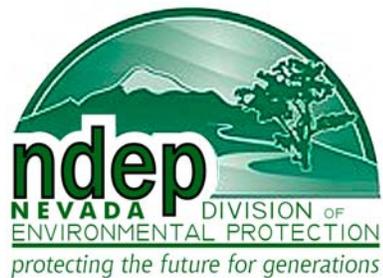


**Work Plan for Deep Monitoring Well Installation  
BMI Common Areas  
Eastside Area**

**February 6, 2008**

**Submitted to:**



**Prepared for:**



***Daniel B. Stephens & Associates, Inc.***

260 Newport Center Drive • Newport Beach, California 92660

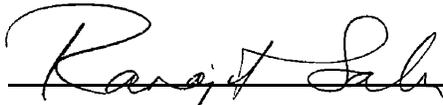
### **Responsible CEM for this Project**

I hereby certify that I am responsible for the services described in this document and for the preparation of this document. The services described in this document have been provided in a manner consistent with the current standards of the profession and, to the best of my knowledge, comply with all applicable federal, state, and local statutes, regulations, and ordinances.



February 6, 2008

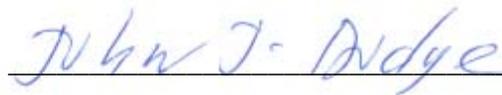
Stephen J. Cullen, Ph.D., C.E.M. (No. 1839, Exp. 11/12/07)  
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February 6, 2008

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## Table of Contents

Section	Page
1. Introduction .....	1
1.1 Location and Setting .....	1
1.2 Objectives .....	2
2. Proposed Scope of Work .....	3
2.1 Field Procedures .....	3
2.2 Well Construction .....	3
2.3 Well Abandonment .....	4
2.4 Quality Assurance/Quality Control Procedures .....	5
3. Reporting .....	5
4. Schedule .....	6
References .....	6

## **List of Figures**

### **Figure**

- 1 Site Location and Topographic Map
- 2 Existing and Proposed Monitoring Wells

## **List of Tables**

### **Table**

- 1 Summary of Existing and Proposed Well Construction

## **1. Introduction**

This work plan presents the scope of work for the installation of several deep wells at the Eastside Area of the Basic Management, Incorporated (BMI) Common Areas/Complex (the "Site") in Clark County, Nevada (Figure 1).

This scope of work has previously been discussed between Basic Remediation Company (BRC) and Nevada Division of Environmental Protection (NDEP) representatives, in NDEP comments (dated January 25, 2007) to the workplan for well installation in the Northeast Area (dated April 23, 2007), as well as more recently just prior to the submission of this work plan. This work plan reflects the outcome of these recent discussions. The scope of work consists of:

- Deep monitoring well installation.
- Well abandonment and replacement.
- Reporting.

### **1.1 Location and Setting**

The Site is located in Clark County, Nevada, and is situated approximately 2 miles west of the River Mountains and 1 mile north of the McCullough Range (Figure 1). As shown in Figure 1, the local surface topography slopes in a westerly to northwesterly direction from the River Mountains and in a northerly to northeasterly direction from the McCullough Range. Near the Site, the surface topography slopes in a northerly direction toward the Las Vegas Wash.

The uppermost water-bearing zone is unconfined and present primarily in alluvium (referred to as the alluvial aquifer). At some locations on portions of the Site, groundwater is first encountered in the uppermost portion of the Tertiary Muddy Creek Formation (TMCf). This unconfined groundwater generally flows in a northerly direction toward Las Vegas Wash.

Deep groundwater at the Site is currently characterized by hydrogeologic data from twelve existing deep wells (Figure 2, Table 1). Deep wells are screened below 270 feet bgs to a maximum depth of 399 ft bgs. Depth to water in the deep wells was measured between 8.4 and

80.30 feet below top of casing (ft btoc) in October 2007 (Table 1) (the most recent available data). One well (MCF-08A) was artesian with the elevation of its potentiometric surface exceeding grade elevation. Groundwater elevation data for the October 2006 groundwater monitoring event show the potentiometric surface of deep groundwater is oriented generally north towards Las Vegas Wash (MWH, 2007).

