



# Board of Adjustment Staff Report

Meeting Date: October 3, 2019

Agenda Item: 8G

SPECIAL USE PERMIT CASE NUMBER:

WSUP19-0015 (Broken Hill Grading)

BRIEF SUMMARY OF REQUEST:

A special use permit for major grading of an area of approximately 2.5 acres to construct an access road to a proposed 325,000 gallon water tank

STAFF PLANNER:

Planner's Name: Julee Olander

Phone Number: 775.328.3627

E-mail: [jolander@washoecounty.us](mailto:jolander@washoecounty.us)

## CASE DESCRIPTION

For possible action, hearing, and discussion to approve a special use permit to allow major grading of an area of approximately 2.5 acres with 8,871 cubic yards of cut and 7,680 cubic yards of fill to construct a paved 1,600 foot long access road to a proposed 325,000 gallon water tank.

Applicant/ Property Owner: Barker-Coleman Investments

Location: off Kinglet Drive in the common area of the Broken Hills subdivision

APN: 089-621-01

Parcel Size: 249.8 acres

Master Plan: Suburban Residential (SR) & Rural (R)

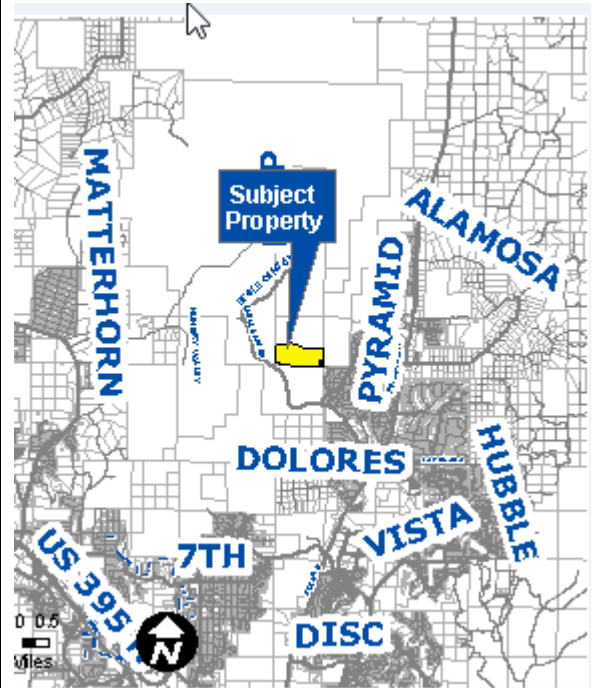
Regulatory Zone: Low Density Suburban (LDS) & General Rural (GR)

Area Plan: Spanish Springs

Citizen Advisory Board: Spanish Springs

Development Code: Authorized in Article 438, Grading and Article 810, Special Use Permits

Commission District: 4 – Commissioner Hartung



## STAFF RECOMMENDATION

APPROVE

**APPROVE WITH CONDITIONS**

DENY

## POSSIBLE MOTION

I move that, after giving reasoned consideration to the information contained in the staff report and information received during the public hearing, the Washoe County Board of Adjustment approve with conditions Special Use Permit Case Number WSUP19-0015 for Barker-Coleman Investments, having made all four findings in accordance with Washoe County Code Section 110. 810. 30

*(Motion with Findings on Page 7)*

**Staff Report Contents**

Special Use Permit.....3

Site Plan.....4

Project Evaluation .....4

Grading Plan .....5

Spanish Springs Citizen Advisory Board (SS CAB) .....6

Reviewing Agencies .....6

Staff Comment on Required Findings.....7

Recommendation .....7

Motion .....7

Appeal Process .....8

---

**Exhibits Contents**

Conditions of Approval .....Exhibit A

Agency Review Letters.....Exhibit B

Noticing Map .....Exhibit C

Project Application.....Exhibit D

**Special Use Permit**

The purpose of a special use permit is to allow a method of review to identify any potential harmful impacts on adjacent properties or surrounding areas for uses that may be appropriate within a regulatory zone; and to provide for a procedure whereby such uses might be permitted by further restricting or conditioning them so as to mitigate or eliminate possible adverse impacts. If the Board of Adjustment grants an approval of the special use permit, that approval is subject to conditions of approval. Conditions of approval are requirements that need to be completed during different stages of the proposed project. Those stages are typically:

- Prior to permit issuance (i.e. a grading permit, a building permit, etc.)
- Prior to obtaining a final inspection and/or a certificate of occupancy on a structure
- Prior to the issuance of a business license or other permits/licenses
- Some Conditions of Approval are referred to as “operational conditions.” These conditions must be continually complied with for the life of the business or project.

The conditions of approval for Special Use Permit Case Number WSUP19-0015 are attached to this staff report and will be included with the action order, if approved.

The subject property is designated as Low Density Suburban (LDS) and General Rural (GR). The proposed grading is permitted with a special use permit per WCC 110.438. Therefore, the applicant is seeking approval of this SUP from the Board of Adjustment.



### Site Plan

#### Project Evaluation

The applicant is requesting to grade an area of a 249.8 acre parcel to construct an access roadway to a proposed 325,000 gallon water tank. The water tank will serve the Broken Hill development, an approved 170 unit single family common open space development. The tank will be approximately 100 feet above the highest residential lot, which will allow the required pressure to the housing units. The tank was originally located farther west, however it has moved to meet Truckee Meadow Water Authority (TMWA) requirements. The site is currently vacant and the BLM owns the parcel to the east and the Indian Tribal Lands own the parcel to the west and south. The parcel to the north is privately owned with a regulatory zoning of General Rural (GR) on 99% and Low Density Suburban (LDS) on 1%.

The area of the 249.8 acre parcel to be graded is 2.5 acres: 2 acres for the roadway and 0.5 acres for the proposed water tank. There will be 8,871 cubic yards of cut and 7,680 cubic yards of fill. The grading will be balanced on site and there will be no import or export of material. There are slopes that are 2:1, which are allowed per Washoe County code when the property is over 5 acres and the slope is more than 100 feet from the property line and the grading for this site meets those requirements (See grading plan on page 5).

The roadway will be approximately 1,600 feet long, paved with asphalt and gated at the cul-de-sac. The road will be 22-feet wide with a 1-foot shoulder on each side and a 60-foot roadway easement that will be dedicated to TMWA or the Broken Hill homeowners association. There will be V-ditches adjacent to the roadway on the south side where the grading is proposed.



A building/grading permit will be submitted for the water tank and road, if the special use permit for the proposed grading is approved. A 6 foot fence will be installed around the area where the tank will be located and the disturbed area will be revegetated.

### **Spanish Springs Citizen Advisory Board (SS CAB)**

The proposed project was presented by the applicant's representative at the regularly scheduled Citizen Advisory Board meeting on September 4, 2019 and the CAB voted to recommend approval of the permit. The CAB minutes were not available at the time that the staff report was prepared. The discussion on the item including the following topics:

- Location of the roadway and visibility
- Motorcycles in the area

### **Reviewing Agencies**

The following agencies received a copy of the project application for review and evaluation.

- Washoe County Community Services Department
  - Planning and Building Division
  - Engineering and Capital Projects Division
  - Utilities/Water Rights
  - Parks and Open Spaces
- Washoe County Health District
  - Air Quality
  - Environmental Health Services Division
- Truckee Meadows Fire Protection District
- Bureau of Indian Affairs
- US Army Corps of Engineers
- State of Nevada
  - Environmental Protection
  - Department of Wildlife
  - Department of Forestry

The following agencies/departments provided comments and/or recommended conditions of approval in response to their evaluation of the project application:

- Washoe County Planning and Building Division addressed the construction plans and revegetation for the project.  
**Contact: Julee Olander, 775.328.3627, [jolander@washoecounty.us](mailto:jolander@washoecounty.us)**
- Washoe County Engineering and Capital Projects Division addressed the requirement for complete construction drawings, grading requirements and other features associated with the project.  
**Contact: Leo Vesely, 775.328.2313, [lvesely@washoecounty.us](mailto:lvesely@washoecounty.us)**
- Washoe County Health District addressed the requirement for a dust permit.  
**Contact: Michael Wolfe, 775.784.7206, [lmwolfe@washoecounty.us](mailto:lmwolfe@washoecounty.us)**

The conditions of approval document is attached to this staff report and will be included with the action order, if approved.

### **Staff Comment on Required Findings**

WCC Section 110.810.30, Article 810, *Special Use Permits*, requires that all of the following findings be made to the satisfaction of the Washoe County Board of Adjustment before granting approval of the request. Staff has completed an analysis of the special use permit application and has determined that the proposal is in compliance with the required findings as follows.

1. Consistency. That the proposed use is consistent with the action programs, policies, standards and maps of the Master Plan and the Spanish Springs Area Plan.

*Staff Comment: The proposed use is consistent with the Policies and Action Programs included in the Spanish Springs Area Plan.*

2. Improvements. That adequate utilities, roadway improvements, sanitation, water supply, drainage, and other necessary facilities have been provided, the proposed improvements are properly related to existing and proposed roadways, and an adequate public facilities determination has been made in accordance with Division Seven.

*Staff Comment: The grading project will allow for the establish of a water tank for the area, which will provided the necessary improvements for the area. The proposed project was reviewed by relevant agencies and no conditions were received regarding additional required improvements.*

3. Site Suitability. That the site is physically suitable for the storage of operable vehicles and for the intensity of such a development.

*Staff Comment: The proposed grading will make the site suitable for proposed water tank.*

4. Issuance Not Detrimental. That issuance of the permit will not be significantly detrimental to the public health, safety or welfare; injurious to the property or improvements of adjacent properties; or detrimental to the character of the surrounding area.

*Staff Comment: The site is currently vacant and the proposed project is anticipated to have minimal impact to the surrounding area and conditions of approval have been included to mitigate any negative potential impacts.*

5. Effect on a Military Installation. Issuance of the permit will not have a detrimental effect on the location, purpose or mission of the military installation.

*Staff Comment: There is no military installation within the area of required notice for this special use permit; therefore, the project will have no effect on a military installation.*

### **Recommendation**

Those agencies which reviewed the application recommended conditions in support of approval of the project. Therefore, after a thorough analysis and review, Special Use Permit Case Number WSUP19-0015 is being recommended for approval with conditions. Staff offers the following motion for the Board's consideration.

### **Motion**

I move that, after giving reasoned consideration to the information contained in the staff report and information received during the public hearing, the Washoe County Board of Adjustment approve with conditions Special Use Permit Case Number WSUP19-0015 for Barker-Coleman Investments, having made all five findings in accordance with Washoe County Code Section 110.810.30:

1. Consistency. That the proposed use is consistent with the action programs, policies, standards and maps of the Master Plan and the Spanish Springs Area Plan;

2. Improvements. That adequate utilities, roadway improvements, sanitation, water supply, drainage, and other necessary facilities have been provided, the proposed improvements are properly related to existing and proposed roadways, and an adequate public facilities determination has been made in accordance with Division Seven;
3. Site Suitability. That the site is physically suitable for proposed grading and for the intensity of such a development;
4. Issuance Not Detrimental. That issuance of the permit will not be significantly detrimental to the public health, safety or welfare; injurious to the property or improvements of adjacent properties; or detrimental to the character of the surrounding area;
5. Effect on a Military Installation. Issuance of the permit will not have a detrimental effect on the location, purpose or mission of the military installation.

**Appeal Process**

Board of Adjustment action will be effective 10 calendar days after the written decision is filed with the Secretary to the Board of Adjustment and mailed to the applicant, unless the action is appealed to the Washoe County Board of County Commissioners, in which case the outcome of the appeal shall be determined by the Washoe County Board of County Commissioners. Any appeal must be filed in writing with the Planning and Building Division within 10 calendar days from the date the written decision is filed with the Secretary to the Board of Adjustment and mailed to the applicant.

Applicant/Owner: Barker-Coleman Investments  
3675 Lakeside Drive, Suite B  
Reno, NV 89509

Representatives: Matzoll Development Consultants  
3675 Lakeside Drive, Suite B  
Reno, NV 89509

email: kmatzoll@mdc-krush.com





# Conditions of Approval

Special Use Permit Case Number WSUP19-0015

The project approved under special use permit Case Number WSUP19-0015 shall be carried out in accordance with the conditions of approval granted by the Board of Adjustment on October 3, 2019. Conditions of approval are requirements placed on a permit or development by each reviewing agency. These conditions of approval may require submittal of documents, applications, fees, inspections, amendments to plans, and more. These conditions do not relieve the applicant of the obligation to obtain any other approvals and licenses from relevant authorities required under any other act.

**Unless otherwise specified**, all conditions related to the approval of this special use permit shall be met or financial assurance must be provided to satisfy the conditions of approval prior to issuance of a grading or building permit. The agency responsible for determining compliance with a specific condition shall determine whether the condition must be fully completed or whether the applicant shall be offered the option of providing financial assurance. All agreements, easements, or other documentation required by these conditions shall have a copy filed with the County Engineer and the Planning and Building Division.

Compliance with the conditions of approval related to this special use permit is the responsibility of the applicant, his/her successor in interest, and all owners, assignees, and occupants of the property and their successors in interest. Failure to comply with any of the conditions imposed in the approval of the special use permit may result in the institution of revocation procedures.

Washoe County reserves the right to review and revise the conditions of approval related to this Special Use Permit should it be determined that a subsequent license or permit issued by Washoe County violates the intent of this approval.

For the purpose of conditions imposed by Washoe County, “may” is permissive and “shall” or “must” is mandatory.

Conditions of Approval are usually complied with at different stages of the proposed project. Those stages are typically:

- Prior to permit issuance (i.e., grading permits, building permits, etc.).
- Prior to obtaining a final inspection and/or a certificate of occupancy.
- Prior to the issuance of a business license or other permits/licenses.
- Some “conditions of approval” are referred to as “operational conditions.” These conditions must be continually complied with for the life of the project or business.

**The Washoe County Commission oversees many of the reviewing agencies/departments with the exception of the following agencies.**

- **The DISTRICT BOARD OF HEALTH, through the Washoe County Health District, has jurisdiction over all public health matters in the Health District. Any conditions set by the Health District must be appealed to the District Board of Health.**

FOLLOWING ARE CONDITIONS OF APPROVAL REQUIRED BY THE REVIEWING AGENCIES. EACH CONDITION MUST BE MET TO THE SATISFACTION OF THE ISSUING AGENCY.

**Washoe County Planning and Building Division**

1. The following conditions are requirements of Planning and Building, which shall be responsible for determining compliance with these conditions.

**Contact Name – Julee Olander, 775.328.3627, jolander@washoecounty.us**

- a. The applicant shall attach a copy of the action order approving this project to all administrative permit applications (including building permits) applied for as part of this special use permit.
- b. The applicant shall demonstrate substantial conformance to the plans approved as part of this special use permit. The Planning and Building Division shall determine compliance with this condition.
- c. The applicant shall submit complete construction plans and building permits shall be issued within two years from the date of approval by Washoe County. The applicant shall complete construction within the time specified by the building permits. Compliance with this condition shall be determined by the Planning and Building Division.
- d. All trash and similar debris within the project area shall be removed.
- e. All areas disturbed by grading activities shall be revegetated and/or landscaped.
- f. A note shall be placed on all construction drawings and grading plans stating:

NOTE

Should any cairn or grave of a Native American be discovered during site development, work shall temporarily be halted at the specific site and the Sheriff's Office as well as the State Historic Preservation Office of the Department of Conservation and Natural Resources shall be immediately notified per NRS 383.170.

- g. The following **Operational Conditions** shall be required for the life of the
  - i. Failure to comply with the conditions of approval shall render this approval null and void. Compliance with this condition shall be determined by Planning and Building.

**Washoe County Engineering and Capital Projects**

2. The following conditions are requirements of the Engineering Division, which shall be responsible for determining compliance with these conditions.

**Contact Name – Leo Vesely, P.E., (775) 328-2041, lvesely@washoecounty.us**

- a. A complete set of construction improvement drawings, including an on-site grading plan, shall be submitted when applying for a building/grading permit. Grading shall comply with best management practices (BMPs) and shall include detailed plans for grading, site drainage, erosion control (including BMP locations and installation details), slope stabilization, and mosquito abatement. Placement or removal of any excavated materials shall be indicated on the grading plan. Silts shall be controlled on-site and not allowed onto adjacent property.

- b. For construction areas larger than 1 acre, the developer shall obtain a Stormwater Discharge Permit from the Nevada Division of Environmental Protection and submit a copy to the Engineering Division prior to issuance of a grading permit.
- c. For construction areas larger than 1 acre, the developer shall complete and submit the Construction Permit Submittal Checklist and pay the Construction Stormwater Inspection Fee prior to obtaining a grading permit. The County Engineer shall determine compliance with this condition.
- d. All cut slopes and fill slopes shall be setback from parcel lines and access easements in accordance with Washoe County Code Article 438.
- e. All cut slopes and fill slopes shall be in accordance with Washoe County Code Article 438.
- f. The applicant shall provide permanent easements to the tank area, access and any required utilities. A copy of the recorded easements shall be submitted to the Engineering Division prior to issuance of a building permit.
- g. All existing and proposed easements shall be shown on the site and/or grading plan.
- h. A grading bond of \$2,000/acre of disturbed area shall be provided to the Engineering Division prior to approval of the building or grading permit.
- i. Appropriate drainage facilities for tank overflow and drainage shall be extended to a natural or improved drainage system.
- j. All disturbed areas left undeveloped for more than 30 days shall be treated with a dust palliative. Disturbed areas left undeveloped for more than 45 days shall be revegetated or mechanically stabilized. Methods and seed mix must be designed by a licensed landscape architect and approved by the County Engineer.

**Washoe County Health District**

- 3. The following conditions are requirements of the Health District, which shall be responsible for determining compliance with these conditions.

**Contact Name – Michael Wolfe, (775) 784-7206, mwolfe@washoecounty.us**

- a. A dust control permit will be obtained from Washoe County Health District.

\*\*\* End of Conditions \*\*\*



# WASHOE COUNTY

## COMMUNITY SERVICES DEPARTMENT

### Engineering and Capital Projects

1001 EAST 9<sup>TH</sup> STREET  
 PO BOX 11130  
 RENO, NEVADA 89520-0027  
 PHONE (775) 328-3600  
 FAX (775) 328.3699

Date: August 28, 2019

To: Julee Olander, Planner

From: Leo Vesely, P.E., Licensed Engineer

Re: Special Use Permit Case **WSUP19-0015 – Broken Hills Tank Grading**

APN 089-621-01

#### GENERAL PROJECT DISCUSSION

Washoe County Engineering staff has reviewed the above referenced application. The Special Use Permit is for the grading required for a future TMWA water tank. The Engineering and Capital Projects Division recommends approval with the following comments and conditions of approval which supplement applicable County Code and are based upon our review of the site and the application prepared by Matzoll Development Consultants, LLC. The County Engineer shall determine compliance with the following conditions of approval.

For questions related to sections below, please see the contact name provided.

#### GENERAL CONDITIONS

Contact Information: Leo Vesely, P.E. (775) 328-2041

1. A complete set of construction improvement drawings, including an on-site grading plan, shall be submitted when applying for a building/grading permit. Grading shall comply with best management practices (BMPs) and shall include detailed plans for grading, site drainage, erosion control (including BMP locations and installation details), slope stabilization, and mosquito abatement. Placement or removal of any excavated materials shall be indicated on the grading plan. Silts shall be controlled on-site and not allowed onto adjacent property.
2. For construction areas larger than 1 acre, the developer shall obtain a Stormwater Discharge Permit from the Nevada Division of Environmental Protection and submit a copy to the Engineering Division prior to issuance of a grading permit.
3. For construction areas larger than 1 acre, the developer shall complete and submit the Construction Permit Submittal Checklist and pay the Construction Stormwater Inspection Fee prior to obtaining a grading permit. The County Engineer shall determine compliance with this condition.
4. All cut slopes and fill slopes shall be setback from parcel lines and access easements in accordance with Washoe County Code Article 438.
5. All cut slopes and fill slopes shall be 3:1 or flatter in accordance with Washoe County Code Article 438.
6. The applicant shall provide permanent easements to the tank area, access and any required utilities. A copy of the recorded easements shall be submitted to the Engineering Division prior to issuance of a building permit.



**INTEGRITY**



**EFFECTIVE COMMUNICATION**



**QUALITY PUBLIC SERVICE**

Subject: **WSUP19-0015 – Broken Hills Tank Grading**

Date: August 28, 2019

Page: 2

7. All existing and proposed easements shall be shown on the site and/or grading plan.
8. A grading bond of \$2,000/acre of disturbed area shall be provided to the Engineering Division prior to approval of the building or grading permit.
9. Appropriate drainage facilities for tank overflow and drainage shall be extended to a natural or improved drainage system.
10. All disturbed areas left undeveloped for more than 30 days shall be treated with a dust palliative. Disturbed areas left undeveloped for more than 45 days shall be revegetated or mechanically stabilized. Methods and seed mix must be designed by a licensed landscape architect and approved by the County Engineer.

**From:** [Fagan, Donna](#)  
**To:** [Bronczyk, Christopher](#); [Olander, Julee](#); [Pelham, Roger](#); [Kirschenman, Sophia](#)  
**Subject:** Fw: August Agency Review Memo IV  
**Date:** Thursday, August 22, 2019 11:46:56 AM  
**Attachments:** [image006.jpg](#)  
[image007.png](#)  
[image008.png](#)  
[image009.png](#)  
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[Outlook-3suxafb0.png](#)  
[Outlook-4yim3ta1.png](#)  
[Outlook-1gf25ltx.png](#)

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Chris, Julee, Roger, and Sophia,

Comments for:

#1 = WSUP19-0014  
#2 = WSUP19-0015  
#3 = WSUP19-0016  
#4 = WSUP19-0017  
#6 = WSUP19-0019

Thanks...Donna



**Donna Fagan**  
**Planning and Building Division | Community Services Department**  
dfagan@washoecounty.us | Office: 775.328.3616  
1001 E 9th Street, Reno, NV 89512-2845



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**From:** Wolf, Mike <MWolf@washoecounty.us>  
**Sent:** Thursday, August 22, 2019 8:55 AM  
**To:** Fagan, Donna <DFagan@washoecounty.us>  
**Subject:** RE: August Agency Review Memo IV

1-4 and 6 will require dust control permits

**Michael Wolf, CEM**

Permitting and Enforcement Branch Chief | Air Quality Management Division | Washoe County Health District

[mwolf@washoecounty.us](mailto:mwolf@washoecounty.us) | O: (775) 784-7206 | 1001 E. Ninth St., Bldg. B, Reno, NV 89512

[OurCleanAir.com](http://OurCleanAir.com)



Please consider the environment before printing this e-mail

**WSUP19-0015**  
**EXHIBIT B**



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**From:** Fagan, Donna  
**Sent:** Wednesday, August 21, 2019 3:48 PM  
**To:** Wolf, Mike; English, James; Rubio, Wesley S; Dayton, Brittany  
**Cc:** Coon, Don; Health – EHS Front Desk  
**Subject:** August Agency Review Memo IV

Mike, Jim, Wes, and Brittany,

Please find the attached Agency Review Memo with a case received this month by CSD, Planning and Building.

You've been asked to review the items as indicated below. Click on the highlighted item descriptions for a link to the application.

**Mike:** Items #1 thru #6

**Jim/Wes:** Items #1 thru #6

**Brittany:** Items #3, #4, and #6

Please send any comments or conditions to the planner for that item.

Thank you,  
Donna



**Donna Fagan**  
Planning and Building Division| Community Services Department  
[dfagan@washoecounty.us](mailto:dfagan@washoecounty.us) | Office: 775.328.3616  
1001 E. 9<sup>th</sup> Street, Reno, NV 89521



**From:** [Thomason, Jennifer C CIV USARMY CESPK \(USA\)](#)  
**To:** [Olander, Julee](#)  
**Subject:** Special Use Permit Case Number WSUP19-0015 (Broken Hills Grading) (UNCLASSIFIED)  
**Date:** Tuesday, September 03, 2019 8:35:52 AM

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[**NOTICE:** This message originated outside of Washoe County -- **DO NOT CLICK** on **links** or open **attachments** unless you are sure the content is safe.]

CLASSIFICATION: UNCLASSIFIED

Hi Julee,

In response to the notice received by our office, we offer the following comment on the subject project:

Please be advised that the U.S. Army Corps of Engineers, through the Regulatory Program, administers and enforces Section 10 of the Rivers and Harbors Act of 1899 (RHA) and Section 404 of the Clean Water Act (CWA). Under RHA Section 10, a permit is required for work or structures in, over or under navigable waters of the United States. Under CWA Section 404, a permit is required for the discharge of dredged or fill material into waters of the United States. If waters of the U.S. are located on the property, a permit from our office may be required. More information regarding our regulatory program and how to identify "waters of the U.S." is available on our website at, <http://www.spk.usace.army.mil/Missions/Regulatory.aspx>. If you have any questions you can contact me at the number below or by email.

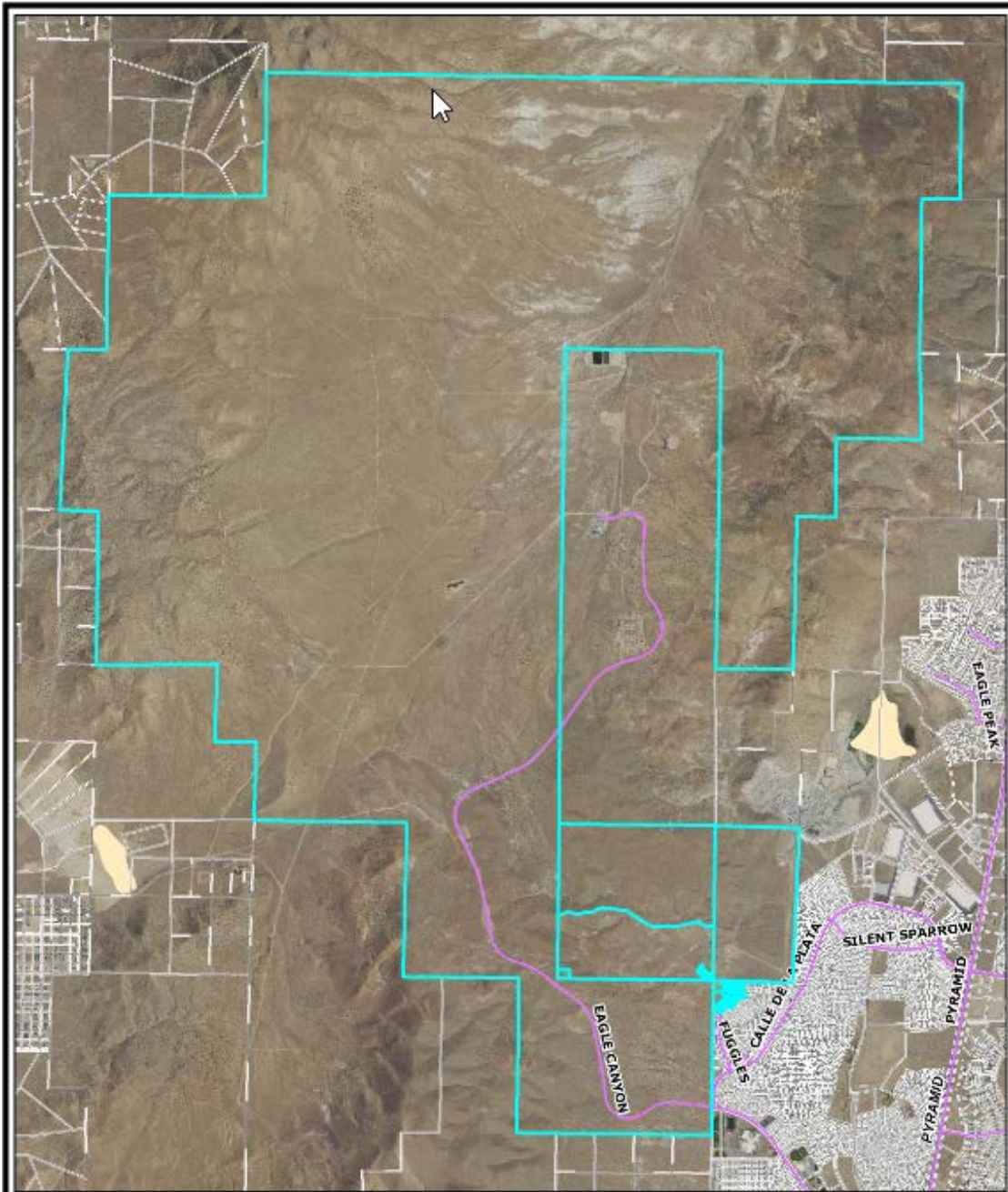
Jennifer C. Thomason  
Senior Project Manager  
US Army Corps of Engineers, Sacramento District  
Reno Regulatory Field Office  
300 Booth Street, Room 3050  
Reno, NV 89509-1361  
(775) 784-5304

\*Upcoming Leave: September 23-27, 2019

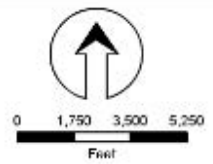
Let us know how we're doing. Please complete the survey at:  
[http://corpsmapu.usace.army.mil/cm\\_apex/f?p=regulatory\\_survey](http://corpsmapu.usace.army.mil/cm_apex/f?p=regulatory_survey)

CLASSIFICATION: UNCLASSIFIED





WADMIN19-0015 Broken Hills grading  
 Noticing Map- 1,000 feet



Community Services  
 Department

**WASHOE COUNTY**  
 NEVADA

1001 E. North St.  
 Reno, Nevada 89517 (775) 203-3000

Source: Planning and Building Division

Date: 08/20/2015

**SPECIAL USE PERMIT  
APPLICATION FOR  
MAJOR GRADING BROKEN HILLS TANK SITE**

**OWNER:**

Barker Coleman Investments Broken Hills, LLC.  
3675 Lakeside Drive  
Reno, NV 89509  
Phone: (775) 690-9925

**PREPARED FOR:**

Barker Coleman Investments Broken Hills, LLC.  
3675 Lakeside Drive  
Reno, NV 89509  
Phone: (775) 690-9925

**PREPARED BY:**



3675 Lakeside Drive, Suite B  
Reno, NV 89509  
Cell: (775) 690-9925

**DATE:**

August 13, 2019

**Table of Contents**

Project Requests .....1  
Project History .....2  
Project Description .....2

**List of Figures:**

Figure 1 – Cut/Fill map with quantities and depths.....4  
Figure 2 – Slope Map .....5

**Appendix A: Development Application and Reports**

- Washoe County Development Application
- Owner Affidavit
- Special Use Permit Application
- Proof of Property Tax Payment
- Assessor’s Map
- Title Report (Original only)
- Soils Report
- Preliminary Hydrology (culvert design)
- TWMA Design Report

