NOTE TO LEGEND	04/16/15	J&L	EDS
2	INCLUDED CONTOURS / X-SECTION	01/16/15	J&L	EDS
1	FINAL	10/02/14	J&L	EDS

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201 South Main Street
Ste.#1800
Salt Lake City, UT 84111

Title:

PORTAL CLOSURE

Scale:	Date:	Design By:	Drawn By:	Approved By:
1"=100'	09/30/14	MEI	J&L	

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3901 South Industrial Road
Cheyenne, Wyoming 82007 USA
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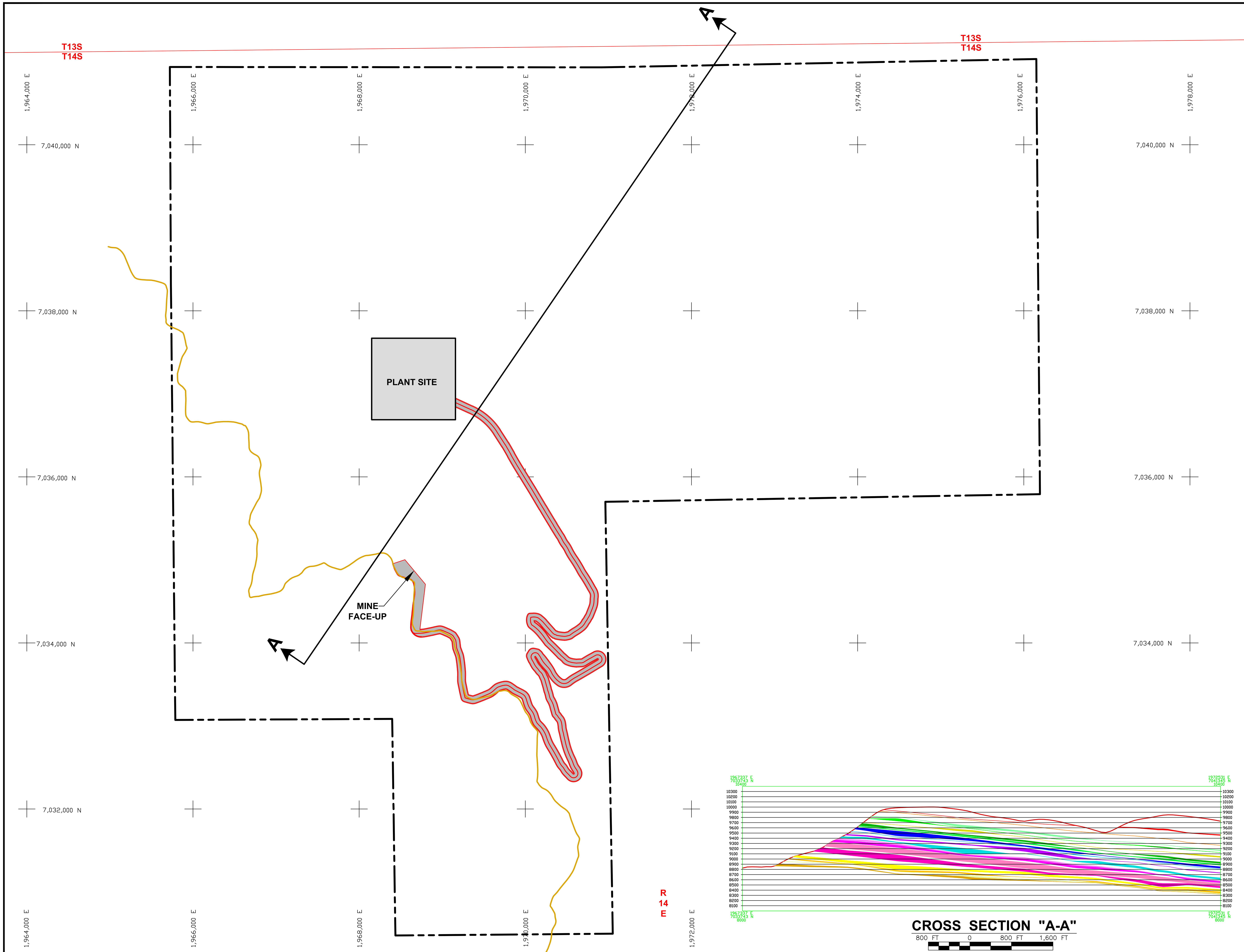
MAP 5

\MEI\MEI Projects\MEI Client Files\Amercian Sands Energy_5-12\Drawings\10-12-12\DRAWINGS\PRELIMINARY DWGS 4-16-15\MAP-5.dwg, 4/17/2015 10:53:02 AM



LEGEND

LAND AFFECTED BOUNDARY
OUTCROP
MINE ROAD

PRELIMINARY FEATURES LAYOUT FOR DESIGN AND ENGINEERING.

"NOT FOR CONSTRUCTION"

ORE SEAMS
T10
T11
T21
T22
T23
T25
T26
T31
T32
T33
T35
T36A
T36B
T37
T38
T41
T42
T43
T45
SURFACE

COORDINATE SYSTEM:

UT83-CF
UTAH STATE PLANES: NAD 83 DATUM, CENTRAL ZONE, US FOOT.

N

500 FT 0 500 FT 1,000 FT

SCALE ACCURATE WHEN PRINTED AT 24"x36"

Professional Certification

No.	REVISION	DATE	BY	CHKD
2	GENERAL REVISIONS	01/23/15	J&L	EDS
1	DESIGN	05/28/14	J&L	EDS

American Sands Energy Corp

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201 South Main Street
Ste.#1800
Salt Lake City, UT 84111

Title: *TYPICAL GEOLOGIC CROSS SECTION*

Scale:	Date:	Design By:	Drawn By:	Approved By:
1"=500'	04/04/14	MEI	J&L	

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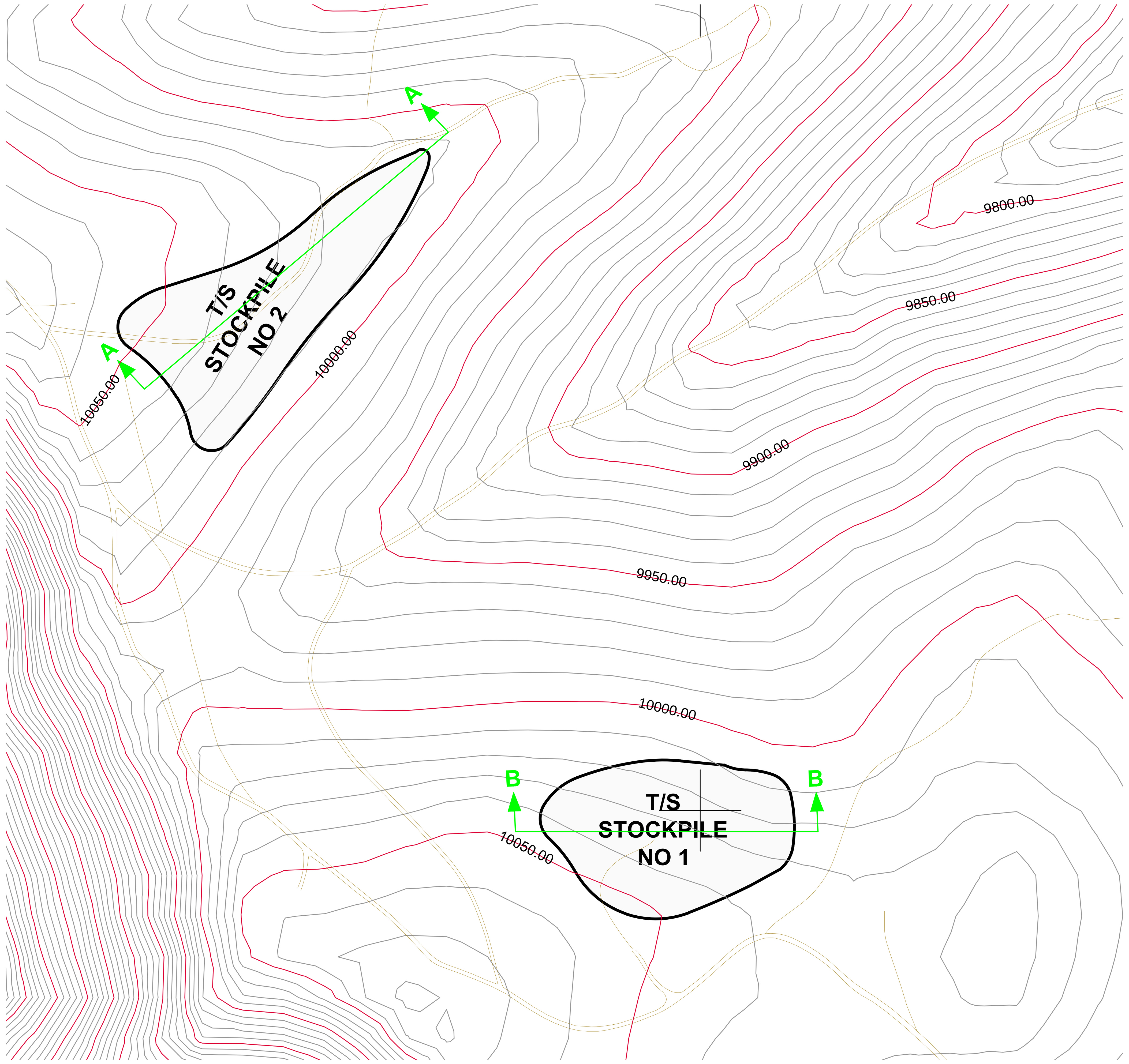
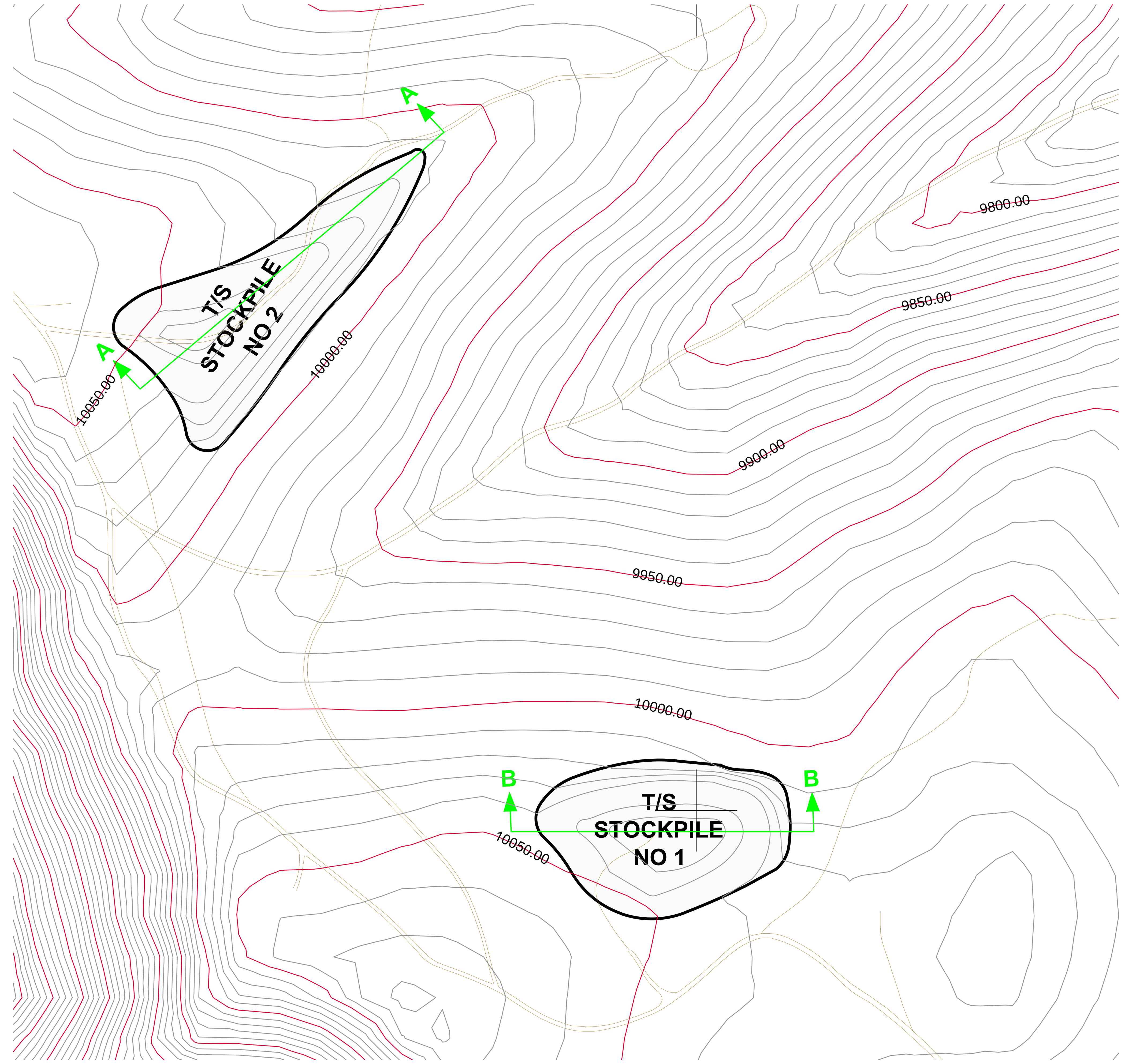
3901 South Industrial Road
Cheyenne, Wyoming 82007 USA
Phone: 307-638-8833 Fax: 307-638-0578

MAP 6



PRE-MINING TOPO

200 FT 0 200 FT 400 FT



BUILD-OUT TOPO

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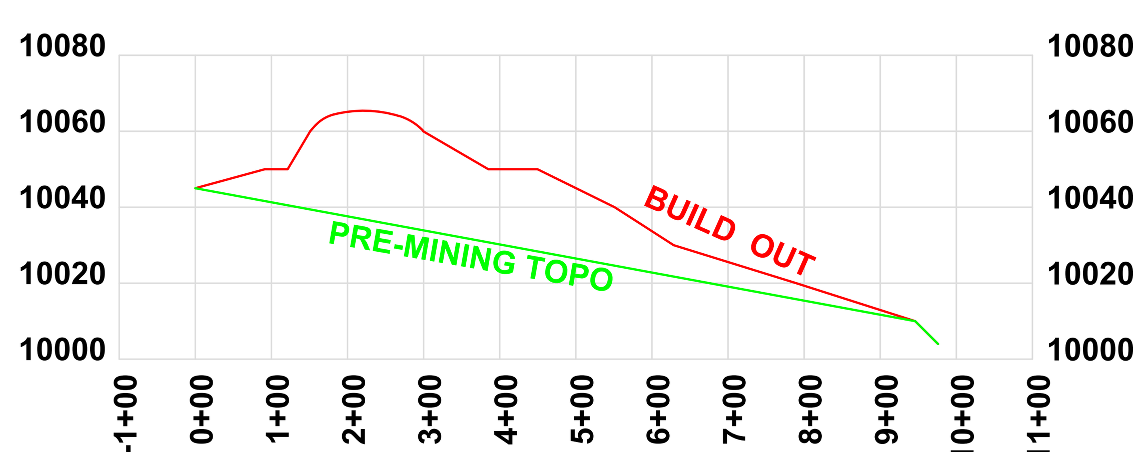
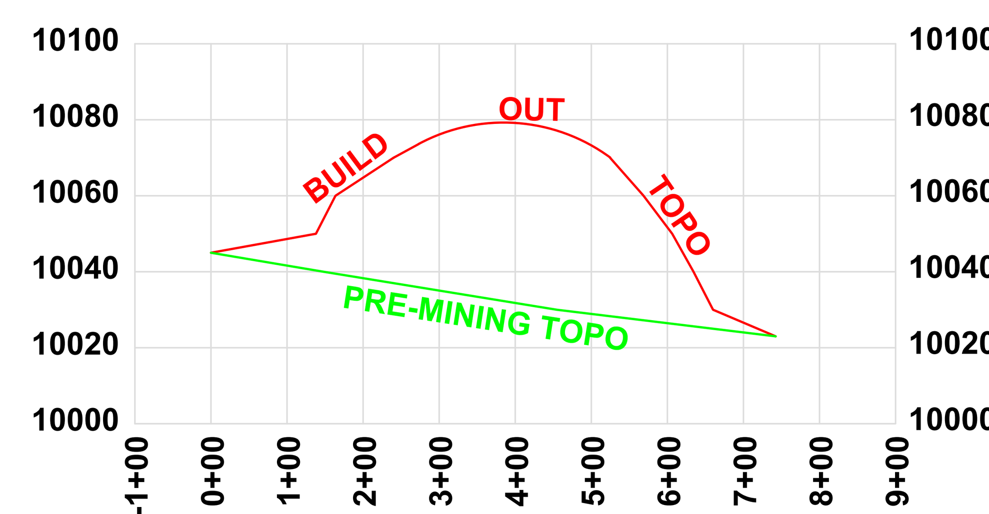


SECTION A-A

200 FT 0 200 FT 400 FT

2H:1V MAXIMUM



SECTION B-B

200 FT 0 200 FT 400 FT

2H:1V MAXIMUM

LEGEND

EXISTING ROADS
TOPSOIL STOCKPILES
CONTOUR SPACING 50 FT

PRELIMINARY FEATURES LAYOUT FOR DESIGN AND ENGINEERING.

"NOT FOR CONSTRUCTION"

COORDINATE SYSTEM:

UT83-CF
UTAH STATE PLANES: NAD 83 DATUM, CENTRAL ZONE, US FOOT.

N

SCALE ACCURATE WHEN PRINTED AT 24"x36"

Professional Certification

No.	REVISION	DATE	BY	CHKD
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2	UPDATE TITLE BLOCK	01/23/15	J&L	EDS
1	DESIGN	06/10/14	J&L	EDS

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201 South Main Street
Ste.#1800
Salt Lake City, UT 84111

Title:

TOP SOIL–GRADING PLAN

Scale:	Date:	Design By:	Drawn By:	Approved By:
1"=200'	06/10/14	MEI	J&L	

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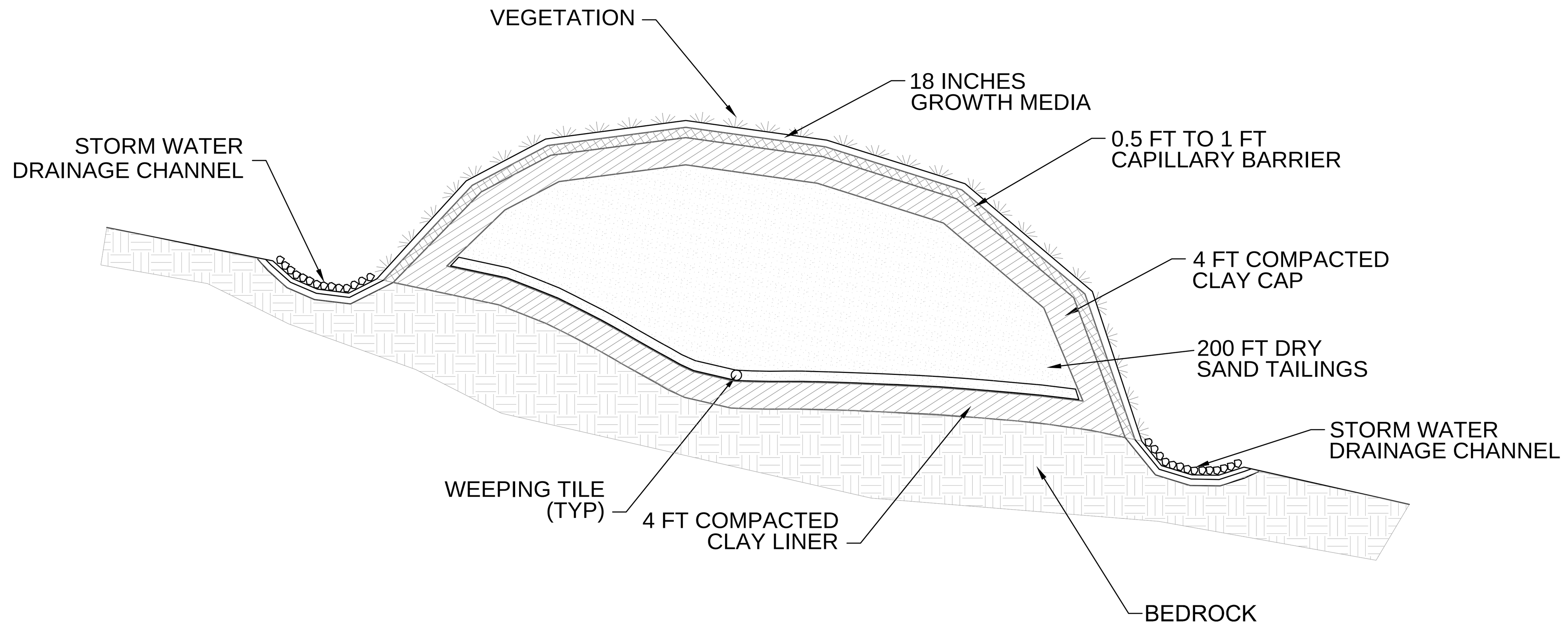
Phone: 307-638-8833 Fax: 307-638-0578

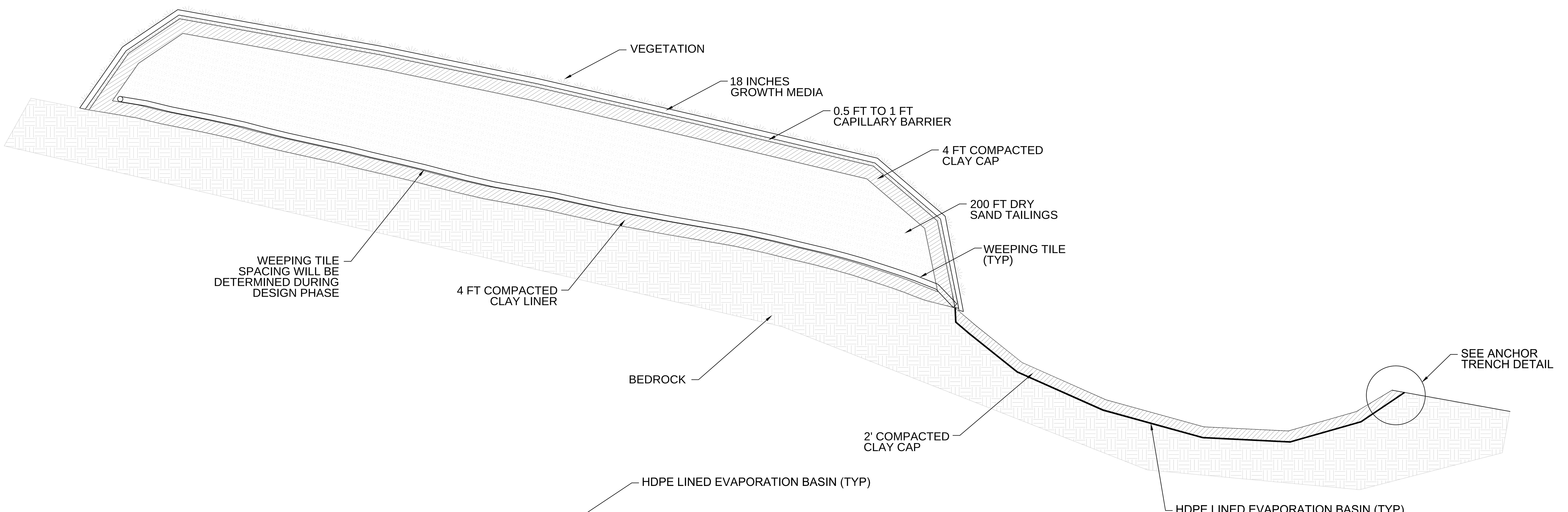
MAP 7

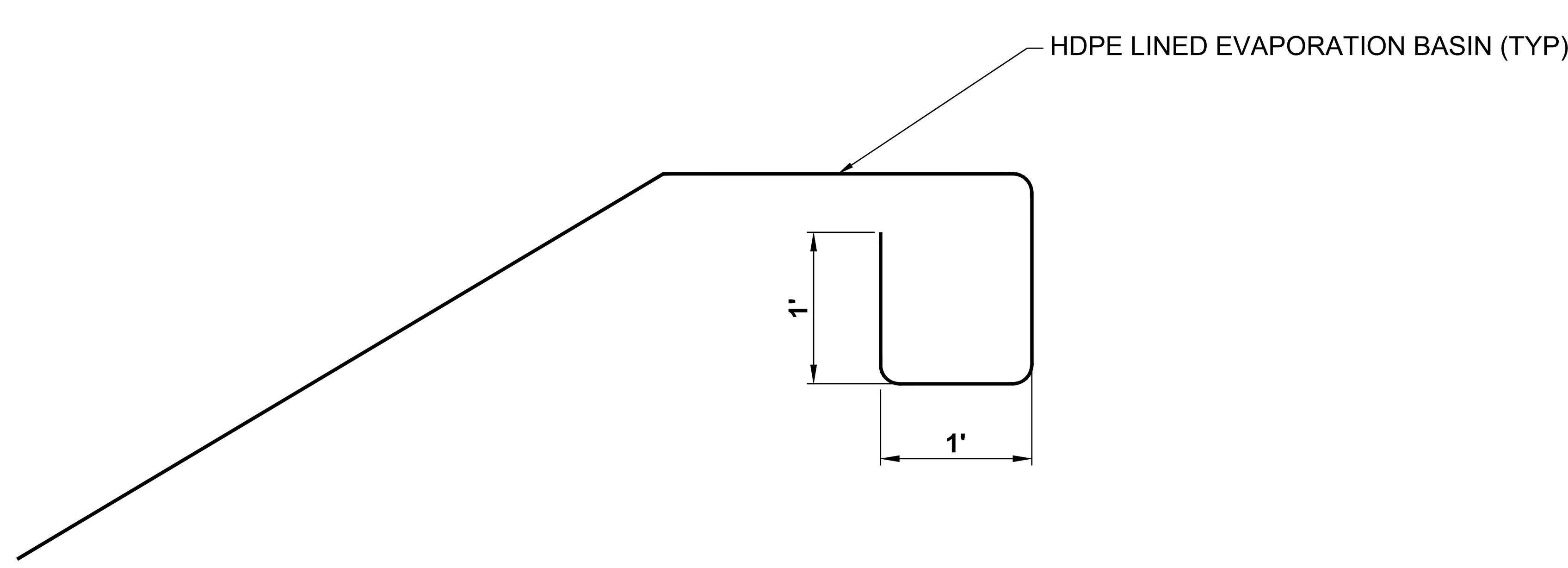
PRELIMINARY FEATURES LAYOUT FOR DESIGN AND ENGINEERING.

"NOT FOR CONSTRUCTION"

SEE MAP 3, TYPICAL CROSS SECTION DRY TAILINGS IMPOUNDMENT (COVER & BASE) FOR LAYOUT AND SCALED CROSS SECTIONS.
SEE MAP 9, TYPICAL CROSS SECTION-DRY TAILINGS IMPOUNDMENT (WEEPING TILE) FOR WEEPING TILE SYSTEM.
NOT TO SCALE-CONCEPT ONLY.



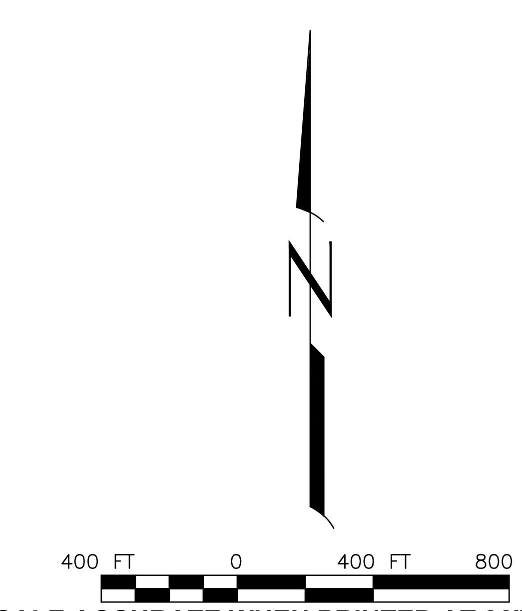




ANCHOR TRENCH DETAIL

COORDINATE SYSTEM:

UT83-CF
UTAH STATE PLANES: NAD 83 DATUM, CENTRAL ZONE, US FOOT.



SCALE ACCURATE WHEN PRINTED AT 36"x30"

Professional Certification

No.	REVISION	DATE	BY	CHKD
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2	MODIFIED TAILINGS COUNTOURS	01/27/15	J&L	EDS
1	PRLIMINARY	02/19/14	J&L	EDS

American Sands Energy Corp
American Sands Energy Corp.
4760 S. Highland Dr., #341
Salt Lake City, UT 84117

Title:
DRY TAILINGS TYPICAL SECTIONS

Scale:	Date:	Design By:	Drawn By:	Approved By:
N/A	02/19/14	MEI	J&L	EDS

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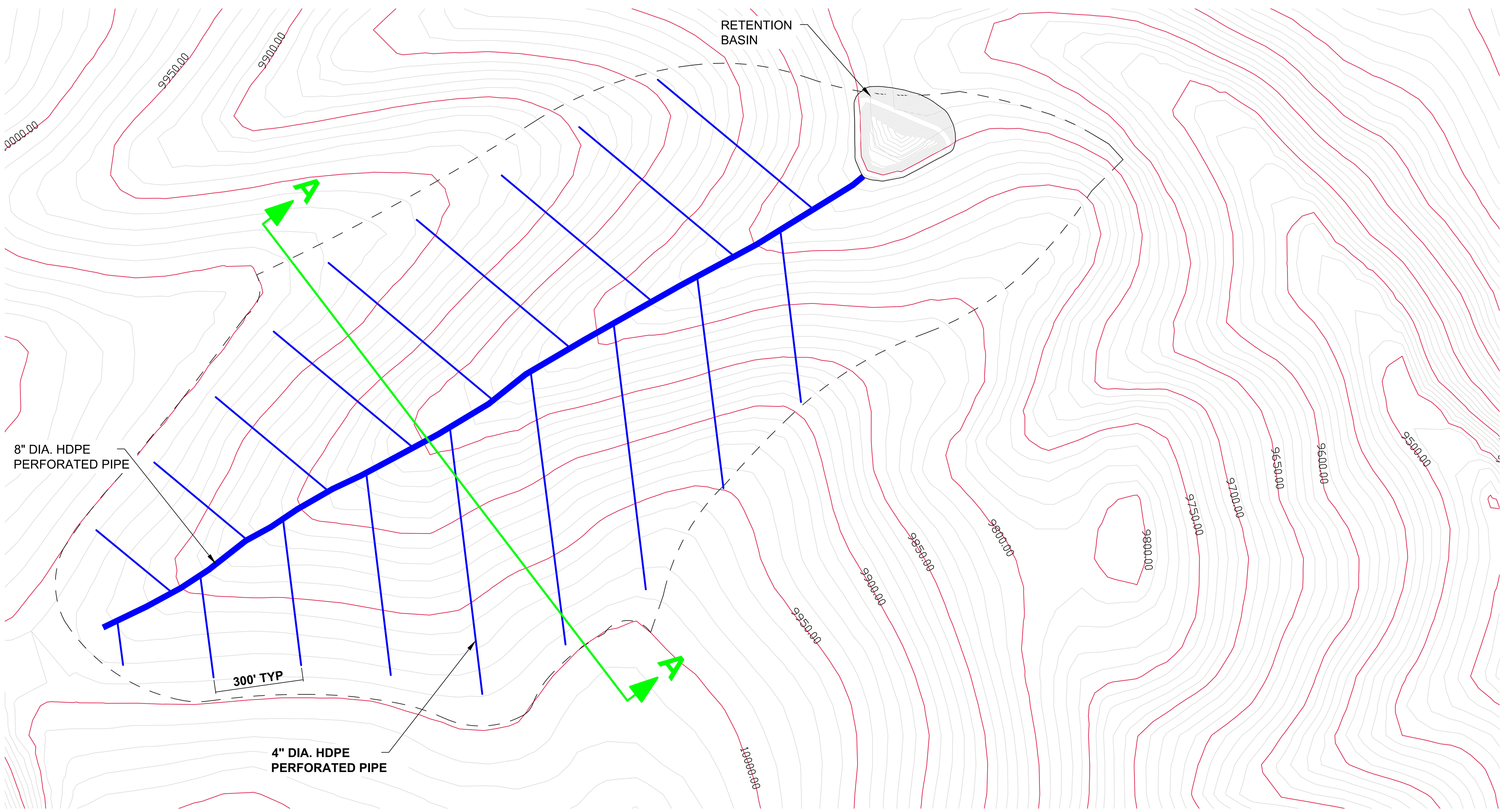
1901 South Industrial Road
Cheyenne, Wyoming 82007 USA
Phone: 307-638-8833 Fax: 307-638-0578

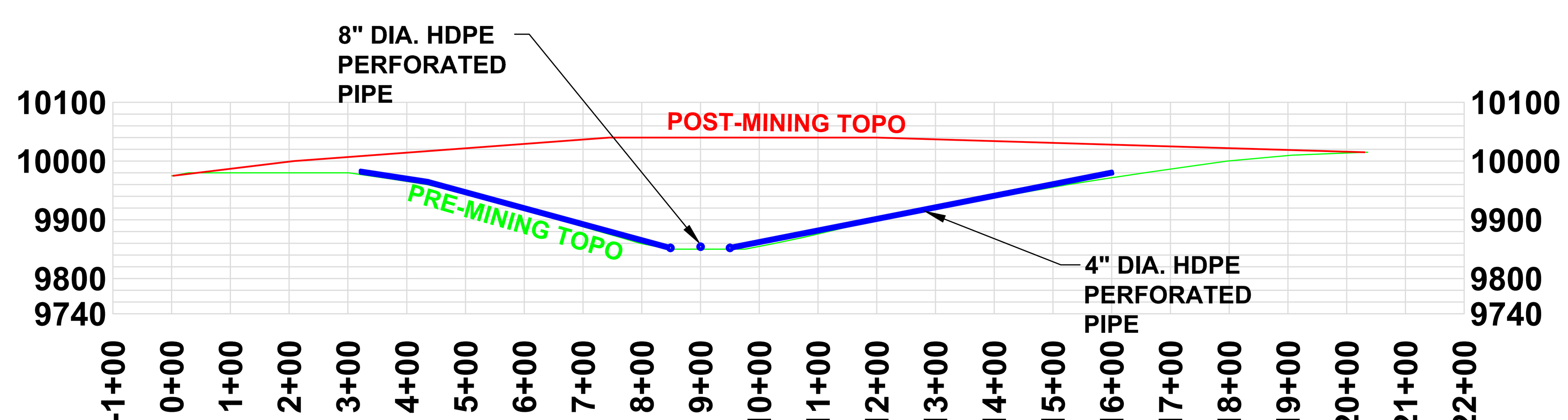
MAP 8

Y:\MEI\MEI Projects\MEI Client Files\American Sands Energy_5-12\Drawings\10-12-12\DRAWINGS\PRELIMINARY DWGS 4-16-15\MAP 8.dwg, 4/17/2015 10:58:05 AM



WEEPING TILE LAYOUT

200 FT 0 200 FT 400 FT



SECTION A-A

400 FT 0 200 FT 400 FT

2H:1V MAXIMUM

LEGEND

- DRY TAILINGS IMPOUNDMENT
- MAJOR CONTOUR SPACING 50 FT
- WEEPING TILE

NOTE:

1. Base to be constructed at 4 feet thick and cover to be constructed at 4 feet thick with compacted clay material to specified permeability. Cover system includes 18 inches of topsoil/plant growth medium placed on the clay cover. Reference "Summary of Preliminary HELP Model Results, American Sands Energy - Bruin Point Mine" by URS, September, 2014.
2. Main line and laterals wrapped in drainage sand with 6" cover, and 2' of stone on either side of pipe centerline.
3. Preliminary conceptual design subject to change during final design.

PRELIMINARY FEATURES LAYOUT FOR DESIGN AND ENGINEERING.

"NOT FOR CONSTRUCTION"

COORDINATE SYSTEM:

UT83-CF
UTAH STATE PLANES: NAD 83 DATUM, CENTRAL ZONE, US FOOT.

N

SCALE ACCURATE WHEN PRINTED AT 24"x36"

Professional Certification

No.	REVISION	DATE	BY	CHKD
6	ADDED NOTE TO LEGEND	04/17/15	J&L	EDS
5	MODIFIED CONTOURS AND X-SECTIONS	01/27/15	J&L	EDS
4	MINOR GENERAL UPDATES	01/23/15	J&L	EDS
3	FINAL	10/16/14	J&L	EDS
2	MODIFIED X-SECTIONS	09/16/14	J&L	EDS
1	PRLIMINARY	02/19/14	J&L	EDS

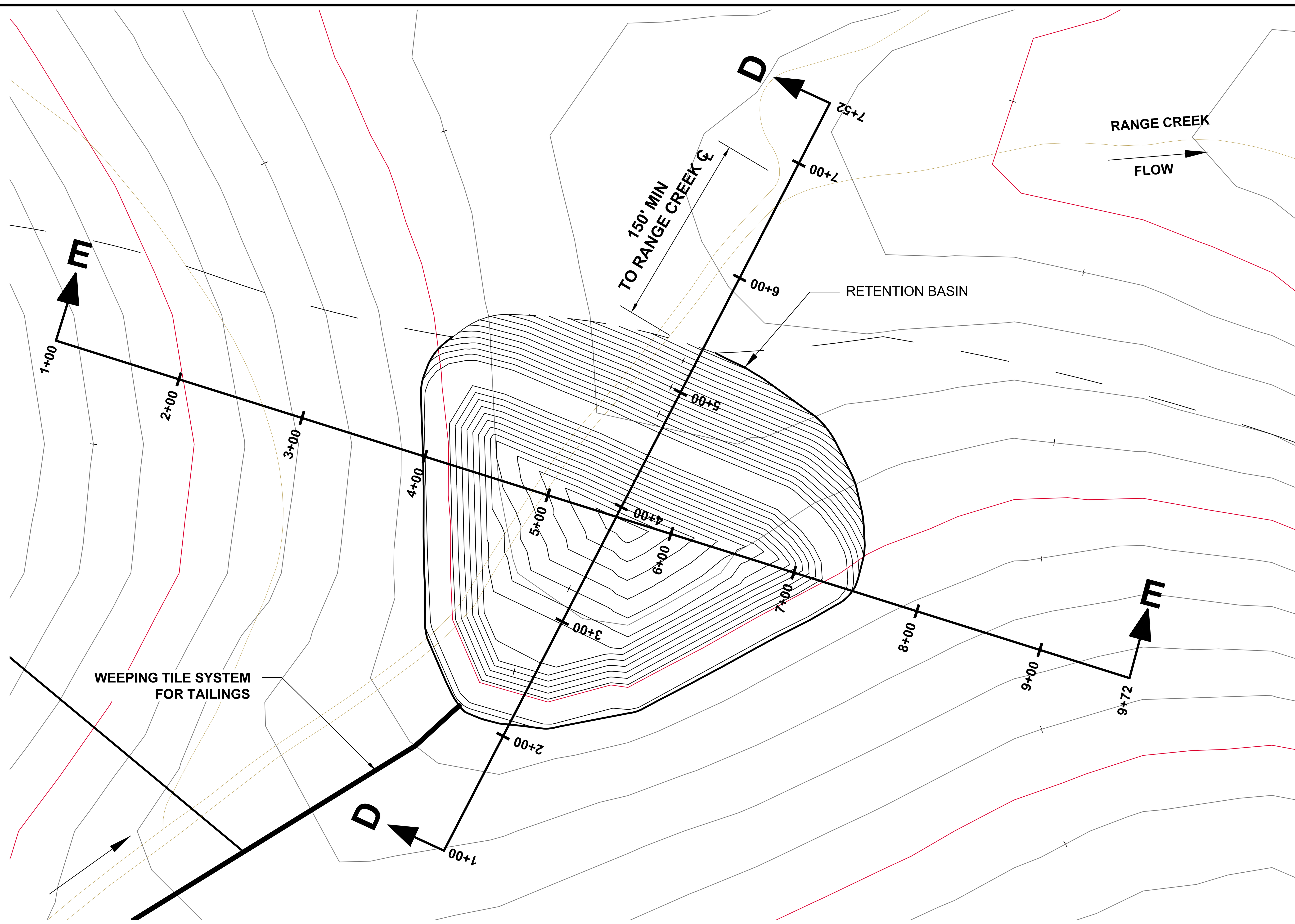
American Sands Energy Corp
American Sands Energy Corp.
201 South Main Street
Ste.#1800
Salt Lake City, UT 84111

Title: TYPICAL CROSS SECTION
DRY TAILINGS IMPOUNDMENT
(WEEPING TILE)

Scale:	Date:	Design By:	Drawn By:	Approved By:
1"=400'	02/19/14	MEI	J&L	EDS

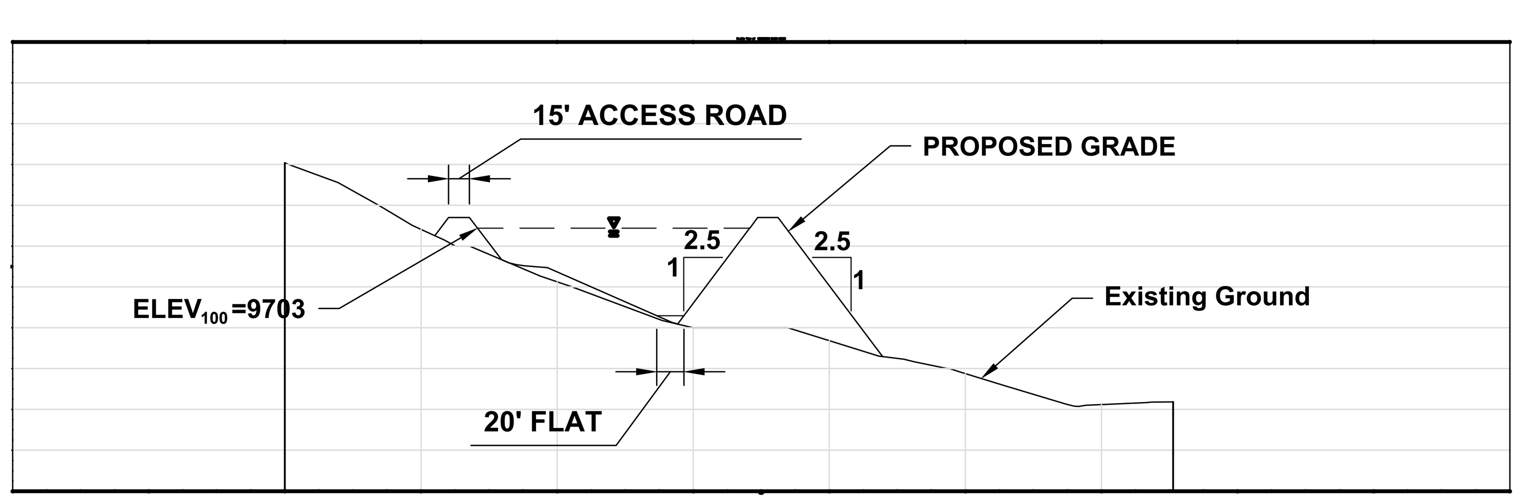
MINE ENGINEERS, INC.
3901 South Industrial Road
Cheyenne, Wyoming 82007 USA
Phone: 307-638-8833 Fax: 307-638-0578

MAP 9



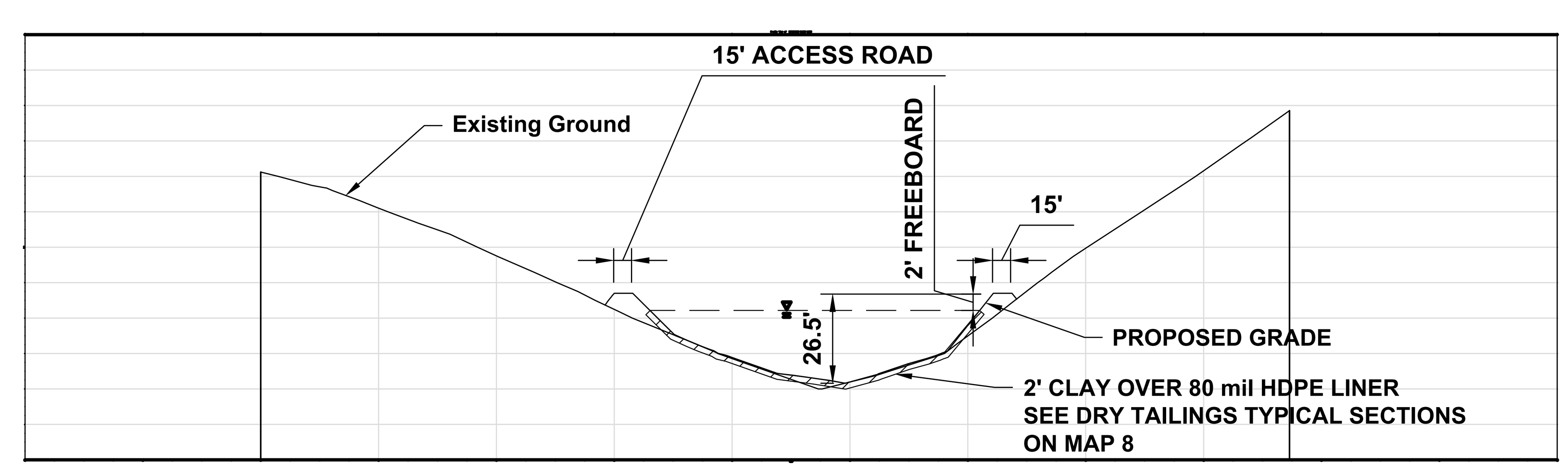
RETENTION BASIN LAYOUT

50 FT 0 50 FT 100 FT



SECTION D-D

100 FT 0 100 FT 200 FT



SECTION E-E

100 FT 0 100 FT 200 FT

LEGEND

- DRY TAILINGS IMPOUNDMENT
- MAJOR CONTOUR SPACING 50 FT
- WEEPING TILE

NOTE:

1. Preliminary conceptual design subject to change during final design.
2. V_{100}Yr, 24 HR= 11.0 AC-FT Required.
3. All runoff within tailings footprint to be contained and discharged to retention basin.
4. Best available technology will be used to pump and drain water out of the basin 72 hours after storm event. Water to be used on tailings for dust control.
5. Further investigation is required to ensure recycled water does not circulate back to retention basin. Surplus water that cannot be re-used and eliminated must be hauled away by a licensed contractor. Treatment may be required.
6. Weeping tiles modeling is conceptual and subject to final design.

PRELIMINARY FEATURES LAYOUT FOR DESIGN AND ENGINEERING "NOT FOR CONSTRUCTION"

COORDINATE SYSTEM:

UT83-CF
UTAH STATE PLANES: NAD 83 DATUM, CENTRAL ZONE, US FOOT.

N

SCALE ACCURATE WHEN PRINTED AT 24"x36"

Professional Certification

No.	REVISION	DATE	BY	CHKD
1	PRLIMINARY	02/19/14	J&L	EDS

American Sands Energy Corp

American Sands Energy Corp.
201 South Main Street
Ste.#1800
Salt Lake City, UT 84111

Title: TYPICAL SECTIONS (RETENTION BASIN)

Scale:	Date:	Design By:	Drawn By:	Approved By:
	04/01/15	DH	LMR	DH

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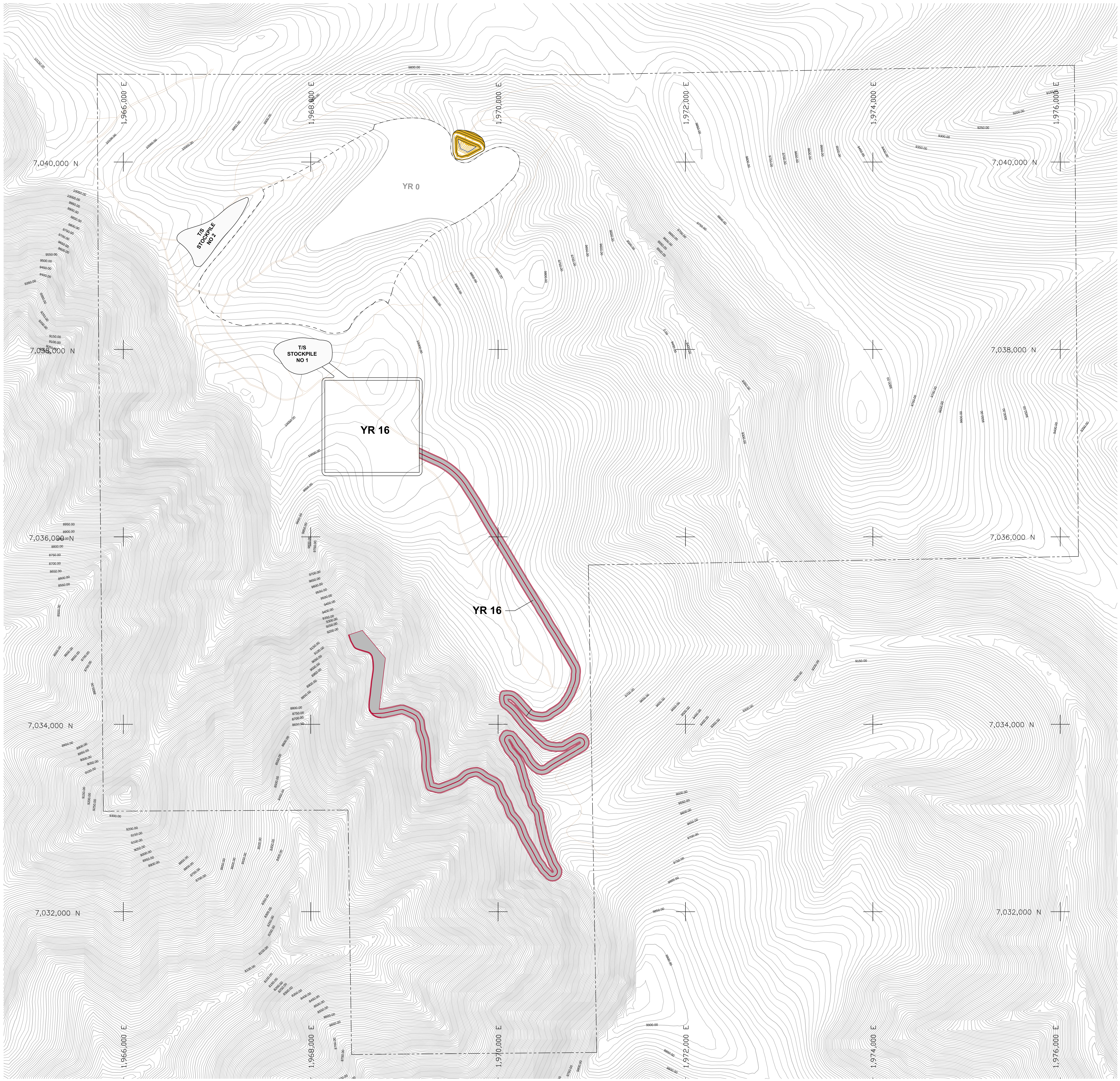
Cheyenne, Wyoming 82007 USA
Phone: 307-638-8833 Fax: 307-638-0578

MAP 10

Y:\MEI\MEI Projects\MEI Client Files\American Sands Energy_5-12\Drawings\10-12-12\DRAWINGS\PRELIMINARY DWGS 4-16-15\MAP-10.dwg, 4/17/2015 11:04:25 AM



LEGEND

- LAND AFFECTED BOUNDARY
- EXISTING ROADS
- DRY TAILINGS IMPOUNDMENT
- MINE ROAD
- ACTIVE

NOTE:

1. PRELIMINARY FEATURES LAYOUT FOR DESIGN AND ENGINEERING. NOT FOR CONSTRUCTION.

COORDINATE SYSTEM:

UT83-CF
UTAH STATE PLANES: NAD 83 DATUM, CENTRAL ZONE, US FOOT.

N

400 FT 0 400 FT 800 FT

SCALE ACCURATE WHEN PRINTED AT 36"x30"

No.	REVISION	DATE	BY	CHKD
2	MODIFIED TAILINGS COUNTOURS	01/27/15	J&L	EDS
1	PRLIMINARY	02/19/14	J&L	EDS

American Sands Energy Corp

American Sands Energy Corp.
4760 S. Highland Dr., #341
Salt Lake City, UT 84117

Title: DRY TAILINGS IMPOUNDMENT STATUS YEAR 1

Scale:	Date:	Design By:	Drawn By:	Approved By:
1"=400'	02/19/14	MEI	J&L	EDS

MINE ENGINEERS, INC.
3901 South Industrial Road
Cheyenne, Wyoming 82007 USA
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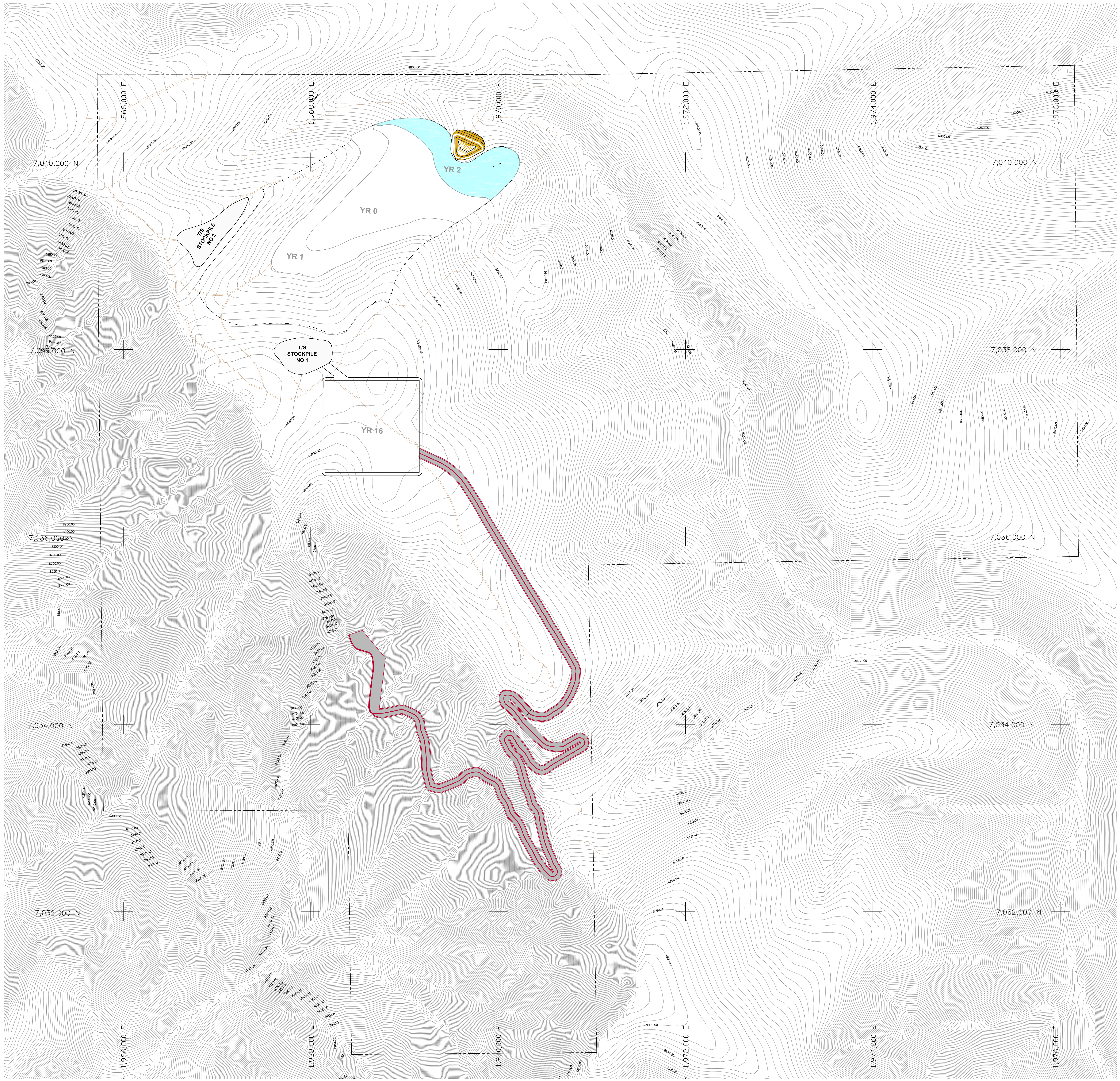
MAP .



LEGEND

- LAND AFFECTED BOUNDARY
- EXISTING ROADS
- DRY TAILINGS IMPOUNDMENT
- MINE ROAD
- ACTIVE
- COVERED

NOTE:

1. PRELIMINARY FEATURES LAYOUT FOR DESIGN AND ENGINEERING. NOT FOR CONSTRUCTION.

COORDINATE SYSTEM:

UT83-CF
UTAH STATE PLANES: NAD 83 DATUM, CENTRAL ZONE, US FOOT.

N

400 FT 0 400 FT 800 FT

SCALE ACCURATE WHEN PRINTED AT 36"x30"

No.	REVISION	DATE	BY	CHKD
2	MODIFIED TAILINGS COUNTOURS	01/27/15	J&L	EDS
1	PRLIMINARY	02/19/14	J&L	EDS

American Sands Energy Corp
American Sands Energy Corp.
4760 S. Highland Dr., #341
Salt Lake City, UT 84117

Title: DRY TAILINGS IMPOUNDMENT STATUS END OF YEAR 1

Scale:	Date:	Design By:	Drawn By:	Approved By:
1"=400'	02/19/14	MEI	J&L	EDS

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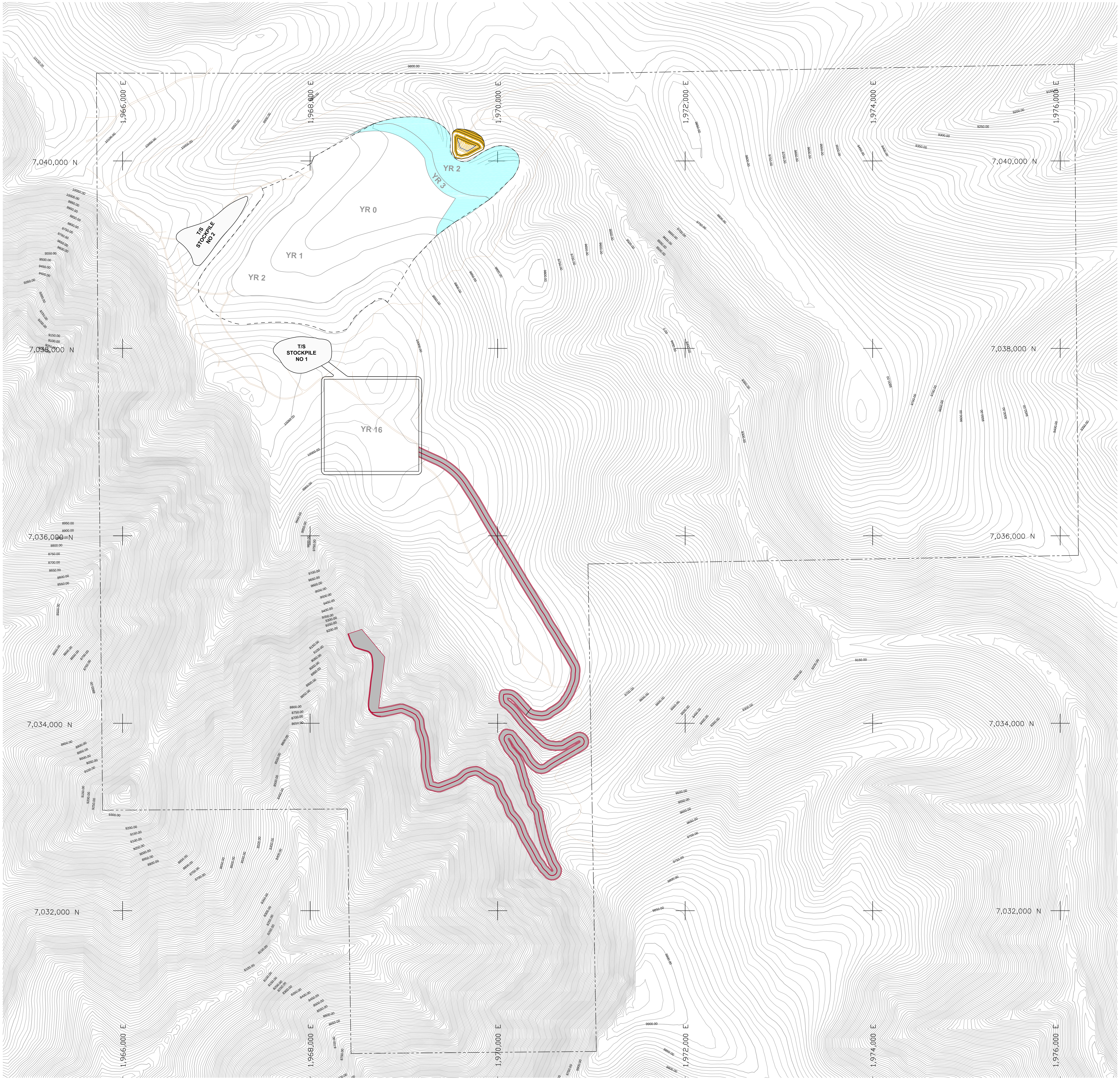
Cheyenne, Wyoming 82007 USA
Phone: 307-638-8833 Fax: 307-638-0578

MAP . 1



LEGEND

- LAND AFFECTED BOUNDARY
- EXISTING ROADS
- DRY TAILINGS IMPOUNDMENT
- MINE ROAD
- ACTIVE
- COVERED

NOTE:

1. PRELIMINARY FEATURES LAYOUT FOR DESIGN AND ENGINEERING. NOT FOR CONSTRUCTION.

COORDINATE SYSTEM:

UT83-CF
UTAH STATE PLANES: NAD 83 DATUM, CENTRAL ZONE, US FOOT.

N

400 FT 0 400 FT 800 FT

SCALE ACCURATE WHEN PRINTED AT 36"x30"

No.	REVISION	DATE	BY	CHKD
2	MODIFIED TAILINGS COUNTOURS	01/27/15	J&L	EDS
1	PRLIMINARY	02/19/14	J&L	EDS

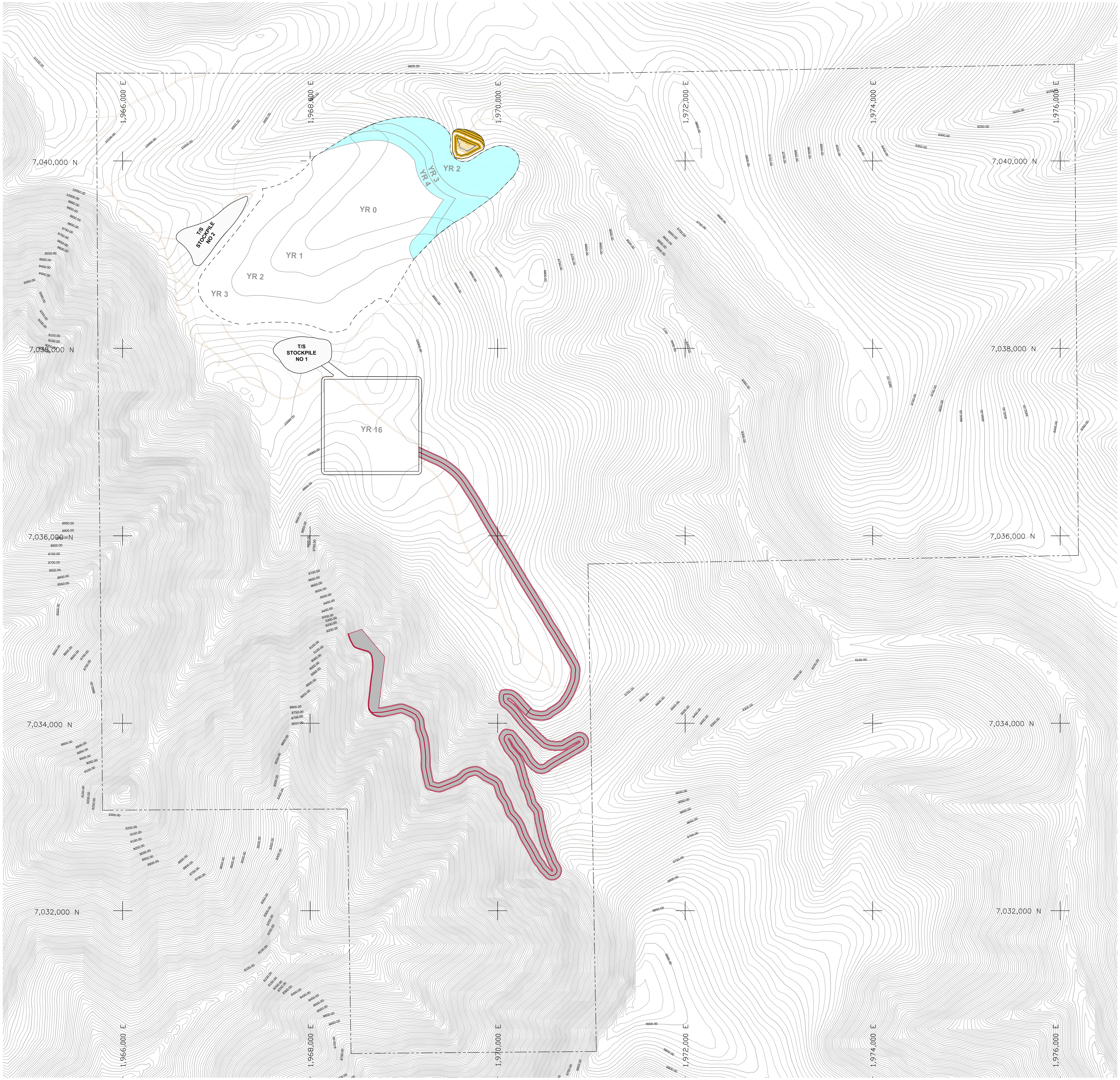
American Sands Energy Corp
American Sands Energy Corp.
4760 S. Highland Dr., #341
Salt Lake City, UT 84117

Title: DRY TAILINGS IMPOUNDMENT STATUS END OF YEAR 2

Scale:	Date:	Design By:	Drawn By:	Approved By:
1"=400'	02/19/14	MEI	J&L	EDS

MINE ENGINEERS, INC.

MAP . 2



LEGEND

- LAND AFFECTED BOUNDARY
- EXISTING ROADS
- DRY TAILINGS IMPOUNDMENT
- MINE ROAD
- ACTIVE
- COVERED

NOTE:

1. PRELIMINARY FEATURES LAYOUT FOR DESIGN AND ENGINEERING. NOT FOR CONSTRUCTION.

COORDINATE SYSTEM:

UT83-CF
UTAH STATE PLANES: NAD 83 DATUM, CENTRAL ZONE, US FOOT.