Separate NDEP-approved project documents provide information regarding area geology and hydrogeology, soils, history, and investigations completed to-date (e.g., BRC, 2006).

## **1.2 Objectives**

The existing deep wells at the site provide limited data to characterize deep groundwater in the Eastside Area. This work plan proposes the installation of additional deep wells in order to provide additional data to support deep groundwater characterization in this area. Please note that this work plan only addresses the installation and development of the proposed wells. Sampling from these wells as well as from the other wells located at the site will be addressed separately. The objectives of this work plan are to:

- Install monitoring wells to characterize deep groundwater quality and flow direction in the Eastside Area.
- Abandon existing offsite deep well MCF-06A and install a new replacement deep monitoring well MCF-06A-R on BRC property. This is required since well MCF-06A is located on private property to which BRC has no current access. The current property owner has requested that this well be abandoned.
- Abandon existing intermediate well MCF-08B, where bentonite has been reported in well purge water, and install a replacement intermediate monitoring well MCF-08B-R.
- Data collected from the proposed wells as well as from other existing wells will be used to refine the hydrogeologic conceptual site model (CSM) for the Eastside Area. The new deep monitoring wells will be installed in the Eastside Area at the proposed locations presented in Figure 2. Well locations previously suggested by NDEP are also shown on Figure 2. The rationale for the location of the new wells (MCF-17A through MCF-23A) at

each proposed location are listed in Table 1. Table 1 also lists, at the request of the NDEP, the rationale for how each of the NDEP-suggested locations are addressed.

## **2. Proposed Scope of Work**

This section identifies the proposed field procedures, well construction and quality assurance/quality control (QA/QC) procedures that will be used during the investigation of the Eastside Area.

### **2.1 Field Procedures**

All field procedures will be consistent with the NDEP-approved *BRC Field Sampling and Standard Operating Procedures* (FSSOP) (BRC, 2007b). The standard operating procedures (SOPs) referred to in this work plan are documented in FSSOP.

The rotary sonic drilling method will be used to allow for continuous core sampling (SOP-1). During drilling, an inner sample barrel (located at the end of the drill string) will be advanced for continuous soil core collection, and an outer, larger-diameter casing will be advanced as necessary to maintain the borehole in areas of unconsolidated sediments. The field geologist will prepare logs for each boring indicating the Unified Soil Classification System (USCS) soil classification (SOP-17), an estimate of field moisture content, sampling depths, progress of drilling (SOP-15), final completion depth, and the nature and resolution of any problems encountered. A representative sample from each sampled interval and/or change in lithology will be photographed to complete the documentation.

### **2.2 Well Construction**

The proposed new wells and replacement wells are shown on Figure 2. The wells will be screened in the TMC to be consistent with the existing deep wells at the Site. Field boring logs and proposed screen intervals will be submitted to NDEP for review and approval before well construction commences.

Field procedures for equipment decontamination (SOP-31), soil, water, and waste disposal (SOP-34), soil borings (SOP-1 and SOP-7), logging of soil borings (SOP-17), and well

installation (SOP-2) protocol are set forth in the governing FSSOP (BRC, 2007b). Project SOPs are in accordance with Nevada Department of Water Resource (NDWR) drilling regulations.

General well design and construction methods are described in SOP-2. Individual well construction details will be designed and overseen by a Nevada Certified Environmental Manger (CEM) such that the resulting wells are comparable in design to monitoring wells previously installed at the Site.

Well development will be performed using a combination of surging, bailing, and pumping (SOP-3). Field measurements of groundwater quality (pH, temperature, electrical conductivity, and turbidity) will be monitored using a portable water quality meter (SOP-5). Well development activities, including well identification, date constructed, date developed, volume of water purged, well recovery rates, and other relevant information, will be recorded by field personnel (SOP-15).

As noted earlier, this work plan addresses only monitoring well installation. Groundwater sampling in the new wells will be conducted under a separate task. BRC will consult with NDEP before finalizing the analyte list and before beginning sampling.

### **2.3 Well Abandonment**

Wells MCF-08B and MCF-06A will be abandoned in preparation for replacement well installation. Well abandonment will be completed in accordance with SOP-19 (borehole abandonment).