**Appendix B: Plan Sets**

- Title Sheet
- Preliminary Grading Plan
- Cross Sections
- Re-Vegetation Plan

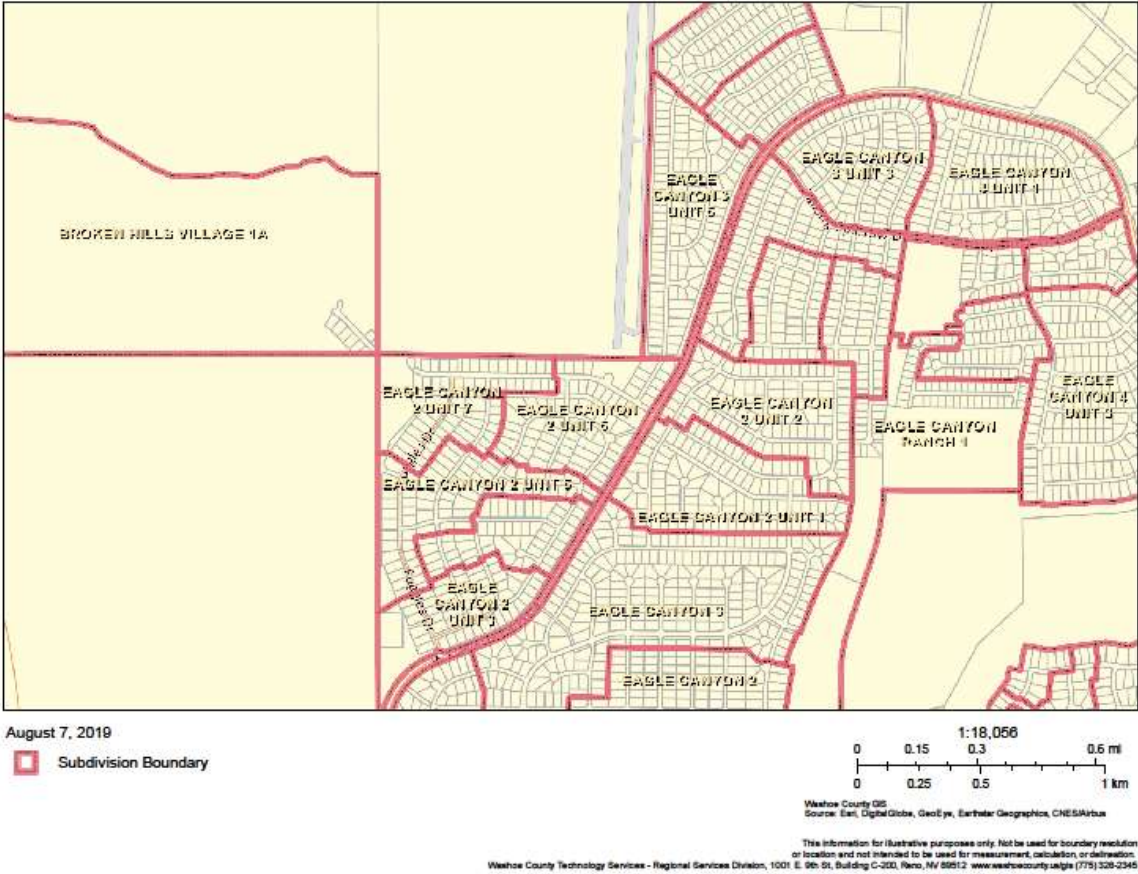
**Project Requests**

This application is for a **Special Use Permit** for:

- A) Major Grading for the Construction of a Tank, Access Road and related improvements

Broken Hills is located just north east of Eagle Canyon Unit II off Kinglet Drive. The proposed tank and access road is in located in the common are the of Broken Hills Subdivision (see below), APN 089-621-01

**Broken Hills Vicinity Map**



**Figure 1 – Vicinity Map**

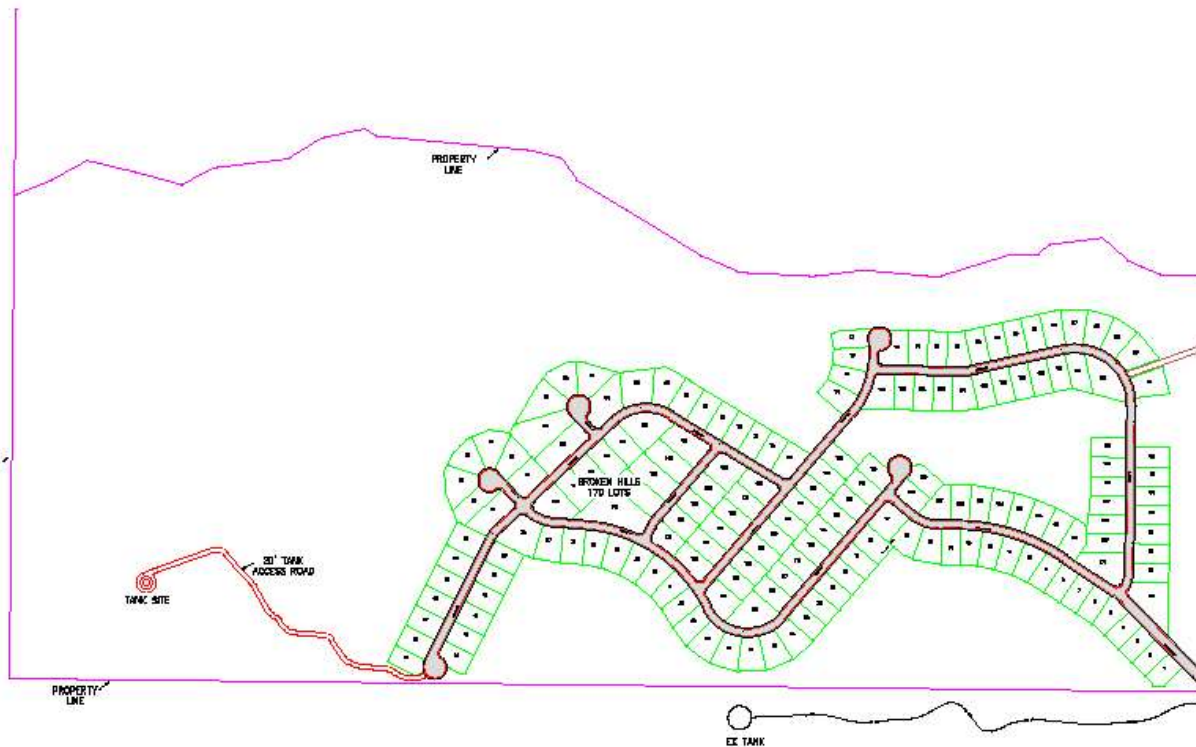


Figure 2 - Site Plan

### Project History

Barker Coleman Development requested and obtained approval for a Tentative Map, case number TM05-012 to develop a 170-lot single family common open space development on 243 acres. (APN 089-621-01). Barker Coleman is currently in the design phases of 75 units and working with TMWA on the construction of a 325,000-gallon tank, access road, 12" waterline, booster pump station and related infrastructure to service the project.

### Project Description

The proposed project is a 325,000-gal water tank with the associated infrastructure of an access road, transmission main and booster pumps station which will service the Broken Hills project (see attached preliminary design). The tank elevation is approximate 100' feet higher than the highest residential unit; this elevation will supply the require pressure to the units. Due to the lack of

**Broken Hills Tank Site**

pressure at the tank site and higher, irrigation cannot be provided. The disturbed areas around the tank and access road therefore will be re-vegetated in accordance with the Washoe County Codes (see attached preliminary landscape plans)

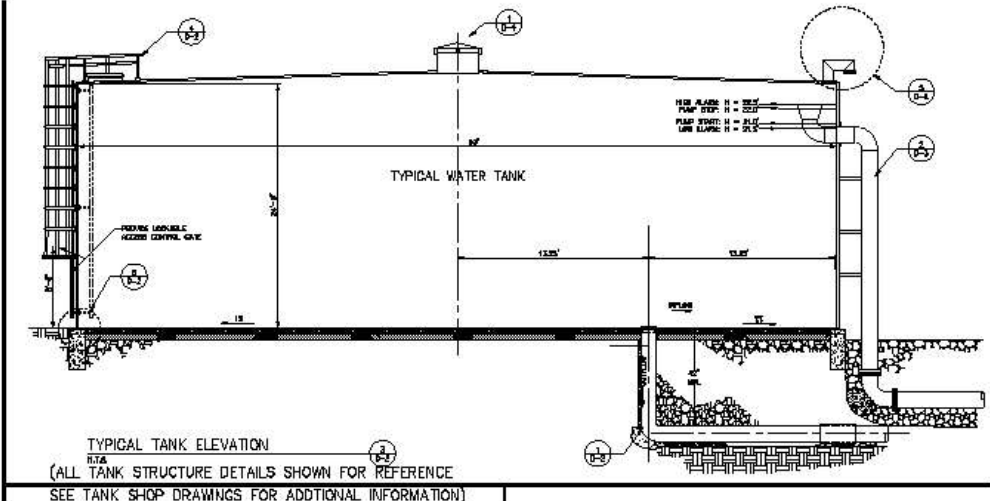
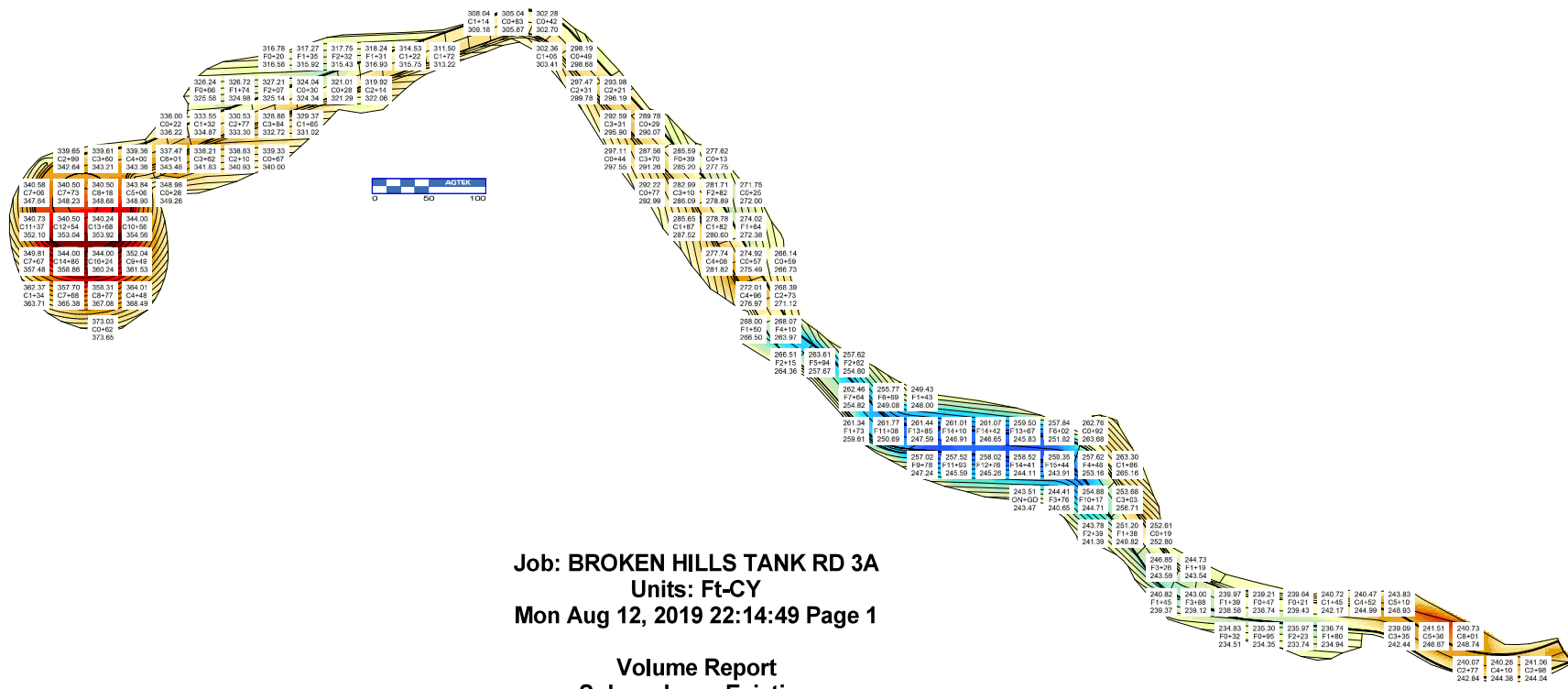


Figure 3 – Typical 325,000 Tank

# LIST OF FIGURES



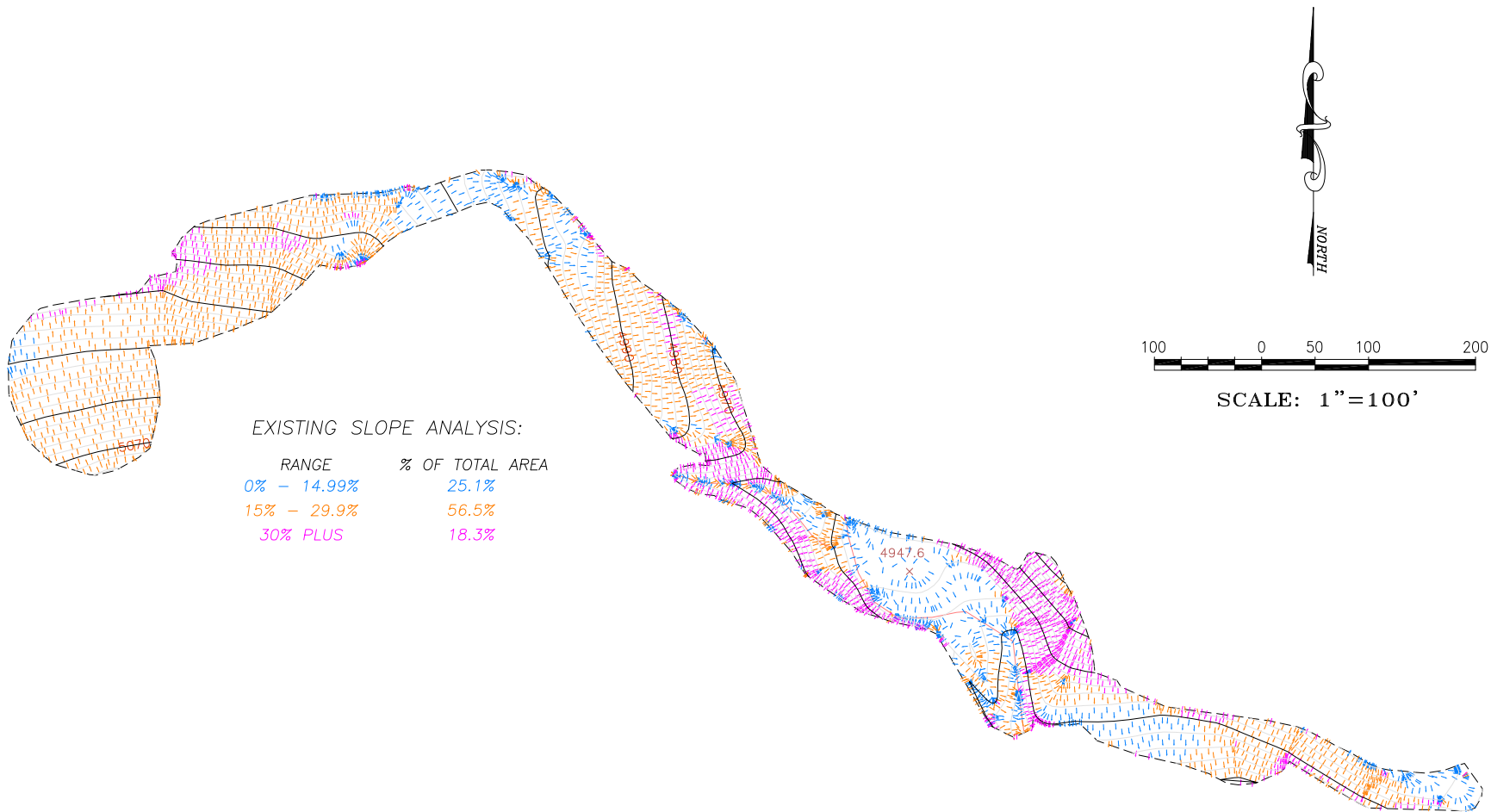
Job: BROKEN HILLS TANK RD 3A  
 Units: Ft-CY  
 Mon Aug 12, 2019 22:14:49 Page 1

**Volume Report  
 Subgrade vs. Existing**

	Total	Cut	Area Fill	OnGrade	Volume Cut	Volume Fill	Comp/Ratio Cut	Comp/Ratio Fill	Compact Cut	Compact Fill	Export -Import	Change Per .1 Ft
<b>TANK ROAD 3</b>	106,150	58,505	44,668	2,977	8,871	7,680	1.00	1.00	8,871	7,680	1,191	393

Sectional Qtys	Plane Area	Slope Area	Depth	Volume
TANK BASE	2,204	2,204	0.500	41
TANK ROAD	34,441	34,657	0.750	963
<b>TANK Sub:</b>	<b>36,645</b>	<b>36,861</b>		<b>1,004</b>
<b>Sectional Total</b>	<b>36,645</b>	<b>36,861</b>		<b>1,004</b>





**BROKEN HILLS TANK SITE AND ACCESS ROAD**

APPENDIX A  
Development Application and Reports

## Washoe County Development Application

Your entire application is a public record. If you have a concern about releasing personal information, please contact Planning and Building staff at 775.328.6100.

<b>Project Information</b>		Staff Assigned Case No.: _____	
Project Name:			
Project Description:			
Project Address:			
Project Area (acres or square feet):			
Project Location (with point of reference to major cross streets <b>AND</b> area locator):			
Assessor's Parcel No.(s):	Parcel Acreage:	Assessor's Parcel No.(s):	Parcel Acreage:
Indicate any previous Washoe County approvals associated with this application: Case No.(s).			
<b>Applicant Information</b> (attach additional sheets if necessary)			
<b>Property Owner:</b>		<b>Professional Consultant:</b>	
Name:		Name:	
Address:		Address:	
Zip:		Zip:	
Phone:                      Fax:		Phone:                      Fax:	
Email:		Email:	
Cell:                              Other:		Cell:                              Other:	
Contact Person:		Contact Person:	
<b>Applicant/Developer:</b>		<b>Other Persons to be Contacted:</b>	
Name:		Name:	
Address:		Address:	
Zip:		Zip:	
Phone:                      Fax:		Phone:                      Fax:	
Email:		Email:	
Cell:                              Other:		Cell:                              Other:	
Contact Person:		Contact Person:	
<b>For Office Use Only</b>			
Date Received:                      Initial:		Planning Area:	
County Commission District:		Master Plan Designation(s):	
CAB(s):		Regulatory Zoning(s):	



### Property Owner Affidavit

**Applicant Name:** Barker Coleman Investments, Broken Hill, LLC

The receipt of this application at the time of submittal does not guarantee the application complies with all requirements of the Washoe County Development Code, the Washoe County Master Plan or the applicable area plan, the applicable regulatory zoning, or that the application is deemed complete and will be processed.

STATE OF NEVADA )

COUNTY OF WASHOE )

I, Keith E. Rush  
(please print name)

being duly sworn, depose and say that I am the owner\* of the property or properties involved in this application as listed below and that the foregoing statements and answers herein contained and the information herewith submitted are in all respects complete, true, and correct to the best of my knowledge and belief. I understand that no assurance or guarantee can be given by members of Planning and Building.

**(A separate Affidavit must be provided by each property owner named in the title report.)**

Assessor Parcel Number(s): \_\_\_\_\_

Printed Name Keith E. Rush

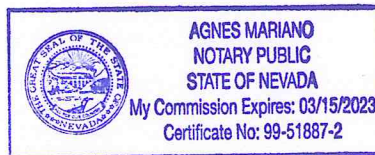
Signed [Signature]

Address 3675 Lakeside Dr., Ste. B  
Reno, NV. 89529  
[Signature]

Subscribed and sworn to before me this 14<sup>th</sup> day of August, 2019.

(Notary Stamp)

Washoe, Nevada  
Notary Public in and for said county and state  
My commission expires: 3/15/2023



\*Owner refers to the following: (Please mark appropriate box.)

- Owner
- Corporate Officer/Partner (Provide copy of record document indicating authority to sign.)
- Power of Attorney (Provide copy of Power of Attorney.)
- Owner Agent (Provide notarized letter from property owner giving legal authority to agent.)
- Property Agent (Provide copy of record document indicating authority to sign.)
- Letter from Government Agency with Stewardship

# Special Use Permit Application Supplemental Information

(All required information may be separately attached)

1. What is the project being requested?

2. Provide a site plan with all existing and proposed structures (e.g. new structures, roadway improvements, utilities, sanitation, water supply, drainage, parking, signs, etc.)

3. What is the intended phasing schedule for the construction and completion of the project?

4. What physical characteristics of your location and/or premises are especially suited to deal with the impacts and the intensity of your proposed use?

5. What are the anticipated beneficial aspects or affects your project will have on adjacent properties and the community?

6. What are the anticipated negative impacts or affect your project will have on adjacent properties? How will you mitigate these impacts?

7. Provide specific information on landscaping, parking, type of signs and lighting, and all other code requirements pertinent to the type of use being purposed. Show and indicate these requirements on submitted drawings with the application.

8. Are there any restrictive covenants, recorded conditions, or deed restrictions (CC&Rs) that apply to the area subject to the special use permit request? (If so, please attach a copy.)

<input type="checkbox"/> Yes	<input type="checkbox"/> No
------------------------------	-----------------------------

9. Utilities:

a. Sewer Service	
b. Electrical Service	
c. Telephone Service	
d. LPG or Natural Gas Service	
e. Solid Waste Disposal Service	
f. Cable Television Service	
g. Water Service	

For most uses, Washoe County Code, Chapter 110, Article 422, Water and Sewer Resource Requirements, requires the dedication of water rights to Washoe County. Please indicate the type and quantity of water rights you have available should dedication be required.

h. Permit #		acre-feet per year	
i. Certificate #		acre-feet per year	
j. Surface Claim #		acre-feet per year	
k. Other #		acre-feet per year	

Title of those rights (as filed with the State Engineer in the Division of Water Resources of the Department of Conservation and Natural Resources).

--

10. Community Services (provided and nearest facility):

a. Fire Station	
b. Health Care Facility	
c. Elementary School	
d. Middle School	
e. High School	
f. Parks	
g. Library	
h. Citifare Bus Stop	

**Special Use Permit Application  
for Grading  
Supplemental Information**  
(All required information may be separately attached)

1. What is the purpose of the grading?

2. How many cubic yards of material are you proposing to excavate on site?

3. How many square feet of surface of the property are you disturbing?

4. How many cubic yards of material are you exporting or importing? If none, how are you managing to balance the work on-site?

5. Is it possible to develop your property without surpassing the grading thresholds requiring a Special Use Permit? (Explain fully your answer.)

6. Has any portion of the grading shown on the plan been done previously? (If yes, explain the circumstances, the year the work was done, and who completed the work.)

7. Have you shown all areas on your site plan that are proposed to be disturbed by grading? (If no, explain your answer.)



8. Can the disturbed area be seen from off-site? If yes, from which directions and which properties or roadways?

9. Could neighboring properties also be served by the proposed access/grading requested (i.e. if you are creating a driveway, would it be used for access to additional neighboring properties)?

10. What is the slope (horizontal/vertical) of the cut and fill areas proposed to be? What methods will be used to prevent erosion until the revegetation is established?

11. Are you planning any berms?

Yes	No	If yes, how tall is the berm at its highest?
-----	----	--

12. If your property slopes and you are leveling a pad for a building, are retaining walls going to be required? If so, how high will the walls be and what is their construction (i.e. rockery, concrete, timber, manufactured block)?

13. What are you proposing for visual mitigation of the work?

14. Will the grading proposed require removal of any trees? If so, what species, how many and of what size?

15. What type of revegetation seed mix are you planning to use and how many pounds per acre do you intend to broadcast? Will you use mulch and, if so, what type?

16. How are you providing temporary irrigation to the disturbed area?

--

17. Have you reviewed the revegetation plan with the Washoe Storey Conservation District? If yes, have you incorporated their suggestions?

--

18. Are there any restrictive covenants, recorded conditions, or deed restrictions (CC&Rs) that may prohibit the requested grading?

Yes	No	If yes, please attach a copy.
-----	----	-------------------------------

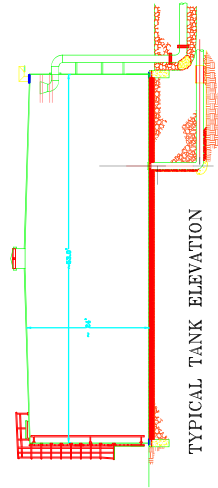
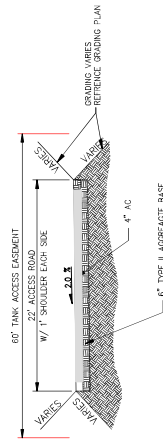
**APPENDIX B**  
**Plan Sets**

# SPECIAL USE PERMIT APPLICATION FOR MAJOR GRADING BROKEN HILLS TANK SITE AND ACCESS ROAD

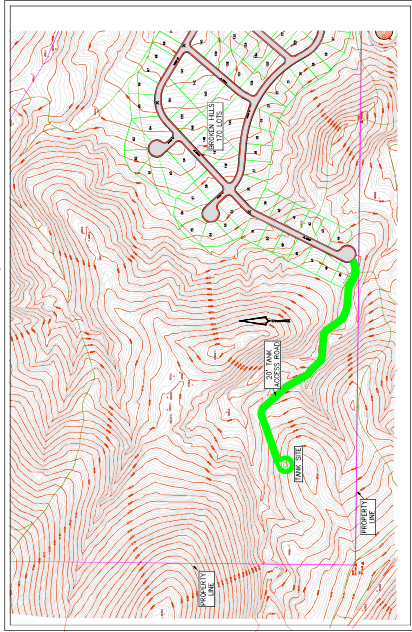
**OWNER/DEVELOPER**  
BARKER COLEMAN INVESTMENT BROKEN HILLS  
3675 LAKESIDE DRIVE SUITE B  
RENO, NEVADA 89509

**ENGINEER**  
MATZOLL DEVELOPMENT CONSULTANTS  
3675 LAKESIDE DRIVE SUITE B  
RENO, NEVADA 89409

### TANK ACCESS ROAD



### WASHOE COUNTY, NEVADA



### SITE PLAN



### VICINITY MAP

### SHEET INDEX

- T-1 TITLE SHEET
- G-1 GRADING PLAN
- C-1 CROSS SECTIONS
- L-1 RE VEGETATION PLAN

### SITE INFORMATION

DISTURBED AREA ~2.5 ACRES  
CUBIC YARDS OF CUT = 8,871  
CUBIC YARDS OF FILL = 7,680  
CLOSEST SETBACK TO TOE OF SLOPE ~23'  
HEIGHT OF FILL SLOPE AT CLOSEST SETBACK~9'  
~ MAXIMUM CUT/FILL = 17'

### ENGINEERS STATEMENT

I, KARL MATZOLL DO HEREBY DECLARE THIS MAP HAS BE PREPARED BY ME OR UNDER MY SUPERVISION AND WAS COMPLETED ON THE 14 DAY OF AUGUST, 2019. THIS GRADING PLAN WAS DESIGNED IN ACCORDANCE WITH THE WASHOE COUNTY DEVELOPMENT CODE WITH EXCEPTIONS

KARL A MATZOLL ----- PE#9000



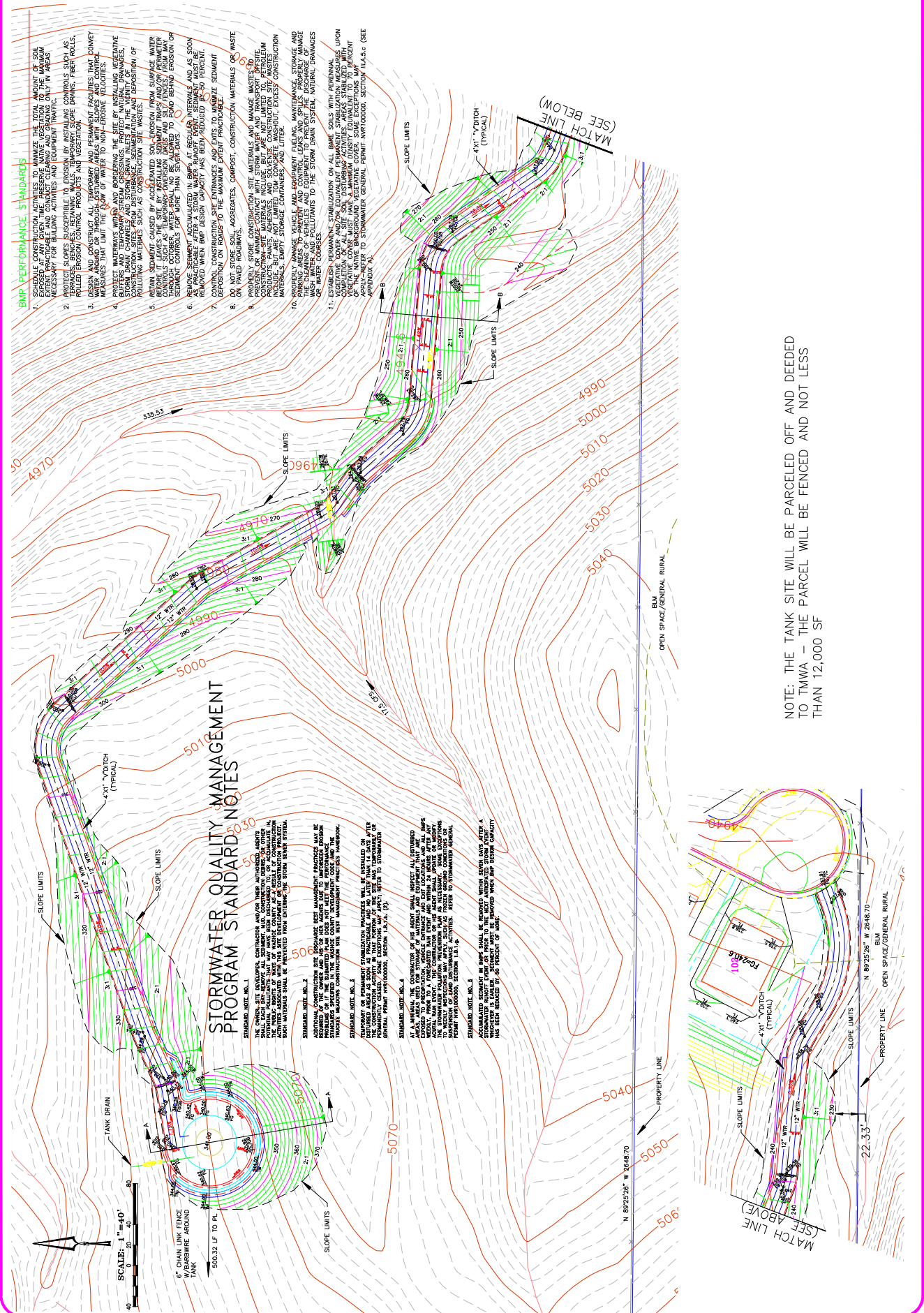
PLANS ARE PRELIMINARY AND SUBJECT TO CHANGE UNTIL SAMPLED, SIGNED, AND APPROVED BY ALL APPROPRIATE GOVERNING AGENCIES.  
DATE: 8/14/19  
TIME: 10:00 AM  
SHEET NO: 4  
SHEET TOTAL: 1