400 FT 0 400 FT 800 FT

SCALE ACCURATE WHEN PRINTED AT 36"x30"

No.	REVISION	DATE	BY	CHKD
2	MODIFIED TAILINGS COUNTOURS	01/27/15	J&L	EDS
1	PRLIMINARY	02/19/14	J&L	EDS

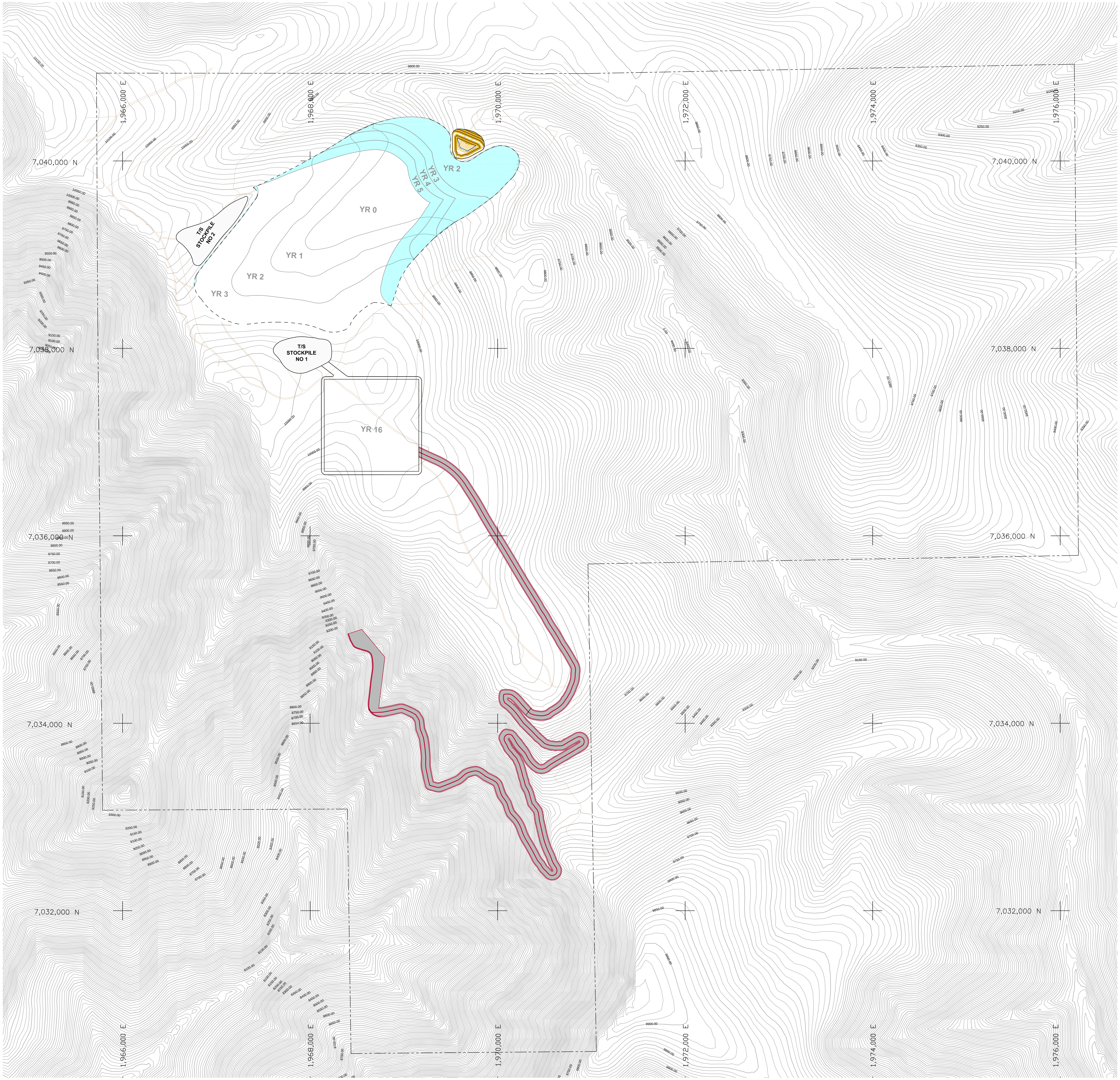
American Sands Energy Corp
American Sands Energy Corp.
4760 S. Highland Dr., #341
Salt Lake City, UT 84117

Title: DRY TAILINGS IMPOUNDMENT STATUS END OF YEAR 3

Scale:	Date:	Design By:	Drawn By:	Approved By:
1"=400'	02/19/14	MEI	J&L	EDS

MINE ENGINEERS, INC.
2901 South Industrial Road
Cheyenne, Wyoming 82007 USA
Phone: 307-638-8833 Fax: 307-638-0378

MAP . 3



LEGEND

- LAND AFFECTED BOUNDARY
- EXISTING ROADS
- DRY TAILINGS IMPOUNDMENT
- MINE ROAD
- ACTIVE
- COVERED

NOTE:

1. PRELIMINARY FEATURES LAYOUT FOR DESIGN AND ENGINEERING. NOT FOR CONSTRUCTION.

COORDINATE SYSTEM:

UT83-CF
UTAH STATE PLANES: NAD 83 DATUM, CENTRAL ZONE, US FOOT.

N

400 FT 0 400 FT 800 FT

SCALE ACCURATE WHEN PRINTED AT 36"x30"

No.	REVISION	DATE	BY	CHKD
2	MODIFIED TAILINGS COUNTOURS	01/27/15	J&L	EDS
1	PRLIMINARY	02/19/14	J&L	EDS

American Sands Energy Corp.
4760 S. Highland Dr., #341
Salt Lake City, UT 84117

Title: DRY TAILINGS IMPOUNDMENT STATUS END OF YEAR 4

Scale:	Date:	Design By:	Drawn By:	Approved By:
1"=400'	02/19/14	MEI	J&L	EDS

MINE ENGINEERS, INC.
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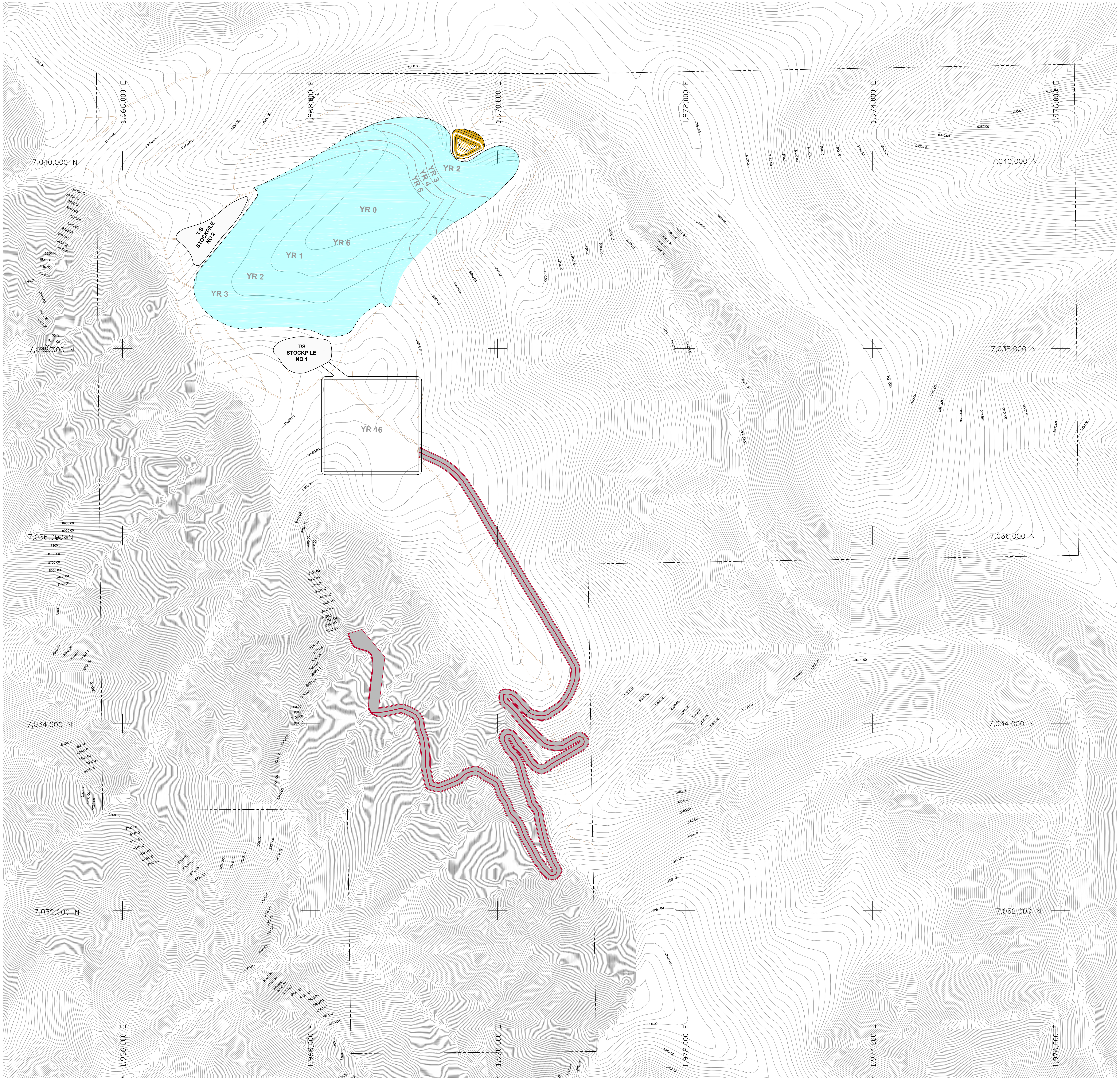
Cheyenne, Wyoming 82007 USA
Phone: 307-638-8833 Fax: 307-638-0378

MAP . 4



LEGEND

- LAND AFFECTED BOUNDARY
- EXISTING ROADS
- DRY TAILINGS IMPOUNDMENT
- MINE ROAD
- ACTIVE
- COVERED

NOTE:

1. PRELIMINARY FEATURES LAYOUT FOR DESIGN AND ENGINEERING. NOT FOR CONSTRUCTION.

COORDINATE SYSTEM:

UT83-CF
UTAH STATE PLANES: NAD 83 DATUM, CENTRAL ZONE, US FOOT.

400 FT 0 400 FT 800 FT

SCALE ACCURATE WHEN PRINTED AT 36"x30"

No.	REVISION	DATE	BY	CHKD
2	MODIFIED TAILINGS COUNTOURS	01/27/15	J&L	EDS
1	PRLIMINARY	02/19/14	J&L	EDS

American Sands Energy Corp
American Sands Energy Corp.
4760 S. Highland Dr., #341
Salt Lake City, UT 84117

Title: DRY TAILINGS IMPOUNDMENT STATUS END OF YEAR 5

Scale:	Date:	Design By:	Drawn By:	Approved By:
1"=400'	02/19/14	MEI	J&L	EDS

MINE ENGINEERS, INC.
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MAP . 5

SPECIFICATIONS

Embankment Liner Tailings Cover
Earthwork Construction Quality Control Plan
Retention Basin
Weeping Tile
Synthetic Liner Installation

SECTION 31 24 00

EMBANKMENTS

PART 1: GENERAL

1.1 DESCRIPTION

A. Embankments including the liner, cap, berms, surface drainage structures, and water retention structures.

B. Permanent Mine tailings stockpile consisting of predominantly fine sand derivative of the oil-sand ore extraction process.

1.2 SUBMITTALS

A. A Liner and Compacted Clay Cap Construction Plan including a Moisture / Density Control Plan for providing the specified density and moisture content of the in-place liner and compacted clay cap. Submit to the Engineer for approval fifteen (15) days prior to any liner/cap construction.

B. A Permanent Tailings Stockpile Construction Plan including a Moisture / Density Control Plan for providing the specified density and moisture content of the in-place tailings sand. Submit to the Engineer for approval fifteen (15) days prior to any tailings pile construction.

C. An Embankment Construction Plan including a Moisture / Density Control Plan for providing the specified density and moisture content of in-place material. Submit to the Engineer for approval fifteen (15) days prior to any embankment construction.

D. A plan for grinding and achieving the specified gradation of mine partings. Submit to the Engineer for approval fifteen (15) days prior to any embankment construction.

E. Submit for approval, all geotechnical materials prior to liner, compacted clay cap, stockpile, and embankment construction. Submit to the Engineer for approval fifteen (15) days prior to any construction.

1.3 DEFINITIONS

A. Mine Partings –native interburden materials (waste-rock strata deposits between ore seams) extracted from the mine to be used as noted in Paragraph 1.4.

B. Mine Partings Fines – the native interburden materials extracted from the mine and graded to a fine material as specified in Paragraph 2.1, to be used as noted in Paragraph 1.4.

C. Mine Tailings – remnant clean sand produced from the ore extraction process as specified in Paragraph 2.3, to be used as noted in Paragraph 1.4.

D. Permanent Tailings Pile – compacted mine tailings pile to remain at completion of mining, and covered as specified herein.

E. Temporary Tailings Pile – post ore extraction mine tailings awaiting transport to permanent tailings pile. Temporary tailings piles will be maintained within the process plant area. Pre ore extraction materials staged in the mine or other locations are not considered temporary tailings piles.

F. Select Clay –native clay without traces of gravel or other deleterious material greater than 1-inch diameter as specified in Paragraph 2.4, excavated and stockpiled to be used as noted in Paragraph 1.4.

G. Non-Select Clay – native clay excavated and stockpiled to be used as a growth media (overtopping revegetation) cover installed over the select clay cap. This clay contains traces of gravel, cobble, and organic matter as specified in Paragraph 2.5, to be used as noted in Paragraph 1.4.

H. Geotechnical Report – the Geotechnical Report "American Sands Energy Corp.: Bruin Point Mine Slope Stability Analyses", prepared by URS Corporation of Salt Lake City, Utah, dated February 4, 2015.

I. Capillary Barrier – A layer of clean, poorly graded crushed rock, stone, or natural sand or gravel having a high permeability which is incorporated into a cap system to cut off the capillary flow of pore water.

J. Drainage Sand – free-draining sand for use in drainage layers.

1.4 PRECONSTRUCTION ACCEPTANCE FOR MINE PARTINGS FINES, MINE TAILINGS, SELECT CLAY, LINER COVER MATERIAL AND NON-SELECT CLAY

A. The Contractor shall submit to Engineer or designee the following preconstruction test data for mine partings fines, mine tailings, select clay, non-select clay, liner cover material, and drainage sand. This information is to be provided for each individual fill source or when in the opinion of Engineer or designee the material differs from the originally tested and approved material. Preconstruction of mine partings fines, mine tailings, select clay, liner cover material, and non-select clay shall include the following testing, with a minimum of two tests each.

Fill Material/ Acceptable Usage	Test Required	Method[1]
Mine Partings Fines/ Liner, Embankments	Unified Soil Classification	ASTM D2487 (2011)
	Modified Proctor	ASTM D1557 (2012)
	Grain Size Analysis	ASTM D422 (2014)
	Sieve Analysis Percent Fines Passing #200 Sieve	ASTM D1140 (2000)
	Atterberg Limits	ASTM D4318 (2014)
	Direct Shear	ASTM D3080 (2011)
	Hydraulic Conductivity	ASTM D5084 (2010)
Mine Tailings/ Permanent Mine Tailings Piles	Unified Soil Classification	ASTM D2487 (2011)
	Modified Proctor	ASTM D1557 (2012)
	Grain Size Analysis	ASTM D422 (2014)
	Sieve Analysis Percent Fines Passing #200 Sieve	ASTM D1140 (2000)
	Atterberg Limits	ASTM D4318 (2014)
	Hydraulic Conductivity	ASTM D5084 (2010)
Select Clay/ Compacted Clay Cap, Embankments	Unified Soil Classification	ASTM D2487 (2011)
	Modified Proctor	ASTM D1557 (2012)
	Grain Size Analysis	ASTM D422 (2014)
	Sieve Analysis Percent Fines Passing #200 Sieve	ASTM D1140 (2000)
	Atterberg Limits	ASTM D4318 (2014)
	Hydraulic Conductivity	ASTM D5084 (2010)
Liner Cover Material/ Cover over HDPE Liner in Retention Basin	Soil Classification	ASTM D2487 (2011)
	Modified Proctor	ASTM D1557 (2012)
	Grain Size Analysis	ASTM D422 (2014)
	Sieve Analysis Percent Fines Passing #200 Sieve	ASTM D1140 (2000)
	Atterberg Limits	ASTM D4318 (2014)
Non-Select Clay/ Growth Media	Soil Classification	ASTM D2487 (2011)
	Modified Proctor	ASTM D1557 (2012)
	Grain Size Analysis	ASTM D422 (2014)
	Sieve Analysis Percent Fines Passing #200 Sieve	ASTM D1140 (2000)
	Atterberg Limits	ASTM D4318 (2014)

[1]-Current active standard will apply.

Fill Material/ Acceptable Usage	Test Required	Method[1]
Drainage Sand/ Drainage Layers	Soil Classification	ASTM D2487 (2011)
	Modified Proctor	ASTM D1557 (2012)
	Grain Size Analysis	ASTM D422 (2014)
	Sieve Analysis Percent Fines Passing #200 Sieve	ASTM D1140 (2000)
	Atterberg Limits	ASTM D4318 (2014)
	Hydraulic Conductivity	ASTM D5084 (2010)
[1]-Current active standard will apply.		

PART 2: MATERIALS

2.1 GENERAL

A. All required select clay, mine parting fines, liner cover material, and mine tailings materials shall be substantially free from organic materials, wood, trash, and other objectionable materials which may be compressible or which cannot be properly compacted. Non-select clay may contain organic matter up to 15% by weight. No fill material shall contain broken concrete, masonry rubble, or other similar materials. Fill material shall have physical properties such that it can be readily spread and compacted to the specified hydraulic conductivity and/or density.

2.2 MINE PARTINGS FINES

A. Natural mine partings rock/soil excavated and stockpiled on site.

B. Mine partings shall be processed to create the mine partings fines with a minimum of 40% and maximum of 80% by weight passing the No. 200 sieve (75-µm), and all material graded to less than the No. 4 sieve (4.75-mm), and will achieve a hydraulic conductivity of 1x10-7 cm/sec or slower in the constructed liner and/or embankments.

C. No partings shall be used prior to Engineer providing the moisture-density/hydraulic conductivity relationship and acceptability envelope for moisture density.

D. Take mine partings from the designated stockpile or other designated sources as approved by Engineer. If there is any variation in the approved material during construction, or material is obtained from an alternate source, additional testing will be required.

E. During the course of construction, the Engineer will make any modification necessary to the moisture-density/ hydraulic conductivity relationship in order to improve the shear strength of the compacted clay or ensure the clay liner and/or embankments meet the specified hydraulic conductivity.

2.3 MINE TAILINGS

A. Mine tailings sand extracted and stockpiled on site containing approximately 90% sand and 10% fines content. Mine tailings shall contain a maximum of 15% by weight of material passing the No. 200 sieve (75-µm).

B. No tailings shall be used prior to Engineer providing the moisture-density relationship and acceptability envelope for moisture density.

C. Take mine tailings from the designated stockpile (temporary mine tailings piles) or other designated sources as approved by Engineer. If there is any variation in the approved material during construction, or material is obtained from an alternate source, additional testing will be required.

D. Stockpile temporary tailings piles within the process plant area to safe height and slope angle to prevent sloughing or uncontrolled sliding.

2.4 SELECT CLAY SOIL

A. Natural clay-rich soil excavated and stockpiled on site.

B. Soil containing or amended to contain sufficient plastic fines (i.e., passing No. 200 sieve), greater such that will achieve a hydraulic conductivity of 1 x 10-7 cm/sec or slower in the constructed embankments. Import materials meeting these requirements can be used to satisfy select clay soils as approved by the Engineer.

C. Provide a maximum clod size of 1 inch.

D. Do not use soil prior to engineers approval of the submitted moisture-density/hydraulic conductivity relationship and acceptability envelope for moisture density.

2.5 NON-SELECT CLAY SOIL

A. Take soil from the designated stockpile or other designated sources as approved by Engineer. Construct the growth media (revegetation cover) with the natural clay-rich soil that contains traces of gravel, cobble, and organic matter.

2.6 LINER COVER MATERIAL

A. Free of visible organics (roots, leaves, grass, etc.), rocks, stones, sticks, deleterious material, and debris of any kind.

B. Free of angular or sharp particles.

C. Contains no particle larger than three-eighths (3/8) inch diameter.

D. Contains no more than 50%, by weight, of material falling between one-fourth (1/4) and three-eighths (3/8) inch diameter.

E. Contains, by weight, at least 15%, but no more than 30%, fines passing the No. 200 sieve (75-µm).

2.7 DRAINAGE SAND

A. Free draining sand.

B. Particles are hard and non-friable.

C. Hydraulic conductivity at least 3x10-2 cm/sec as determined by D5084

D. Free of visible organics (roots, leaves, grass, etc.), frozen materials, and other deleterious materials.

E. Exhibit the following gradation as determined by ASTM D422.

Particle Size (U.S. Standard Sieve)	Percent Passing (by Weight)
3/8 inch	100
No. 8	70-100
No. 16	40-100
No. 30	10-75
No. 50	0-30
No. 100	0-10
No. 200	0-5

2.8 WATER

A. Water, free of environmental contaminants, will be used to adjust the moisture content of the low permeability liner/cap during construction. Captured storm water and/or contact water can be used to adjust the moisture content of the tailings pile and berms where any runoff will be recaptured in retention pond structures. Water will come from the following sources: Connate, captured storm, tailings impoundment or purchased trucked in and will be confirmed to be of sufficient quality prior to use.

PART 3: EXECUTION

3.1 GENERAL PREPARATION OF THE LINER, CAP, AND CAPILLARY BARRIER

A. Excavate and stockpile liner, cap, and embankment materials as specified elsewhere. Segregate stockpiles to prevent contamination and degradation of the material engineering properties.

B. Snow, ice, and frozen soil will not be permitted.

C. Complete preparation of area to receive embankment. Verify areas to be backfilled are free of debris, snow, ice, water and deleterious material. Do not place any embankment or liner material until the Engineer or Owner's representative has inspected and approved the prepared subgrade.

D. Note any discrepancies and plan operations so that upon completion of the liner and the cap, the top grades conform to the proposed disposal facility grades. The Engineer will supply a drawing showing the elevations of the disposal facility floor and subgrade.

E. Shape surfaces for sumps, pipe trenches, and anchor trenches.

F. If, during the course of construction the engineering properties of the soil change, the Engineer reserves the right to make whatever adjustment necessary to improve the strength or hydraulic conductivity values of the soil. In general, it is likely soil compaction conditions will remain as specified; however, variation in soil conditions could require greater compactive effort or some modification of the moisture content.

G. Demonstrate that equipment and construction techniques can obtain the proper compaction at the specified moisture content within the first 6 lifts of the liner and cap. The job superintendent, Engineer (or Owner's representative), and equipment operators shall be present to observe and assist in the development of a placement procedure that can be used to the completion of the project. Obtain proper shear strength of the soil and bonding of each lift to the existing slope.

H. Provide safe access to the Engineer for sampling. The borrow soil and excavated areas may be sampled and tested by the Engineer during construction in accordance with a separate excavation observation and geotechnical testing plan.

3.2 INSTALLATION OF THE LINER, CAP, AND CAPILLARY BARRIER

A. Use material from a designated stockpile or other source as approved by the Engineer.

B. Mixing and Hydration.

For liner and cap construction, demonstrate prior to construction the capability of pulverizing and mixing large volumes of soils so that it will pass a one-inch sieve for cap and No. 4 sieve for liner. Stage material prior to placement and provide uniform soil moisture in the range from optimum up to 3% wet of optimum. Moisture contents outside of the specified range shall be approved by the Engineer prior to placement. The material shall be hydrated for 72 hours prior to testing.

C. Placement and Compaction.

If the following material specifications or construction methods are to be changed, additional tests may be required at the discretion of the Engineer or Owner's representative.

Placement – The following placement methods are required:

- Do not place or compact frozen low permeability liner/cap material.
- Do not place or compact low permeability liner/cap material on frozen subgrade or previous lifts of liner/cap that are frozen.
- Screen, process disc, or work as needed to reduce soil clod size to 1 inch prior to compaction. Mine partings fines shall be graded as specified in Paragraph 2.1.
- Approved low permeability liner/cap material will be placed in uniform layers not exceeding 9 inches (loose lift). If the pads of the compactor to be used will not penetrate a 9-inch loose lift, the thickness of the loose lift will be reduced to allow for full penetration by the compactor pads. In constructing a 4-foot thick low permeability liner, a minimum of eight lifts will be used. Compaction equipment will be maintained to avoid clogging around the compactor pads.
- Prior to compaction, representative samples shall be tested for moisture content. If moisture content is within the range specified by preconstruction testing, compaction can begin.
- If the moisture content is outside the acceptable range, the soil will be wetted or dried and reworked accordingly. The soil shall be sprinkled or sprayed with water and dozed, wind-rowed, disc-plowed, or processed to uniformly increase the moisture content of the soil if the material is below the specified moisture content. The soil shall be dozed, wind-rowed, disc-plowed, or processed if the moisture content is too high.

- If water is to be added to the material, it shall be sprinkled or sprayed uniformly and worked to provide relatively uniform moisture content within the material to be compacted.
- Contaminated water will not be used in the construction work.

Compaction – The following compaction methods are required:

- As each lift (approximate 6-inch compacted thickness) of low permeability liner has been completed, field density and moisture content tests will be performed at the frequency outlined in the following Paragraphs.
- Minimum field compaction criteria for constructed low permeability liner and cap shall be 95% of modified proctor maximum dry density from optimum up to 3% wet of optimum moisture content.
- Compaction of loose lifts shall be performed with an appropriately heavy, properly ballasted, penetrating foot compactor such as a pad foot, prong-foot, or sheepsfoot compactor that provides equivalent or greater compactive effort as a CAT 815 compactor.
- A minimum of four passes is required, with a pass being defined as two applications of the compacting roller (i.e., for a one-roller compactor, a pass is a trip forward and back, for a two-roller compactor, a pass is a trip forward or backward). Additional passes may be required to achieve compaction requirements. Dozed or scraper equipment shall not be used for primary compactive effort.
- Within a construction area, each lift shall be thoroughly compacted and satisfy moisture and density testing requirements prior to placement of subsequent lifts.
- Previously compacted lifts will be roughened to a shallow depth and moisture conditioned prior to placement of subsequent lifts to promote bonding between lifts. The length of the compactor pads shall be sufficient to penetrate the subsequent loose lift and the lift interface to provide bonding between lifts. During construction, finished lifts or sections will be sprinkled with water as needed to prevent drying and desiccation.
- If desiccation and crusting of a lift surface occurs before placement of the next lift, the area shall be sprinkled with water, scarified, recompacted, and tested for acceptable moisture content and density prior to placement of a subsequent lift.

- Completed sections of low permeability liner and cap shall be sealed by rolling with a rubber tire or smooth drum roller and sprinkled with water as needed.
- Any ponded water that accumulates on newly constructed low permeability liner shall be promptly and appropriately removed. Saturation of these soils by ponding water is not an acceptable practice.

D. Permeability.

The in-place permeability of the low-permeability liner and cap shall meet the specified hydraulic conductivity.

E. Capillary Barrier.

A capillary barrier will be installed as part of the cap system. The layer thickness of the capillary barrier layers will be specified in the project plans.

F. Finishing.

Place and finish top lift to a smooth, uniform appearance using a smooth drum roller, and be free of cracks or other openings that would allow drying of underlying layers.

The minimum liner and cover thickness is 4.0 ft measured perpendicular to the slope. Thickness tolerance for liners is +0.8 feet on the sidewall and +0.1 feet on the floor or final cap unless otherwise approved by the engineer. Maintain the sidewall slope as indicated in the Geotechnical Report. Tolerance for slopes shall be 0 to –1/2 percent of slope specified in the Geotechnical Report.

The surface shall at all times be free of desiccation cracks. Check moisture content at least every 7 days at a minimum depth of 6 inches. Wet and smooth roll finished soil liner and performance cap immediately prior to placement of the first lift of mine tailings pile. Restrict all vehicular traffic except as required for redressing or other necessary construction activities. Mark areas completed and approved by the Engineer or Owner’s representative along the perimeters by lathe and flagging or other suitable means.

G. Rejected Work and Rework.

Rework or remove and replace compacted soil material which fails to meet the required thickness, compaction or moisture content requirements, suitability as determined by the Engineer representative (i.e., too wet, too dry, or otherwise compromised) or exhibits cracking, drying, or suffers any material damage prior to certification. Repair all penetrations in the liner or cap resulting from moisture / density testing with a granular bentonite material. Hydrate the bentonite material with clean water as previously specified and pack in 2-inch lifts.

Maintain backfill embankment zones or lifts open until approval of testing is secured from the Engineer. Any work covered up prior to approval shall be excavated and reconstructed. Any materials that become unstable as the result of improper selection of techniques, equipment, or operations during inclement wet weather shall be replaced with suitable material.

3.3 CONSTRUCTION OF PERMANENT TAILINGS PILE

A. Use tailings material from a designated stockpile or other source as approved by the Engineer.

B. Mixing and Moisture Conditioning.

Demonstrate prior to construction the capability of pulverizing and mixing large volumes of soils so that it will pass a one-inch sieve. Moisture condition tailings immediately prior to compaction within the range from optimum moisture content up to 3% wet of optimum.

C. Placement and Compaction.

Submit a plan for the tailings pile construction. If the following material specifications or construction methods are to be changed, additional tests may be required at the discretion of the Engineer.

<u>Placement</u> – The following placement methods are required:

- Frozen mine tailings pile material will not be placed or compacted. Mine tailings pile material will not be placed or compacted upon frozen liner or previous lifts of mine tailings that are frozen.
- Store frozen mine tailings within the lined permanent tailings pile area during periods of freezing temperatures in an isolated and identifiable location. Once materials have reached above freezing temperatures, compact as specified herein.
- Screen, process, disc, or work as needed to reduce soil clod size to 1 inch or less prior to compaction. The material shall contain no rocks or rock pieces larger than 1-inch diameter or that total more than 10% weight.
- Place approved tailings pile material in uniform layers not exceeding 9 inches (loose lift).
- Prior to compaction, representative samples shall be tested for moisture content. If moisture content is within the range specified by preconstruction testing, compaction can begin.

- If the moisture content is outside the acceptable range, wet or dry and rework as needed. Sprinkle or spray with water and doze, wind-row disc,-plow, or process to uniformly increase the moisture content of the soil if the material is below the specified moisture content. Doze, wind-row, disc-plow, or process if the moisture content is too high.
- If water is to be added to the material, sprinkle or spray uniformly and worked to provide relatively uniform moisture content within the material to be compacted.

Compaction – The following compaction methods are required:

- As each lift (approximate 6-inch compacted thickness) of the mine tailings pile has been completed, field density and moisture content tests will be performed at the frequency outlined in the following Paragraphs.
- Minimum field compaction criteria for constructed mine tailings pile shall be 85% of modified proctor maximum dry density from optimum up to 3% wet of optimum moisture content.
- Minimum field compaction criteria for the top ten (10) feet of completed mine tailings pile (ten feet of tailings sand immediately below cap) shall be 90% of modified proctor maximum dry density from optimum to 3% wet of optimum moisture content.
- Perform compaction of loose lifts with an appropriately heavy, properly ballasted, smooth drum vibrating roller-compactor that provides sufficient or greater compactive effort to achieve the specified in-place relative density.
- A minimum of two passes is required, with a pass being defined as two applications of the compacting roller (i.e., for a one-roller compactor, a pass is a trip forward and back, for a two-roller compactor, a pass is a trip forward or backward). Additional passes may be required to achieve compaction requirements. Dozer or scraper equipment shall not be used for primary compactive effort.
- Thoroughly compact and satisfy moisture and density testing requirements for each lift within a construction area prior to placing subsequent lifts.
- Roughen previously compacted lifts to a shallow depth and moisture condition prior to placing subsequent lifts to promote bonding between lifts. During construction, sprinkle finished

lifts or sections with water as needed to prevent drying and desiccation.

- If desiccation and crusting of a lift surface occurs before placement of the next lift, sprinkle the area with water, scarified, and test for acceptable moisture content prior to placing a subsequent lift.
- Promptly and appropriately remove any ponded water that accumulates on newly constructed tailings pile sections. Saturation of these soils by ponding water is not an acceptable practice.

D. Finishing.

Maintain the sidewall slope as indicated on in the Geotechnical Report. Tolerance for slopes shall be 0 to –1/2 percent of slope specified in the Geotechnical Report.

Restrict all vehicular traffic except as required for redressing or other necessary construction activities. Mark areas completed and approved by the Engineer along the perimeters by lathe and flagging or other suitable means.

E. Rejected Work and Rework.

Rework or remove and replace compacted tailings material which fails to meet the required compaction or moisture content requirements, suitability as determined by the Engineer (i.e., too wet, too dry, or otherwise compromised) or exhibits cracking, drying, or suffers any material damage prior to certification.

Maintain backfill embankment zones or lifts open until approval of testing is secured from the Engineer. Any work covered up prior to approval shall be excavated and reconstructed at contractor's expense. Work in inclement wet weather is at contractor's risk. Replace any materials that become unstable as the result of improper selection of techniques, equipment, or operations during inclement wet weather at contractor's expense with suitable material.

3.4 INSTALLATION OF OTHER EMBANKMENTS

A. Other embankments include water diversion berms, surface drainage structures, and/or water retention structures.

B. Install other embankments in accordance with Paragraph 3.2.

C. Provide a minimum of 4 feet in thickness of mine partings fines and/or select clay liners used for construction of water retention structures as measured perpendicular from the slope.

3.5 INSTALLATION OF GROWTH MEDIA

A. Place non-select clay in multiple 9-inch loose lifts compacted to a minimum density of 80% of modified proctor maximum dry density. Maintain moisture content in the range of –3% to +3% of optimum moisture. All density tests shall be taken with the probe at a minimum depth of 6 inches to ensure that a uniform measurement of the entire layer is accomplished. Areas exceeding the maximum density of 90% shall be scarified to a minimum depth of 12 inches and retested until compliance is accomplished.

B. The minimum growth media thickness is 1.5 ft measured perpendicular to the slope. Thickness tolerance for liners is +/-0.2 feet unless otherwise approved by the engineer. Maintain the sidewall slopes to match the select compacted clay cap.

3.6 DENSITY TEST RECORD DOCUMENTATION

A. This section applies to all density test reporting. Density tests will be performed by the Engineer or Owner's representative and the results shall include the following:

1. Horizontal and vertical location of test.
2. Dry density, moisture content and percent of modified proctor.
3. Material description and results of the modified proctor.

B. Density Test Frequency on Compacted Materials.

1. Fill soil analysis shall be tested as discussed in Paragraph 1.4.
2. All moisture-density testing shall be performed by the Engineer on each lift of liner, cap, tailings pile, or other embankment construction, but not less than one test for each day of placement. The following tests may be performed:

Field Testing of Non-Select Clay/Growth Media

Test Required	Method[1]	Testing Frequency
Field Moisture	ASTM D6938 (2010)[2]	1 per 10,000 sq ft with a minimum of 2 test per lift per lift
Field Density	ASTM D6938 (2010)[2]	1 per 10,000 sq ft with a minimum of 2 test per lift per lift

Field Testing for Liner, Cap and Other Embankments

Test Required	Method[1]	Testing Frequency
Field Moisture	ASTM D6938 (2010) [2]	1 per 10,000 sq ft with a minimum of 2 test per lift
Field Density	ASTM D6938 (2010) [2]	1 per 10,000 sq ft with a minimum of 2 test per lift per lift
Grain Size Analysis & Percent Fines Passing #200 Sieve	ASTM D422 (2014) & D1140 (2000)	1 per 10,000 cy of soil with a minimum of 2 tests per layer
Atterberg Limits	ASTM D4318 (2014)	1 per 10,000 cy of soil with a minimum of 2 tests per layer
Hydraulic conductivity	ASTM D5084 (2003)	1 per acre per lift
Thickness	Registered Surveyor	1 survey per 2,500 sf
Laboratory Proctor	ASTM D1557 (2012)	1 per 10,000 cy

Field Testing for Permanent Tailings Piles

Test Required	Method[1]	Testing Frequency
Field Moisture	ASTM D6938 (2010) [2]	1 per 10,000 sq ft with a minimum of 2 test per lift
Field Density	ASTM D6938 (2010) [2]	1 per 10,000 sq ft with a minimum of 2 test per lift
Grain Size Analysis & Percent Fines Passing #200 Sieve	ASTM D422 (2014) & D1140 (2000)	1 per 10,000 cy
Atterberg Limits	ASTM D4318 (2014)	1 per 10,000 cy
Thickness	Registered Surveyor	1 survey per 2,500 sf
Laboratory Proctor	ASTM D1557	1 per 10,000 cy

Field Testing Notes: [1]-Current active standard will apply.
[2]-ASTM D1556 (2007) Standard Method for Density and Unit Weight of Soil in Place by Sand-Cone Method is an acceptable substitute.

3. Continuously observe compaction of the low-permeability soil liner throughout its construction. The number of passes shall be counted and documented once per acre by the Engineer.

4. Determine the thickness of the low-permeability liner by comparison of record survey drawings of the top of the previous liner system component to the top of the completed, compacted liner at the locations of the established 50-foot control grid.

5. The Engineer shall observe and document that the liner does not desiccate before it is covered.

6. Perform final soil moisture content tests within 24 hours prior to placement of first lift of tailings. All measurements shall be at a minimum of 6-inch depth and must be in the range from optimum up to 3% wet of optimum moisture content.

7. Repair all holes in the liner and cap resulting from tests that are performed. Repair holes by filling with compacted partings, clay and/or bentonite. Allow Engineer or Owner's representative to check and document all of the filled holes.

8. Retesting costs at locations of failed or unacceptable work are the responsibility of the contractor.

END OF SECTION

Mine Tailings Material Stockpile
Bruin Point Mine
Earthwork Construction
Quality Control Plan

American Sands Energy Corp

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1.0 GENERAL

1.1 Purpose

The purpose of the *Earthwork Construction Quality Control Plan* (CQCP) is to provide the measures that will be used for the proper earthwork construction of the mine partings fines liner, select clay cap, and non-select clay overtopping cap at the Bruin Point Mine in compliance with:

- the approved engineering design,
- the Embankment Specifications Section 31 24 00
- this CQCP, and
- industry practice and other applicable technical criteria.

This CQCP establishes quantifiable criteria that will be used in the field and laboratory to measure the quality of the installed environmental control systems. The more stringent action will govern for any discrepancies between this document and the Specifications. Specific construction elements that are addressed in this plan include:

- soils, equipment, and construction methods for fill and compacted layers and cap,
- guidance for testing the soils.

1.2 Overview of Tailings Stockpile Design

The sequence of tailings pile development shall follow the design plan and not be altered.

All wastes will be disposed within the Green River Formation separated with a liner. After excavation and stockpiling of the top soil, the underlying Green River Formation will be lined with an engineered liner system (Quality Level 2). The final tailings stockpile will consist of (from the bottom up):

- 4 feet of select mine partings fines liner that will be compacted to achieve a hydraulic conductivity less than or equal to 1×10^{-7} cm/sec;
- Weeping tile;
- Compacted sand tailings;
- 4 feet of protective clay soil cap;
- 0.5 to 1 feet of capillary barrier; and

- 1.5 feet of protective and revegetated growth media soil cover.

1.3 Definitions

The following list of definitions pertinent to this CQCP is provided for reference:

Atterberg Limits: The liquid limit and plastic limit (ASTM D4318). The water content when the soil behavior changes from the liquid to the plastic state is the liquid limit; from the plastic to the semi-solid state is the plastic limit.

Classification System: The soil classification system shall be in accordance with the standard test method for classification of soils for engineering purposes (ASTM D2487).

Compaction: The process of increasing the density or unit weight of soil by rolling, tamping, vibrating, or other mechanical means.

Construction Certification Report: Report that documents construction and testing of each component of the liner, final cap, and weeping tile collection systems. The report also certifies that construction and materials are in accordance with the approved engineering design, license, and CQCP.

Construction Grid: A location reference system used by the surveyors, contractors and operators to identify locations within the landfill. This grid system is similar to a city map grid with gridlines spaced at 100 feet apart measured along perpendicular lines.

Density: Density of a soil is its weight per unit volume; usually reported in pounds per cubic foot.

Fines Content: The percent of soil material passing the No. 200 sieve (75-µm).

Geotechnical Report: The Geotechnical Report "American Sands Energy Corp.: Bruin Point Mine Slope Stability Analyses", prepared by URS Corporation of Salt Lake City, Utah, dated February 4, 2015.

Oversight Technician (OT): A dedicated individual who possesses experience in geotechnical engineering, and soil materials testing. The OT provides monitoring of construction, construction surveillance, testing services, and surveying services or technical oversight of testing and surveying services; and is responsible for the implementation of the CQCP and for assuring that construction is in accordance with the engineering design, CQCP and specifications outlined herein. While the OT is the on-site individual, within this document, OT collectively refers to the on-site individual, his or her firm, or staff and technicians working under his or her direct supervision.

Hydraulic Conductivity: Ratio of flow velocity to driving force for viscous flow under saturated conditions of a specified liquid in a porous medium. Rates of hydraulic conductivity are generally reported in centimeters per second (cm/sec).

In-situ: "As Is", or as it exists in place naturally.

Liner: For the Mine Tailings Material Stockpile, a 4-foot thick layer of low permeability mine partings fines which acts as a barrier to the movement of liquids. The liner is Quality Level 2.

Mine Partings: native interburden materials (waste-rock strata deposits between ore seams) extracted from the mine.

Mine Partings Fines: the native interburden materials extracted from the mine and graded to a fine material with a minimum of 40% and maximum of 80% by weight passing the No. 200 sieve (75-µm), and all material graded to less than the No. 4 sieve (4.75mm).

Mine Tailings: remnant clean sand produced from the ore extraction process containing approximately 90% sand and 10% fines content.

Moisture Content: Ratio of quantity of water in the soil (by weight) to the weight of the soil solids (dry soil), expressed in percentage; also referred to as water content.

Non-Select Clay: native clay excavated and stockpiled to be used as a growth media (overtopping revegetation) installed over the select clay cap. This clay contains traces of gravel, cobble, and organic matter and as specified.

Optimum Moisture Content (OMC): Moisture content corresponding to maximum dry density as determined in modified Proctor test (ASTM D1557).

Permanent Tailings Pile: compacted mine tailings pile to remain at completion of mining, and covered as specified.

Permeability: Capacity of a rock or soil mass for transmitting fluid.

Plasticity: Ability of soil to be remolded without raveling or breaking apart. The plasticity index, numerically equal to the difference between the liquid and plastic limit, is a comparative number that describes the range of moisture contents over which soil behavior is plastic.

Project Representative: The on-site or designated representative of the owner.

Qualified Engineering Technician (QET): is a representative of the OT who shall be NICET-certified in Geotechnical Engineering Technology at level 2 or higher, an engineering technician with a minimum of four years of directly related experience, or a graduate engineer or geologist with one year of directly related experience.

Select Clay: native clay excavated and stockpiled to be used as compacted clay cap or embankments. This is a clayey material with a minimum of 30% by weight passing the No. 200 sieve (75-µm) and without traces of gravel or other deleterious material greater than 1-inch diameter in any dimension and as specified.

Site Grid: A location reference system used by the surveyors, engineers and operators to identify locations within the tailings pile and surrounding area. The Site Grid shall be established by a Licensed Surveyor in the State of Utah using established project control.

Temporary Tailings Pile: portions of tailings will be temporarily stored at the process facilities and subsequently placed by conveyance or other methods back into the underground mine workings.

2.0 FILL MATERIALS

Fill materials used in the tailings pile design include, select clay, non-select clay, and mine tailings. Fill material, as specified here, does not include mine partings fines, which is used to construct low-permeability liners and is further described in Section 3.0.

2.1 Material Acceptance Testing

The Contractor shall submit the following preconstruction test data to the OT for approval for each soil proposed for use as fill material. This information is to be provided for each individual fill source or when, in the opinion of the OT, the material differs from the originally tested and approved material.

Preconstruction testing of fill materials shall include the testing listed in **Error! Reference source not found.** as appropriate for granular or cohesive materials:

Table 1. Preconstruction Testing of Fill Materials (Non Liner)

Fill Material/ Acceptable Usage	Test Required	Method[1]	Required Results
Mine Tailings/ Permanent and Temporary Mine Tailings piles	Unified Soil Classification	ASTM D2487	CH, CL, SC
	Modified Proctor	ASTM D1557	Moisture/density curve for reference
	Grain Size Analysis	ASTM D422 & ASTM D1140	See Note
	Atterberg Limits	ASTM D4318	See Note
Select Clay/ Cap, Embankments	Unified Soil Classification	ASTM D2487	CH, CL, SC
	Modified Proctor	ASTM D1557 (2012)	Moisture/density curve for reference
	Grain Size Analysis	ASTM D422 (2014)	See Note
	Sieve Analysis Percent Fines Passing #200 Sieve	ASTM D1140 (2000)	See Note
	Atterberg Limits	ASTM D4318 (2014)	See Note
	Hydraulic Conductivity	ASTM D5084 (2010)	$\leq 1x10^{-7}$ cm/sec
Non-Select Clay/ Growth Media	Soil Classification	ASTM D2487 (2011)	CH, CL, SC
	Modified Proctor	ASTM D1557 (2012)	Moisture/density curve

Fill Material/ Acceptable Usage	Test Required	Method[1]	Required Results
			for reference
	Grain Size Analysis	ASTM D422 (2014)	See Note
	Sieve Analysis Percent Fines Passing #200 Sieve	ASTM D1140 (2000)	See Note
	Atterberg Limits	ASTM D4318 (2014)	See Note

[1]-Current active standard will apply.

[2]-ASTM D1556 (2007) Standard Method for Density and Unit Weight of Soil in Place by Sand-Cone Method is acceptable substitute.

Note: Sieve analysis and Atterberg limits will be conducted only for comparison to field test data in order for the OT to identify if the material has changed significantly.

Preconstruction testing of select clay, mine tailings, and non-select clay fill shall be as described below:

- Soil classification will be conducted to determine if the soil is a minimum of 30% clay material. If the soil is a clay material, a Modified Proctor compaction test will be conducted to determine the maximum dry density and optimum moisture content.

- Using the results from the Modified Proctor test, a hydraulic conductivity test sample will be prepared at no less than 95% Modified Proctor maximum dry density and optimum moisture content. A moisture-density compaction curve must be established prior to field testing. The moisture-density compaction curve shall include a zero air voids line. It is required that the specific gravity used for the zero air voids line be included, but it may be estimated.

- Hydraulic conductivity tests will be conducted per the specified test method using tap water as the permeant fluid. Distilled or deionized water is not acceptable for use as permeant fluid.

- If the hydraulic conductivity of select clay is 1×10^{-7} cm/sec or less, grading and placement of liner construction can begin with that soil material.

- <u>Mine tailings and non-select clay will not require hydraulic conductivity testing.</u> Grading and placement of mine tailings pile and non-select clay overtopping construction can begin subsequent to approval of the moisture-density curve submittal at the appropriate phase of construction.

- If the hydraulic conductivity test for the select clay sample prepared at 95% Modified Proctor dry density and optimum moisture content does not satisfy the required hydraulic conductivity of 1×10^{-7} cm/sec or less, hydraulic conductivity test(s) with increased dry density and/or increased moisture content will be required if the soil material is to be used for clay liner construction. When using systematic increases in compaction effort and/or moisture content, additional hydraulic conductivity test sample(s) shall be prepared and tested.

- The compaction criteria for grading and leveling fill construction will be based on the criteria used in the hydraulic conductivity test which met the hydraulic conductivity requirement of 1 x 10^{-7} cm/sec or less.

- All hydraulic conductivity test data on soil materials that are used for grading and leveling fill must be submitted in the Construction Certification Report regardless of test method used or test result.

If tests for the fill materials proposed for construction are made by a certified testing laboratory employed by the Contractor, the test information will be submitted to the OT for approval before any material is used in construction. If, in the opinion of the OT, the Contractor's proposed soil is unsuitable for the proposed application, the Contractor shall submit the above evidence for soil of another type or from another source for consideration by the OT.

2.2 Field Quality Control

Preconstruction tests shall be repeated during construction upon visual changes or as specified in Table 2 or if the fill borrow source changes.

Approved select clay, tailings, and non-select clay used as specified will be placed in uniform 9-inch loose lifts and compacted. Previously compacted lifts will be roughened to a shallow depth prior to placement of subsequent lifts to promote bonding between lifts.

Field testing of select clay, tailings, and non-select clay used as specified, shown in Table 2, shall be conducted by the OT:

Table 2. Field Testing of Select Clay, Tailings, and Non-Select Clay

Test Required	Method[1]	Testing Frequency
Field Moisture	ASTM D6938[2]	1 per 10,000 sq ft with a minimum of 2 test per lift
Field Density	ASTM D6938[2]	1 per 10,000 sq ft with a minimum of 2 test per lift
Sieve Analysis	ASTM D422 & D1140	1 per 10,000 cy
Atterberg Limits	ASTM D4318	1 per 10,000 cy
Hydraulic Conductivity (select clay only)[3]	ASTM D5084	1 per acre per lift
Thickness	Registered Surveyor	1 survey per 2,500 sf
Laboratory Proctor	ASTM D1557	1 per 10,000 cy

[1]-Current active standard will apply.
[2]-ASTM D1556 (2007) Standard Method for Density and Unit Weight of Soil in Place by Sand-Cone Method is acceptable substitute.
[3]-Hydraulic conductivity testing not required on tailings and non-select clay.

Select clay, tailings and non-select clay fill will be placed at or above of the specified Modified Proctor maximum dry density, and will be at or within +3% of optimum moisture content. The OT is to perform on-site field moisture (ASTM D6938) and density testing (ASTM D1557) for each maximum 9-inch loose lift on a 100-foot grid over the entire area of grading and leveling fill placement (ASTM D1556 by the Sand-Cone Method may be used as an acceptable substitute for in-place density). Each field moisture density test will be considered to represent a maximum area of 100 feet by 100 feet. Any areas not meeting the specified compaction will be reworked or replaced and recompacted and retested until a passing test is achieved.

In areas where the degree of compaction or uniformity of materials is doubtful, additional tests will be made as directed by the OT.

When sampling for hydraulic conductivity tests, two Shelby tubes/drive cylinders will be retrieved. One tube/cylinder shall serve as the primary test sample. The second tube/cylinder shall serve as the backup sample in case of damage or sample disturbance in the first tube, or in case of a non-conforming hydraulic conductivity test. Shelby tube sample locations will be patched as specified.

3.0 COMPACTED LOW PERMEABILITY MINE PARTINGS FINES LINER

3.1 Low Permeability Liner Requirements

The low permeability liner shall be constructed of mine partings fines as specified in Section 31 24 00. The low permeability liner shall have continuous on-site inspection during construction by the OT or a qualified engineering technician under his direct supervision. All field sampling and testing, both during construction and after completion of the low permeability liner construction, shall be performed by the OT or a qualified engineering technician under his supervision.

3.2 Preconstruction Testing – Low Permeability Liner

Characteristic testing will be conducted on representative samples of the material as follows:

Table 3. Preconstruction Testing for Liner

Test Required	Method	Frequency	Required Value
Soil Classification	ASTM D2487	One per soil type	As specified
Modified Proctor – Moisture/Density Relationship	ASTM D1557	One per soil type	Moisture/density curve for reference
Sieve Analysis – Percent Fines Passing #200 Sieve	ASTM D422 & D1140	One per soil type	>30%, <80% passing #200 sieve
Atterberg Limits	ASTM D4318	One per soil type	Liquid Limit (LL) ≥30

Table 3. Preconstruction Testing for Liner

Test Required	Method	Frequency	Required Value
			Plasticity Index (PI) $\geq$15
Hydraulic Conductivity	ASTM D5084	1 per Standard Proctor	$k \leq 1X10^{-7}$ cm/sec

Sieve analysis, Atterberg limits and soil classification will be conducted to determine if the mine partings fines meets the criteria outlined above. If the results of these tests indicate acceptable source material, a Modified Proctor compaction test will be conducted to determine the maximum dry density and optimum moisture content.

Using the results from the Modified Proctor test, a hydraulic conductivity test sample will be prepared at no less than 95% Modified Proctor maximum dry density and optimum moisture content. A moisture-density compaction curve must be established prior to field testing. The moisture-density compaction curve shall include a zero air voids line. It is required that the specific gravity used for the zero air voids line be included, but it may be estimated.

Hydraulic conductivity tests will be conducted per the specified test method using tap water as the permeant fluid. Distilled or deionized water is not acceptable for use as permeant fluid.

If the hydraulic conductivity is $1x10^{-7}$ cm/sec or less, low permeability liner construction can begin with that material.

If the hydraulic conductivity test for the sample prepared at 95% Modified Proctor maximum dry density and optimum moisture content does not satisfy the required hydraulic conductivity of $1x10^{-7}$ cm/sec or less, hydraulic conductivity test(s) with increased dry density and/or increased moisture content will be required if the soil material is to be used for liner construction. When using systematic increases in compaction effort and/or moisture content, additional hydraulic conductivity test sample(s) shall be prepared and tested.

The compaction criteria for liner construction will be based on the criteria used in the hydraulic conductivity test which met the hydraulic conductivity requirement of $1x10^{-7}$ cm/sec or less.

All hydraulic conductivity test data on soil materials which are used for liner must be submitted in the Construction Certification Report regardless of test method used or test result.

Quality control of the soil plasticity will be closely adhered to and maintained during material selection for liner construction. Test results of the Atterberg limits and gradation will be continually reviewed so that any changes in either physical property can be detected and additional appropriate laboratory testing performed. Any time the LL or PI changes by more than 10 points, a new compaction series shall be run in the laboratory to determine the maximum dry density, optimum moisture, and the laboratory hydraulic conductivity. To adequately determine the variability of the soil used for liner construction, it is strongly recommended that all liner soil borrow sources be thoroughly tested prior to use to establish their Atterberg limits and compaction parameters.

3.3 Construction Methods – Low Permeability Liner

Low permeability liner construction testing will be conducted in a systematic and timely fashion. A construction period of 60 days or less will be targeted for each area. For construction periods exceeding 60 days for a given area, explanation for the delayed construction and methods used to ensure low permeability liner integrity will be provided in the Construction Certification Report.

3.3.1 Preparation

- Excavation should be to the designed subgrade; however, if fill is necessary to reach subgrade design elevations, fill will be constructed and tested using select clay as described in Section 2.0.

- Prior to placing mine partings fines liner materials, the subgrade should be proof-rolled unless the in-situ material is such that removal or scarification can only be achieved by ripping with a bulldozer. If the excavation has been backfilled or inundated by heavy rain, any localized soft spots shall be removed and replaced with compacted select clay fill.

- The subgrade will be surveyed on the 50-foot construction grid prior to liner construction, for documentation that elevations are within ±0.1 feet of design grade, except where an over-excavated hydrated clay surface has been exposed, in which case this requirement does not apply. The survey shall document the over-excavated condition. All materials placed on such an over-excavated surface shall meet liner specifications.

- Construction shall be sequenced in such a manner as to maintain drainage and minimize the potential effects of precipitation on the construction.

- Continuous visual inspection of the materials being used will be performed by the OT and contractor to ensure proper soils are being used.

- Due to the cohesive nature, it may be difficult to hydrate the mine partings fines to the required moisture content necessary for compaction. Prior to adding water, reduce clod size through disking, pulverizing, or rotavating. Add water, thoroughly mix the soil and stockpile to allow adequate time to hydrate. The higher the plasticity of the soils, the longer this mixing and hydration process will take.

- In-situ material and backfill shall be moisture conditioned. Multiple water spray applications shall be made as required until loose material is hydrated and can be compacted.

3.3.2 Placement

- Low permeability liner material will not be placed or compacted during sustained periods of temperatures below 32^{o}F.

- If necessary, the soil material will be screened, processed, disced, or worked to reduce soil clod size to 1 inch or less prior to compaction. The mine partings fines shall contain material (gravel, coarse sand, etc.) larger than the No. 4 sieve (4.75 mm) or that total more than 10% weight.

- Approved low permeability liner material will be placed in uniform layers not exceeding 9 inches (loose lift). If the pads of the compactor to be used will not penetrate a 9-inch loose lift, the thickness of the loose lift will be reduced to allow for full penetration by the compactor pads. In constructing a 4-foot thick low permeability liner, a minimum of six lifts will be used. Compaction equipment will be maintained to avoid clogging around the compactor pads.

- Prior to compaction, representative samples shall be tested for moisture content. If moisture content is at wet of optimum or within the range specified by preconstruction testing, compaction can begin.

- If the moisture content is outside the acceptable range, the soil will be wetted or dried and reworked accordingly. The soil shall be sprinkled or sprayed with water and dozed, wind-rowed, disc-plowed, or processed to uniformly increase the moisture content of the soil if the material is below the specified moisture content. The soil shall be dozed, wind-rowed, disc-plowed, or processed if the moisture content is too high.

- If water is to be added to mine partings fines, it shall be sprinkled or sprayed uniformly and worked to provide relatively uniform moisture content within the material to be compacted.

- Contaminated water will not be used in the construction of the low permeability liner.

3.3.3 Compaction

- As each lift (approximate 6-inch compacted thickness) of low permeability liner has been completed, field density and moisture content tests will be performed at the frequency outlined in the following section.

- Minimum field compaction criteria for constructed low permeability liner shall be 95% Modified Proctor maximum dry density at a moisture content as specified, or the compaction criteria established during preconstruction testing.

- Compaction of loose lifts shall be performed with an appropriately heavy, properly ballasted, penetrating foot compactor such as a pad foot, prong-foot, or sheepsfoot compactor similar to a CAT 815 or equivalent.

- A minimum of four passes is required, with a pass being defined as two applications of the compacting roller (i.e., for a one-roller compactor, a pass is a trip forward and back, for a two-roller compactor, a pass is a trip forward or backward). Additional passes may be required to achieve compaction requirements. Dozer or scraper equipment shall not be used for primary compactive effort.

- Within a construction area, each lift shall be thoroughly compacted and satisfy moisture and density testing requirements prior to placement of subsequent lifts.

3.3.4 Lift Bonding

- Previously compacted lifts will be roughened to a shallow depth and moisture conditioned prior to placement of subsequent lifts to promote bonding between lifts. The length of the compactor pads shall be sufficient to penetrate the subsequent loose lift and the lift interface to provide bonding between lifts. During construction, finished lifts or sections will be sprinkled with water as needed to prevent drying and desiccation.

- If desiccation and crusting of a lift surface occurs before placement of the next lift, the area shall be sprinkled with water, scarified, and tested for acceptable moisture content prior to placement of a subsequent lift.

- Completed sections of compacted low permeability liner shall be sealed by rolling with a rubber tired or smooth drum roller and sprinkled with water as needed.

- Any ponded water that accumulates on newly constructed low permeability liner shall be promptly and appropriately removed. Saturation of these soils by ponding water is not an acceptable practice.

3.3.5 Low Permeability Liner Tie-in

- Tie-ins to existing low permeability liner areas will be made using a sloped transition or stair-step approach. When additional low permeability liner is to be constructed, the leading edge of the existing material will be cut back and scarified in a sloped or stair step manner and the new low permeability liner tied into the existing low permeability liner (a minimum 15-foot length of leading edge will be reworked for a 4-foot thick low permeability liner). The intent of this method of construction is to prevent a vertical joint through the constructed low permeability liner.

- Markers will be provided at the limits of constructed low permeability liner, but may be removed upon approval of subsequent liner construction. The markers must be tied into the site grid system for reference and shall be placed immediately adjacent to and not through the constructed liner.

3.4 Field Testing – Low Permeability Liner

Minimum requirements for field testing by the OT during construction of low permeability liner for each cell or portion thereof are as follows. Construction is expected to use 6-inch parallel lifts, but horizontal lifts for sidewall construction may also be used.

Table 4. Field Testing for Liner

Test Required	Method[1]	Frequency

Table 4. Field Testing for Liner

Test Required	Method[1]	Frequency
Field Moisture	ASTM D6938[2]	1 per 10,000 sq ft with a minimum of 2 test per lift
Field Density	ASTM D6938[2]	1 per 10,000 sq ft with a minimum of 2 test per lift
Sieve Analysis	ASTM D422 & D1140	1 per 10,000 cy
Atterberg Limits	ASTM D4318	1 per 10,000 cy
Hydraulic Conductivity (select clay only)[3]	ASTM D5084	1 per acre per lift
Thickness	Registered Surveyor	1 survey per 2,500 sf
[1]-Current active standard will apply. [2]-ASTM D1556 (2007) Standard Method for Density and Unit Weight of Soil in Place by Sand-Cone Method is acceptable substitute.		

When sampling for hydraulic conductivity tests, two Shelby tubes/drive cylinders will be retrieved. One tube/cylinder shall serve as the primary test sample. The second tube/cylinder shall serve as the backup sample in case of damage or sample disturbance in the first tube, or in case of a non-conforming hydraulic conductivity test. Shelby tube sample locations will be patched as specified.

Care will be taken to reference field density tests to the correct Proctor curve for the material being used in construction.

An increase in the frequency of field density testing does not require a corresponding increase in sieve analysis, Atterberg limits or hydraulic conductivity testing.

Throughout construction, test results will be reviewed by the OT so that any changes in physical properties can be detected and additional appropriate laboratory tests performed. Any time the LL or PI changes by more than 10 points as compared to the preconstruction testing, a new compaction series shall be run in the laboratory to determine the maximum dry density, optimum moisture, and the laboratory hydraulic conductivity. The laboratory hydraulic conductivity test will be performed on the varying material to ensure a hydraulic conductivity of $1x10^{-7}$ cm/sec or less will be achieved using the construction compaction criteria.

3.5 Survey Control – Low Permeability Liner

The as-built thickness of the constructed low permeability liner shall be determined by survey methods on a pre-established 2,500 square foot construction grid.

Prior to the placement of any low permeability liner, the subgrade shall be surveyed to verify constructed tolerance of ±0.1 ft. Upon completion and prior to the installation of subsequent liner or cap elements, the top of the low permeability liner shall be surveyed to ensure the specified minimum 4-foot thickness of low permeability clay has been achieved.

4.0 TAILINGS RETENTION BASIN

4.1 General

The tailings retention basin will be constructed to provide a foundation for the HDPE liner that is free of debris, angular gravel, rock, bedrock, or any other material that may damage the liner. If the prepared area does not meet the requirements of the specifications, debris, gravel, rock, bedrock, and other deleterious materials should be removed and replaced material per the specifications.

Conventional surveying methods should be used as specified by the contractor to measure the thickness of the liner subgrade. Areas of the liner subgrade that are observed to be deficient should be scarified; moisture conditioned, receive additional select clay or mine partings fines and compacted to meet the requirements of the specifications.

If non-conforming tests are produced during field density testing, refer to Section 6.2.

The HDPE retention basin liner should be installed by a specialty contractor with previous experience installing liners of this size in accordance with the specifications. All fused seams of the HDPE shall be checked along the entire seam using an approved method proposed in the construction plan in accordance with the project specifications. Any leaks will be refused and sealed to the satisfaction of the OT.

Adequate slack will be provided in the liner to prevent overstressing or tearing of the liner during placement of cover soils. In the case that the liner is damaged during installation or placement of cover soils the liner will be exposed, cleaned, repaired, fused, leak tested, and covered to the satisfaction of the OT.

The contractor will provide a cover plan demonstrating the proposed method to cover the HDPE liner with lightweight equipment. The plan will show that turning and cornering of equipment of any size will not be required over the liner. Additionally, the plan will demonstrate that proposed lightweight equipment will not damage the HDPE liner.

5.0 WEEPING TILE

5.1 General

Each lot of weeping tile and fittings will be inspected upon delivery to the site. All materials should be free of cracks, defects, foreign inclusions, or other injurious defects. All defective materials shall be replaced. No defective material will be used in the weeping tile system.

In the case that liner grades are not as shown in the project plans, the area shall be re-graded until the correct grade is restored while maintaining the minimum liner thickness and positive drainage in all areas as shown on the project plans.

In the case that weeping tiles are moved, displaced, cracked, crushed, or damaged in any way during installation or covering operations, the weeping tile will be removed and replaced.

If non-conforming tests are produced during field density testing, refer to Section 6.2.

6.0 OTHER REQUIREMENTS

6.1 Test Holes

All soil sampling or testing locations shall be backfilled and compacted with the subject material or bentonite seal. These locations include field density test locations, material sample locations and tube sample locations, as well as any other liner or final cap penetration.

6.2 Non-Conforming Tests

6.2.1 Field Density and Moisture Tests

Sections of compacted low permeability liner, tailings pile, or cap that do not meet the density and moisture content requirements will be reworked and retested until the section passes the criteria or the section will be removed and replaced to passing standards.

In the event of a failed moisture or density test, it is necessary to isolate the non-conforming area. Additional tests will be performed approximately halfway between the failed test and the nearest adjacent passing test locations. If the additional tests pass, the area bounded by passing tests will be reworked and retested, or removed and replaced. If the additional tests fail, a second set of additional tests will be performed between the failing additional tests and surrounding passing tests. This process will be repeated until the non-conforming area is defined. Once the non-conforming area is defined, it will be reworked and retested until compaction and moisture criteria are met or removed and replaced.

In lieu of additional tests to define the non-conforming area, it is acceptable to rework the entire area bounded by the initial surrounding passing tests.

If reworking consistently fails and the section does not pass the criteria, the non-conforming area shall be removed and replaced.

All reworked areas shall be tested and confirmed to satisfy the compaction criteria. The reporting of retests shall clearly indicate the number and location of the non-conforming test and the subsequent conforming retest. Retests shall be taken near the location of the original non-conforming test.

6.2.2 Hydraulic Conductivity Tests

In the event of a non-conforming hydraulic conductivity test on the constructed low permeability liner or cap, the test procedures and test sample will be reviewed for inconsistency in test procedure or flaw in the hydraulic conductivity test sample. A review of the associated soil characteristic tests and field density/moisture content tests shall be performed to confirm that the appropriate compaction criteria were used.

A hydraulic conductivity sample will be prepared from the backup drive cylinder or Shelby tube sample and an additional hydraulic conductivity test shall be performed on the backup sample.

If the backup sample provides an acceptable hydraulic conductivity result, the results of the first sample will be disregarded. If the backup sample does not provide an acceptable hydraulic conductivity, a review of the required compaction criteria will be performed to determine if the compaction criteria require revision.

Additional hydraulic conductivity test samples will be retrieved between the non-conforming hydraulic conductivity location and the surrounding passing hydraulic conductivity test locations. The results from these additional hydraulic conductivity tests will be used to bound the area requiring rework or removal and replacement. The area to be reworked or removed and replaced will be bounded by passing hydraulic conductivity tests. In lieu of additional testing to define the nonconforming area, the area between the initial passing hydraulic conductivity tests will be reworked or removed and replaced.

If reworking consistently fails and the section does not pass the criteria, the non-conforming area will be removed and replaced.

All reworked areas will be tested and confirmed to satisfy the compaction and hydraulic conductivity criteria. The reporting of retests will clearly indicate the number and location of the non-conforming test and the subsequent conforming retest. Retests shall be taken near the location of the original non-conforming test.

6.2.3 Reporting

All test results shall be reported. In case of non-conforming test results, the steps taken to correct the nonconformity shall be explained in the Construction Certification Report.

6.3 Clay Protection from Desiccation

Completed portions of low permeability mine partings liner shall be kept moist so the material will not desiccate before it is covered with mine tailings. In uncovered areas, soil moisture will be checked at least weekly, with the final soil moisture content test performed within 24 hours prior to placement of mine tailings. All measurements shall be at a 6-inch depth and must be no less than 1% of the minimum allowable moisture content specified.

7.0 DOCUMENTATION

A draft Construction Certification Report (CCR) will be prepared by the OT and submitted to the Owner to document the installation quality and procedures. A cover letter will preface the report providing names and telephone numbers of contact personnel. In addition, at a minimum, the information listed below will be included with the CCR.

1. A scaled plot will be made for each compacted lift of any material. This plot will contain locations and identification number for all the tests conducted on a particular lift and sample locations. For clarity, multiple plots for the same compacted lift may be provided (i.e., one plot for field density/moisture tests and another plot for soils characteristics and hydraulic conductivity test sample locations). The locations of all soils tests (passing and failing) will be recorded. The site grid system will be overlain onto the plot. North arrows and bar scales will be provided.

2. Summary tables will be provided for test results. At a minimum, test and/or sample number, location, and result will be reported. Actual field and/or laboratory data and test sheets will be provided if needed. Where appropriate, laboratory test numbers will cross-reference corresponding field density/moisture tests. Cross-references will be provided between non-conforming tests and subsequent passing retests.

3. In addition to reporting the results of hydraulic conductivity tests, test data calculations will be included for all hydraulic conductivity tests.

4. A site layout plan will be included indicating area of low permeability liner construction covered by the submittal, filled areas, active areas, site grid plan, graphic scale, north arrow, and other pertinent site information.

5. Reference locations will be noted on a drawing of the area evaluated. All elevation calculations necessary for thickness determination shall be attached as part of the supporting documentation to the report.

6. A construction log will be provided that indicates dates, stage of construction, and weather conditions.

SECTION ZZ ZZ ZZ

RETENTION BASIN

PART 1: GENERAL

1.1 DESCRIPTION

A. Retention Basin Liner including liner subgrade, geosynthetic basin liner, and liner cover material.

1.2 SUBMITTALS

A. A Retention Basin Liner Construction Plan including the soil gradation for Liner Cover Material. Submit to the Engineer for approval fifteen (15) days prior to Retention Basin liner construction.