At MCF-08B, the replacement well will be installed within approximately 25 feet (upgradient) of the original well location. Drilling will proceed without logging to the total depth of the former well screen interval. New well MCF-08B-R will be screened in the same interval (107.5 to 137.5) as the original well.

At MCF-06A, a replacement well will be installed on BRC property as close as possible to the original well location. Soil logging will not be completed if the replacement well can be installed within approximately 25 feet of the original well location. In this case, replacement well MCF-06A-R will be screened in the same elevation interval as the original well (local variations in

topographic relief will be considered when determining the final depth below ground surface). Drilling will proceed without logging to the total depth of the former well screen interval. MCF-06A-R will be drilled, logged, and screened as a new well if it must be located further away.

#### **2.4 Quality Assurance/Quality Control Procedures**

The QA/QC procedures that will be followed during this task are detailed in Section B of the BRC Quality Assurance Project Plan (QAPP) (BRC, 2007a).

### **3. Reporting**

The data obtained during the tasks presented in this work plan will undergo a QA/QC review in accordance with the procedures described in the BRC QAPP (BRC, 2007a). These procedures will be followed to verify that the data are sufficient to meet the goals of this project. Only those data determined by the QA/QC review to be suitable for use will be considered for project use.

Boring log and well completion data will be presented in graphical and tabular format in the report. Boring log data to be presented will include:

- Drilling method
- The USCS of logged soils
- Soil color
- Qualitative evaluation of soil moisture content (USCS)
- Qualitative evaluation of particle size distribution
- Observation of mineralogical and/or other observed anomalies in the sampled soil material
- Depth to the contact between the Qa and TMCf
- Coarse- and fined-grained facies within the TMCf (if encountered)
- Total depth of boring
- Depth and location at which soil physical samples are collected
- Chain of custody for soil samples

Well completion and development data to be presented will include:

- Well identification and location (northing and easting)
- Well completion details
- Well development completion date
- Well screen interval
- Static water level after development completion
- Well screen swabbing data
- Sediment bailing data
- Purging date
- Purge method
- Purge volume
- Average purge rate
- Well recharge rate
- Notes of observations made during well installation and development

#### **4. Schedule**

Field activities will be initiated upon receipt of NDEP approval to proceed. Assuming a 6-week period for field work, it is anticipated that a well installation report will be submitted to NDEP within approximately 10 weeks of field work initiation.

#### **References**

Basic Remediation Company (BRC), Environmental Resources Management (ERM), and Daniel B. Stephens & Associates, Inc. (DBS&A). 2006. *Closure plan, BMI Common Areas, Clark County, Nevada*. Prepared for Basic Remediation Company (BRC), Henderson, Nevada. August 2006.

Basic Remediation Company (BRC), ERM, and MWH. 2007a. BRC Quality Assurance Project Plan. BMI Common Areas, Clark County, Nevada. August.

Basic Remediation Company (BRC), ERM, and MWH. 2007b. BRC Field Sampling and Standard Operating Procedures, BMI Common Areas, Clark County, Nevada. August.

MWH, 2007. *Third quarterly groundwater monitoring report, October - November 2006, BMI Common Areas (Eastside), Clark County, Henderson, Nevada.* Prepared for Basic Remediation Company (BRC), Henderson, Nevada. March 13, 2007.