BROKEN-HILLS-TANK-AND-ACCESS-ROAD  
TITLE-SHEET  
APN-089-621-01  
WASHOE-COUNTY NEVADA

REV.	DATE	DESCRIPTION	BY	APP'D

SCALE	HORIZ. N/A	VERT. N/A	JOB# BHTANK
SHEET 4	OF 1		

REV.	DATE	DESCRIPTION	BY	APP'D



NOTE: THE TANK SITE WILL BE PARCELED OFF AND DEEDED TO TMWA - THE PARCEL WILL BE FENCED AND NOT LESS THAN 12,000 SF

3875 LAYBROOK DRIVE SUITE B  
 RENO, NEVADA 89508  
 (775) 980-9925

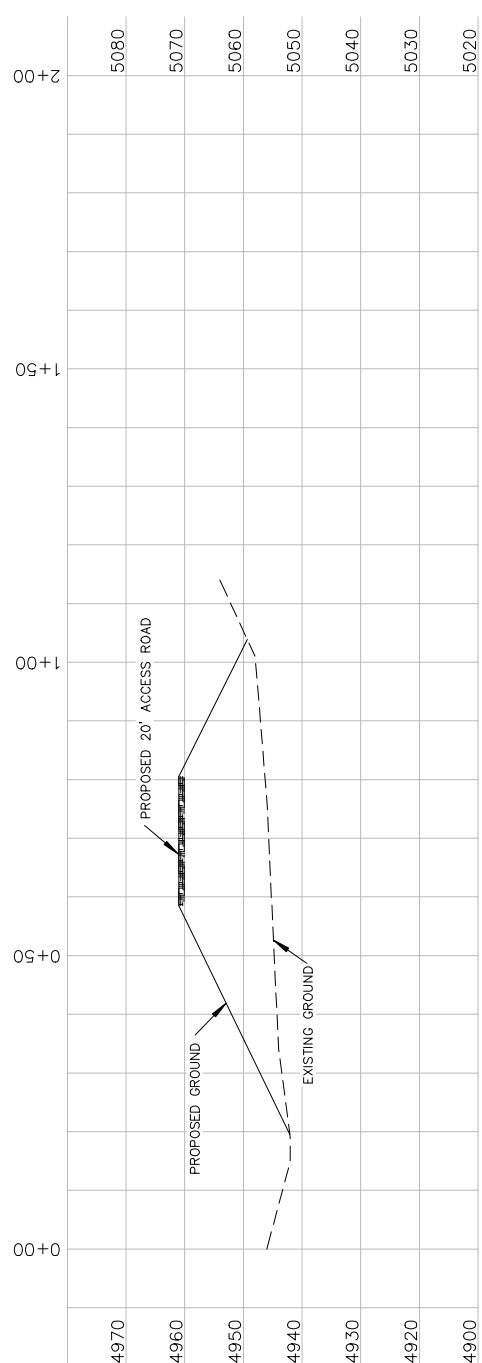
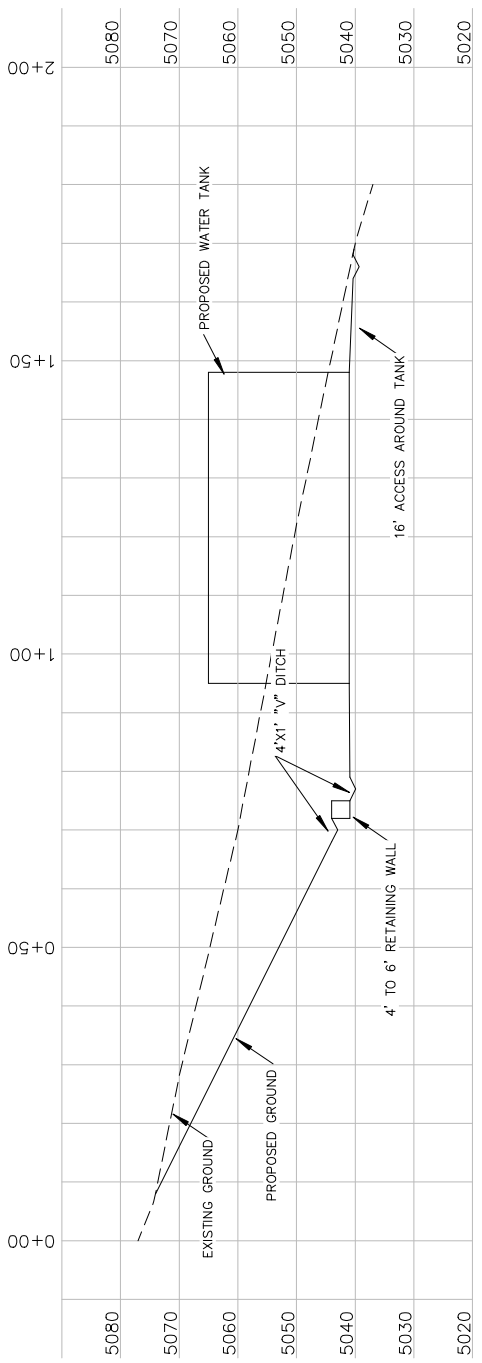


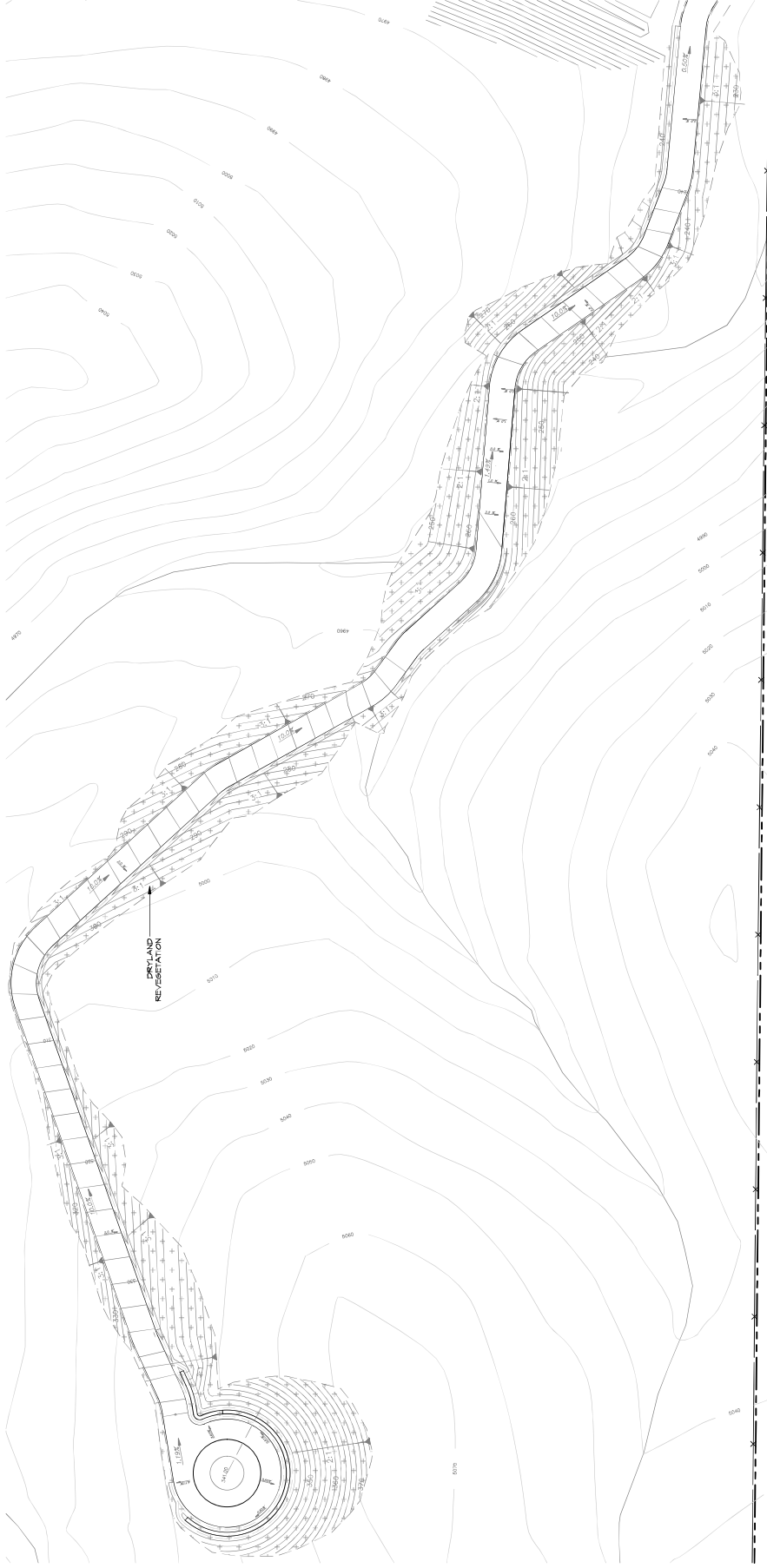
PLANS ARE PRELIMINARY AND  
 SUBJECT TO CHANGE UNTIL  
 STAMPED, SIGNED, AND APPROVED  
 BY ALL APPROPRIATE GOVERNING  
 AGENCIES.

BROKEN-HILLS-TANK-AND-ACCESS-ROAD  
 CROSS-SECTIONS  
 APN-089-621-01  
 WASHOE-COUNTY  
 NEVADA

REV.	DATE	DESCRIPTION	BY	APP'D

SHEET	3
of	C-1
HORIZ.	1"=10'
VERT.	1"=10'
JOB#	BHANK
SCALE	





**REVEGETATION SPECIFICATIONS**

1. WHERE POSSIBLE SEEDS & SEEDLINGS SHOULD BE PLANTED AT THE SITE. TOPSOIL CONTRACTOR SHALL PROVIDE EAST CONTROL FOR STOCKPILED TOPSOIL AS REQUIRED BY REGULATORY AGENCIES.
2. UNLESS OTHERWISE SPECIFIED, SEEDS SHALL BE APPLIED TO REVEGETATION AREAS. TOPSOIL SHALL CONSIST OF NATURAL TOPSOIL. TOPSOIL SHALL BE FREE OF LARGE BRUSH, STUMPS, CELESTONABLE WEEDS, LARGE STONES OR ROCKS EXCEPT AS SPECIFIED ON PLANS. AND SUBSISTED TONS OF PLANTS AS PER PLANS. SEEDS SHALL BE PLACED TO A DEPTH OF 2 INCHES IN THE TOP 6 INCHES OF SUBGRADE SOIL MATERIAL.
3. REVEGETATION SEEDING IS RECOMMENDED TO TAKE PLACE IN THE FALL TO ALLOW SEEDS TO ESTABLISH IN THE WINTER. HYDRATED SLURRY, THE APPLICATION RATE (LBS PER 1000 SQ FT) SHALL BE APPLIED AT A MINIMUM RATE OF 50 LBS PER ACRE.
4. REVEGETATION SEEDS IN THE BUNKERS SHALL BE APPLIED FOLLOWED BY AN IMMEDIATE APPLICATION USING 100% OF THE PLANTING SEEDS RECOMMENDED RATE.

**6. FOLLOWING SEEDS, APPLY HYDRO-SLURRY MIX OVER SLOPED SURFACE PER VPO'S SPECIFICATIONS. SLURRY SHALL CONSIST OF THE FOLLOWING:**

SPECIES	PLS #/ACRE
NEATGRASS STREAMBANK	400
BULLSTOCK GRASS	200
BULMORPH GRASS	200
RESQUE SHEEP	300
INDIAN RICEGRASS	500
SHRUBS	50
RAEBERTSH SUBBER	250
WYOMON TEA GREEN	100
BITTERBUSH	100
DEERY FLEASH	100
FLORIDA BUCKLE	200
NURSE CROPP	600
INTERGRASS ANNUAL	900
<b>TOTAL PLS #/ACRE: 9000</b>	

SEEDS AVAILABLE FROM: CONISTOCK SEED, MINDEN NY

SEEDS AVAILABLE FROM: CONISTOCK SEED, MINDEN NY



# PROPERTY TAX INFORMATION





Washoe County Treasurer  
Tammi Davis

Washoe County Treasurer  
P.O. Box 30039, Reno, NV 89520-3039  
ph: (775) 328-2510 fax: (775) 328-2500  
Email: tax@washoecounty.us

Account Detail

[Back to Account Detail](#)

[Change of Address](#)

[Print this Page](#)

**Disclaimer**

- **ALERTS:** If your real property taxes are delinquent, the search results displayed may not reflect the correct amount owing. Please contact our office for the current amount due.
- For your convenience, online payment is available on this site. E-check payments are accepted without a fee. However, a service fee does apply for online credit card payments. See [Payment Information](#) for details.

**CollectionCart**

Collection Cart	Items	Total	<a href="#">Checkout</a>	<a href="#">View</a>
	0	\$0.00		

**Pay Online**

**Washoe County Parcel Information**

Parcel ID	Status	Last Update
08962101	Active	8/7/2019 2:07:39 AM

**Current Owner:**  
BARKER-COLEMAN INVESTMENTS  
C/O KEITH RUSH MANAGER  
3675 LAKESIDE DR STE B  
RENO, NV 89509

**SITUS:**  
0 KINGLET DR  
WCTY NV

**Taxing District**  
4000

**Geo CD:**

Legal Description

Range 20 Block Lot 2-A SubdivisionName BROKEN HILLS VILLAGE 1A Section Township 21

**Tax Bill (Click on desired tax year for due dates and further details)**

Tax Year	Net Tax	Total Paid	Penalty/Fees	Interest	Balance Due
<a href="#">2019</a>	\$11,333.60	\$11,333.60	\$0.00	\$0.00	\$0.00
<a href="#">2018</a>	\$11,333.61	\$11,333.61	\$0.00	\$0.00	\$0.00
<a href="#">2017</a>	\$11,333.77	\$11,333.70	\$0.00	\$0.00	\$0.00
<a href="#">2016</a>	\$12,491.89	\$12,491.89	\$0.00	\$0.00	\$0.00
<a href="#">2015</a>	\$12,466.80	\$12,466.80	\$0.00	\$0.00	\$0.00
<b>Total</b>					<b>\$0.00</b>

**Pay By Check**

Please make checks payable to:  
**WASHOE COUNTY TREASURER**

**Mailing Address:**  
P.O. Box 30039  
Reno, NV 89520-3039

**Overnight Address:**  
1001 E. Ninth St., Ste D140  
Reno, NV 89512-2845

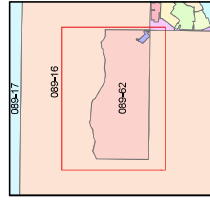
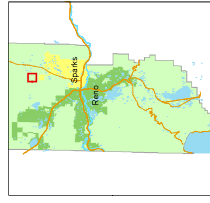
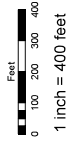


# ASSESSOR'S MAP



Assessor's Map Number  
**089-62**

STATE OF NEVADA  
**WASHOE COUNTY**  
**ASSESSOR'S OFFICE**  
Joshua G. Wilson, Assessor  
1001 East Ninth Street  
Building D  
Reno, NV 89512  
(775) 328-2331



created by: **TWT 11/30/2011**  
last updated: \_\_\_\_\_

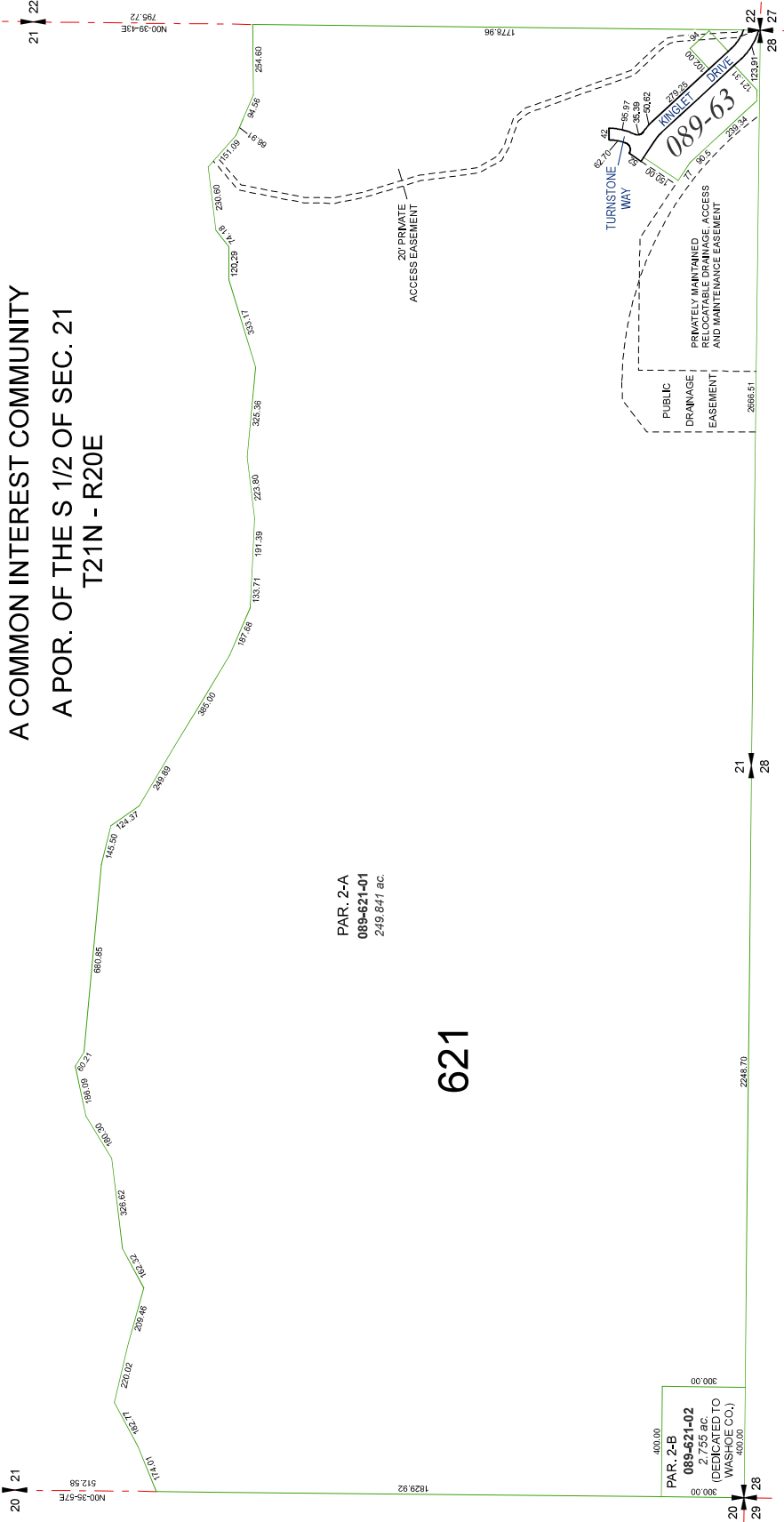
area previously shown on map(s)  
**089-16**

NOTE: This map was prepared for the use of the Washoe County Assessor for assessment and illustrative purposes only. It does not represent a warranty of accuracy or any other guarantee as to the sufficiency or accuracy of the data delineated hereon.

# (#4821) BROKEN HILLS VILLAGE 1A

## A COMMON INTEREST COMMUNITY

### A POR. OF THE S 1/2 OF SEC. 21 T21N - R20E



# SOILS REPORT



**GEOTECHNICAL INVESTIGATION  
BROKEN HILLS – UNIT 1  
WASHOE COUNTY, NEVADA**

**PREPARED FOR:**

Mr. Karl Matzoll, PE  
**RIGHTWAY INVESTMENTS**  
5945 Los Altos Parkway, Suite 101  
Sparks, Nevada 89436

March 2007

**JAMES EDWARD ENGINEERING**  
**I N C O R P O R A T E D**



March 10, 2007  
Project No. 1422.01

Mr. Karl Matzoll, PE  
RIGHTWAY INVESTMENTS  
5945 Los Altos Parkway, Suite 101  
Sparks, Nevada 89436

RE: **GEOTECHNICAL ADDENDUM  
BROKEN HILLS – PHASE 1**

Dear Mr. Matzoll:

This letter presents our update to the Broken Hills geotechnical report originally prepared by our firm under the name of Matrix Construction Services in August, 2004. This addendum specifically addresses Phase 1. Unless specifically modified in this addendum, our opinions and recommendations stated in the original geotechnical report are applicable (Appendix B).

As indicated in Figure 1, the Phase 1 is situated in the southeast corner of the Broken Hills development area. The terrain surrounding this unit is relatively rugged with a substantial drainage forming the central open space area.

The site was explored by excavating five additional test pits along the proposed roadway alignments utilizing a Deere 410 E backhoe. The profile encountered typically consisted of poorly graded sand to clayey sand extending through the depths of our borings or capping bedrock. The bedrock encountered has typically been weathered and decomposed to excavate to a dense silty sandy consistency however along the southern ridge, the bedrock is more competent and less weathered. Soil profiles are presented a Plate A-2 in Appendix A of this report.

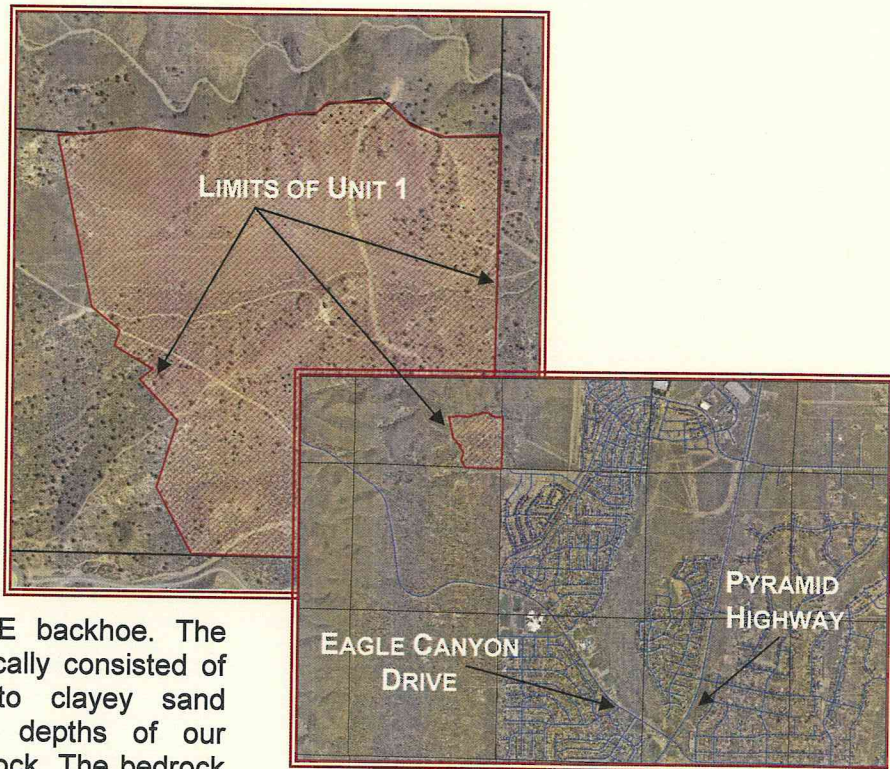


FIGURE 1 – Unit 1 and Vicinity Map

Based on the preliminary Griffith Canyon Quadrangle Geologic Map (USBM&G), Phase 1 overlies: Late Tertiary/early to mid-Pleistocene alluvial fan deposits and the Quaternary Alluvium associated with the drainages. One fault has been mapped in the immediate area, just northwest of the limits of Unit 1, trending north-northeast. This fault does not lie within the limits of Phases 1 or 2. The Quaternary Fault Map of Nevada, Reno Sheet (Bell 1984) was reviewed. This fault was not delineated on the Quaternary Fault map and no additional faults were mapped trending in the immediate vicinity of or through the site. The Spanish Springs Valley Fault Zone is located approximately 1 to 1 ½ miles east of the site.

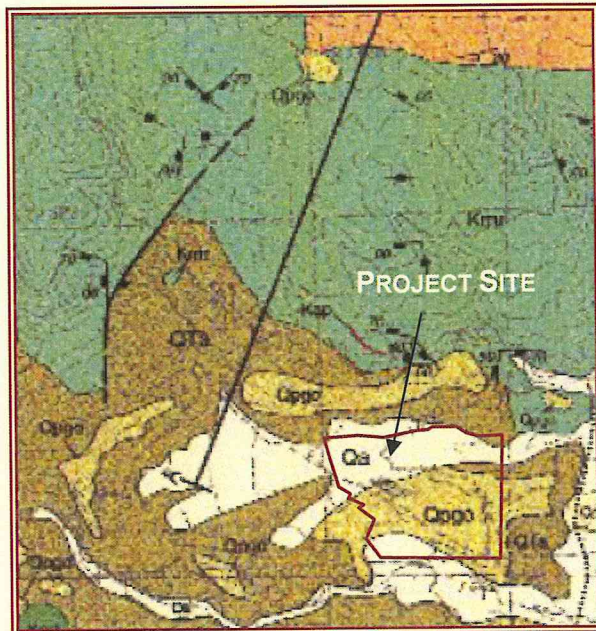


FIGURE 2 - Geologic Map of Project Area

Due to the presence of medium dense to dense granular soils, the site would be assigned Site Class D (stiff soil profile) listed in Table 1615.1 of the 2003 International Building Code. Based on the average latitude and longitude of the site (39.6677°N, 119.7393°W), the mapped spectral response accelerations for the 0.2 seconds ( $S_s$ ) and 1 second ( $S_1$ ) periods are 1.35 and 0.49, respectively (USGS Earthquake Hazards Program). Based on these mapped spectral response accelerations, the Site Coefficients  $F_a$  and  $F_v$ , as a function of site class, are 1.0 and 1.51, respectively.

Our original geotechnical report has been presented as Appendix B. The *Site Preparation, Grading and Filling, Trenching and Excavations, Foundations, Slope Stability and Erosion Control, Site Drainage, Concrete Slabs, and Asphaltic Concrete* sections of report are applicable to the grading and construction of the site. Based on our current understanding of the project development, no modifications are presented at this time. However, it should be noted that bedrock was encountered in Test Pits D and E and local difficulty in excavation should be anticipated.

R-Value testing on the native soils resulted in an R-Value of 69, indicating that the Washoe County minimum structural design section of 3-inches plantmix bituminous pavement capping 6-inches of Type 2 Class B aggregate base should perform satisfactorily. The structural section was evaluated in accordance with the AASHTO design procedure for low volume roads and a maximum residential service load of 150 residences. Structural pavement section evaluation is presented as Plate A-5 in Appendix A of this report. All public and private improvements should be constructed in accordance with the Standard Specifications for Public Works Construction and Washoe County Standards, whichever is more stringent.

Corrosive soil potential tests were performed on the near surface alluvium. Test results were in the negligible exposure range for sulfate as established in Table 1904.3 of the 2003 IBC and special concrete considerations to address sulfate attack would not be required. The test results as well as a summary of their applicability as per AWWA Standard C-105 are summarized below.

**1 – Earth resistivity - 4100  $\Omega$ -cm (saturated paste – Method 2510B, 0 points)**

Earth resistivity was determined on a remolded sample obtained from the near surface alluvium which extended from the ground surface to depths of 6 to 10 feet below existing grade which would be representative of most of the waterline embedment soils. Groundwater was not present at the time of our investigation and lies at a depth below the zone of influence with the piping associated with this tank. Therefore, the percentage of time the soil is likely to be water saturated is anticipated to be less than 5 percent. The soil sample was obtained on March 6, 2007. Due to the weather pattern and depth of sample, freezing soil conditions were not present at the time of sampling.

**2 – pH – XX6.44X (saturated paste – Method 9045B, 0 points)**

**3 – Oxidation-reduction potential – (0 points)**

Results of redox potential indicated a potential greater than +100 mV indicating that the soil is sufficiently aerated (+330 mV).

**4 – Sulfides – (0 points)**

No effervescence was noted from the soil sample upon being subjected to the 3-percent sodium azide in a 0.1N iodine solution indicating that the sulfide concentration is negative.

**5 – Moisture Content – Good drainage, generally dry (0 points)**

6.5 percent by dry weight of soil.

**6 – Soil description**

0 – 10' Poorly Graded Sand (SC) – medium dense to dense, slightly moist, orange brown

**7 – Potential Stray Direct Current – Not applicable**

Based on the soil characteristics the soil is not considered corrosive to ductile-iron pipe.

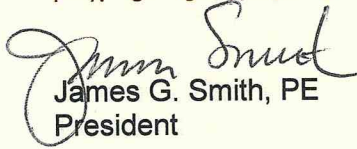


Mr. Karl Matzoll, PE  
RIGHTWAY INVESTMENTS  
March 10, 2007  
Page 4 of 4

We appreciate the opportunity to provide these services for you. Please do not hesitate to contact our office should you have any related questions or comments.

Sincerely,

**JAMES EDWARD ENGINEERING**  
I N C O R P O R A T E D

  
James G. Smith, PE  
President

Mischelle J. Smith, PE  
Engineering Manager  
RE Number 6972  
Expires 6/30/08



JGS:MJS:dh

## **CONSTRUCTION OBSERVATION AND TESTING SERVICES**

The recommendations presented in this report are based on the assumption that the contractor performs his work as required by the project documents and that owner/project manager provides sufficient field-testing and construction review during all phases of construction. Prior to construction, the owner/project manager should schedule a pre-job conference including, but not limited to, the owner, architect, civil engineer, the general contractor, earthwork and materials subcontractors, building official, and geotechnical engineer. It is the owner's/project manager responsibility to set-up this meeting and contact all responsible parties. The conference will allow parties to review the project plans, specifications, and recommendations presented in this report, and discuss applicable material quality and mix design requirements. All quality control reports should be submitted to the owner/project manager for review and distributed to the appropriate parties.

During construction, James Edward Engineering, Inc. should have the opportunity to provide sufficient on-site observation of site preparation and grading, over-excavation, fill placement, foundation installation, and paving. These observations would allow us to document that the geotechnical conditions are as anticipated and that the contractor's work meets with the criteria in the approved plans and specifications. The site should be surveyed by a licensed professional surveyor for grade and location prior to placing structural fill over clay soils. Without this verification, JEE cannot provide verification that the work being completed is in accordance with the project's plans, specifications, or geotechnical report. If certification by a licensed surveyor is not provided, verification of horizontal and vertical control must be provided by whoever was responsible for establishing those boundaries.

## **STANDARD LIMITATION CLAUSE**

This report has been prepared in accordance with generally accepted local geotechnical practices. The analyses and recommendations submitted are based upon field exploration performed at the locations shown on Plate A-2 of this report. This report does not reflect soils variations that may become evident during the construction period, at which time re-evaluation of the recommendations may be necessary. We recommend our firm be retained to perform construction observation in all phases of the project related to geotechnical factors to document compliance with our recommendations. The owner/project manager is responsible for distribution of this geotechnical report to all designers and contractors whose work is related to geotechnical factors.

It is the contractor's responsibility for the grading and construction of the designed improvements. This responsibility includes the means, methods, techniques, sequence, and procedures of construction and safety of construction at the site. All construction shall conform to the requirements of the most recently adopted version of the Standard Specifications for Public Works Construction and the requirements of Washoe County, Nevada. Failure to inspect the work shall not relieve the contractor from his obligation to perform sound and reliable work as described herein and as described in the Standard Specifications for Public Works Construction.

All plans and specifications should be reviewed by the design engineer responsible for this geotechnical report, to determine if they have been completed in accordance with the recommendations contained in this report, prior to submitting to the building department for review. It is the owner's/project manager responsibility to provide the plans and specifications to the engineer.

Water level readings were made on the date shown on Plate A-2 of this report. Fluctuations in the water table may occur due to rainfall, temperature, seasonal runoff or adjacent irrigation practices. Construction planning should be based on assumptions of possible variations.

This report has been prepared to provide information allowing the architect and engineer to design the project. The owner/project manager is responsible for distribution of this report to all designers and contractors whose work is affected by geotechnical aspects. In the event of changes in the design, location, or ownership of the project after presentation of this report, our recommendations should be reviewed and possibly modified by the geotechnical engineer. If the geotechnical engineer is not accorded the privilege of making this recommended review, he can assume no responsibility for misinterpretation or misapplication of his recommendations or their validity in the event changes have been made in the original design concept without his prior review. The engineer makes no other warranties, either expressed or implied, as to the professional advice provided under the terms of this agreement and included in this report.