B. Submit for approval, all geotechnical materials prior to liner subgrade and liner cover material placement. Submit to the Engineer for approval fifteen (15) days prior to any construction.

1.3 DEFINITIONS

A. Retention Basin – Basin intended to retain all contact water within the tailings footprint.

B. Liner Subgrade –Soil under the geosynthetic liner in the Retention Basin.

C. Geosynthetic Basin Liner – A High Density Polyethylene (HDPE) membrane used to line the Retention Basin.

D. Liner Cover Material – A layer of non-flowing, erosion-resistant soil used to cover the HDPE liner of the Retention Basin.

1.4 PRECONSTRUCTION ACCEPTANCE FOR SELECT CLAY SOIL AND LINER COVER MATERIAL

A. The Contractor shall submit to Engineer or designee the following preconstruction test data for select clay soil and liner cover material as specified in Section 31 24 00. This information is to be provided for each individual fill source or when in the opinion of Engineer or designee the material differs from the originally tested and approved material. Preconstruction of select clay and liner cover material shall include the required testing, with a minimum of two tests each.

PART 2: EXECUTION

3.1 GENERAL PREPARATION OF LINER SUBGRADE

A. Complete preparation of basin area including clearing vegetation, sticks, debris of any kind, organic matter, rocks, boulders, stones, and other angular or sharp particles, regardless of diameter, from the upper 24 inches of the liner subgrade measured perpendicular from the slope.

B. The six (6) inches of soil located immediately beneath the liner shall consist of no more than 50 percent by weight of any particles between one-quarter (1/4) and three-eighths (3/8) inch in diameter.

C. If the natural soil within the basin does not meet the requirements of the specifications, the natural soil shall be removed and replaced with select clay soil, mine partings fines, or liner cover material per the specifications as necessary to provide a suitable foundation for the geosynthetic liner that is free of debris, angular gravel, rock, bedrock, or any other material that may damage the liner.

D. The liner subgrade should be compacted to 95% of modified proctor maximum dry density.

E. The liner subgrade shall be graded and rolled to provide a smooth, flat surface for placing the liner within (+,-) 0.2 feet of design elevations. The final surface should be void of all abrupt changes in grade, such as vehicular ruts.

F. The liner subgrade shall be sloped to within (+,-) 0.5% of 1.5% from the center of the retention basin to the dikes to ensure that air cannot be trapped under the liner.

G. The Engineer or Owner’s representative shall inspected and approve the basin to verify that all liner subgrade areas meet specification requirements before placement of the geosynthetic liner.

3.2 INSTALLATION OF THE GEOSYNTHETIC LINER

A. See Specification ZZ ZZ ZZ Synthetic Liner Installation for more information.

3.3 GENERAL PLACEMENT OF LINER COVER MATERIAL

A. As a minimum, a uniform 24-inch layer of liner cover material shall be placed above the geosynthetic liner to prevent damage to the liner.

B. The soil located immediately above the liner shall be consistent with specification requirements for liner cover material being inorganic, free of all rocks, stones, sticks, debris of any kind, and consist of no more than 50 percent by weight of any particles between one-quarter (1/4) and three-eighths (3/8) inch in diameter.

C. Placement of cover material shall be done in such a manner as to preclude any damage to the liner. Turning or abrupt stops and starts of equipment on the liner cover soil can cause damage to the liner.

D. Upon completion of the covering operation, the cover material shall be smoothed to the required elevation (+,-) 0.2 feet without damaging the liner.

E. The contractor shall use low ground pressure equipment to prevent damage to the liner. Any damage that occurs to the line shall be repaired at no expense to the owner.

END OF SECTION

SECTION ZZ ZZ ZZ

WEEPING TILE

PART 1: GENERAL

1.1 DESCRIPTION

A. Weeping tile is a perforated pipe used for underground collection and discharge of contact water.

1.2 SUBMITTALS

A. Drainage system construction plan.

B. Submit for approval, sample of weeping tile pipe, specifications of weeping tile pipe.

1.3 DEFINITIONS

A. Not used

1.4 REFERENCES

ASTM D1248 Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable

ASTM D2513 Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings

ASTM D3261 Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing

ASTM D2487 Soils for Engineering Purposes (Unified Soil Classification System)

ASTM D698 Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. ft. (600 kN-m/cu. m.))

ASTM D5084 Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

ASTM D422 Standard Test Method for Particle-Size Analysis of Soils

Specification 31 24 00 Embankments

Specification on Earthwork CQCP Plan

PART 2: MATERIALS

2.1 WEEPING TILE

A. The HDPE pipe should be manufactured from high density polyethylene resin which meets or exceeds the requirements of Type III, Category 4 or 5, Grade P33 or P34, Class C, as per ASTM D1248. The pipe should be designed to withstand the pressures of the materials placed over the pipe.

B. Where possible, pipe and fittings should be produced by the same manufacturer from identical materials. Special or custom fittings may be exempted from this requirement.

C. The pipe and fittings shall be homogenous throughout and free from visible cracks, foreign inclusions, or other injurious defects.

D. Nominal pipe diameter shall be as shown on the drawings. The nominal pipe inside diameter of the pipe shall be true to the specified pipe size in accordance with ASTM D2513.

E. Fittings and joints shall be of a schedule, pressure class, external load carrying capacity, SDR, or pipe stiffness that equals or exceeds that of the pipe. The fittings and joints shall have standard dimensions that conform to ASTM D3261.

F. Minimum wall thickness shall be SDR 11.

G. Perforations shall be either circular or slots and free of cuttings or frayed edges on both the inside and outside.

H. If the tailings sand is capable of passing through the weeping tile a geotextile filter should be used around the weeping tile to prevent clogging.

2.2 BACKFILL AND BEDDING

See specification 31 24 00 Embankments

PART 3: EXECUTION

3.1 PERFORATED PIPE PLACEMENT

A. Excavate to dimensions indicated. Provide a bedding surface of tailings sand material to specified thickness over the compacted select clay liner as indicated in the project plans.

B. Tailings sand material shall be placed by dumping from a height no more than 2 feet.

C. Tailings sand material placed below the weeping tile shall be firmly compacted prior to pipe placement using hand-operated vibratory compaction equipment to 95 percent of maximum laboratory density per ASTM D698, or to the satisfaction of the Oversight Technician (OT) defined in the CQCP Plan.

D. Place weeping tile at the grades specified in the project plans.

E. Place pipe with slots or perforations as specified in the project plans.

F. Maximum lengths of joined pipe to be handled as one section shall be according to the manufacturer’s recommendations as to pipe size, pipe SDR so as to not cause distresses to the pipe.

G. Following placement of weeping tile, tailings sand material shall be placed to the grades specified in the project plans in such a manner as to prevent damage to, and substantial deflection of the pipe according to the manufacturer’s recommendations.

END OF SECTION

SECTION ZZ ZZ ZZ

SYNTHETIC LINER INSTALLATION

PART 1: GENERAL

1.1 DESCRIPTION

A. An overview of procedures for installation of the geosynthetic basin liner.

1.2 SUBMITTALS

A. A Retention Basin Liner Construction Plan, as specified herein, selected geosynthetic liner sample, and associated specifications.

B. Subcontractor Qualifications Submittal for approval fifteen (15) days prior to liner construction. The plan should also demonstrate prior experience installing HDPE liners on at least 5 projects of similar size within the last 5 years.

1.3 DEFINITIONS

A. Retention Basin – Basin intended to retain all contact water within the tailings footprint.

B. Liner Subgrade –Soil under the geosynthetic liner in the Retention Basin.

C. Geosynthetic Basin Liner – A High Density Polyethylene (HDPE) membrane used to line the Retention Basin.

1.4 STANDARD TEST METHODS

ASTM D 6392: Standard Test Methods For Determining The Integrity Of NonReinforced Geomembrane Seams Produced Using ThermoFusion Methods

ASTM D 5820: Standard Practice For Pressurized Air Channel Evaluation of Dual Seamed Geomembrane

ASTM D 5641: Standard Practice For Geomembrane Seam Evaluation By Vacuum Chamber

ASTM D 6497: Standard Guide For Mechanical Attaclunent of Geomembrane to Penetrations or Structures

ASTM D 7240: Standard Practice for Leak Location using Geomembrane with an Insulating Layer in Intimate Contact with a Conductive Layer via Electrical Capacitance Technique (Conductive Geomembrane Spark Test)

GRI Standard GM13: Test Properties, Testing Frequency and Recommended Warranty for High Density Polyethylene (HDPE) Smooth and Textured Geomembrane

GRI Standard GM14: Selecting Variable Intervals for Taking Geomembrane Destructive Seam Samples Using the Method of Attributes

GRI Standard GM17: Test Properties, Testing Frequency and Recommended Warranty for Linear Low Density Polyethylene (LLDPE) Smooth and Textured Geomembrane

GRI Standard GM19: Standard Specification for Seam Strength and Related Properties of Thermally Bonded Polyolefin Geomembrane

1.5 PRECONSTRUCTION ACCEPTANCE FOR GEOMEMBRANE

A. Upon arrival on site, QC personnel will inventory all materials on the job site.

B. Roll numbers of Geomembrane will be documented and cross-referenced with the Bill of Lading for materials supplied by the supplier.

C. Copies of the Material Delivery Log and signed Bill of Lading will be provided to Owner's Rep while the QA personnel retains the original copies.

D. Any visible damage to roll materials should be noted on the roll and Inventory Check List.

PART 2: EXECUTION

2.1 PREPARATION OF SUBGRADE

A. The subgrade will be prepared and maintained by the contractor, and will be inspected by the Supervisor according to Specification ZZ ZZ ZZ Retention Basin.

2.2 PREPARATION AND PLACEMENT OF THE GEOSYNTHETIC LINER PANELS

A. Each panel will be assigned a number as described below.

1. When there is one layer, panels may be designated with only a number, i.e... 1, 2, 3, 4 etc.

2. When two or more layers are required, use a letter and number, i.e....

   Primer Liner P1, P2, P3, P4 etc...

   Secondary Liner S1, S2, S3, S4 etc...

Tertiary Liner T1, T2, T3, T4 etc...

B. This numbering system should be used whenever possible. Agreement to a panel numbering system should be made at the pre-construction meeting. However, it is essential that the Supervisor and the owner representative and third party QA inspector agree.

C. Panel numbers shall be written in large block letters in the center of each deployed panel. The roll number, date of deployment and length (gross) should be noted below the panel number. All notes should be made, so that they are easily visible from a distance. On long panels it is beneficial to write information on both ends.

D. Panel numbers shall be documented along with the roll number and other information such as layer type, dimensions, and date deployed.

E. If there is a partial roll left after deployment, it is important to write the last four digits of the roll number in several locations on the roll along with the estimated length for future identification.

F. Deployment of geomembrane panels shall be performed in a manner that will comply with the following guidelines:

1. Unroll geomembrane using methods that will not damage geomembrane and will protect underlying surface from damage.

2. Place temporary ballast, such as sandbags, on geomembrane that will not damage the geomembrane and to prevent wind uplift.

3. Personnel walking on geomembrane shall not engage in activities or wear shoes that could damage it. Smoking is not permitted on the geomembrane.

4. Do not allow heavy vehicular traffic directly on geomembrane. Rubber tired and tracked ATV's and equipment are acceptable if contact pressure is less than 8 psi.

   a. Protect geomembrane in areas of heavy traffic by placing protective cover over the geomembrane.

   b. Prior to driving on any geomembrane layer, please check for sharp edges, embedded rocks, or other foreign objects that may protrude in the tires and tracks.

   c. Path driven on geomembranes shall be as straight as possible with no sharp turns, sudden stops or quick starts.

   d. Areas where driving occurs shall be continuously and thoroughly inspected throughout the deployment process by the contractor and the third party CQA.

2.3 TRIAL WELDS

A. Seaming apparatus shall be allowed to warm up a minimum of 5 minutes before performing trial welds.

B. Each seaming apparatus along with the welding technician will pass a trial weld prior to use. Trial welds to be performed in the morning and afternoon, as a minimum, as well as whenever there is a power shutdown.

C. Fusion or wedge welds will always be performed or conducted on samples at least 6.0 ft long. Extrusion welds will be done on samples at least 3.0 ft long.

D. Operating temperatures should be monitored while welding. The welding technician should verify that the equipment is capable of maintaining temperature while welding.

E. Sampling Procedure

1. Cut four 1.0 in wide specimens from the trial weld sample. Specimens will always be cut using a 1.0 in die cutter, so the peel values may be used for qualitative analysis.

2. When cutting coupons from the trial weld samples, the inside and outside tracks on the coupon should be identified to assist in troubleshooting problems in case the weld fails. The outside track will be defined as the track, which would be peeled if pulling the overlap exposed in a typical installation, or the seam that is closest to the edge of the top sheet. The inside track is the seam closest to the edge of the bottom sheet.

F. Cutter

1. Only cut one sample at a time to avoid damaging the die cutter.

2. Samples should be free of sand and grit prior to cutting sample.

3. Inspect the die edge weekly for nicks, dents or signs of dullness. Dullness of the cutting edge may damage the units.

4. Remove die when edge has been dulled and lightly reshape it with a medium hand file. When wear is excessive return it for a replacement die.

5. When the cutting board becomes deeply scored and/or interferes with coupon cutting it should be replaced.

6. To adjust the depth of the die cut into the cutting board, after replacing the cutting board or sharpening the die, 0.015 in washer shims can be added or removed between the cutting ram and the ram extension. Only add shims when cutting is difficult due to lack of depth of cut.

G. Trial Weld Testing

1. Allow coupons to cool prior to testing. Avoid separating the coupons while hot as failure of the sheet may be initiated and false readings indicated.

2. In extreme heat the coupons may need to be cooled, using water or an insulated cooler prior to peel testing. Lab conditions specify 70 degrees (plus or minus 4 degrees) Fahrenheit. Coupon temperatures greater than 70 degrees may result in lowered strengths.

3. Visually inspect the coupons for squeeze-out, footprint, pressure and general appearance.

4. Two coupons will be tested in peel on the field tensiometer at a separation rate of 2 in per minute (for HDPE). Two coupons will be tested in Shear.

H. Pass/Fail Criteria

1. Criteria for passing trial welds will be as follows:

   a. Seam must exhibit film tear bond (FTB). Trial welds should have no incursion into the weld.

   b. Peel and shear values shall meet or exceed the values as listed in Appendix A, Table 1 for HDPE smooth or textured sheet (@ 2 in/min).

   c. Peel and shear values shall meet or exceed the values as listed in Appendix A, Table 2 for LLDPE smooth or textured sheet (@ 2 in/min).

   d. Both tracks of fusion welded samples must pass for the trial weld to be considered acceptable. If any of the four coupons fail due to seam incursion (no FTB) or low strength values, the trial weld must be performed again.

   e. The QC personnel will give approval to proceed with welding after observing and recording all trial welds.

2. All trial weld data will be documented

3. When logging fusion welded peel values, indicate the values for the outside track first, followed by the inside track.

4. Speed and temperature setting will be recorded for each machine trial weld as appropriate.

2.4 GEOMEMBRANE FIELD SEAMING

A. The seam number takes the identity of the panels on each side. The seam between panels 1 & 2 becomes seam 1/2.

B. Welding technicians will record their initials, machine number, date and time at the start of every seam. QC personnel will document it. The technician should also periodically mark temperatures along the seam and at the end of the seam.

C. Approved processes for field seaming and repairing are fusion welding and extrusion welding. All welding equipment shall have accurate temperature monitoring devices installed and working to ensure proper measurement.

D. Fusion welding shall be used for seaming panels together and is not used for patching or detail work. The Supervisor shall verify that:

1. The equipment used is functioning properly.
2. All work is performed on clean surfaces and done in a professional manner. No seaming will be performed in adverse weather conditions.

E. Extrusion welding shall be used primarily for repairs, patching and special detail fabricating and may be used for seaming. The Supervisor shall verify that:

1. Equipment used is functioning properly.
2. Welding personnel are purging the extrusion welders of heat degraded extrudate prior to actual use.
3. All work is performed on clean surfaces and done in a professional manner. No seaming will be performed in adverse weather conditions.

F. For seam preparation, the welding technician shall verify that:

1. Prior to seaming, the seaming area is free of moisture, dust, dirt, sand or debris of any nature.
2. The seam is overlapped properly for fusion welding.
3. The seam is overlapped or extended beyond damaged areas at least 4.0 in when extrusion welding.
4. The seam is properly heat tacked and abraded prior to extrusion welding.
5. Seams are welded with fewest number of unmatched wrinkles or "fishmouths".

G. No seaming will be performed in ambient air temperatures or adverse weather conditions that would jeopardize the integrity of the liner installation.

2.5 FIELD DESTRUCTIVE TESTING

A. Destructive seam tests shall be performed to evaluate bonded seam strength. The frequency of sample removal shall be one sample per 1000 ft of seam, unless site specifications differ. Location of the destructive samples will be selected and marked by the QA technician or third party QA inspector. Field testing should take place as soon as possible after seam is completed.

B. Samples should be labeled in numerical order, i.e. DS-1, DS-2 etc.... This should carry thru any layer and or multiple ponds; do not start numbering from 1 again. The size of samples and distribution should be approximately 12 in x 39 in (Size may vary depending on job requirements) and distributed as follows:

1. 12 in x 12 in piece for field testing.
2. 12 in x 12 in piece given to Owner for archive, if required.
3. 12 in x 12 in piece given to Owner's Rep for independent testing, if required.

NOTE: All samples will be labeled showing test number, seam number, machine number, job number, date welded, and welding tech number.

C. The sample for field testing shall have ten coupons cut and be tested with a tensiometer adjusted to a pull rate as shown below. The strength of four out of five specimens should meet or exceed the values below, and the fifth specimen must meet or exceed 80% of the value below.

1. Seam must exhibit film tear bond (FTB). Welds should have ≥25% incursion into the weld.
2. Peel and shear values shall meet or exceed the values as listed in Appendix A, Table 1 for HDPE smooth or textured sheet (@2 in/min).
3. Peel and shear values shall meet or exceed the values as listed in Appendix A, Table 2 for LLDPE smooth or textured sheet (@20 in/min).

D. All weld destructive test data will be documented.

E. When logging fusion welded peel values, indicate the values for the outside track first, followed by the inside track.

F. Test results will be noted as Pass (P) or Fail (F).

G. If a test fails, additional samples will be cut, approximately 10 ft on each side of the failed test, and retested. These will be labeled A (After) & B (Before). This procedure will repeat itself until a sample passes. Then the area of failed seam between the two tests that pass will be capped or reconstructed.

2.6 NON-DESTRUCTIVE TESTING

A. Non-destructively testing shall be performed on all seams over their full length using an air pressure or vacuum test. The purpose of this test is to check the continuity of the seam.

B. For air pressure testing, the following procedures are applicable to those seams welded with a double seam fusion welder.

1. The equipment used shall consist of an air tank or pump capable of producing a minimum 35 psi and a sharp needle with a pressure gauge attached to insert into the air chamber.

2. Seal both ends of the seam by heating and squeezing them together. Insert the needle with the gauge into the air channel. Pressurize the air channel to 30 psi. Note time tests starts and wait a minimum of 5 minutes to check. If pressure after five minutes has dropped less than 3 psi then the test is successful (Thickness of material may cause variance).

3. Cut opposite seam end and listen for pressure release to verify full seam has been tested.

4. If the test fails, follow these procedures:

    a. While channel is under pressure walk the length of the seam listening for a leak.

    b. While channel is under pressure apply a soapy solution to the seam edge and look for bubbles formed by air escaping.

    c. Re-test the seam in smaller increments until the leak is found.

5. Once the leak is found using one of the procedures above, cut out the area and retest the portions of the seams between the leak areas per 4a to 4b above. Continue this procedure until all sections of the seam pass the pressure test.

6. Repair the leak with a patch and vacuum test.

C. For vacuum testing, the following procedures are applicable to those seams welded with an extrusion welder.

1. The equipment used shall consist of a vacuum pumping device, a vacuum box and a foaming agent in solution.

2. Wet a section with the foaming agent, place vacuum box over wetted area. Evacuate air from the vacuum box to a pressure suitable to affect a seal between the box and geomembrane. Observe the seam through the viewing window for the presence of soap bubbles emitting from the seam.

3. If no bubbles are observed, move box to the next area for testing. If bubbles are observed, mark the area of the leak for repair per section 3.2 and re-test per section 2.6 (this section).

   Note: If vacuum testing fusion welded seams, the overlap flap must be cut off to perform the tests.

4. All non-destructive tests will be noted.

PART 3: REPAIR

3.1 DEFECTS & REPAIRS

A. All seams and non-seam areas of the geomembrane lining system shall be examined for defects.

B. Identification of the defect should be made using the following procedures:

1. For any defect in the seam or sheet that is an actual breach (hole) in the liner, installation personnel shall circle the defect and mark with the letter R alongside the circle. The letter R indicates a patch is required.
2. For any defect that is not an actual hole, installation personnel shall circle the defect indicating that the repair method may be only an extruded bead and that a patch is not required.
3. Each suspect area that has been identified as repair shall be repaired in accordance with section 3.2 and in the non-destructively testing per section 2.6. After all work is completed, the Supervisor will conduct a final walk-through to confirm all repairs have been completed and debris removed. Only after this final evaluation by the Supervisor, the owner, and the agent shall any material be placed over the installed liner.

3.2 REPAIR PROCEDURES

A. Any portion of the geomembrane lining system exhibiting a defect that has been marked for repair may be repaired with any one or combination of the following procedures:

1. Patching – Used to repair holes, tears, undispersed raw materials in the sheet.
2. Grind and Reweld – Used to repair small sections of extrusion welded seams.
3. Spot Welding – Used to repair small minor, localized flaws.
4. Flap Welding – Used to extrusion weld the flap of a fusion weld in lieu of a full cap.

5. Capping – Used to repair failed seams.

B. The following conditions shall apply to the above methods:

1. Surfaces of the geomembrane which are to be repaired shall be prepared according to this section.
2. All surfaces must be clean and dry at the time of the repair.
3. All seaming equipment used in repairing procedures shall be qualified.
4. All patches and caps shall extend at least 4 in beyond the edge of the defect, and all patches must have rounded comers.
5. All cut out holes in liner must have rounded comers of 3.0 in minimum radius.

C. Patches should be labeled in numerical order, i.e. R-1, R-2, etc... This should carry through any layer and/or multiple ponds, and do not start with the number 1 again.

3.3 AS-BUILT DRAWINGS

As-built drawings will be prepared as follows:

A. As-built drawings will be provided at the completion of the project.

B. AutoCad as-built drawings will be provided in hard copy, AutoCAD digital file format, and PDF format.

C. As-built drawings will include geomembrane panels and panel numbers with the last four digits of the roll number.

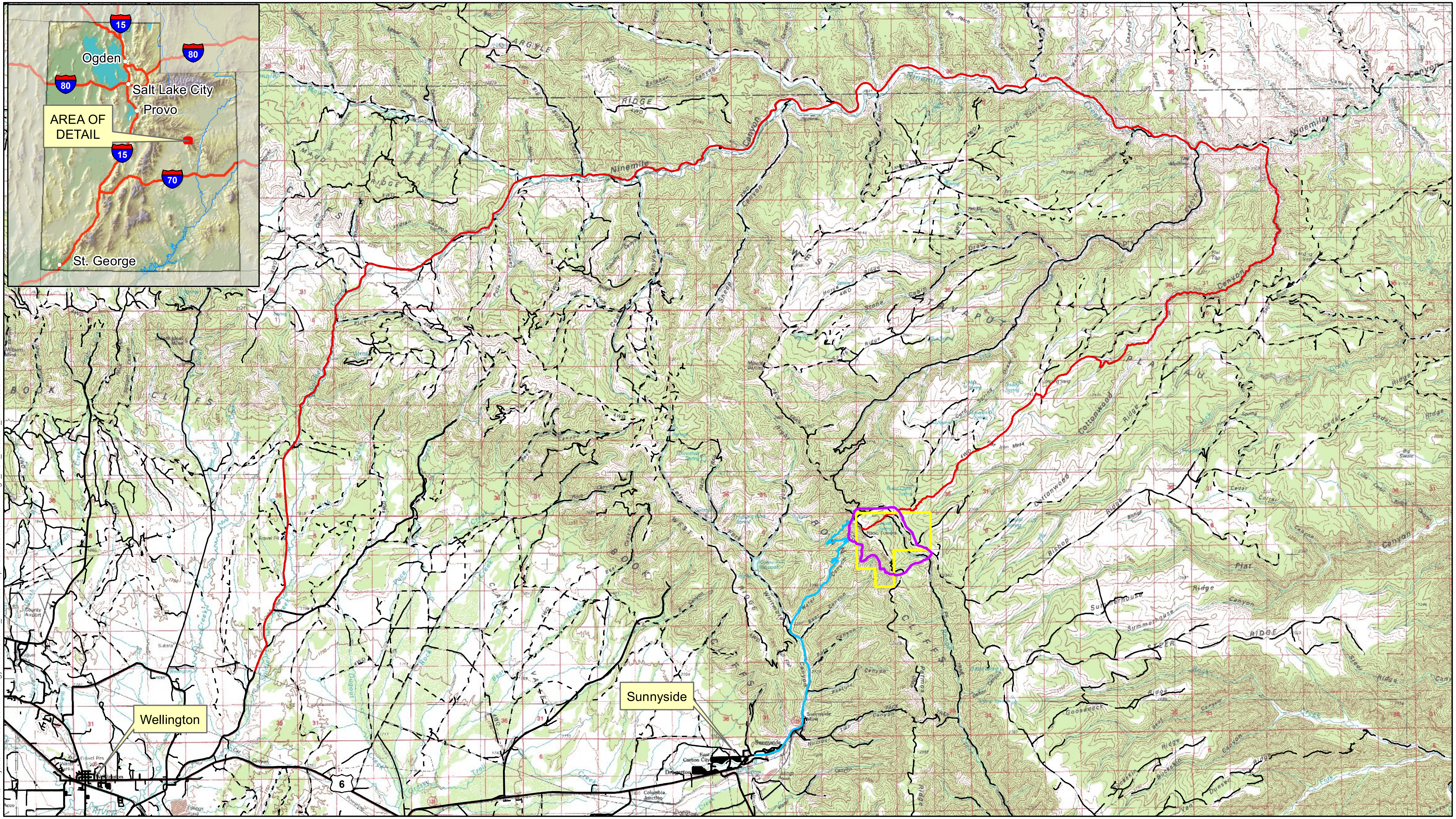
D. Panel numbers and the full roll numbers will correspond with the FLSI Panel Identification Log.

E. All destructive testing and repair locations will be placed on the as-built drawings.

END OF SECTION

GRAPHICS

Figure 1 Location Map
Figure 2 Mine Plan
Figure 3 Material Handling Plan
Figure 4 Conceptual Surface Water Control Plan



Site Access Road
Additional Access Route to Site
Paved Road
Improved Road
Dirt Road
Road (Conditions Unknown)

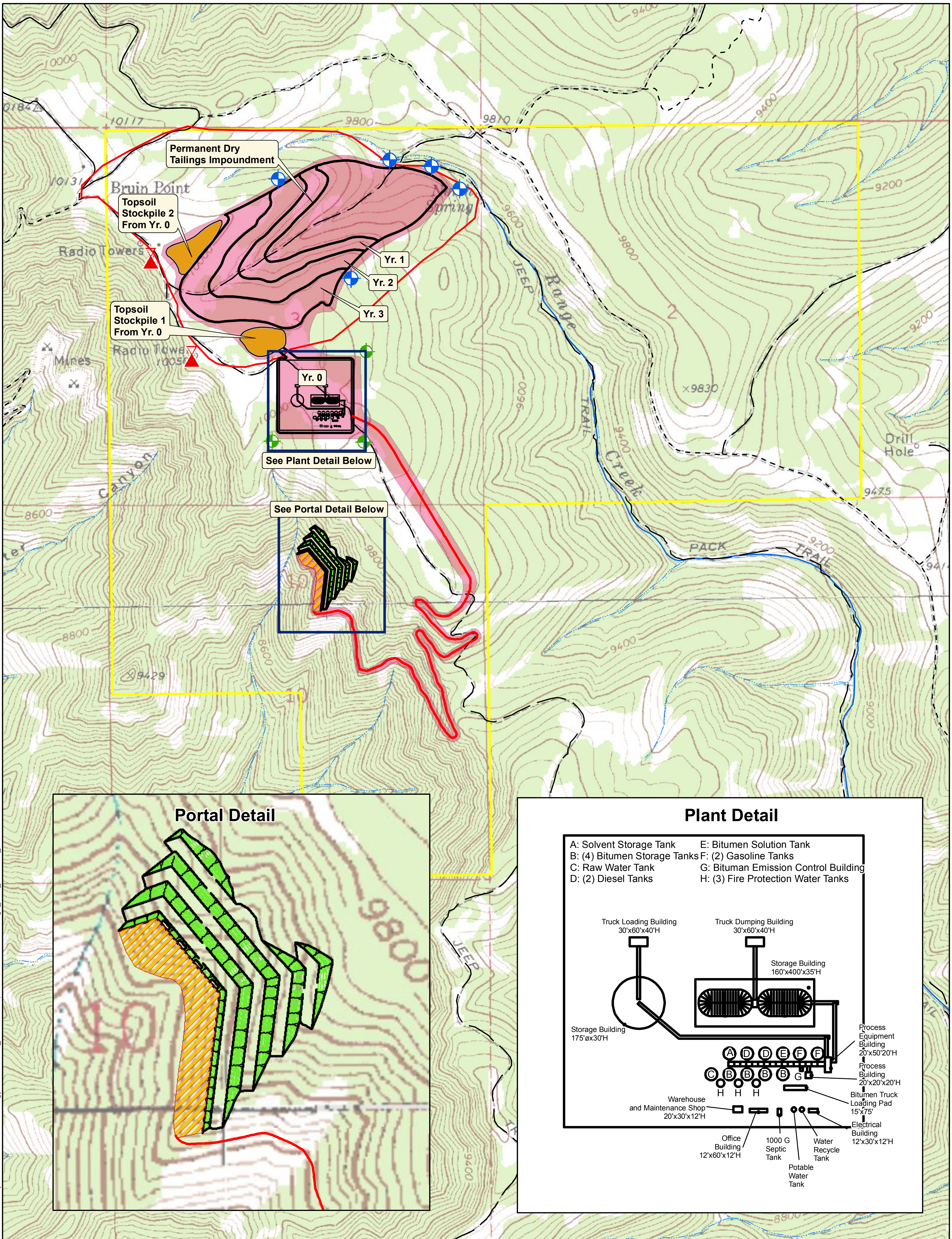
Lease Boundary
Survey Boundary
(area in which baseline surveys were conducted
i.e., soils vegetation, wildlife, cultural, raptor)

N

2.5 0 2.5 5
Miles

Title: Location Map	
General Construction Permit American Sands	Proj No: 24585638
	Figure: 1
American Sands Energy Corp	Date: March 2015
	URS

Path: Q:\Projects\American Sands Energy\24585638\09_Data\GIS\Maps\Construction Permit\Fig1_ASE_Location_construction.mxd



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- Lease Boundary
- Mine Haul Road
- Radio Tower
- Perennial Stream
- Intermittent Stream
- Top Soil Removal (yr.#: years in which topsoil is removed)
- Portal Pad
- Topsoil Stockpile
- Improved Road
- Dirt Road
- Road (Conditions Unknown)
- Dry Material Impoundment Monitoring Well
- Process Area Monitoring Well
- Affected Area

N

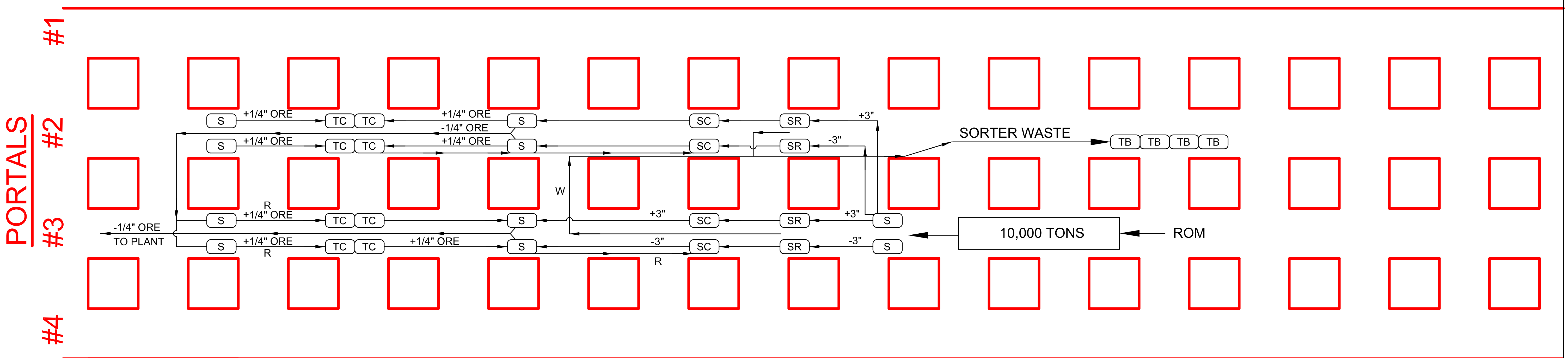
625 0 625 1,250 Feet

Title:	Mine Plan Map	
General Construction Permit American Sands Permit Application	Proj No:	24585638
	Figure:	2
American Sands Energy Corp	Date:	March 2015
	URS	

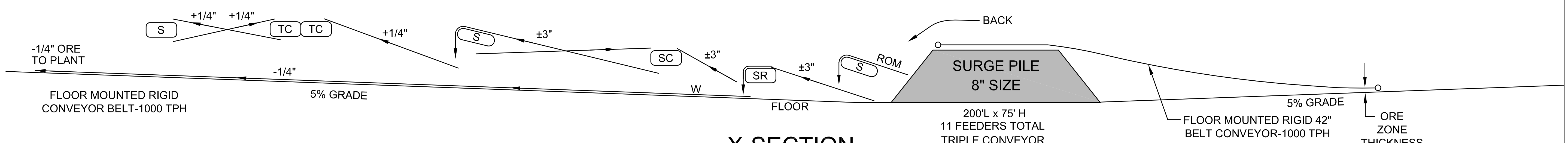
TYPICAL LAYOUT OF CRUSHING PLANT
U/G - 2 - 500TPH CIRCUITS
1 INSTALLED OUTSIDE
1 INSTALLED U/G #3 HEADING & THE OUTSIDE
UNIT MOVED U/G #2 HEADING

SCALE: 1" = 100'-0"

2 - PRIMARY SCREENS
2 - SETS OF SORTER EQUIPMENT @ 500TPH EACH
4 - SECONDARY CRUSHERS
4 - SECONDARY SCREENS
8 - FINE CRUSHERS
4 - FINE SCREENS
2 - PRIMARY CRUSHERS-IN EACH MINING AREA
1 - 10,000 TON LIVE SURGE PILE U/G, REST OF
STORAGE IS IN HEADINGS / BENCHES~60,000 TONS



PLAN VIEW



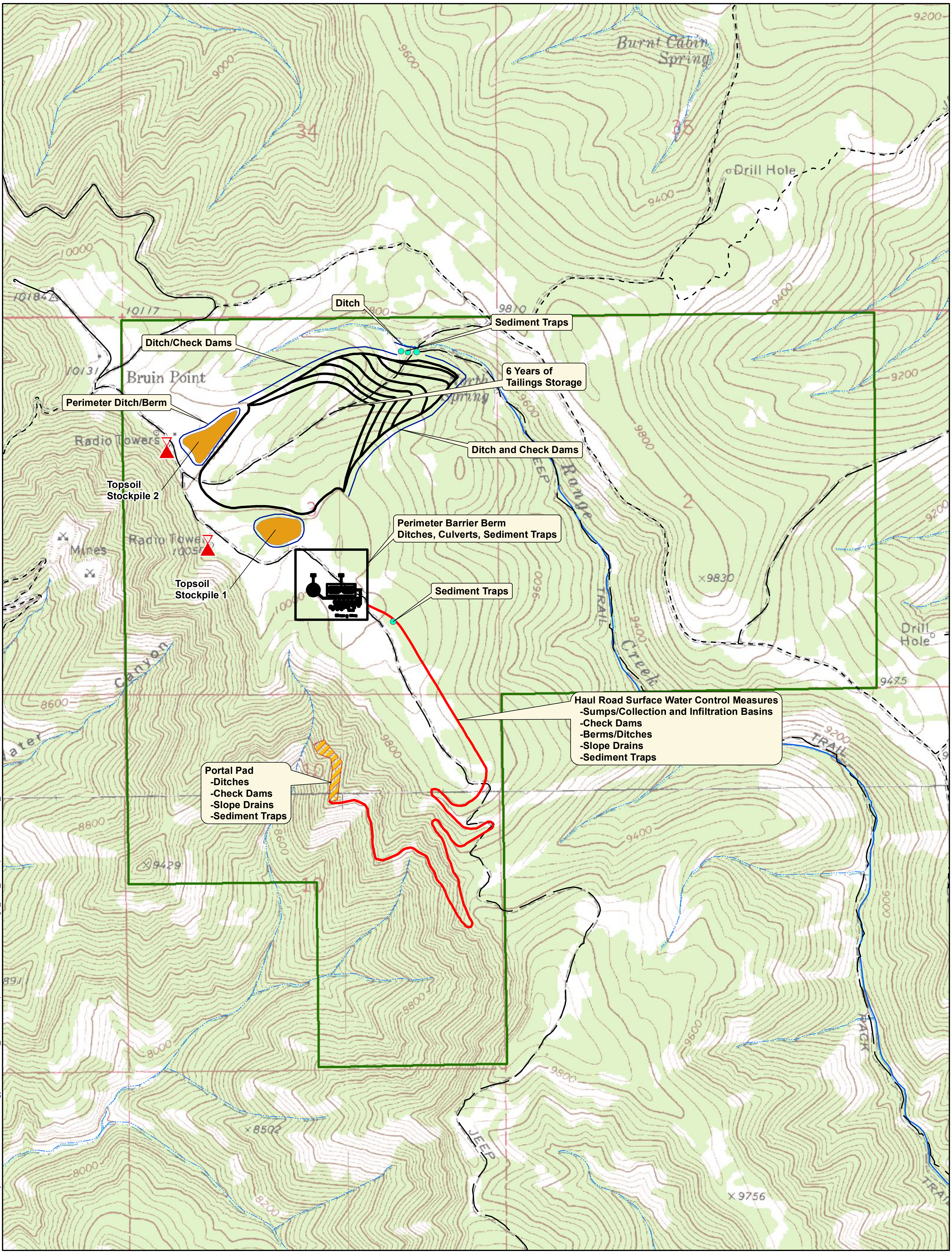
X-SECTION

TB - TRUCK BIN
ROM 12" FROM PRIMARY CUSHERS
NEED 50'x1500' FOR CRUSHING PLAN AT PORTAL TO
START WITH +PRIMARY CRUSH+1/4" ORE LOADING /
BINS / STOCKPILE.

SR - SORTER +3" -3"
S - SCREEN SIZING DEVICE
SC - SECONDARY CRUSHER
R - RETURN TO CRUSHER
TC - FINE CRUSHING

NOTE:
SEE MINE PLAN FIGURE 2 FOR
LOCATION AND ORIENTATION

Title: MATERIAL HANDLING PLAN	
Bruin Point Mine Permit Application	Proj No: 24585638
	Figure: 3
American Sands Energy Corp	Date: MAY 2014



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Lease Boundary
Mine Haul Road
Radio Tower
Perennial Stream
Intermittent Stream
Sediment Traps
Top Soil Removal
Portal Pad
Topsoil Stockpile
Improved Road
Dirt Road
Road (Conditions Unknown)

N

625 0 625 1,250 Feet

Title:	Conceptual Surface Water Control Plan
General Construction Permit American Sands Permit Application	Proj No: 24585638
	Figure: 4
American Sands Energy Corp	Date: March 2015
	URS

APPENDIX A

Preliminary Stability and Hydrology Analyses

URS

FINAL REPORT Revision 1

PRELIMINARY STABILITY AND HYDROLOGY ANALYSES

BRUIN POINT MINE

For

American Sands Energy Corp

Green River Resources Inc.
201 South Main 1800
Salt Lake City, UT 84111

February 4, 2015

Preliminary Stability and Hydrology Analyses
Bruin Point Utah

Prepared for:

American Sands
Energy Corp

Green River Resources Inc.
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ACRONYMS

ASE	American Sands Energy Corporation
ASTM	American Society for Testing and Materials
BGS	Below Ground Surface
CFS	Cubic Feet per Second
CN	Curve Numbers
DEG	Degrees
DOGM	Utah Division of Oil, Gas and Mining
FT	Feet
GPS	Global Positioning System
HEC-HMS	Hydrologic Modeling System
KSF	Kips per Square Foot
LL	Liquid Limit
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NP	Non-Plastic
PCF	Pounds per Cubic Foot
P.G.	Professional Geologist
PGA	Peak Horizontal Ground Acceleration
PI	Plasticity Index
PL	Plastic Limit
PSF	Pounds per Square Foot
SCS	Soil Conservation Service
URS	URS Corporation
USCS	Unified Soil Classification System
USGS	United States Geological Survey

1.0 INTRODUCTION

1.1 Project Description

Green River Resources (GRR) is proposing to develop the Bruin Point Mine Site in the mountains east of Sunnyside, Utah. URS Corporation (URS) understands that if approved, development of the site will include the following surface features: construction of office space and associated parking, a warehouse and maintenance shop, a tank farm, an electrical building, a graded material processing area for associated covered ore stockpiles, topsoil stockpiles, permanent tailings stockpile, and underground mine portal.

URS understands that the Utah Division of Oil, Gas and Mining (DOGM) has requested additional design information regarding the Bruin Point Mine (Utah DOGM M&RP M/007/0040) to demonstrate that the proposed surface structures can be constructed to prevent harm to nearby natural resources.

Design criteria were prepared to address potential impacts to Range Creek and are supported by slope stability analyses and preliminary analyses of erosion control measures. These analyses are based on material properties measured during the field investigation and engineering judgment. The purpose of the design criteria and analyses are to demonstrate the technical feasibility of slope stability and erosion controls to be incorporated into facility design and allow DOGM approval of the Notice of Intent (NOI) (URS, 2014). Our scope of services is based on our understanding of the assumptions noted in this report and does not include any foundation investigation for buildings or structures.

1.2 Purpose, Authorization, and Work Scope

This report presents the results of work performed by URS. The purpose of this work was to gather subsurface information and develop geotechnical criteria for stockpiling of topsoil and mine tailings derived from the Bruin Point Mine, and to provide criteria for surface contact-water retention regarding the specific size, type, functionality, and purpose of the water retention facilities.

The scope of work performed was presented in our proposal dated July 8, 2014, and authorized on July 23, 2014. The scope of work, as completed, consisted of four tasks:

- Review documents provided to URS including mine layout, drainage plans, and proposed stockpile slopes.
- Investigate subsurface conditions by means of test pit excavations and perform laboratory testing of select soil specimens.
- Develop geotechnical and erosion control design criteria.
- Project Management including administrative tasks, client meetings, and reporting.

As part of its work, URS also developed and implemented a safe work plan prior to the beginning of field work which included a task-specific hazard analysis.

2.0 FIELD INVESTIGATION AND LABORATORY TESTING

2.1 General

Field investigations were performed at the site in two phases. The first phase consisted of a site visit for geological and hydrological reconnaissance and to assess the suitability of the site for drilling or excavation of test pits. The second phase consisted of excavating test pits to investigate subsurface materials.

The project area is in the Roan Cliffs and comprises 1,760 acres of private parcels located in Township 14 South, Range 14 East, Sections 2, 3, and 10, Salt Lake Meridian (Figure 1). The area is in mountainous terrain; elevations range from approximately 8,000 feet to over 10,150 feet at Bruin Point, near the northwest corner of the project area. Access to the site is gained through improved gravel roads to two large antenna arrays present at the site.

2.2 Field Investigation

2.2.1 Geological and Hydrological Reconnaissance

A site visit was performed at the site on July 31, 2014, by a URS Professional Geologist (P.G.) and hydrologist to observe general geologic and hydrologic conditions of the mine portal, processing plant, and topsoil/tailings stockpile areas. Major fractures were measured in the rock outcropping at the proposed mine portal area. The topography of the site is variable with some areas of steep rugged terrain and areas of gradual slopes on the plateau consisting of native clayey topsoil, moderate vegetation, and sandstone or limestone outcroppings.

Thin surface soils (0-4 ft [feet] thick) were observed at the surface of the plateau (Bruin Point). The Parachute Creek Member of the Green River Formation was observed exposed on the improved gravel roads and is covered with stress relief factures as shown in Photo 1. Relief fractures occur when compressional stress on underlying rocks is removed by the erosion of overlying rock layers (Wyrick and Borchers, 1981). The relief of stress on exposed material on valley/canyon walls and floors results in a predictable pattern of shallow, interconnected vertical and horizontal fractures.

Photo 1. Improved gravel road covered with stress relief fractures.

The mine portal area is located within the head waters of Bear Canyon on the Roan Cliffs. The proposed portal is located on steep rugged terrain (slopes between 30-50 degrees) approximately 800-900 feet below the top of the Plateau. There are no roads to the proposed mine portal area and access is by foot. Portal area is covered with thin layer (2-6 inches) of soil and vegetation debris mixture with steeper slopes (> 30°) barren of soil/vegetation debris. The area between the proposed mine portal to the top of the plateau contains loss rock and with high rock fall hazard.

The proposed mine portal area was not highly fractured with the majority of the fractures observed located in bitumen barren sandstone units. The fracture observed within the mine portal area has an orientation of 70° to 105° southeast with near vertical dip of 85-90° to the northeast as shown in Photo 2.

Photo 2. Fracture observed within mine portal area.

The high bitumen sandstone units within the mine portal area appear to contain stress relief exfoliation-like fractures as shown in Photo 3. These stress relief exfoliation-like fractures are likely related to the stress of the overburden units pressing downward and laterally releasing the stress outward away from the cliff face.

Photo 3. Stress relief exfoliation in high bitumen sandstone units.

The surface of the ore body (high bitumen containing sandstones) is covered with desiccation-like texture as shown in Photo 4. This texture is likely related to the dry/oxidation of the bitumen on the surface sub sequential differential erosion of the surface.

Photo 4. Surface of high-bitumen sandstone covered with desiccation-like texture.

2.2.2 Test Pit Excavations

Eight sites were selected (TH14-01 through TH14-08) at which test pit explorations were to be completed. One planned exploration test pit, identified as TH14-02 in Figure 2, was not performed because locked gates prevented access to the test pit location. However, based on the consistency of the surrounding test pits, the exclusion of TH14-02 was not significant. All test pits for this study were excavated using a Bobcat E45 compact excavator. A Garmin Rino650, hand-held Global Positioning System (GPS) equipment was used to locate test pit sites in the field. Where possible, the sites were collocated with historic drilling sites to reduce ground disturbance at the site. Associated equipment and excavation services were provided on August 11, 2014, by Direct Push Services, LLC, of Salt Lake City, Utah, under subcontract to URS. Each test pit was excavated to refusal, which was encountered at various depths as indicated on the Surface and Shallow Soil Sampling Logs (test pit logs) presented in Appendix A.

Test pit excavations were observed, logged, and sampled, by a URS field engineer. In general, samples were collected from the wall of the excavation by hand-digging/shovel use. Some samples were selectively collected from the excavator bucket where depth of excavation precluded entry for hand-sampling. The investigation locations are shown in Figure 2 and summarized in Table 1.

Table 1. Test Pit Location Summary

Test Pit ID	**Exploration Depth**[1] *(ft)*	**Northing** *(ft)*	**Easting** *(ft)*	**Surface Elevation** *(ft)*
TP14-1	2.4	7,039,763	1,967,721	9,982
TP14-2	N/A[2]	7,039,641	1,968,988	9,762
TP14-3	3.8	7,039,242	1,966,905	10,035
TP14-4	6	7,038,686	1,968,936	9,977
TP14-5	8	7,038,699	1,967,445	9,925
TP14-6	1.7	7,037,679	1,967,755	10,056
TP14-7	5.8	7,037,320	1,968,517	10,027
TP14-8	5.3	7,037,026	1,968,918	10,015

Notes: State Plane Coordinates (Utah Central NAD 83); ft = feet

1. The depth was measured from the ground surface.
2. The site was inaccessible and exploration was not performed; identified coordinates were proposed.

Groundwater was not encountered during test pit exploration.

2.3 Laboratory Testing

Laboratory testing was performed on select soil specimens obtained during the field investigation to assist in their classification as well as to evaluate engineering properties. Testing was performed by IGES of Salt Lake City, Utah, in general accordance with ASTM International (ASTM) standards. Laboratory tests included: fines content (ASTM D1140); Atterberg limits (ASTM D4318), and natural moisture content (ASTM D2216). Strength and permeability testing was performed in remolded samples. Laboratory test results sheets are presented in Appendix B.

2.3.1 Index Properties

The results of index tests performed in each test pit are summarized in Table 2, and also shown on the logs in Appendix A, and included in the Laboratory Test Results in Appendix B.

Table 2. Summary of Index Testing

Location	Approximate Depth BGS *(ft)*	USCS Classification[1] *(-)*	Fines Content *(%)*	LL *(%)*	PI *(%)*	Moisture Content *(%)*
TH14-03	1	CH	82.0	57	31	16.4
TH14-04	1.5	SC	45.2	35	11	7.9
TH14-04	3	SC	26.1	37	14	13.1
TH14-05	3.75	CL	60.5	40	19	16.7
Tailings[2]	N/A	SP-SM	9.1	NP	NP	--
Partings[2]	N/A	SC	38.2	29	8	--

Notes: BGS = Below Ground Surface; USCS = Unified Soil Classification System; ft = feet; LL = Liquid Limit; PI = Plasticity Index; NP = Non-plastic

1. The classification was based on ASTM D2487.
2. The sample was provided to URS by ASE.

2.3.2 Direct Shear Testing

Strength testing was performed on remolded samples from test pit TH14-04 and on tailings and partings samples provided to URS by ASE. Strength testing consisted of a series of direct shear tests under drained conditions in general accordance to ASTM D3080. The results of the strength testing are also provided in Appendix B.

Direct shear testing was performed on a sample from testing pit TH14-04 at a moisture content (after conditioning) of approximately 16 percent and a target dry density of 105 pounds per cubic foot (pcf). A vertical confining stress of approximately 8 kips per square foot (ksf) was selected to simulate the weight of the stockpile embankment above the shear surface resulting in a one-point drained strength of 31 degrees.

Direct shear testing was performed on processed and moisture conditioned tailings sand obtained from ASE at a target dry density of 105 pcf. The vertical confining stresses of 4, 8, and 16 ksf, were selected to simulate the anticipated stress conditions in the field resulting in a measured drained strength of 33 degrees with a cohesion intercept of 129 pounds per square foot (psf).

Additionally, direct shear testing was performed on the partings sample obtained from ASE. The partings material is anticipated to be used as a liner material below the tailings stockpile and was provided in the form of a rock-core. The rock-core sample was modified by IGES to create field-form samples in two steps. Beginning with rock cores obtained from the target layer, the partings were crushed using a proctor hammer until all crushed rock particles were finer than the No. 4 sieve. The particles were then pulverized further using a cast iron mortar and pestle. After moisture conditioning the partings to 16 percent, samples were compacted to a dry density of 110 pcf. Shear testing was performed at confining pressures of 4, 8, and 16 ksf, to simulate anticipated stress conditions within the liner.

2.3.3 Permeability Testing

Permeability testing was performed on a single partings sample provided to URS by ASE in general accordance with ASTM D5084. The procedure for crushing, pulverizing, moisture conditioning, and compacting, the partings sample was performed in the same manner as described in Section 2.3.2. The results of the test provided an average hydraulic conductivity of 2.3×10^{-7} cm/s using a flexible wall permeameter. The results of this test are also provided in Appendix B.

3.0 SITE CONDITIONS

3.1 Regional Geologic Setting

The Bruin Point Mine is located in eastern Utah in the Book Cliff-Roan Plateau section of the Colorado Plateau physiographic province (Stokes, 1986) in rugged, mountainous terrain with steep slopes. The mine is located approximately 25 miles east of Price near the headwaters of Dry Creek and Range Creek at elevations between 9,200 and 10,200 feet above mean sea level.

The bitumen sand deposits at the mine site are within what is collectively known as the Sunnyside tar sands. The deposits occur in late Paleocene/early Eocene (circa 60-40 million years ago) rocks in the upper part of the Colton Formation and the lower part of the Green River Formation, both of Eocene age. Both are derived from deposition into Lake Uinta, a prehistoric lake that persisted for 15 million years in a large intermontane basin occupying the regions of the present-day Uinta and Piceance Basins. These units consist of interbedded, fine-grained shales and sandstones. Bitumen has migrated from the shale into the sand units.

The Green River Formation overlies the Colton Formation. This formation consists of freshwater marlstone, oil shale, limestone, siltstone, sandstone, tar sands, and shale. The contact between the Colton and Green River Formations is identified as the horizon where dominantly fluvial strata below give way to dominantly lacustrine strata above (Morrison Knudsen, 1984). The tar sands beds occurring in the lower part of the Green River are similar in origin and appearance to the tar sands beds of the Colton Formation.

Bitumen occurs chiefly in the sandstone beds of the Colton and lower part of the Green River Formations. The tar sands beds outcrop conspicuously along the west face of the Book Cliffs, locally known as Bruin Point near the headwaters of Range Creek. Tar sands outcrops are persistent for over nine miles along the west face of the Book Cliffs (Morrison Knudsen, 1984).

3.2 Specific Site Conditions

3.2.1 General

A site plan for the Bruin Pont Mine site showing the locations of test pit explorations is provided in Figure 2. Details of the field investigations performed at this site and laboratory test results are presented in Section 2.

3.2.2 Soil Conditions

In large part, the ground surface was observed in the test pit excavations to consist of approximately 1 foot of dark-colored topsoil containing roots, fibrous matter, and/or other organic components. The topsoil is generally unsuitable for engineering purposes. The surface is vegetated with grasses and sage, with patches of pine and aspen trees. The surficial soil (topsoil) is generally underlain by brown clayey sand (SC) or clay (CL, CH) with varying amounts of sand and increasing gravel and cobble content with depth. Cobbles encountered were generally observed to be less than 10 inches in diameter. The clayey soils are underlain by bedrock materials. See the test pit logs in Appendix A.

4.0 DESIGN CRITERIA

4.1 General

The project site is located at the headwaters of Range Creek. Range Creek is a natural water way, which flows into the Green and Colorado Rivers. The following design criteria are required and provided to outline the standard of care for protection of groundwater and surface water in Range Creek. The criteria are based on the slope stability analyses and preliminary hydrological assessments performed for the site and proposed surface structures. Design criteria are provided below for each of the primary surface structures.

All hydrological criteria provide below are based on consideration of the site as a zero discharge facility based on the 100-year preliminary storm event calculations provided herein, 150-foot disturbance zone around Range Creek, lining of all pond and drainage swales with properly compacted mine partings, a 3-foot minimum freeboard limit for all ponds, and regular maintenance.

4.2 Mine Portal

Geotechnical

- Orient portal openings parallel to strike and dip of predominant joints and fractures.
- Provide benching of upslope rock/soil face.
- Provide mesh and / or rock catchment above portals.
- Provide patterned rock bolting with cable mesh at portal face.

Hydrological

- Provide drainage berms and channels around the plant site to direct any surface water away from the site and contain on-site storm water and erosion. The berms will be constructed as described in Section 5.
- Direct process and on-site storm water to a retention pond.

4.3 Plant Site

The plant site will contain the process equipment for the bitumen extraction process along with an ore stockpile that will be covered.

Geotechnical

- Provide a clay liner of mine partings material that is adequately broken down and compacted according to the project specifications.
- Provide compacted gravel working surface above the clay liner.
- The slope angles of stockpiles formed with conveyor discharge will likely vary depending on the moisture content of the stockpiled material.
- Angle of repose data for ore produced at the mine are not available.

Hydrological

- Provide clay liner below the plant site to minimize infiltration of process and storm water into the bedrock and on-site soils.
- Provide drainage berms and channels around the plant site to direct any surface water away from the site and contain on-site storm water and erosion. Construct the berms as described in Section 5.
- Direct process and on-site storm water to a retention pond.

4.4 Topsoil Stockpiles

The surface soils at the site consist of topsoil underlain by a 1 to 7-foot layer of clayey soils. Topsoil and clayey soils are proposed to be stripped from the large tailings stockpile area and stockpiled separately. The clayey soils may later be mixed with clayey mine partings, and used as cover for the proposed tailings stockpile.

Geotechnical

- Screen topsoil and clayey surficial soils to remove cobble or large size rocks to facilitate compaction. Stockpile for later use of this material as cap or cover for the tailings stockpile. Mine partings materials may be mixed with topsoil and surficial clayey soils.
- Provide compaction of the clayey surficial soils using the compaction criteria provided in the project specifications. Topsoil will be placed under reduced compaction criteria as specified in the field because the compaction criteria outlined in the specifications will be difficult to implement in topsoil with high organic content.
- Construct compacted topsoil stockpiles at slopes no steeper than 2.25H:1V to meet appropriate factors of safety based on stability modeling discussed in the stability section of this report.
- Do not stockpile snow on, or near slopes.

Hydrological

- Provide drainage berms and channels around the stockpiles to direct any surface water away from the site and contain storm water and eroded soils within the site. The berms will be constructed as described in Section 5.
- Direct process and on-site storm water to a retention pond.

4.5 Tailings Stockpile

A permanent stockpile is proposed for long-term storage of tar sand tailings material. The tailings will be mechanically transported to the permanent tailings stockpile, moisture conditioned to achieve specified compaction criteria, and mechanically compacted using conventional compaction equipment. No hydraulic transportation or deposition of tailings will be performed. Strip surface soils below the stockpile as outlined below and a clay liner will be constructed before mechanical placement of tailings begins.

Geotechnical

- Strip topsoil and surficial clayey soils in sufficient quantity to provide a suitable cover or cap material during reclamation. This includes all surficial soils with significant organic matter (greater than approximately 5% organics by volume), debris, deleterious or loose material, or high-plasticity soils (LL>50).

- Provide compaction of the tailings stockpiles using the compaction criteria provided in the project specifications.
- Construct compacted tailings stockpiles at slopes no steeper than 2.25H:1V to meet appropriate factors of safety based on stability modeling discussed in the stability section of this report.
- Do not stockpile snow on, or near slopes.

Hydrological

- Provide clay liner below the tailings stockpile to prevent infiltration of process and storm water into bedrock. The liner will be constructed according to the requirements in the project specifications.
- Provide cap or cover for the tailings facility as soon as possible to reduce infiltration into the stockpile.
- Provide single or multiple retention basins to contain storm water that falls within the tailing stockpile. This water can be used as process water.
- Provide drainage berms and channels around the tailings stockpile to direct any surface water away from the site and contain on-site storm water and erosion. The berms will be constructed as described in Section 5.
- Provide check dams to reduce erosion potential. The check dams will be constructed as described in Section 5.
- Direct process and on-site storm water to a retention pond.

5.0 HYDROLOGY

5.1 Hydrology

The existing terrain at the site is mountainous with steep slopes and the area is subject to high intensity, high frequency storm events. The majority of the project is situated within the Range Creek Watershed and a lesser portion of the project lies within the Grassy Trail Creek Watershed (see Appendix C for the Watershed Map). During the previously noted July 31, 2014, site visit, the existing land cover terrain, soil type, and topographic features were verified. Precipitation for this area was acquired from National Oceanic and Atmospheric Administration (NOAA) Atlas 14 for the area east of Sunnyside, Utah, at the Bruin Point on Patmos Ridge (The exact location is 39.6343 latitude and -110.3391 longitude with an elevation of 10,073 feet). Precipitation for the 10- and 100-year storm events (over 24 hours) are 2.22 and 3.25 inches, respectively. The Soil Conservation Service (SCS) type II storm event was analyzed using Hydrologic Modeling-System (HEC-HMS) v4.0 for the 10- and 100-year events.

The amount of rainfall that contributes to runoff can be calculated based on empirical relationships referred to as runoff curve numbers (CN). The CN values are related to soil type, soil infiltration capacity, land use, and depth to the phreatic surface and were chosen for the site based on field observations, laboratory test data, and engineering judgment. The site can be characterized using three CN groups including areas as follows:

1. Minor disturbance including the topsoil stockpiles, road shoulders, staging areas, and other areas of infrequent access.
2. Significant disturbance such as roads, structures and the immediate mine portal access vicinity.
3. Tailings site exhibiting a high level of compaction with little interstitial space.

The site soils and tailings materials were available for visual inspection. The results of the hydrologic analysis are provided in Appendix C.

Retention basins are required at various locations around the site and will be sized with appropriate safety factors to contain all surface water and prevent any discharge off the site based on the 100-year storm event discussed above. Disturbance from this project will be considered as a minimum of one hundred fifty feet away from Range Creek.

To minimize any infiltration, the retention basins must be lined with mine partings or other form of equivalent protection. The basins will maintain minimum of 3 ft of freeboard and will be regularly maintained to ensure design capacity.

To capture and contain all runoff during the 100-year storm event, eight retention basins were designed based on preliminary calculations for the site and assuming a 72-hr (hour) holding time. Table 3 presents the preliminary Q100 volume and peak inflow for each basin. These eight basins are shown on Figure 3. The ultimate configuration and detailed design will require a cursory review from State of Utah Department of Dam Safety. A more detailed analysis will need to be completed to verify assumptions made in this analysis at the design level. Operational control will allow the placement of retention facilities to be strategically placed based on site layout and these basins may be split into multiple locations.

Table 3. Summary of Hydrologic Results

Basin	Location	Peak Inflow 100-YR *(cfs)*	Total Volume 100-YR *(acre-ft)*
1	Mine Portal	5.0	0.4
2-5	Haul Road	5.1	0.4
6	Plant Site West	22.6	1.9
7	Plant Site East	22.6	1.9
8	Tailings	89.0	18.7

Notes: cfs = cubic feet per second; ft = feet

5.2 Erosion Control

Water that falls within the project areas will be separated from rainfall outside the project area using earthen berms with clay lining or suitable geomembrane. The earthen berms were conceptually designed for both containment of drainage runoff within the project area and to divert offsite flow. The preliminary conceptual design of the berms did not consider the effects of significant erosion or slope failure of any kind. Final engineering design of berms and ditches should be performed during final design.

Construct 4-ft high, earthen berms of clean native or import soil around the perimeter of any disturbance to ensure all runoff within the project area is diverted to a retention pond. Construct the berms with a 2-ft wide flat top with 2H:1V side slopes and be lined with a clean 2-ft thick clay liner. As an alternative, the berms may also be lined with a geo-membrane of suitable thickness to minimize ripping or puncture. The berms will not be constructed of topsoil and will be free of organic material. Channels to divert surface water will be integrated into the perimeter berms to minimize infiltration.

The tailings material and other disturbed soils have a very high potential to be suspended in runoff and erode quickly. Construct check dams to block sediment transport down the face of the tailings stockpile. Construct check dams measuring 3-ft in height of suitable rock. Inspect routinely and maintain as needed to insure proper performance. After the life of project is complete, construct a cap over the tailings material.

6.0 SLOPE STABILITY ANALYSIS RESULTS

6.1 Slope Stability Analysis Results

6.1.1 General

Slope stability analyses were performed for the maximum cross sections of the topsoil and permanent tailings stockpiles at the Bruin Point Mine Site. Two orthogonal sections of the permanent tailings stockpile and four sections of the topsoil stockpiles were examined using limit-equilibrium analyses.

The limit-equilibrium computer program Slide, version 6.005 by Rocscience, Inc. of Toronto, Canada, and Spencer's method of slices were used for the analyses. Spencer's method satisfies all conditions of static equilibrium, including horizontal and vertical force imbalance and moment imbalance. Search routines available within the software package were used to define circular trial shear surfaces. Additional noncircular trial shear surfaces were also examined to locate critical shear surfaces.

Preliminary conceptual drawings of the tailings and topsoil stockpiles were provided to URS by ASE. These drawings included cross sections of each stockpile (identified as A-A and/or B-B for each stockpile). Additional cross sections were developed by URS to include more critical stability cases (identified as A-A' and/or B-B'). The slope stability cross section locations used in the analyses are shown in Figure 4. Some of the preliminary conceptual A-A and B-B stockpile cross sections showed discontinuities and localized slope variations that are not typical of stockpile construction. Thus, some interpretation and line smoothing was performed in stability model development.

At final completion, the proposed tailings stockpile will be on the order of 430-ft high, 3,600-ft long, and 2,000-ft wide. The north and south topsoil stockpiles will be approximately 30- and 50-ft high, respectively.

Temporary plant site stockpile configurations were not provided to URS. However, plant stockpiles are anticipated to consist of loose or uncompacted mine tailings or tar sand ore awaiting processing or transportation to permanent stockpiles. As such, stability can be considered based on the angle of repose. The angle of repose is defined as the largest possible angle of incline for a slope of loose material or soil, which can be maintained without sliding under the force of gravity. This slope depends only on material properties (moisture, particle size, etc.) and is not affected by vertical confining pressure. Furthermore, slope failures tend to consist of sliding surficial particles or material rather than a larger slump failure. The mine tailings angle of repose was measured under various moisture conditions as provided to URS and included in Appendix B; however, a sample or measurement of the tar sand ore angle of repose was not provided to URS.

The local phreatic surface was presumed to be located in bedrock below each stockpile as no groundwater was observed in the subsurface explorations. Therefore, it is not expected to impact the stability of each stockpile. Furthermore, anticipated rain/snowfall in the area and the free-draining nature of the stockpile materials is believed to preclude the possibility of significant moisture accumulation in, or beneath, the stockpile or liner material.

6.1.2 Material Strength Characterization

A material strength characterization was performed to estimate the unit weight and drained-strength parameters of each material considered in the modeling process. The unit weight, drained cohesion, and drained friction angle of the materials were obtained from values measured in laboratory tests. Because soils at the site are expected to be unsaturated and stockpile construction above the clay liner is expected to take years to be completed, drained-strength parameters were used in the analyses to consider long-term loading conditions with the stockpiles in-place. A summary of material strength properties used to develop the stability model is provided in Table 4. In the case of seismic stability, the strength parameters of the clay liner were reduced by approximately 20 percent to conservatively account for cyclical softening of the clay due to ground shaking. The strength parameters of the bedrock, native topsoil, and tailings sand, were not reduced.

The strength parameters for bedrock were assumed based on published geologic descriptions of rock types in the area (limestone, siltstone, mudstone, sandstone, and shale). This is a conservative assumption as bedrock strength is unlikely to be the determining factor in stockpile stability. A minimum setback distance from the edge of the plateau of 25 feet was calculated based on rock mass dipping planes measured at the site. However, it is likely that operation constraints will dictate a larger setback distance.

During field investigations, native topsoil samples were collected on which laboratory tests were later performed. Because only one sample was tested, the cohesion was back-calculated from the laboratory test data assuming a drained friction angle, ϕ', of 28 degrees.

Preliminary direct shear testing was performed on tailings sand and proposed clay-liner samples provided to URS by ASE. The laboratory test results were used to estimate drained-strength parameters for the tailings sand and clay liner; however, the proposed clay-liner strength parameters are contingent on achieving acceptable permeability using proposed production methods and also based on very limited testing. As such, additional testing and analyses should be performed to provide higher reliability of the final design. If another suitable material must be selected to achieve adequate liner permeability, these analyses may no longer be appropriate.

Table 4. Material Properties for Slope Stability Analyses

Material Description	**Unit Weight** *(pcf)*	**Cohesion, c′** *(psf)*	**Drained Friction Angle, ϕ'** *(deg)*
Bedrock	140	5,000	30
Native Topsoil	120	600	28
Tailings Sand	120	130	33
Clay Liner (Crushed Mine Partings)	125	735 / 590[1]	30 / 24[1]

Notes: pcf = pounds per cubic foot; psf = pounds per square foot; deg = degrees

1. Strength parameters (c′ and ϕ') were reduced by 20% in seismic-case stability analyses.

6.1.3 Slope Stability Results

Slope stability was considered for general stability of stockpile materials for large continuous uniform slopes, and for the preliminary conceptual cross sections as provided by ASE and discussed in Section 6.1.1. Each case also considered seismic stability for a 2,475-year seismic event (2% probability of exceedance in 50 years). The associated peak horizontal ground acceleration, PGA, was determined to be 0.174g (USGS, 2014). Seismic cases were modeled using a pseudo-static analysis, where dynamic earthquake loading simulated using a static force equal to the soil weight multiplied by a seismic coefficient, k. For the seismic analyses, the pseudo-static seismic coefficient was calculated as half the PGA.

6.1.3.1 Stability Results for Required Slope Angles

For each stockpile material, cross sections were developed with various slope angles to identify a required acceptable slope for each stockpile. The required slopes determined from each of the general stability models and associated factors of safety, by stockpile type, are presented in Table 5. Source information for Table 5 is included in Appendix D, Figures D1 through D4. The slope constraints shown in Table 5 should be applied to existing and future drawings and cross sections. The general slope analysis and results in Table 5 supersede all other analyses. See Sections 4.4 and 4.5 for more information about required slope angles.

Table 5. General Slope Stability Results

Stockpile Description	Slope	Static Factor of Safety	Seismic Factor of Safety
Native Topsoil	2.25H:1V or flatter	1.55	1.26
Tailings Sand	2.25H:1V or flatter	1.51	1.22

Notes: Target Static Factor of Safety = 1.5; Target Seismic Factor of Safety = 1.2

6.1.3.2 Stability Results of Preliminary Conceptual Cross Sections

For each of the three stockpiles (2 native topsoil stockpiles; 1 tailings stockpile), slope stability analyses were performed based on preliminary conceptual cross sections provided by the client and additional cross sections developed by URS as discussed in Section 6.1.1. On average, the preliminary conceptual tailings and topsoil stockpile slopes are flatter than the acceptable slope 2.25H:1V. However, the preliminary conceptual drawings should be revised to reflect the required 2.25H:1V slopes during final design.

Because a clay liner is expected to be constructed beneath the tailings stockpile, a well-defined planar layer will exist between the tailings stockpile and the natural bedrock. The clay liner should be expected to provide adequate resistance against sliding of the entire stockpile and noncircular failure surfaces shearing along the liner interface. To examine this case, a thin 4-foot-thick clay layer was modeled beneath the tailings stockpile extending well beyond the head and toe of the stockpile. An automated search for failure surfaces, which intersect all or part of the clay liner beneath the stockpile, was performed.

The results for both static and seismic loading of the preliminary conceptual cross sections provided by the client are presented in Table 6. Source information for Table 6 is included in Appendix D, Figures D5 through D20.

Table 6. Slope Stability Results of Proposed Conceptual Cross Sections

Stockpile Description	Section	Static Factor of Safety	Seismic Factor of Safety
Topsoil Stockpile No. 1	B-B	>3.0	2.70
Topsoil Stockpile No. 1	B-B′	2.57	2.05
Topsoil Stockpile No. 2	A-A	>3.0	>3.0
Topsoil Stockpile No. 2	A-A′	>3.0	2.74
Tailings Stockpile	A-A	1.51	1.23
Tailing Stockpile (Liner)[1]	A-A	1.72	1.24
Tailings Stockpile	B-B	1.82	1.44
Tailing Stockpile (Liner)[1]	B-B	2.91	1.96

Notes: Target Static Factor of Safety = 1.5; Target Seismic Factor of Safety = 1.2

1. For these cases the shear surfaces were forced to pass through the liner at the base of the tailings stockpile. This resulted in higher factors of safety compared to shear surfaces evaluated higher up in the model. See Appendix D for more information.

6.2 Kinematic Analysis Results

6.2.1 General

A preliminary kinematic analysis of the predominate joints and fractures was performed based on observations collected in the field. The mine portal will be constructed in accordance with MSHA regulations and constructed in a way to prevent any rockfall.

6.2.2 Mine Portal Opening Orientation

The mine portal opening will be aligned parallel to the strike of the predominant joint set and the dip of the portal face will also be designed to parallel the predominant dip of the near-vertical fractures. Detailed drawings of the portal orientation were not available for review at the time of this report. The mine portal opening will be constructed in a way that meets MSHA standards.

Due to the exfoliation visible at the surface, pattern-rock bolting and cable mesh will be incorporated into the design of the portal face. Stabilization using shotcrete is not recommended because of the potential to building pore pressure behind the shotcrete over time.

6.2.3 Mine Portal Opening Protection

Mine portal protection is paramount for safe operations in the vicinity of the mine entrance. The mine portal will be prepared and developed by removal and stabilization of loose and fractured surface rock, with which may include the following:

- Benching of the upslope rock/soil face.
- Installation of high-resistance and high-capacity rockfall catchment fences and containment wire mesh positioned upslope of the mine portal.

7.0 CONCLUSION

The design criteria contained in this report are based on URS field investigations, preliminary stability and hydrologic analyses, and engineering judgment. The design criteria may be utilized to provide response to DOGM in support of approval of the NOI (URS, 2014). However, the engineering analyses provided herein are not adequate for final design and construction as they are based on initial data and preliminary design information.

7.1 LIMITATIONS

The recommendations contained in this report are based on the limited field investigation and laboratory testing agreed to in the project scope, and on our understanding of the proposed preliminary construction plans provided to us. There is an inherent potential for variability in the subsurface materials and conditions that exist between points investigated as well as in the properties of the materials themselves. It is not practical or possible to obtain a large enough sampling to eliminate the risk of variation. Logs of subsurface conditions, collected samples, and test results should be considered a limited sampling of existing materials that may not fully represent the actual range of conditions.

Additional engineering services are recommended to assist in design optimization for the project. These services should include additional investigation, sampling and testing to better characterize subsurface material and conditions and reduce the risk of significant variation. URS represents that its services are performed within the limitations prescribed by ASE, in a manner consistent with the level of care and skill ordinarily exercised by other professional consultants under similar circumstances. No other representation to the American Sands Energy Corp., expressed or implied, and no warranty or guarantee is included or intended. URS does not assume responsibility for the accuracy of project information provided by others.

This report may not contain sufficient information for purposes of other parties or for other uses. This information is not to be used for bidding purposes. The scope of work did not include an investigation of potential geoenvironmental hazards such as soil and/or groundwater contamination, or the potential for hazardous materials at the site.

8.0 REFERENCES

Morrison Knudsen. 1984. Sunnyside Tar Sands Project: 1983 Geologic Evaluation. Boise, Idaho.

Stokes, William Lee. 1986. Geology of Utah. 1st ed. Salt Lake City, Utah: Utah Museum of Natural History and Utah Geological and Mineral Survey.

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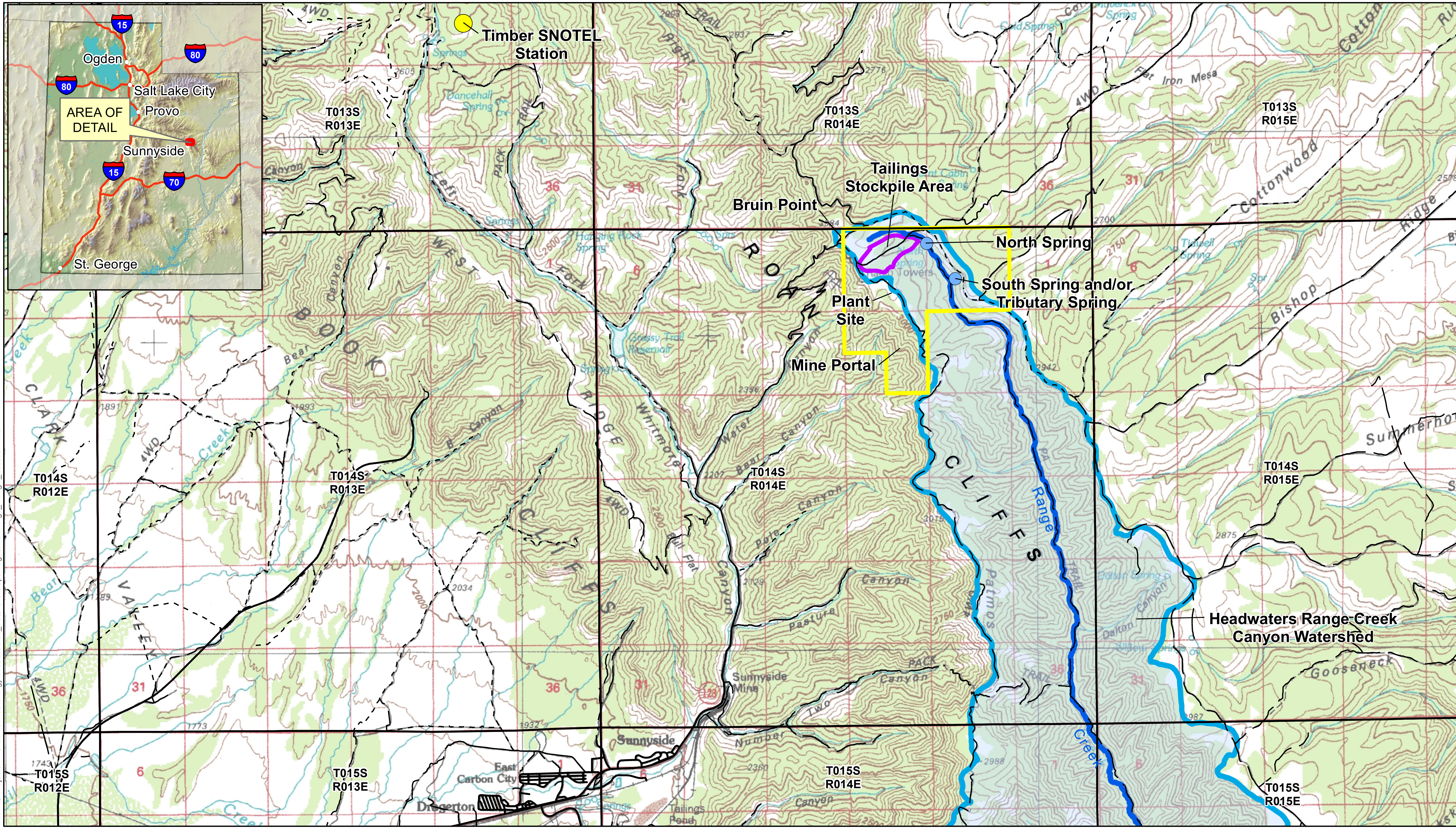
URS Corporation, and Mine Engineers, Inc. 2014. "Notice of Intention To Commence Large Mining Operations: Bruin Point Mine". Salt Lake City, Utah: American Sands Energy Corporation.

Wyrick, G.G., and J.W. Borchers. 1981. Hydrologic effects of stress-relief fracturing in an Appalachian Valley. US Geological Survey Water-Supply Paper 2177, US Government Printing Office.

<u>FIGURES</u>



Path: Q:\Projects\American Sands Energy\24585638\09_Data\GIS\Maps\August 2014\Fig1_ASEgw_Location.mxd

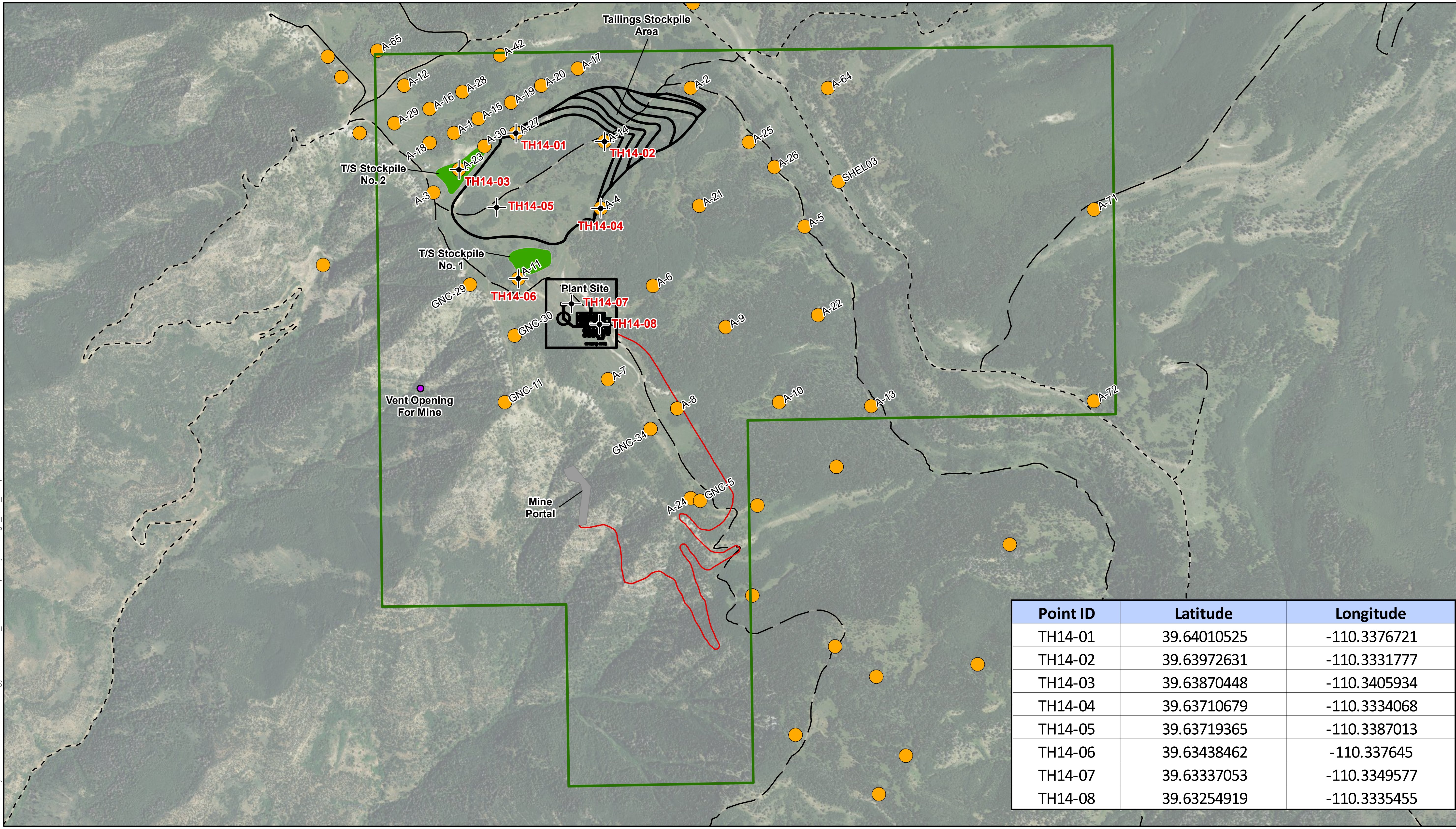
- Spring
- Access Road
- Paved Road
- Improved Road
- Dirt Road
- Road (Conditions Unknown)
- Permit Boundary
- Dry Material Storage Impoundment
- Range Creek Watershed
- PLSS Township & Range

Note:
Elevation in meters above mean sea level

N

1 0 1 2 Miles

Title:	Site Plan and Vicinity Map	
Bruin Point Mine	Proj No:	24585638
	Figure:	1
American Sands Energy Corp	Date:	Sept 2014
	URS	



Point ID	Latitude	Longitude
TH14-01	39.64010525	-110.3376721
TH14-02	39.63972631	-110.3331777
TH14-03	39.63870448	-110.3405934
TH14-04	39.63710679	-110.3334068
TH14-05	39.63719365	-110.3387013
TH14-06	39.63438462	-110.337645
TH14-07	39.63337053	-110.3349577
TH14-08	39.63254919	-110.3335455

Sample Point
Investigation Location 2014
Improved Road
Dirt Road
Road (Conditions Unknown)
Mine Haul Road
40 foot Contour Line
Elevation Data from 5m DEM Utah AGRC

Topsoil Stockpile
Topsoil Removal / Tailings Stockpile
Permit Boundary

N

675 0 675 1,350 Feet

Title: Investigation Location Map

Bruin Point Mine

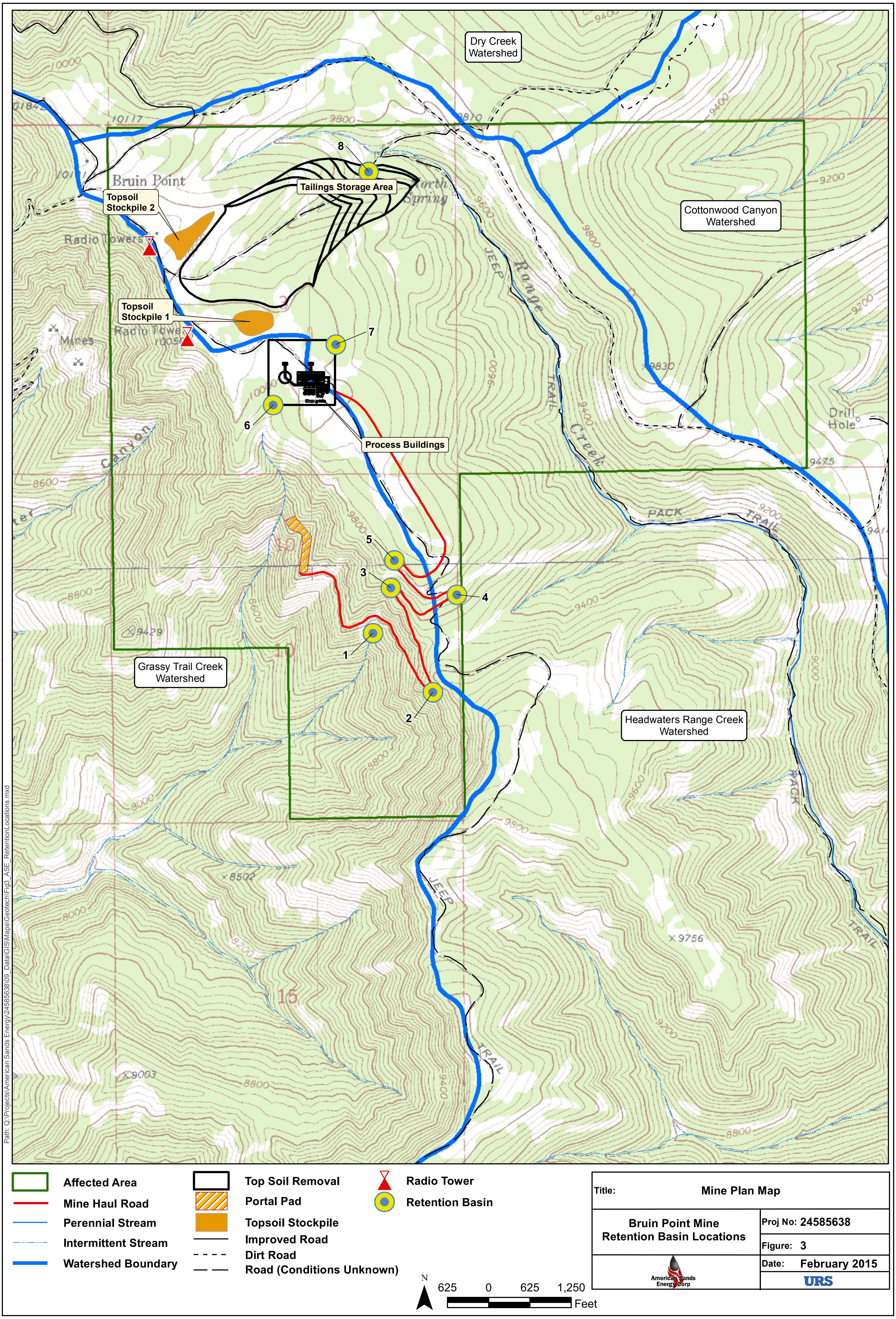
Proj No: 24585638

Figure: 2

Date: February 2015

American Sands Energy Corp

URS



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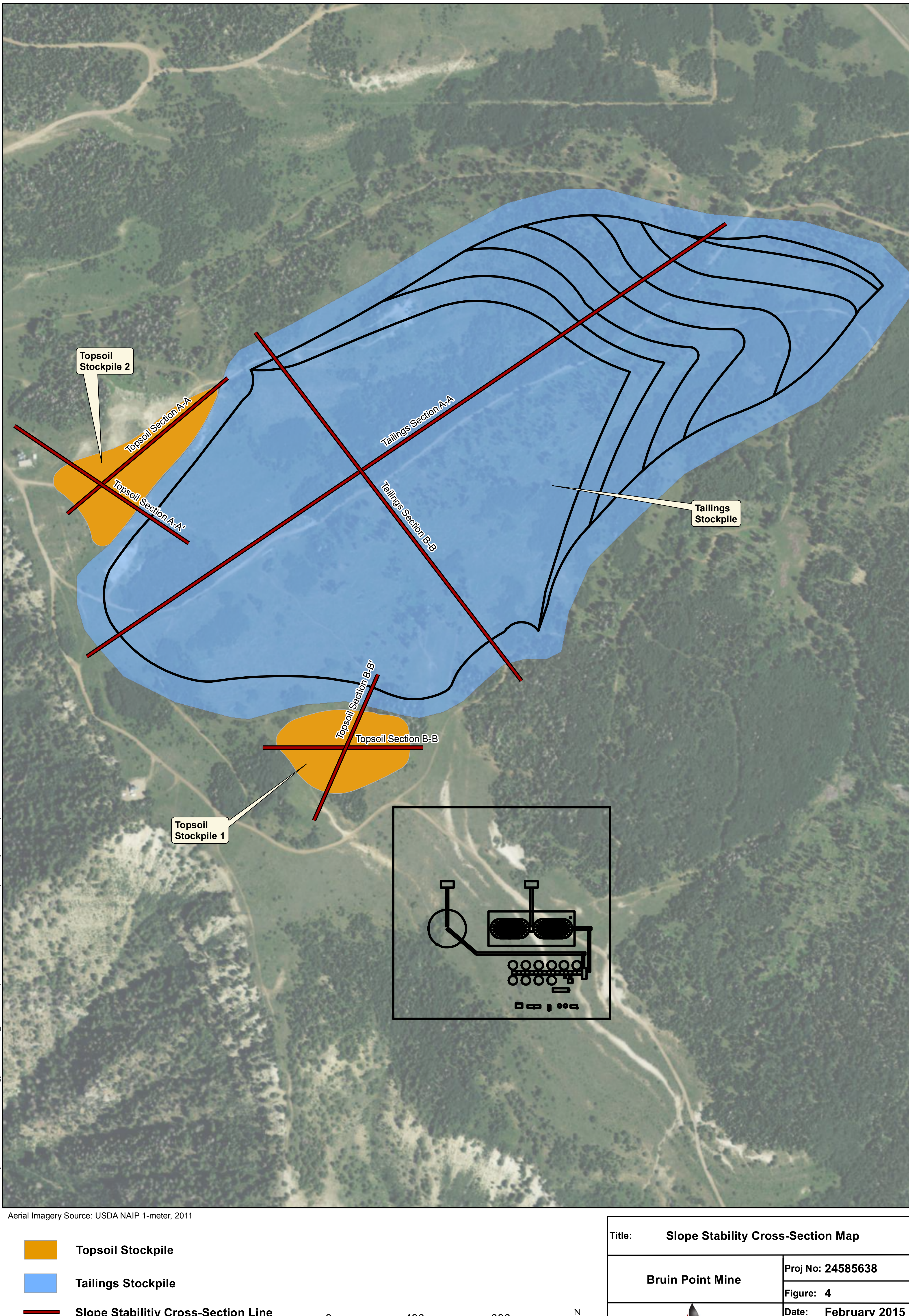
Title: Mine Plan Map	
Bruin Point Mine Retention Basin Locations	Proj No: 24585638
	Figure: 3
American Sands Energy Corp	Date: February 2015
	URS



Aerial Imagery Source: USDA NAIP 1-meter, 2011

Topsoil Stockpile

Tailings Stockpile

Slope Stabilitiy Cross-Section Line

0 400 800 Feet

N

Title:	Slope Stability Cross-Section Map
Bruin Point Mine	Proj No: 24585638
	Figure: 4
American Sands Energy Corp	Date: February 2015
	URS

APPENDIX A
TEST PIT LOGS

Surface and Shallow Soil Sampling Log

URS

Log ID: TH14-01

US State Plane, Utah Central, NAD 83	
Northing: 7,039,763 ft	
Easting: 1,967,721 ft	**Elevation:** 9,982 ft

General Information

Project Number: 24585638	**Project Name:** Bruin Point Mine	**Page:** 1 of 1
Location: 39.64010525, -110.3376721; Vicinity of A-27		**Date:** 08/11/14
Field Investigator: Ethan Lamiman		
Sampling Excavation Method: Bobcat E45 Excavator	**Sampling Method:** Grab	
Depth of Excavation: 29"	**Depth to Water:** Not Encountered	**Backfill Material:** Spoils

Sample Information

Depth (in)	Lithologic Description	Comments /Analysis Results
0-7	**Surficial Soil**, Dark Brown Clay with little sand, trace organics and root hairs, dry to moist	
7-12	Dark Brown to Brown, Fat CLAY (CH), trace to little fine sand , moist	Bag Sample Collected @1'
12-29	Interbedded Clay (CH) and Claystone/MudStone, horizontally bedded, 2-4" thicknesses, moist	
29	Rock	Refusal/ Terminated @ 29"

Photograph/Sketch

Description

View of test pit TH14-01.

Recorded By: E. Lamiman	Date 08/11/14	Checked By: D. Pond	Date: 8/24/14

Surface and Shallow Soil Sampling Log

Surface and Shallow Soil Sampling Log	URS	Log ID: TH14-03
		US State Plane, Utah Central, NAD 83
		Northing: 7,039,242 ft
		Easting: 1,966,905 ft **Elevation:** 10,035 ft

General Information

Project Number: 24585638	**Project Name:** Bruin Point Mine	**Page:** 1 of 1
Location: 39.63870448, -110.3405934; Vicinity of A-23		**Date:** 08/11/14
Field Investigator: Ethan Lamiman		
Sampling Excavation Method: Bobcat E45 Excavator	**Sampling Method:** Grab	
Depth of Excavation: 46”	**Depth to Water:** Not Encountered	**Backfill Material:** Spoils

Sample Information

Depth (in)	Lithologic Description	Comments /Analysis Results
0-9	**Surficial Soil**, Dark Brown Clay with little sand, trace organics and root hairs, dry to moist	
9-46	Brown, Fat CLAY (CH), trace to little fine sand, trace cobble 3-10” diameter, semi-angular, moist	Bag Sample Collected @ 1’ W=16.4%, F= 82.0%, LL=57, PL=26, PI=31
46	Rock	Refusal/ Terminated @ 46” Sample Collected – Fragmented Rock

Photograph/Sketch

Description

View of test pit TH14-03.

Recorded By: E. Lamiman	Date 08/11/14	Checked By: D. Pond	Date: 8/24/14

Surface and Shallow Soil Sampling Log

URS

Log ID: TH14-04	
US State Plane, Utah Central, NAD 83	
Northing: 7,038,686 ft	
Easting: 1,968,936 ft	**Elevation:** 9,977 ft

General Information

Project Number: 24585638	**Project Name:** Bruin Point Mine	**Page:** 1 of 1
Location: 39.63710679, -110.3334068; Vicinity of A-4		**Date:** 08/11/14
Field Investigator: Ethan Lamiman		
Sampling Excavation Method: Bobcat E45 Excavator	**Sampling Method:** Grab	
Depth of Excavation: 72”	**Depth to Water:** Not Encountered	**Backfill Material:** Spoils

Sample Information

Depth (in)	Lithologic Description	Comments /Analysis Results
0-7	**Surficial Soil**, Dark Brown Clay with little sand, trace organics and root hairs, dry to moist	
7-24	Brown, Clayey SAND (SC), little fine to coarse gravel, moist	Bag Sample Collected @ 1’ W=7.9%, F=45.2%, LL=35, PL=24, PI=11
24-72	Brown, Clayey SAND (SC), little fine to coarse gravel, contains cobble 3-10” diameter , moist	Bag Sample Collected @ 3’ W=13.1%, F=26.1%, LL=37, PL=23, PI=14
72	Rock	Refusal/Boring Terminated @ 6’ Sample Collected – Fragmented Rock

Photograph/Sketch

Description

View of test pit TH14-04.

Recorded By: E. Lamiman	Date 08/11/14	Checked By: D. Pond	Date: 8/24/14

Surface and Shallow Soil Sampling Log

URS

Log ID: TH14-05
US State Plane, Utah Central, NAD 83
Northing: 7,038,699 ft
Easting: 1,967,445 ft | **Elevation:** 9,925 ft

General Information

Project Number: 24585638	**Project Name:** Bruin Point Mine	**Page:** 1 of 1
Location: 39.63719365, -110.3387013		**Date:** 08/11/14
Field Investigator: Ethan Lamiman		
Sampling Excavation Method: Bobcat E45 Excavator	**Sampling Method:** Grab	
Depth of Excavation: 96”	**Depth to Water:** Not Encountered	**Backfill Material:** Spoils

Sample Information

Depth (in)	Lithologic Description	Comments /Analysis Results
0-8	**Surficial Soil**, Dark Brown Clay with little sand, trace organics and root hairs, dry to moist	
8-42	Brown, Clayey SAND (SC), little fine to coarse gravel, moist	
42-96 @66 Below 66”	Light Tan to Gray, LEAN CLAY (CL), trace fine sand, trace fine to coarse gravel, moist -2-3” thick rock shelf, moderately soft siltstone -same: Lean Clay (CL) contains small 2-4” angular siltstone and cobble below 66”, moist	Bag Sample Collected @ 3.75’ W=16.7%, F=60.5%, LL=40, PL=21, PI=19
96	Rock	Boring Terminated @ 8’

Photograph/Sketch

Description

View of test pit TH14-05

Recorded By: E. Lamiman	Date 08/11/14	Checked By: D. Pond	Date: 8/24/14

Surface and Shallow Soil Sampling Log

Log ID: TH14-06			
US State Plane, Utah Central, NAD 83			
Northing: 7,037,679 ft			
Easting: 1,967,755 ft	**Elevation:** 10,056 ft		

General Information

Project Number: 24585638	**Project Name:** Bruin Point Mine	**Page:** 1 of 1
Location: 39.63438462, -110.3376450; Vicinity of A-11		**Date:** 08/11/14
Field Investigator: Ethan Lamiman		
Sampling Excavation Method: Bobcat E45 Excavator	**Sampling Method:** Grab	
Depth of Excavation: 20”	**Depth to Water:** Not Encountered	**Backfill Material:** Spoils

Sample Information

Depth (in)	Lithologic Description	Comments /Analysis Results
0-10	**Surficial Soil**, Dark Brown Clay with little sand, trace organics and root hairs, dry to moist	
10-12	Brown, Clayey SAND (SC), trace fine to coarse gravel, moist	
12-20	Tan to Brown to Dark Brown Mudstone, moist	Bag Sample Collected @ 1.5’
20	Rock	Refusal/ Terminated @ 20”

Photograph/Sketch

Description

View of test pit TH14-06.

Recorded By: E. Lamiman	Date 08/11/14	Checked By: D. Pond	Date: 8/24/14

Surface and Shallow Soil Sampling Log

URS

Log ID: TH14-07
US State Plane, Utah Central, NAD 83
Northing: 7,037,320 ft
Easting: 1,968,517 ft | **Elevation:** 10,027 ft

General Information

Project Number: 24585638	**Project Name:** Bruin Point Mine	**Page:** 1 of 1
Location: 39.63337053, -110.3349577; Vicinity of Proposed Plant Site		**Date:** 08/11/14
Field Investigator: Ethan Lamiman		
Sampling Excavation Method: Bobcat E45 Excavator	**Sampling Method:** Grab	
Depth of Excavation: 69”	**Depth to Water:** Not Encountered	**Backfill Material:** Spoils

Sample Information

Depth (in)	Lithologic Description	Comments /Analysis Results
0-10	**Surficial Soil**, Dark Brown Clay with little sand, trace organics and root hairs, dry to moist	
10-36	Tan to White, Calcareous Sandstone shelf, highly weathered, ripable with excavator bucket, dry to moist	
36-69	Soft Siltstone/Mudstone, moist	Sample collected @ 3.5’
69	Rock	Refusal/ Terminated @ 5’9”

Photograph/Sketch

Description

View of test pit TH14-07.

Left Photo: Top of sandstone shelf at 10”

Right Photo: To bottom of excavation

Recorded By: E. Lamiman	Date 08/11/14	Checked By: D. Pond	Date: 8/24/14

Surface and Shallow Soil Sampling Log

URS

Log ID: TH14-08	
US State Plane, Utah Central, NAD 83	
Northing: 7,037,026 ft	
Easting: 1,968,918 ft	**Elevation:** 10,015 ft

General Information

Project Number: 24585638	**Project Name:** Bruin Point Mine	**Page:** 1 of 1
Location: 39.63254919, -110.3335455; Vicinity of Proposed Plant Site		**Date:** 08/11/14
Field Investigator: Ethan Lamiman		
Sampling Excavation Method: Bobcat E45 Excavator	**Sampling Method:** Grab	
Depth of Excavation: 64"	**Depth to Water:** Not Encountered	**Backfill Material:** Spoils

Sample Information

Depth (in)	Lithologic Description	Comments /Analysis Results
0-7	**Surficial Soil**, Dark Brown Clay with little sand, trace organics and root hairs	
7-12	Fine to coarse gravel, unnaturally bedded: possible disturbed material	Subsurface observed to be disturbed, offset 15' ESE into vegetated area.
0-10	**Surficial Soil**, Dark Brown Clay with little sand, trace organics and root hairs	
10-36	Brown, Clayey SAND (SC), little fine to coarse gravel, moist	
36-64	Tan to White, Calcareous Sandstone shelf, highly weathered, ripable with excavator bucket, dry to moist	Bag Sample Collected @ 3'
64	Rock	Refusal/ Terminated @ 5'4"

Photograph/Sketch

Description

View of test pit TH14-08.

Recorded By: E. Lamiman	Date 08/11/14	Checked By: D. Pond	Date: 8/24/14

APENDIX B

LABORATORY TEST RESULTS

Water Content and Unit Weight of Soil

(In General Accordance with ASTM D7263 Method B and D2216)

IGES

Project: URS
No: M00100-180 (24585638.1)
Location: American Sands Energy
Date: 8/20/2014
By: JDF

Sample Info.	Boring No.	TH14-03	TH14-04	TH14-04	TH14-05				
	Sample	3	4	5	6				
	Depth	1'	1.5'	3'	3.75'				
	Split	No	Yes	Yes	Yes				
	Split sieve		No.4	3/4"	3/8"				
	Total sample (g)		568.29	1274.42	880.96				
	Moist coarse fraction (g)		87.50	357.03	66.36				
	Moist split fraction (g)		480.79	917.39	814.60				
	Sample height, H (in)								
	Sample diameter, D (in)								
	Mass rings + wet soil (g)								
	Mass rings/tare (g)								
	Moist unit wt., γ_m (pcf)								
Coarse Fraction	Wet soil + tare (g)		212.47	478.43	194.45				
	Dry soil + tare (g)		208.63	444.90	190.81				
	Tare (g)		124.96	121.41	128.08				
	Water content (%)		4.6	10.4	5.8				
Split Fraction	Wet soil + tare (g)	363.41	259.65	618.44	550.74				
	Dry soil + tare (g)	330.33	249.25	559.18	486.98				
	Tare (g)	128.53	127.05	140.31	126.79				
	Water content (%)	16.4	8.5	14.1	17.7				
	Water Content, w (%)	**16.4**	**7.9**	**13.1**	**16.7**				
	Dry Unit Wt., γ_d (pcf)								

Entered by:___________

Reviewed:___________

Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

Project: URS
No: M00100-180 (24585638.1)
Location: American Sands Energy
Date: 8/20/2014
By: BRR

Boring No.: TH14-03
Sample: 3
Depth: 1'
Description: Brown fat clay

Preparation method: Wet
Liquid limit test method: Multipoint

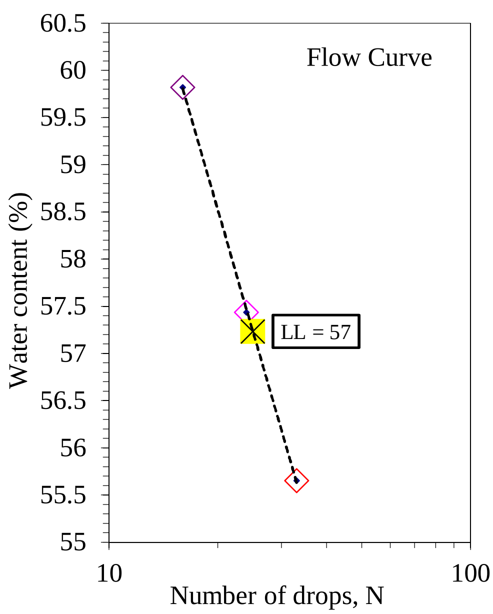
Plastic Limit

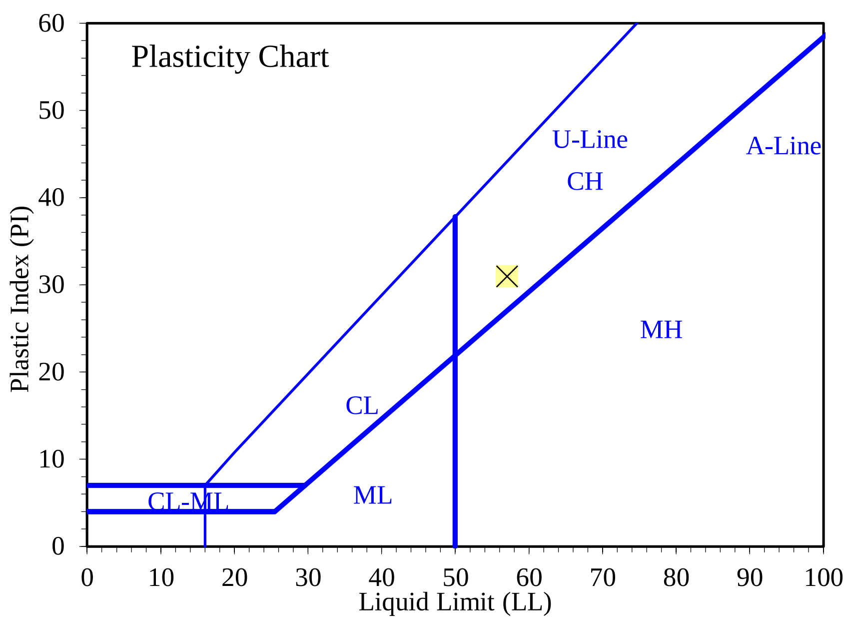
Determination No	1	2				
Wet Soil + Tare (g)	31.30	29.24				
Dry Soil + Tare (g)	29.41	27.77				
Water Loss (g)	1.89	1.47				
Tare (g)	22.11	22.18				
Dry Soil (g)	7.30	5.59				
Water Content, w (%)	25.89	26.30				

Liquid Limit

Determination No	1	2	3			
Number of Drops, N	33	24	16			
Wet Soil + Tare (g)	29.14	30.42	28.93			
Dry Soil + Tare (g)	26.58	27.37	26.25			
Water Loss (g)	2.56	3.05	2.68			
Tare (g)	21.98	22.06	21.77			
Dry Soil (g)	4.60	5.31	4.48			
Water Content, w (%)	55.65	57.44	59.82			
One-Point LL (%)		57				

Liquid Limit, LL (%)	**57**
Plastic Limit, PL (%)	**26**
Plasticity Index, PI (%)	**31**





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Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

Project: URS
No: M00100-180 (24585638.1)
Location: American Sands Energy
Date: 8/20/2014
By: BRR

Boring No.: TH14-04
Sample: 4
Depth: 1.5'
Description: Brown lean clay

Preparation method: Wet
Liquid limit test method: Multipoint

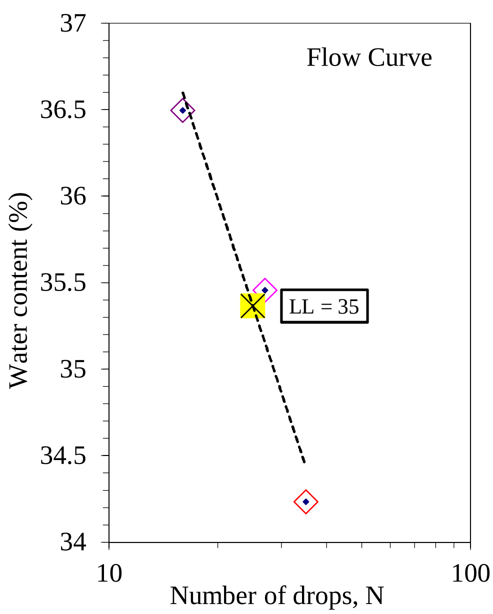
Plastic Limit

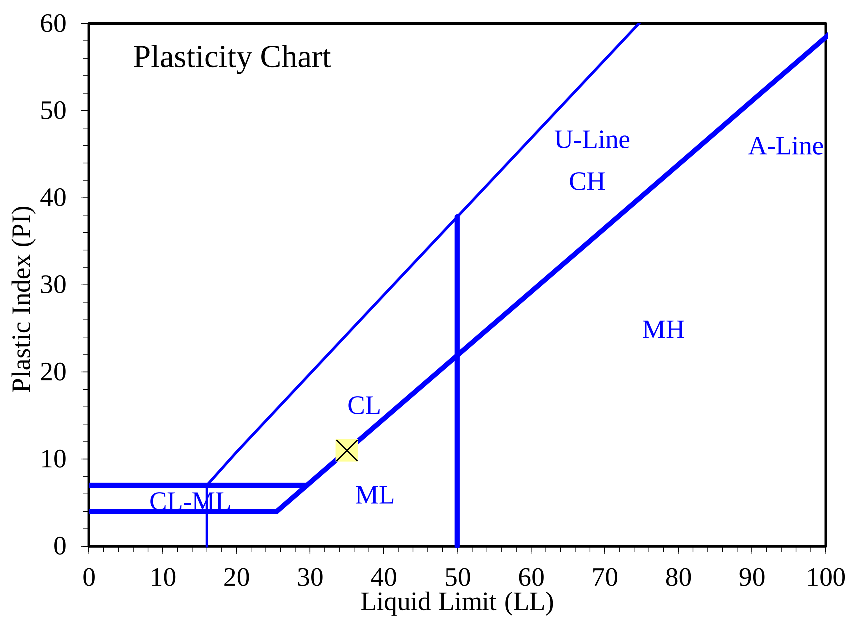
Determination No	1	2				
Wet Soil + Tare (g)	30.39	31.14				
Dry Soil + Tare (g)	28.74	29.34				
Water Loss (g)	1.65	1.80				
Tare (g)	21.80	21.65				
Dry Soil (g)	6.94	7.69				
Water Content, w (%)	23.78	23.41				

Liquid Limit

Determination No	1	2	3			
Number of Drops, N	35	27	16			
Wet Soil + Tare (g)	30.83	28.32	30.34			
Dry Soil + Tare (g)	28.55	26.65	28.11			
Water Loss (g)	2.28	1.67	2.23			
Tare (g)	21.89	21.94	22.00			
Dry Soil (g)	6.66	4.71	6.11			
Water Content, w (%)	34.23	35.46	36.50			
One-Point LL (%)		36				

Liquid Limit, LL (%)	**35**
Plastic Limit, PL (%)	**24**
Plasticity Index, PI (%)	**11**





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Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

Project: URS
No: M00100-180 (24585638.1)
Location: American Sands Energy
Date: 8/20/2014
By: BRR

Boring No.: TH14-04
Sample: 5
Depth: 3'
Description: Brown lean clay

Preparation method: Wet
Liquid limit test method: Multipoint

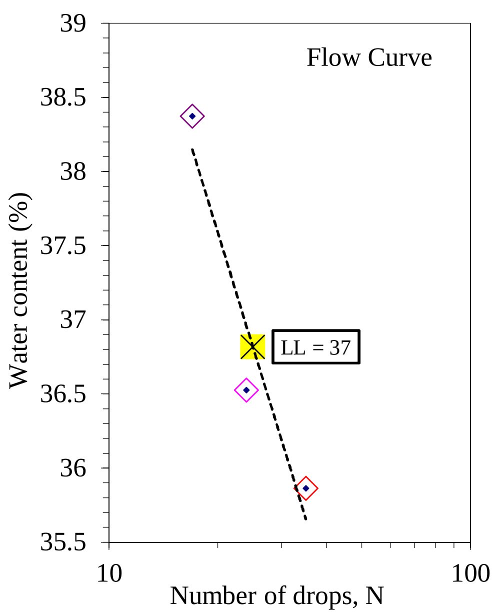
Plastic Limit

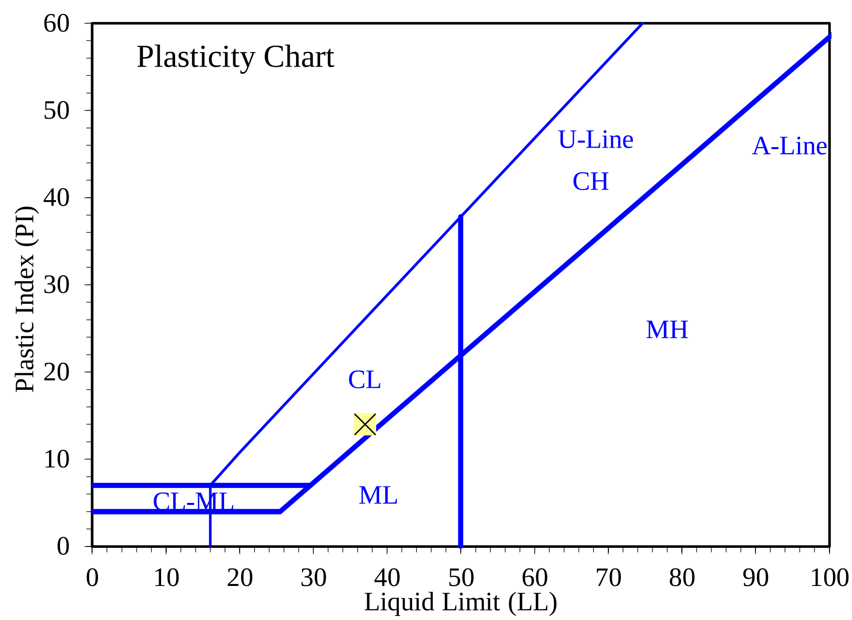
Determination No	1	2				
Wet Soil + Tare (g)	30.58	31.42				
Dry Soil + Tare (g)	28.99	29.55				
Water Loss (g)	1.59	1.87				
Tare (g)	22.16	21.47				
Dry Soil (g)	6.83	8.08				
Water Content, w (%)	23.28	23.14				

Liquid Limit

Determination No	1	2	3			
Number of Drops, N	35	24	17			
Wet Soil + Tare (g)	30.47	30.50	30.49			
Dry Soil + Tare (g)	28.25	28.25	28.13			
Water Loss (g)	2.22	2.25	2.36			
Tare (g)	22.06	22.09	21.98			
Dry Soil (g)	6.19	6.16	6.15			
Water Content, w (%)	35.86	36.53	38.37			
One-Point LL (%)		36				

Liquid Limit, LL (%)	**37**
Plastic Limit, PL (%)	**23**
Plasticity Index, PI (%)	**14**





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Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

Project: URS
No: M00100-180 (24585638.1)
Location: American Sands Energy
Date: 8/20/2014
By: BRR

Boring No.: TH14-05
Sample: 6
Depth: 3.75'
Description: Brown lean clay

Preparation method: Wet
Liquid limit test method: Multipoint

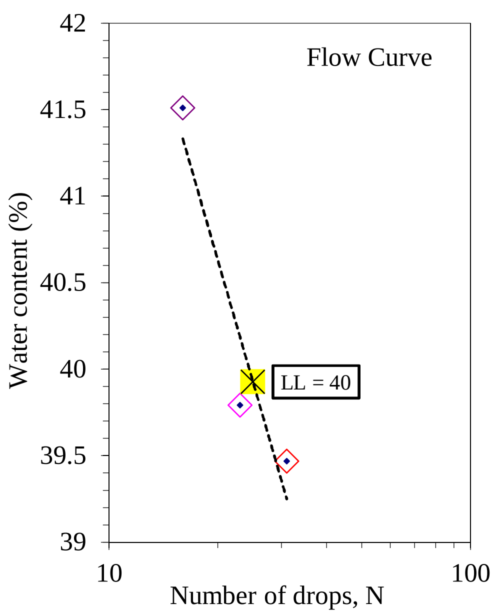
Plastic Limit

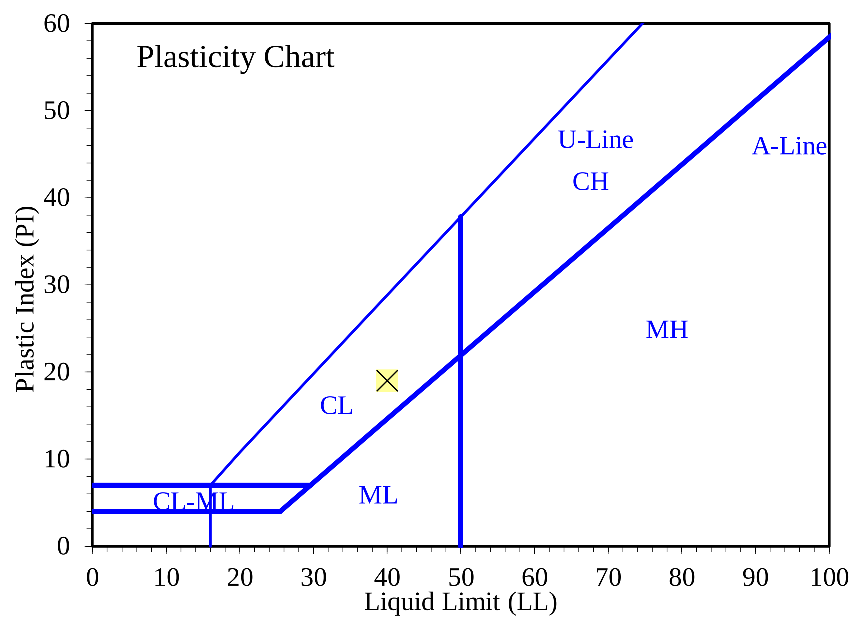
Determination No	1	2				
Wet Soil + Tare (g)	29.19	29.93				
Dry Soil + Tare (g)	27.94	28.59				
Water Loss (g)	1.25	1.34				
Tare (g)	22.01	22.20				
Dry Soil (g)	5.93	6.39				
Water Content, w (%)	21.08	20.97				

Liquid Limit

Determination No	1	2	3			
Number of Drops, N	31	23	16			
Wet Soil + Tare (g)	30.59	29.96	30.93			
Dry Soil + Tare (g)	28.21	27.66	28.24			
Water Loss (g)	2.38	2.30	2.69			
Tare (g)	22.18	21.88	21.76			
Dry Soil (g)	6.03	5.78	6.48			
Water Content, w (%)	39.47	39.79	41.51			
One-Point LL (%)		39				

Liquid Limit, LL (%)	**40**
Plastic Limit, PL (%)	**21**
Plasticity Index, PI (%)	**19**





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Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

Project: URS
No: M00100-180 (24585638.1)
Location: American Sands Energy
Date: 8/25/2014
By: BRR

Boring No.: Parting
Sample: 1
Depth:
Description: Grey lean clay

Preparation method: Wet
Liquid limit test method: Multipoint

Plastic Limit

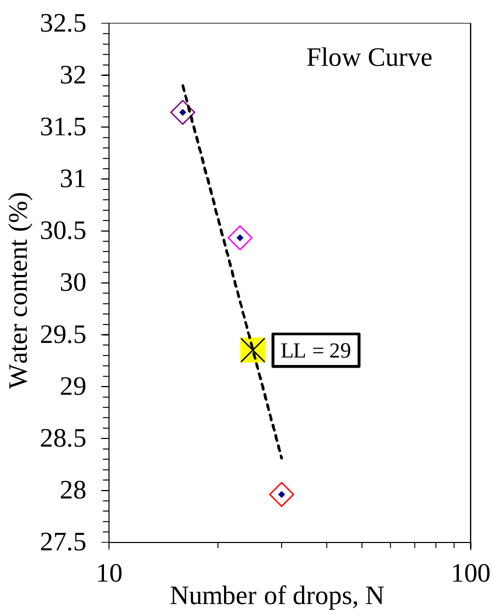
Determination No	1	2				
Wet Soil + Tare (g)	31.71	29.70				
Dry Soil + Tare (g)	30.09	28.43				
Water Loss (g)	1.62	1.27				
Tare (g)	22.25	22.26				
Dry Soil (g)	7.84	6.17				
Water Content, w (%)	20.66	20.58				

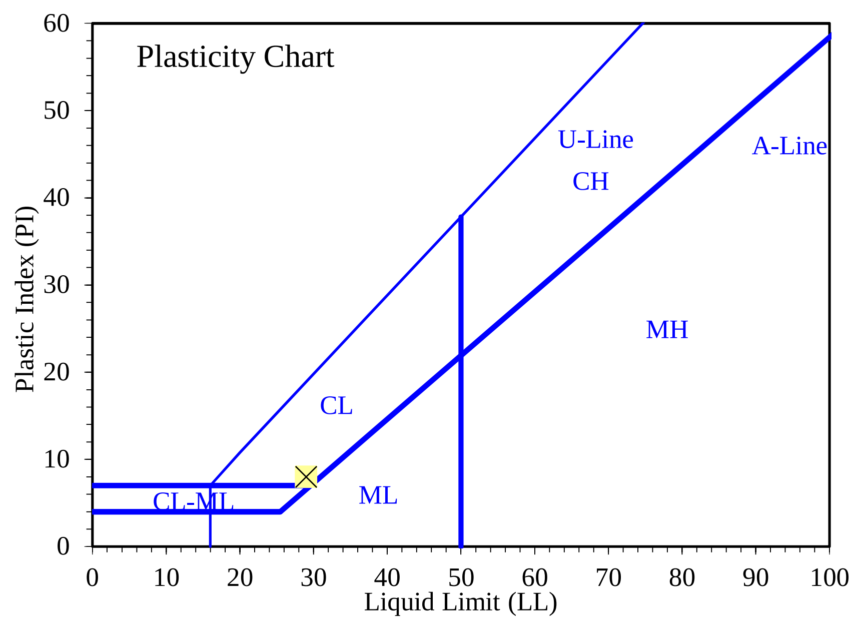
Liquid Limit

Determination No	1	2	3			
Number of Drops, N	30	23	16			
Wet Soil + Tare (g)	30.45	30.63	31.37			
Dry Soil + Tare (g)	28.49	28.60	29.06			
Water Loss (g)	1.96	2.03	2.31			
Tare (g)	21.48	21.93	21.76			
Dry Soil (g)	7.01	6.67	7.30			
Water Content, w (%)	27.96	30.43	31.64			
One-Point LL (%)	29	30				

Liquid Limit, LL (%)	**29**
Plastic Limit, PL (%)	**21**
Plasticity Index, PI (%)	**8**

Comments:
Test specimen created by crushing core sample.





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Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

(ASTM D6913)

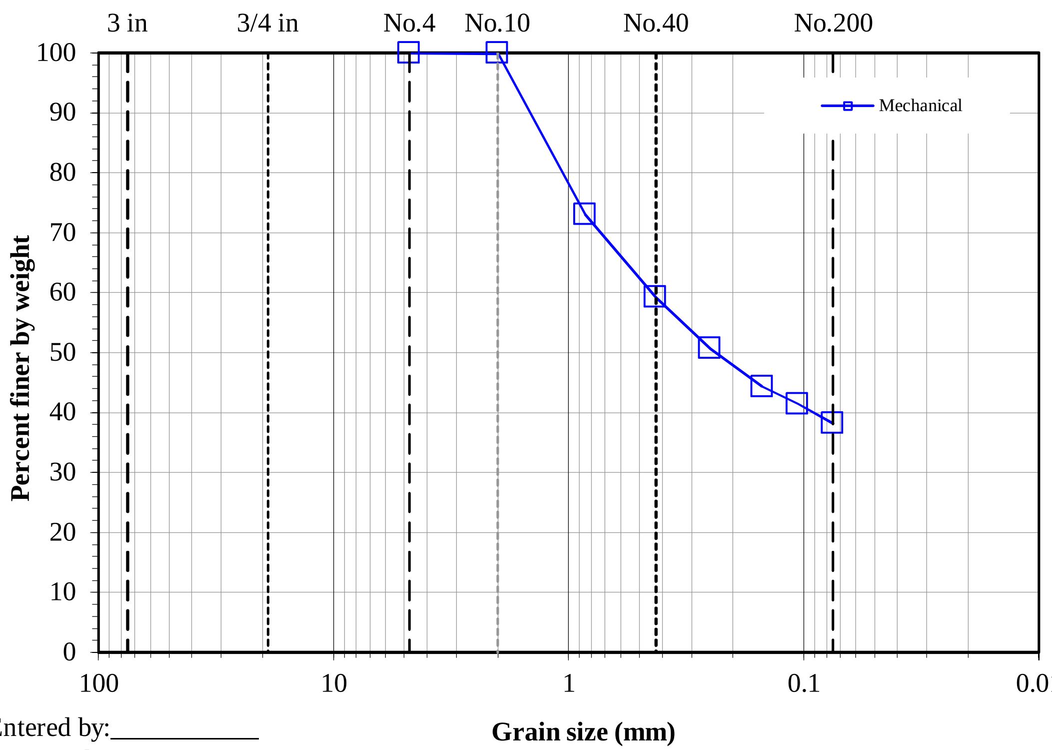
Project: URS
No: M00100-180 (24585638.1)
Location: American Sands Energy
Date: 8/22/2014
By: NB

Boring No.: Parting
Sample: 1
Depth:
Description: Light grey clayey sand

Split:	No	
	-	
	Moist	Dry
Total sample wt. (g):	129.79	124.68
Split fraction:	1.000	

Water content data		
Moist soil + tare (g):	-	596.81
Dry soil + tare (g):	-	591.70
Tare (g):	-	467.02
Water content (%):	0.0	4.1

Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer
8"	-	200	-
6"	-	150	-
4"	-	100	-
3"	-	75	-
1.5"	-	37.5	-
3/4"	-	19	-
3/8"	-	9.5	-
No.4	-	4.75	100.0
No.10	0.12	2	99.9
No.20	33.63	0.85	73.0
No.40	50.87	0.425	59.2
No.60	61.53	0.25	50.6
No.100	69.43	0.15	44.3
No.140	73.04	0.106	41.4
No.200	77.05	0.075	38.2



Gravel (%): 0.0
Sand (%): 61.8
Fines (%): 38.2

Comments:
Test specimen created by crushing core sample.