This report was prepared by James Edward Engineering, Inc. for the account of Rightway Investments, Inc. The material in it reflects James Edward Engineering Inc.'s best judgment in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. James Edward Engineering Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.



March 10, 2007  
Project No. 1422.01

Mr. Karl Matzoll, PE  
RIGHTWAY INVESTMENTS  
5945 Los Altos Parkway, Suite 101  
Sparks, Nevada 89436

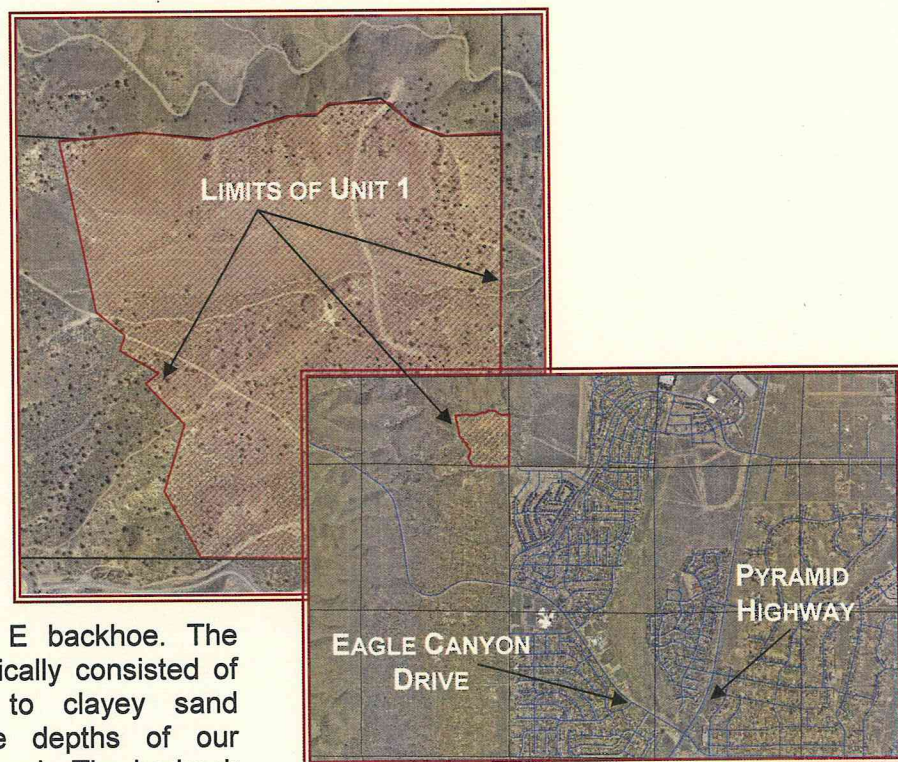
**RE: GEOTECHNICAL ADDENDUM  
BROKEN HILLS – PHASE 1**

Dear Mr. Matzoll:

This letter presents our update to the Broken Hills geotechnical report originally prepared by our firm under the name of Matrix Construction Services in August, 2004. This addendum specifically addresses Phase 1. Unless specifically modified in this addendum, our opinions and recommendations stated in the original geotechnical report are applicable (Appendix B).

As indicated in Figure 1, the Phase 1 is situated in the southeast corner of the Broken Hills development area. The terrain surrounding this unit is relatively rugged with a substantial drainage forming the central open space area.

The site was explored by excavating five additional test pits along the proposed roadway alignments utilizing a Deere 410 E backhoe. The profile encountered typically consisted of poorly graded sand to clayey sand extending through the depths of our borings or capping bedrock. The bedrock encountered has typically been weathered and decomposed to excavate to a dense silty sandy consistency however along the southern ridge, the bedrock is more competent and less weathered. Soil profiles are presented a Plate A-2 in Appendix A of this report.



**FIGURE 1 – Unit 1 and Vicinity Map**

Based on the preliminary Griffith Canyon Quadrangle Geologic Map (USBM&G), Phase 1 overlies: Late Tertiary/early to mid-Pleistocene alluvial fan deposits and the Quaternary Alluvium associated with the drainages. One fault has been mapped in the immediate area, just northwest of the limits of Unit 1, trending north-northeast. This fault does not lie within the limits of Phases 1 or 2. The Quaternary Fault Map of Nevada, Reno Sheet (Bell 1984) was reviewed. This fault was not delineated on the Quaternary Fault map and no additional faults were mapped trending in the immediate vicinity of or through the site. The Spanish Springs Valley Fault Zone is located approximately 1 to 1 ½ miles east of the site.

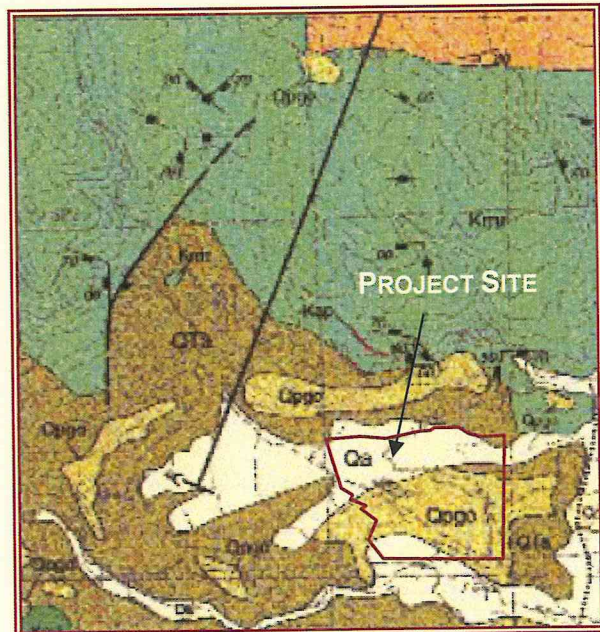


FIGURE 2 - Geologic Map of Project Area

Due to the presence of medium dense to dense granular soils, the site would be assigned Site Class D (stiff soil profile) listed in Table 1615.1 of the 2003 International Building Code. Based on the average latitude and longitude of the site (39.6677°N, 119.7393°W), the mapped spectral response accelerations for the 0.2 seconds ( $S_s$ ) and 1 second ( $S_1$ ) periods are 1.35 and 0.49, respectively (USGS Earthquake Hazards Program). Based on these mapped spectral response accelerations, the Site Coefficients  $F_a$  and  $F_v$ , as a function of site class, are 1.0 and 1.51, respectively.

Our original geotechnical report has been presented as Appendix B. The *Site Preparation, Grading and Filling, Trenching and Excavations, Foundations, Slope Stability and Erosion Control, Site Drainage, Concrete Slabs, and Asphaltic Concrete* sections of report are applicable to the grading and construction of the site. Based on our current understanding of the project development, no modifications are presented at this time. However, it should be noted that bedrock was encountered in Test Pits D and E and local difficulty in excavation should be anticipated.

R-Value testing on the native soils resulted in an R-Value of 69, indicating that the Washoe County minimum structural design section of 3-inches plantmix bituminous pavement capping 6-inches of Type 2 Class B aggregate base should perform satisfactorily. The structural section was evaluated in accordance with the AASHTO design procedure for low volume roads and a maximum residential service load of 150 residences. Structural pavement section evaluation is presented as Plate A-5 in Appendix A of this report. All public and private improvements should be constructed in accordance with the Standard Specifications for Public Works Construction and Washoe County Standards, whichever is more stringent.

Corrosive soil potential tests were performed on the near surface alluvium. Test results were in the negligible exposure range for sulfate as established in Table 1904.3 of the 2003 IBC and special concrete considerations to address sulfate attack would not be required. The test results as well as a summary of their applicability as per AWWA Standard C-105 are summarized below.

**1 – Earth resistivity - 4100  $\Omega$ -cm (saturated paste – Method 2510B, 0 points)**

Earth resistivity was determined on a remolded sample obtained from the near surface alluvium which extended from the ground surface to depths of 6 to 10 feet below existing grade which would be representative of most of the waterline embedment soils. Groundwater was not present at the time of our investigation and lies at a depth below the zone of influence with the piping associated with this tank. Therefore, the percentage of time the soil is likely to be water saturated is anticipated to be less than 5 percent. The soil sample was obtained on March 6, 2007. Due to the weather pattern and depth of sample, freezing soil conditions were not present at the time of sampling.

**2 – pH – XX6.44X (saturated paste – Method 9045B, 0 points)**

**3 – Oxidation-reduction potential – (0 points)**

Results of redox potential indicated a potential greater than +100 mV indicating that the soil is sufficiently aerated (+330 mV).

**4 – Sulfides – (0 points)**

No effervescence was noted from the soil sample upon being subjected to the 3-percent sodium azide in a 0.1N iodine solution indicating that the sulfide concentration is negative.

**5 – Moisture Content – Good drainage, generally dry (0 points)**

6.5 percent by dry weight of soil.

**6 – Soil description**

0 – 10' Poorly Graded Sand (SC) – medium dense to dense, slightly moist, orange brown

**7 – Potential Stray Direct Current – Not applicable**

Based on the soil characteristics the soil is not considered corrosive to ductile-iron pipe.

Mr. Karl Matzoll, PE  
RIGHTWAY INVESTMENTS  
March 10, 2007  
Page 4 of 4

We appreciate the opportunity to provide these services for you. Please do not hesitate to contact our office should you have any related questions or comments.

Sincerely,

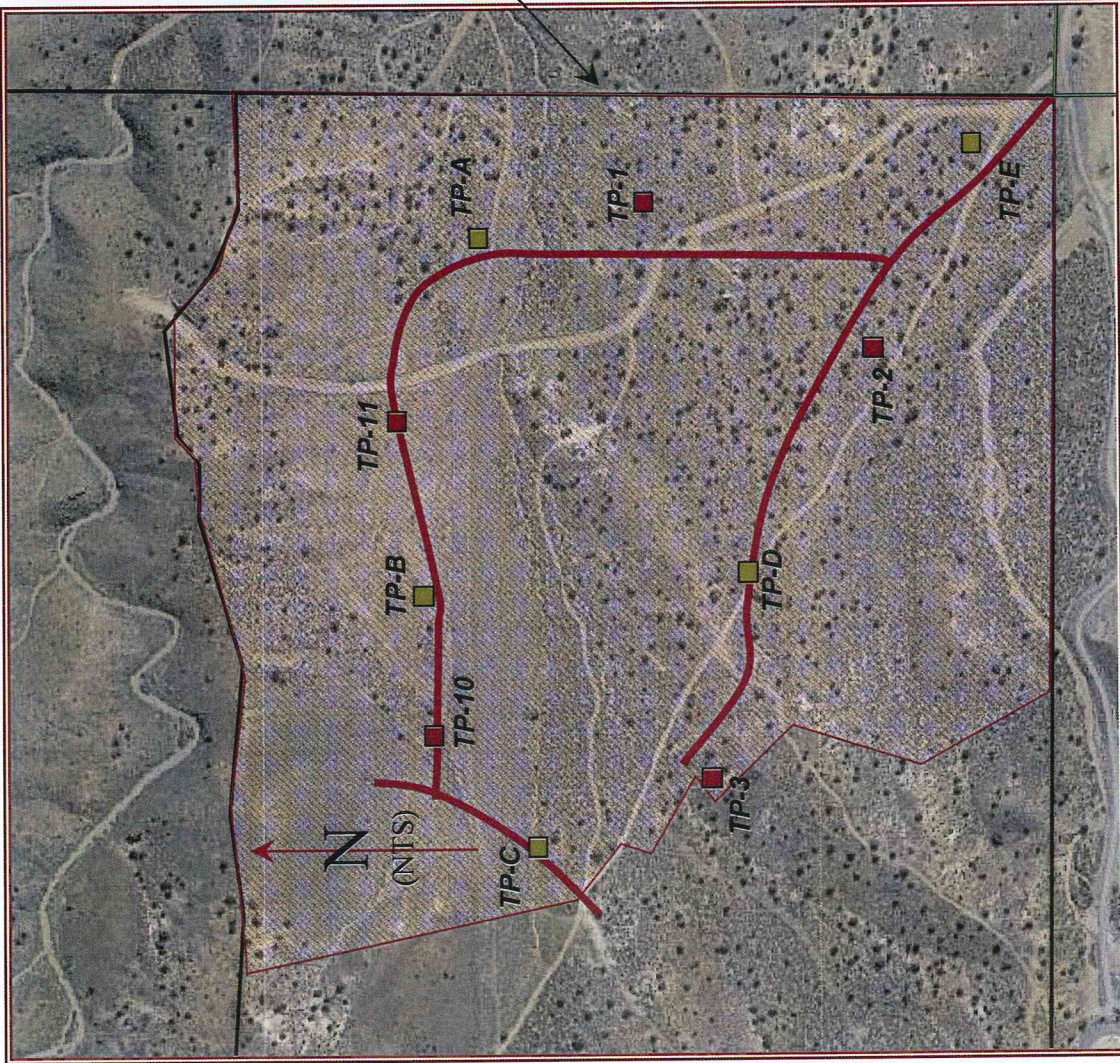
**JAMES EDWARD ENGINEERING**  
I N C O R P O R A T E D

  
James G. Smith, PE  
President

  
Michelle J. Smith, PE  
Engineering Manager  
RE Number 6972  
Expires 6/30/08

JGS:MJS:dh

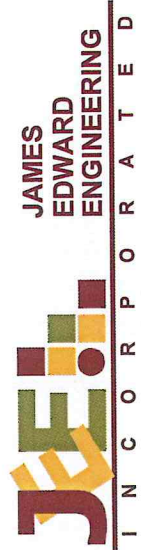
# **APPENDIX A**



VICINITY MAP (NTS)

**LEGEND**

- TP-1 ■ 2004 Explorations
- TP-A ■ 2007 Explorations
- Approximate Roadway Alignment



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**SITE PLAN AND APPROXIMATE  
EXPLORATION LOCATIONS**

Geotechnical Investigation

**BROKEN HILLS PHASE I**

Project No.: 1422.01  
Date: 03/10/07

**PLATE  
A-1**



# LOG OF TEST PIT NO. A

PROJECT NAME:	BROKEN HILLS - PHASE 1
LOCATION:	SEE PLAN
DATE:	3/9/2007

PROJECT NUMBER:	1422.01
SURFACE ELEVATION:	SEE PLAN
EXPLORATION EQUIPMENT:	DEERE 410E

Depth in Feet	Unified Soil Classification	Graphical Log	Sample	Sample Type	Sample No.	Moisture	Visual Description	Pocket Penetrometer (tsf)	Moisture Content (% of Dry Weight)	Laboratory Tests	
1	SP	[Dotted Pattern]	[Yellow Box]	B	A1	M	0 - 10' Poorly Graded Sand (SP) with Some Silt - medium dense, moist, brown (estimated <10% low plastic fines, >90% sand)				
2											
3											
4											
5											
6											
7											
8											
9											
10											
11	BEDROCK	[Grid Pattern]	[Yellow Box]	[Yellow Box]	[Yellow Box]	S	10 - 13' Bedrock - Partially Decomposed State (PDS), Craters to Dents (C to D), Solid, Unit Weight <130 (estimated), excavates to a dense, poorly graded sand consistency				
12											
13											
							Bottom of Test Pit @ 13 Feet No Free Water Encountered				

GROUNDWATER & SOIL MOISTURE				SAMPLE TYPE			LABORATORY TESTS	
	Depth	Hour	Date	D - DRY	A - Drill Cuttings	B - Bulk Sample	A- Atterberg Limits	
∇	NE		3/9/2007	S - SLIGHTLY MOIST	C - CME Sample	R - Rotary Cuttings	B- Grain Size Distribution	
▽				M - MOIST	S- 2" O.D. 1.38" I.D. Tube Sample		C- Consolidation	
NE- No Free Water Encountered				V - VERY MOIST	U- 3" O.D. 2.42 " I.D. Tube Sample		MD- Moisture/Density	
				W - WET	T- 3" O.D. Thin-Walled Shelby Tube		DS - Direct Shear	



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Plate  
**A-2**

# LOG OF TEST PIT NO. B

PROJECT NAME:	BROKEN HILLS - PHASE 1
LOCATION:	SEE PLAN
DATE:	3/9/2007

PROJECT NUMBER:	1422.01
SURFACE ELEVATION:	SEE PLAN
EXPLORATION EQUIPMENT:	DEERE 410E

Depth in Feet	Unified Soil Classification	Graphical Log	Sample	Sample Type	Sample No.	Moisture	Visual Description	Pocket Penetrometer (tsf)	Moisture Content (% of Dry Weight)	Laboratory Tests
1		●●●●●					0 - 10' Poorly Graded Sand (SP) with Some Silt - medium dense, slightly moist to moist, brown (estimated <10% low plastic fines, >90% sand)			
2		●●●●●								
3		●●●●●								
4		●●●●●		B	B1					
5	SP	●●●●●				S/M				
6		●●●●●								
7		●●●●●								
8		●●●●●								
9		●●●●●								
10		●●●●●								
Bottom of Test Pit @ 10 Feet No Free Water Encountered										

GROUNDWATER & SOIL MOISTURE				SAMPLE TYPE		LABORATORY TESTS	
	Depth	Hour	Date	D - DRY	A - Drill Cuttings	B - Bulk Sample	A - Atterberg Limits
∇	NE		3/9/2007	S - SLIGHTLY MOIST	C - CME Sample	R - Rotary Cuttings	B - Grain Size Distribution
▽				M - MOIST	S- 2" O.D. 1.38" I.D. Tube Sample		C- Consolidation
NE- No Free Water Encountered				V - VERY MOIST	U- 3" O.D. 2.42" I.D. Tube Sample		MD- Moisture/Density
				W - WET	T- 3" O.D. Thin-Walled Shelby Tube		DS - Direct Shear



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Plate  
A-2

**LOG OF TEST PIT NO. C**

PROJECT NAME:	BROKEN HILLS - PHASE 1
LOCATION:	SEE PLAN
DATE:	3/9/2007

PROJECT NUMBER:	1422.01
SURFACE ELEVATION:	SEE PLAN
EXPLORATION EQUIPMENT:	DEERE 410E

Depth in Feet	Unified Soil Classification	Graphical Log	Sample	Sample Type	Sample No.	Moisture	Visual Description	Pocket Penetrometer (tsf)	Moisture Content (% of Dry Weight)	Laboratory Tests
1	BEDROCK			B	C1	S	0 - 8' <b>Bedrock</b> - Partially Decomposed State (PDS), Craters to Dents (C to D), Solid, Unit Weight <130 (estimated), excavates to a dense, poorly graded <b>Silty Sand (SM)</b> consistency			
2										
3										
4										
5										
6										
7										
8										
Bottom of Test Pit @ 8 Feet No Free Water Encountered										
GROUNDWATER & SOIL MOISTURE				SAMPLE TYPE				LABORATORY TESTS		
Depth	Hour	Date	D - DRY	A - Drill Cuttings	B - Bulk Sample	A- Atterberg Limits				
∇	NE	3/9/2007	S - SLIGHTLY MOIST	C - CME Sample	R - Rotary Cuttings	B- Grain Size Distribution				
∇			M - MOIST	S- 2" O.D. 1.38" I.D. Tube Sample		C- Consolidation				
NE- No Free Water Encountered			V - VERY MOIST	U- 3" O.D. 2.42" I.D. Tube Sample		MD- Moisture/Density				
			W - WET	T- 3" O.D. Thin-Walled Shelby Tube		DS - Direct Shear				



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Plate  
A-2

## LOG OF TEST PIT NO. D

PROJECT NAME:	BROKEN HILLS - PHASE 1
LOCATION:	SEE PLAN
DATE:	3/9/2007

PROJECT NUMBER:	1422.01
SURFACE ELEVATION:	SEE PLAN
EXPLORATION EQUIPMENT:	DEERE 410E

Depth in Feet	Unified Soil Classification	Graphical Log	Sample	Sample Type	Sample No.	Moisture	Visual Description	Pocket Penetrometer (tsf)	Moisture Content (% of Dry Weight)	Laboratory Tests
1	SC	[Diagonal Hatching]				M	0 - 1' <b>Clayey Sand (SC)</b> - loose, moist, dark brown (estimated 25% medium plastic fines, 75% sand)			
2	SC	[Diagonal Hatching]				M	1 - 2' <b>Clayey Sand (SC)</b> - medium dense, moist, brown (estimated 20% low plastic fines, 80% sand)			
3		[Grid Pattern]				S	2 - 7' <b>Bedrock</b> - Stained State (STS), Compression (DQ), Intersecting Open Planes (3-D), Unit Weight estimated 130-140 pcf, excavates to a dense <b>Sandy Gravel (GP)</b> consistency, with CaCO <sub>3</sub> staining			
4	BEDROCK	[Grid Pattern]								
5		[Grid Pattern]								
6		[Grid Pattern]								
7		[Grid Pattern]								
Bottom of Test Pit @ 7 Feet No Free Water Encountered										

GROUNDWATER & SOIL MOISTURE				SAMPLE TYPE		LABORATORY TESTS	
	Depth	Hour	Date	D - DRY	A - Drill Cuttings	B - Bulk Sample	A- Atterberg Limits
☒	NE		3/9/2007	S - SLIGHTLY MOIST	C - CME Sample	R - Rotary Cuttings	B- Grain Size Distribution
☒				M - MOIST	S- 2" O.D. 1.38" I.D. Tube Sample		C- Consolidation
NE- No Free Water Encountered				V - VERY MOIST	U- 3" O.D. 2.42" I.D. Tube Sample		MD- Moisture/Density
				W - WET	T- 3" O.D. Thin-Walled Shelby Tube		DS - Direct Shear



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**Plate**  
**A-2**

# LOG OF TEST PIT NO. E

PROJECT NAME:	BROKEN HILLS - PHASE 1
LOCATION:	SEE PLAN
DATE:	3/9/2007

PROJECT NUMBER:	1422.01
SURFACE ELEVATION:	SEE PLAN
EXPLORATION EQUIPMENT:	DEERE 410E

Depth in Feet	Unified Soil Classification	Graphical Log	Sample	Sample Type	Sample No.	Moisture	Visual Description	Pocket Penetrometer (tsf)	Moisture Content (% of Dry Weight)	Laboratory Tests	
1	SC					S	0 - 1' Clayey Sand (SC) - loose, slightly moist, brown (estimated 25% low plastic fines, 75% sand)				
2							1 - 10' <b>Bedrock</b> - Stained State (STS), Compression (DQ), Intersecting Open Planes (3-D), Unit Weight estimated 130-140 pcf, excavates to a dense <b>Sandy Gravel with Clay (GC)</b> consistency, with CaCO3 staining				
3											
4											
5	BEDROCK					S					
6				B	E1						
7											
8											
9											
10											
Bottom of Test Pit @ 10 Feet No Free Water Encountered											

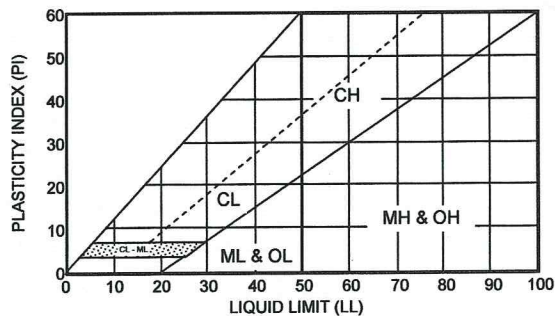
GROUNDWATER & SOIL MOISTURE				SAMPLE TYPE		LABORATORY TESTS	
	Depth	Hour	Date	D - DRY	A - Drill Cuttings	B - Bulk Sample	A- Atterberg Limits
Σ	NE		3/9/2007	S - SLIGHTLY MOIST	C - CME Sample	R - Rotary Cuttings	B- Grain Size Distribution
∇				M - MOIST	S- 2" O.D. 1.38" I.D. Tube Sample		C- Consolidation
NE- No Free Water Encountered				V - VERY MOIST	U- 3" O.D. 2.42" I.D. Tube Sample		MD- Moisture/Density
				W - WET	T- 3" O.D. Thin-Walled Shelby Tube		DS - Direct Shear



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Plate  
A-2

MAJOR DIVISION					TYPICAL NAMES
COARSE-GRAINED SOILS MORE THAN HALF IS COARSER THAN NO. 200 SIEVE	GRAVEL MORE THAN HALF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE	CLEAN SANDS WITH LITTLE OR NO FINES	○○○	GW	WELL GRADED GRAVELS WITH OR WITHOUT SAND, LITTLE OR NO FINES
			●●●	GP	POORLY GRADED GRAVELS WITH OR WITHOUT SAND, LITTLE OR NO FINES
		GRAVELS WITH OVER 12% FINES	●●●●	GM	SILTY GRAVELS, SILTY GRAVELS WITH SAND
			●●●●●	GC	CLAYEY GRAVELS, CLAYEY GRAVELS WITH SAND
	SAND MORE THAN HALF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE	CLEAN SANDS WITH LITTLE OR NO FINES	○○○○	SW	WELL GRADED SANDS WITH OR WITHOUT GRAVEL, LITTLE OR NO FINES
			●○○○	SP	POORLY GRADED SAND WITH OR WITHOUT GRAVEL, LITTLE OR NO FINES
		SANDS WITH OVER 12% FINES	●●○○	SM	SILTY SANDS WITH OR WITHOUT GRAVEL
			●●●●	SC	CLAYEY SANDS WITH OR WITHOUT GRAVEL
FINE-GRAINED SOILS MORE THAN HALF IS FINER THAN NO. 200 SIEVE	SILT AND CLAY LIQUID LIMIT 50% OR LESS			ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTS WITH SANDS AND GRAVELS
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY CLAYS WITH SANDS AND GRAVELS, LEAN CLAYS
				OL	ORGANIC SILTS OR CLAYS OF LOW PLASTICITY
	SILT AND CLAY LIQUID LIMIT GREATER THAN 50%			MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOLID, ELASTIC SILTS
				CH	INORGANIC CLAYS OR HIGH PLASTICITY, FAT CLAYS
				OH	ORGANIC SILTS OR CLAYS MEDIUM TO HIGH PLASTICITY
HIGHLY ORGANIC SOILS				Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS



CONSISTENCY		RELATIVE DENSITY	
SILTS & CLAYS	SPT BLOW* COUNTS (N)	SANDS & GRAVELS	SPT BLOW* COUNTS (N)
VERY SOFT	0 - 2	VERY LOOSE	0 - 4
SOFT	3 - 4	LOOSE	5 - 10
MEDIUM STIFF	5 - 8	MEDIUM DENSE	11 - 30
STIFF	9 - 15	DENSE	31 - 50
VERY STIFF	16 - 30	VERY DENSE	50 +
HARD	30 +		

\* The Standard Penetration Resistance (N) In blows per foot is obtained by the ASTM D1585 procedure using 2" O.D., 1 3/8" I.D. samplers.

DESCRIPTION OF ESTIMATED PERCENTAGES OF GRAVEL, SAND, AND FINES	
TRACE	Particles are present but est. < 5%
FEW	5% - 10%
LITTLE	15% - 20%
SOME	30% - 45%
MOSTLY	50% - 100%

NOTE: Percentages are presented within soil description for soil horizon with laboratory tested soil samples.

DEFINITIONS OF SOIL FRACTIONS	
SOIL COMPONENT	PARTICLE SIZE RANGE
COBBLES	ABOVE 3 INCHES
GRAVEL	3 IN. TO NO. 4 SIEVE
COARSE GRAVEL	3 IN. TO 3/4 IN.
FINE GRAVEL	3/4 IN. TO NO. 4 SIEVE
SAND	NO. 4 TO NO. 200
COARSE SAND	NO. 4 TO NO. 10
MEDIUM SAND	NO. 10 TO NO. 40
FINE SAND	NO. 40 TO NO. 200
FINES (SILT OR CLAY)	MINUS NO. 200 SIEVE

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**UNIFIED SOIL CLASSIFICATION AND KEY TO SOIL DESCRIPTIONS**

**Geotechnical Investigation**

**BROKEN HILLS**

**PHASE 1**

Project No.: 1422.01  
Date: 03/10/07

**PLATE A-3**

**UNIFIED ROCK CLASSIFICATION SYSTEM  
(URCS)**


<b>DEGREE OF WEATHERING</b>						
<b>REPRESENTATIVE</b>		<b>ALTERED</b>	<b>WEATHERED</b>			
Micro Fresh State (MFS)	Visually Fresh State (VFS)		>GRAVEL SIZE	<SAND SIZE		
				Stained State (STS)	Partially Decomposed State (PDS)	Completely Decomposed State (CDS)
<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>		<b>E</b>	
Unit Weight Relative Absorption		Compare to Fresh State	Non-Plastic	Plastic	Non-Plastic	Plastic

<b>ESTIMATED STRENGTH</b>				
<b>REACTION TO IMPACT OF 1LB BALL PEEN HAMMER</b>				<b>REMOLDING<sup>1</sup></b>
"Rebounds" (RQ)	"Pits" (Tensional) (PQ)	"Dents" (Compression) (DQ)	"Craters" (Shears) (CQ)	Moldable (Friable) (MQ)
<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>
>15,000 psi <sup>2</sup>	8,000-15,000 psi <sup>2</sup>	3,000-8,000 psi <sup>2</sup>	1,000-3,000 psi <sup>2</sup>	<1,000 psi <sup>2</sup>

<sup>1</sup> Strength estimated by soil mechanics techniques  
<sup>2</sup> Approximate unconfined compressive strength

<b>DISCONTINUITIES</b>				
<b>VERY LOW PERMEABILITY</b>			<b>MAY TRANSMIT WATER</b>	
Solid (Random Breakage) (SRB)	Solid (Preferred Breakage) (SPB)	Solid (Latent Planes of Separation) (LPS)	Nonintersecting Open Planes (2-D)	Intersecting Open Planes (3-D)
<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>

<b>UNIT WEIGHT</b>				
> 160 pcf	150-160 pcf	140-150 pcf	130-140 pcf	<130 pcf
<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>


 <p><b>JAMES EDWARD ENGINEERING</b> INCORPORATED</p> <p>9475 Double R Boulevard, Reno, NV 89521 Phone 775.828.1866 Fax 775.828.1871</p>	<p align="center"><b>SUMMARY OF TEST RESULTS</b></p>	<p align="right"><i>Geotechnical Investigation</i></p> <p align="center"><b>BROKEN HILLS PHASE 1</b></p>
		<p>Project No.: 1422.01 Date: 03/10/07</p>

ESAL RANGE	
High	700,000 - 1,000,000
Medium	400,000 - 600,000
Low (125 - 750 Residences)	50,000 - 300,000

ESAL DETERMINATION		
Design Life (yrs)	L	20
Number of Lots	N	150
Average Daily Two Way Trips per Lot	T <sub>d</sub>	10
Percent Heavy Trucks	T	2
Average Truck Factor	T <sub>f</sub>	0.52
Construction Traffic (Trips per Lot)	T <sub>c</sub>	20
Construction Truck Factor	T <sub>cf</sub>	1.0
ESAL <sub>20</sub>	5.99E+04	

STRUCTURAL NUMBER (CLIMATE ZONE V)			
Relative Quality of Roadbed Soil	Traffic Level	Reliability	
		50% SN	75% SN
Very Good (R>35)	High	2.4 - 2.6	2.7 - 2.8
	Medium	2.2 - 2.4	2.4 - 2.6
	Low	1.6 - 2.1	1.7 - 2.2
Good (R>15)	High	2.7 - 2.9	3.0 - 3.1
	Medium	2.5 - 2.7	2.6 - 2.9
	Low	1.8 - 2.4	2.0 - 2.5
Fair (R>10)	High	2.9 - 3.1	3.2 - 3.3
	Medium	2.6 - 2.8	2.8 - 3.1
	Low	1.9 - 2.5	2.1 - 2.7
Poor (R>7)	High	3.2 - 3.4	3.5 - 3.6
	Medium	2.9 - 3.2	3.1 - 3.4
	Low	2.2 - 2.8	2.3 - 2.9
Very Poor (R>5)	High	3.4 - 3.6	3.7 - 3.8
	Medium	3.1 - 3.3	3.3 - 3.6
	Low	2.3 - 3.0	2.5 - 3.1

Material Type	Reference	Structural Coefficient	Thickness (in) - Wa. Co.	Thickness (in)	Thickness (in)	Thickness (in)
Plantmix Surface	AC	0.35	3	4	4	0
Plantmix Base	PB	0.32	0	0	0	0
Cement Treated	CTB	0.2	0	0	0	0
Type 2 Class B	AB	0.1	6	6	8	0
Structural Fill (R-45)	SF	0.07	0	0	0	0
Structural Number for Section			1.7	2.0	2.2	0.0



**JAMES EDWARD ENGINEERING**  
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**STRUCTURAL PAVEMENT SECTION DESIGN (Low Volume Roads)**

*Geotechnical Investigation*  
**BROKEN HILLS** PHASE 1  
Project No.: 1422.01  
Date: 03/10/07

**PLATE A-5**



# APPENDIX B

**PRELIMINARY GEOTECHNICAL  
INVESTIGATION  
EAGLE CANYON - BROKEN HILLS  
WASHOE COUNTY, NEVADA**

**PREPARED FOR:**

**BARKER COLEMAN CONSTRUCTION  
Mr. Karl Matzoll, PE  
Matrix Engineering and Consulting, Inc.  
4741 Caughlin Parkway, Suite 1B  
Reno, Nevada 89509**

**August 2004**

**MATRIX CONSTRUCTION SERVICES  
I N C O R P O R A T E D**

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**MATRIX CONSTRUCTION SERVICES**  
I N C O R P O R A T E D

August 12, 2004  
Project Number: 1083.01

**BARKER COLEMAN CONSTRUCTION**  
c/o Mr. Karl Matzoll, P.E.  
**MATRIX ENGINEERING & CONSULTING INC.**  
4741 Caughlin Parkway, Suite 1B  
Reno, Nevada 89509

**RE: PRELIMINARY GEOTECHNICAL INVESTIGATION**  
**EAGLE CANYON – BROKEN HILLS**  
**RENO, NEVADA**

Dear Mr. Matzoll:

Matrix Construction Services, Inc. is pleased to present the results of our preliminary geotechnical investigation for the referenced residential subdivision to be constructed in Washoe County, Nevada. The site encompasses an area of approximately 253 acres, with 100 acres to be developed into an estimated 170 residential lots. Eagle Canyon Drive passes near the southwest corner of the parcel and provides access. Numerous dirt roads also provide access to the development area.