Entered by:___________
Reviewed:___________

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Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

(ASTM D6913)

Project: URS
No: M00100-180 (24585638.1)
Location: American Sands Energy
Date: 8/22/2014
By: NB

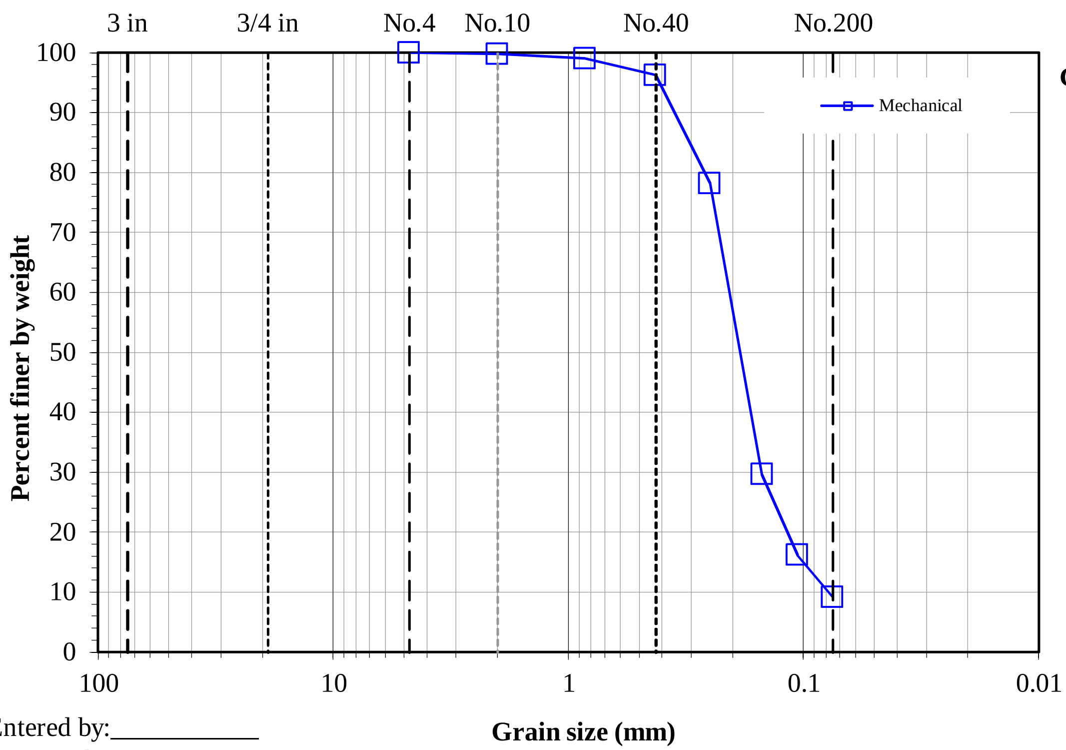
Boring No.: Tailings
Sample: 2
Depth:
Description: Brown sand with silt

Split:	No	
	-	
	Moist	Dry
Total sample wt. (g):	293.32	289.04
Split fraction:	1.000	

Water content data

Moist soil + tare (g):	-	624.08
Dry soil + tare (g):	-	619.80
Tare (g):	-	330.76
Water content (%):	0.0	1.5

Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer
8"	-	200	-
6"	-	150	-
4"	-	100	-
3"	-	75	-
1.5"	-	37.5	-
3/4"	-	19	-
3/8"	-	9.5	-
No.4	-	4.75	100.0
No.10	0.74	2	99.7
No.20	2.85	0.85	99.0
No.40	10.91	0.425	96.2
No.60	63.00	0.25	78.2
No.100	203.45	0.15	29.6
No.140	242.34	0.106	16.2
No.200	262.62	0.075	9.1



Gravel (%): 0.0
Sand (%): 90.9
Fines (%): 9.1

Entered by:___________
Reviewed:___________

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Amount of Material in Soil Finer than the No. 200 (75μm) Sieve

(ASTM D1140)

IGES

Project: URS
No: M00100-180 (24585638.1)
Location: American Sands Energy
Date: 8/20/2014
By: JDF

Sample Info.	Boring No.	TH14-03	TH14-04	TH14-04	TH14-05				
	Sample	3	4	5	6				
	Depth	1'	1.5'	3'	3.75'				
	Split	No	Yes	Yes	Yes				
	Split Sieve*		No. 4	3/4"	3/8"				
	Method	A	A	A	A				
	Moist total sample wt. (g)	234.88	568.30	1274.42	880.96				
	Moist coarse fraction (g)		85.06	350.52	65.48				
	Moist split fraction + tare (g)		259.65	618.44	550.74				
	Split fraction tare (g)		127.05	140.31	126.79				
	Dry split fraction (g)		122.20	418.87	360.19				
	Dry retained No. 200 + tare (g)	164.82	183.92	406.70	249.78				
	Wash tare (g)	128.53	127.05	140.31	126.79				
	No. 200 Dry wt. retained (g)	36.29	56.87	266.39	122.99				
	Split sieve* Dry wt. retained (g)		81.33	317.60	61.89				
	Dry total sample wt. (g)	201.80	526.67	1126.99	754.72				
Coarse Fraction	Moist soil + tare (g)		212.47	478.43	194.45				
	Dry soil + tare (g)		208.63	444.90	190.81				
	Tare (g)		124.96	121.41	128.08				
	Water content (%)		4.59	10.37	5.80				
Split Fraction	Moist soil + tare (g)	363.41	259.65	618.44	550.74				
	Dry soil + tare (g)	330.33	249.25	559.18	486.98				
	Tare (g)	128.53	127.05	140.31	126.79				
	Water content (%)	16.39	8.51	14.15	17.70				
	Percent passing split sieve* (%)		**84.6**	**71.8**	**91.8**				
	Percent passing No. 200 sieve (%)	**82.0**	**45.2**	**26.1**	**60.5**				

Entered by:___________

Reviewed:___________

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Specific Gravity of Soil Solids by Water Pycnometer

(ASTM D854)

Project: **URS**
No: **M00100-180 (24585638.1)**
Location: American Sands Energy
Date: 8/27/2014
By: DKS

Drill hole / Sample:	Parting	Tailings				
Sample No:	1	2				
Depth (ft)						
Engineering Classification	Not req.	Not req.				
Method	A	A				
Material passing No. 4 seive, *P* (%)	100	100				
Pycnometer No.	8	1				
Mass of pycnometer (g)	188.92	167.64				
Mass of pycnometer, soil, and water, $M_{\rho ws,t}$ (g)	721.54	711.16				
Temperature, T_t (°C)	21.2	21.2				
Mass of pycnometer and water at test temperature, $M_{pw,t}$ (g)	687.61	666.08				
Mass of tare + dry soil (g)	382.76	401.44				
Mass of tare (g)	328.33	328.97				
Mass of soil, M_s (g)	54.43	72.47				
Specific gravity of soil solids at test temperature, G_t	2.655	2.646				
Temperature coefficient, *K*	0.99974	0.99974				
Specific gravity of soil solids at 20°C, $G_{20°C}$	**2.654**	**2.645**				
Apparent specific gravity of solids retained on No. 4, $G_{1@20°C}$						
Average specific gravity at 20°C, $G_{avg\ @20°C}$						

Tested by:___________

Reviewed by:___________

Direct Shear Test for Soils Under Drained Conditions

(ASTM D3080)

Project: URS
No: M00100-180 (24585638.1)
Location: American Sands Energy
Date: 8/20/2014
By: JDF

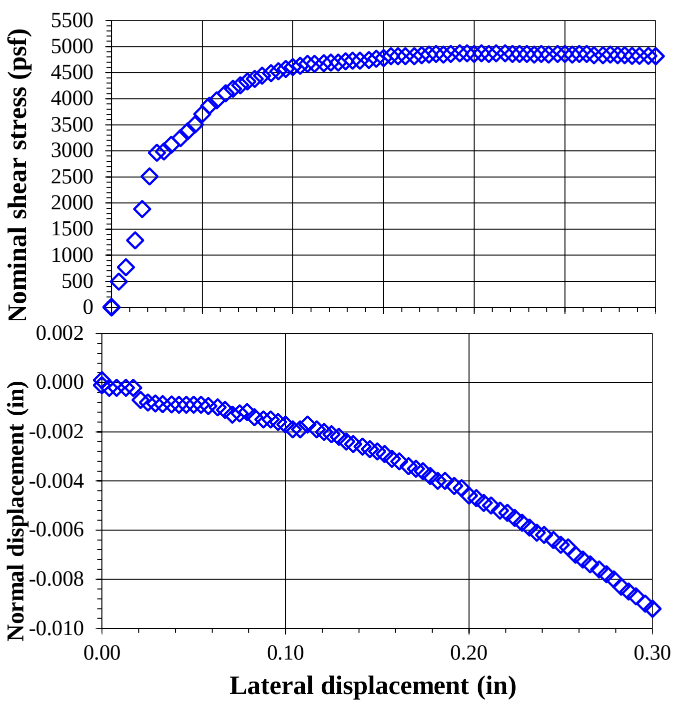
Boring No.: TH14-04
Sample: 4
Depth: 1.5'
Sample Description: Brown silty sand
Sample type: Laboratory compacted
Dry unit weight 105 pcf
at 16 (%) w
Compaction specifications: Provided by client

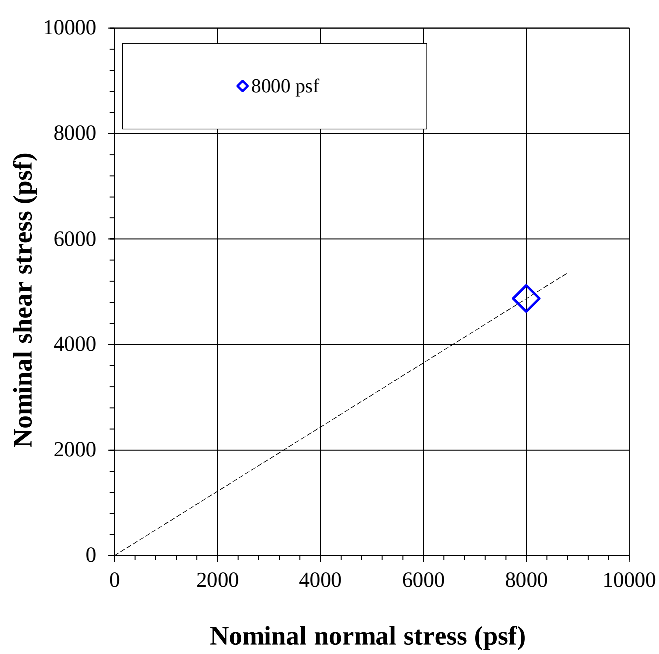
Test type: Inundated
Lateral displacement (in.): 0.3
Shear rate (in./min): 0.0035
Specific gravity, Gs: 2.65 Assumed

	Sample 1	
Nominal normal stress (psf)	8000	
Peak shear stress (psf)	4872	
Lateral displacement at peak (in)	0.192	
Load Duration (min)	195	
	Initial	Pre-shear
Sample height (in)	1.0000	0.9803
Sample diameter (in)	2.416	2.416
Wt. rings + wet soil (g)	189.37	195.07
Wt. rings (g)	42.67	42.67
Wet soil + tare (g)	222.94	
Dry soil + tare (g)	209.61	
Tare (g)	126.19	
Water content (%)	16.0	20.5
Dry unit weight (pcf)	105.1	107.2
Void ratio, e, for assumed Gs	0.57	0.54
Saturation (%)*	73.8	100.0

ϕ' (deg)	31
c' (psf)	0

*Pre-shear saturation set to 100% for phase calculations





Entered by:___________
Reviewed:___________

Direct Shear Test for Soils Under Drained Conditions

(ASTM D3080)

Project: URS
No: M00100-180 (24585638.1)
Location: American Sands Energy

Boring No.: TH14-04
Sample: 4
Depth: 1.5'

Nominal normal stress = 8000 psf		
Lateral Displacement (in.)	Nominal Shear Stress (psf)	Normal Displacement (in.)
0.000	0	0.000
0.000	12	0.000
0.004	492	0.000
0.008	768	0.000
0.013	1284	0.000
0.017	1884	0.000
0.021	2508	-0.001
0.025	2964	-0.001
0.029	2988	-0.001
0.033	3117	-0.001
0.038	3246	-0.001
0.042	3375	-0.001
0.046	3504	-0.001
0.050	3708	-0.001
0.054	3864	-0.001
0.058	3972	-0.001
0.063	4104	-0.001
0.067	4188	-0.001
0.071	4260	-0.001
0.075	4332	-0.001
0.079	4380	-0.001
0.083	4440	-0.001
0.088	4488	-0.002
0.092	4524	-0.002
0.096	4572	-0.002
0.100	4608	-0.002
0.104	4632	-0.002
0.108	4668	-0.002
0.112	4668	-0.002
0.117	4680	-0.002
0.121	4692	-0.002
0.125	4692	-0.002
0.129	4716	-0.002
0.133	4728	-0.002
0.137	4728	-0.003
0.142	4740	-0.003
0.146	4764	-0.003
0.150	4776	-0.003
0.154	4812	-0.003
0.158	4812	-0.003
0.162	4812	-0.003
0.167	4812	-0.003
0.171	4836	-0.004
0.175	4848	-0.004
0.179	4860	-0.004
0.183	4848	-0.004
0.187	4860	-0.004
0.192	4872	-0.004
0.196	4872	-0.004
0.200	4860	-0.005
0.204	4872	-0.005
0.208	4860	-0.005
0.212	4872	-0.005
0.217	4872	-0.005
0.221	4860	-0.005
0.225	4860	-0.006
0.229	4860	-0.006
0.233	4848	-0.006
0.237	4860	-0.006
0.241	4848	-0.006
0.246	4860	-0.006
0.250	4860	-0.007
0.254	4848	-0.007
0.258	4860	-0.007
0.262	4860	-0.007

Direct Shear Test for Soils Under Drained Conditions

(ASTM D3080)

Project: URS
No: M00100-180 (24585638.1)
Location: American Sands Energy

Boring No.: TH14-04
Sample: 4
Depth: 1.5'

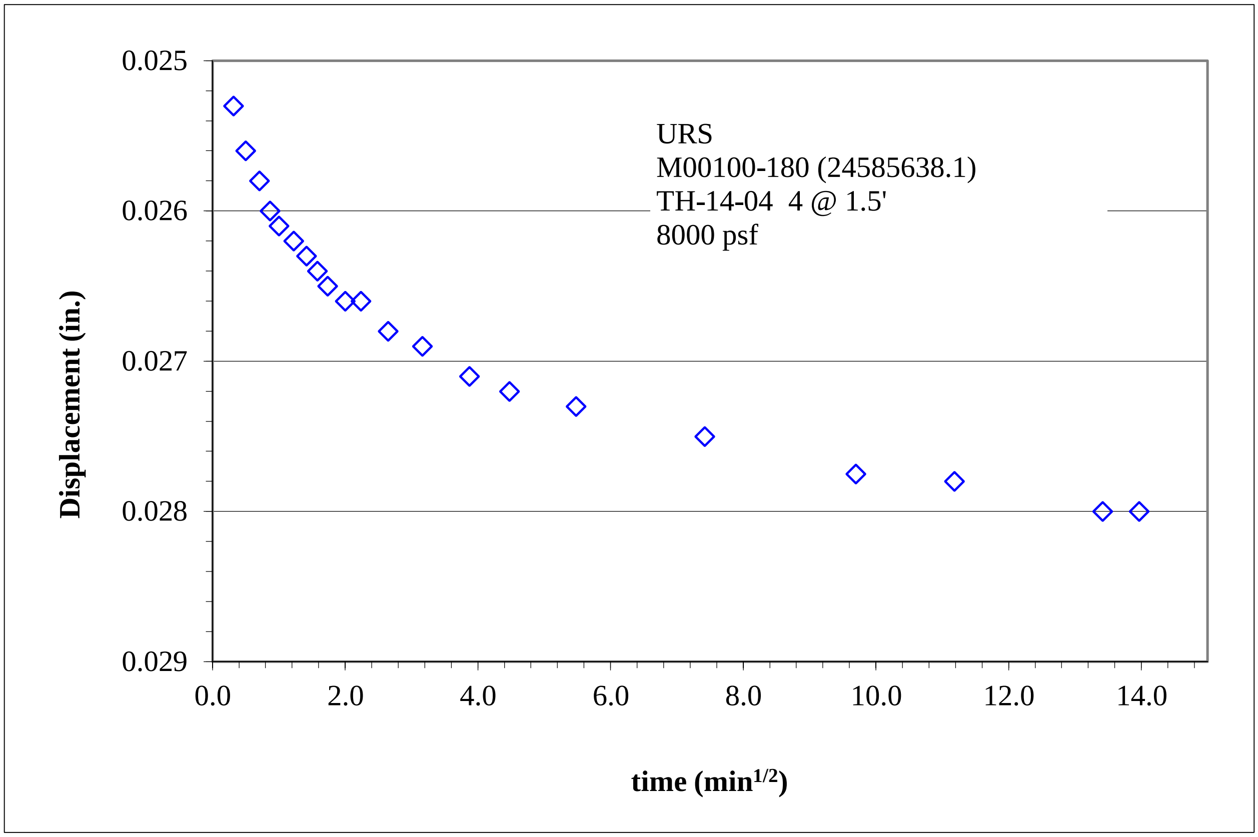
Nominal normal stress = 8000 psf		
Lateral Displacement (in.)	Nominal Shear Stress (psf)	Normal Displacement (in.)
0.266	4836	-0.007
0.271	4836	-0.008
0.275	4848	-0.008
0.279	4836	-0.008
0.283	4836	-0.008
0.287	4824	-0.009
0.291	4824	-0.009
0.296	4824	-0.009
0.300	4812	-0.009
0.300	4812	-0.009

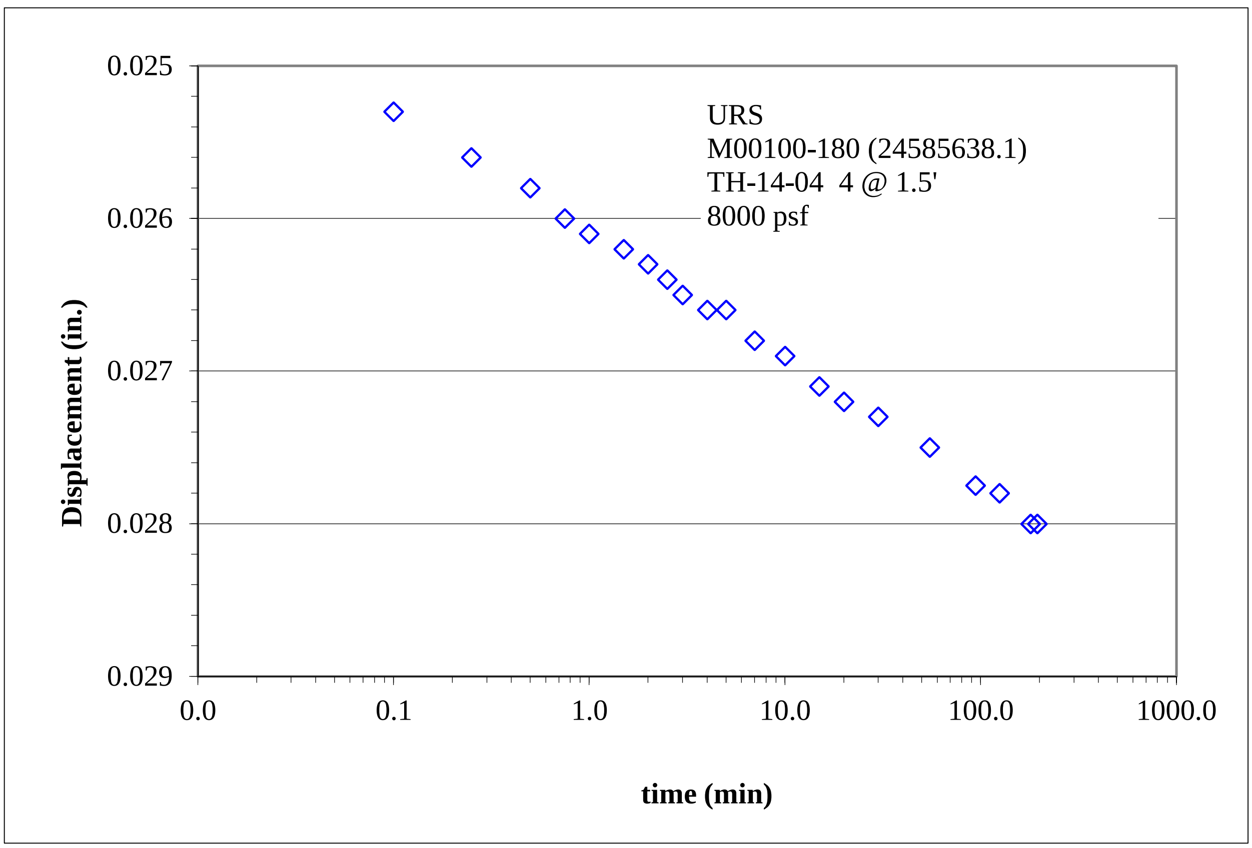
Direct Shear Test for Soils Under Drained Conditions

(ASTM D3080)

Project: URS
No: M00100-180 (24585638.1)
Location: American Sands Energy

Boring No.: TH14-04
Sample: 4
Depth: 1.5'





Direct Shear Test for Soils Under Drained Conditions

(ASTM D3080)

Project: URS
No: M00100-180 (24585638.1)
Location: American Sands Energy
Date: 8/25/2014
By: NB

Boring No.: Parting
Sample: 1
Depth:
Sample Description: Light grey clayey sand
Sample type: Laboratory compacted
Dry unit weight 110 pcf
at 16 (%) w
Compaction specifications: Provided by client

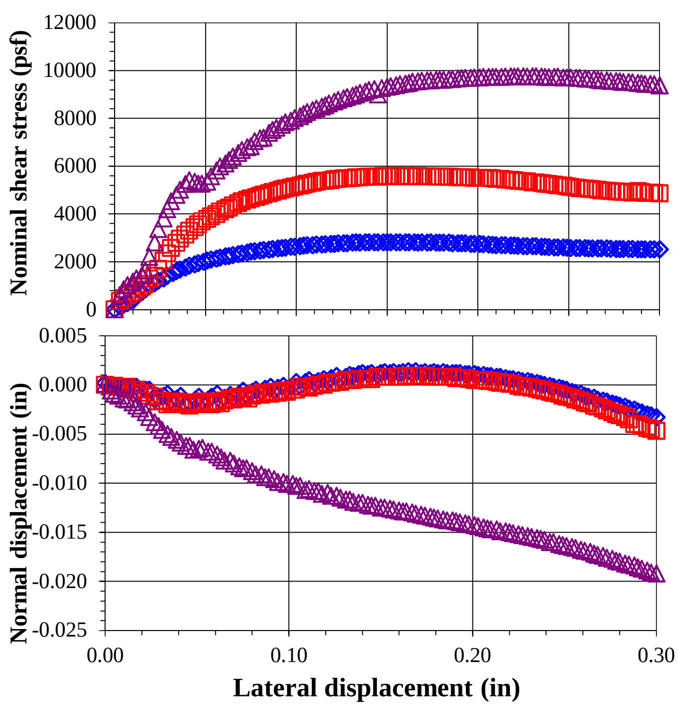
Test type: Inundated
Lateral displacement (in.): 0.3
Shear rate (in./min): 0.0035
Specific gravity, Gs: 2.654 Determined

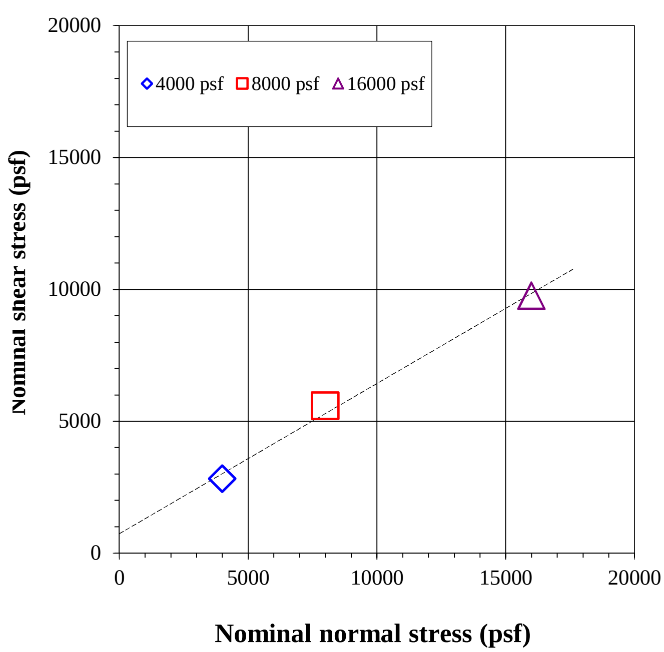
	Sample 1		Sample 2		Sample 3	
Nominal normal stress (psf)	4000		8000		16000	
Peak shear stress (psf)	2820		5580		9755	
Lateral displacement at peak (in)	0.138		0.148		0.218	
Load Duration (min)	1387		1499		460	
	Initial	Pre-shear	Initial	Pre-shear	Initial	Pre-shear
Sample height (in)	1.0000	0.9817	1.0000	0.9623	1.0000	0.9464
Sample diameter (in)	2.416	2.416	2.416	2.416	2.416	2.416
Wt. rings + wet soil (g)	199.17	201.42	196.62	197.41	198.35	197.95
Wt. rings (g)	45.48	45.48	42.93	42.93	44.66	44.66
Wet soil + tare (g)	509.87		509.87		509.87	
Dry soil + tare (g)	461.38		461.38		461.38	
Tare (g)	168.11		168.11		168.11	
Water content (%)	16.5	18.2	16.5	17.1	16.5	16.2
Dry unit weight (pcf)	109.6	111.6	109.6	113.8	109.6	115.7
Void ratio, e	0.51	0.48	0.51	0.45	0.51	0.43
Saturation (%)*	85.7	100.0	85.7	100.0	85.7	100.0

ϕ' (deg)	30
c' (psf)	733

Average of 3 samples	Initial	Pre-shear
Water content (%)	16.5	17.2
Dry unit weight (pcf)	109.6	113.7

*Pre-shear saturation set to 100% for phase calculations





Entered by:___________
Reviewed:___________

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Direct Shear Test for Soils Under Drained Conditions

(ASTM D3080)

Project: URS
No: M00100-180 (24585638.1)
Location: American Sands Energy

Boring No.: Parting
Sample: 1
Depth:

Nominal normal stress = 4000 psf			Nominal normal stress = 8000 psf			Nominal normal stress = 16000 psf		
Lateral Displacement (in.)	Nominal Shear Stress (psf)	Normal Displacement (in.)	Lateral Displacement (in.)	Nominal Shear Stress (psf)	Normal Displacement (in.)	Lateral Displacement (in.)	Nominal Shear Stress (psf)	Normal Displacement (in.)
0.000	0	0.000	0.000	0	0.000	0.000	0	0.000
0.003	132	0.000	0.003	360	0.000	0.003	600	-0.001
0.005	204	0.000	0.005	480	0.000	0.005	852	-0.001
0.007	276	0.000	0.007	600	0.000	0.007	1020	-0.001
0.010	396	0.000	0.010	720	0.000	0.010	1176	-0.001
0.012	576	0.000	0.012	840	0.000	0.012	1308	-0.002
0.015	732	0.000	0.015	960	-0.001	0.015	1440	-0.002
0.017	852	0.000	0.017	1068	-0.001	0.017	1644	-0.002
0.019	984	-0.001	0.019	1296	-0.001	0.019	2196	-0.002
0.022	1104	-0.001	0.022	1404	-0.001	0.022	2796	-0.003
0.024	1212	-0.001	0.024	1704	-0.001	0.024	3360	-0.003
0.027	1308	-0.002	0.027	2040	-0.001	0.027	3804	-0.004
0.029	1416	-0.001	0.029	2340	-0.002	0.029	4188	-0.004
0.032	1524	-0.001	0.031	2580	-0.002	0.031	4524	-0.005
0.034	1608	-0.001	0.034	2784	-0.002	0.034	4788	-0.005
0.036	1680	-0.002	0.036	2964	-0.002	0.036	5004	-0.005
0.039	1752	-0.001	0.039	3132	-0.002	0.039	5244	-0.006
0.041	1836	-0.001	0.041	3300	-0.002	0.041	5412	-0.006
0.044	1896	-0.002	0.044	3444	-0.002	0.044	5340	-0.006
0.046	1944	-0.002	0.046	3564	-0.002	0.046	5268	-0.006
0.049	2004	-0.002	0.048	3684	-0.002	0.048	5268	-0.007
0.051	2052	-0.001	0.051	3792	-0.002	0.051	5340	-0.007
0.053	2088	-0.002	0.053	3900	-0.002	0.053	5568	-0.006
0.056	2136	-0.002	0.056	3996	-0.002	0.056	5808	-0.007
0.058	2172	-0.001	0.058	4092	-0.002	0.058	5988	-0.007
0.061	2220	-0.001	0.061	4188	-0.002	0.061	6108	-0.007
0.063	2244	-0.002	0.063	4260	-0.002	0.063	6252	-0.007
0.065	2280	-0.001	0.065	4356	-0.002	0.065	6396	-0.008
0.068	2316	-0.001	0.068	4440	-0.001	0.068	6540	-0.008
0.070	2352	-0.001	0.070	4524	-0.002	0.070	6660	-0.008
0.073	2388	-0.001	0.073	4596	-0.001	0.073	6792	-0.008
0.075	2424	-0.001	0.075	4644	-0.001	0.075	6828	-0.009
0.077	2436	-0.001	0.078	4704	-0.001	0.077	7044	-0.009
0.080	2460	-0.001	0.080	4752	-0.001	0.080	7164	-0.009
0.082	2496	-0.001	0.082	4812	-0.001	0.082	7188	-0.009
0.085	2508	-0.001	0.085	4860	-0.001	0.085	7392	-0.009
0.087	2532	0.000	0.087	4920	-0.001	0.087	7512	-0.009
0.090	2556	0.000	0.090	4968	-0.001	0.089	7596	-0.009
0.092	2568	-0.001	0.092	5016	-0.001	0.092	7716	-0.010
0.094	2592	0.000	0.094	5064	-0.001	0.094	7824	-0.010
0.097	2628	0.000	0.097	5100	-0.001	0.097	7896	-0.010
0.099	2628	0.000	0.099	5136	-0.001	0.099	8004	-0.010
0.102	2652	0.000	0.102	5184	-0.001	0.102	8088	-0.010
0.104	2676	0.000	0.104	5220	-0.001	0.104	8172	-0.010
0.106	2688	0.000	0.106	5268	0.000	0.106	8255	-0.010
0.109	2700	0.000	0.109	5304	0.000	0.109	8339	-0.011
0.111	2724	0.001	0.111	5340	0.000	0.111	8399	-0.011
0.114	2724	0.000	0.114	5376	0.000	0.114	8483	-0.011
0.116	2736	0.000	0.116	5388	0.000	0.116	8543	-0.011
0.119	2748	0.001	0.119	5412	0.000	0.118	8615	-0.011
0.121	2748	0.000	0.121	5448	0.000	0.121	8699	-0.011
0.123	2772	0.001	0.123	5460	0.000	0.123	8759	-0.011
0.126	2772	0.001	0.126	5484	0.000	0.126	8831	-0.011
0.128	2772	0.001	0.128	5484	0.000	0.128	8891	-0.012
0.131	2796	0.001	0.131	5508	0.001	0.131	8939	-0.012
0.133	2808	0.001	0.133	5532	0.001	0.133	8999	-0.012
0.135	2796	0.001	0.135	5532	0.001	0.135	9059	-0.012
0.138	2820	0.001	0.138	5544	0.001	0.138	9119	-0.012
0.140	2820	0.001	0.140	5556	0.001	0.140	9179	-0.012
0.143	2820	0.001	0.143	5556	0.001	0.143	9215	-0.012
0.145	2820	0.001	0.145	5556	0.001	0.145	8987	-0.012
0.148	2820	0.001	0.148	5580	0.001	0.147	9263	-0.012
0.150	2820	0.001	0.150	5568	0.001	0.150	9311	-0.013
0.152	2820	0.001	0.152	5580	0.001	0.152	9347	-0.013
0.155	2808	0.001	0.155	5580	0.001	0.155	9383	-0.013

Direct Shear Test for Soils Under Drained Conditions

(ASTM D3080)

Project: URS
No: M00100-180 (24585638.1)
Location: American Sands Energy

Boring No.: Parting
Sample: 1
Depth:

Nominal normal stress = 4000 psf			Nominal normal stress = 8000 psf			Nominal normal stress = 16000 psf		
Lateral Displacement (in.)	Nominal Shear Stress (psf)	Normal Displacement (in.)	Lateral Displacement (in.)	Nominal Shear Stress (psf)	Normal Displacement (in.)	Lateral Displacement (in.)	Nominal Shear Stress (psf)	Normal Displacement (in.)
0.157	2820	0.001	0.157	5568	0.001	0.157	9419	-0.013
0.160	2808	0.001	0.160	5580	0.001	0.160	9443	-0.013
0.162	2820	0.001	0.162	5568	0.001	0.162	9479	-0.013
0.165	2820	0.001	0.164	5568	0.001	0.164	9527	-0.013
0.167	2796	0.001	0.167	5580	0.001	0.167	9539	-0.013
0.169	2808	0.001	0.169	5568	0.001	0.169	9563	-0.013
0.172	2796	0.001	0.172	5568	0.001	0.172	9587	-0.013
0.174	2808	0.001	0.174	5568	0.001	0.174	9587	-0.013
0.177	2796	0.001	0.177	5556	0.001	0.177	9611	-0.013
0.179	2796	0.001	0.179	5556	0.001	0.179	9611	-0.014
0.181	2796	0.001	0.181	5556	0.001	0.181	9611	-0.014
0.184	2796	0.001	0.184	5556	0.001	0.184	9635	-0.014
0.186	2772	0.001	0.186	5544	0.001	0.186	9635	-0.014
0.189	2772	0.001	0.189	5532	0.001	0.189	9659	-0.014
0.191	2772	0.001	0.191	5532	0.001	0.191	9671	-0.014
0.193	2772	0.001	0.193	5532	0.001	0.193	9683	-0.014
0.196	2748	0.001	0.196	5532	0.001	0.196	9683	-0.014
0.198	2748	0.001	0.198	5508	0.001	0.198	9695	-0.014
0.201	2748	0.001	0.201	5508	0.001	0.201	9707	-0.014
0.203	2736	0.001	0.203	5508	0.001	0.203	9731	-0.014
0.206	2724	0.001	0.206	5508	0.001	0.206	9731	-0.015
0.208	2712	0.001	0.208	5484	0.000	0.208	9731	-0.015
0.210	2700	0.001	0.210	5460	0.000	0.210	9731	-0.015
0.213	2700	0.001	0.213	5460	0.000	0.213	9731	-0.015
0.215	2700	0.001	0.215	5436	0.000	0.215	9743	-0.015
0.218	2676	0.001	0.218	5424	0.000	0.218	9755	-0.015
0.220	2676	0.001	0.220	5412	0.000	0.220	9743	-0.015
0.222	2664	0.001	0.222	5388	0.000	0.222	9755	-0.015
0.225	2652	0.001	0.225	5364	0.000	0.225	9755	-0.015
0.227	2652	0.000	0.227	5352	0.000	0.227	9743	-0.015
0.230	2652	0.000	0.230	5316	0.000	0.230	9755	-0.015
0.232	2652	0.000	0.232	5316	0.000	0.232	9755	-0.016
0.235	2628	0.000	0.235	5292	0.000	0.235	9743	-0.016
0.237	2628	0.000	0.237	5268	-0.001	0.237	9731	-0.016
0.239	2616	0.000	0.239	5244	-0.001	0.239	9719	-0.016
0.242	2604	0.000	0.242	5220	-0.001	0.242	9731	-0.016
0.244	2604	0.000	0.244	5196	-0.001	0.244	9743	-0.016
0.247	2604	0.000	0.247	5184	-0.001	0.247	9707	-0.016
0.249	2592	0.000	0.249	5148	-0.001	0.249	9707	-0.016
0.251	2580	-0.001	0.251	5124	-0.001	0.251	9695	-0.016
0.254	2580	-0.001	0.254	5100	-0.001	0.254	9683	-0.017
0.256	2580	-0.001	0.256	5076	-0.002	0.256	9683	-0.017
0.259	2568	-0.001	0.259	5064	-0.002	0.259	9659	-0.017
0.261	2556	-0.001	0.261	5052	-0.002	0.261	9647	-0.017
0.263	2556	-0.001	0.263	5028	-0.002	0.264	9647	-0.017
0.266	2556	-0.001	0.266	5004	-0.002	0.266	9611	-0.017
0.268	2556	-0.002	0.268	4980	-0.002	0.268	9587	-0.017
0.271	2556	-0.002	0.271	4968	-0.002	0.271	9575	-0.017
0.273	2544	-0.002	0.273	4956	-0.003	0.273	9551	-0.018
0.276	2532	-0.002	0.276	4944	-0.003	0.276	9551	-0.018
0.278	2532	-0.002	0.278	4932	-0.003	0.278	9539	-0.018
0.280	2532	-0.002	0.280	4920	-0.003	0.280	9515	-0.018
0.283	2532	-0.002	0.283	4908	-0.003	0.283	9515	-0.018
0.285	2532	-0.002	0.285	4884	-0.004	0.285	9503	-0.018
0.288	2520	-0.003	0.288	4956	-0.004	0.288	9479	-0.018
0.290	2520	-0.003	0.290	4908	-0.004	0.290	9467	-0.019
0.292	2520	-0.003	0.292	4872	-0.004	0.292	9431	-0.019
0.295	2520	-0.003	0.295	4884	-0.004	0.295	9431	-0.019
0.297	2520	-0.003	0.297	4872	-0.005	0.297	9419	-0.019
0.300	2520	-0.003	0.300	4860	-0.005	0.300	9371	-0.019
0.300	2520	-0.003	0.300	4860	-0.005	0.300	9371	-0.019

Direct Shear Test for Soils Under Drained Conditions

(ASTM D3080)

Project: URS

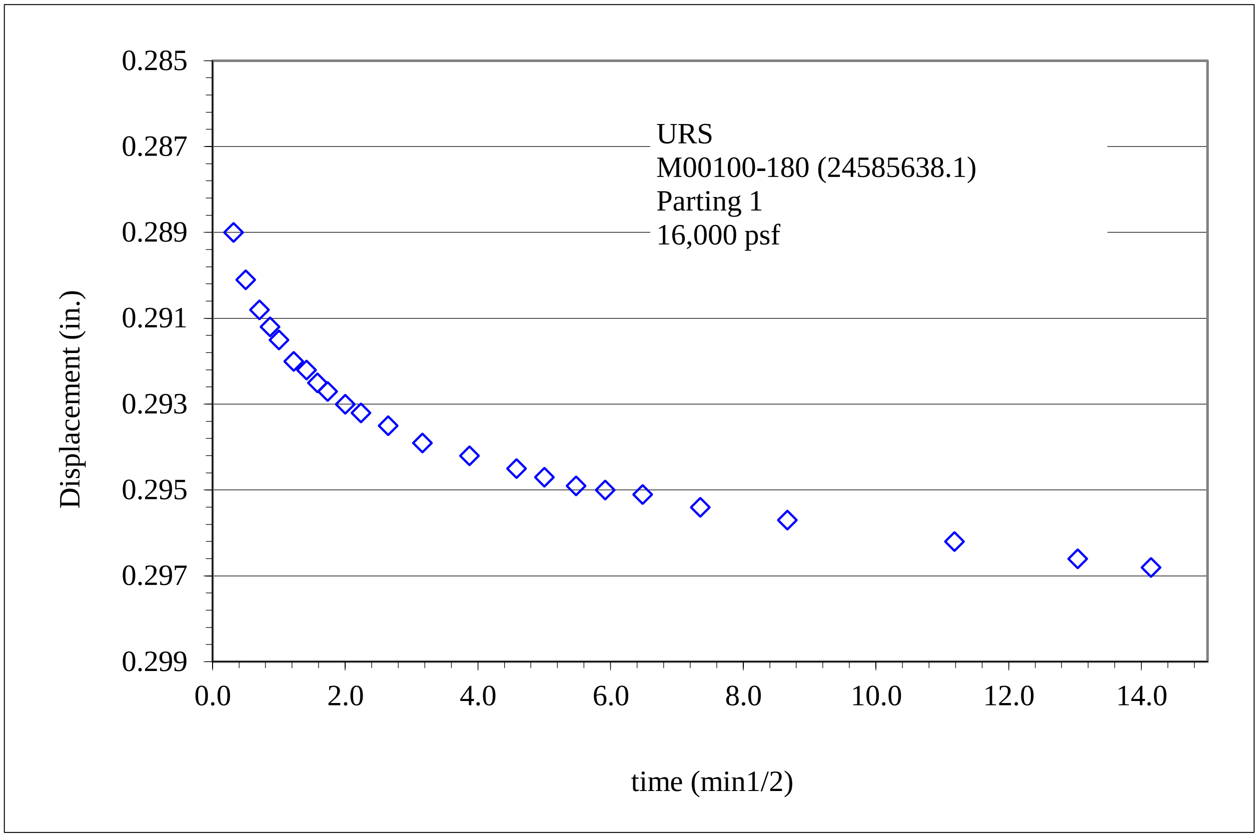
No: M00100-180 (24585638.1)

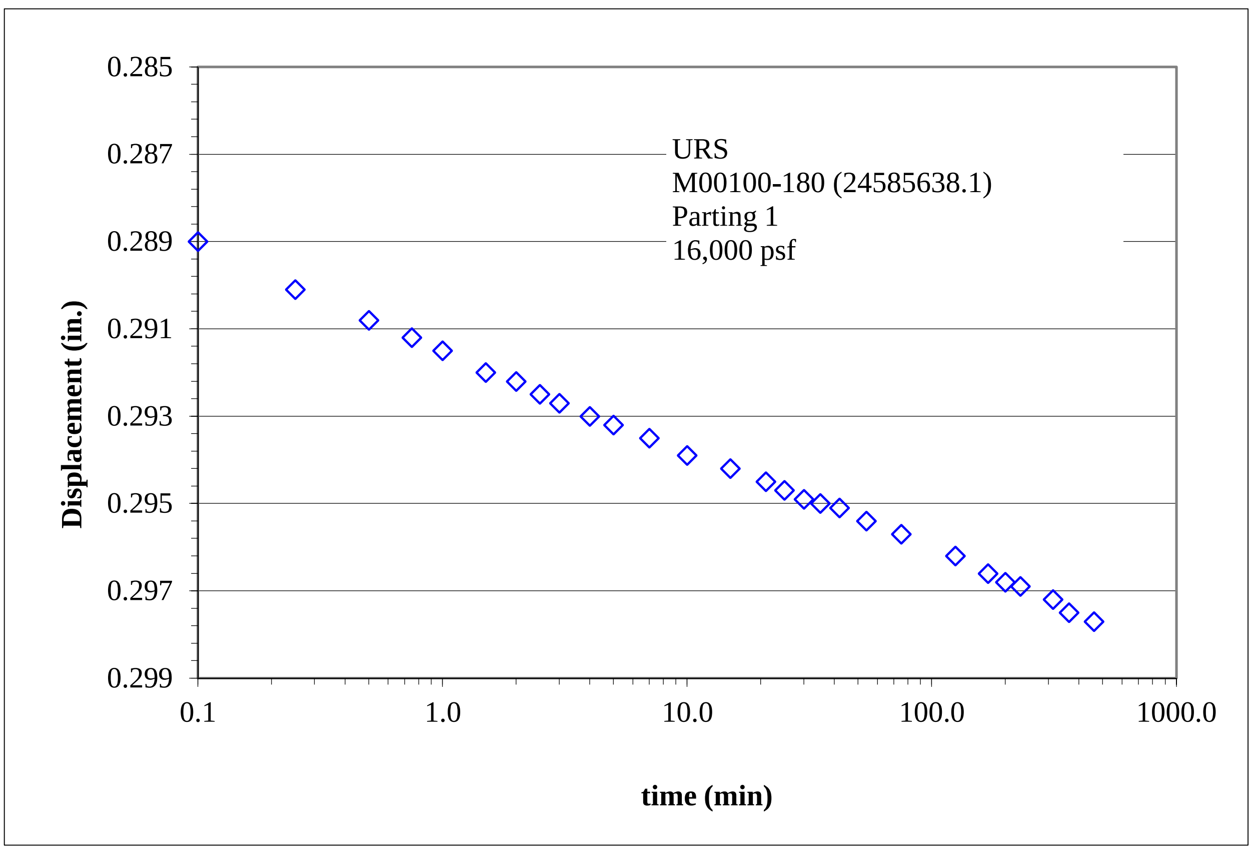
Location: American Sands Energy

Boring No.: Parting

Sample: 1

Depth:





Direct Shear Test for Soils Under Drained Conditions

(ASTM D3080)

Project: URS
No: M00100-180 (24585638.1)
Location: American Sands Energy
Date: 8/25/2014
By: NB

Boring No.: Tailings
Sample: 2
Depth:
Sample Description: Brown sand with silt
Sample type: Laboratory compacted
Dry unit weight 90 pcf
at 3 (%) w
Compaction specifications: Provided by client

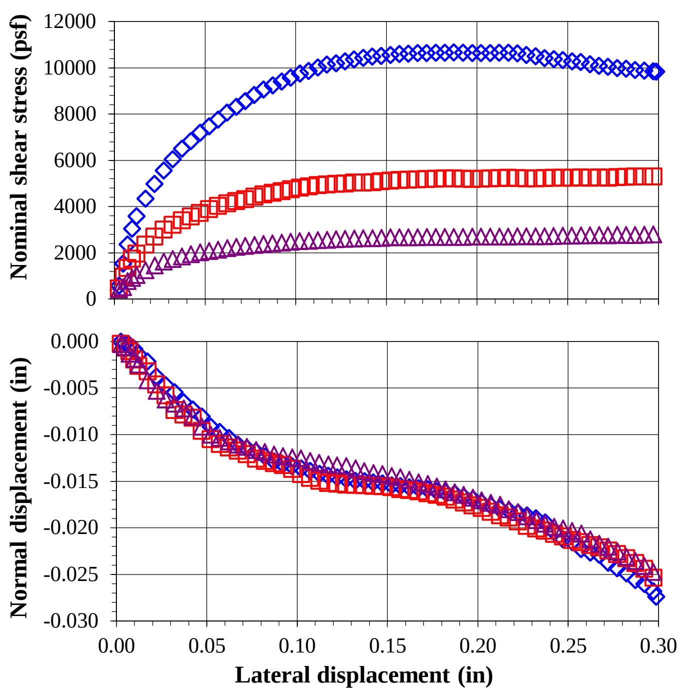
Test type: Inundated
Lateral displacement (in.): 0.3
Shear rate (in./min): 0.0172
Specific gravity, Gs: 2.645 Determined

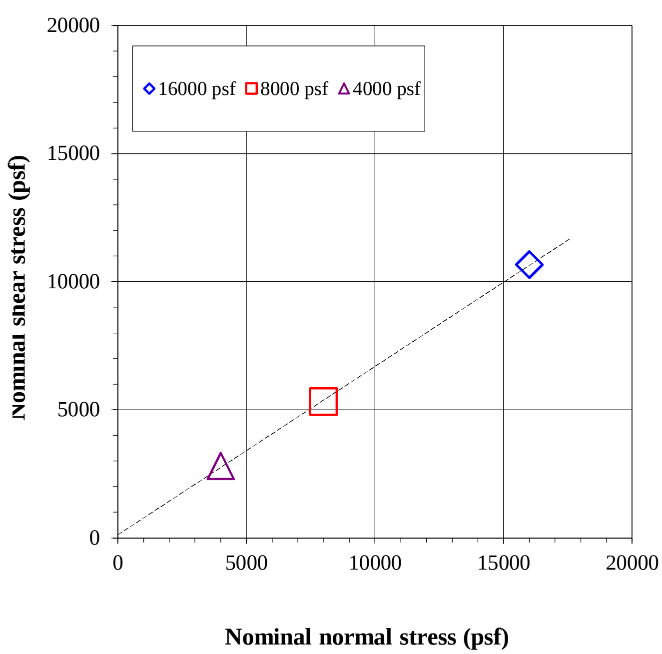
	Sample 1		Sample 2		Sample 3	
Nominal normal stress (psf)	16000		8000		4000	
Peak shear stress (psf)	10670		5315		2807	
Lateral displacement at peak (in)	0.187		0.301		0.300	
Load Duration (min)	3698		3731		3731	
	Initial	Pre-shear	Initial	Pre-shear	Initial	Pre-shear
Sample height (in)	1.0000	0.9319	1.0000	0.9497	1.0000	0.9618
Sample diameter (in)	2.416	2.416	2.416	2.416	2.416	2.416
Wt. rings + wet soil (g)	153.03	178.97	153.93	181.21	154.05	182.24
Wt. rings (g)	41.38	41.38	42.28	42.28	42.40	42.40
Wet soil + tare (g)	440.39		440.39		440.39	
Dry soil + tare (g)	431.91		431.91		431.91	
Tare (g)	122.78		122.78		122.78	
Water content (%)	2.7	26.6	2.7	27.8	2.7	28.7
Dry unit weight (pcf)	90.3	96.9	90.3	95.0	90.3	93.8
Void ratio, e	0.83	0.70	0.83	0.74	0.83	0.76
Saturation (%)*	8.8	100.0	8.8	100.0	8.8	100.0

φ' (deg)	33
c' (psf)	129

Average of 3 samples	Initial	Pre-shear
Water content (%)	2.7	27.7
Dry unit weight (pcf)	90.3	95.3

*Pre-shear saturation set to 100% for phase calculations





Entered by:___________
Reviewed:___________

Direct Shear Test for Soils Under Drained Conditions

(ASTM D3080)

IGES

Project: URS
No: M00100-180 (24585638.1)
Location: American Sands Energy

Boring No.: Tailings
Sample: 2
Depth:

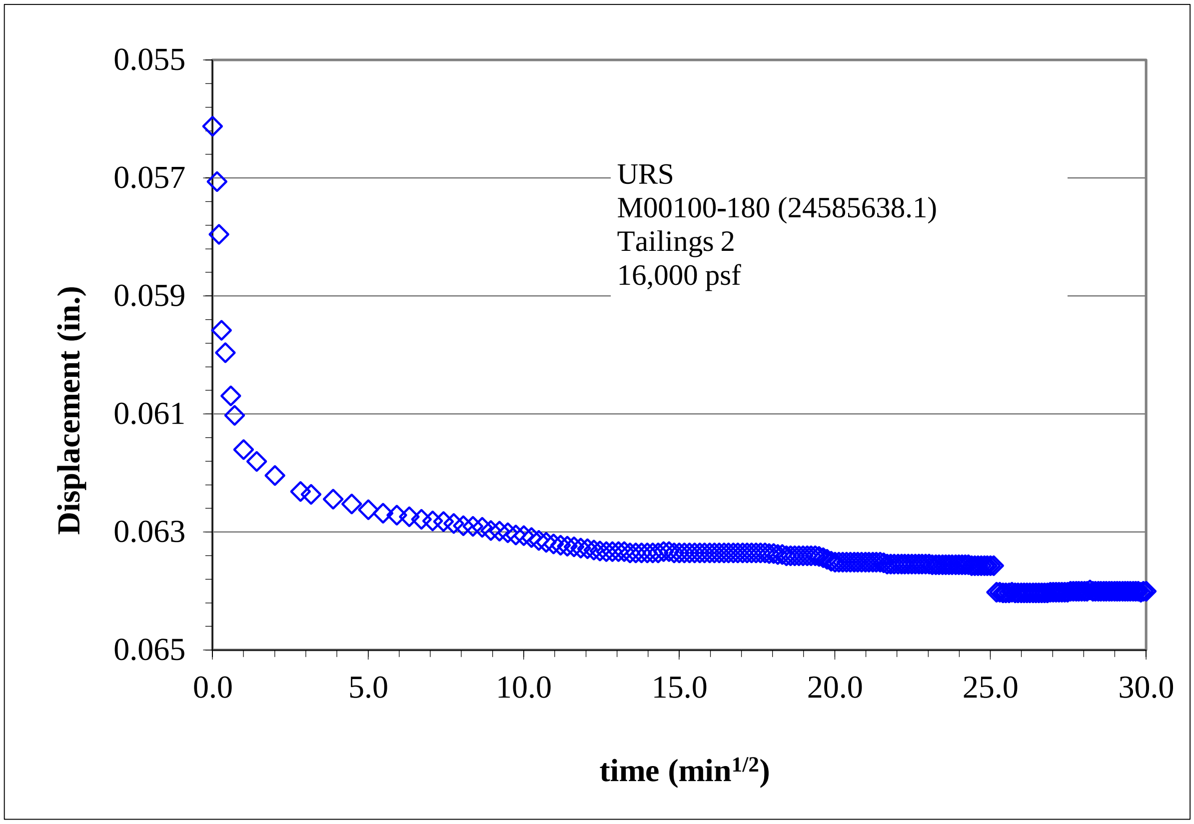
Nominal normal stress = 16000 psf			Nominal normal stress = 8000 psf			Nominal normal stress = 4000 psf		
Lateral Displacement (in.)	Nominal Shear Stress (psf)	Normal Displacement (in.)	Lateral Displacement (in.)	Nominal Shear Stress (psf)	Normal Displacement (in.)	Lateral Displacement (in.)	Nominal Shear Stress (psf)	Normal Displacement (in.)
0.002	579	0.000	0.002	458	0.000	0.002	415	0.000
0.005	1541	0.000	0.005	979	-0.001	0.005	521	-0.001
0.007	2369	0.000	0.007	1339	-0.001	0.007	774	-0.001
0.010	3049	-0.001	0.010	1742	-0.002	0.010	922	-0.002
0.012	3589	-0.001	0.012	1966	-0.003	0.012	1040	-0.002
0.017	4345	-0.002	0.017	2351	-0.003	0.017	1255	-0.004
0.022	4978	-0.004	0.022	2700	-0.005	0.022	1454	-0.005
0.027	5559	-0.005	0.027	3007	-0.006	0.027	1621	-0.006
0.032	6048	-0.005	0.032	3212	-0.007	0.032	1736	-0.007
0.037	6501	-0.006	0.037	3401	-0.008	0.037	1841	-0.007
0.042	6841	-0.007	0.042	3567	-0.008	0.042	1935	-0.008
0.047	7203	-0.008	0.047	3726	-0.010	0.047	2019	-0.009
0.052	7476	-0.009	0.052	3889	-0.010	0.052	2081	-0.010
0.057	7759	-0.010	0.057	4030	-0.011	0.057	2140	-0.010
0.062	8070	-0.010	0.062	4136	-0.011	0.062	2199	-0.011
0.067	8315	-0.011	0.067	4231	-0.012	0.067	2254	-0.011
0.072	8572	-0.011	0.072	4325	-0.012	0.072	2299	-0.011
0.077	8837	-0.012	0.077	4432	-0.013	0.077	2345	-0.012
0.082	9063	-0.012	0.082	4531	-0.013	0.082	2384	-0.012
0.087	9246	-0.013	0.087	4595	-0.013	0.087	2418	-0.012
0.092	9408	-0.013	0.092	4665	-0.013	0.092	2440	-0.012
0.097	9578	-0.013	0.097	4751	-0.014	0.097	2477	-0.012
0.102	9753	-0.014	0.102	4815	-0.014	0.102	2502	-0.013
0.107	9874	-0.014	0.107	4880	-0.015	0.107	2522	-0.013
0.112	10020	-0.014	0.112	4926	-0.015	0.112	2547	-0.013
0.117	10140	-0.014	0.117	4961	-0.015	0.117	2565	-0.013
0.122	10200	-0.015	0.122	4984	-0.015	0.122	2587	-0.013
0.127	10290	-0.015	0.127	4992	-0.015	0.127	2605	-0.013
0.132	10370	-0.015	0.132	5036	-0.015	0.132	2619	-0.014
0.137	10430	-0.015	0.137	5047	-0.015	0.137	2634	-0.014
0.142	10490	-0.015	0.142	5060	-0.015	0.142	2636	-0.014
0.147	10520	-0.015	0.147	5091	-0.016	0.147	2650	-0.014
0.152	10560	-0.015	0.152	5120	-0.016	0.152	2668	-0.014
0.157	10600	-0.016	0.157	5144	-0.016	0.157	2668	-0.015
0.162	10620	-0.016	0.162	5162	-0.016	0.162	2679	-0.015
0.167	10640	-0.016	0.167	5176	-0.016	0.167	2681	-0.015
0.172	10650	-0.016	0.172	5194	-0.016	0.172	2684	-0.015
0.177	10660	-0.016	0.177	5211	-0.016	0.177	2687	-0.016
0.182	10660	-0.016	0.182	5219	-0.017	0.182	2688	-0.016
0.187	10670	-0.016	0.187	5215	-0.017	0.187	2688	-0.016
0.192	10660	-0.017	0.192	5208	-0.017	0.192	2693	-0.016
0.197	10640	-0.017	0.197	5196	-0.018	0.197	2699	-0.017
0.202	10640	-0.017	0.202	5204	-0.018	0.202	2704	-0.017
0.207	10650	-0.018	0.207	5221	-0.018	0.207	2704	-0.017
0.212	10660	-0.018	0.212	5230	-0.019	0.212	2703	-0.018
0.217	10660	-0.018	0.217	5241	-0.019	0.217	2706	-0.018
0.222	10630	-0.018	0.222	5238	-0.019	0.222	2713	-0.018
0.227	10560	-0.019	0.227	5224	-0.020	0.227	2715	-0.019
0.232	10500	-0.019	0.232	5219	-0.020	0.232	2718	-0.019
0.237	10420	-0.019	0.237	5231	-0.020	0.237	2719	-0.020
0.242	10380	-0.020	0.242	5241	-0.021	0.242	2736	-0.020
0.247	10340	-0.021	0.247	5247	-0.021	0.247	2740	-0.020
0.252	10290	-0.022	0.252	5245	-0.021	0.252	2748	-0.020
0.257	10250	-0.022	0.257	5260	-0.022	0.257	2751	-0.021
0.262	10160	-0.023	0.262	5245	-0.022	0.262	2756	-0.021
0.267	10090	-0.023	0.267	5256	-0.022	0.267	2766	-0.022
0.272	10050	-0.024	0.272	5250	-0.022	0.272	2764	-0.022
0.277	9992	-0.024	0.277	5270	-0.023	0.277	2780	-0.023
0.282	9959	-0.025	0.282	5286	-0.023	0.282	2771	-0.023
0.287	9907	-0.026	0.287	5297	-0.024	0.287	2766	-0.024
0.292	9881	-0.026	0.292	5300	-0.024	0.292	2782	-0.024
0.297	9853	-0.027	0.297	5306	-0.025	0.297	2801	-0.025
0.299	9843	-0.027	0.301	5315	-0.026	0.300	2807	-0.025

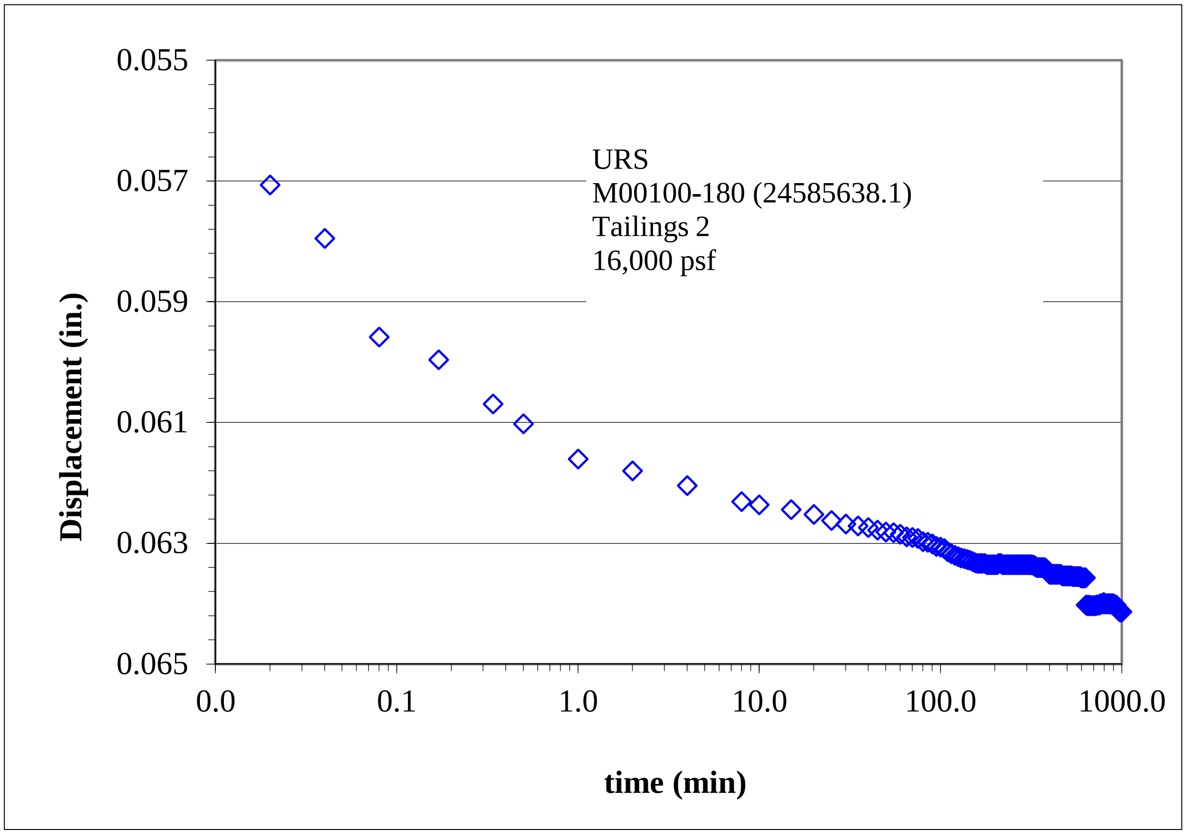
Direct Shear Test for Soils Under Drained Conditions

(ASTM D3080)

Project: URS
No: M00100-180 (24585638.1)
Location: American Sands Energy

Boring No.: Tailings
Sample: 2
Depth:





Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter, Method C (ASTM D5084)

IGES

Project: URS
No: M00100-180 (24585638.1)
Location: American Sands Energy
Date: 8/26/2014
By: JDF

Boring No.: Parting
Sample: 1
Depth:
Sample Description: Light grey clayey sand
Sample Type: Remolded
Compaction Specifications: 110 pcf
at 16 (%) w

	Initial (o)	Final (f)
Sample Height, H (in)	3.128	3.101
Sample Diameter, D (in)	2.863	2.80
Sample Length, L (cm)	7.945	7.877
Sample Area, A (cm^2)	41.534	39.649
Sample Volume, V (cm^3)	329.99	312.32
Wt. Rings + Wet Soil (g)	674.13	673.69
Wt. Rings (g)	0	0
Wet Unit Wt., γ_m (pcf)	127.5	134.7
Wet Soil + Tare (g)	509.87	991.29
Dry Soil + Tare (g)	461.38	895.94
Tare (g)	168.11	316.57
Weight of solids, Ws (g)	578.48	578.48
Water Content, w (%)	16.53	16.46
Dry Unit Wt, γ_d (pcf)	109.4	115.6
Void ratio, e	0.51	0.44
Saturation (%)	85.4	100 [a]
Average K[b] (cm/sec)	**2.3E-07**	

[a] Saturation set to 100% for phase calculations
[b] K corrected to 20°C

Gs	2.654	Determined
Cell No.	4	
Station No.	2	
Permeant liquid used	De-aired tap water	
Total backpressure (psi)	20	
Effective horiz. consolidation stress (psi)	55.6	
Effective vert. consolidation stress (psi)	55.6	

	Initial (o)	Final (f)
B value	0.54	0.96
External Burette (cm^3)	12.80	42.20
Cell Pressure (psi)	0.0	75.6

Backpressure bottom (psi)	21.0
Backpressure top (psi)	20.0
System volume coefficient (cm^3/psi)	0.155
System volume change (cm^3)	11.73
Net sample volume change (cm^3)	-17.67
Bottom burette ground length, l_b (cm)	81.99
Top burette ground length, l_t (cm)	81.97
Burette area, a (cm^2)	0.197
Conversion, reading to cm head (cm/rd)	5.076

Start Date and Time: 8/25/14 9:01

Elapsed time (sec)	Bottom Burette (cm^3)	Top Burette (cm^3)	h_1 (cm)	h_2 (cm)	K (cm/sec)	Temp (°C)	Visc. Ratio R_f	K[b] (cm/sec)
1440.0	0.10 0.30	9.94 9.74	120.28	118.25	2.3E-07	22.8	0.93	2.2E-07
2580.0	0.30 0.68	9.74 9.36	118.25	114.39	2.5E-07	22.9	0.93	2.3E-07
2220.0	0.68 0.99	9.36 9.02	114.39	111.09	2.6E-07	22.8	0.93	2.4E-07
3240.0	0.99 1.42	9.02 8.58	111.09	106.67	2.5E-07	24.0	0.91	2.2E-07
6060.0	1.42 2.20	8.58 7.76	106.67	98.55	2.6E-07	25.0	0.89	2.3E-07
4800.0	2.20 2.80	7.76 7.15	98.55	92.41	2.6E-07	24.3	0.90	2.4E-07

Entered by:____________
Reviewed:____________

Inberg-Miller Engineers
350 Parsley Blvd
Cheyenne WY 82001
Ph: 307-635-6827
Fax: 307-635-2713
cheyenne@inberg-miller.com

Aggregate-Soil Testing Summary

Client: Mine Engineers, Inc.
Address: 3901 South Industrial Rd.
Cheyenne, WY 82007
Attention: Eldon Strid
IME Project No: 16484-HM
Project Name: General Testing
Project Location:
Sample Location/ID: American Sands Energy - Utah

IME Sample No: **16484-2**
Sampled By: Client
Sample Date:
Date Received in Lab: 12/19/2013
Type of Material:
Source: American Sands Energy - Utah
Sample Description: Light brown fine SAND
Report Date: 1/15/14
Reviewed By: MTJ

Particle Size Analysis
ASTM C117 & C136

Sieve	% Passing	Specification
2 1/2" (63.5mm)		
2" (50.8mm)		
1 1/2" (37.5mm)		
1" (25mm)		
3/4" (19mm)		
1/2" (12.5mm)		
3/8" (9.5mm)		
No. 4 (4.75mm)	100%	
No. 8 (2.36mm)	100%	
No. 16 (1.18mm)	99%	
No. 30 (600μm)	98%	
No. 40 (425μm)		
No. 50 (300μm)	87%	
No. 100 (150μm)	21%	
No. 200 (75μm)	9.6%	
0.020 mm (20μm)		

Atterberg Limits
ASTM D4318

Test	Result	Specification
Liquid Limit (%)		
Plastic Limit (%)		
Plasticity Index (%)		

Remarks:

Mine Engineers, Inc.

Other Testing

Test	Result	Specifications /Notes	ASTM
Fineness Modulus:	0.95		C136
Moisture Content (%):	0.1%	(from sieve sample)	D2216
Relative Density (pcf)			D4254
Minimum Density	89.3		
Maximum Density	94.7		
Angle of Repose			
Moisture Content (%)			
0%	26.5°		
4%	33.8°		
6%	37.7°		
Specific Gravity	**Fine /**	**Coarse**	
Absorption %			C128/C127
Bulk (Dry)			C128/C127
Bulk (SSD)			C128/C127
Apparent			C128/C127

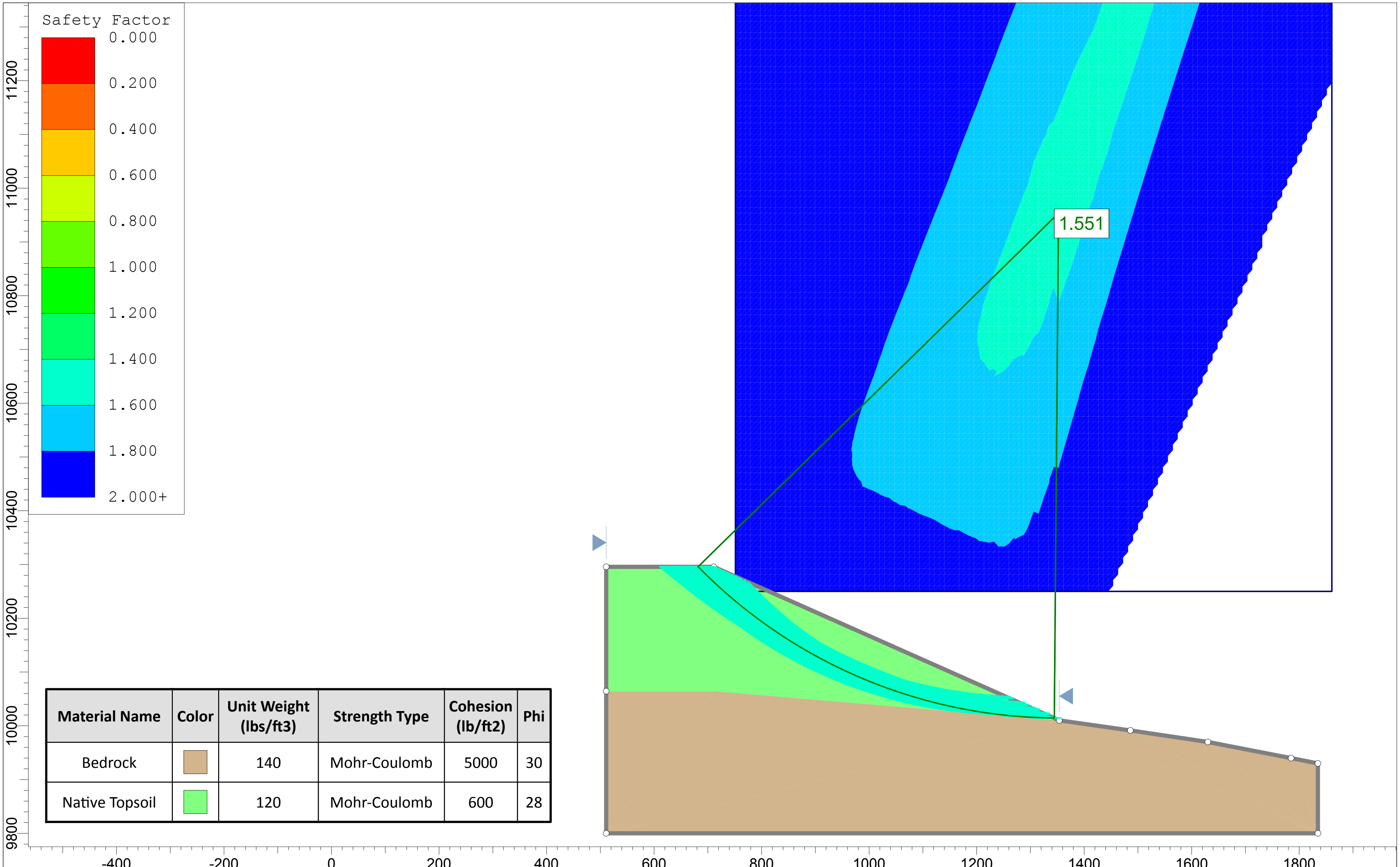
APPENDIX C
HYDROLOGY RESULTS

10YR

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Basin 1	0.0045312	2.4	01Jan2014, 13:00	0.2
Basin 2-5	0.0040680	2.7	01Jan2014, 13:00	0.2
Basin 6	0.0190000	12.1	01Jan2014, 13:00	1.0
Basin 7	0.0190000	12.1	01Jan2014, 13:00	1.0
Basin 8	0.1870000	47.1	01Jan2014, 13:45	10.2

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Basin 1	0.0045312	5.0	01Jan2014, 13:00	0.4
Basin 2-5	0.0040680	5.1	01Jan2014, 13:00	0.4
Basin 6	0.0190000	22.6	01Jan2014, 13:00	1.9
Basin 7	0.0190000	22.6	01Jan2014, 13:00	1.9
Basin 8	0.1870000	89.0	01Jan2014, 13:45	18.7

APPENDIX D
SLOPE STABILITY RESULTS



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi
Bedrock		140	Mohr-Coulomb	5000	30
Native Topsoil		120	Mohr-Coulomb	600	28

Description/Notes:

Stability analysis was performed using Slide v. 6.005 by Rocscience, Inc., of Toronto, Canada, and Spencer's Method of Slices.

By: BWF 9/2/2014 **Checked:** ECL 9/2/2014

Client: American Sands Energy Corp

Title: General Topsoil Slope 2.25H:1V

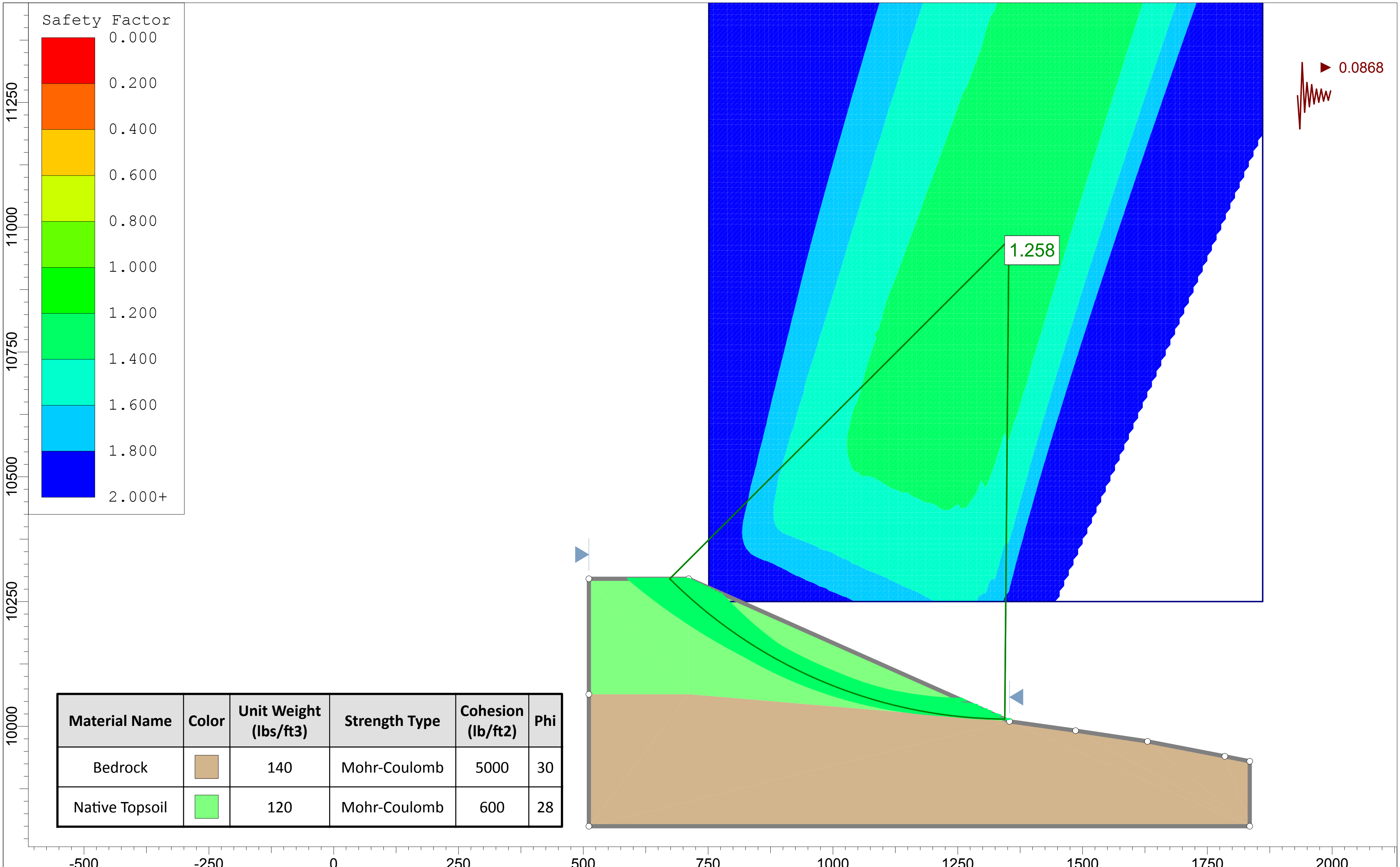
Project: American Sands Bruin Point

Date: January 2015 **Project No.:** 24585638

Figure: D1

URS Carbon County, Utah

Q:\Projects\American Sands Energy\24585638\05_Analysis and Engineering\Geotech\Stability Analysis\Top Soil\Top Soil A-A-Prime (2.25 to 1.0) [Larger Slope].slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi
Bedrock		140	Mohr-Coulomb	5000	30
Native Topsoil		120	Mohr-Coulomb	600	28

Description/Notes:

Stability analysis was performed using Slide v. 6.005 by Rocscience, Inc., of Toronto, Canada, and Spencer's Method of Slices.