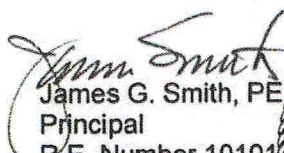
In general, the geotechnical profile consists of silty to clayey sand with gravel capping weathered bedrock. The weathered bedrock typically excavated as silty sandy gravel with limited plasticity. The deepest test pit was advanced to 18 feet and refusal was not met. Cuts and fills are anticipated to be less than 10 feet. The material generated during grading should provide adequate subgrade support for foundations and roadways.

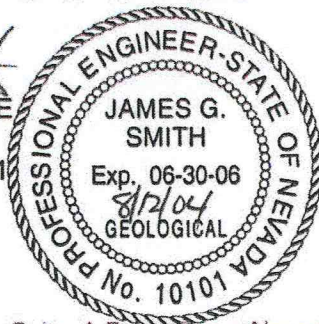
The following report presents our findings, discusses our methods, and provides preliminary geotechnical recommendations for design and construction of the project as currently planned. The recommendations presented herein are intended to reduce the risk of structural distress due to expansion and/or consolidation of the native soils and structural fill.


We wish to thank you for the opportunity to provide you with our services, and look forward to working with you during construction.

Sincerely,

**MATRIX CONSTRUCTION SERVICES**  
I N C O R P O R A T E D

  
James G. Smith, PE  
Principal  
R.E. Number 10101  
Expires 6-30-06



  
Mischelle J. Smith, PE  
Project Engineer

JGS:MJS:er

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**TABLE OF CONTENTS**

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<b>INTRODUCTION</b> .....	1
<b>PROJECT DESCRIPTION</b> .....	1
<b>SITE CONDITIONS</b> .....	2
<b>EXPLORATION</b> .....	2
<b>LABORATORY TESTING</b> .....	3
<b>GEOLOGIC AND GENERAL SOIL AND GROUNDWATER CONDITIONS</b> .....	3
<b>SEISMIC HAZARDS</b> .....	3
<b>DISCUSSION AND RECOMMENDATIONS</b> .....	4
<b>GENERAL INFORMATION</b> .....	4
Soil Profile Type Amplification Factors .....	5
Site Preparation .....	5
Grading and Filling.....	6
Trenching and Excavation .....	7
Foundations .....	8
Slope Stability and Erosion Control .....	9
Site Drainage .....	10
Concrete Slabs .....	11
Asphaltic Concrete.....	12
Asphalt Design Life.....	12
<b>CONSTRUCTION OBSERVATION AND TESTING SERVICES</b> .....	13
<b>STANDARD LIMITATION CLAUSE</b> .....	13
<b>REFERENCES</b> .....	15

**FIGURES**

- Figure 1 – Project Site
- Figure 2 – Site and soil conditions associated with Test Pit 3 (TP-3)
- Figure 3 – Options for maintaining maximum fill differential beneath residences.

**TABLES**

- Table 1 – Guideline Specification for Imported Structural Fill
- Table 2 – Maximum Allowable Temporary Slopes
- Table 3 – Foundation Allowable Bearing Pressures

**PLATES**

- Appendix A
- Plate A-1 – Site Map
- Plate A-2 – Logs of Test Pits
- Plate A-3 – Unified Soil Classification System and Key to Soil Description
- Plate A-4 – Summary of Test Results

**PRELIMINARY GEOTECHNICAL INVESTIGATION**  
**EAGLE CANYON – BROKEN HILLS**  
**Washoe County, Nevada**

**INTRODUCTION**

Presented herein are the results of Matrix Construction Services' geotechnical exploration, laboratory testing, and associated geotechnical design recommendations for the proposed residential development, Eagle Canyon – Broken Hills, to be located in Washoe County, Nevada. These recommendations are based on surface and subsurface conditions encountered in our explorations, and on details of the proposed project as described in this report. The objectives of this study were to:

1. Determine general soil and ground water conditions pertaining to design and construction of the proposed subdivision.
2. Provide recommendations for design and construction of the project, as related to these geotechnical conditions.

The area covered by this report is shown in Figure 1 and on Plate A-1 (Site Plan & Approximate Test Pit Locations) in Appendix A. Our study included field exploration, laboratory testing, and engineering analyses to identify the physical and mechanical properties of the various on-site materials. Results of our field exploration and testing programs are included in this report and form the basis for all conclusions and recommendations.

**PROJECT DESCRIPTION**

The overall site, located in Washoe County, Nevada, encompasses an area of approximately 253 acres, with approximately 100 acres to be developed. The development is contained in Section 21, Township 21N, Range 20E, M.D.M. As shown in Figure 1, undeveloped land surrounds the immediate parcel perimeter. Eagle Canyon Drive passes near the southwest corner of the parcel.

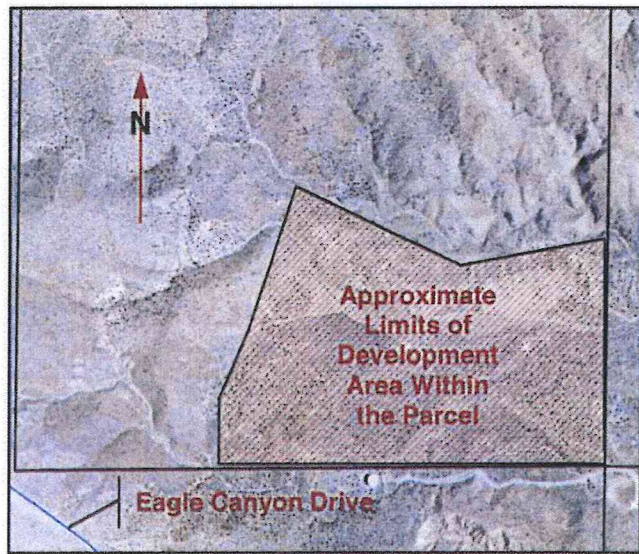


Figure 1 – Project Site

The project consists of developing a single-family residential subdivision. Homes will be one to two-story, wood-framed, with raised floor construction. Foundation loads are anticipated to be light.

All street improvements will be dedicated to Washoe County. Underground utilities will be provided by a variety of public and private companies.

The development will be phased for a balance of cut and fills with little or no required import. Cuts and fills are anticipated to be less than 10 feet.

### **SITE CONDITIONS**

The site is situated at the base of the eastern flank of Hungry Mountain, along a ridgeline separating Hungry and Spanish Springs Valleys. Slopes vary from slight (~5%) to steep. Vegetation is light to moderate and typically consists of grasses, brush, and trees. Several dirt roads cross the property.



**Figure 2 – Site and soil conditions associated with Test Pit 3 (TP-3).**

### **EXPLORATION**

The project was explored in June 2004 by excavating a series of 11 test pits using a Cat EL300B trackhoe. The approximate locations of the test pits are shown on Plate A-1 – Site Map and Approximate Test Pit Locations. The maximum depth of test pit advance was 18 feet below the existing ground surface. Bulk samples for index testing were collected from the trench walls at specific depths in each soil horizon.

Matrix Construction Services' personnel examined and classified all soils in the field in general accordance with ASTM D 2488 (Description and Identification of Soils). During exploration, representative bulk samples were placed in sealed plastic bags and returned to our Reno, Nevada laboratory for testing. Additional soil classifications, as well as verification of the field classifications, were subsequently performed in accordance with ASTM 2487 (Unified Soil Classification System [USCS]) upon completion of laboratory testing as described below in the **Laboratory Testing**

section. Logs of the test boring and test pits are presented as Plate A-2. A USCS chart has been included as Plate A-3 - Graphic Soils Classification Chart.

### **LABORATORY TESTING**

All soil testing performed in the Matrix Construction Services' laboratory is conducted in accordance with the standards and methods described in Volume 4.08 (Soil and Rock; Dimension Stone; Geosynthetics) of the ASTM Standards.

Samples of significant soil types were analyzed to determine their in-situ moisture contents (ASTM D 2216), grain size distributions (ASTM D 422), and plasticity indices (ASTM D 4318). Results of these tests are shown on Plate B-1 - Index Test Results. The test results were used to classify the soils according to the USCS (ASTM D 2487) and to verify the field logs, which were then updated.

### **GEOLOGIC AND GENERAL SOIL AND GROUNDWATER CONDITIONS**

Based on the Geologic Map of Washoe and Storey Counties, Nevada (1969), the site is mapped in an area of Pliocene sedimentary units capping undifferentiated plutonic rocks, most commonly granodiorite. The soils/bedrock units encountered in our explorations typically consisted of clayey sand and silty sand locally capping granodiorite bedrock.

Groundwater was not encountered in any of our explorations.

### **SEISMIC HAZARDS**

The Spanish Springs Valley area lies sandwiched between the Pah Rah Range to the east and Hungry Mountain to the west, within the Western extreme of the Basin and Range physiographic province. The Basin and Range is bounded by the seismically active zones of the Wasatch Front and the eastern front of the Sierra Nevada Mountains to the east and west, respectively.

The criteria for Quaternary earthquake fault evaluation has been formulated by a professional committee for the State of Nevada Seismic Safety Council, but has not yet been adopted by the State or Counties. These guidelines define active faults as those with evidence of displacement within the past 11,000 years (Holocene time). Those faults with evidence of displacement during Pleistocene time (11,000 to 2,000,000 years before present) are generally considered potentially active. Several north-south trending faults transect the older plutonic units but are

obscured by the younger Pliocene deposits and would therefore be considered inactive. No mapped faults transect the site.

Liquefaction is a loss of soil shear strength that can occur during a seismic event, as excessive pore water pressure, between the soil grains, is induced by cyclic shear stresses. This phenomenon is limited to unconsolidated, clean to silty sand (up to 35 percent non-plastic fines) lying below the ground water table (typically less than 40 feet deep). Based on the information obtained during our exploration and research programs, no liquefaction potential exists at the site due to the competent nature of the subgrade soil and bedrock and depth to groundwater.

## **DISCUSSION AND RECOMMENDATIONS**

### **General Information**

The following definitions characterize terms utilized in this report:

- ◆ Fine-grained soil possesses more than 40 percent by weight passing the number 200 sieve and exhibits a plasticity index lower than 15.
- ◆ Clay soil possesses more than 30 percent passing the number 200 sieve and exhibits a plasticity index greater than 15.
- ◆ Granular soil does not meeting the above criteria and has a maximum particle size less than 6-inches.

The recommendations provided herein, particularly under **Site Preparation, Grading and Filling, Foundation Design, Site Drainage** and **Quality Control** are intended to reduce risks of structural distress related to consolidation or expansion of native soils and/or structural fills. These recommendations, along with proper design and construction of the planned structure(s) and associated improvements, work together as a system to improve overall performance. If any aspect of this system is ignored or poorly implemented, the performance of the project will suffer. Barker Coleman has Matrix Construction Services, Inc., under contract to provide construction testing and observation services. Any evaluation of the site for the presence of surface or subsurface hazardous substances is beyond the scope of this study. When suspected hazardous substances are encountered during routine geotechnical investigations,



they are noted in the exploration logs and reported to the client. No such substances were identified during our exploration.

The test pits were excavated by backhoe at the approximate locations shown on the site plan. All test pits were backfilled upon completion of the field portion of our study. The backfill was compacted to the extent possible with the equipment on hand. However, the backfill was not compacted to the requirements presented herein under Grading and Filling. If structures, concrete flatwork, pavement, utilities or other improvements are to be located in the vicinity of any of the test pits, the backfill should be removed and re-compacted in accordance with the requirements contained in the soils report. Failure to properly compact backfill could result in excessive settlement of improvements located over test pits.

Structural areas referred to in this report include all areas of buildings, concrete slabs, asphalt pavements, as well as pads for any minor structures. All compaction requirements presented in this report are relative to ASTM D 1557<sup>1</sup>.

### **Soil Profile Type Amplification Factors**

The project is located within Seismic Zone 3, an area with a strong potential for ground shaking. In accordance with 1997 UBC guidelines, there are 6 different soil profile type amplification factors ranging from  $S_a$  to  $S_f$ . The recommended soil profile type amplification factor is based on two criteria: density (for soils based on SPT blow count data) or hardness (for bedrock sites), and soil and/or bedrock classification for sites with soil profiles that have been determined to a depth of 100-feet. However, if the soil profile has not been characterized to a depth of 100-feet, the UBC allows the use of a default soil type of  $S_d$ .

### **Site Preparation**

All vegetation and topsoil is to be stripped and grubbed from structural areas. A minimum stripping depth of 0.3 to 0.5 feet is anticipated. Localized deeper areas may be required in areas of large brush and tress. Some vegetation could be placed in backyard non-structural fill areas at least 5 feet away from the structure footprint. Concentration of the vegetation must be avoided, since placing large concentrated layers of vegetation could lead to excessive settlement and subsequent surface depressions.

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<sup>1</sup> \* Relative compaction refers to the ratio (percentage of the in-place density of a soil divided by the same soil's maximum dry density) as determined by the ASTM D 1557 laboratory test procedure. Optimum moisture content is the corresponding moisture content of the same soil at its maximum dry density.

All areas to receive structural fill or structural loading should be densified to a minimum depth of 8-inches to at least 90 percent relative compaction in accordance with ASTM D 1557. It is recommended that soils have moisture contents of plus or minus 3 percent of optimum moisture (ASTM D1557) prior to densification. Higher moisture contents will be acceptable if the soil horizon is stable and density can be achieved in subsequent structural fill lifts. Scarification and moisture conditioning may be required to achieve the required soil moisture content recommendations.

**Grading and Filling**

Structural fill is defined as any material placed below structural elements, including; foundations, concrete slabs-on-grade, pavements, or any structure that derives support from the underlying soil. Granular and fine-grained soil generated on-site and free of vegetation, organic matter, and other deleterious material can be used as structural fill. If imported structural fill is required, it should be free of vegetation, organic matter, and other deleterious material and meet the requirements of Table 1.

<b>TABLE 1 - GUIDELINE SPECIFICATION FOR IMPORTED STRUCTURAL FILL</b>		
<u>Sieve Size</u>	<u>Percent by Weight Passing</u>	
6 Inch	100	
¾ Inch	70 – 100	
No. 40	15 – 70	
No. 200	10 – 40	
<u>Percent Passing No. 200 Sieve</u>	<u>MAXIMUM LIQUID LIMIT</u>	<u>Maximum Plastic Index</u>
10 – 20	40	15
21 – 40	35	10

Adjustments to the recommended limits presented in Table 1 can be provided to allow the use of other granular, non-expansive material, including rock fills. Any such adjustments must be made and approved by the geological engineer, in writing, prior to importing fill to the site. Rock fills must consist of a 12-inch-minus, well-graded soil, placed and compacted in maximum 15-inch thick lifts. A soil fill or 3-inch minus rock fill is normally used for the final 12 inches of pad fills to facilitate fine grading and utility trenching.

Structural fill should be placed in maximum 12-inch thick (loose) level lifts or layers and densified to at least 90 percent relative compaction. The required moisture content of the soils prior to densification depends on the soil type and the moisture-density relationship test results (ASTM D1557). However, soils should have moisture contents of at least plus or minus 3 percent of optimum moisture (ASTM D1557). Higher moisture contents are acceptable if the soil lifts are stable and required relative compaction can be attained in the soil lift and subsequent soil lifts. Where structural fills exceed 5 feet in thickness the minimum compaction requirement shall be increased to 95 percent.

The maximum fill differential beneath a single structure shall be limited to 5 feet. As shown in Figure 3, overexcavation and replacement of insitu soils or extending foundations may be necessary to meet this requirement.

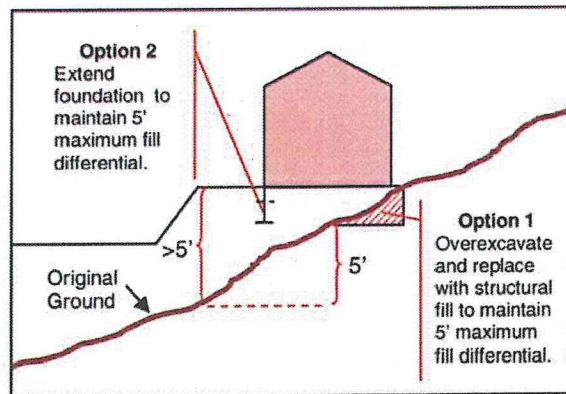


Figure 3 – Options for maintaining maximum fill differential beneath residences.

The exterior face of any embankment should be constructed with an inclination of no steeper than 2H:1V. The surface of the slope should be compacted to the same percent compaction as the body of the fill. This may be accomplished by compacting the surface of the embankment as it is constructed or by overbuilding the fill and cutting back to its compacted core. However, the cut away material should be placed and compacted as outlined above rather than left at the base of the slope.

### Trenching and Excavation

Regulations amended in Part 1926, Volume 54, Number 209 of the Federal Register (Table B-1, October 31, 1989) require that the temporary sidewall slopes be no greater than those presented in Table 2. Temporary trenches with near vertical sidewalls should be relatively stable to a depth of approximately five feet. Excavations to greater depths will require shoring or laying back of sidewalls to maintain adequate stability.

<b>TABLE 2 - MAXIMUM ALLOWABLE TEMPORARY SLOPES</b>		
<b><u>Soil or Rock Type</u></b>	<b>Maximum Allowable Slopes<sup>1</sup> For Deep Excavations Less Than 20 Feet Deep<sup>2</sup></b>	
<b>Stable Rock</b>	Vertical	(90 degrees)
<b>Type A<sup>3</sup></b> - cohesive, non-fissured soils, with an unconfined compressive strength of 1.5 tons per square foot (tsf) or greater	3H:4V	(53 degrees)
<b>Type B</b> - cohesive soils with an unconfined compressive strength between 0.5 and 1.5 tsf	1H:1V	(45 degrees)
<b>Type C</b> - unconfined compressive strength below 0.5 tsf	3H:2V	(34 degrees)
<b>NOTES:</b>		
1. Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from the horizontal. Angles have been rounded off. Numerous additional factors and exclusions are included in the formal definitions.		
2. Sloping or benching for excavations greater than 20 feet deep shall be designed by a registered professional engineer.		
3. A short-term (open 24 hours or less) maximum allowable slope of 1H:2V (63 degrees) is allowed in excavations in Type A soil that are 12 feet or less in depth. Short-term maximum allowable slopes for excavations greater than 12 feet in depth shall be 3H:4V (53 degrees).		

Based on the results of our exploration, it is our opinion that the bulk of the site soils appear to be predominately Type B, although variations exist. Areas with poorly graded sands with silt were encountered and these soils are classified as a Type C soil. All trenching should be performed and stabilized in accordance with local, state, and OSHA standards. Bank stability is the responsibility of the contractor, who is present at the site, able to observe changes in ground conditions, and has control over personnel and equipment.

### Foundations

It is our understanding that spread footings will be utilized for this project. Provided the foundation soils have been prepared in accordance with the recommendations of this report, the bearing pressures presented in Table 3 can be utilized for design.

<b>TABLE 3 – FOUNDATION ALLOWABLE BEARING PRESSURES</b>	
<b>Loading Conditions</b>	<b>Maximum Soil Net Allowable Bearing Pressures<sup>1</sup> (pounds per square foot)</b>
Dead Loads plus full time live loads	2,000
Dead Loads plus live loads, plus transient wind, or seismic loads.	2,700
<b>NOTES:</b>	
1. The net allowable bearing pressure is that pressure at the base of the footing in excess of the adjacent overburden pressure.	

For frost protection, footings should all be set at least two feet below adjacent outside or unheated interior finish grades. Footings not located within frost prone areas should be placed at least 12 inches below surrounding ground or slab level for confinement. Regardless of loading, individual pad foundations and continuous spread foundations should be at least 18 and 12 inches wide, respectively, or as required by code.

Lateral loads, such as wind or seismic, may be resisted by passive soil pressure and friction on the bottom of the footing. The recommended coefficient of base friction is 0.38, and has been reduced by a factor of 1.5 on the ultimate soil strength. Design values for active and passive equivalent fluid pressures are 33 and 300 pounds per square foot per foot of depth, respectively. In designing for passive pressure, the upper one-foot of the soil profile should not be included unless confined by a concrete slab, or pavement. These design values are based on spread footings bearing on native granular soils, native fine-grained soils, or structural fill and backfilled with structural fill.

If loose, soft, wet, or disturbed soils are encountered at the foundation subgrade, these soils should be removed to expose suitable foundation soils, and the resulting over-excavation backfilled with compacted structural fill. The base of all excavations should be dry and free of loose materials at the time of concrete placement.

Total settlement for the structures is anticipated to be on the order of 1 inch, or less. Differential settlement between foundations with similar loads and sizes is anticipated to be ½ of the total settlement.

### **Slope Stability and Erosion Control**

Stability of cut and filled surfaces involves two separate aspects. The first concerns true slope stability related to mass wasting, landslides or the enmasse downward movement of soil or rock. Cut and fill slopes, with gradients of 2H:1V (horizontal to vertical) or flatter, are suitable for the project soils.

The second aspect of stability involves erosion potential and is dependent on numerous factors involving grain size distribution, cohesion, moisture content, slope angle and the velocity of the water or wind on the ground surface. Erosion protection should be in accordance with the City of Reno *Public Works Design Manual*.

Temporary (during construction) and permanent (after construction) erosion control will be required for all disturbed areas. The contractor shall prevent dust from being generated during construction in compliance with all applicable city, county, state and federal regulations, and shall submit an acceptable dust control plan to the Washoe County District Health Department prior to starting site preparation or earthwork. The project specifications should include an indemnification by the contractor of the owner and engineer for any dust generation during the construction period. The owner will be responsible for mitigation of dust after his acceptance of the project.

### **Site Drainage**

Adequate surface drainage must be constructed and maintained away from the structures. The permanent finish slopes away from the structure should be sufficient to allow water to drain away quickly from and prevent any ponding of water adjacent to the structure. All runoff should be collected within permanent drainage paths that can convey water off the property. A system of roof gutters and downspouts is recommended to collect roof drainage and direct it away from the foundations.

Crawl space moisture is commonly associated with raised floor construction. Introduction of this moisture is due to several sources including, but not limited to: excessive landscape irrigation, poor site drainage, excessive precipitation, or leakage pools, ponds, irrigation lines, etc. In addition, it is common for water to seep into fill material, perch on the native or compacted soils, travel along the surface of the native or compacted soils, and daylight where the cut/fill line is exposed. This perched water can daylight in any number of locations such as slope faces, roadway subgrade, and crawl spaces.

Foundation and stem wall backfill should be densified to at least 90 percent relative compaction in accordance with the requirements given in Section 9.4 – Grading and Filling. Compacting the backfill material decreases permeability and reduces the amount of irrigation and storm water available to enter under floor areas.

We recommend the developer collect the moisture via drainage swales excavated along the interior of the perimeter footing and sloped the water to the sewer lateral and gravel bed the lateral from the crawl space to the sewer main. The trench should start out a minimum depth of 3 inches below footing grade and slope to the sewer lateral at approximately 1 percent, and

should be backfilled with drain rock. Once the swales are constructed, the entire crawl space should be covered with a moisture barrier (visqueen sheeting). Refer to Appendix D for a construction detail of the proposed drainage swale alternative.

Crawl space drainage systems are not a guarantee against sporadic wetting caused by large storms, unusually large and/or rapid snowmelt or plumbing leaks. The purpose of a crawl space drainage system is to reduce the amount of moisture that accumulates in the crawl space under normal conditions and to drain the moisture caused by an unusual condition within a few days or possibly weeks. Positive crawl space drainage does not insure that soils are dry, only that ponding water is not normally present. As with other design features of the residence, maintenance is required.

Moist to wet soils are normal in crawl spaces, particularly in the vicinity of the perimeter footings. Any perceived harmful effects from this moisture are usually alleviated by the proper installation of a visqueen vapor retarder placed over the crawl space surface. Crawl space vents should be open all year to help facilitate the evaporation and reduction of moisture.

### **Concrete Slabs**

A compacted base with a minimum R-value of 60 shall underlie private concrete slabs-on-grade. Type 2, Class B aggregate base is the preferred alternative. However, other material types such as decomposed granite, or native poorly graded sand with silt meeting the R-value requirement is acceptable within private improvements such as patios, private walks, and driveways. The base material should be 6 inches beneath driveways and 4 inches beneath private flatwork. All dedicated and public easement improvements shall be constructed in accordance with the Standard Specifications for Public Works Construction.

We recommend that all concrete placement and curing be performed in accordance with procedures outlined by the American Concrete Institute. Special considerations should be given to concrete placed and cured during hot or cold weather conditions. Proper control joints and reinforcing should be provided to minimize any damage resulting from shrinkage.

## **Asphaltic Concrete**

The minimum structural section for roadways within Washoe County is 3 inches of asphaltic concrete and 6 inches of base material with a Type II Slurry Seal. Based on our analyses, the minimum structural section can be used for the streets within the subdivision.

All roadway construction shall be in accordance with the approved plans and the Standard Specifications for Public Works Construction. Roadway subgrade shall be prepared in accordance with the requirements of this report. The Contractor should submit a pavement mix design to the Owner, for approval, at least 5 working days prior to paving. When pavement is placed directly adjacent to concrete flatwork, the finish compacted grade of the pavement be at least ½ of an inch higher than the edge of adjacent concrete surface to allow adequate compaction of the pavement without damaging the concrete.

## **Asphalt Design Life**

Maintenance is **mandatory** to long-term pavement performance. Maintenance refers to any activity performed on the pavement that is intended to preserve its original service life or load-carrying capacity. Examples of maintenance activities include patching, crack or joint sealing, and seal coats. If these maintenance activities are ignored or deferred, premature failure of the pavement **will occur**.

The cost associated with proper maintenance is generally much less than the cost for reconstruction due to the premature failure of the pavement. Therefore, since pavement quality is an integral consideration in the formulation of our design recommendations, we strongly recommend the owner/project manager implement a pavement management program.

Premature failure of asphaltic concrete frequently occurs adjacent to poorly graded ponding areas and/or landscape areas. Failures may occur due to excessive precipitation, irrigation and landscaping water infiltrating into the subgrade soils causing subgrade failure. As such, in areas where saturation of the subgrade soils beneath asphaltic pavement may occur, we strongly recommend the owner/project manager install a subdrain system to eliminate the potential for saturation of subgrade soils. The subdrain system should discharge into a permanent drainage area that will not impede drainage flow to cause the system to back-up and/or clog. Appropriate maintenance procedures should be implemented to ensure the subdrain system does not plug and allow for proper drainage of surface and subsurface water beneath paved areas. Subdrain



location and configuration should be evaluated once final grading and landscaping plans have been prepared. If the ultimate traffic exceeds the anticipated levels, it may be necessary to reevaluate and overlay the pavement at some time in the future.

## **CONSTRUCTION OBSERVATION AND TESTING SERVICES**

Matrix Construction Services is currently under contract to provide testing and observation services during site preparation, grading, over-excavation, fill placement, and paving. These observations would allow us to document that the geotechnical conditions are as anticipated and that the contractor's work meets with the criteria in the approved plans and specifications.

## **STANDARD LIMITATION CLAUSE**

This report has been prepared in accordance with generally accepted local geotechnical practices. The analyses and recommendations submitted are based upon field exploration performed at the locations shown on Plate A-1 – Site Plan of this report. This report does not reflect soils variations that may become evident during the construction period, at which time re-evaluation of the recommendations may be necessary. We recommend our firm be retained to perform construction observation in all phases of the project related to geotechnical factors to document compliance with our recommendations. The owner/project manager is responsible for distribution of this geotechnical report to all designers and contractors whose work is related to geotechnical factors.

All plans and specifications should be reviewed by the design engineer responsible for this geotechnical report, to determine if they have been completed in accordance with the recommendations contained in this report, prior to submitting to the building department for review. It is the owner's/project manager responsibility to provide the plans and specifications to the engineer.

This report has been prepared to provide information allowing the architect and engineer to design the project. The owner/project manager is responsible for distribution of this report to all designers and contractors whose work is affected by geotechnical aspects. In the event of changes in the design, location, or ownership of the project after presentation of this report, our recommendations should be reviewed and possibly modified by the geotechnical engineer. If the geotechnical engineer is not accorded the privilege of making this recommended review, he can assume no responsibility for misinterpretation or misapplication of his recommendations or their validity in the event changes have been made in the original design concept without his

prior review. The engineer makes no other warranties, either expressed or implied, as to the professional advice provided under the terms of this agreement and included in this report.

## REFERENCES

- American Society for Testing and Materials (ASTM), 1993, *Soil and Rock; Dimension Stone; Geosynthetics*, Volume 4.08.
- The Asphalt Institute, 1991, *Thickness Design - Asphalt Pavements for Highways and Streets*, Manual Series No. 1 (MS-1).
- Bonham, Harold F., *Geology and Mineral Deposits of Washoe and Storey Counties, Nevada* (1969), Nevada Bureau of Mines and Geology, Bulletin 70
- Bowles, J. E., 1996, *Foundation Analysis and Design*, McGraw Hill.
- Sowers, George, F., 1979, *Introductory Soil Mechanics and Foundations: Geotechnical Engineering*
- Standard Specifications for Public Works Construction*, 1996 (Washoe County, Sparks-Reno, Carson City, Yerington, Nevada).
- Uniform Building Code, 1997.; *International Conference of Building Officials*.

# APPENDIX A



SITE PLAN AND APPROXIMATE TEST PIT LOCATIONS

(nts)

BROKEN HILLS  
Site Plan  
Plate A-1

Matrix Construction Services, Inc.  
4741 Caughlin Parkway, Suite 1-B  
Reno, Nevada 89509  
Ph 775.828.1866 Fax 775.825.4469



# LOG OF TEST PIT NO. 1

**PROJECT NAME:** Broken Hills  
**LOCATION:** See Site Plan - Finishing Area  
**DATE:** 6/29/2004

**PROJECT NUMBER:** 1083.01  
**SURFACE ELEVATION:** 4750'  
**EXPLORATION EQUIPMENT:** EL 300B

Depth in Feet	Unified Soil Classification	Graphical Log	Sample	Sample Type	Sample No.	Moisture	Visual Description	Pocket Penetrometer (tsf)	Moisture Content (% of Dry Weight)	Laboratory Tests
1	SC			B	1	D/M	0 - 4 ½' Clayey Sand with occasional Gravel (SC) - dense, dry to moist, brown, moderate vegetation	> 4.5		13.5%-200 NP
2										
3										
4										
5	Kgd			B		D/M	4 ½ - 10' Granodiorite (Kgd) - hard, strong, moderately weathered, little fracturing			
6										
7										
8										
9										
10										
Bottom of Test Pit @ 10 Feet No Free Water Encountered										

GROUNDWATER & SOIL MOISTURE				SAMPLE TYPE		LABORATORY TESTS	
	Depth	Hour	Date	D - DRY	A - Drill Cuttings	B - Bulk Sample	A- Atterberg Limits
☒	NE		6/29/2004	M - MOIST	C - CME Sample	R - Rotary Cuttings	B- Grain Size Distribution
☒				W - WET	S- 2" O.D. 1.38" I.D. Tube Sample		C- Consolidation
NE- No Free Water Encountered				V-VERY MOIST	U- 3" O.D. 2.42" I.D. Tube Sample		MD- Moisture/Density
				S- SLIGHTLY MOIST	T- 3" O.D. Thin-Walled Shelby Tube		DS - Direct Shear



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Plate  
A-2

# LOG OF TEST PIT NO. 2

PROJECT NAME:	Broken Hills
LOCATION:	See Site Plan - Finishing Area
DATE:	6/29/2004

PROJECT NUMBER:	1083.01
SURFACE ELEVATION:	4775'
EXPLORATION EQUIPMENT:	EL 300B

Depth in Feet	Unified Soil Classification	Graphical Log	Sample	Sample Type	Sample No.	Moisture	Visual Description	Pocket Penetrometer (tsf)	Moisture Content (% of Dry Weight)	Laboratory Tests
1	SC			B		D/M	0 - 2' Clayey Sand with occasional Gravel (SC) - very dense, dry to moist, brown	> 4.5		
2						D	2 - 10' Granodiorite (Kgd) - hard, strong, deeply weathered at surface			
3										
4										
5										
6	Kgd									
7										
8										
9										
10							Bottom of Test @ 10 Feet No Free Water Encountered			

GROUNDWATER & SOIL MOISTURE				SAMPLE TYPE		LABORATORY TESTS	
	Depth	Hour	Date	D - DRY	A - Drill Cuttings	B - Bulk Sample	A - Atterberg Limits
Σ	NE		6/29/2004	M - MOIST	C - CME Sample	R - Rotary Cuttings	B - Grain Size Distribution
Σ				W - WET	S - 2" O.D. 1.38" I.D. Tube Sample		C - Consolidation
NE - No Free Water Encountered				V - VERY MOIST	U - 3" O.D. 2.42" I.D. Tube Sample		MD - Moisture/Density
				S - SLIGHTLY MOIST	T - 3" O.D. Thin-Walled Shelby Tube		DS - Direct Shear



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Plate  
A-2

# LOG OF TEST PIT NO. 3

PROJECT NAME:	Broken Hills
LOCATION:	See Site Plan - Finishing Area
DATE:	6/29/2004

PROJECT NUMBER:	1083.01
SURFACE ELEVATION:	4779'
EXPLORATION EQUIPMENT:	EL 300B

Depth in Feet	Unified Soil Classification	Graphical Log	Sample	Sample Type	Sample No.	Moisture	Visual Description	Pocket Penetrometer (tsf)	Moisture Content (% of Dry Weight)	Laboratory Tests
1	SC			B		M	0 - 6 ½' Clayey Sand with Gravel (SC) - very dense, moist, brown	> 4.5		
2										
3										
4										
5										
6										
7	SP/SM					M	6 ½ - 12' Poorly Graded Sand with Silt (SP/SM) - dense, moist, brown			
8										
9										
10										
11										
12										
Bottom of Test Pit @ 12 Feet No Free Water Encountered										

GROUNDWATER & SOIL MOISTURE				SAMPLE TYPE			LABORATORY TESTS	
	Depth	Hour	Date	D - DRY	A - Drill Cuttings	B - Bulk Sample	A- Atterberg Limits	
☒	NE		6/29/2004	M - MOIST	C - CME Sample	R - Rotary Cuttings	B- Grain Size Distribution	
☒				W - WET	S- 2" O.D. 1.38" I.D. Tube Sample		C- Consolidation	
NE- No Free Water Encountered				V- VERY MOIST	U- 3" O.D. 2.42" I.D. Tube Sample		MD- Moisture/Density	
				S- SLIGHTLY MOIST	T- 3" O.D. Thin-Walled Shelby Tube		DS - Direct Shear	



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Plate  
 A-2



# LOG OF TEST PIT NO. 4

PROJECT NAME:	Broken Hills
LOCATION:	See Site Plan - Finishing Area
DATE:	6/29/2004

PROJECT NUMBER:	1083.01
SURFACE ELEVATION:	4814'
EXPLORATION EQUIPMENT:	EL 300B

Depth in Feet	Unified Soil Classification	Graphical Log	Sample	Sample Type	Sample No.	Moisture	Visual Description	Pocket Penetrometer (tsf)	Moisture Content (% of Dry Weight)	Laboratory Tests
1	SC			B	2		0 - 5' Clayey Sand with occasional Gravel (SC) - very dense, dry to moist, brown			
2										
3										
4	SM					D/M	5 - 14' Silty Sand with occasional Gravel (SM) - dense, dry to moist, brown			2.1%-200 NP
5										
6										
7										
8										
9										
10										
11										
12										
13										
14	Bottom of Test Pit @ 14 Feet No Free Water Encountered									

GROUNDWATER & SOIL MOISTURE				SAMPLE TYPE		LABORATORY TESTS	
	Depth	Hour	Date	D - DRY	A - Drill Cuttings	B - Bulk Sample	A - Atterberg Limits
☒	NE		6/29/2004	M - MOIST	C - CME Sample	R - Rotary Cuttings	B - Grain Size Distribution
☒				W - WET	S - 2" O.D. 1.38" I.D. Tube Sample		C - Consolidation
NE - No Free Water Encountered				V - VERY MOIST	U - 3" O.D. 2.42" I.D. Tube Sample		MD - Moisture/Density
				S - SLIGHTLY MOIST	T - 3" O.D. Thin-Walled Shelby Tube		DS - Direct Shear



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Plate  
 A-2

# LOG OF TEST PIT NO. 5

PROJECT NAME: Broken Hills  
 LOCATION: See Site Plan - Finishing Area  
 DATE: 6/29/2004

PROJECT NUMBER: 1083.01  
 SURFACE ELEVATION: 4824'  
 EXPLORATION EQUIPMENT: EL 300B

Depth in Feet	Unified Soil Classification	Graphical Log	Sample	Sample Type	Sample No.	Moisture	Visual Description	Pocket Penetrometer (tsf)	Moisture Content (% of Dry Weight)	Laboratory Tests
1		SC					0 - 10' Clayey Sand with occasional Gravel (SC) - very dense, moist, brown			
2										
3										
4										
5								Excavation difficult from 5 feet	> 4.5	
6										
7										
8										
9										
10								Bottom of Test Pit @ 10 Feet No Free Water Encountered		

GROUNDWATER & SOIL MOISTURE				SAMPLE TYPE			LABORATORY TESTS	
☐	NE	6/29/2004	D - DRY	A - Drill Cuttings	B - Bulk Sample	A- Atterberg Limits		
☒			M - MOIST	C - CME Sample	R - Rotary Cuttings	B- Grain Size Distribution		
☒			W - WET	S- 2" O.D. 1.38" I.D. Tube Sample		C- Consolidation		
NE- No Free Water Encountered			V-VERY MOIST	U- 3" O.D. 2.42" I.D. Tube Sample		MD- Moisture/Density		
			S- SLIGHTLY MOIST	T- 3" O.D. Thin-Walled Shelby Tube		DS - Direct Shear		



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Plate  
A-2

# LOG OF TEST PIT NO. 6

PROJECT NAME: Broken Hills  
 LOCATION: See Site Plan - Finishing Area  
 DATE: 6/29/2004

PROJECT NUMBER: 1083.01  
 SURFACE ELEVATION: 4841'  
 EXPLORATION EQUIPMENT: EL 300B

Depth in Feet	Unified Soil Classification	Graphical Log	Sample	Sample Type	Sample No.	Moisture	Visual Description	Pocket Penetrometer (tsf)	Moisture Content (% of Dry Weight)	Laboratory Tests
1 2 3 4 5 6 7	SC	●●●●●●●●●●		B		D/M	0 - 7' Clayey Sand with occasional Gravel (SC) - very dense, dry to moist, brown			
Refusal @ 7 Feet No Free Water Encountered										

GROUNDWATER & SOIL MOISTURE				SAMPLE TYPE		LABORATORY TESTS	
☒	NE	6/29/2004	D - DRY	A - Drill Cuttings	B - Bulk Sample	A- Atterberg Limits	
☒			M - MOIST	C - CME Sample	R - Rotary Cuttings	B- Grain Size Distribution	
☒			W - WET	S- 2" O.D. 1.38" I.D. Tube Sample		C- Consolidation	
NE- No Free Water Encountered			V-VERY MOIST	U- 3" O.D. 2.42" I.D. Tube Sample		MD- Moisture/Density	
			S- SLIGHTLY MOIST	T- 3" O.D. Thin-Walled Shelby Tube		DS - Direct Shear	



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Plate  
A-2

# LOG OF TEST PIT NO. 7

PROJECT NAME:	Broken Hills
LOCATION:	See Site Plan - Finishing Area
DATE:	6/29/2004

PROJECT NUMBER:	1083.01
SURFACE ELEVATION:	4881'
EXPLORATION EQUIPMENT:	EL 300B

Depth in Feet	Unified Soil Classification	Graphical Log	Sample	Sample Type	Sample No.	Moisture	Visual Description	Pocket Penetrometer (tsf)	Moisture Content (% of Dry Weight)	Laboratory Tests	
1		[Graphical Log: 0-8' Clayey Sand with occasional Gravel (SC) - very dense, dry, brown]					0 - 8' Clayey Sand with occasional Gravel (SC) - very dense, dry, brown				
2											
3											
4	SC										
5											
6					B						
7											
8		[Graphical Log: 8-10' Silty Sand with occasional Gravel (SM) - dense, moist, brown]					8 - 10' Silty Sand with occasional Gravel (SM) - dense, moist, brown				
9	SM										
10											
11	Kgd	[Graphical Log: 10-12' Granodiorite (Kgd) - very little fracturing, moderately hard, weak, deeply weathered]					10 - 12' Granodiorite (Kgd) - very little fracturing, moderately hard, weak, deeply weathered				
12											
Bottom of Test Pit @ 12 Feet No Free Water Encountered											

GROUNDWATER & SOIL MOISTURE				SAMPLE TYPE			LABORATORY TESTS	
	Depth	Hour	Date	D - DRY	A - Drill Cuttings	B - Bulk Sample	A- Atterberg Limits	
☒	NE		6/29/2004	M - MOIST	C - CME Sample	R - Rotary Cuttings	B- Grain Size Distribution	
☒				W - WET	S- 2" O.D. 1.38" I.D. Tube Sample		C- Consolidation	
NE- No Free Water Encountered				V-VERY MOIST	U- 3" O.D. 2.42 " I.D. Tube Sample		MD- Moisture/Density	
				S- SLIGHTLY MOIST	T- 3" O.D. Thin-Walled Shelby Tube		DS - Direct Shear	



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Plate  
  
 A-2

# LOG OF TEST PIT NO. 8

PROJECT NAME:	Broken Hills
LOCATION:	See Site Plan - Finishing Area
DATE:	6/29/2004

PROJECT NUMBER:	1083.01
SURFACE ELEVATION:	4938'
EXPLORATION EQUIPMENT:	EL 300B

Depth in Feet	Unified Soil Classification	Graphical Log	Sample	Sample Type	Sample No.	Moisture	Visual Description	Pocket Penetrometer (tsf)	Moisture Content (% of Dry Weight)	Laboratory Tests
1	SC						0 - 3 1/2' Clayey Sand with occasional Gravel (SC) - dense, dry, brown			
2										
3										
4	SP/SM						3 1/2 - 6' Poorly Graded Sand with Silt (SP-SM) - dense, dry, brown			
5										
6							6 - 17' Granodiorite (Kgd) - very little fracture, hard, weak, deeply weathered			15.8%-200 NP
7										
8										
9										
10	Kgd									
15										
18	Bottom of Test Pit @ 18 Feet No Free Water Encountered									

GROUNDWATER & SOIL MOISTURE				SAMPLE TYPE		LABORATORY TESTS	
☐	NE	Hour	Date	D - DRY	A - Drill Cuttings	B - Bulk Sample	A- Atterberg Limits
☐			6/29/2004	M - MOIST	C - CME Sample	R - Rotary Cuttings	B- Grain Size Distribution
☐				W - WET	S- 2" O.D. 1.38" I.D. Tube Sample		C- Consolidation
NE- No Free Water Encountered				V-VERY MOIST	U- 3" O.D. 2.42" I.D. Tube Sample		MD- Moisture/Density
				S- SLIGHTLY MOIST	T- 3" O.D. Thin-Walled Shelby Tube		DS - Direct Shear



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Plate  
  
 A-2

# LOG OF TEST PIT NO. 9

PROJECT NAME: Broken Hills  
 LOCATION: See Site Plan - Finishing Area  
 DATE: 6/29/2004

PROJECT NUMBER: 1083.01  
 SURFACE ELEVATION: 4897'  
 EXPLORATION EQUIPMENT: EL 300B

Depth in Feet	Unified Soil Classification	Graphical Log	Sample	Sample Type	Sample No.	Moisture	Visual Description	Pocket Penetrometer (tsf)	Moisture Content (% of Dry Weight)	Laboratory Tests					
1	SC	[Pattern]		B			0 - 10 1/2' Clayey Sand with occasional Gravel (SC) - dense, moist, brown								
2															
3															
4															
5															
6															
7															
8													cobbles at 8 feet		
9															
10															
Bottom of Test Pit @ 10 1/2 Feet No Free Water Encountered															

GROUNDWATER & SOIL MOISTURE				SAMPLE TYPE		LABORATORY TESTS	
☐	Depth	Hour	Date	D - DRY	A - Drill Cuttings	B - Bulk Sample	A- Atterberg Limits
☒	NE		6/29/2004	M - MOIST	C - CME Sample	R - Rotary Cuttings	B- Grain Size Distribution
☑				W - WET	S- 2" O.D. 1.38" I.D. Tube Sample		C- Consolidation
NE- No Free Water Encountered				V-VERY MOIST	U- 3" O.D. 2.42" I.D. Tube Sample		MD- Moisture/Density
				S- SLIGHTLY MOIST	T- 3" O.D. Thin-Walled Shelby Tube		DS - Direct Shear



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Plate  
A-2

**LOG OF TEST PIT NO. 10**

PROJECT NAME:	Broken Hills
LOCATION:	See Site Plan - Finishing Area
DATE:	6/29/2004

PROJECT NUMBER:	1083.01
SURFACE ELEVATION:	4771'
EXPLORATION EQUIPMENT:	EL 300B

Depth in Feet	Unified Soil Classification	Graphical Log	Sample	Sample Type	Sample No.	Moisture	Visual Description	Pocket Penetrometer (tsf)	Moisture Content (% of Dry Weight)	Laboratory Tests
1	SC						0 - 13' Clayey Sand with occasional Gravel (SC) - very dense, dry to moist, brown			
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
Bottom of Test Pit @ 13 Feet No Free Water Encountered										

GROUNDWATER & SOIL MOISTURE				SAMPLE TYPE		LABORATORY TESTS	
<input type="checkbox"/>	Depth	Hour	Date	D - DRY	A - Drill Cuttings	B - Bulk Sample	A- Atterberg Limits
<input checked="" type="checkbox"/>	NE		6/29/2004	M - MOIST	C - CME Sample	R - Rotary Cuttings	B- Grain Size Distribution
<input type="checkbox"/>				W - WET	S- 2" O.D. 1.38" I.D. Tube Sample		C- Consolidation
<input type="checkbox"/>	NE- No Free Water Encountered			V-VERY MOIST	U- 3" O.D. 2.42" I.D. Tube Sample		MD- Moisture/Density
				S- SLIGHTLY MOIST	T- 3" O.D. Thin-Walled Shelby Tube		DS - Direct Shear



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Plate  
A-2

# LOG OF TEST PIT NO. 11

PROJECT NAME:	Broken Hills
LOCATION:	See Site Plan - Finishing Area
DATE:	6/29/2004

PROJECT NUMBER:	1083.01
SURFACE ELEVATION:	4747'
EXPLORATION EQUIPMENT:	EL 300B

Depth in Feet	Unified Soil Classification	Graphical Log	Sample	Sample Type	Sample No.	Moisture	Visual Description	Pocket Penetrometer (tsf)	Moisture Content (% of Dry Weight)	Laboratory Tests
1	SC						0 - 5' Clayey Sand with occasional Gravel (SC) - dense, dry to moist, brown			
2										
3										
4										
5										
6	SM			B			5 - 11 1/2' Silty Sand with occasional Gravel (SM) - dense, moist, brown			
7										
8										
9										
10										
11										

Bottom of Test Pit @ 11 1/2 Feet  
No Free Water Encountered

GROUNDWATER & SOIL MOISTURE				SAMPLE TYPE			LABORATORY TESTS	
	Depth	Hour	Date	D - DRY	A - Drill Cuttings	B - Bulk Sample	A- Atterberg Limits	
☒	NE		6/29/2004	M - MOIST	C - CME Sample	R - Rotary Cuttings	B- Grain Size Distribution	
☒				W - WET	S- 2" O.D. 1.38" I.D. Tube Sample		C- Consolidation	
NE- No Free Water Encountered				V-VERY MOIST	U- 3" O.D. 2.42" I.D. Tube Sample		MD- Moisture/Density	
				S- SLIGHTLY MOIST	T- 3" O.D. Thin-Walled Shelby Tube		DS - Direct Shear	

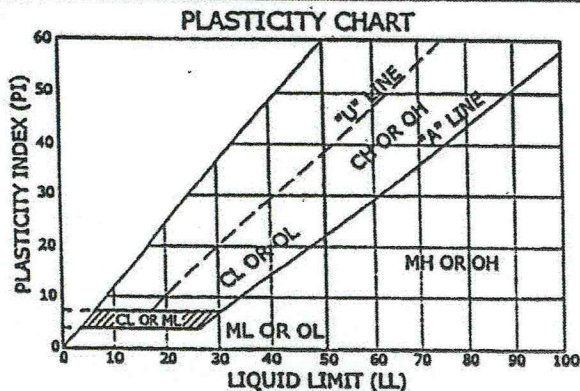


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Plate  
 A-2



MAJOR DIVISION					TYPICAL NAMES		
COARSE-GRAINED SOILS MORE THAN HALF IS COARSER THAN NO. 200 SIEVE	GRAVELS  MORE THAN HALF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE	CLEAN GRAVELS WITH LITTLE OR NO FINES		GW	WELL GRADED GRAVELS WITH OR WITHOUT SAND, LITTLE OR NO FINES		
		GRAVELS WITH OVER 12% FINES		GP	POORLY GRADED GRAVELS WITH OR WITHOUT SAND, LITTLE OR NO FINES		
		SANDS  MORE THAN HALF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE	CLEAN SANDS WITH LITTLE OR NO FINES		SW	WELL GRADED SANDS WITH OR WITHOUT GRAVEL, LITTLE OR NO FINES	
			SANDS WITH OVER 12% FINES		SP	POORLY GRADED SAND WITH OR WITHOUT GRAVEL, LITTLE OR NO FINES	
	FINE-GRAINED SANDS MORE THAN HALF IS FINER THAN NO. 200 SIEVE	SILT AND CLAYS  LIQUID LIMIT 50% OR LESS		GM	SILTY GRAVELS, SILTY GRAVELS WITH SAND		
				GC	CLAYEY GRAVELS, CLAYEY GRAVELS WITH SAND		
				ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTS WITH SANDS AND GRAVELS		
		SILT AND CLAYS  LIQUID LIMIT GREATER THAN 50%		CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY CLAYS WITH SANDS AND GRAVELS, LEAN CLAYS		
				OL	ORGANIC SILTS OR CLAYS OF LOW PLASTICITY		
				MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOLID, ELASTIC SILTS		
HIGHLY ORGANIC SOILS				CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS		
				OH	ORGANIC SILTS OR CLAYS MEDIUM TO HIGH PLASTICITY		
				Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS		



DESCRIPTION OF ESTIMATED PERCENTAGES OF GRAVEL, SAND, AND FINES	
TRACE	Particles are present but est. < 5%
FEW	5%-10%
LITTLE	15%-20%
SOME	30%-45%
MOSTLY	50%-100%

NOTE: Percentages are presented within soil description for soil horizon with laboratory tested soil samples.

CONSISTENCY		RELATIVE DENSITY	
SILTS & CLAYS	SPT BLOW* COUNTS (N)	SANDS & GRAVELS	SPT BLOW* COUNTS (N)
VERY SOFT	0-2	VERY LOOSE	0-4
SOFT	3-4	LOOSE	5-10
MEDIUM STIFF	5-8	MEDIUM DENSE	11-30
STIFF	9-15	DENSE	31-50
VERY STIFF	16-30	VERY DENSE	50+
HARD	30+		

\* The Standard Penetration Resistance (N) in blows per foot is obtained by the ASTM D1585 procedure using 2" O.D., 1 3/8" LD. samplers.

DEFINITIONS OF SOIL FRACTIONS	
SOIL COMPONENT	PARTICLE SIZE RANGE
COBBLES	ABOVE 3 INCHES
GRAVEL	3 IN. TO NO. 4 SIEVE
COARSE GRAVEL	3 IN. TO 3/4 IN.
FINE GRAVEL	3/4 IN. TO NO. 4 SIEVE
SAND	NO. 4 TO NO. 200
COARSE SAND	NO. 4 TO NO. 10
MEDIUM SAND	NO. 10 TO NO. 40
FINE SAND	NO. 40 TO NO. 200
FINES (SILTS OR CLAYS)	BELOW NO. 200 SIEVE



**MATRIX  
CONSTRUCTION  
SERVICES, INC.**

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**UNIFIED SOIL CLASSIFICATION  
SYSTEM AND KEY TO SOIL  
DESCRIPTION**

Scale: NTS

Date: DEC 2003

Sheet No: A-3

**WSUP19-0015  
EXHIBIT D**

**SUMMARY OF TEST RESULTS**

**EAGLE CANYON - BROKEN HILLS**

Sample	TP-1	TP-4	TP-8
Depth (ft)	1 - 3'	3 - 5'	6 - 7'
Sample No.	1	2	3
Sieve Size	Percent Passing by Weight		
2"			
1 1/2"			
1"	100	100	
3/4"	99	98	100
1/2"	98	95	99
3/8"	97	93	90
# 4	94	85	80
# 10	75	68	58
# 40	31	37	18
# 100	19	23	5
# 200	13.5	15.8	2.1
% Moisture	4.1	2.9	2.1
Liquid Limit	-	-	-
Plasticity Index	NP	NP	NP
Classification	SM	SM	SP



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**LABORATORY  
TEST RESULTS**

Project No.: 1083.01

Date: 8/4/2004

Plate No: A-4



June 6, 2007  
Project No. 1422.01

Mr. Karl Matzoll, PE  
RIGHTWAY INVESTMENTS  
5945 Los Altos Parkway, Suite 101  
Sparks, Nevada 89436

**RE: GEOTECHNICAL ADDENDUM  
BROKEN HILLS – PHASE 1**

Dear Mr. Matzoll:

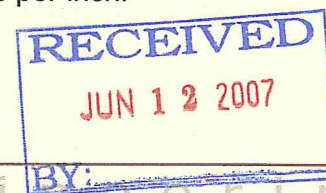
This letter presents our update to the Broken Hills geotechnical report originally prepared by our firm under the name of Matrix Construction Services in August, 2004 and subsequently updated by James Edward Engineering in March, 2007. Two retention basins, associated with the natural drainage that runs through the development area, are planned. This addendum specifically addresses percolation tests performed for use in the evaluation and design of those retention basins. Unless specifically modified in this addendum, our opinions and recommendations stated in the original geotechnical report are applicable (Appendix B).

The site was explored by excavating two additional test pits near or within the limits of the proposed retention basins utilizing a Deere 410 E backhoe. In P-1, the profile encountered typically consisted of sandy clay capping weathered bedrock. The bedrock has typically been weathered and decomposed to excavate to as dense, clayey sand to sandy clay. The fines associated with the weathered bedrock are medium to highly plastic. In P-2 the soils consisted of silty sand. The soil profiles are presented on Plates A-1a and b of this update letter.

Percolation testing was performed in accordance with the standards established by Washoe County. Two tests were performed in each test pit at depths of 1 and 3 feet. Individual percolation test results are presented on Plates A-1a and b. On average however, the percolation rate associated with P-1 could be considered 60 minutes per inch, and the percolation rate associated with P-2 could be considered 3 minutes per inch.



**FIGURE 1 – Site Plan and  
Approximate Exploration Locations**



James Edward Engineering

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1455 Deming Way Suite 1C • Sparks Nevada 89431 • Phone (775) 331-1505 • Fax (775) 331-1258

**WSUP19-0015  
EXHIBIT D**

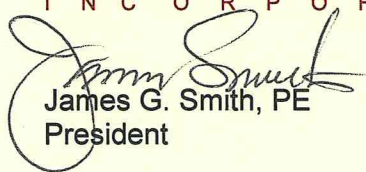
Mr. Karl Matzoll, PE  
RIGHTWAY INVESTMENTS  
June 6, 2007  
Page 2 of 2

The soils generated during grading of the retention ponds can be used to construct any berms and embankments associated with the ponds. The soils associated with P-1 will be clayey and once compacted relatively impermeable. The soils associated with P-2 will be granular, and although compact will readily allow seepage into the embankment. Prior to constructing any berms or embankments the subgrade shall be cleared, grubbed, and compacted as prescribed in the geotechnical report prepared for the project. The embankment fills are considered structural and should be compacted to not less than 90 percent of the soils maximum dry density in accordance with ASTM D 1557. Due to the presence of clay soils, the embankment fills associated with P-1 shall be moisture conditioned to at least optimum prior to compacting.

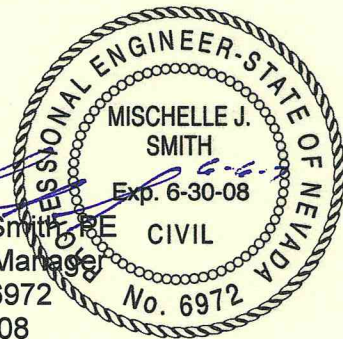
We appreciate the opportunity to provide these services for you. Please do not hesitate to contact our office should you have any related questions or comments.