By: BWF 9/2/2014 **Checked:** ECL 9/2/2014

Client: American Sands Energy Corp

Title: General Topsoil Slope [Seismic]

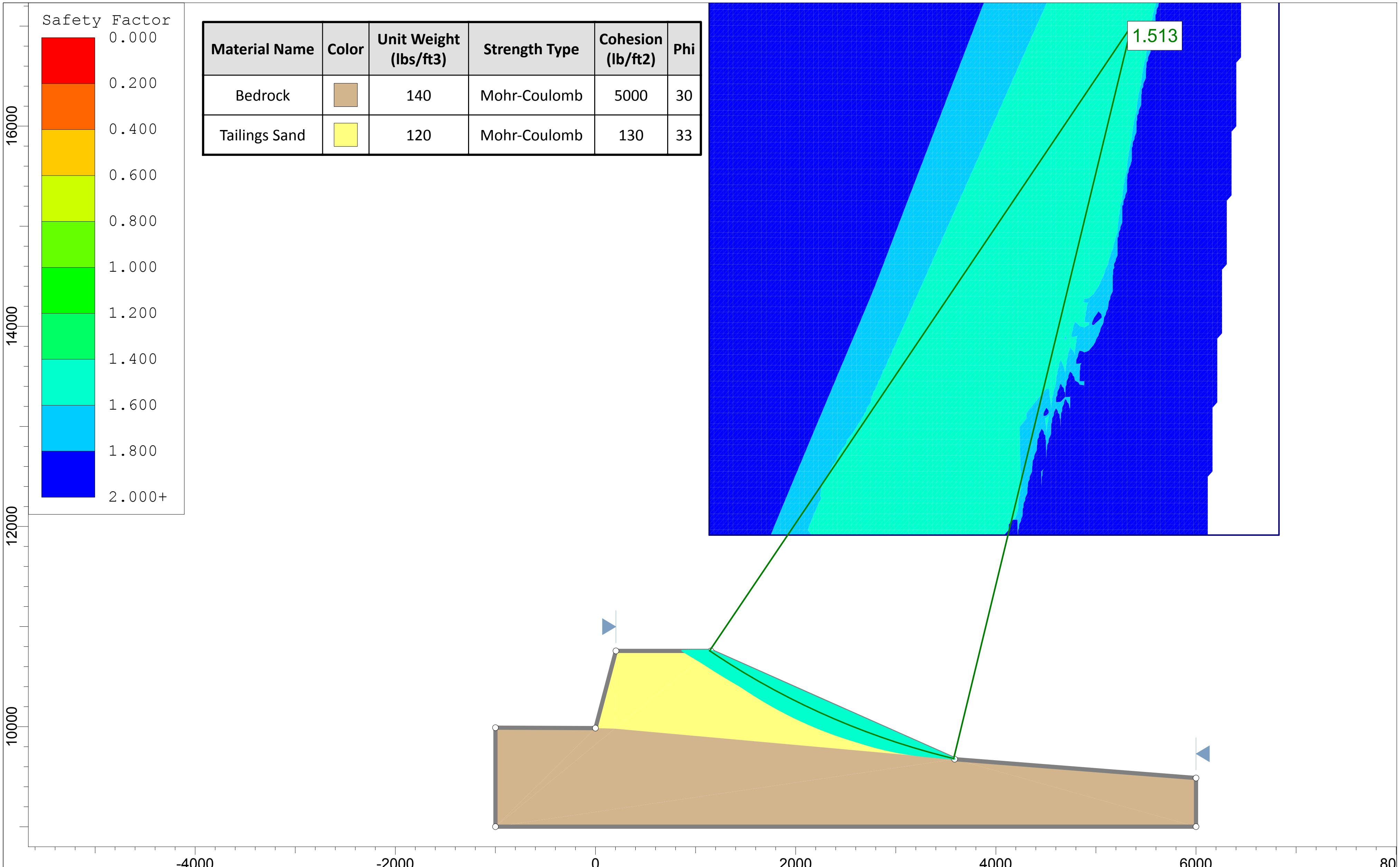
Project: American Sands Bruin Point

Date: January 2015 **Project No.:** 24585638

Figure: D2

URS Carbon County, Utah

Q:\Projects\American Sands Energy\24585638\05_Analysis and Engineering\Geotech\Stability Analysis\Top Soil\Top Soil A-A-Prime (2.25 to 1.0) [Larger Slope]_Seismic.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi
Bedrock		140	Mohr-Coulomb	5000	30
Tailings Sand		120	Mohr-Coulomb	130	33

Description/Notes:

Stability analysis was performed using Slide v. 6.005 by Rocscience, Inc., of Toronto, Canada, and Spencer's Method of Slices.

Client: American Sands Energy Corp

Title: General Tailings Slope 2.25H:1V

Project: American Sands Bruin Point

Date: January 2015

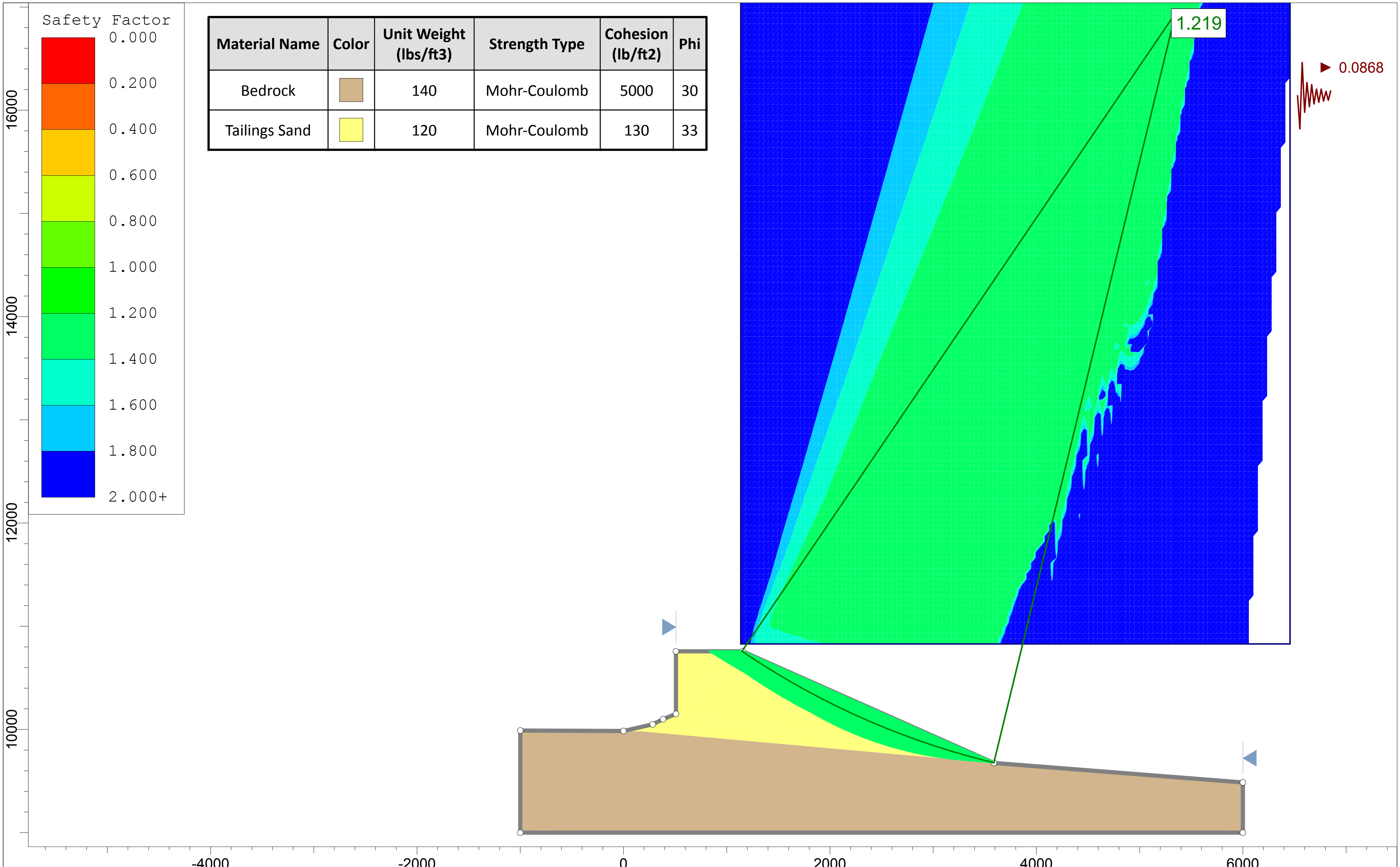
Project No.: 24585638

Figure: D3

URS — Carbon County, Utah

By: BWF 9/2/2014 **Checked:** ECL 9/2/2014

Q:\Projects\American Sands Energy\24585638\05_Analysis and Engineering\Geotech\Stability Analysis\Tailings (c = 100) psf\Tailings Slope PHI=33deg, c=130 psf (2.25 to 1.0).slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi
Bedrock		140	Mohr-Coulomb	5000	30
Tailings Sand		120	Mohr-Coulomb	130	33

Description/Notes:

Stability analysis was performed using Slide v. 6.005 by Rocscience, Inc., of Toronto, Canada, and Spencer's Method of Slices.

Client: American Sands Energy Corp

Title: General Tailings Slope [Seismic]

Project: American Sands Bruin Point

Date: January 2015

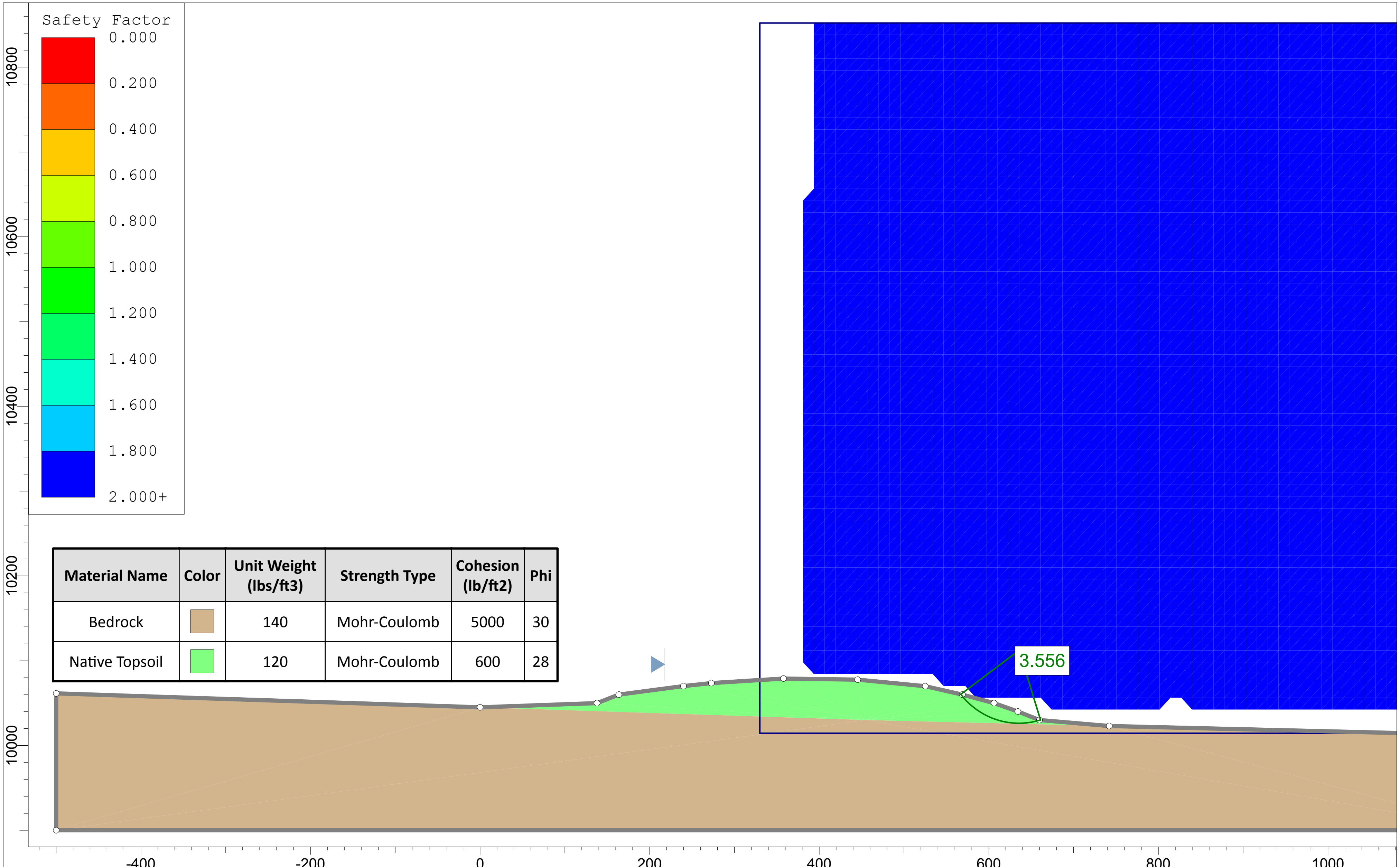
Project No.: 24585638

Figure: D4

URS — Carbon County, Utah

By: BWF 9/2/2014 **Checked:** ECL 9/2/2014

Q:\Projects\American Sands Energy\24585638\05_Analysis and Engineering\Geotech\Stability Analysis\Tailings (c = 100) psf\Tailings Slope PHI=33deg, c=130 psf (2.25 to 1.0)_Seismic.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi
Bedrock		140	Mohr-Coulomb	5000	30
Native Topsoil		120	Mohr-Coulomb	600	28

Description/Notes:

Stability analysis was performed using Slide v. 6.005 by Rocscience, Inc., of Toronto, Canada, and Spencer's Method of Slices.

By: BWF 9/2/2014 **Checked:** ECL 9/2/2014

Client: American Sands Energy Corp

Title: Topsoil Stockpile No. 1 (B-B)

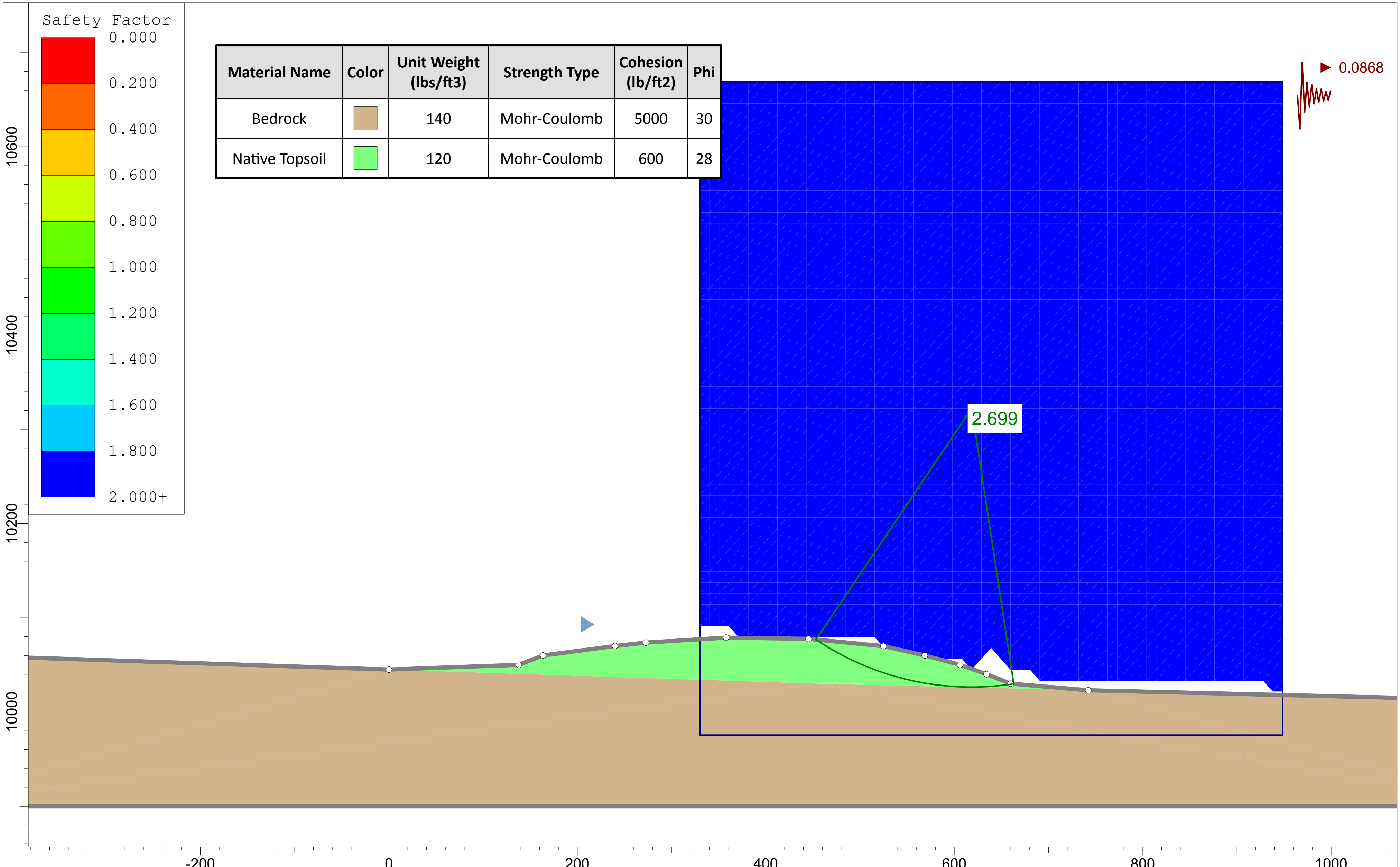
Project: American Sands Bruin Point

Date: January 2015 **Project No.:** 24585638

Figure: D5

URS Carbon County, Utah

Q:\Projects\American Sands Energy\24585638\05_Analysis and Engineering\Geotech\Stability Analysis\Proposed Geometry\Top Soil B-B (Right).slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi
Bedrock		140	Mohr-Coulomb	5000	30
Native Topsoil		120	Mohr-Coulomb	600	28

Description/Notes:

Stability analysis was performed using Slide v. 6.005 by Rocscience, Inc., of Toronto, Canada, and Spencer's Method of Slices.

By: BWF 9/2/2014 | Checked: ECL 9/2/2014

Client: American Sands Energy Corp

Title: Topsoil Stockpile No. 1 (B-B) [Seismic]

Project: American Sands Bruin Point

Date: January 2015

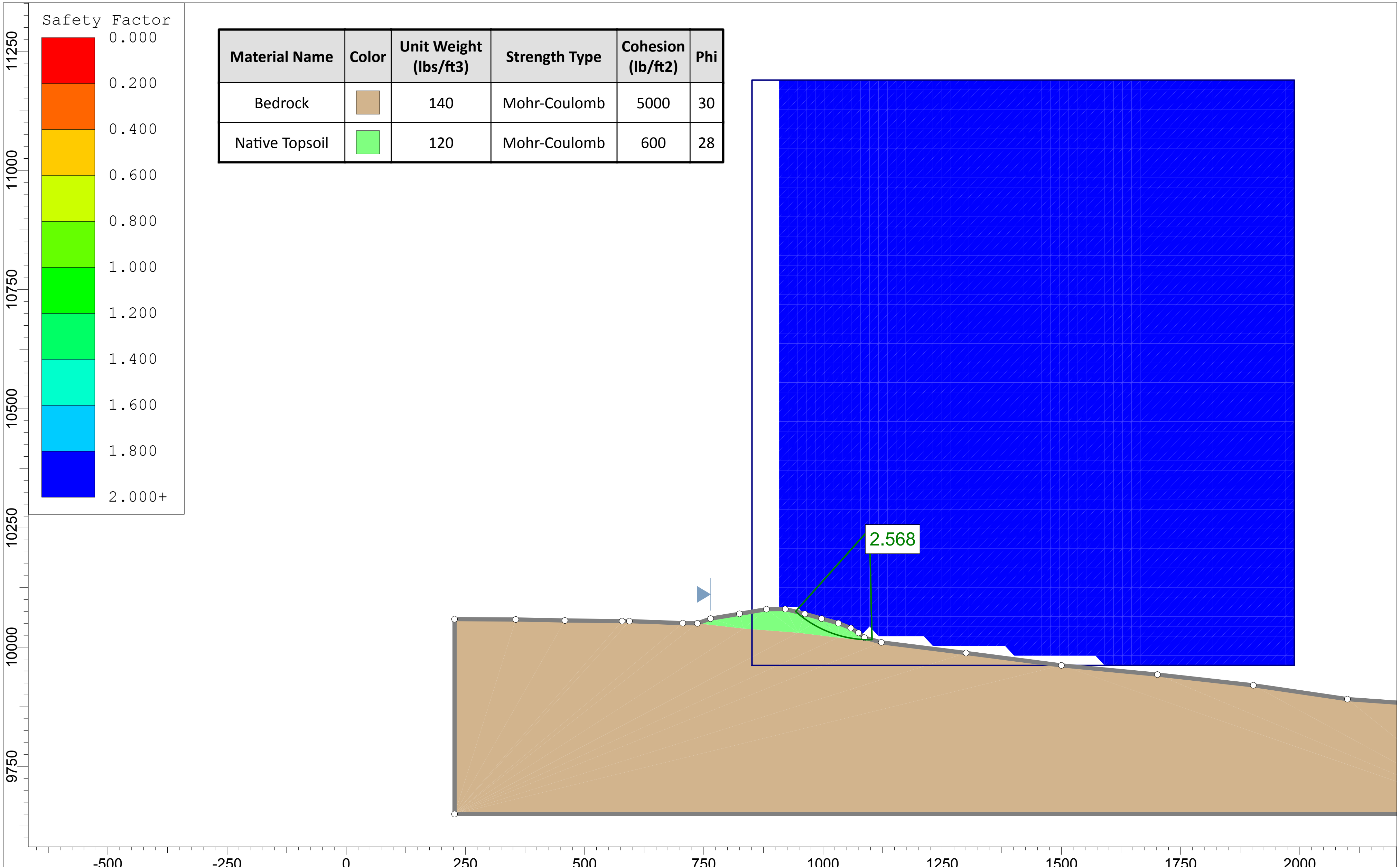
Project No.: 24585638

Figure: D6

URS

Carbon County, Utah

Q:\Projects\American Sands Energy\24585638\05_Analysis and Engineering\Geotech\Stability Analysis\Seismic\Top Soil B-B (Right).slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi
Bedrock		140	Mohr-Coulomb	5000	30
Native Topsoil		120	Mohr-Coulomb	600	28

Description/Notes:

Stability analysis was performed using Slide v. 6.005 by Rocscience, Inc., of Toronto, Canada, and Spencer's Method of Slices.

Client: American Sands Energy Corp

Title: Topsoil Stockpile No. 1 (B-B')

Project: American Sands Bruin Point

Date: January 2015

Project No.: 24585638

Figure: D7

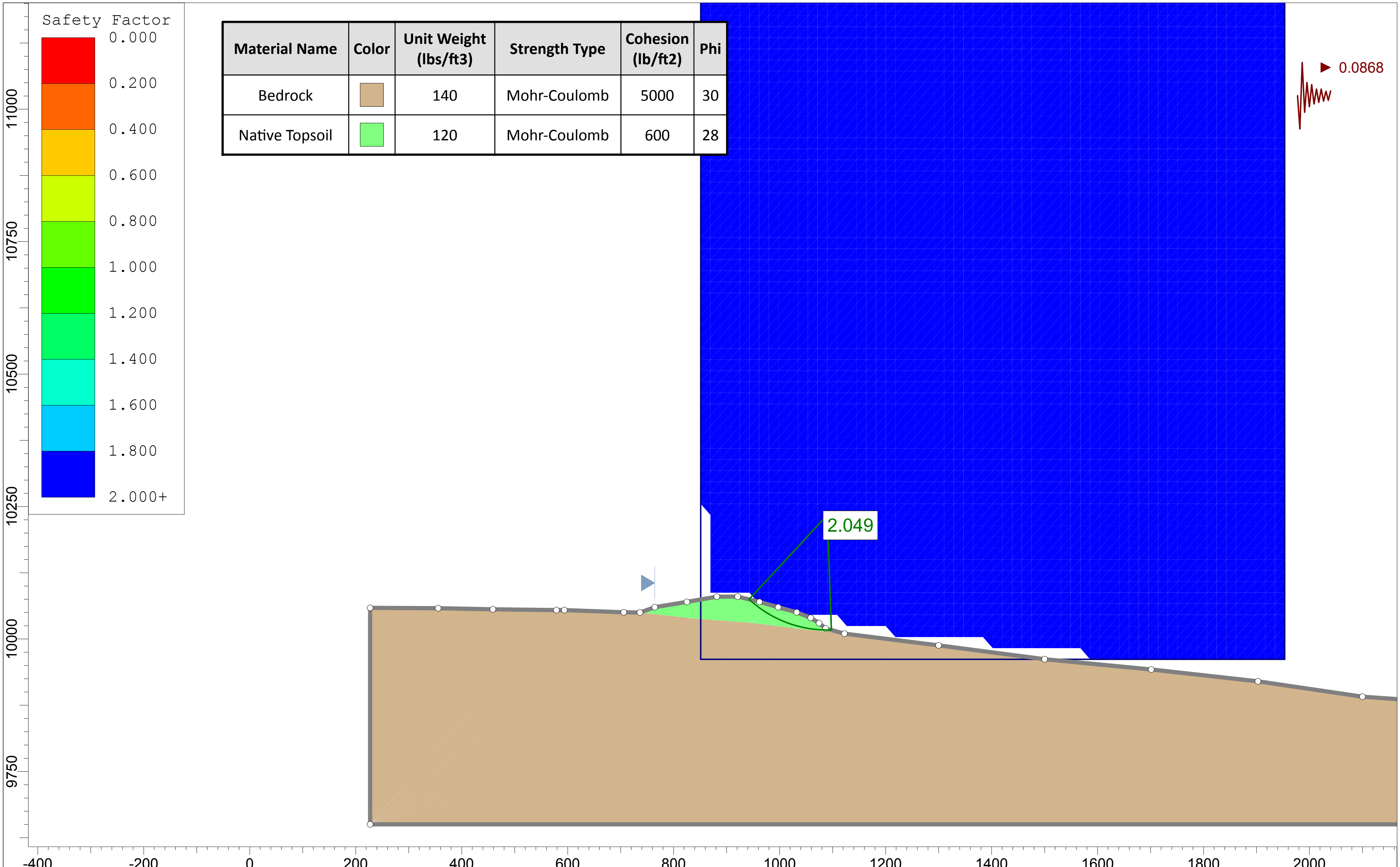
URS

Carbon County, Utah

By: BWF 9/2/2014

Checked: ECL 9/2/2014

Q:\Projects\American Sands Energy\24585638\05_Analysis and Engineering\Geotech\Stability Analysis\Proposed Geometry\Top Soil B-B-Prime.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi
Bedrock		140	Mohr-Coulomb	5000	30
Native Topsoil		120	Mohr-Coulomb	600	28

Description/Notes:

Stability analysis was performed using Slide v. 6.005 by Rocscience, Inc., of Toronto, Canada, and Spencer's Method of Slices.

Client: American Sands Energy Corp

Title: Topsoil Stockpile No. 1 (B-B') [Seismic]

Project: American Sands Bruin Point

Date: January 2015

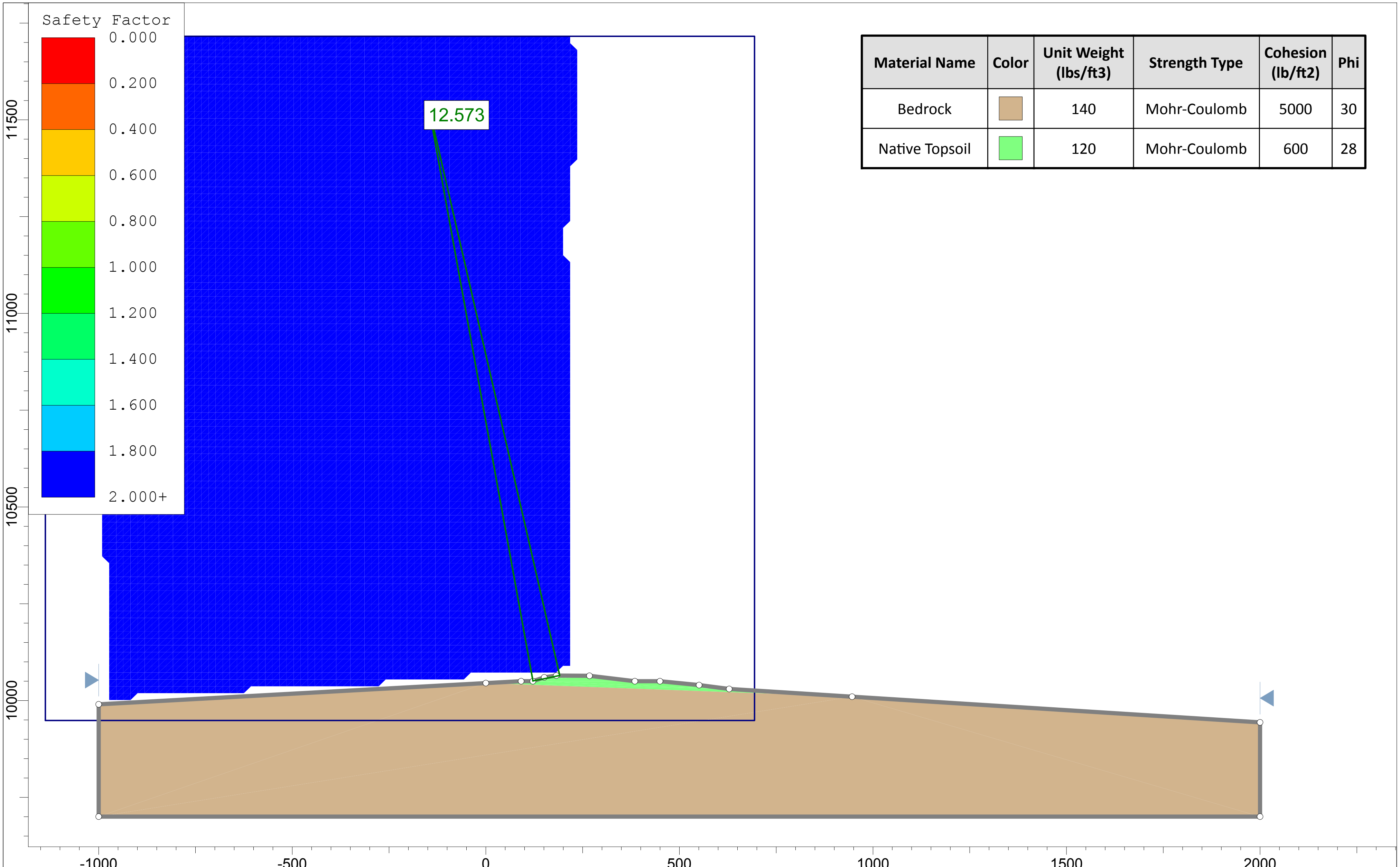
Project No.: 24585638

Figure: D8

URS — Carbon County, Utah

By: BWF 9/2/2014 **Checked:** ECL 9/2/2014

Q:\Projects\American Sands Energy\24585638\05_Analysis and Engineering\Geotech\Stability Analysis\Seismic\Top Soil B-B-Prime.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi
Bedrock		140	Mohr-Coulomb	5000	30
Native Topsoil		120	Mohr-Coulomb	600	28

Description/Notes:

Stability analysis was performed using Slide v. 6.005 by Rocscience, Inc., of Toronto, Canada, and Spencer's Method of Slices.

By: BWF 9/2/2014 **Checked:** ECL 9/2/2014

Client: American Sands Energy Corp

Title: Topsoil Stockpile No. 2 (A-A)

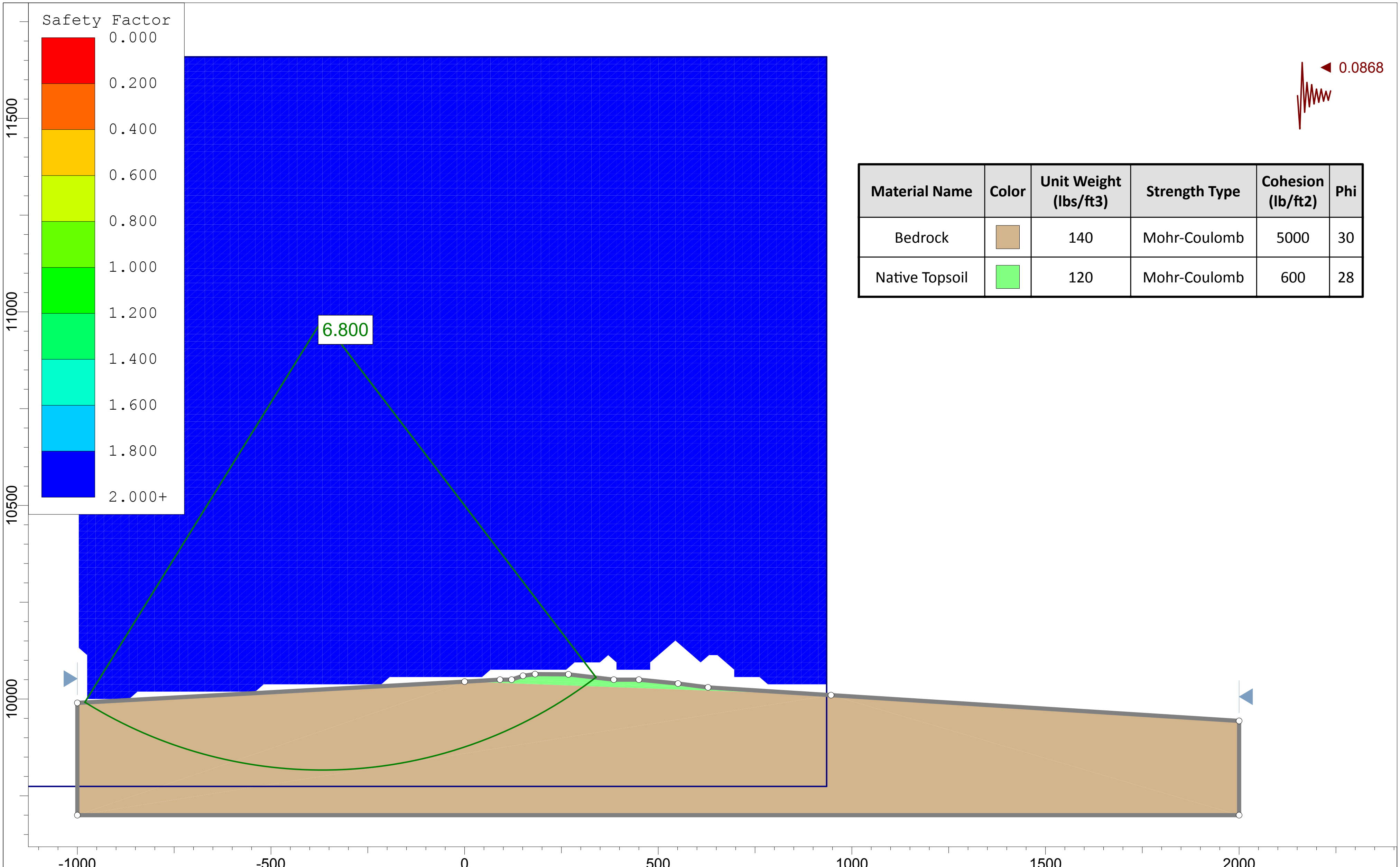
Project: American Sands Bruin Point

Date: January 2015 **Project No.:** 24585638

Figure: D9

URS Carbon County, Utah

Q:\Projects\American Sands Energy\24585638\05_Analysis and Engineering\Geotech\Stability Analysis\Proposed Geometry\Top Soil A-A.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi
Bedrock		140	Mohr-Coulomb	5000	30
Native Topsoil		120	Mohr-Coulomb	600	28

Description/Notes:

Stability analysis was performed using Slide v. 6.005 by Rocscience, Inc., of Toronto, Canada, and Spencer's Method of Slices.

Client: American Sands Energy Corp

Title: Topsoil Stockpile No. 2 (A-A) [Seismic]

Project: American Sands Bruin Point

Date: January 2015

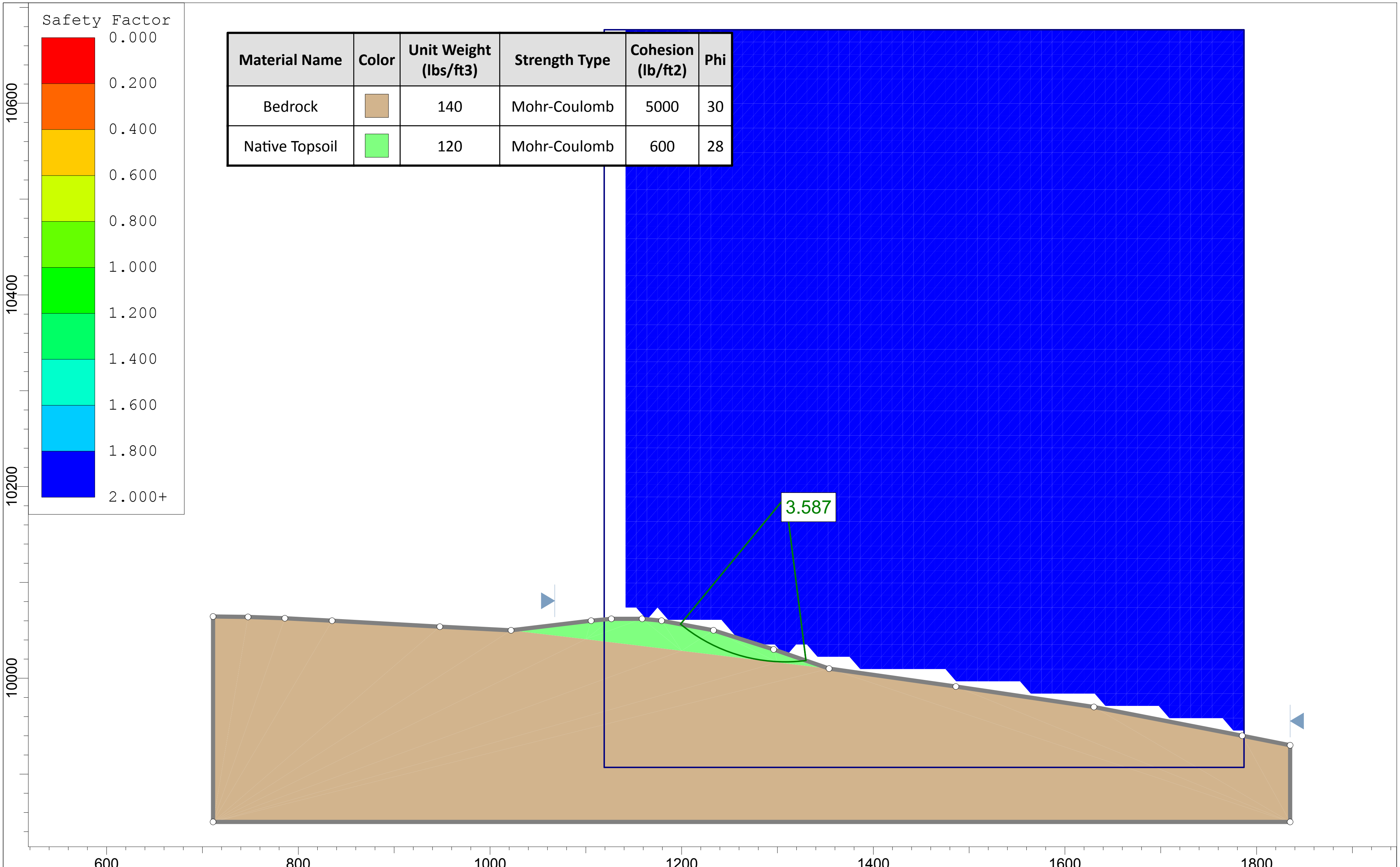
Project No.: 24585638

Figure: D10

URS Carbon County, Utah

By: BWF 9/2/2014 **Checked:** ECL 9/2/2014

Q:\Projects\American Sands Energy\24585638\05_Analysis and Engineering\Geotech\Stability Analysis\Seismic\Top Soil A-A.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi
Bedrock		140	Mohr-Coulomb	5000	30
Native Topsoil		120	Mohr-Coulomb	600	28

Description/Notes:

Stability analysis was performed using Slide v. 6.005 by Rocscience, Inc., of Toronto, Canada, and Spencer's Method of Slices.

Client: American Sands Energy Corp

Title: Topsoil Stockpile No. 2 Section A-A'

Project: American Sands Bruin Point

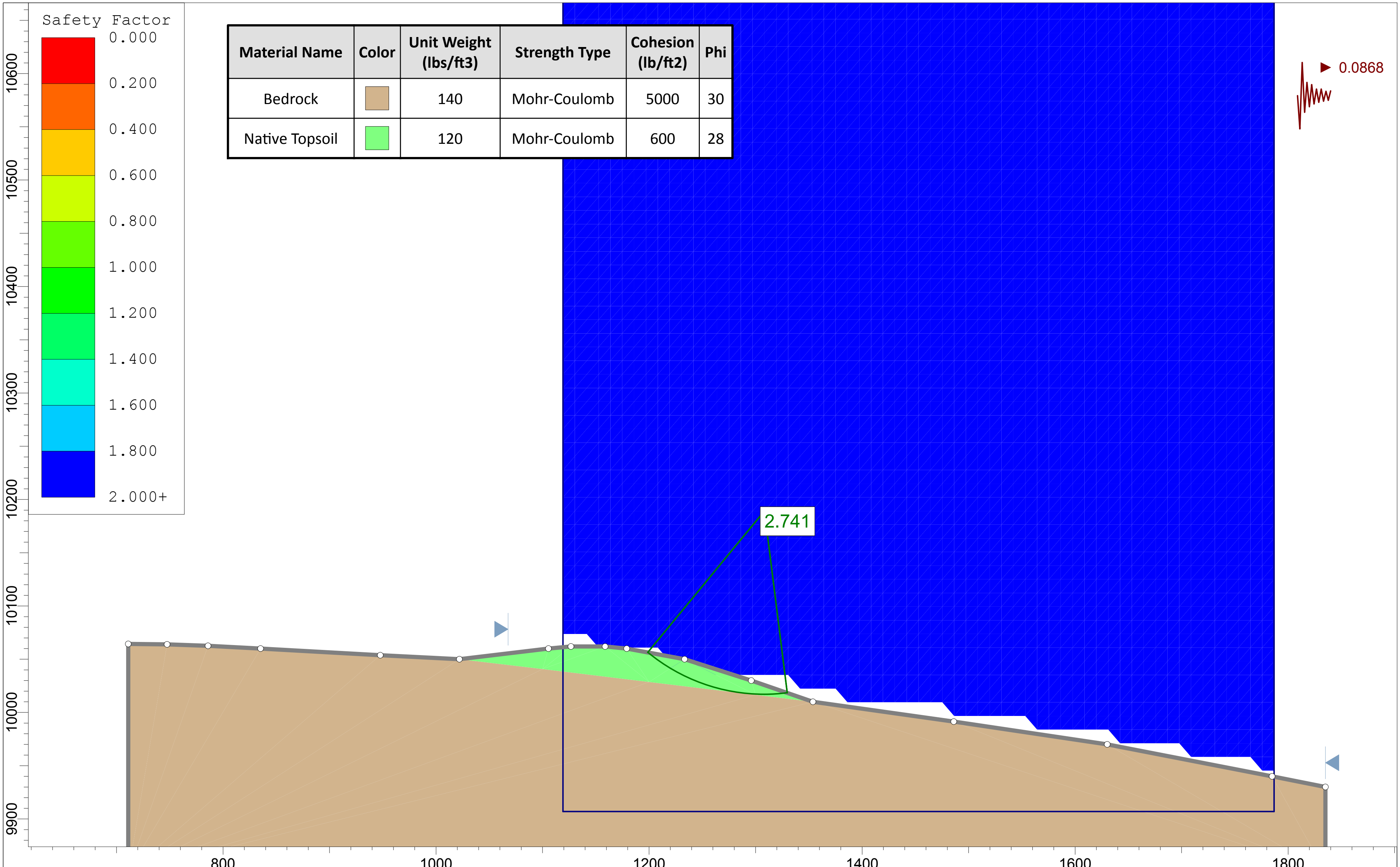
Date: January 2015 **Project No.:** 24585638

Figure: D11

URS Carbon County, Utah

By: BWF 9/2/2014 **Checked:** ECL 9/2/2014

Q:\Projects\American Sands Energy\24585638\05_Analysis and Engineering\Geotech\Stability Analysis\Proposed Geometry\Top Soil A-A-Prime.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi
Bedrock		140	Mohr-Coulomb	5000	30
Native Topsoil		120	Mohr-Coulomb	600	28

Description/Notes:

Stability analysis was performed using Slide v. 6.005 by Rocscience, Inc., of Toronto, Canada, and Spencer's Method of Slices.

By: BWF 9/2/2014 **Checked:** ECL 9/2/2014

Client: American Sands Energy Corp

Title: Topsoil Stockpile No. 2 (A-A') [Seismic]

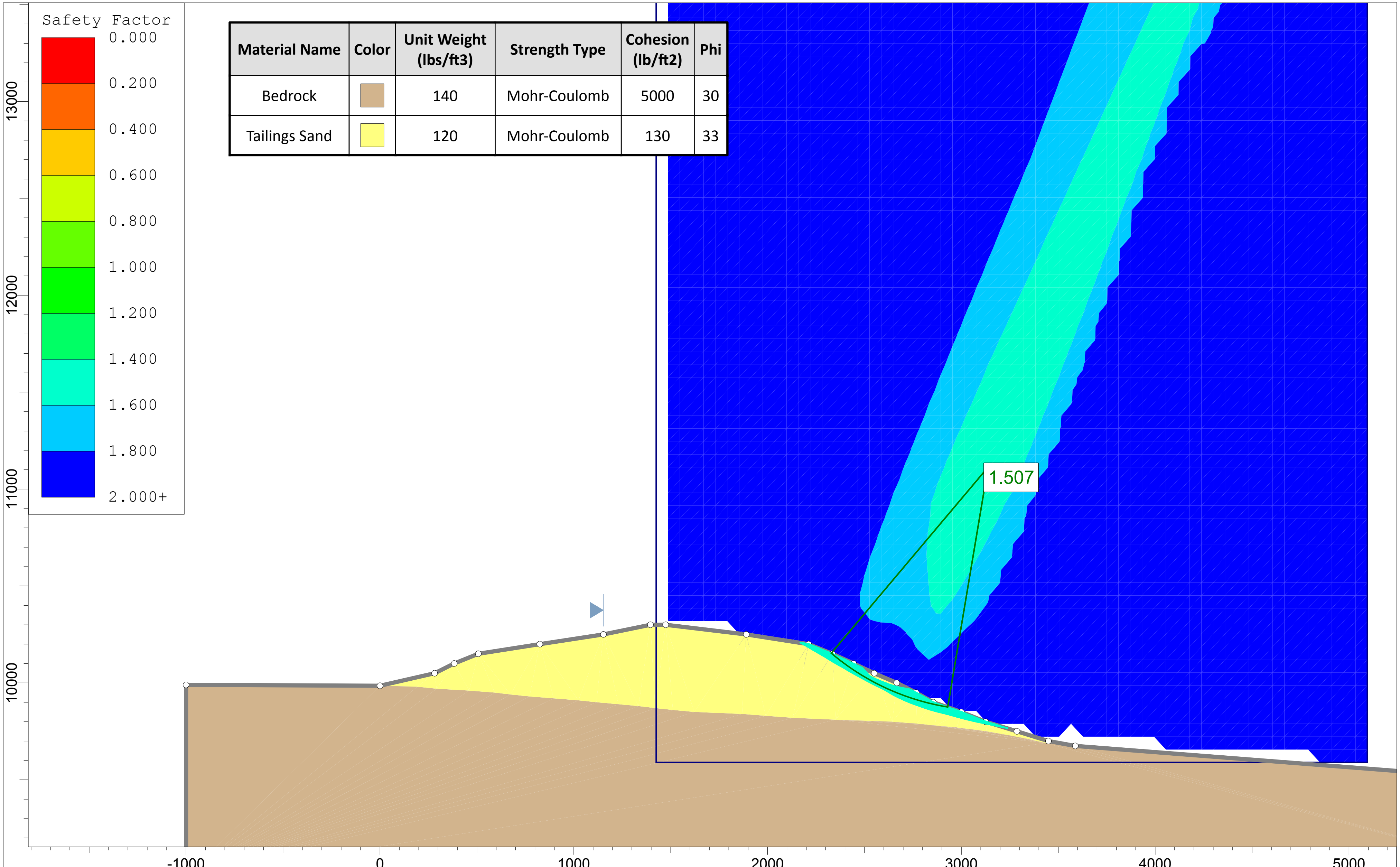
Project: American Sands Bruin Point

Date: January 2015 **Project No.:** 24585638

Figure: D12

URS Carbon County, Utah

Q:\Projects\American Sands Energy\24585638\05_Analysis and Engineering\Geotech\Stability Analysis\Seismic\Top Soil A-A-Prime.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi
Bedrock		140	Mohr-Coulomb	5000	30
Tailings Sand		120	Mohr-Coulomb	130	33

Description/Notes:

Stability analysis was performed using Slide v. 6.005 by Rocscience, Inc., of Toronto, Canada, and Spencer's Method of Slices.

By: BWF 9/2/2014 **Checked:** ECL 9/2/2014

Client: American Sands Energy Corp

Title: Tailings Stockpile (A-A)

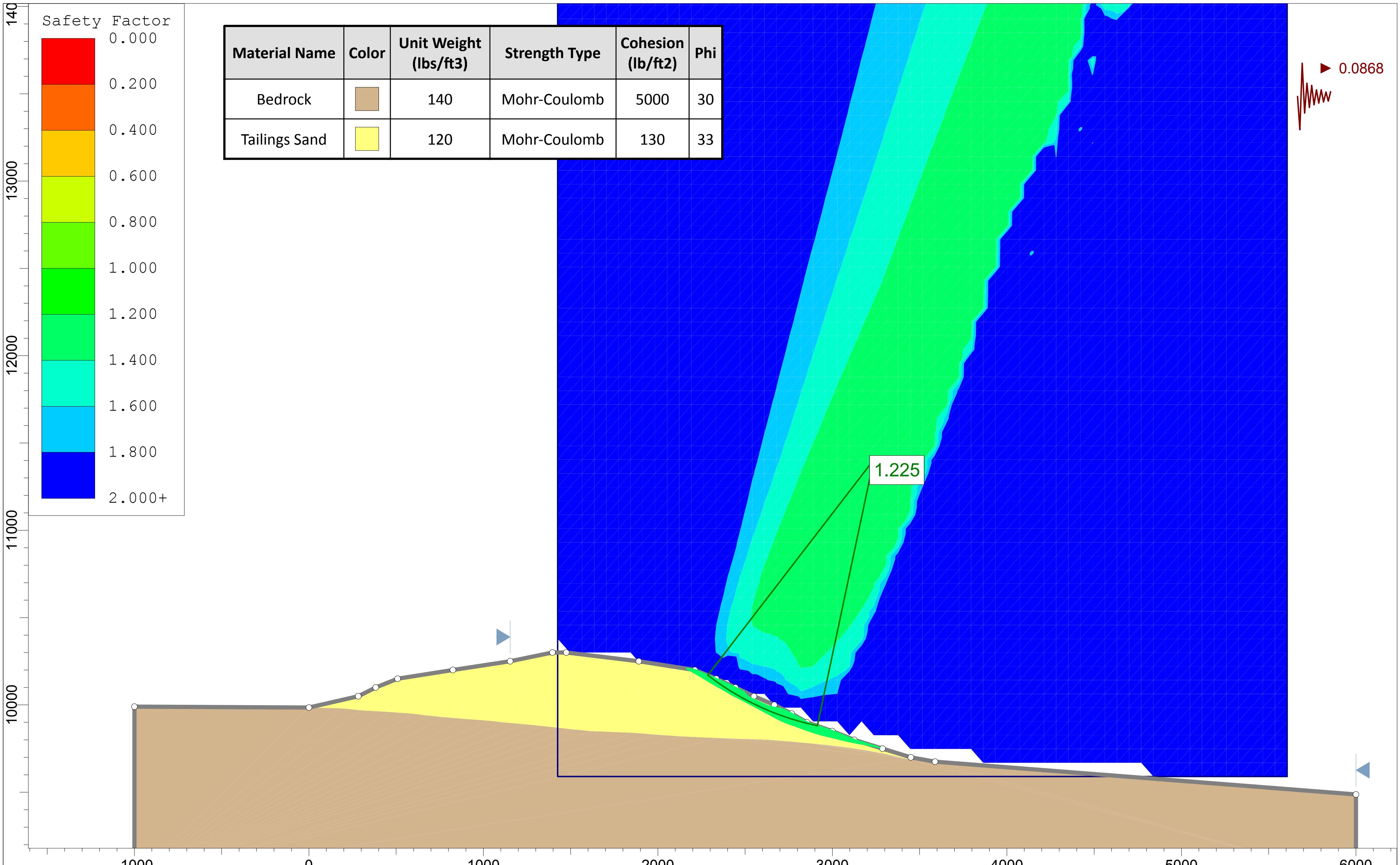
Project: American Sands Bruin Point

Date: January 2015 **Project No.:** 24585638

Figure: D13

URS Carbon County, Utah

Q:\Projects\American Sands Energy\24585638\05_Analysis and Engineering\Geotech\Stability Analysis\Proposed Geometry\Tailings A-A (Right).slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi
Bedrock		140	Mohr-Coulomb	5000	30
Tailings Sand		120	Mohr-Coulomb	130	33

Description/Notes:

Stability analysis was performed using Slide v. 6.005 by Rocscience, Inc., of Toronto, Canada, and Spencer's Method of Slices.

By: BWF 9/2/2014 **Checked:** ECL 9/2/2014

Client: American Sands Energy Corp

Title: Tailings Stockpile (A-A) [Seismic]

Project: American Sands Bruin Point

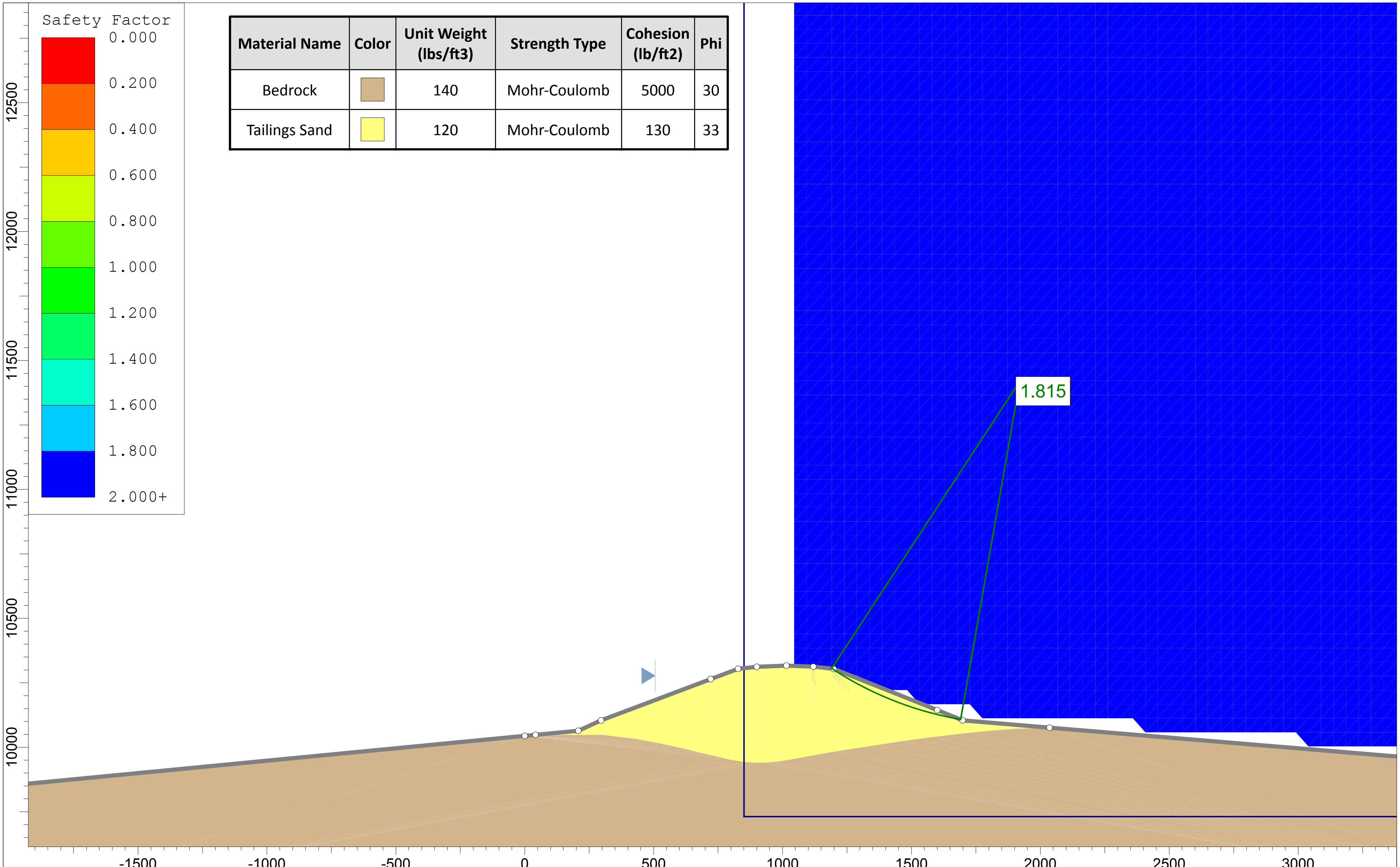
Date: January 2015 **Project No.:** 24585638

Figure: D14

URS Carbon County, Utah

Q:\Projects\American Sands Energy\24585638\05_Analysis and Engineering\Geotech\Stability Analysis\Seismic\Tailings A-A (Right).slim

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi
Bedrock		140	Mohr-Coulomb	5000	30
Tailings Sand		120	Mohr-Coulomb	130	33



Description/Notes:

Stability analysis was performed using Slide v. 6.005 by Rocscience, Inc., of Toronto, Canada, and Spencer's Method of Slices.

By: BWF 9/2/2014 **Checked:** ECL 9/2/2014

Client: American Sands Energy Corp

Title: Tailings Stockpile (B-B)

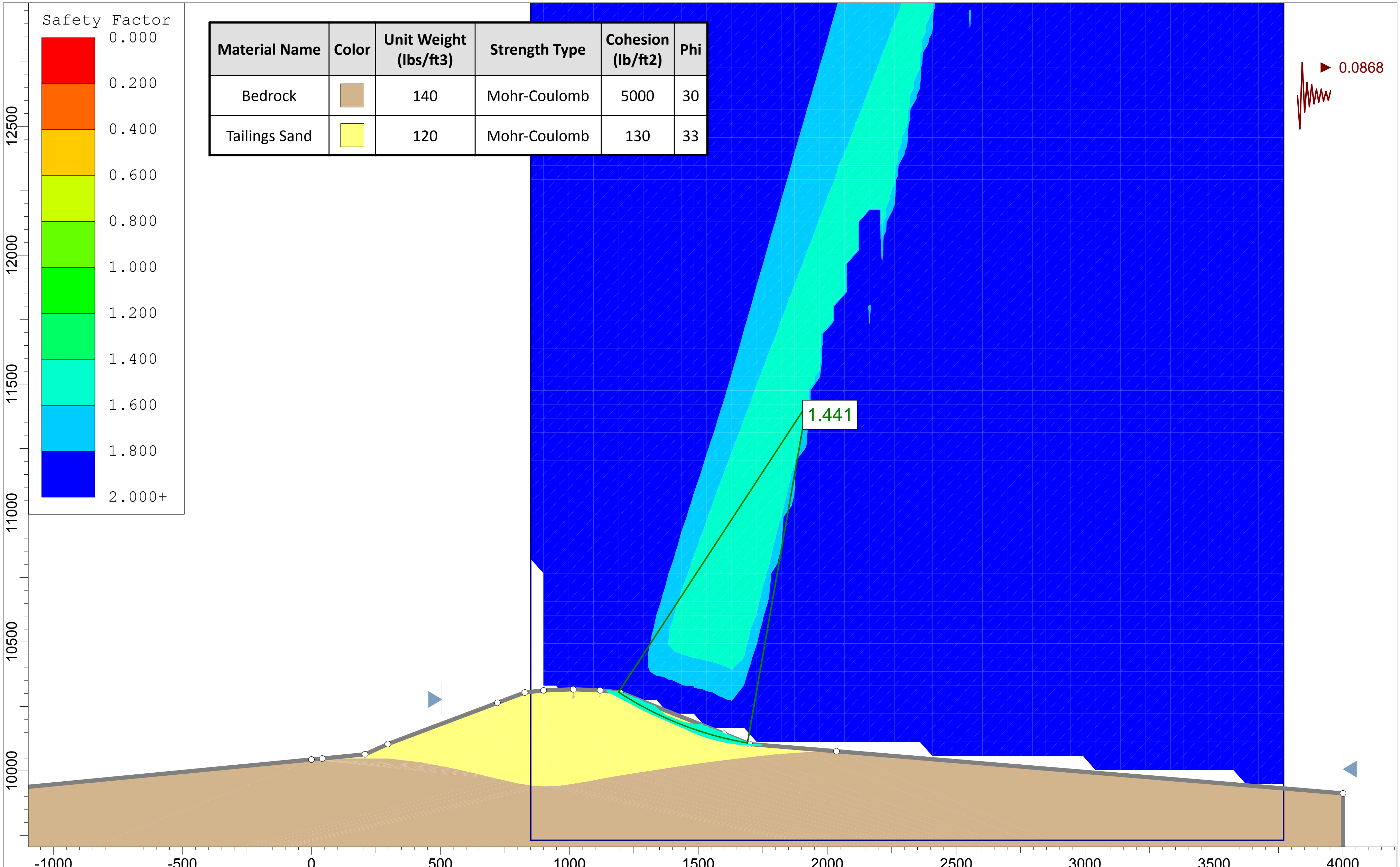
Project: American Sands Bruin Point

Date: January 2015 **Project No.:** 24585638

Figure: D15

URS Carbon County, Utah

Q:\Projects\American Sands Energy\24585638\05_Analysis and Engineering\Geotech\Stability Analysis\Proposed Geometry\Tailings B-B (Right).slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi
Bedrock		140	Mohr-Coulomb	5000	30
Tailings Sand		120	Mohr-Coulomb	130	33

Description/Notes:

Stability analysis was performed using Slide v. 6.005 by Rocscience, Inc., of Toronto, Canada, and Spencer's Method of Slices.

Client: American Sands Energy Corp

Title: Tailings Stockpile (B-B) [Seismic]

Project: American Sands Bruin Point

Date: January 2015

Project No.: 24585638

Figure: D16

URS Carbon County, Utah

By: BWF 9/2/2014 **Checked:** ECL 9/2/2014

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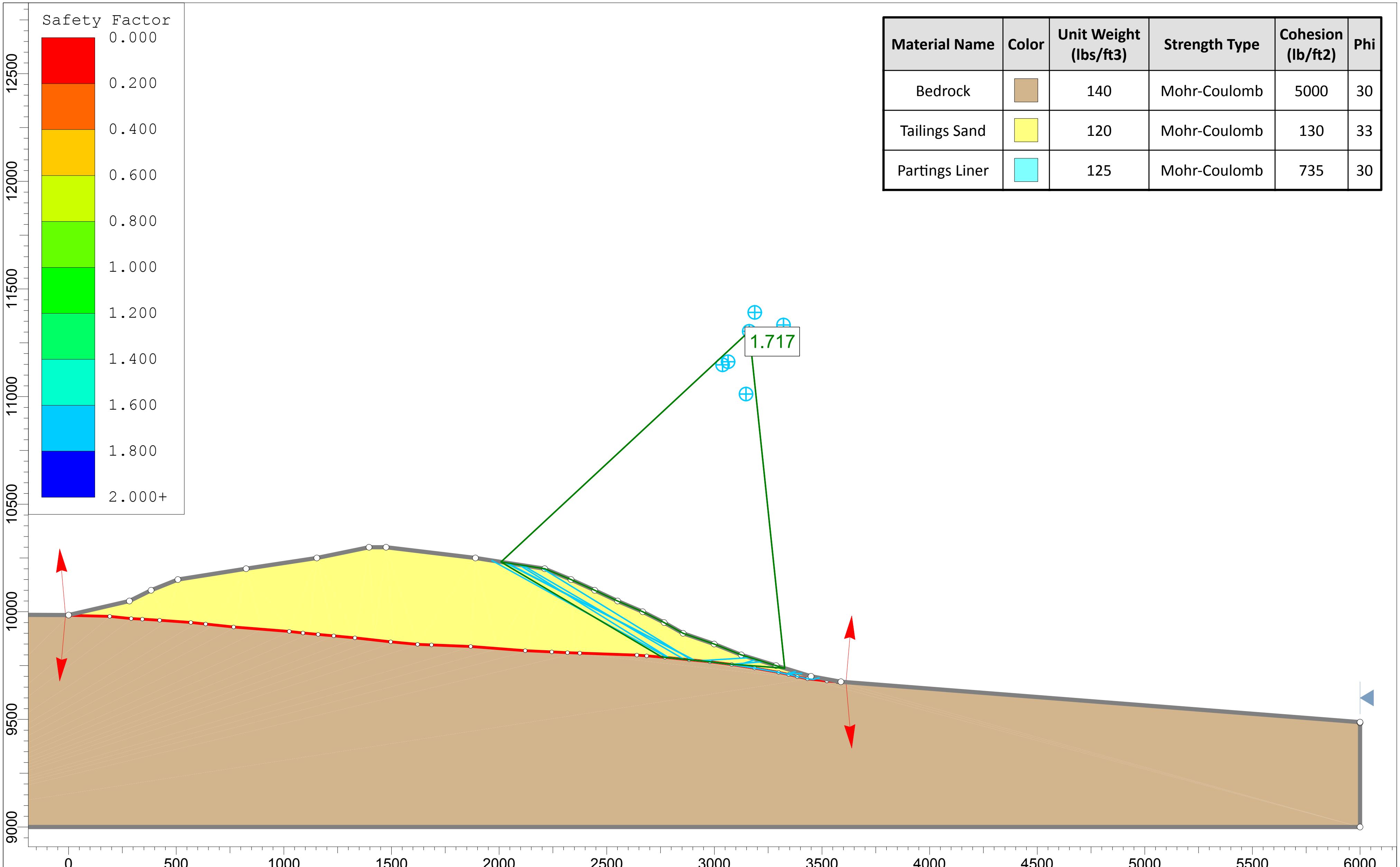


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi
Bedrock		140	Mohr-Coulomb	5000	30
Tailings Sand		120	Mohr-Coulomb	130	33
Partings Liner		125	Mohr-Coulomb	735	30

Description/Notes:

Stability analysis was performed using Slide v. 6.005 by Rocscience, Inc., of Toronto, Canada, and Spencer's Method of Slices.

By: BWF 9/2/2014 **Checked:** ECL 9/2/2014

Client: American Sands Energy Corp

Title: Tailings with Liner (A-A)

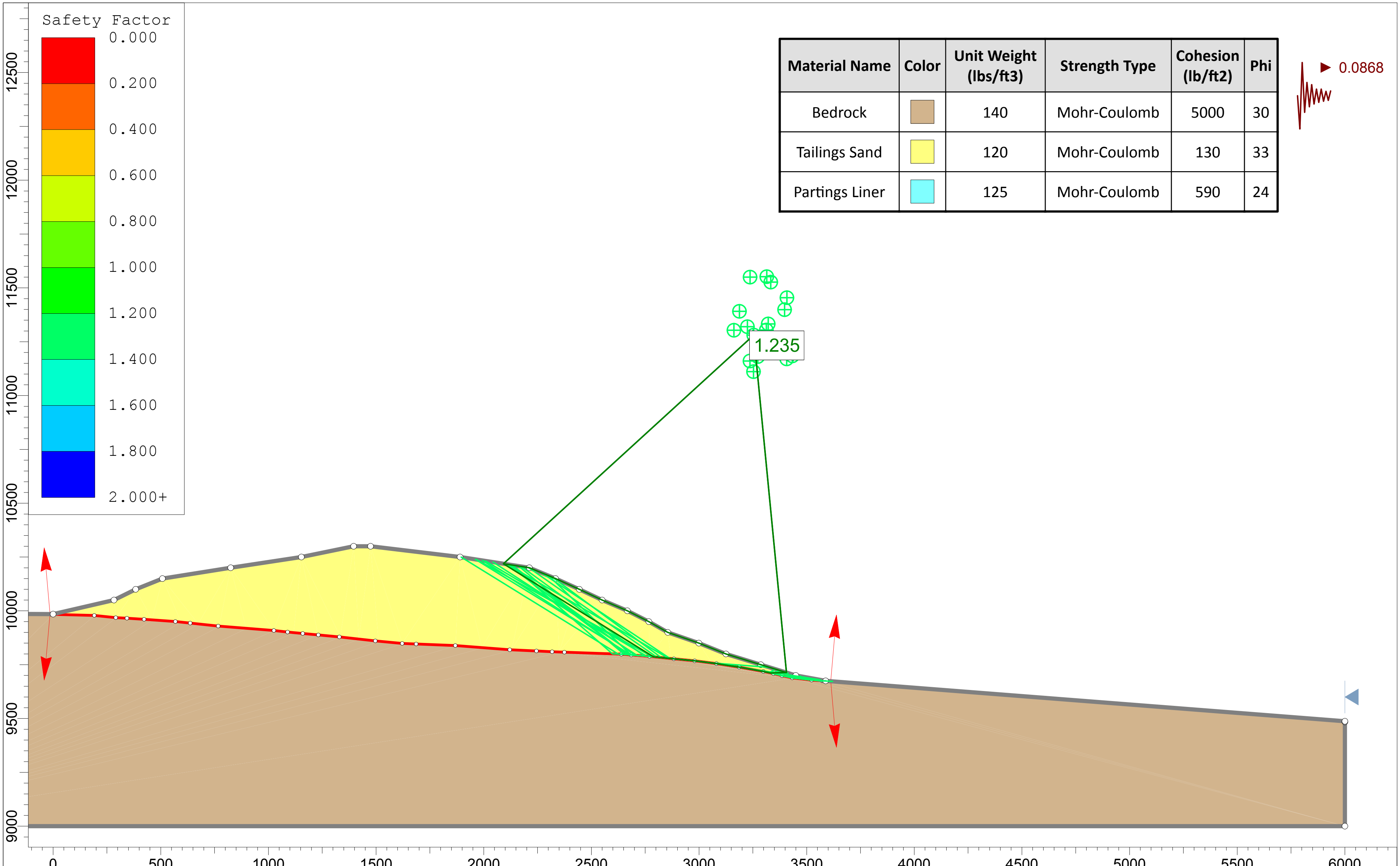
Project: American Sands Bruin Point

Date: January 2015 **Project No.:** 24585638

Figure: D17

URS Carbon County, Utah

Q:\Projects\American Sands Energy\24585638\05_Analysis and Engineering\Geotech\Stability Analysis\Proposed Geometry\Clay Liner\Tailings A-A (Right).slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi
Bedrock		140	Mohr-Coulomb	5000	30
Tailings Sand		120	Mohr-Coulomb	130	33
Partings Liner		125	Mohr-Coulomb	590	24

Description/Notes:

Stability analysis was performed using Slide v. 6.005 by Rocscience, Inc., of Toronto, Canada, and Spencer's Method of Slices.

Client: American Sands Energy Corp

Title: Tailings with Liner (A-A) [Seismic]

Project: American Sands Bruin Point

Date: January 2015

Project No.: 24585638

Figure: D18

URS Carbon County, Utah

By: BWF 9/2/2014 **Checked:** ECL 9/2/2014

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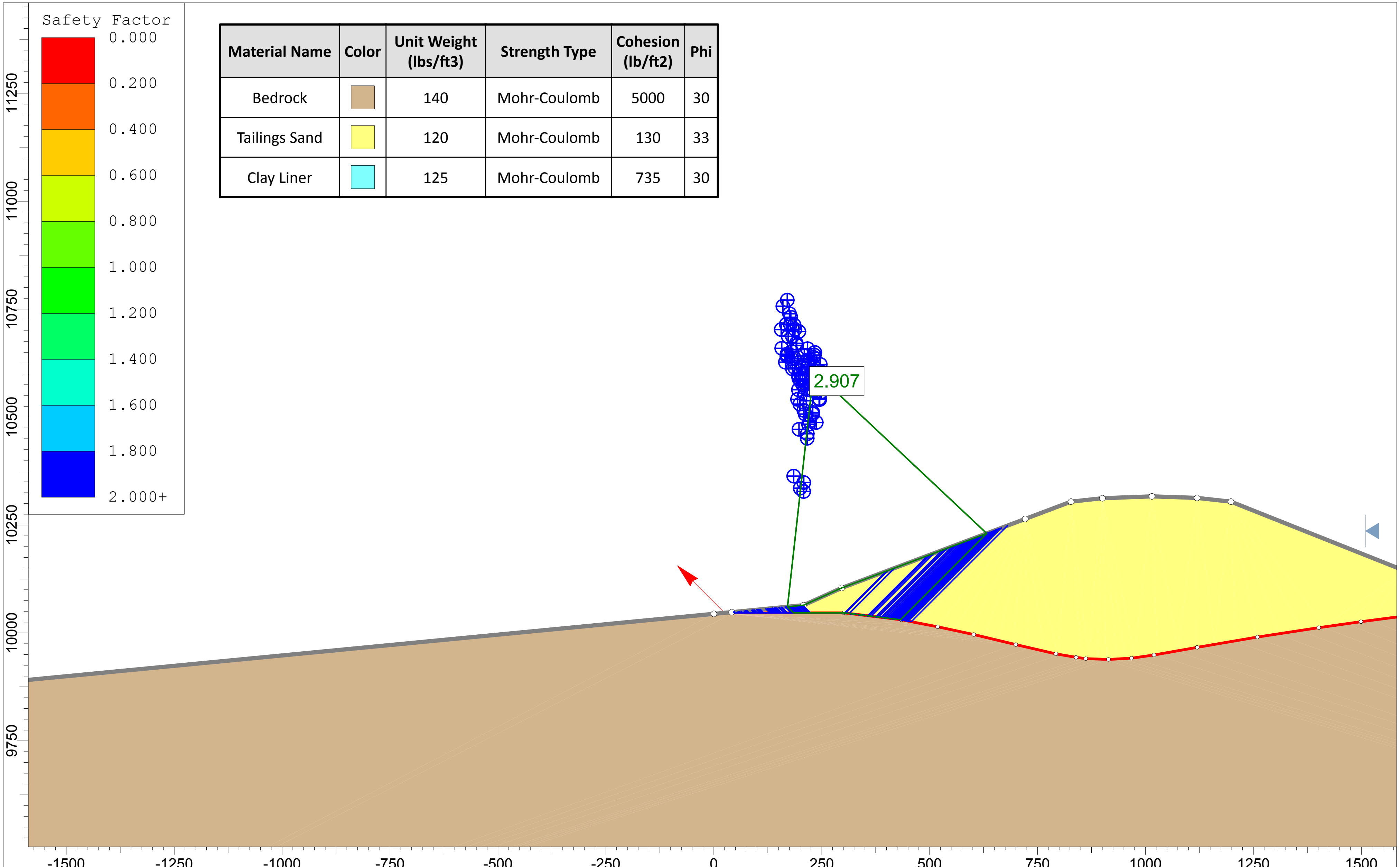

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi
Bedrock		140	Mohr-Coulomb	5000	30
Tailings Sand		120	Mohr-Coulomb	130	33
Clay Liner		125	Mohr-Coulomb	735	30

Description/Notes:

Stability analysis was performed using Slide v. 6.005 by Rocscience, Inc., of Toronto, Canada, and Spencer's Method of Slices.

By: BWF 1/20/2015 **Checked:** ECL 1/20/2015

Client: American Sands Energy Corp

Title: Tailings with Liner (B-B)

Project: American Sands Bruin Point

Date: January 2015 **Project No.:** 24585638

Figure: D19

URS Carbon County, Utah

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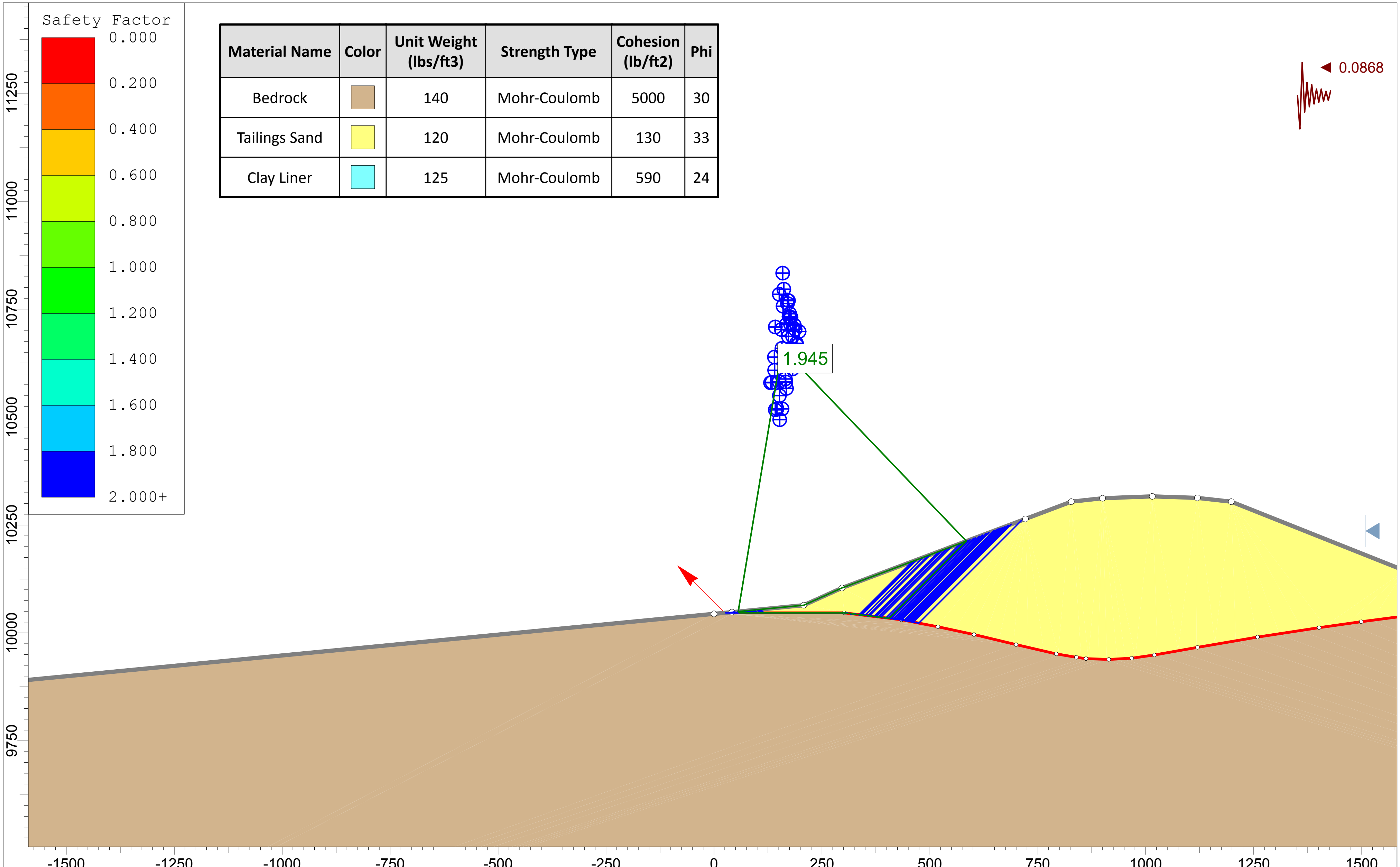

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi
Bedrock		140	Mohr-Coulomb	5000	30
Tailings Sand		120	Mohr-Coulomb	130	33
Clay Liner		125	Mohr-Coulomb	590	24

Description/Notes:

Stability analysis was performed using Slide v. 6.005 by Rocscience, Inc., of Toronto, Canada, and Spencer's Method of Slices.

By: BWF 1/20/2015 **Checked:** ECL 1/20/2015

Client: American Sands Energy Corp

Title: Tailings with Liner (B-B) [Seismic]

Project: American Sands Bruin Point

Date: January 2015 **Project No.:** 24585638

Figure: D20

URS Carbon County, Utah

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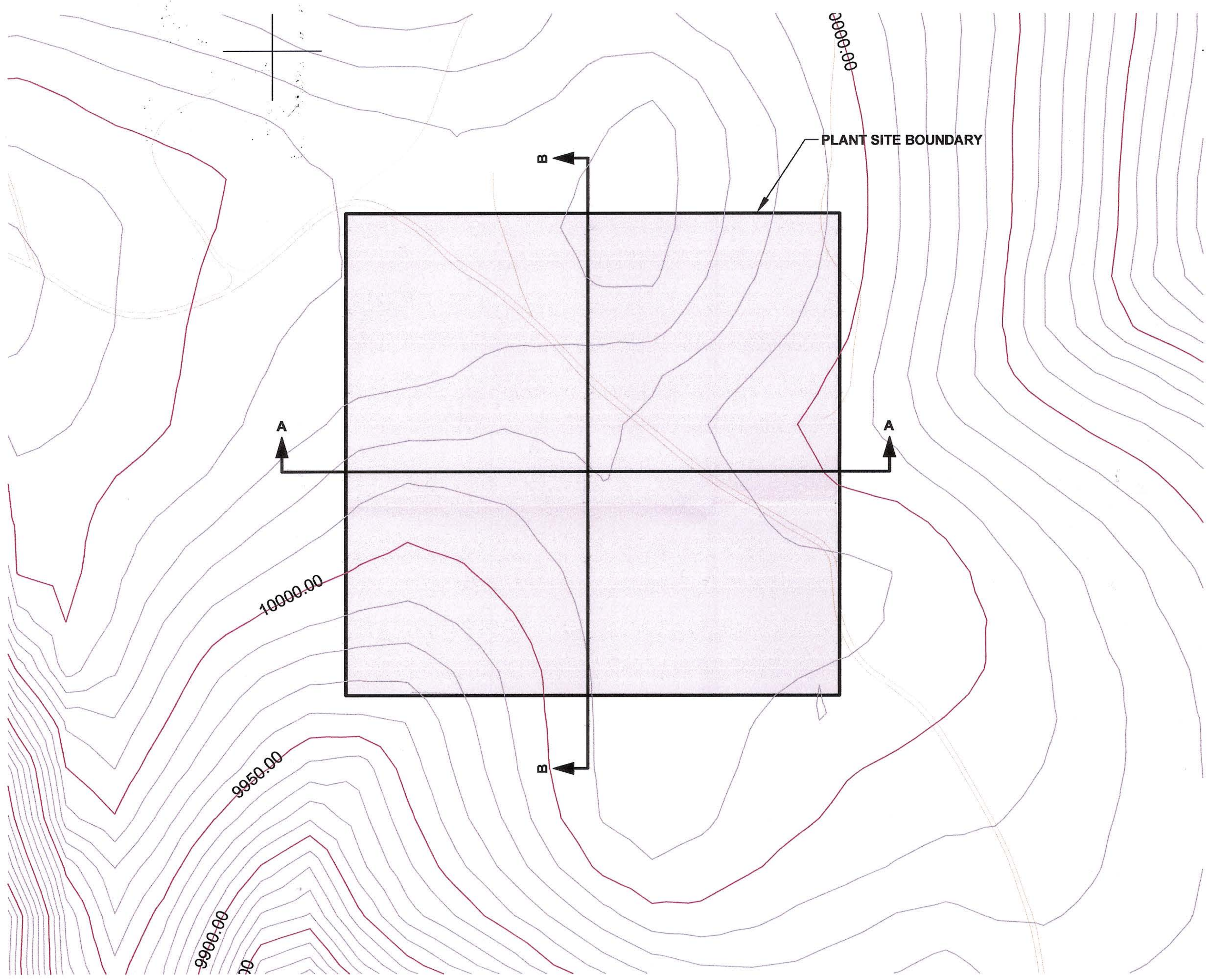

PLANT SITE
PRE-PLANT TOPO

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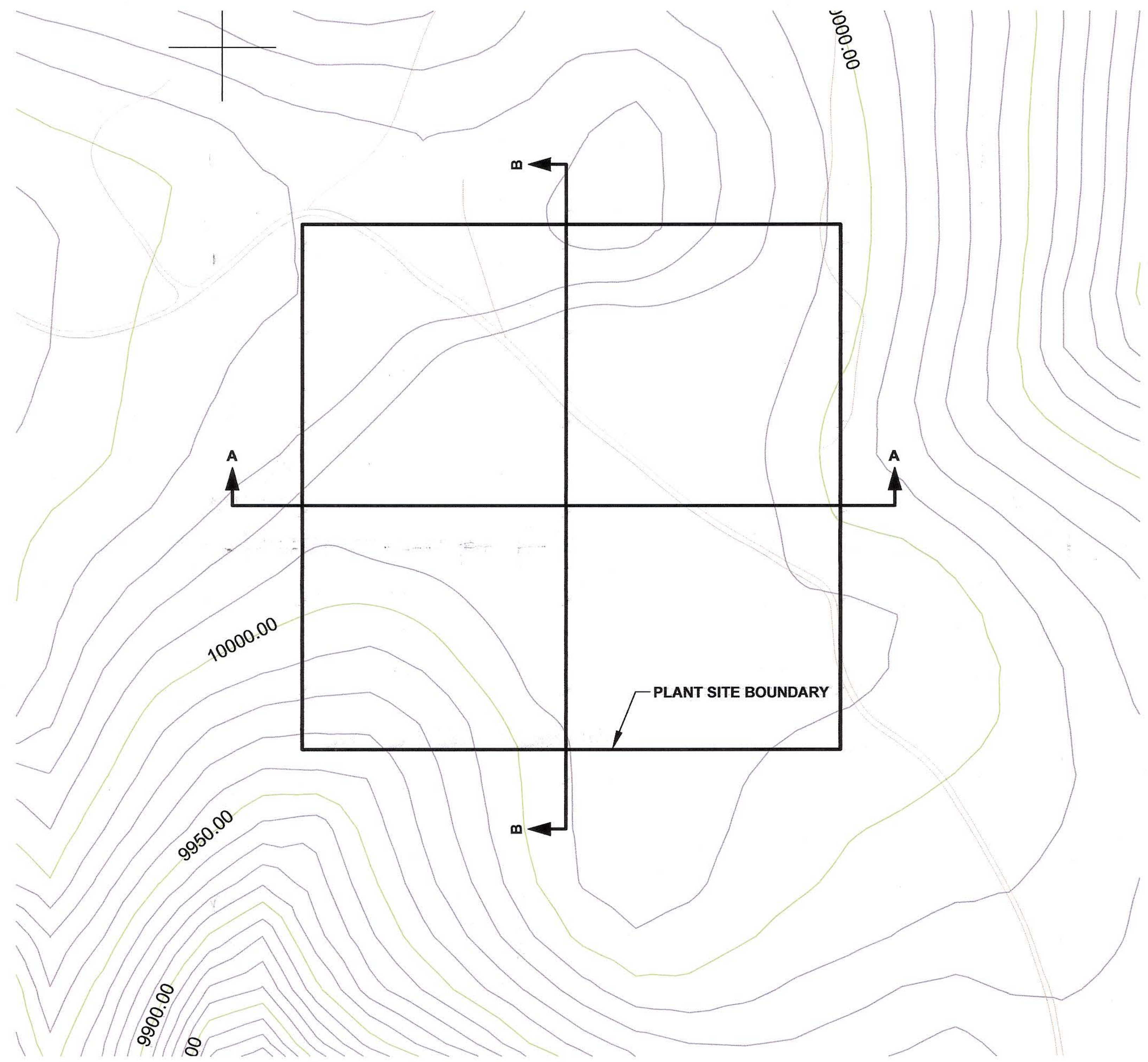
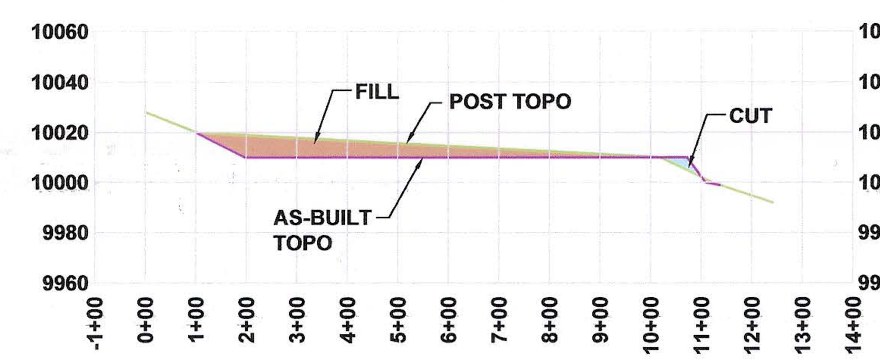


PLANT SITE
POST TOPO

200 FT 0 200 FT 1,000 FT



SECTION A-A
POST - PLANT SITE TOPOGRAPHY

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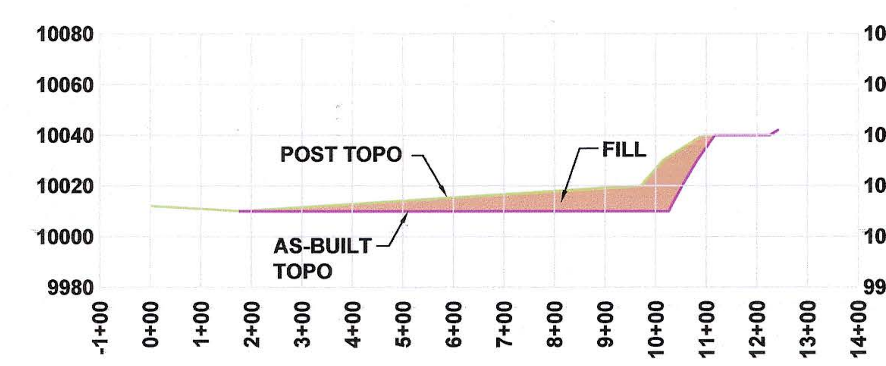
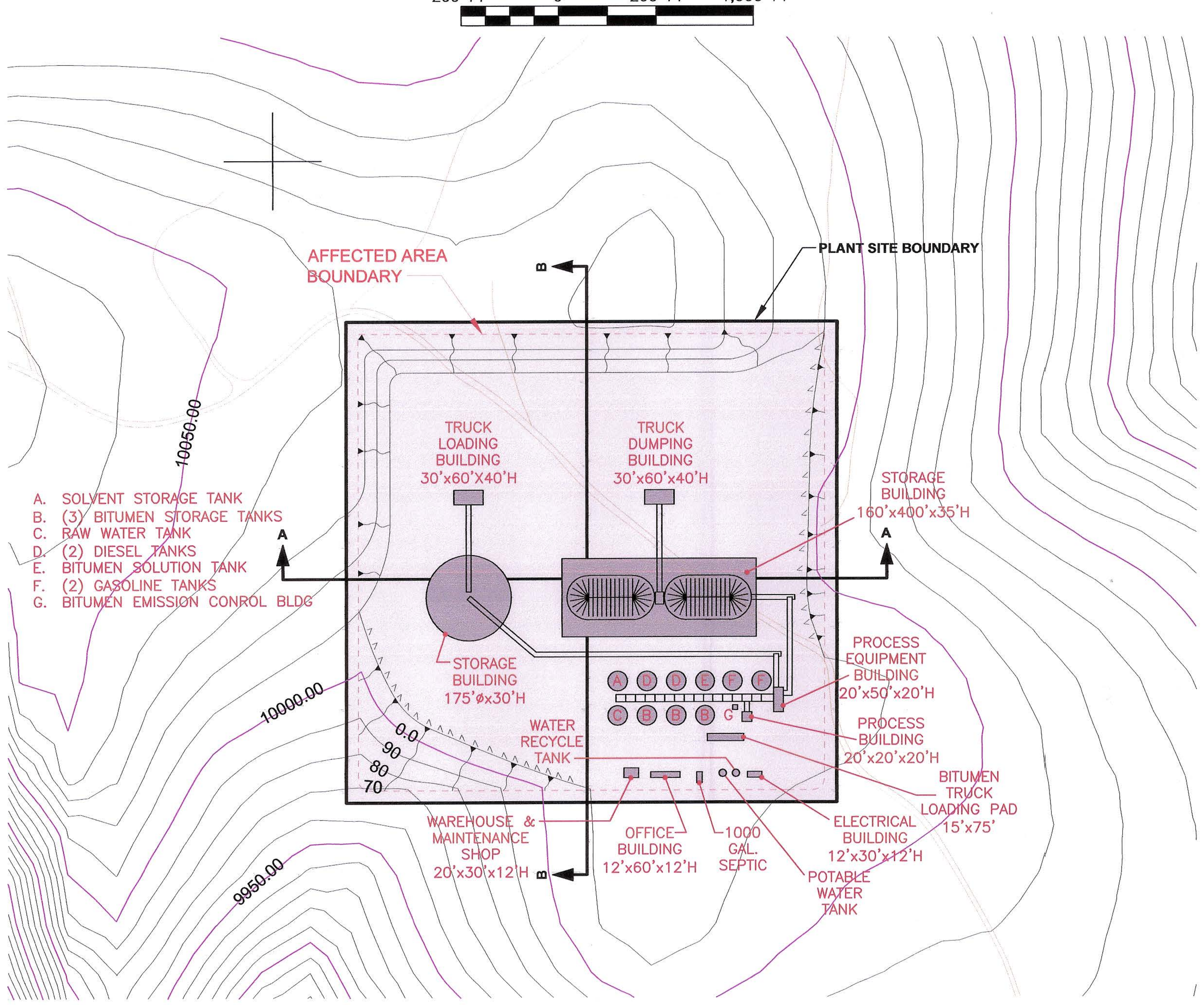
2H:1V MAXIMUM



SECTION B-B
POST - PLANT SITE TOPOGRAPHY

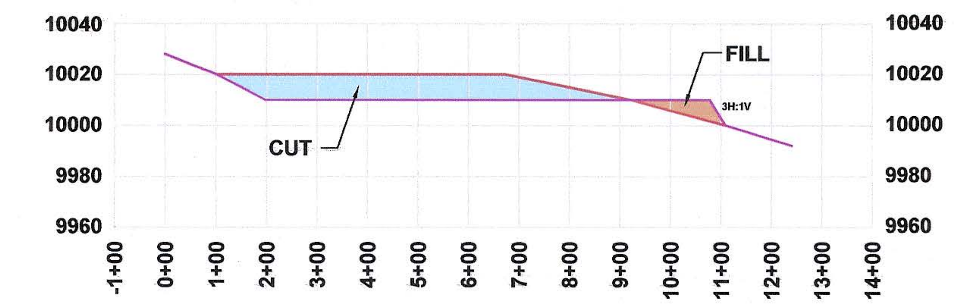
300 FT 0 300 FT 600 FT

2H:1V MAXIMUM



PLANT SITE
AS-BUILT TOPO

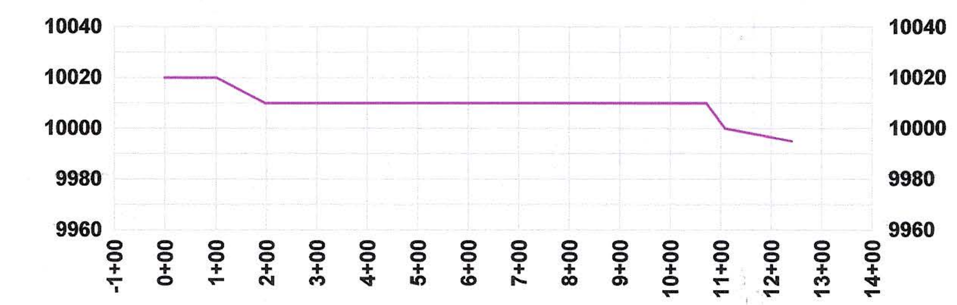
200 FT 0 200 FT 1,000 FT



SECTION A-A
PRE - PLANT SITE TOPOGRAPHY

300 FT 0 300 FT 600 FT

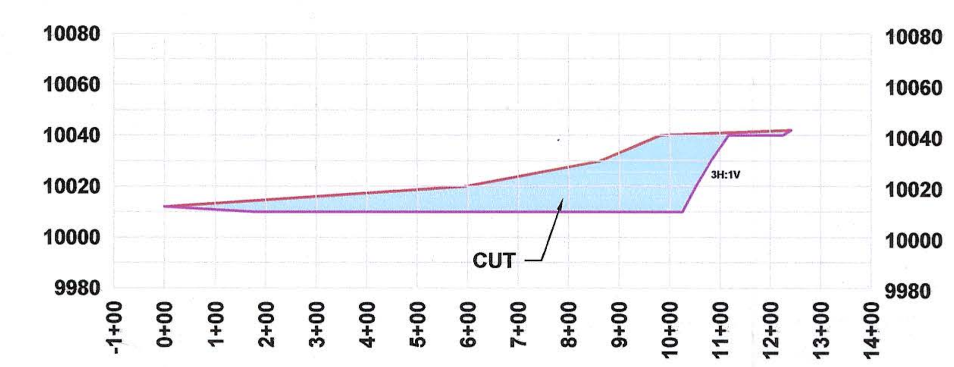
2H:1V MAXIMUM



SECTION A-A
AS-BUILT SITE TOPOGRAPHY

300 FT 0 300 FT 600 FT

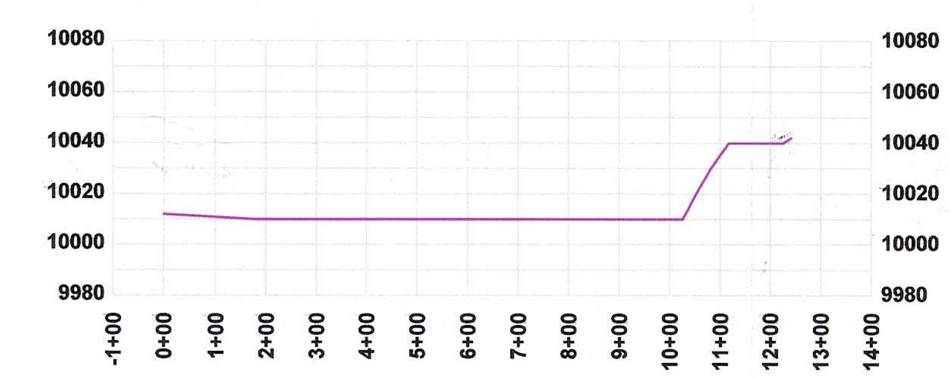
2H:1V MAXIMUM



SECTION B-B
PRE - PLANT SITE TOPOGRAPHY

300 FT 0 300 FT 600 FT

2H:1V MAXIMUM



SECTION B-B
AS-BUILT SITE TOPOGRAPHY

300 FT 0 300 FT 600 FT

2H:1V MAXIMUM

LEGEND

- EXISTING ROADS
- CONTAINMENT BERM
- AFFECTED AREA BOUNDARY
- MAJOR CONTOUR SPACING 50 FT

PRELIMINARY FEATURES LAYOUT FOR DESIGN AND ENGINEERING.

"NOT FOR CONSTRUCTION"

COORDINATE SYSTEM:

UT83-CF
UTAH STATE PLANES: NAD 83 DATUM, CENTRAL ZONE, US FOOT.

SCALE ACCURATE WHEN PRINTED AT 24"x36"

Professional Certification

REGISTERED PROFESSIONAL ENGINEER No. 161136 Eldon D. Strid STATE OF UTAH

No.	REVISION	DATE	BY	CHKD
6	GENERAL MODIFICATIONS	05/16/15	J&L	EDS
5	SHOW FIRE WATER TANKS	01/30/15	J&L	EDS
4	UPDATED LEGEND / POST MAP	01/09/15	J&L	EDS
3	LABEL CORRECTIONS	12/23/14	J&L	EDS
2	ADDED LABELS	12/05/14	J&L	EDS
1	DESIGN	06/06/14	J&L	EDS

American Sands Energy Corp

American Sands Energy Corp.
201 South Main Street
Ste.#1800
Salt Lake City, UT 84111

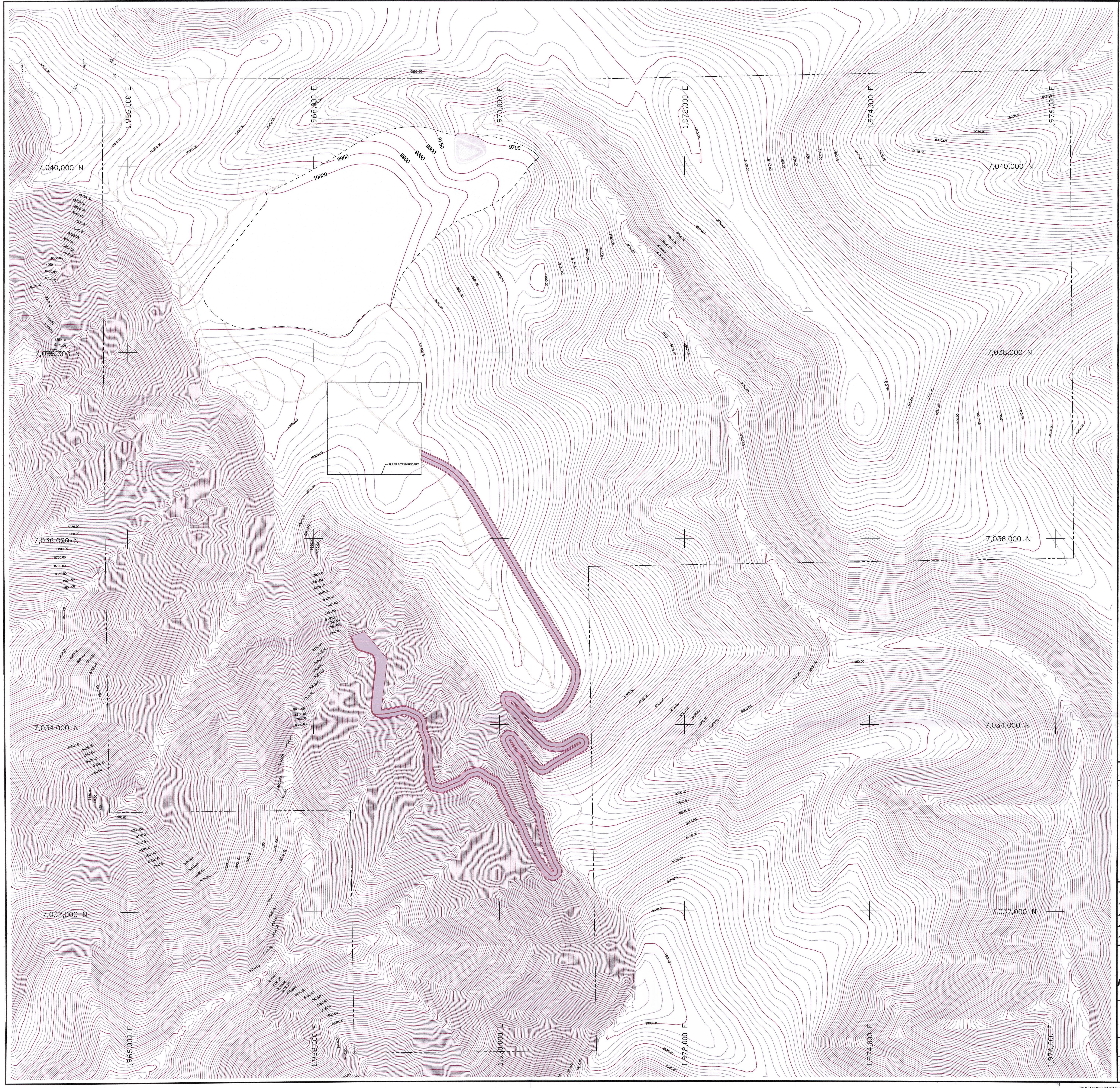
Title:
PLANT SITE–GRADING PLAN

Scale:	Date:	Design By:	Drawn By:	Approved By:
1"=200'	04/04/14	MEI	J&L	

MINE ENGINEERS, INC.
3901 South Industrial Road
Cheyenne, Wyoming 82007 USA
Phone: 307-638-8833 Fax: 307-638-0578

MAP 1

Y:\MEI\MEI Projects\MEI Client Files\American Sands Energy_5-12\Drawings\10-12-12\DRAWINGS\PRELIMINARY DWGS 4-16-15\MAP-1.dwg, 4/17/2015 11:31:23 AM



LEGEND

- LAND AFFECTED BOUNDARY
- EXISTING ROADS
- DRY TAILINGS IMPOUNDMENT
- MINE ROAD
- MAJOR CONTOUR SPACING 50 FT

PRELIMINARY FEATURES LAYOUT FOR DESIGN AND ENGINEERING.

"NOT FOR CONSTRUCTION"

COORDINATE SYSTEM:

UT83-CF
UTAH STATE PLANES: NAD 83 DATUM, CENTRAL ZONE, US FOOT.

N

400 FT 0 400 FT 800 FT

SCALE ACCURATE WHEN PRINTED AT 24"x36"

Professional Certification

REGISTERED PROFESSIONAL ENGINEER No. 161136 Eldon D. Strid 4/17/15 STATE OF UTAH

No.	REVISION	DATE	BY	CHKD
5	SHOWED RETENTION BASIN	04/17/15	J&L	EDS
4	UPDATE TAILINGS STOCKPILE	01/09/15	J&L	EDS
3	FINAL	10/02/14	J&L	EDS
2	GENERAL REVISION	09/02/14	J&L	EDS
1	PRLIMINARY	02/19/14	J&L	EDS

American Sands Energy Corp

American Sands Energy Corp.
201 South Main Street
Ste.#1800
Salt Lake City, UT 84111

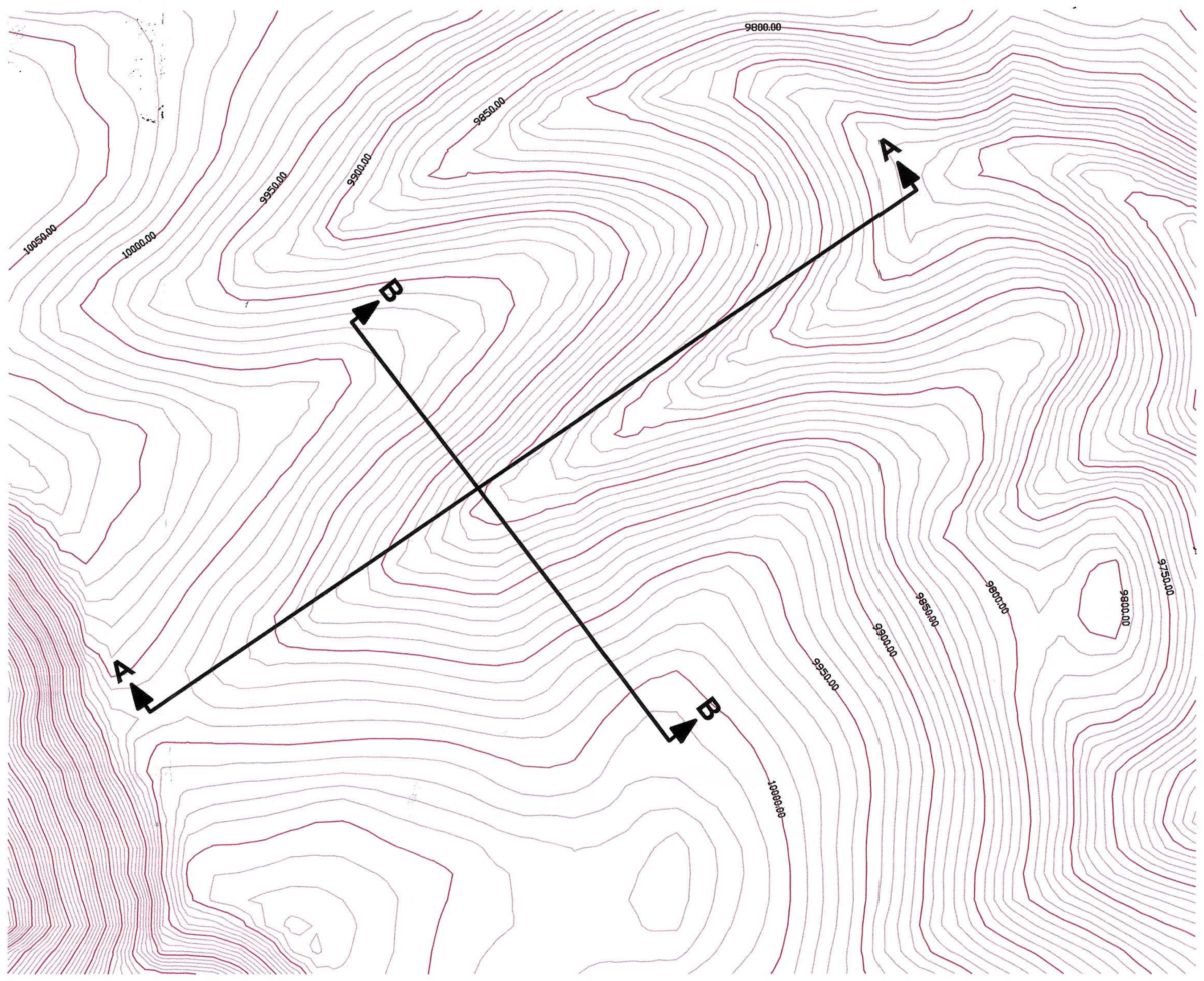
Title:

DRY TAILINGS IMPOUNDMENT

Scale:	Date:	Design By:	Drawn By:	Approved By:
1"=400'	02/19/14	MEI	J&L	EDS

MINE ENGINEERS, INC.
3901 South Industrial Road
Cheyenne, Wyoming 82007 USA
Phone: 307-638-8833 Fax: 307-638-0578

MAP 2



PRE-MINING TOPO

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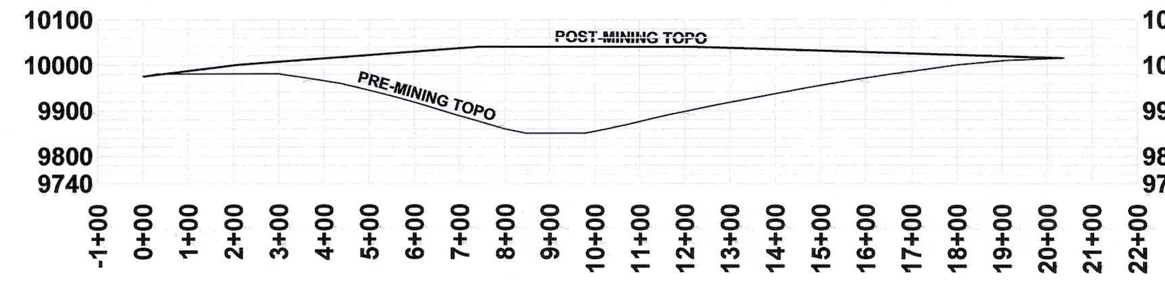
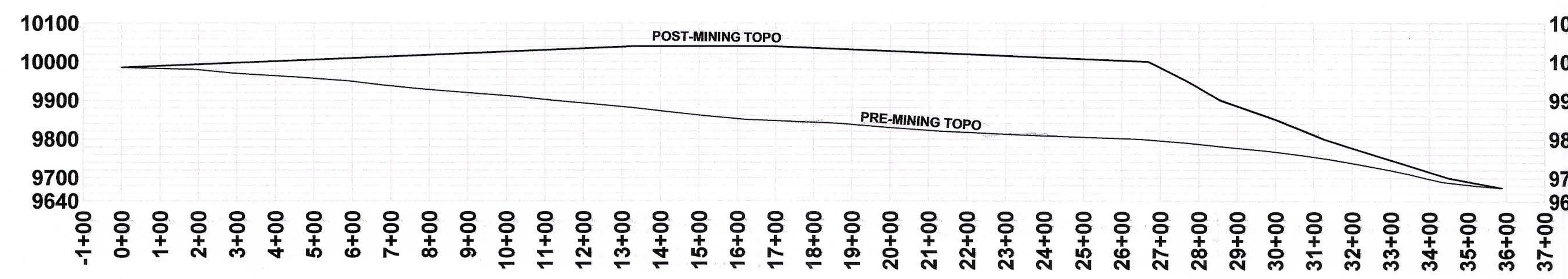


SECTION B-B

300 FT 0 300 FT 600 FT

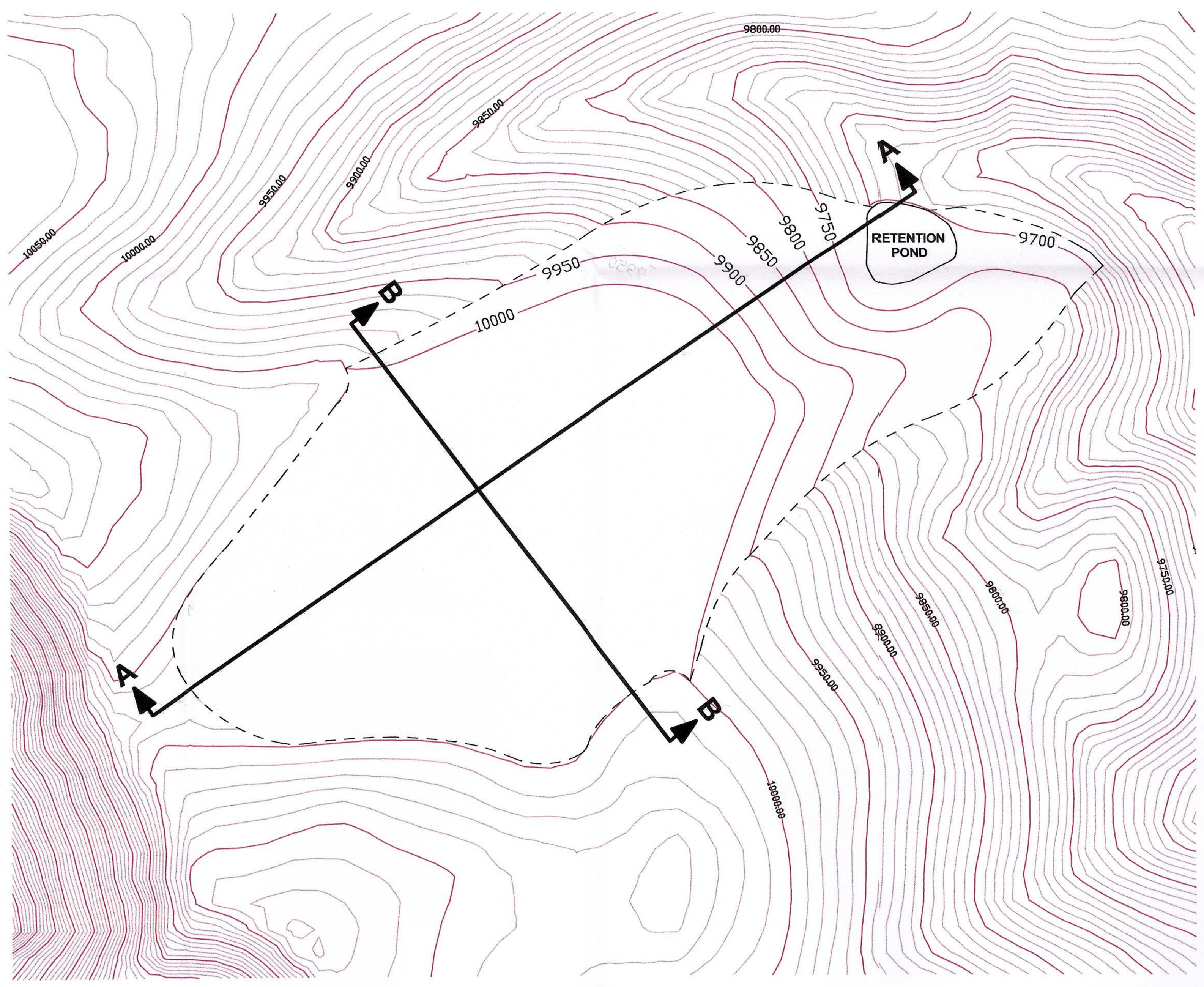
2H:1V MAXIMUM



SECTION A-A

300 FT 0 300 FT 600 FT

2H:1V MAXIMUM



POST MINING TOPO

400 FT 0 400 FT 800 FT

LEGEND

EXISTING TRAILS

DRY TAILINGS IMPOUNDMENT

MAJOR CONTOUR SPACING 50 FT

NOTE: Base to be constructed at 4 feet thick and cover to be constructed at 4 feet thick with compacted clay material to specified permeability. Cover system includes 18 inches of topsoil/plant growth medium placed on the clay cover. Reference "Summary of Preliminary HELP Model Results, American Sands Energy - Bruin Point Mine" by URS, September, 2014.

PRELIMINARY FEATURES LAYOUT
FOR DESIGN AND ENGINEERING
"NOT FOR CONSTRUCTION"

COORDINATE SYSTEM:

UT83-CF
UTAH STATE PLANES: NAD 83 DATUM,
CENTRAL ZONE, US FOOT.

SCALE ACCURATE WHEN PRINTED AT 24"x36"

Professional Certification

REGISTERED PROFESSIONAL ENGINEER No. 191139 STATE OF UTAH

No.	REVISION	DATE	BY	CHKD
6	GENERAL UPDATES	04/17/15	J&L	EDS
5	MODIFIED CONTOURS AND X-SECTIONS	01/27/15	J&L	EDS
4	MINOR GENERAL UPDATES	01/23/15	J&L	EDS
3	FINAL	10/16/14	J&L	EDS
2	MODIFIED X-SECTIONS	09/16/14	J&L	EDS
1	PRLIMINARY	02/19/14	J&L	EDS

American Sands Energy Corp

American Sands Energy Corp.
201 South Main Street
Ste.#1800
Salt Lake City, UT 84111

Title: TYPICAL CROSS SECTION
DRY TAILINGS IMPOUNDMENT
(COVER AND BASE)

Scale:	Date:	Design By:	Drawn By:	Approved By:
1"=400'	02/19/14	MEI	J&L	EDS

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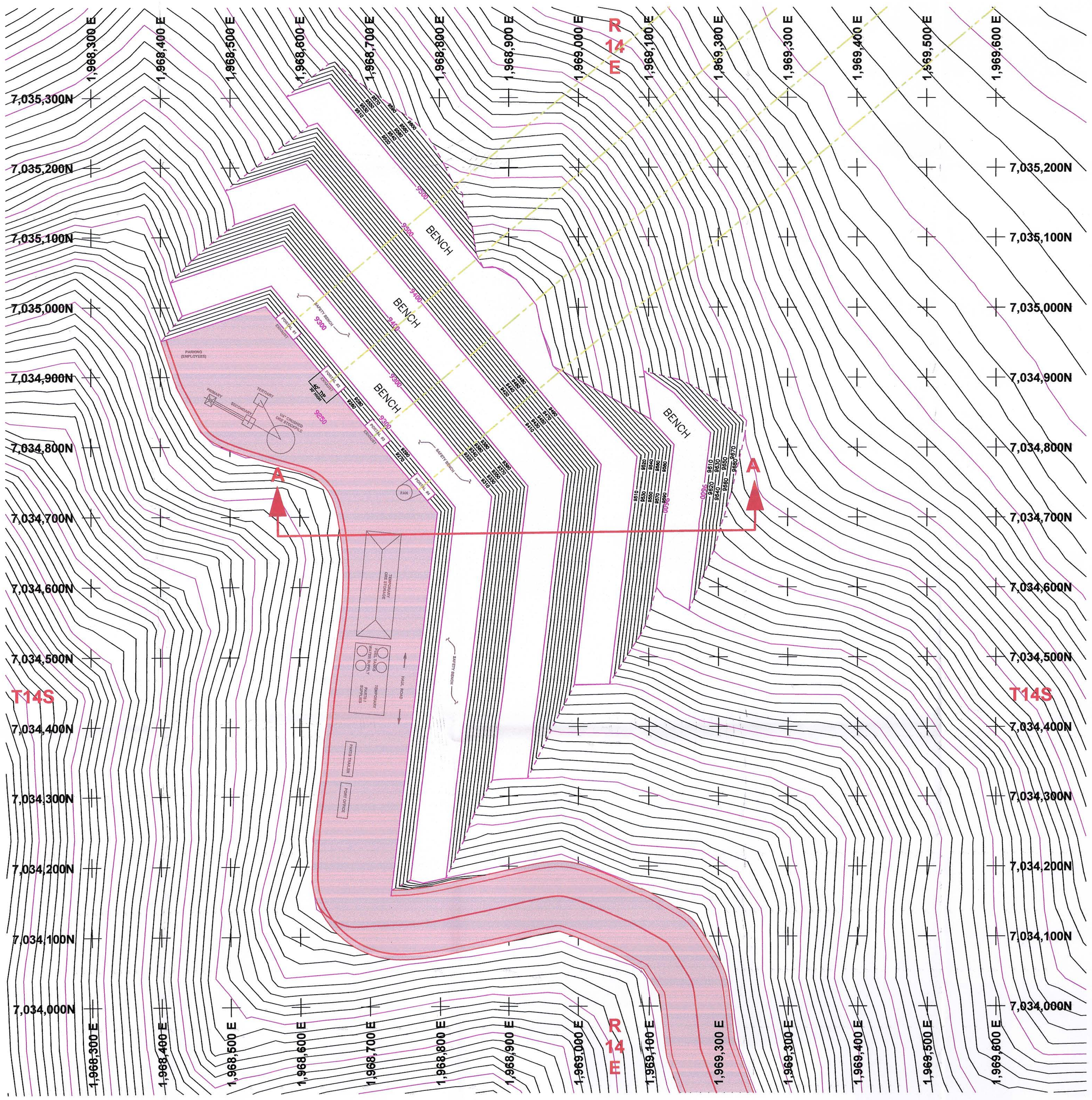
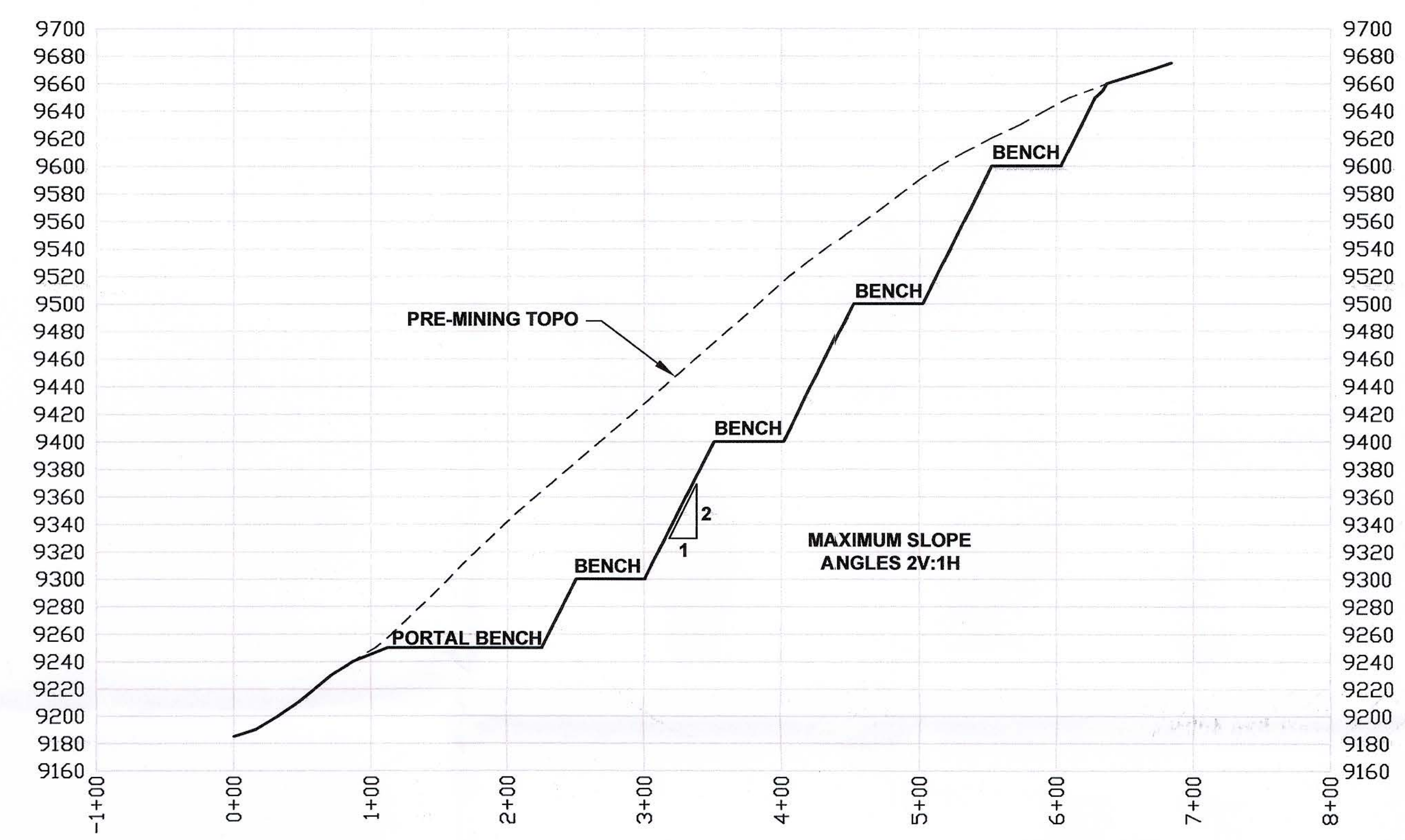
3901 South Industrial Road
Cheyenne, Wyoming 82007 USA
Phone: 307-638-8833 Fax: 307-638-0578

MAP 3



AS-BUILT TOPO

100 FT 0 100 FT 200 FT



SECTION A-A

100 FT 0 100 FT 200 FT

LEGEND

- MINE ROAD
- CUT LINE
- PORTALS
- MAJOR CONTOUR SPACING 50 FT
- CONTOUR SPACING 10 FT

PRELIMINARY FEATURES LAYOUT FOR DESIGN AND ENGINEERING.

"NOT FOR CONSTRUCTION"

COORDINATE SYSTEM:

UT83-CF
UTAH STATE PLANES: NAD 83 DATUM, CENTRAL ZONE, US FOOT.

N

SCALE ACCURATE WHEN PRINTED AT 24"x36"

Professional Certification

REGISTERED PROFESSIONAL ENGINEER No. 161136 Eldon D. Strid 4/17/15 STATE OF UTAH

No.	REVISION	DATE	BY	CHKD
6	GENERAL REVISIONS	04/16/15	J&L	EDS
5	GENERAL REVISIONS	01/23/15	J&L	EDS
4	ADDED CONTOURS / SECTION	01/16/15	J&L	EDS
3	ADDED NOTE	12/23/14	J&L	EDS
2	ADDED FEATURES	12/05/14	J&L	EDS
1	DESIGN	09/30/14	J&L	EDS

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201 South Main Street
Ste.#1800
Salt Lake City, UT 84111

Title:

PORTAL TOPO

Scale:	Date:	Design By:	Drawn By:	Approved By:
1"=100'	09/30/14	MEI	J&L	

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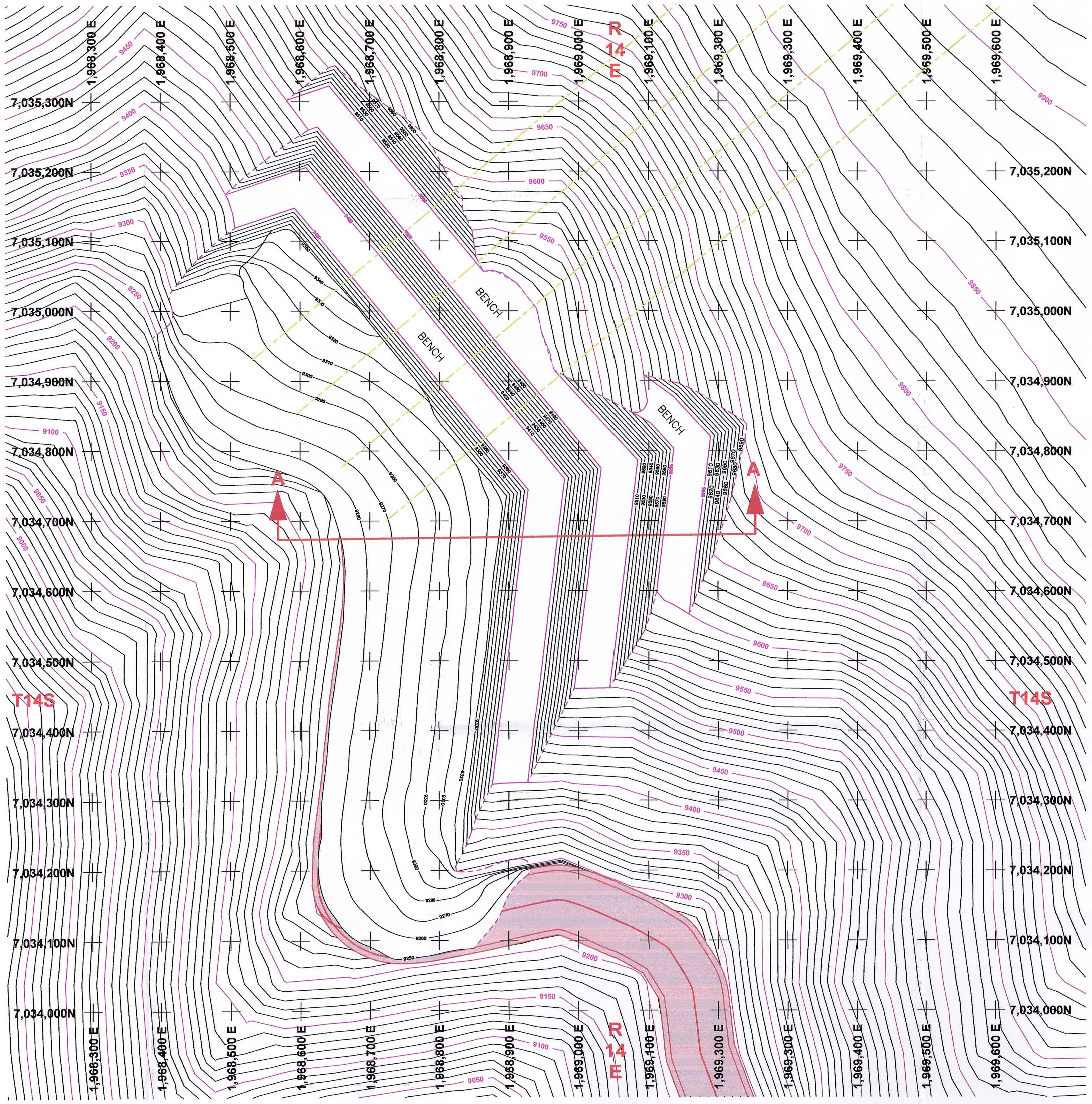
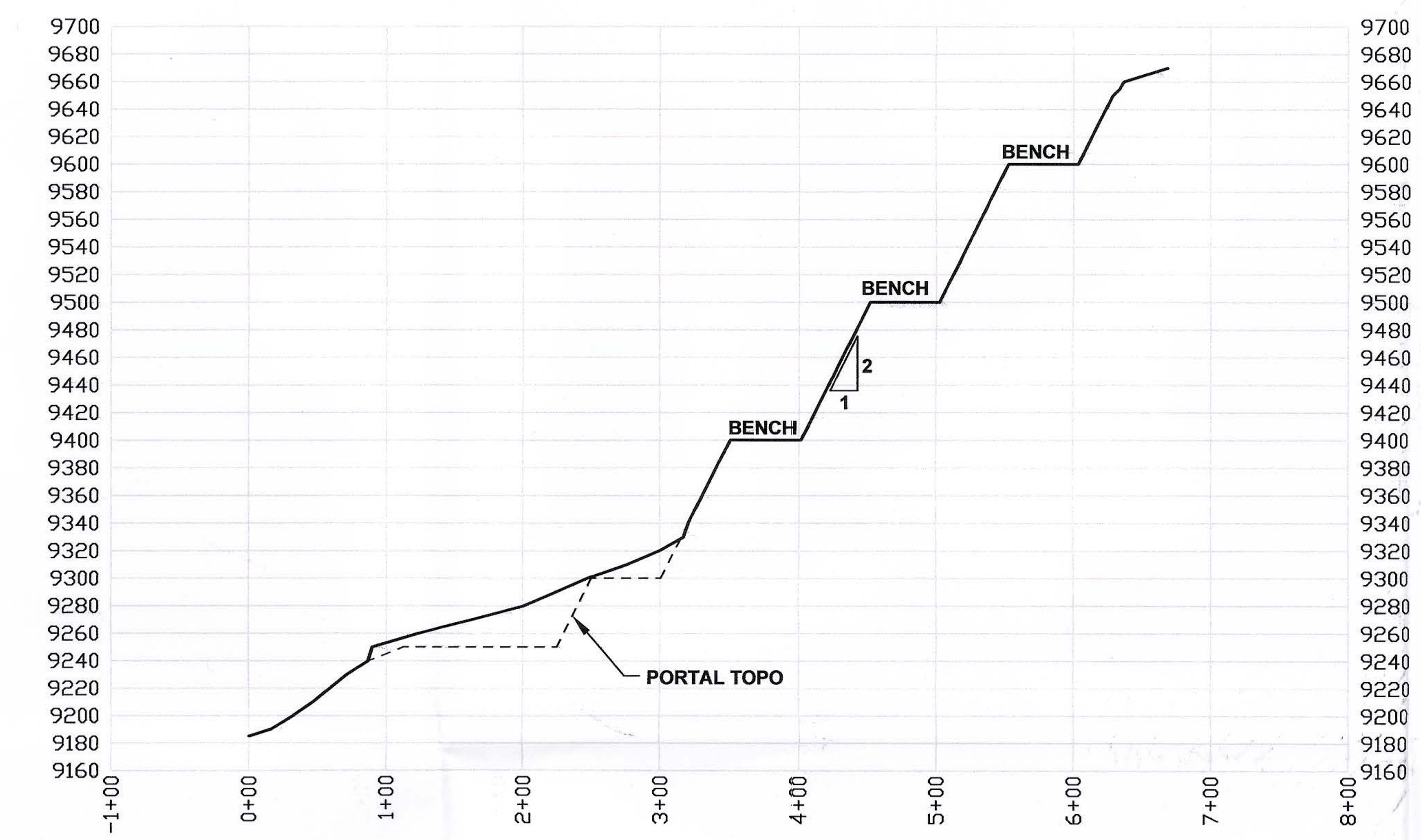
Cheyenne, Wyoming 82007 USA
Phone: 307-638-8833 Fax: 307-638-0578

MAP 4



POST-MINING (PORTAL CLOSURE) TOPO

100 FT 0 100 FT 100 FT



SECTION A-A

100 FT 0 100 FT 100 FT

LEGEND

MINE ROAD
CUT LINE
PORTALS
MAJOR CONTOUR SPACING 50 FT
CONTOUR SPACING 10 FT

PRELIMINARY FEATURES LAYOUT FOR DESIGN AND ENGINEERING.

"NOT FOR CONSTRUCTION"

COORDINATE SYSTEM:

UT83-CF
UTAH STATE PLANES: NAD 83 DATUM, CENTRAL ZONE, US FOOT.