Sincerely,

**JAMES EDWARD ENGINEERING**  
I N C O R P O R A T E D

  
James G. Smith, PE  
President

Mischelle J. Smith, PE  
Engineering Manager  
RE Number 6972  
Expires 6/30/08





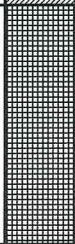
Cc: Mr. Todd Gammill – Wood Rodgers Consulting

JGS:MJS:jm

# LOG OF TEST PIT NO. P-1

PROJECT NAME:	BROKEN HILLS - PONDS
LOCATION:	SEE PLAN
DATE:	5-22-07 & 5-23-07

PROJECT NUMBER:	1422.01
SURFACE ELEVATION:	SEE PLAN
EXPLORATION EQUIPMENT:	DEERE 410E

Depth in Feet	Unified Soil Classification	Graphical Log	Sample	Sample Type	Sample No.	Moisture	Visual Description	Pocket Penetrometer (tsf)	Moisture Content (% of Dry Weight)	Laboratory Tests
1	SC					D	0 - 1' Clayey Sand (SC) - loose, dry, brown			
2	CL					S	1 - 2 1/2' Sandy Clay (CL) - stiff to hard, slightly moist, red brown (medium to highly plastic fines)			55 min/in
3	BEDROCK					S	2 1/2 - 6' BEDROCK - Intensely weathered and decomposed to excavate as dense to very dense Clayey Sand (SC) (estimated 35% medium plastic fines, 65% sand)			60 min/in
4										
5										
6										

Bottom of Test Pit @ 6 Feet  
No Free Water Encountered

Test @ 12"					
Time	Drop	Min/In	Time	Drop	Min/In
9:43	15/16	32	12:22	8/16	60
10:13			12:52		
10:15	6/16	80	12:54	9/16	53
10:45			1:24		
10:47	7/16	69	1:25	9/16	53
11:17			1:55		
11:19	9/16	53			
11:49					
11:50	10/16	48			
12:20					

Test @ 36"					
Time	Drop	Min/In	Time	Drop	Min/In
9:47	1 10/16	18	12:25	9/16	53
10:17			12:55		
10:19	10/16	48	12:57	9/16	53
10:49			1:27		
10:50	10/16	48	1:30	8/16	60
11:20			2:00		
11:21	9/16	53			
11:51					
11:53	10/16	48			
12:23					

GROUNDWATER & SOIL MOISTURE				SAMPLE TYPE		LABORATORY TESTS	
∇	NE	5/22/2007	D - DRY	A - Drill Cuttings	B - Bulk Sample	A - Atterberg Limits	
∇			S - SLIGHTLY MOIST	C - CME Sample	R - Rotary Cuttings	B - Grain Size Distribution	
∇			M - MOIST	S - 2" O.D. 1.38" I.D. Tube Sample		C - Consolidation	
NE - No Free Water Encountered			V - VERY MOIST	U - 3" O.D. 2.42" I.D. Tube Sample		MD - Moisture/Density	
			W - WET	T - 3" O.D. Thin-Walled Shelby Tube		DS - Direct Shear	



**JAMES EDWARD ENGINEERING**  
 I N C O R P O R A T E D  
 9475 Double R Boulevard  
 Reno, Nevada 89521  
 Phone 775.828.1866 Fax 775.828.1871

Plate  
A-2

# LOG OF TEST PIT NO. P-2

PROJECT NAME:	BROKEN HILLS - PONDS
LOCATION:	SEE PLAN
DATE:	5/22/2007

PROJECT NUMBER:	1422.01
SURFACE ELEVATION:	SEE PLAN
EXPLORATION EQUIPMENT:	DEERE 410E

Depth in Feet	Unified Soil Classification	Graphical Log	Sample	Sample Type	Sample No.	Moisture	Visual Description	Pocket Penetrometer (tsf)	Moisture Content (% of Dry Weight)	Laboratory Tests
1	SM	[Pattern]				D	0 - 1 ½' Silty Sand (SM) - loose, dry, brown			2 min/in
2	SC	[Pattern]				D	1 ½ - 2 ½' Clayey Sand (SC) - medium dense, dry, brown			
3	SP	[Pattern]				S	2 ½ - 6' Poorly Graded Sand (SP) with some Gravel - dense, slightly moist, brown			
4	SP	[Pattern]				S				
5										
6										

Bottom of Test Pit @ 6 Feet  
No Free Water Encountered

Test @ 12"					
Time	Drop	Min/In	Time	Drop	Min/In
11:19	4 2/16	1	11:50	4 10/16	1
11:23			11:55		
11:25	4 13/16	1	11:56	4	2
11:29			12:03		
11:31	4 9/16	1	12:03	4 2/16	2
11:35			12:10		
11:39	3 15/16	1	12:11	4 8/16	2
11:43			12:19		
11:43	5 4/16	1	12:19	3 2/16	2
11:49			12:25		

Test @ 36"					
Time	Drop	Min/In	Time	Drop	Min/In
11:17	4 8/16	2	12:13	3 3/16	3
11:27			12:23		
11:28	4 7/16	2			
11:36					
11:37	3 15/16	3			
11:47					
11:48	2 11/16	4			
11:58					
12:02	3	3			
12:12					

GROUNDWATER & SOIL MOISTURE				SAMPLE TYPE		LABORATORY TESTS	
∇	NE	5/22/2007	D - DRY	A - Drill Cuttings	B - Bulk Sample	A - Atterberg Limits	B - Grain Size Distribution
∇			S - SLIGHTLY MOIST	C - CME Sample	R - Rotary Cuttings	C - Consolidation	MD - Moisture/Density
			M - MOIST	S - 2" O.D. 1.38" I.D. Tube Sample		DS - Direct Shear	
			V - VERY MOIST	U - 3" O.D. 2.42" I.D. Tube Sample			
			W - WET	T - 3" O.D. Thin-Walled Shelby Tube			
NE - No Free Water Encountered							



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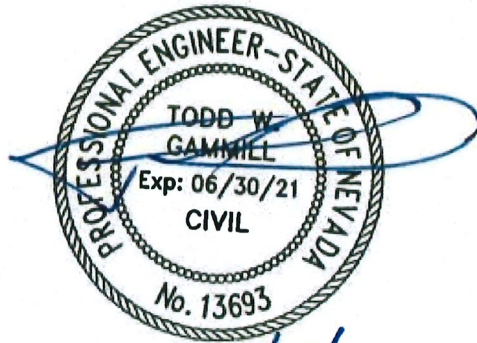
Plate  
A-2

**PRELIMINARY DRAINAGE REPORT**  
**FOR**  
**BROKEN HILLS WATER TANK SPECIAL USE PERMIT**

*Prepared for:*

**Barker Coleman Investments Broken Hills, LLC**  
**539 Riverside Drive**  
**Reno NV 89502**

August 14, 2019



*8/14/19*

*Prepared by:*  
**Wood Rodgers Inc.**  
**1361 Corporate Boulevard**  
**Reno, Nevada 89502**  
**(775) 823-4068**  
**Todd Gammill, PE – Associate**



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**WSUP19-0015**  
**EXHIBIT D**

## TABLE OF CONTENTS

<b>1</b>	<b>Introduction .....</b>	<b>1</b>
1.1	Historic Drainage .....	1
1.2	Regulatory Perspective .....	1
1.3	FEMA Flood Hazard Information .....	1
<b>2</b>	<b>Preliminary Design .....</b>	<b>1</b>
<b>3</b>	<b>Hydrologic Analysis .....</b>	<b>2</b>
<b>4</b>	<b>Hydraulic Analysis .....</b>	<b>2</b>
<b>5</b>	<b>Conclusions .....</b>	<b>3</b>
<b>6</b>	<b>References .....</b>	<b>3</b>

### **APPENDIX**

VICINITY MAP

GRADING PLAN

HYDROLOGIC INPUT AND OUTPUT

CULVERT CALCULATIONS





## **1 INTRODUCTION**

This report shall serve as the preliminary drainage report for the Broken Hills Water Tank Special Use Permit (SUP), a domestic water tank and access road project. The site is located approximately 1.5 miles northwest of the intersection of Eagle Canyon Road and Calle de la Plata. Access to the project site is currently provided via jeep roads, which can be accessed off of Kinglet Drive through Eagle Canyon II, Unit 7. The project site is identified by the Washoe County Assessor's Office as APN 089-621-01.

A Vicinity Map is included in the **Appendix** of this report for reference. As this report is preliminary in nature, a more detailed study will need to be conducted and a final drainage report will need to be submitted with the final improvement plans for the project.

### **1.1 HISTORIC DRAINAGE**

The existing site is undeveloped with terrain sloping for west to east. Storm runoff leaving the site flows south and east through Sparks and eventually to the Truckee River.

### **1.2 REGULATORY PERSPECTIVE**

The Broken Hills Water Tank SUP site is located within Washoe County jurisdiction and therefore falls under its jurisdiction. Hydrologic and hydraulic calculations were completed per the standards contained within the Truckee Meadows Regional Drainage Manual (TMRDM) and Washoe County Development Code. The drainage facilities will be private and maintained by TMWA.

### **1.3 FEMA FLOOD HAZARD INFORMATION**

The Broken Hills Water Tank SUP site is located within FEMA Flood Zone 'X', areas of minimal flood hazard outside the 0.2% (500-year) annual chance floodplain.

## **2 PRELIMINARY DESIGN**

The proposed project consists of a TMWA water tank and associated access road grading. The alignment of the access road requires crossing of two drainage ways, and culverts will be placed at existing drainage way flowlines to convey storm flows underneath the access road.

The preliminary grading for the site is depicted on Sheet G-1 of 4, Grading Plan, of the “Broken Hills Tank and Access Road” plans by Matzoll Development Consultants. A reduced copy of the grading plan is included in the **Appendix**, but full size copies are included with the SUP package, which this report is intended to supplement. The grading as shown is intended to keep proposed drainage consistent with the existing drainage, and to allow the site to drain to an existing detention basin to the east, just south and west of the terminus of Kinglet Drive.

### **3 HYDROLOGIC ANALYSIS**

The Army Corps of Engineers HEC-HMS software was used to determine storm flow magnitude in the 100-year, 24 hour storm using precipitation data from NOAA Atlas 14. Existing drainage basins were identified using USGS data and two separate basins affect the alignment of the access road, depicted as basins E-1 and E-2 in the associated figures in the **Appendix**. It is not anticipated that detention will be required, as the ratio of developed area to existing area is extremely small. Relatively small drainage areas will need to be analyzed for areas around the tank and access that may require small drainage ditches. Those basins were not analyzed with this preliminary study and will need to be analyzed during final design. The intent of this report is to analyze the large scale drainage basins and drainage way crossings.

### **4 HYDRAULIC ANALYSIS**

Where the existing drainages cross the access road alignment, culverts are proposed. Basin E-2 is proposed to be conveyed under the access road via a 24” culvert, and the combination of Basins E-1 and E-2 will be conveyed under the access road via either a 4’ high by 8’ wide concrete box culvert or dual 48” CMP pipes. Preliminary culvert calculations are provided in the **Appendix** for the three scenarios. Headwall configuration and erosion control protection for the inlet and outlet conditions will need to be provided with final design and are not contemplated with this preliminary report.



## **5 CONCLUSIONS**

The drainage facilities that will be constructed with the Broken Hills Water Tank SUP have been designed to capture and perpetuate the design storm event flows for the culvert crossings. The conveyance of flows is in conformance with the Washoe County Code and the TMRDM. There will be no negative impacts to any adjacent or downstream properties as a result of development of the access road and tank, as the existing storm flows will be conveyed via appropriately sized culverts and it is not anticipated that detention will be required, as the ratio of developed area to existing area is extremely small. As previously stated, this report is preliminary in nature and a more detailed study will need to be conducted and a final technical drainage report will need to be submitted with the final improvement plans for the project.

## **6 REFERENCES**

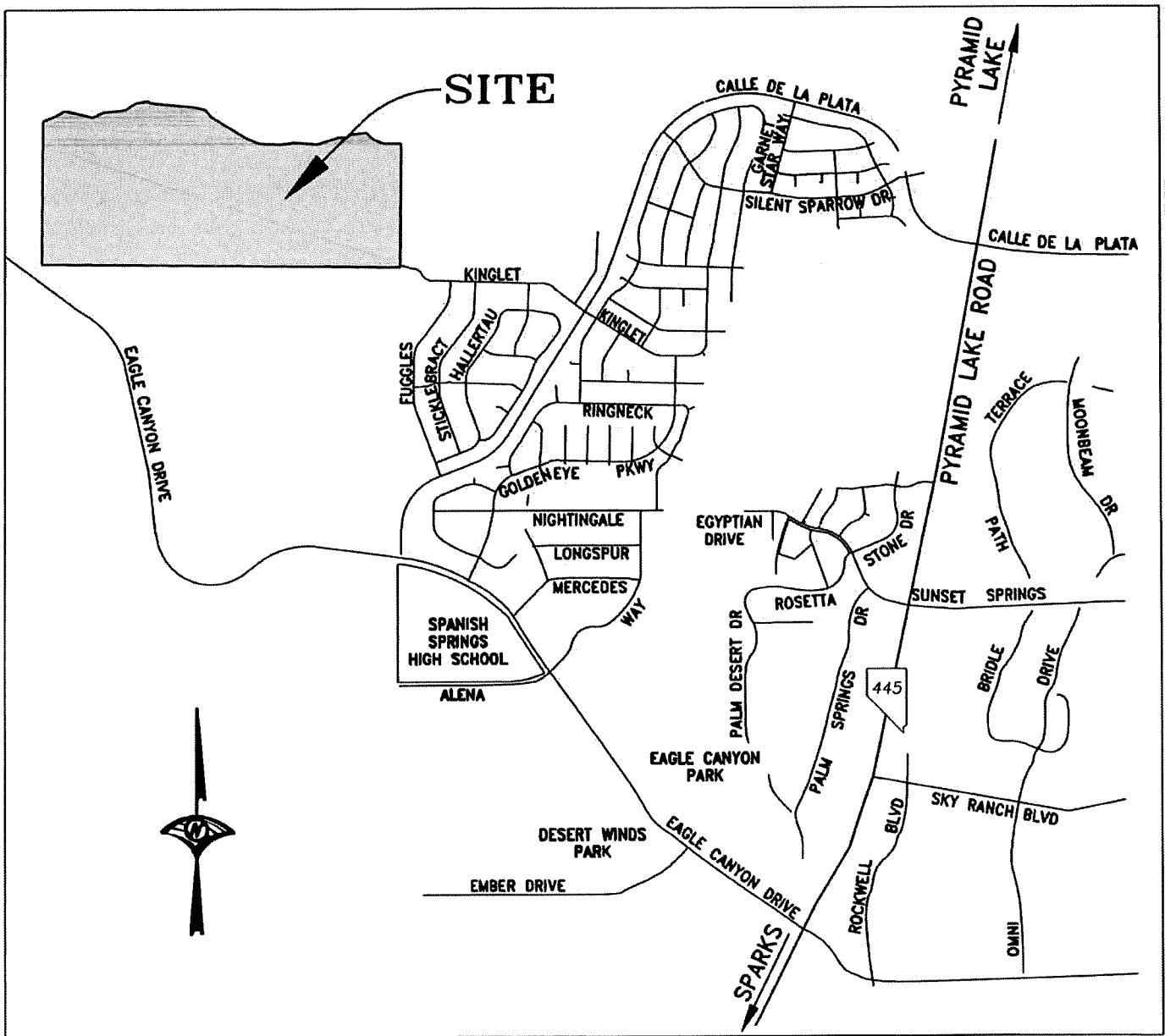
Truckee Meadows Regional Drainage Manual, April 30, 2009.

Washoe County Development Code, Latest Edition.

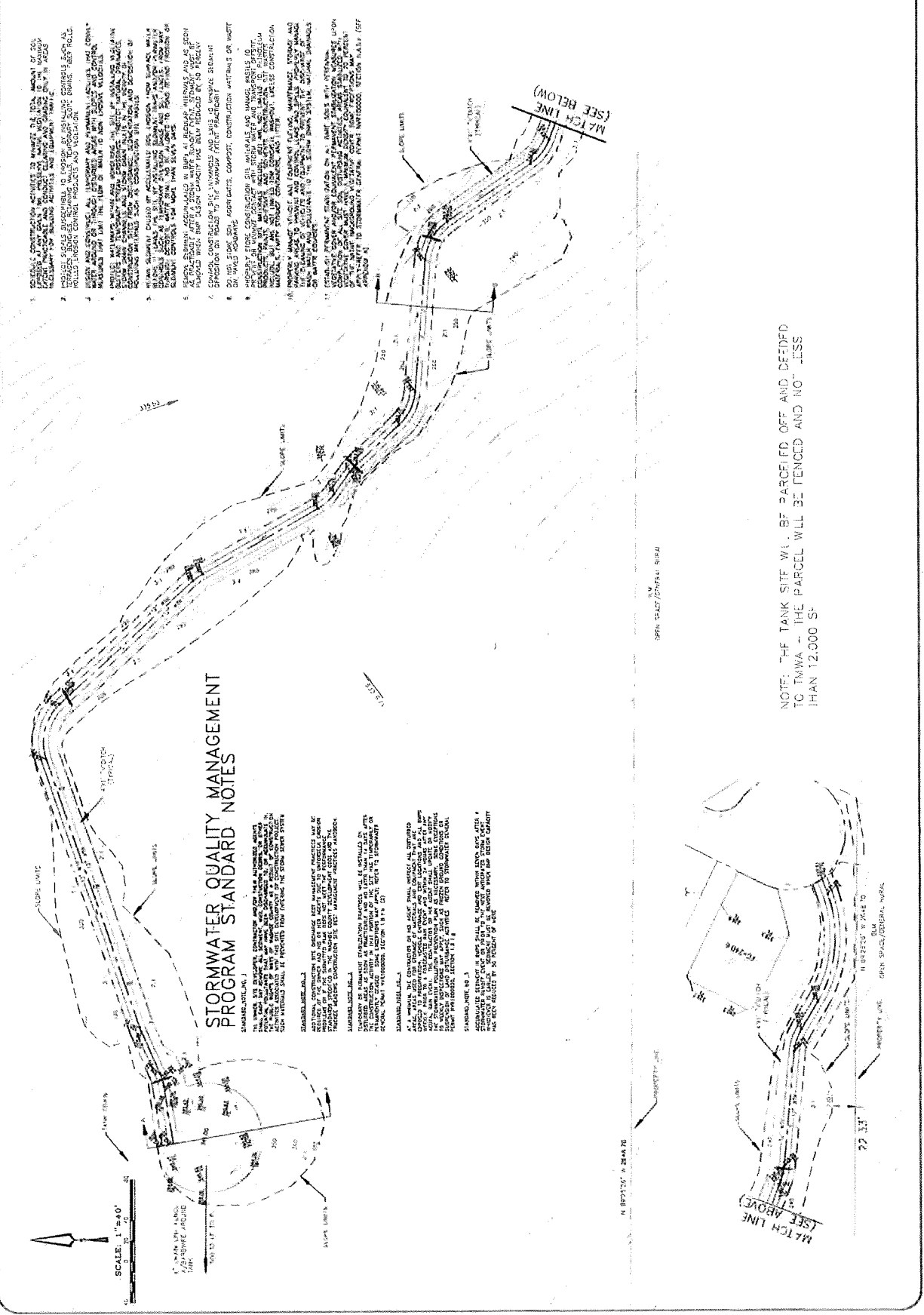


# APPENDIX





VICINITY MAP  
NOT TO SCALE



**STORMWATER QUALITY MANAGEMENT PROGRAM STANDARD NOTES**

1. ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE CITY OF LAS VEGAS, NEVADA, CHAPTER 48A, SUBCHAPTER 48A-1, AND THE CITY OF LAS VEGAS, NEVADA, CHAPTER 48A, SUBCHAPTER 48A-2, AND THE CITY OF LAS VEGAS, NEVADA, CHAPTER 48A, SUBCHAPTER 48A-3, AND THE CITY OF LAS VEGAS, NEVADA, CHAPTER 48A, SUBCHAPTER 48A-4, AND THE CITY OF LAS VEGAS, NEVADA, CHAPTER 48A, SUBCHAPTER 48A-5, AND THE CITY OF LAS VEGAS, NEVADA, CHAPTER 48A, SUBCHAPTER 48A-6, AND THE CITY OF LAS VEGAS, NEVADA, CHAPTER 48A, SUBCHAPTER 48A-7, AND THE CITY OF LAS VEGAS, NEVADA, CHAPTER 48A, SUBCHAPTER 48A-8, AND THE CITY OF LAS VEGAS, NEVADA, CHAPTER 48A, SUBCHAPTER 48A-9, AND THE CITY OF LAS VEGAS, NEVADA, CHAPTER 48A, SUBCHAPTER 48A-10, AND THE CITY OF LAS VEGAS, NEVADA, CHAPTER 48A, SUBCHAPTER 48A-11, AND THE CITY OF LAS VEGAS, NEVADA, CHAPTER 48A, SUBCHAPTER 48A-12, AND THE CITY OF LAS VEGAS, NEVADA, CHAPTER 48A, SUBCHAPTER 48A-13, AND THE CITY OF LAS VEGAS, NEVADA, CHAPTER 48A, SUBCHAPTER 48A-14, AND THE CITY OF LAS VEGAS, 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NOTE: THE TANK SITE WILL BE PARCELED OFF AND DEED'D TO TANKA - THE PARCEL WILL BE FENCED AND NOT LESS THAN 12,000 SF



**NOAA Atlas 14, Volume 1, Version 5**  
**Location name: Sparks, Nevada, USA\***  
**Latitude: 39.66°, Longitude: -119.76°**  
**Elevation: 5287.81 ft\*\***



\* source: ESRI Maps  
 \*\* source: USGS

**POINT PRECIPITATION FREQUENCY ESTIMATES**

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fengjin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

[PF tabular](#) | [PF graphical](#) | [Maps & aerials](#)

**PF tabular**

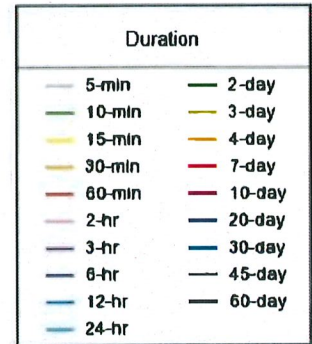
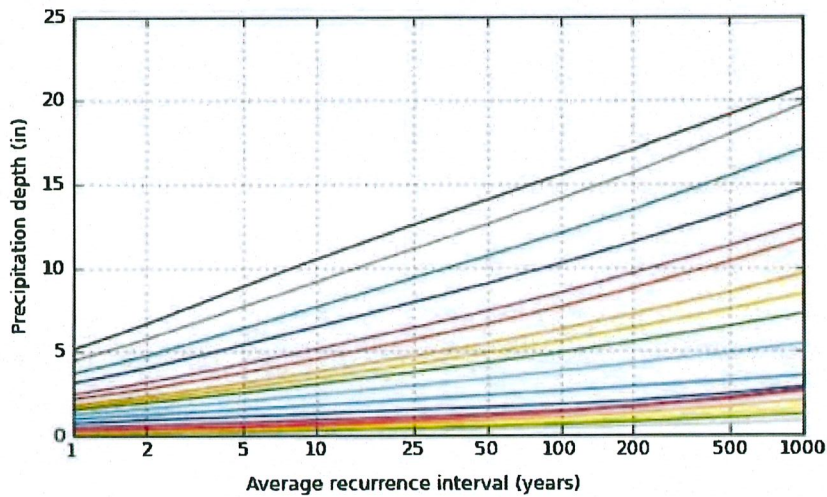
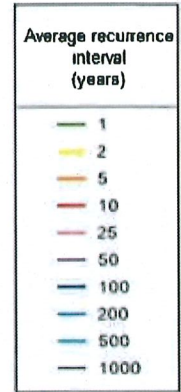
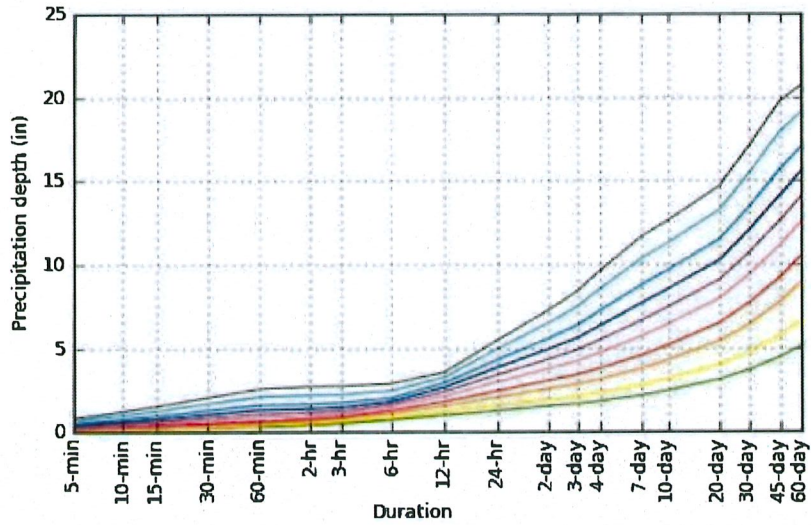
<b>PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)<sup>1</sup></b>										
<b>Duration</b>	<b>Average recurrence interval (years)</b>									
	<b>1</b>	<b>2</b>	<b>5</b>	<b>10</b>	<b>25</b>	<b>50</b>	<b>100</b>	<b>200</b>	<b>500</b>	<b>1000</b>
<b>5-min</b>	0.100 (0.084-0.115)	0.125 (0.105-0.145)	0.167 (0.142-0.197)	0.208 (0.176-0.246)	0.277 (0.229-0.333)	0.342 (0.275-0.417)	0.419 (0.328-0.521)	0.514 (0.387-0.655)	0.670 (0.478-0.885)	0.815 (0.558-1.10)
<b>10-min</b>	0.152 (0.128-0.175)	0.190 (0.159-0.221)	0.255 (0.215-0.299)	0.317 (0.268-0.375)	0.421 (0.348-0.507)	0.520 (0.418-0.636)	0.638 (0.499-0.794)	0.783 (0.590-0.997)	1.02 (0.728-1.35)	1.24 (0.848-1.68)
<b>15-min</b>	0.189 (0.159-0.217)	0.235 (0.198-0.274)	0.315 (0.267-0.371)	0.392 (0.332-0.464)	0.522 (0.432-0.629)	0.644 (0.518-0.788)	0.791 (0.618-0.984)	0.970 (0.731-1.24)	1.26 (0.903-1.67)	1.54 (1.05-2.08)
<b>30-min</b>	0.255 (0.214-0.292)	0.317 (0.266-0.369)	0.425 (0.359-0.499)	0.528 (0.447-0.625)	0.703 (0.582-0.847)	0.868 (0.698-1.06)	1.07 (0.833-1.33)	1.31 (0.984-1.67)	1.70 (1.22-2.25)	2.07 (1.42-2.80)
<b>60-min</b>	0.315 (0.264-0.362)	0.392 (0.329-0.457)	0.526 (0.445-0.618)	0.654 (0.553-0.774)	0.870 (0.720-1.05)	1.07 (0.864-1.31)	1.32 (1.03-1.64)	1.62 (1.22-2.05)	2.11 (1.51-2.78)	2.56 (1.75-3.47)
<b>2-hr</b>	0.415 (0.367-0.477)	0.516 (0.457-0.594)	0.662 (0.581-0.764)	0.792 (0.686-0.913)	0.993 (0.839-1.15)	1.18 (0.989-1.38)	1.39 (1.12-1.66)	1.67 (1.30-2.08)	2.21 (1.63-2.81)	2.71 (1.92-3.50)
<b>3-hr</b>	0.503 (0.450-0.570)	0.625 (0.564-0.712)	0.784 (0.700-0.889)	0.913 (0.809-1.04)	1.10 (0.958-1.26)	1.26 (1.08-1.46)	1.46 (1.23-1.71)	1.75 (1.44-2.10)	2.24 (1.79-2.84)	2.73 (2.10-3.54)
<b>6-hr</b>	0.729 (0.657-0.819)	0.911 (0.819-1.02)	1.13 (1.01-1.27)	1.29 (1.15-1.46)	1.51 (1.32-1.71)	1.67 (1.45-1.90)	1.83 (1.57-2.11)	2.04 (1.72-2.38)	2.46 (2.03-2.92)	2.88 (2.34-3.57)
<b>12-hr</b>	0.988 (0.887-1.11)	1.24 (1.11-1.39)	1.56 (1.39-1.75)	1.81 (1.61-2.03)	2.14 (1.88-2.41)	2.39 (2.08-2.72)	2.65 (2.27-3.05)	2.91 (2.45-3.39)	3.25 (2.67-3.87)	3.56 (2.87-4.29)
<b>24-hr</b>	1.27 (1.13-1.43)	1.60 (1.43-1.80)	2.06 (1.83-2.32)	2.43 (2.16-2.74)	2.96 (2.60-3.34)	3.38 (2.94-3.83)	3.82 (3.29-4.37)	4.29 (3.65-4.93)	4.94 (4.12-5.74)	5.46 (4.48-6.42)
<b>2-day</b>	1.54 (1.36-1.75)	1.96 (1.73-2.23)	2.56 (2.25-2.92)	3.05 (2.67-3.48)	3.76 (3.25-4.30)	4.33 (3.71-4.98)	4.94 (4.18-5.73)	5.59 (4.66-6.54)	6.51 (5.31-7.73)	7.26 (5.81-8.75)
<b>3-day</b>	1.68 (1.49-1.92)	2.15 (1.90-2.45)	2.84 (2.50-3.24)	3.41 (2.99-3.90)	4.24 (3.66-4.85)	4.91 (4.20-5.65)	5.63 (4.75-6.53)	6.41 (5.33-7.50)	7.52 (6.10-8.94)	8.43 (6.72-10.2)
<b>4-day</b>	1.83 (1.61-2.09)	2.34 (2.06-2.67)	3.13 (2.75-3.57)	3.78 (3.30-4.32)	4.72 (4.08-5.41)	5.48 (4.69-6.32)	6.32 (5.33-7.34)	7.22 (5.99-8.45)	8.53 (6.90-10.1)	9.60 (7.63-11.6)
<b>7-day</b>	2.17 (1.89-2.50)	2.78 (2.42-3.22)	3.75 (3.26-4.34)	4.55 (3.93-5.27)	5.69 (4.86-6.62)	6.64 (5.60-7.76)	7.66 (6.39-9.03)	8.76 (7.19-10.4)	10.3 (8.30-12.5)	11.6 (9.19-14.2)
<b>10-day</b>	2.45 (2.13-2.83)	3.16 (2.76-3.66)	4.27 (3.70-4.94)	5.15 (4.45-5.97)	6.40 (5.48-7.45)	7.42 (6.28-8.67)	8.50 (7.12-10.0)	9.65 (7.96-11.5)	11.3 (9.11-13.6)	12.6 (10.0-15.4)
<b>20-day</b>	3.12 (2.72-3.59)	4.03 (3.52-4.65)	5.42 (4.72-6.24)	6.49 (5.63-7.48)	7.94 (6.84-9.16)	9.06 (7.76-10.5)	10.2 (8.66-12.0)	11.5 (9.62-13.5)	13.3 (10.9-15.9)	14.7 (11.9-17.7)
<b>30-day</b>	3.69 (3.22-4.27)	4.78 (4.18-5.53)	6.42 (5.58-7.43)	7.67 (6.66-8.87)	9.38 (8.07-10.8)	10.7 (9.14-12.4)	12.1 (10.2-14.1)	13.5 (11.3-15.8)	15.5 (12.8-18.4)	17.1 (13.9-20.5)
<b>45-day</b>	4.45 (3.88-5.07)	5.77 (5.03-6.57)	7.71 (6.70-8.78)	9.16 (7.94-10.4)	11.1 (9.57-12.7)	12.6 (10.8-14.4)	14.1 (12.0-16.3)	15.7 (13.2-18.2)	17.9 (14.8-21.0)	19.7 (16.1-23.4)
<b>60-day</b>	5.12 (4.45-5.84)	6.67 (5.80-7.61)	8.91 (7.74-10.2)	10.5 (9.11-12.0)	12.5 (10.8-14.3)	14.1 (12.1-16.1)	15.6 (13.2-17.9)	17.0 (14.4-19.7)	19.1 (15.9-22.4)	20.7 (17.1-24.4)

<sup>1</sup> Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).  
 Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.  
 Please refer to NOAA Atlas 14 document for more information.