SCALE ACCURATE WHEN PRINTED AT 24"x36"

Professional Certification

REGISTERED PROFESSIONAL ENGINEER STATE OF UTAH

No.	REVISION	DATE	BY	CHKD
3	ADDED NOTE TO LEGEND	04/16/15	J&L	EDS
2	INCLUDED CONTOURS / X-SECTION	01/16/15	J&L	EDS
1	FINAL	10/02/14	J&L	EDS

American Sands Energy Corp

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201 South Main Street
Ste.#1800
Salt Lake City, UT 84111

Title:

PORTAL CLOSURE

Scale:	Date:	Design By:	Drawn By:	Approved By:
1"=100'	09/30/14	MEI	J&L	

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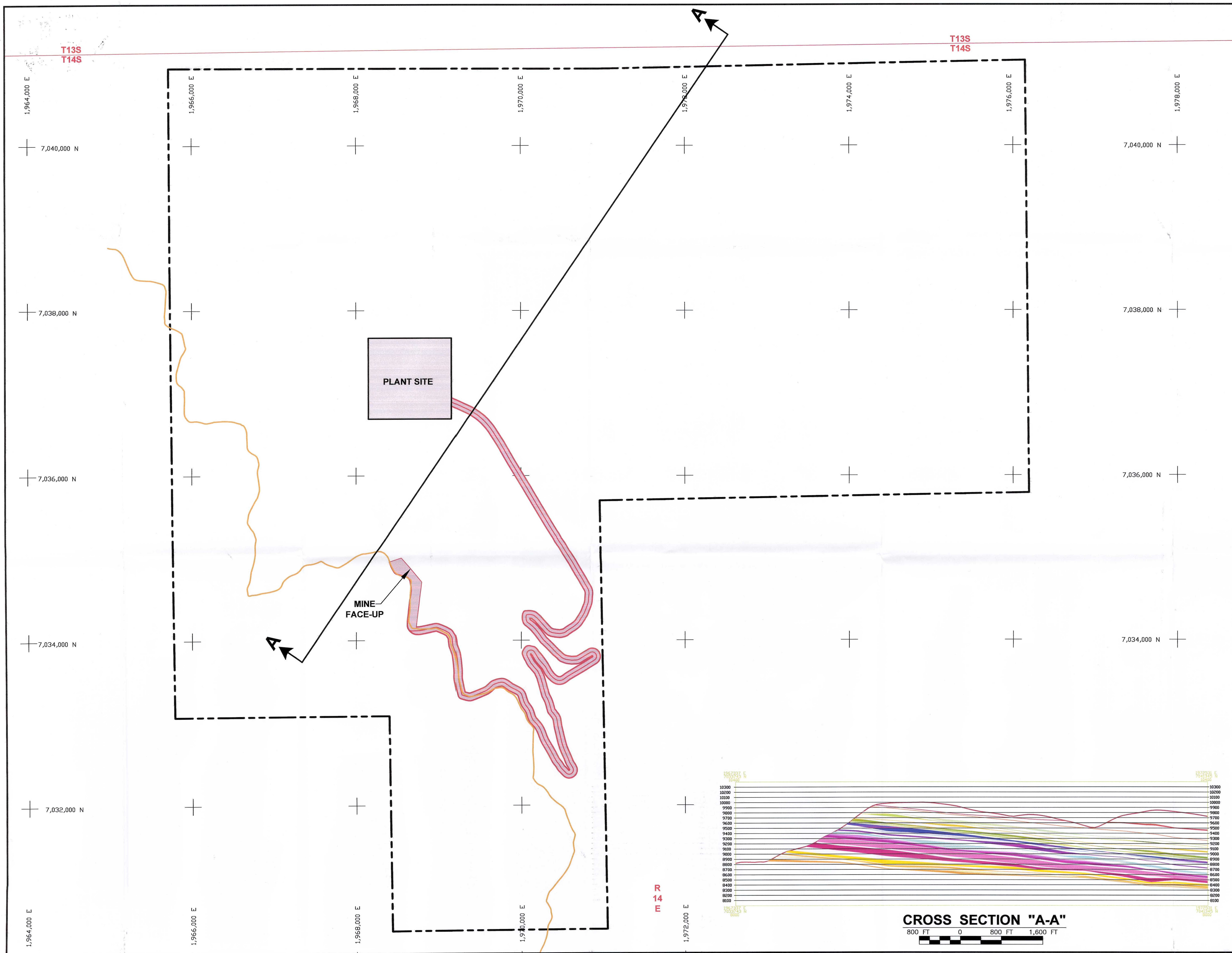
Cheyenne, Wyoming 82007 USA
Phone: 307-638-8833 Fax: 307-638-0578

MAP 5



LEGEND

LAND AFFECTED BOUNDARY
OUTCROP
MINE ROAD

PRELIMINARY FEATURES LAYOUT FOR DESIGN AND ENGINEERING.

"NOT FOR CONSTRUCTION"

ORE SEAMS
T10
T11
T21
T22
T23
T25
T26
T31
T32
T33
T35
T36A
T36B
T37
T38
T41
T42
T43
T45
SURFACE

COORDINATE SYSTEM:

UT83-CF
UTAH STATE PLANES: NAD 83 DATUM, CENTRAL ZONE, US FOOT.

N

500 FT 0 500 FT 1,000 FT

SCALE ACCURATE WHEN PRINTED AT 24"x36"

Professional Certification

REGISTERED PROFESSIONAL ENGINEER
STATE OF UTAH

No.	REVISION	DATE	BY	CHKD
2	GENERAL REVISIONS	01/23/15	J&L	EDS
1	DESIGN	05/28/14	J&L	EDS

American Sands Energy Corp

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201 South Main Street
Ste.#1800
Salt Lake City, UT 84111

Title: TYPICAL GEOLOGIC CROSS SECTION

Scale:	Date:	Design By:	Drawn By:	Approved By:
1"=500'	04/04/14	MEI	J&L	

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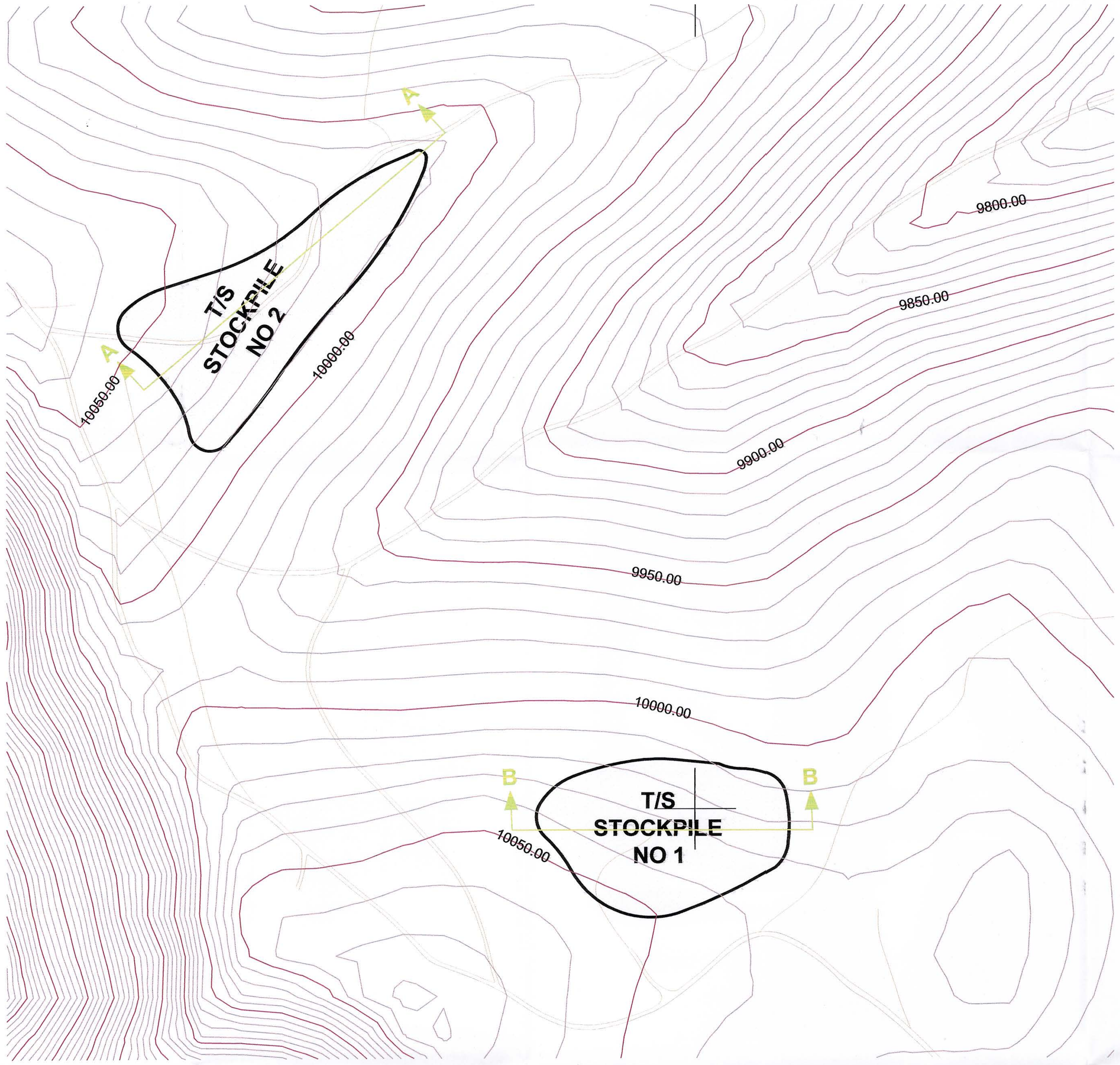
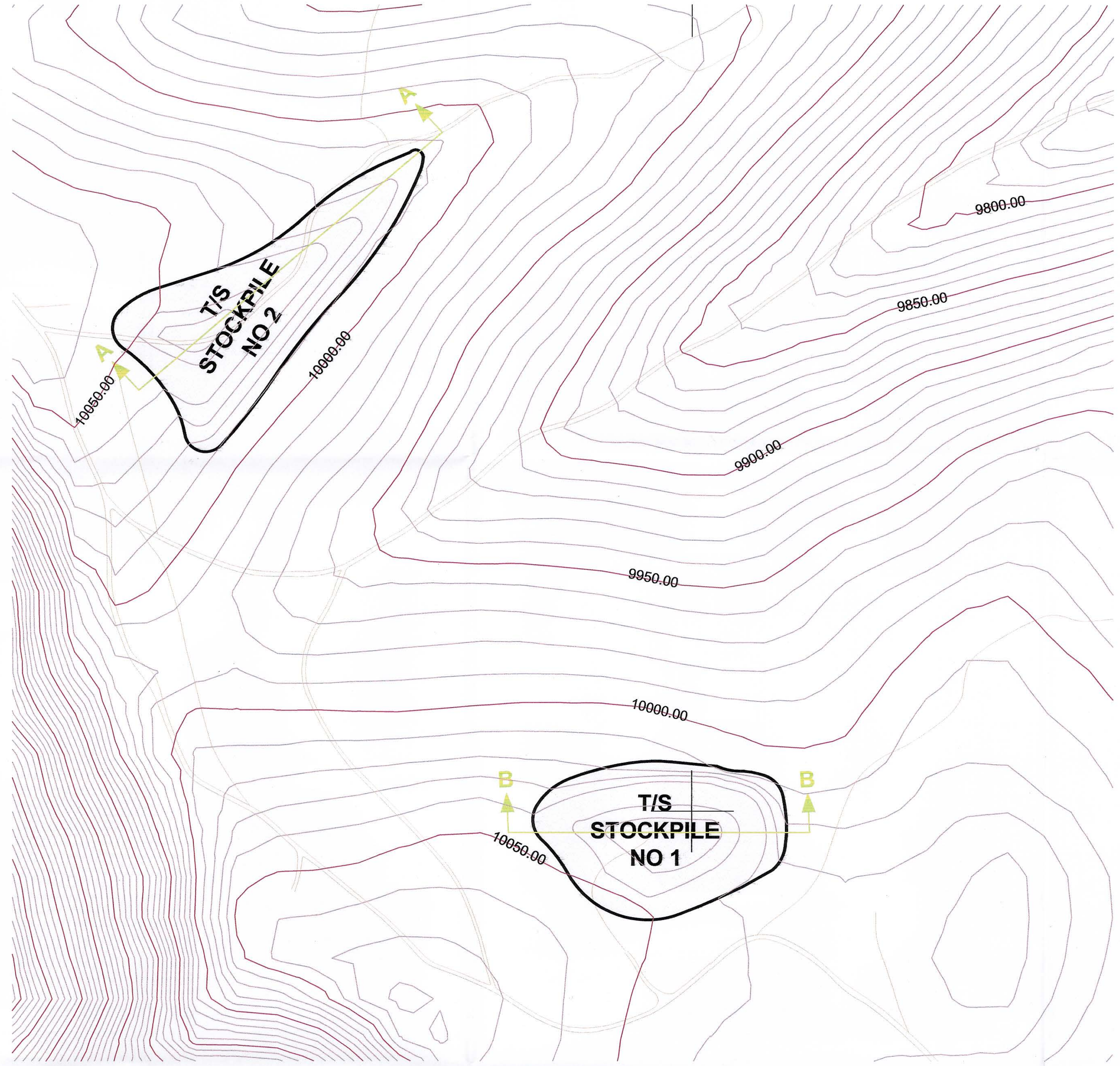
3901 South Industrial Road
Cheyenne, Wyoming 82007 USA
Phone: 307-638-8833 Fax: 307-638-0378

MAP 6



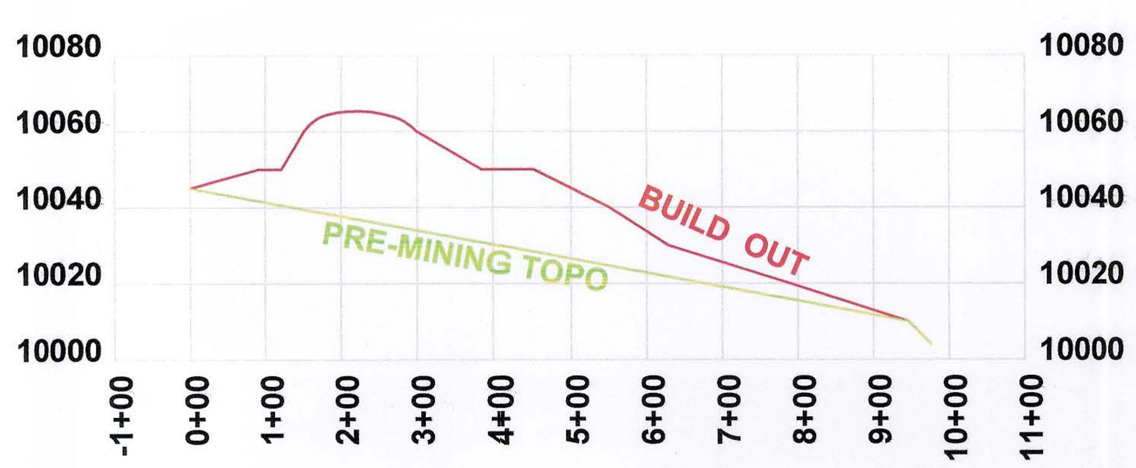
PRE-MINING TOPO

200 FT 0 200 FT 400 FT



BUILD-OUT TOPO

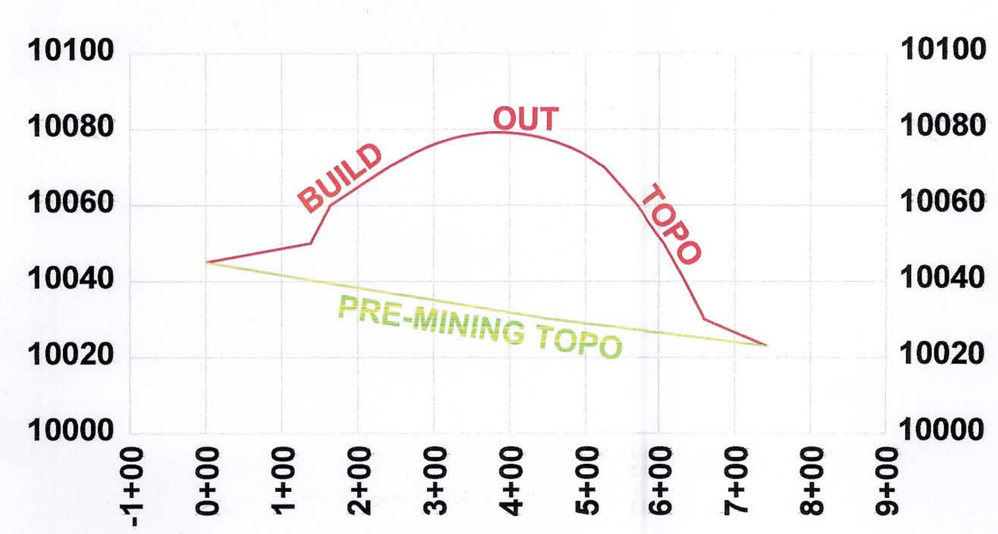
200 FT 0 200 FT 400 FT



SECTION A-A

200 FT 0 200 FT 400 FT

2H:1V MAXIMUM



SECTION B-B

200 FT 0 200 FT 400 FT

2H:1V MAXIMUM

LEGEND

EXISTING ROADS

TOPSOIL STOCKPILES

CONTOUR SPACING 50 FT

PRELIMINARY FEATURES LAYOUT FOR DESIGN AND ENGINEERING.

"NOT FOR CONSTRUCTION"

COORDINATE SYSTEM:

UT83-CF
UTAH STATE PLANES: NAD 83 DATUM, CENTRAL ZONE, US FOOT.

N

SCALE ACCURATE WHEN PRINTED AT 24"x36"

Professional Certification

No.	REVISION	DATE	BY	CHKD
3	ADDED NOTE TO LEGEND	04/16/15	J&L	EDS
2	UPDATE TITLE BLOCK	01/23/15	J&L	EDS
1	DESIGN	06/10/14	J&L	EDS

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201 South Main Street
Ste.#1800
Salt Lake City, UT 84111

Title:

TOP SOIL–GRADING PLAN

Scale:	Date:	Design By:	Drawn By:	Approved By:
1"=200'	06/10/14	MEI	J&L	

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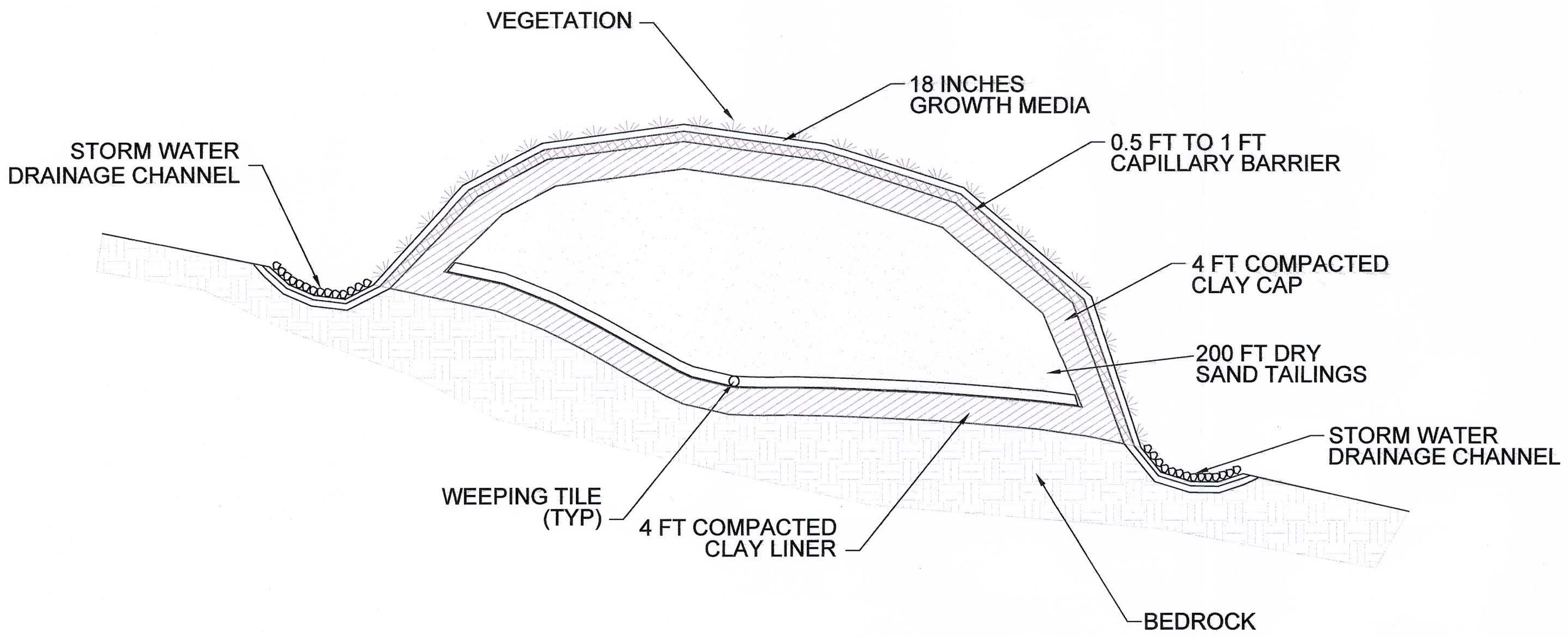
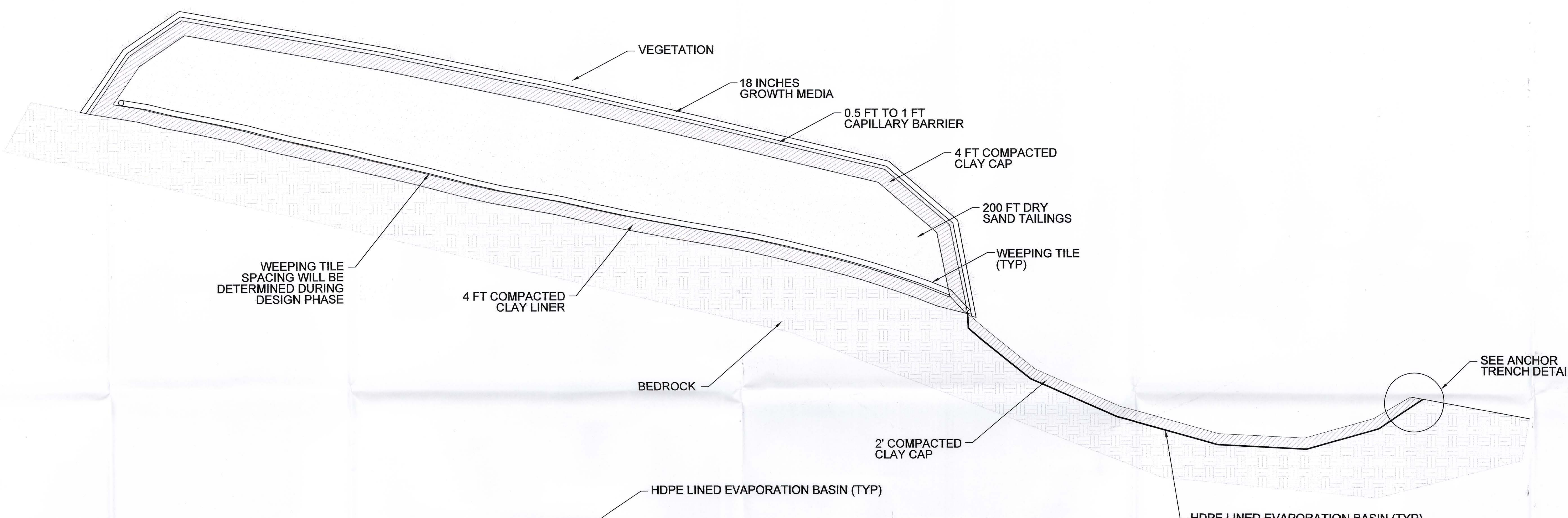
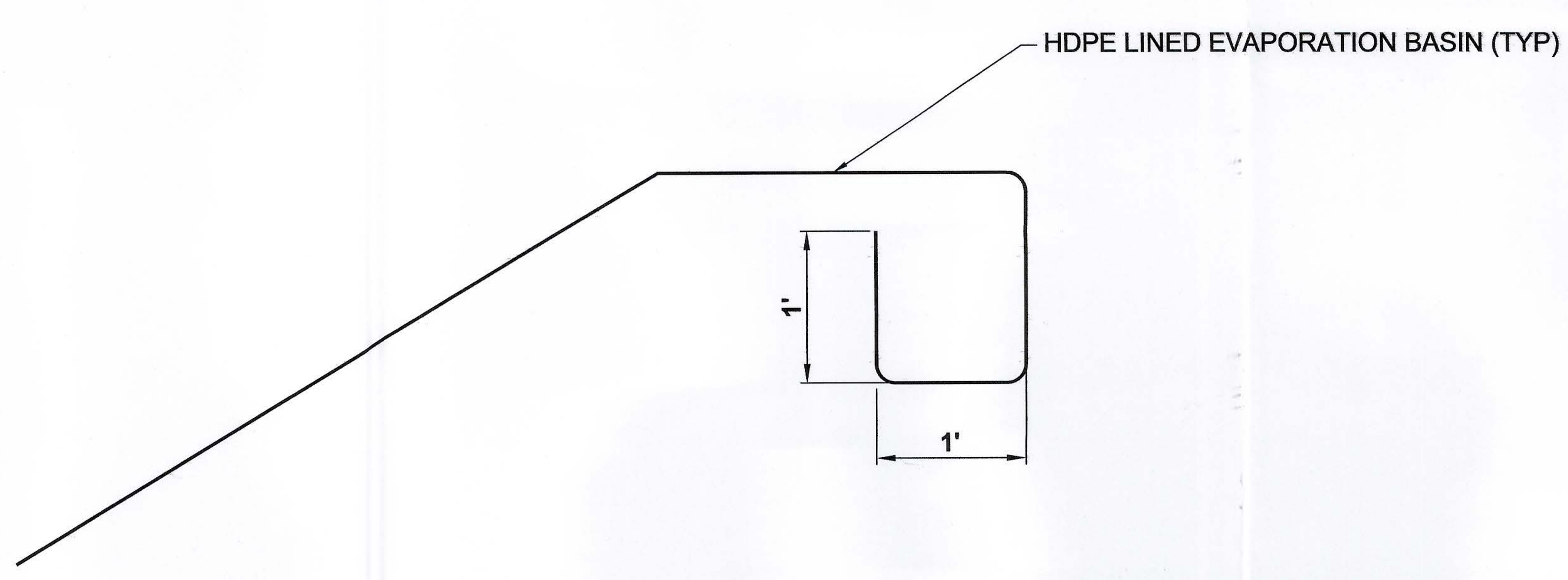
Cheyenne, Wyoming 82007 USA
Phone: 307-638-8833 Fax: 307-638-0578

MAP 7







ANCHOR TRENCH DETAIL

PRELIMINARY FEATURES LAYOUT FOR DESIGN AND ENGINEERING.

"NOT FOR CONSTRUCTION"

SEE MAP 3, TYPICAL CROSS SECTION DRY TAILINGS IMPOUNDMENT (COVER & BASE) FOR LAYOUT AND SCALED CROSS SECTIONS.
SEE MAP 9, TYPICAL CROSS SECTION-DRY TAILINGS IMPOUNDMENT (WEEPING TILE) FOR WEEPING TILE SYSTEM.
NOT TO SCALE-CONCEPT ONLY.

COORDINATE SYSTEM:

UT83-CF
UTAH STATE PLANES: NAD 83 DATUM, CENTRAL ZONE, US FOOT.

N

400 FT 0 400 FT 800 FT

SCALE ACCURATE WHEN PRINTED AT 36"x30"

Professional Certification

No.	REVISION	DATE	BY	CHKD
3	ADDED NOTES	04/16/15	J&L	EDS
2	MODIFIED TAILINGS CONTOURS	01/27/15	J&L	EDS
1	PRLIMINARY	02/19/14	J&L	EDS

American Sands Energy Corp

American Sands Energy Corp.
4760 S. Highland Dr., #341
Salt Lake City, UT 84117

Title: DRY TAILINGS TYPICAL SECTIONS

Scale:	Date:	Design By:	Drawn By:	Approved By:
N/A	02/19/14	MEI	J&L	EDS

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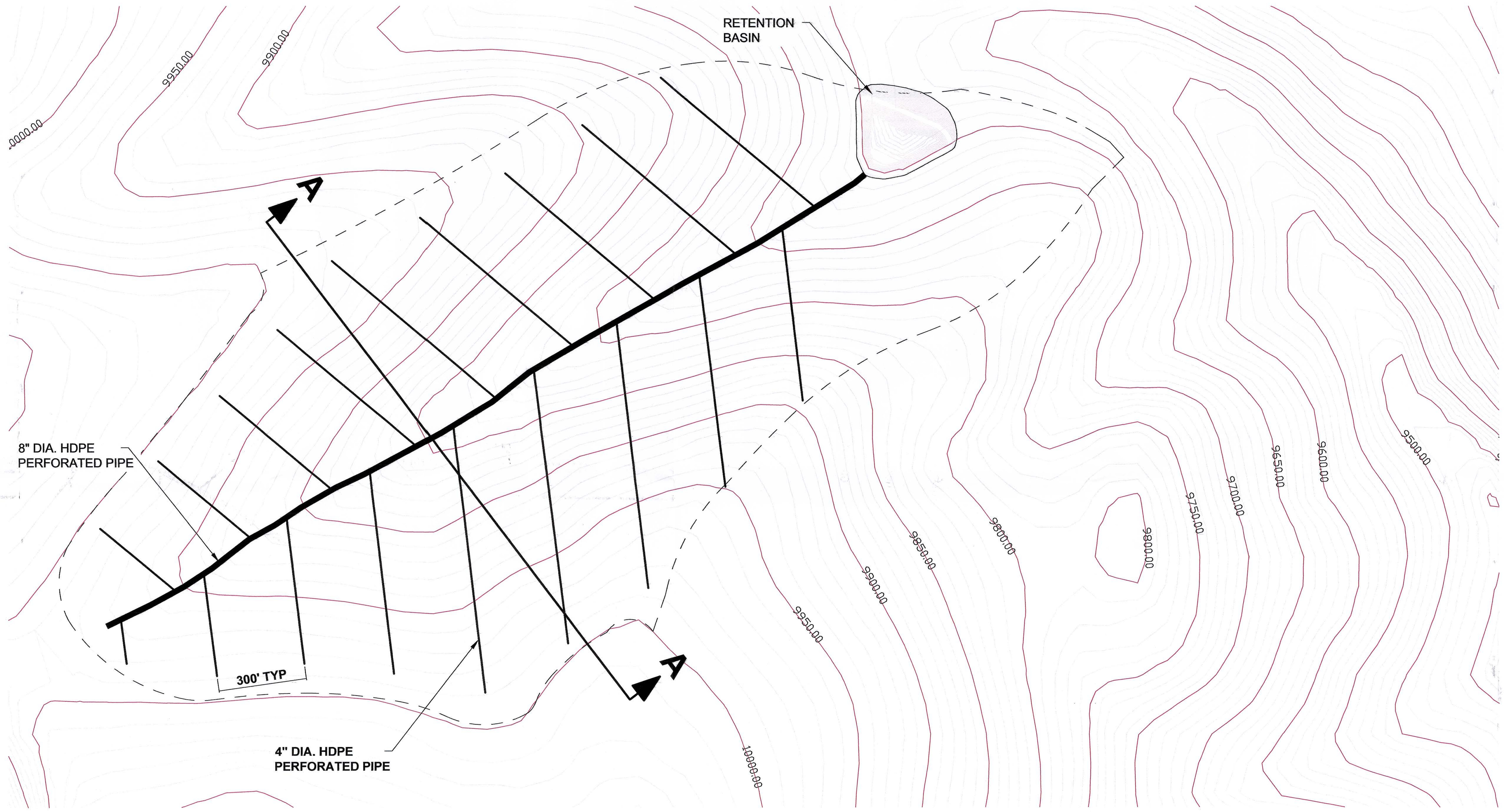
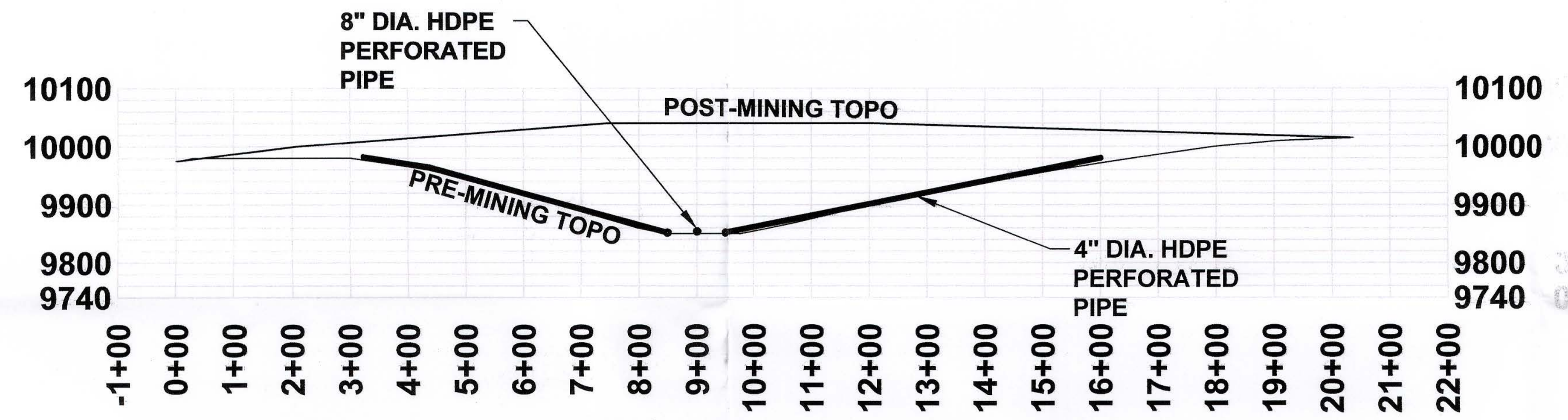
Cheyenne, Wyoming 82007 USA
Phone: 307-638-8833 Fax: 307-638-0578

MAP 8



WEEPING TILE LAYOUT

200 FT 0 200 FT 400 FT



SECTION A-A

400 FT 0 200 FT 400 FT

2H:1V MAXIMUM

LEGEND

- DRY TAILINGS IMPOUNDMENT
- MAJOR CONTOUR SPACING 50 FT
- WEEPING TILE

NOTE:

1. Base to be constructed at 4 feet thick and cover to be constructed at 4 feet thick with compacted clay material to specified permeability. Cover system includes 18 inches of topsoil/plant growth medium placed on the clay cover. Reference "Summary of Preliminary HELP Model Results, American Sands Energy - Bruin Point Mine" by URS, September, 2014.
2. Main line and laterals wrapped in drainage sand with 6" cover, and 2' of stone on either side of pipe centerline.
3. Preliminary conceptual design subject to change during final design.

PRELIMINARY FEATURES LAYOUT FOR DESIGN AND ENGINEERING.

"NOT FOR CONSTRUCTION"

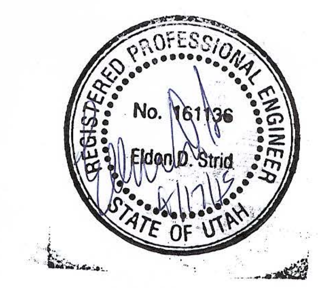
COORDINATE SYSTEM:

UT83-CF
UTAH STATE PLANES: NAD 83 DATUM, CENTRAL ZONE, US FOOT.

N

SCALE ACCURATE WHEN PRINTED AT 24"x36"

Professional Certification



No.	REVISION	DATE	BY	CHKD
6	ADDED NOTE TO LEGEND	04/17/15	J&L	EDS
5	MODIFIED CONTOURS AND X-SECTIONS	01/27/15	J&L	EDS
4	MINOR GENERAL UPDATES	01/23/15	J&L	EDS
3	FINAL	10/16/14	J&L	EDS
2	MODIFIED X-SECTIONS	09/16/14	J&L	EDS
1	PRLIMINARY	02/19/14	J&L	EDS

American Sands Energy Corp

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201 South Main Street
Ste.#1800
Salt Lake City, UT 84111

Title: TYPICAL CROSS SECTION DRY TAILINGS IMPOUNDMENT (WEEPING TILE)

Scale:	Date:	Design By:	Drawn By:	Approved By:
1"=400'	02/19/14	MEI	J&L	EDS

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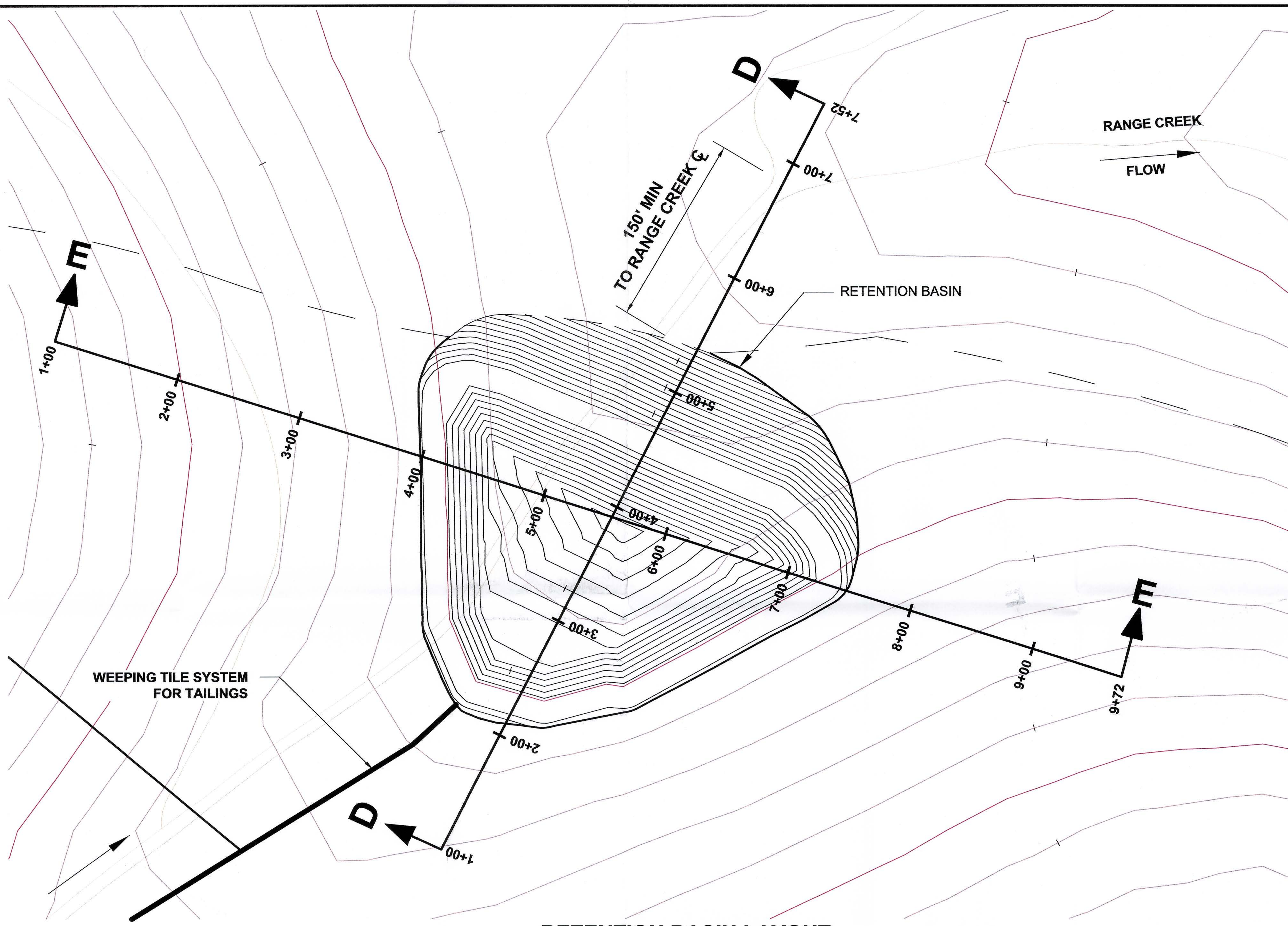
Cheyenne, Wyoming 82007 USA
Phone: 307-638-8833 Fax: 307-638-0578

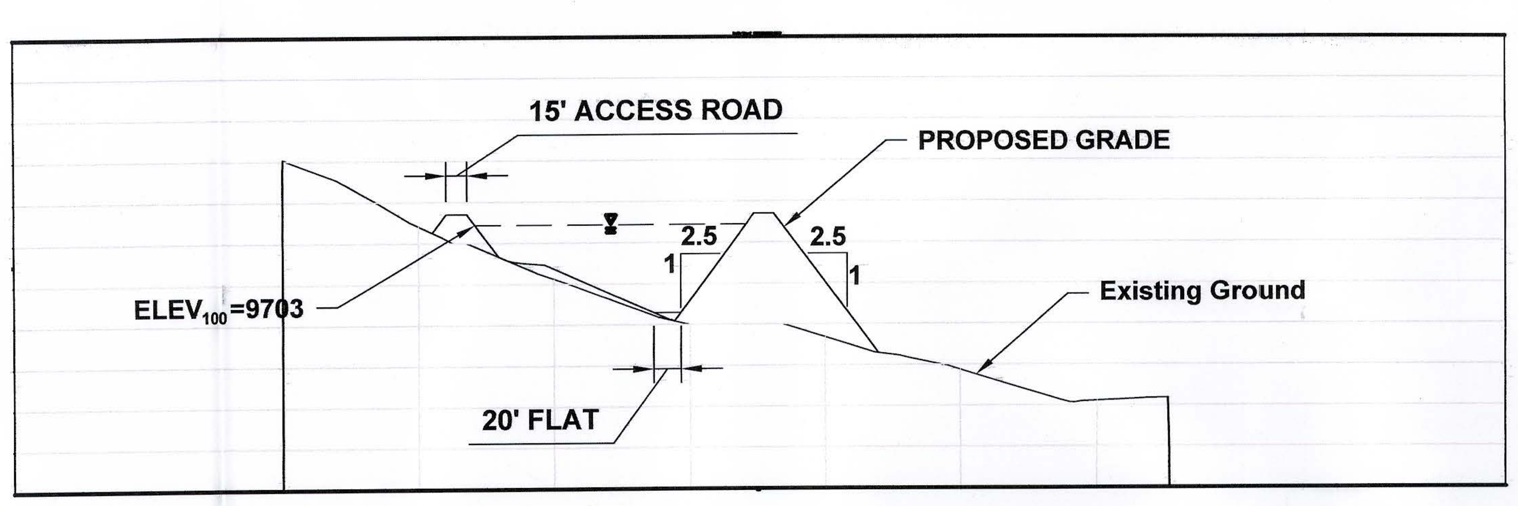
MAP 9

Y:\MEI\MEI Projects\MEI Client Files\American Sands Energy_5-12\Drawings\10-12-12\DRAWINGS\PRELIMINARY DWGS 4-16-15\MAP-9.dwg, 4/17/2015 11:57:21 AM



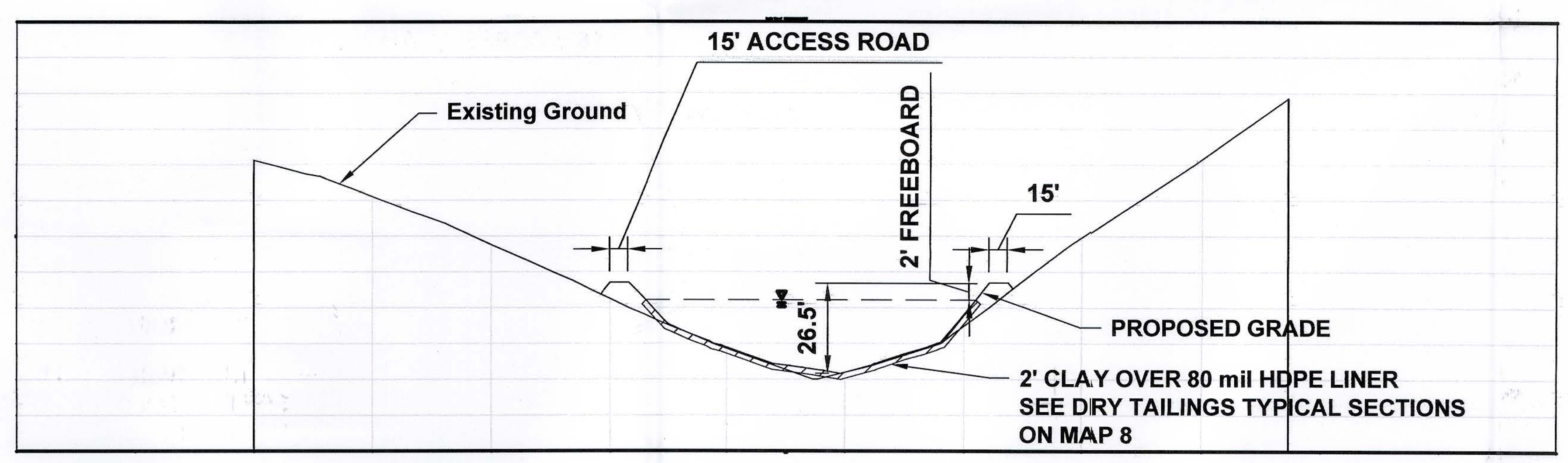
RETENTION BASIN LAYOUT

50 FT 0 50 FT 100 FT



SECTION D-D

100 FT 0 100 FT 200 FT



SECTION E-E

100 FT 0 100 FT 200 FT

LEGEND

DRY TAILINGS IMPOUNDMENT
MAJOR CONTOUR SPACING 50 FT
WEEPING TILE

NOTE:

1. Preliminary conceptual design subject to change during final design.
2. V$_{100}$Yr, 24 HR= 11.0 AC-FT Required.
3. All runoff within tailings footprint to be contained and discharged to retention basin.
4. Best available technology will be used to pump and drain water out of the basin 72 hours after storm event. Water to be used on tailings for dust control.
5. Further investigation is required to ensure recycled water does not circulate back to retention basin. Surplus water that cannot be re-used and eliminated must be hauled away by a licensed contractor. Treatment may be required.
6. Weeping tiles modeling is conceptual and subject to final design.

PRELIMINARY FEATURES LAYOUT
FOR DESIGN AND ENGINEERING
"NOT FOR CONSTRUCTION"

COORDINATE SYSTEM:

UT83-CF
UTAH STATE PLANES: NAD 83 DATUM,
CENTRAL ZONE, US FOOT.

SCALE ACCURATE WHEN PRINTED AT 24"x36"

Professional Certification

REGISTERED PROFESSIONAL ENGINEER No. 161136 Eldon D. Strid STATE OF UTAH

No.	REVISION	DATE	BY	CHKD
1	PRLIMINARY	02/19/14	J&L	EDS

American Sands Energy Corp

American Sands Energy Corp.
201 South Main Street
Ste.#1800
Salt Lake City, UT 84111

Title: TYPICAL SECTIONS (RETENTION BASIN)

Scale:	Date:	Design By:	Drawn By:	Approved By:
	04/01/15	DH	LMR	DH

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1001 South Industrial Road
Cheyenne, Wyoming 82007 USA
Phone: 307-638-8833 Fax: 307-638-0578

MAP 10

LEGEND

- LAND AFFECTED BOUNDARY
- EXISTING ROADS
- DRY TAILINGS IMPOUNDMENT
- MINE ROAD
- ACTIVE
- COVERED

NOTE:

1. PRELIMINARY FEATURES LAYOUT FOR DESIGN AND ENGINEERING. NOT FOR CONSTRUCTION.

COORDINATE SYSTEM:

UT83-CF
UTAH STATE PLANES: NAD 83 DATUM, CENTRAL ZONE, US FOOT.

400 FT 0 400 FT 800 FT

SCALE ACCURATE WHEN PRINTED AT 36"x30"

No.	REVISION	DATE	BY	CHKD
2	MODIFIED TAILINGS COUNTOURS	01/27/15	J&L	EDS
1	PRLIMINARY	02/19/14	J&L	EDS

American Sands Energy Corp

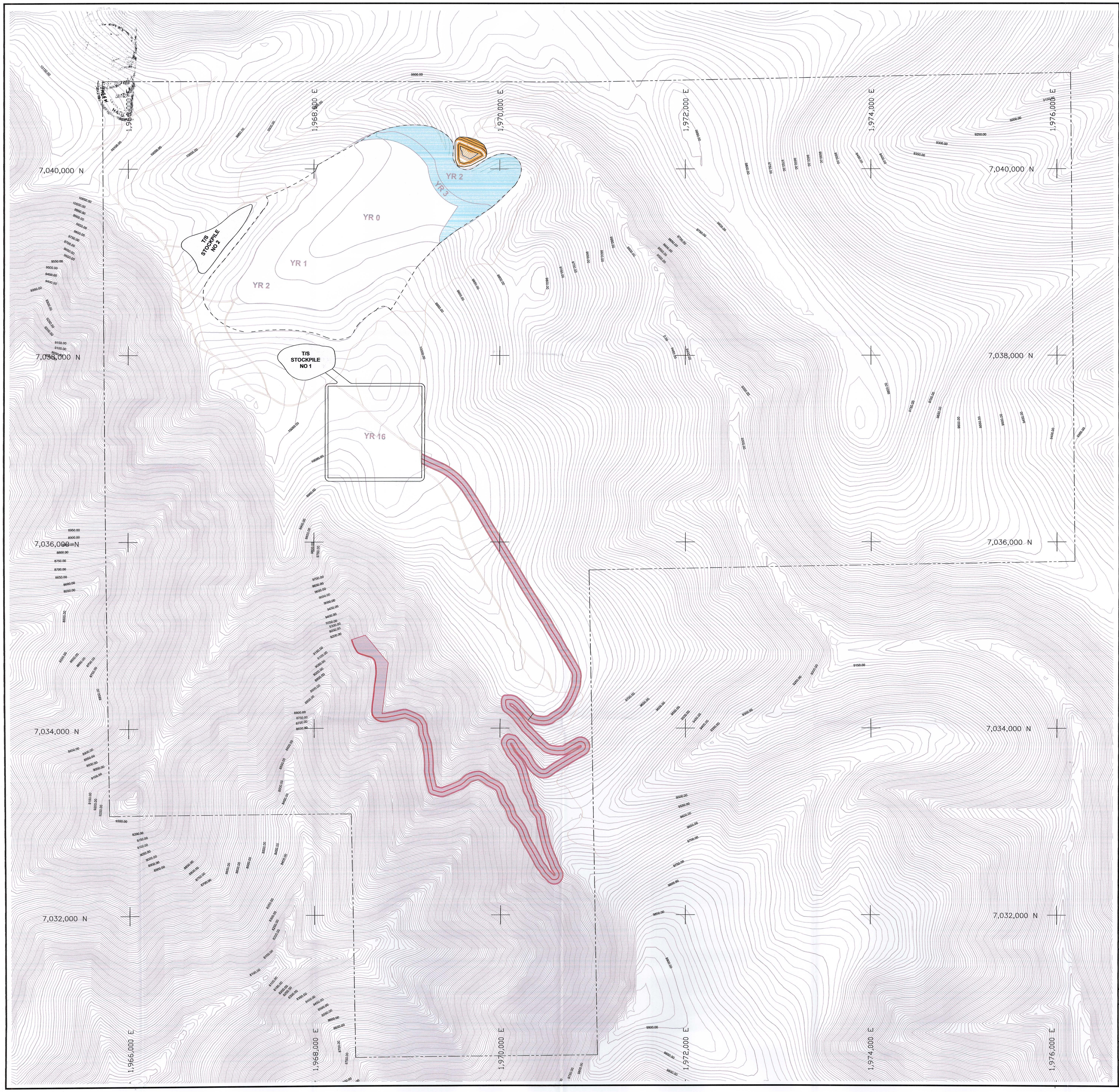
American Sands Energy Corp.
4760 S. Highland Dr., #341
Salt Lake City, UT 84117

Title: DRY TAILINGS IMPOUNDMENT STATUS END OF YEAR 1

Scale:	Date:	Design By:	Drawn By:	Approved By:
1"=400'	02/19/14	MEI	J&L	EDS

MINE ENGINEERS, INC.
3901 South Industrial Road
Cheyenne, Wyoming 82007 USA
Phone: 307-638-8833 Fax: 307-638-0578

MAP . 1



LEGEND

- LAND AFFECTED BOUNDARY
- EXISTING ROADS
- DRY TAILINGS IMPOUNDMENT
- MINE ROAD
- ACTIVE
- COVERED

NOTE:

1. PRELIMINARY FEATURES LAYOUT FOR DESIGN AND ENGINEERING. NOT FOR CONSTRUCTION.

COORDINATE SYSTEM:

UT83-CF
UTAH STATE PLANES: NAD 83 DATUM, CENTRAL ZONE, US FOOT.

REGISTERED PROFESSIONAL ENGINEER
STATE OF UTAH

400 FT 0 400 FT 800 FT

SCALE ACCURATE WHEN PRINTED AT 36"x30"

No.	REVISION	DATE	BY	CHKD
2	MODIFIED TAILINGS COUNTOURS	01/27/15	J&L	EDS
1	PRLIMINARY	02/19/14	J&L	EDS

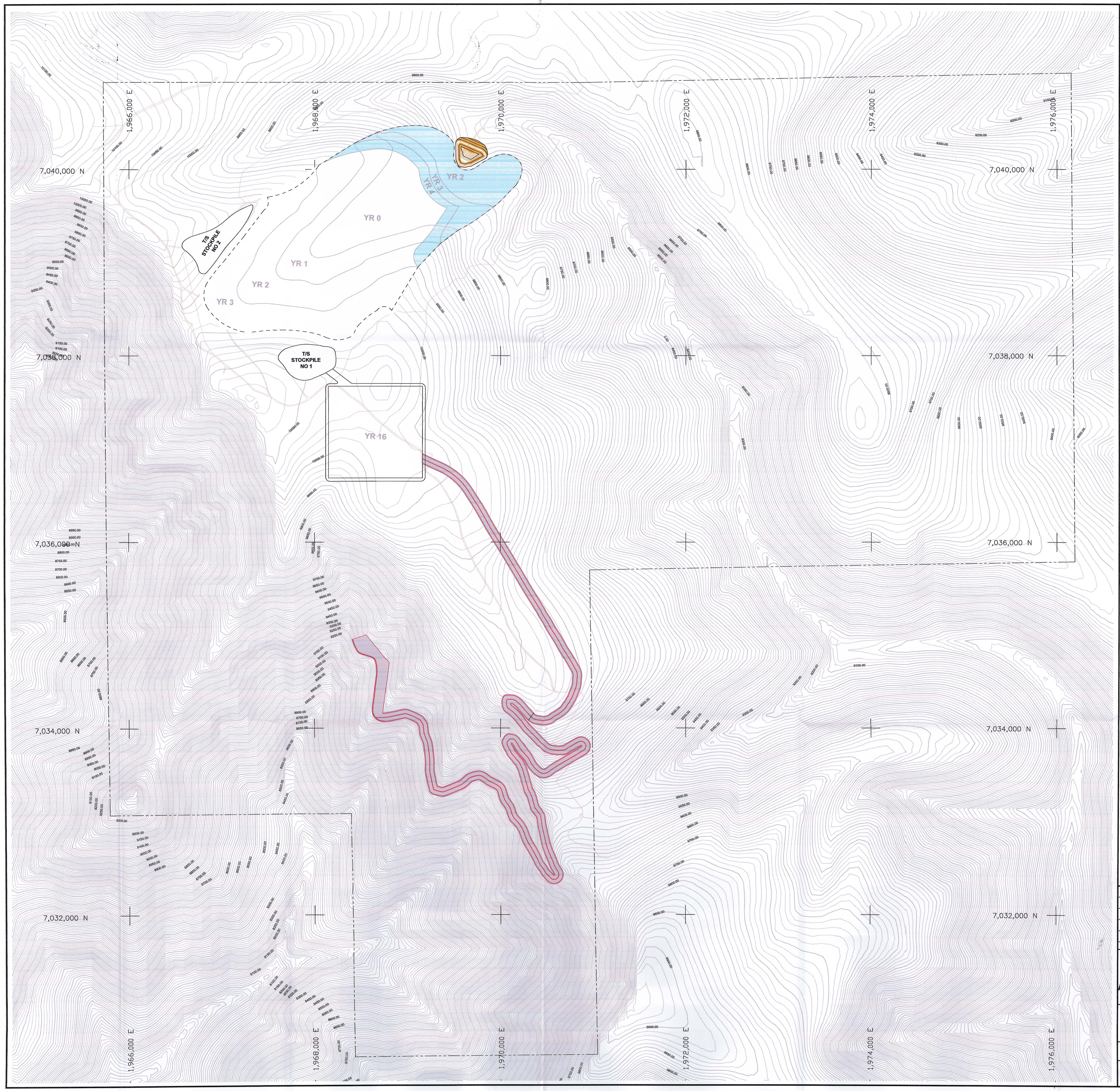
American Sands Energy Corp
American Sands Energy Corp.
4760 S. Highland Dr., #341
Salt Lake City, UT 84117

Title: DRY TAILINGS IMPOUNDMENT STATUS END OF YEAR 2

Scale:	Date:	Design By:	Drawn By:	Approved By:
1"=400'	02/19/14	MEI	J&L	EDS

MINE ENGINEERS, INC.
3901 South Industrial Road
Cheyenne, Wyoming 82007 USA
Phone: 307-638-8833 Fax: 307-638-0578

MAP . 2



LEGEND

- LAND AFFECTED BOUNDARY
- EXISTING ROADS
- DRY TAILINGS IMPOUNDMENT
- MINE ROAD
- ACTIVE
- COVERED

NOTE:

1. PRELIMINARY FEATURES LAYOUT FOR DESIGN AND ENGINEERING. NOT FOR CONSTRUCTION.

COORDINATE SYSTEM:

UT83-CF
UTAH STATE PLANES: NAD 83 DATUM, CENTRAL ZONE, US FOOT.

REGISTERED PROFESSIONAL ENGINEER No. 184136 Ethan D. Strid STATE OF UTAH

400 FT 0 400 FT 800 FT

SCALE ACCURATE WHEN PRINTED AT 36"x30"

No.	REVISION	DATE	BY	CHKD
2	MODIFIED TAILINGS COUNTOURS	01/27/15	J&L	EDS
1	PRLIMINARY	02/19/14	J&L	EDS

American Sands Energy Corp

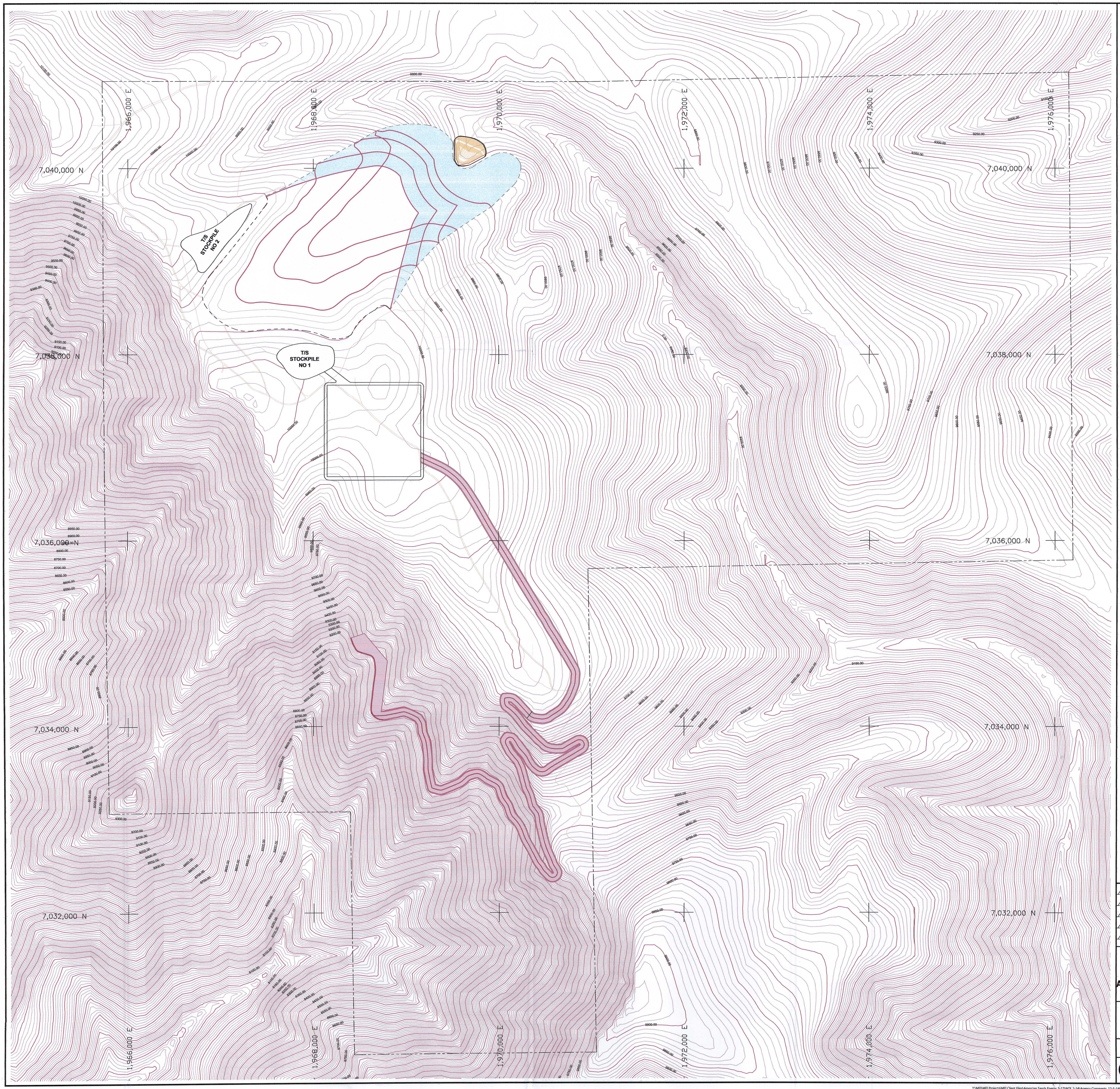
American Sands Energy Corp.
4760 S. Highland Dr., #341
Salt Lake City, UT 84117

Title: DRY TAILINGS IMPOUNDMENT STATUS END OF YEAR 3

Scale:	Date:	Design By:	Drawn By:	Approved By:
1"=400'	02/19/14	MEI	J&L	EDS

MINE ENGINEERS, INC.
3901 South Industrial Road
Cheyenne, Wyoming 82007 USA
Phone: 307-638-8833 Fax: 307-638-0578

MAP . 3



LEGEND

- LAND AFFECTED BOUNDARY
- EXISTING ROADS
- DRY TAILINGS IMPOUNDMENT
- MINE ROAD
- ACTIVE
- COVERED

PRELIMINARY FEATURES LAYOUT
FOR DESIGN AND ENGINEERING
"NOT FOR CONSTRUCTION"

COORDINATE SYSTEM:

UT83-CF
UTAH STATE PLANES: NAD 83 DATUM, CENTRAL ZONE, US FOOT.

400 FT 0 400 FT 800 FT

SCALE ACCURATE WHEN PRINTED AT 36"x30"

No.	REVISION	DATE	BY	CHKD
3	GENERAL REVISIONS	04/17/15	J&L	EDS
2	MODIFIED TAILINGS CONTOURS	01/27/15	J&L	EDS
1	PRLIMINARY	02/19/14	J&L	EDS

American Sands Energy Corp

American Sands Energy Corp.
4760 S. Highland Dr., #341
Salt Lake City, UT 84117

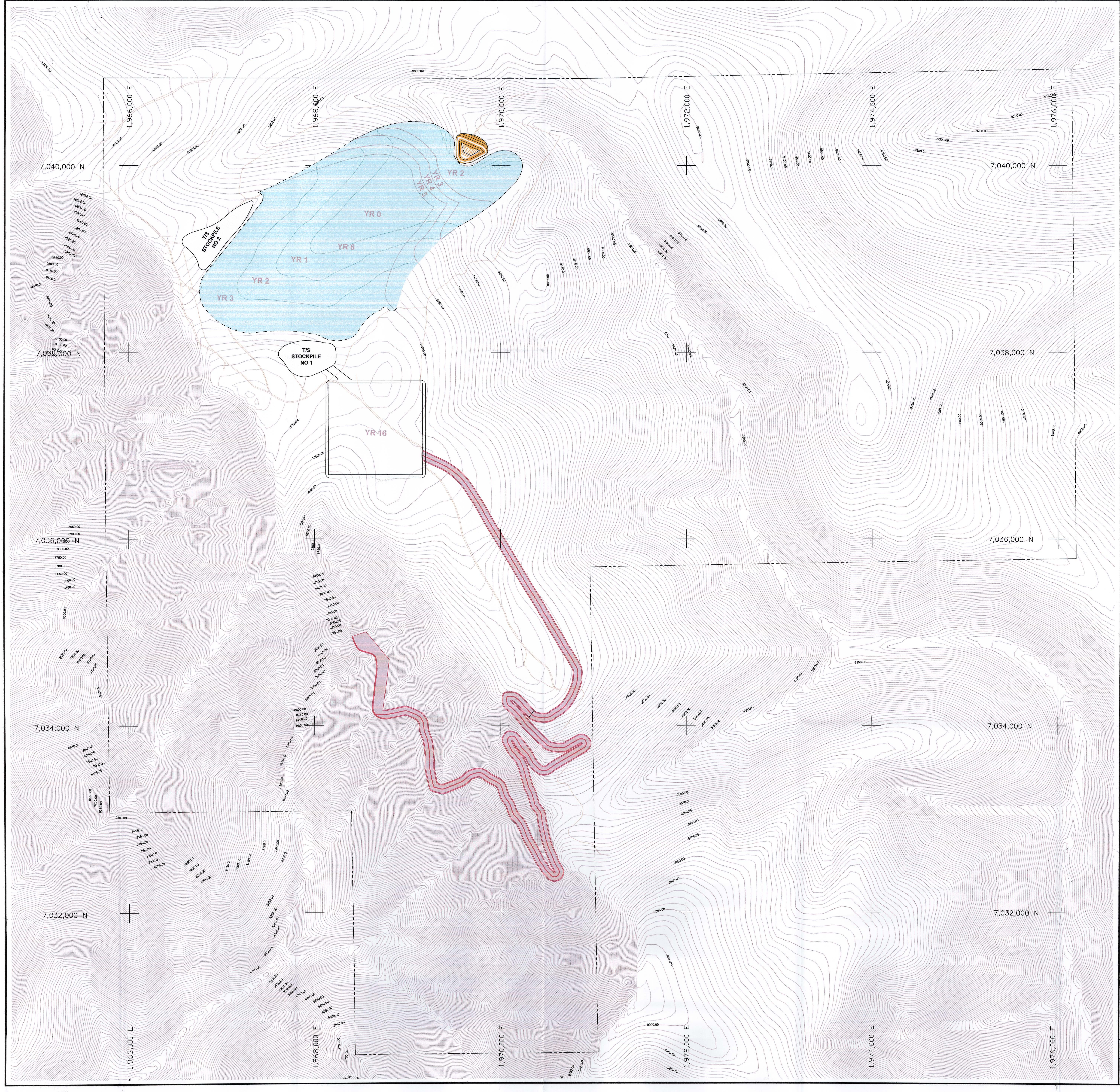
Title: DRY TAILINGS IMPOUNDMENT STATUS END OF YEAR 4

Scale:	Date:	Design By:	Drawn By:	Approved By:
1"=400'	02/19/14	MEI	J&L	EDS

MINE ENGINEERS, INC.
3901 South Industrial Road
Cheyenne, Wyoming 82007 USA
Phone: 307-638-8833 Fax: 307-638-0578

MAP . 4

Comments_12-5-14\Maps_4-15-15\TOPSOIL REMOVAL-REPLACEMENT YR 5 - Standard\TOPSOIL REMOVAL-REPLACEMENT YR 5.dwg, 4/17/2015 5:12:51 PM



LEGEND

- LAND AFFECTED BOUNDARY
- EXISTING ROADS
- DRY TAILINGS IMPOUNDMENT
- MINE ROAD
- ACTIVE
- COVERED

NOTE:

1. PRELIMINARY FEATURES LAYOUT FOR DESIGN AND ENGINEERING. NOT FOR CONSTRUCTION.

COORDINATE SYSTEM:

UT83-CF
UTAH STATE PLANES: NAD 83 DATUM, CENTRAL ZONE, US FOOT.

REGISTERED PROFESSIONAL ENGINEER No. 161136 STATE OF UTAH

400 FT 0 400 FT 800 FT

SCALE ACCURATE WHEN PRINTED AT 36"x30"

No.	REVISION	DATE	BY	CHKD
2	MODIFIED TAILINGS COUNTOURS	01/27/15	J&L	EDS
1	PRLIMINARY	02/19/14	J&L	EDS

American Sands Energy Corp

American Sands Energy Corp.
4760 S. Highland Dr., #341
Salt Lake City, UT 84117

Title: DRY TAILINGS IMPOUNDMENT STATUS END OF YEAR 5

Scale:	Date:	Design By:	Drawn By:	Approved By:
1"=400'	02/19/14	MEI	J&L	EDS

MINE ENGINEERS, INC.
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