[Back to Top](#)

# PF graphical

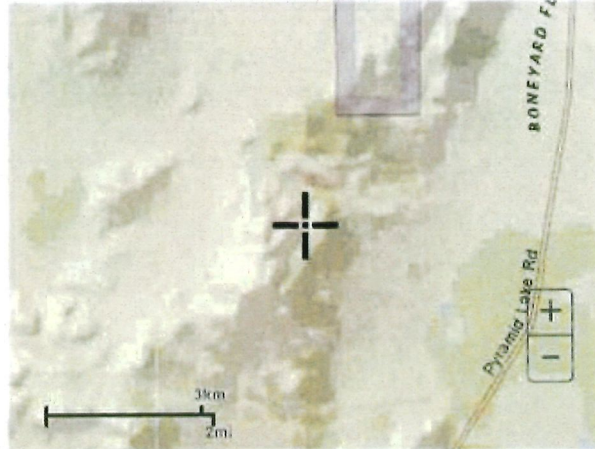
PDS-based depth-duration-frequency (DDF) curves  
 Latitude: 39.6600°, Longitude: -119.7600°





# Maps & aerials

## Small scale terrain



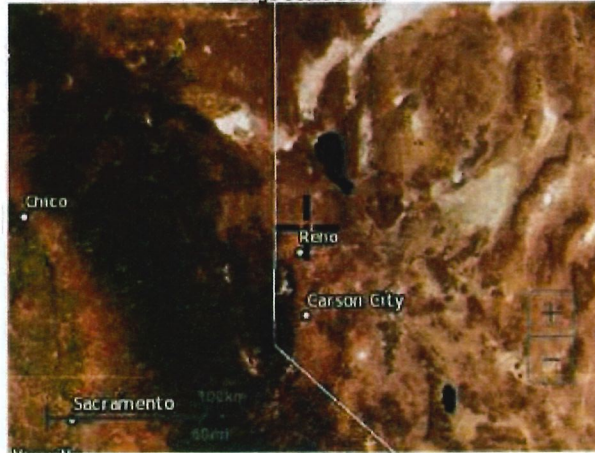
## Large scale terrain



## Large scale map



Large scale aerial

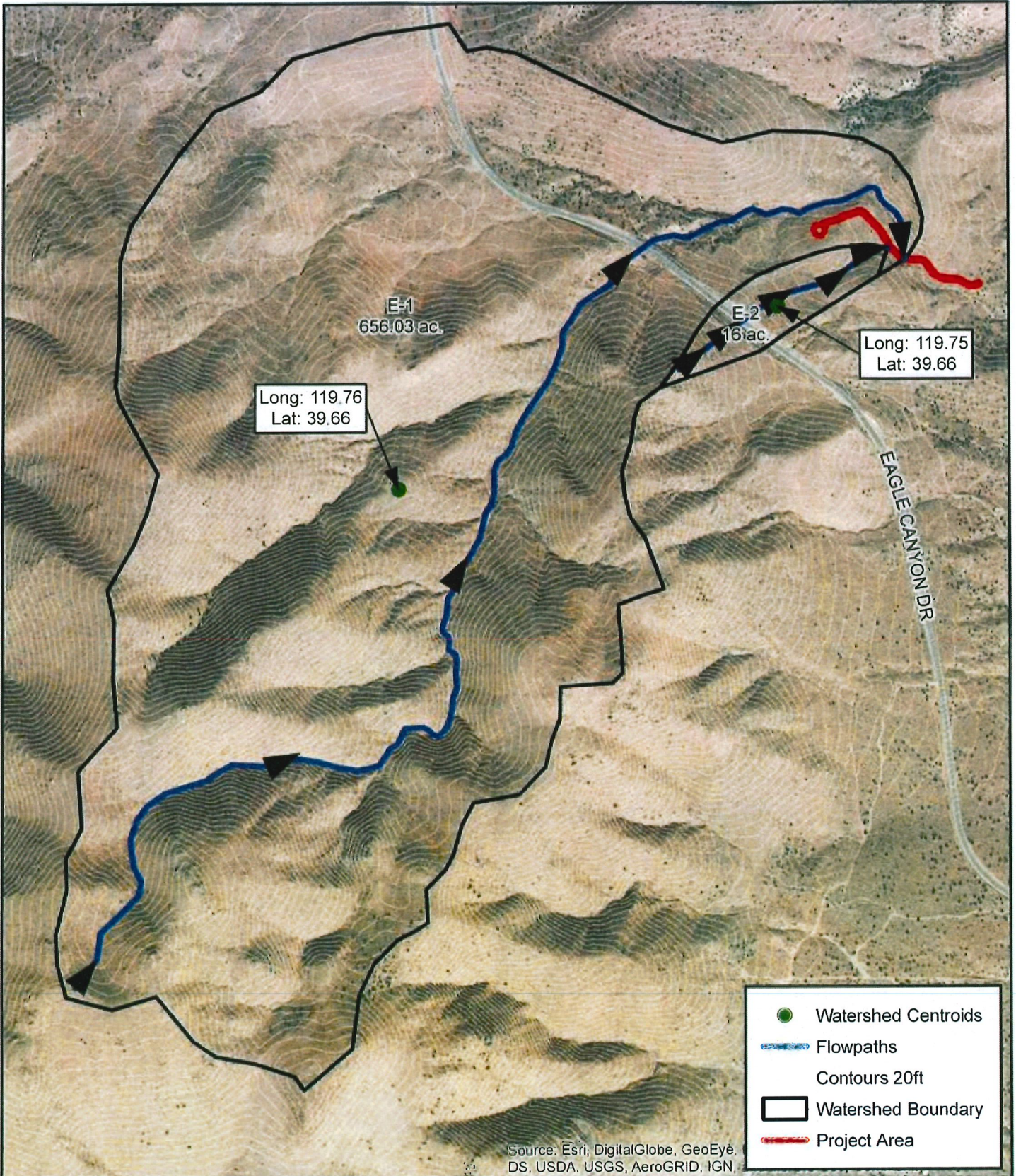


[Back to Top](#)

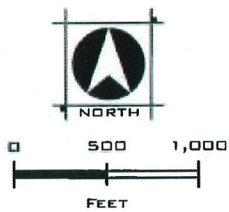
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[National Water Center](#)  
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Silver Spring, MD 20910  
Questions?: [HDSC.Questions@noaa.gov](mailto:HDSC.Questions@noaa.gov)

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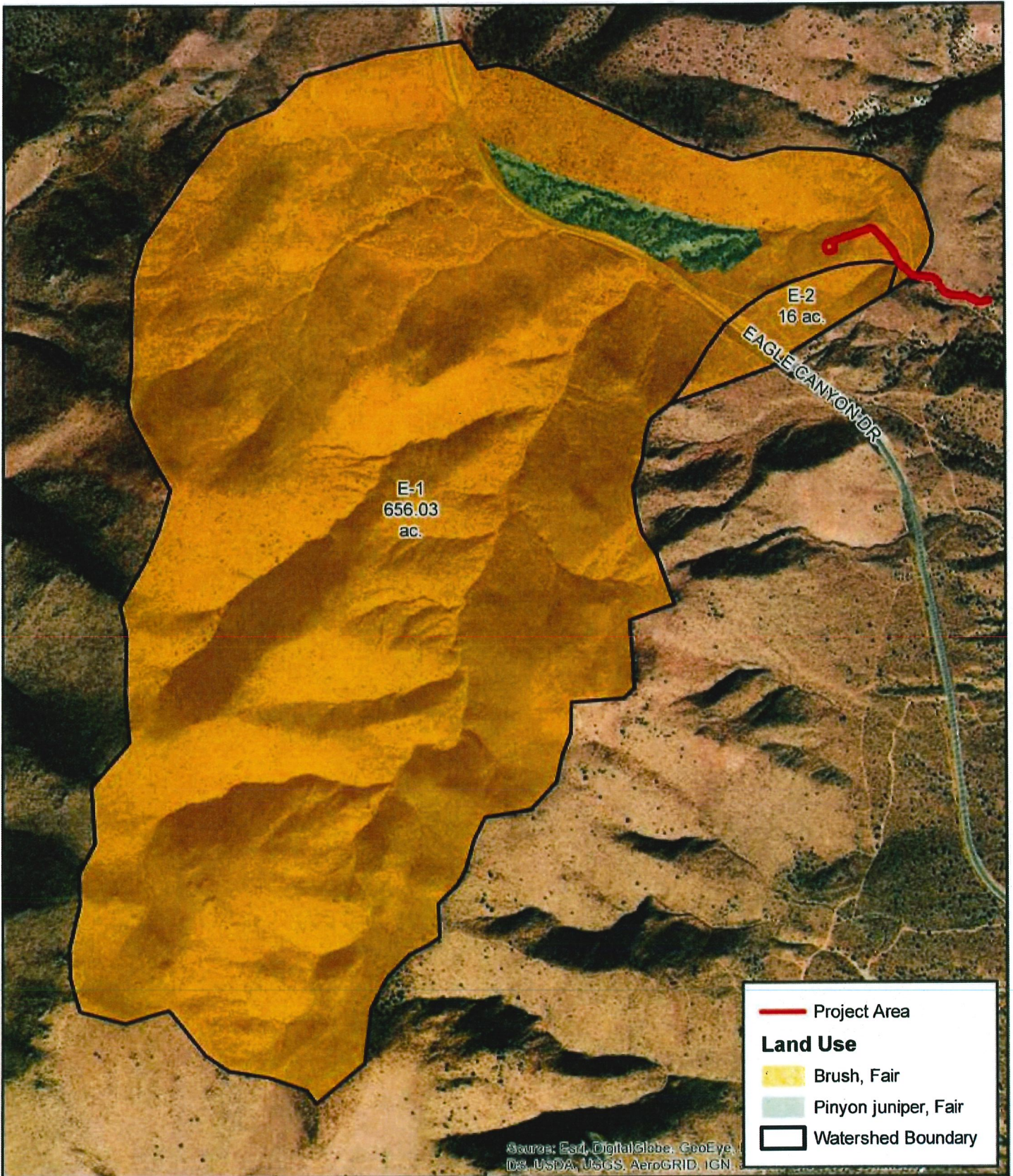


**FLOWPATHS**  
 BROKEN HILL  
 WASHOE COUNTY, NV  
 AUGUST, 2019  
 NOTES

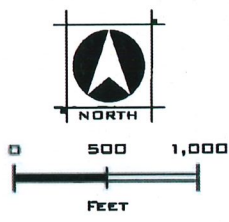


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 Fax: 775.823.4066

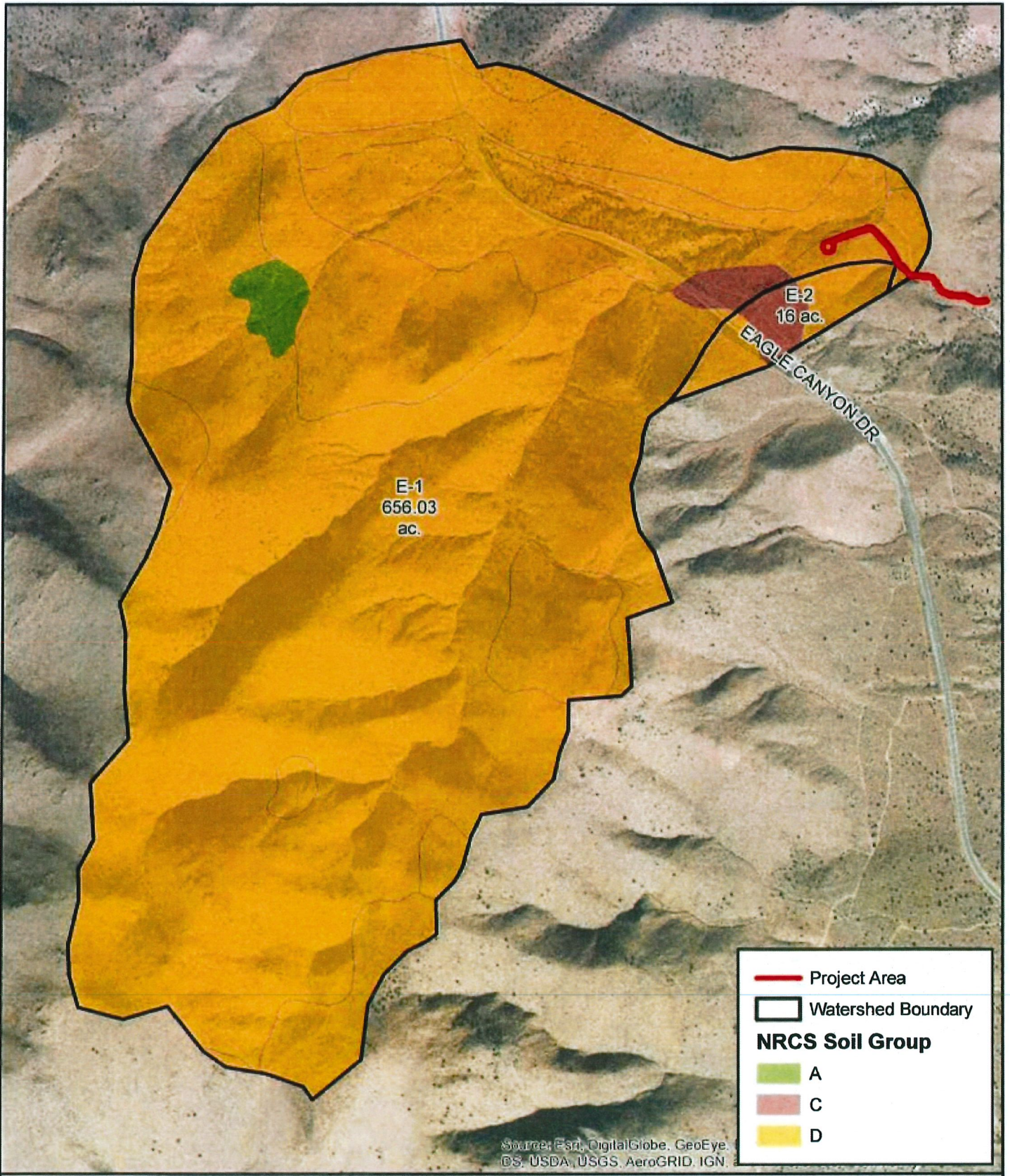
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LAND USE  
 BROKEN HILL  
 WASHOE COUNTY, NV  
 AUGUST, 2019  
 NOTES



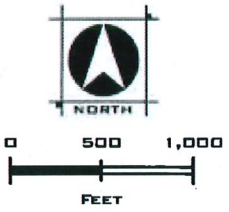
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Source: Esri, DigitalGlobe, GeoEye,  
 ©S. USDA, USGS, AeroGRID, IGN

	Project Area
	Watershed Boundary
<b>NRCS Soil Group</b>	
	A
	C
	D

**SOIL GROUPS**  
 BROKEN HILL  
 WASHOE COUNTY, NV  
 AUGUST, 2019  
 NOTES



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# Truckee Meadows Regional Drainage Manual

April 30, 2009

Reno



Sparks



Washoe County



**RUNOFF CURVE NUMBERS FOR ARID AND SEMIARID RANGELANDS<sup>1</sup>**

**Runoff Curve Numbers**

Cover Description	Hydrologic Condition <sup>2</sup>	Soil Comp A <sup>3</sup>	Soil Comp B	Soil Comp C	Soil Comp D
Herbaceous – mixture of grass, weeds, and low-growing brush, with brush the minor element.	Poor		80	87	93
	Fair		71	81	89
	Good		62	74	85
Oak-aspen – mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush	Poor		66	74	79
	Fair		48	57	63
	Good		30	41	48
Pinyon-juniper – pinyon, juniper, or both; grass understory	Poor		75	85	89
	Fair		58	73	80
	Good		41	61	71
Sagebrush with grass understory	Poor		67	80	85
	Fair		51	63	70
	Good		35	47	55
Desert shrub – major plants include saltbrush, greasewood, creosotebush, blackbrush, bursage, palo verde, mesquite, and cactus	Poor	63	77	85	88
	Fair	55	72	81	86
	Good	49	68	79	84

<sup>1</sup>Average runoff condition, and  $I_a = 0.2S$ . For range in humid regions, use Table 702 - 3 of 4.

<sup>2</sup>*Poor*: < 30% ground cover (litter, grass, and brush overstory)

*Fair*: 30 to 70% ground cover

*Good*: > 70% ground cover

<sup>3</sup>Curve numbers for group A have been developed only for desert shrub.

VERSION: April 30, 2009

WTC ENGINEERING INC

REFERENCE:

210-VI-TR-55, Second Edition, June 1986

TABLE

702

4 of 4

TRUCKEE MEADOWS REGIONAL DRAINAGE MANUAL

**RUNOFF CURVE NUMBERS FOR OTHER AGRICULTURAL LANDS<sup>1</sup>**

**Runoff Curve Numbers**

Cover Type	Hydrologic Condition	Soil Comp A	Soil Comp B	Soil Comp C	Soil Comp D
Pasture, grassland, or range – continuous forage for grazing <sup>2</sup>	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow – continuous grass, protected from grazing and generally mowed for hay	-	30	58	71	78
Brush – brush-weed-grass mixture with brush the major element <sup>3</sup>	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30 <sup>4</sup>	48	65	73
Woods – grass combination (orchard or tree farm) <sup>5</sup>	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods <sup>6</sup>	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30 <sup>4</sup>	55	70	77
Farmsteads – buildings, lanes, driveways, and surrounding lots	-	59	74	82	86

<sup>1</sup>Average runoff condition, and  $I_a = 0.2S$

<sup>2</sup>*Poor:* < 50% ground cover or heavily grazed with no mulch  
*Fair:* 50 to 75% ground cover and not heavily grazed  
*Good:* > 75% ground cover and lightly or only occasionally grazed

<sup>3</sup>*Poor:* < 50% ground cover  
*Fair:* 50 to 75% ground cover  
*Good:* >75% ground cover

<sup>4</sup>Actual curve number is less than 30; use CN = 30 for runoff computations.

<sup>5</sup>CNs shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CNs for woods and pasture.

<sup>6</sup>*Poor:* Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.  
*Fair:* Woods are grazed but not burned, and some forest litter covers the soil.  
*Good:* Woods are protected from grazing, and litter and brush adequately cover the soil.

VERSION: April 30, 2009

WRC ENGINEERING INC

REFERENCE:

210-VI-TR-55, Second Edition, June 1986

TABLE

702

3 of 4



<b>E-1</b>			
<b>Land Use</b>	<b>Soil</b>	<b>Area</b>	<b>Curve Number</b>
Brush, Fair	A	6.4	35
Brush, Fair	C	5.0	70
Brush, Fair	D	627.9	77
Pinyon juniper, Fair	C	0.1	73
Pinyon juniper, Fair	D	16.7	80
Total Area		656.0	
Final Curve Number			77

<b>E-2</b>			
<b>Land Use</b>	<b>Soil</b>	<b>Area</b>	<b>Curve Number</b>
Brush, Fair	C	4.8	70
Brush, Fair	D	11.2	77
Total Area		16.0	
Final Curve Number			75

Time of Concentration  
Existing Onsite Basins

	Drainage Area (AC)	Kn	L	Lc	S (ft/mi)	TLAG(hours)	TLAG(min)
E-1	656.03	0.09	2.09	1.14	569.84	0.93	55.78
E-2	16.00	0.09	0.36	0.19	1087.28	0.26	15.54

Project: BrokenHills Simulation Run: 100yr\_24hour

Start of Run: 01Jan2019, 00:00 Basin Model: ExistingBasin  
End of Run: 02Jan2019, 00:00 Meteorologic Model: Met 1  
Compute Time: 12Aug2019, 13:10:28 Control Specifications:Control 1

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
E-1	1.025	335.53	01Jan2019, 12:58	1.56
E-2	0.025	17.57	01Jan2019, 12:18	1.50
Junction-1	1.050	337.39	01Jan2019, 12:58	1.56

## Culvert Calculator Report 24" Culvert -Basin E-2

Solve For: Headwater Elevation

Culvert Summary			
Allowable HW Elevation	268.00 ft	Headwater Depth/Height	1.31
Computed Headwater Elev.	265.62 ft	Discharge	17.60 cfs
Inlet Control HW Elev.	265.50 ft	Tailwater Elevation	260.00 ft
Outlet Control HW Elev.	265.62 ft	Control Type	Entrance Control

Grades			
Upstream Invert	263.00 ft	Downstream Invert	257.00 ft
Length	68.00 ft	Constructed Slope	0.088235 ft/ft

Hydraulic Profile			
Profile CompositePressureProfileS1S2		Depth, Downstream	3.00 ft
Slope Type	N/A	Normal Depth	0.70 ft
Flow Regime	N/A	Critical Depth	1.51 ft
Velocity Downstream	5.60 ft/s	Critical Slope	0.007147 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	2.00 ft
Section Size	24 inch	Rise	2.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	265.62 ft	Upstream Velocity Head	0.74 ft
Ke	0.50	Entrance Loss	0.37 ft

Inlet Control Properties			
Inlet Control HW Elev.	265.50 ft	Flow Control	Transition
Inlet Type	Square edge w/headwall	Area Full	3.1 ft <sup>2</sup>
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

## Culvert Calculator Report

### 4'x8' Box Culvert - Basin E-1

Solve For: Headwater Elevation

Culvert Summary			
Allowable HW Elevation	256.00 ft	Headwater Depth/Height	1.67
Computed Headwater Elev.	255.19 ft	Discharge	337.00 cfs
Inlet Control HW Elev.	255.19 ft	Tailwater Elevation	248.00 ft
Outlet Control HW Elev.	254.59 ft	Control Type	Inlet Control

Grades			
Upstream Invert	248.50 ft	Downstream Invert	242.00 ft
Length	168.00 ft	Constructed Slope	0.038690 ft/ft

Hydraulic Profile			
Profile Composite	PressureProfileS1S2	Depth, Downstream	1.93 ft
Slope Type	N/A	Normal Depth	1.68 ft
Flow Regime	N/A	Critical Depth	3.81 ft
Velocity Downstream	21.87 ft/s	Critical Slope	0.003847 ft/ft

Section			
Section Shape	Box	Mannings Coefficient	0.013
Section Material	Concrete	Span	8.00 ft
Section Size	8 x 4 ft	Rise	4.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	254.59 ft	Upstream Velocity Head	1.90 ft
Ke	0.20	Entrance Loss	0.38 ft

Inlet Control Properties			
Inlet Control HW Elev.	255.19 ft	Flow Control	Submerged
Inlet Type	90° headwall w 45° bevels	Area Full	32.0 ft <sup>2</sup>
K	0.49500	HDS 5 Chart	10
M	0.66700	HDS 5 Scale	2
C	0.03140	Equation Form	2
Y	0.82000		

## Culvert Calculator Report Dual 48" Culverts - Basin E-1

Solve For: Headwater Elevation

Culvert Summary			
Allowable HW Elevation	256.00 ft	Headwater Depth/Height	2.10
Computed Headwater Elev.	256.88 ft	Discharge	337.00 cfs
Inlet Control HW Elev.	256.88 ft	Tailwater Elevation	248.00 ft
Outlet Control HW Elev.	255.79 ft	Control Type	Inlet Control

Grades			
Upstream Invert	248.50 ft	Downstream Invert	242.00 ft
Length	168.00 ft	Constructed Slope	0.038690 ft/ft

Hydraulic Profile			
Profile CompositePressureProfileS1S2		Depth, Downstream	2.42 ft
Slope Type	N/A	Normal Depth	2.22 ft
Flow Regime	N/A	Critical Depth	3.72 ft
Velocity Downstream	21.21 ft/s	Critical Slope	0.011905 ft/ft

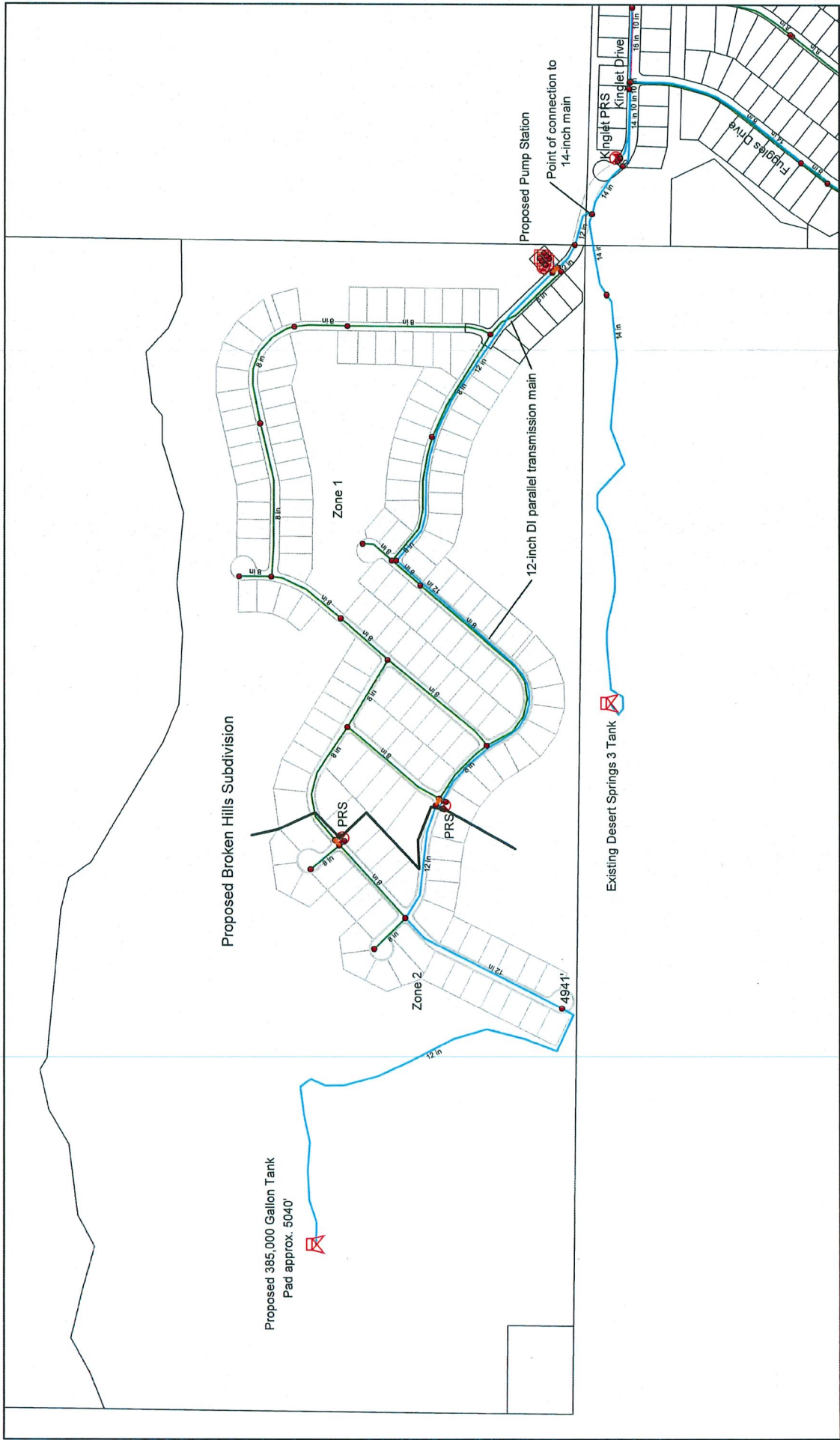
Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	4.00 ft
Section Size	48 inch	Rise	4.00 ft
Number Sections	2		


Outlet Control Properties			
Outlet Control HW Elev.	255.79 ft	Upstream Velocity Head	2.98 ft
Ke	0.20	Entrance Loss	0.60 ft

Inlet Control Properties			
Inlet Control HW Elev.	256.88 ft	Flow Control	Submerged
Inlet Type	Groove end projecting	Area Full	25.1 ft <sup>2</sup>
K	0.00450	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	3
C	0.03170	Equation Form	1
Y	0.69000		

# TMWA DESIGN REPORT





 <p><b>TRUCKEE MEADOWS WATER</b> A U T H O R I T Y <i>Quality. Delivered.</i></p>		<p><b>Broken Hills Annexation Conceptual Water Service Plan</b> Preliminary and Subject to Change Desert Springs System Expansion</p>		<p>DATE: 6/20/2019 MAP BY: hmf REQUESTED BY: pa SCALE: 1 inch = 411 feet</p>
			19-6844	<p>IND 03 NEVADA STATE PLANS (FEE) \$100</p>

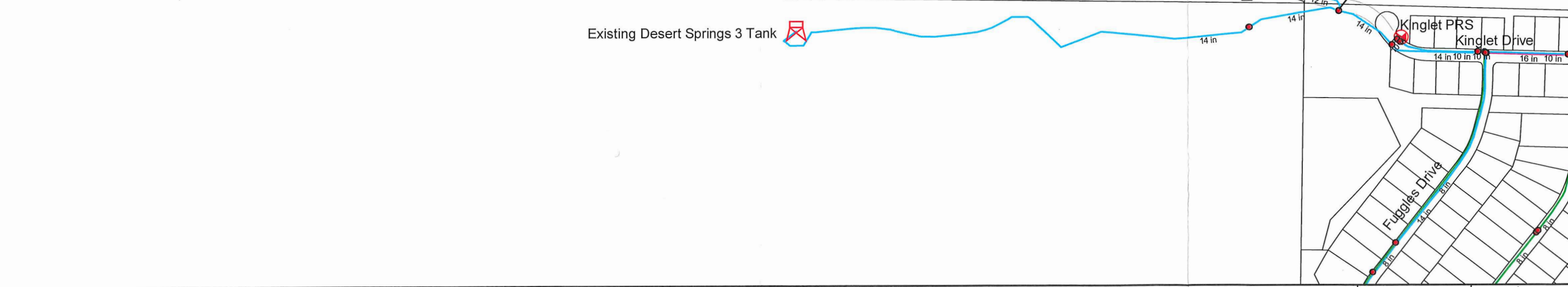
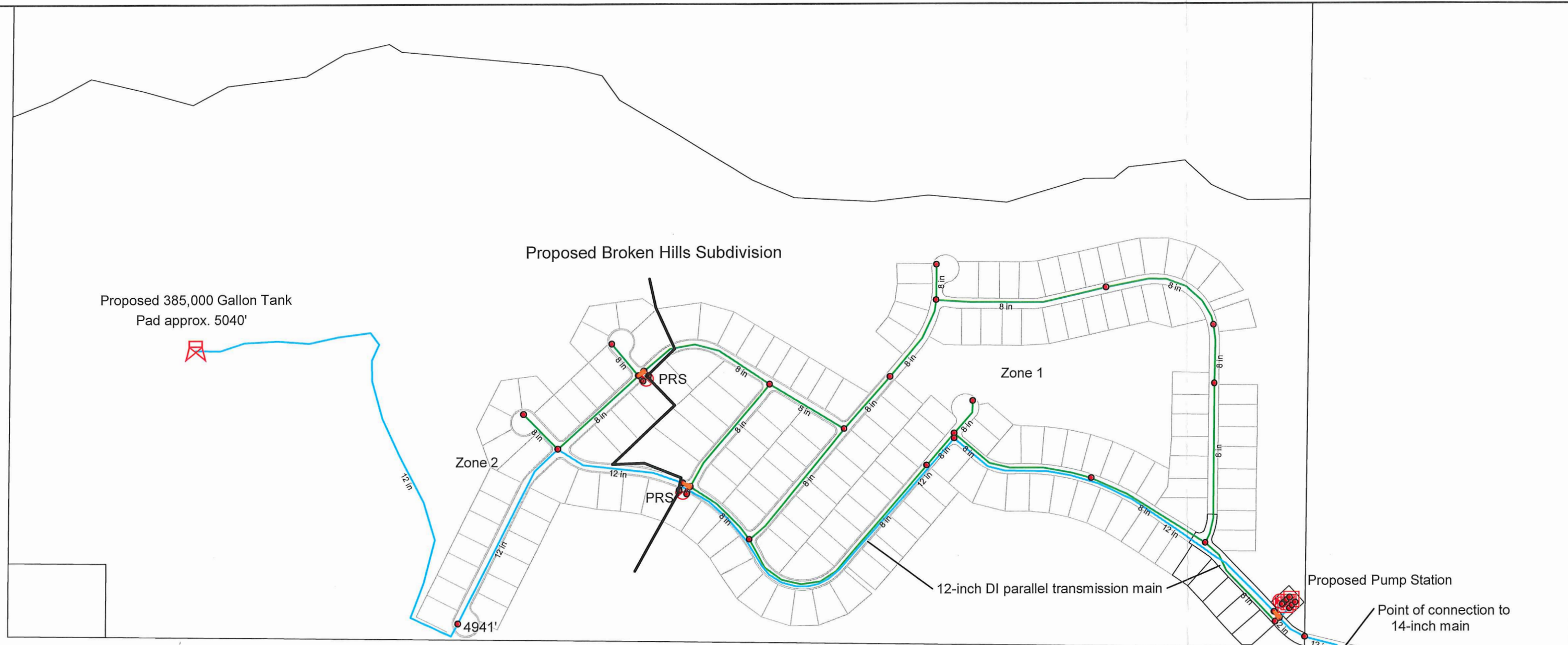
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# TMWA DESIGN REPORT



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Broken Hills Annexation Conceptual Water Service Plan  
 Preliminary and Subject to Change  
 Desert Springs System Expansion

DATE:	6/20/2019
MAP BY:	hmf
REQUESTED BY:	pa
SCALE:	1 inch = 411 feet PLANE WEST FEET

19-6844

WSUP-19-0015  
EXHIBIT D