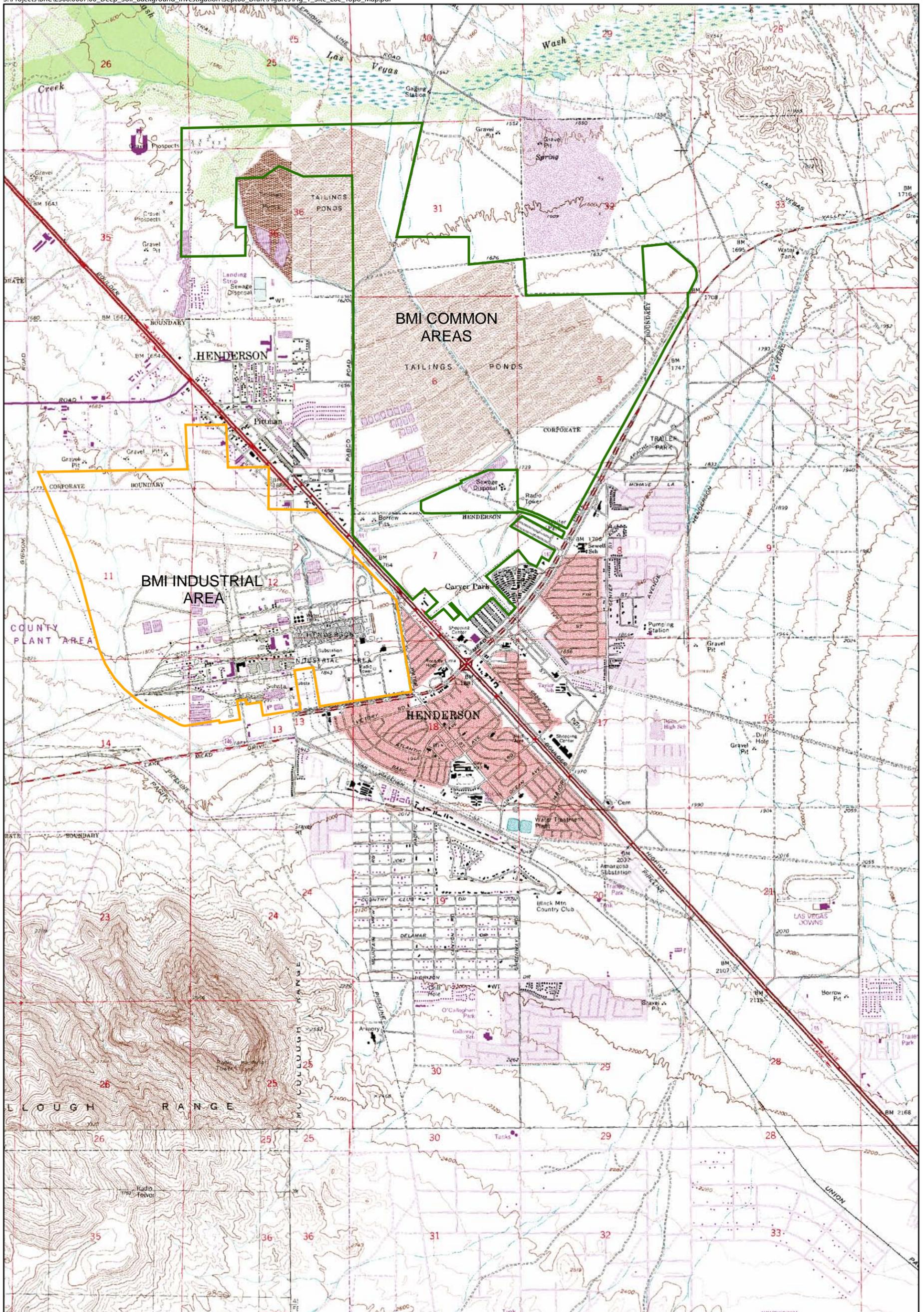
**Table**

**Table 1. Summary of Existing and Proposed Well Construction**

Well ID	Diameter of Casing (inches)	Surface Elevation (feet msl)	Top of Casing Elevation (feet msl)	Depth to Top of Screen (feet bgs)	Depth to Bottom of Screen (feet bgs)	Total Measured Depth of Well (feet btoc)	Depth to Water (feet btoc) 10/16-17/06	Groundwater Elevation (feet msl) 10/16-17/06	Objective for New Well
<b>Existing Deep Wells</b>									
MCF-01A	4	1754.44	1756.61	335	355	355.45	28.74	1727.87	--
MCF-02A	4	1816.44	1818.42	360	380	377.90	41.94	1776.48	--
MCF-03A	4	1783.23	1784.06	364	384	386.10	46.49	1737.57	--
MCF-04	4	1748.35	1750.42	379	399	402.30	34.12	1716.30	--
MCF-06A	4	1588.80	1590.69	373.5	393.5	396.00	78.69	1512.00	--
MCF-07	4	1610.12	1612.63	350	370	369.50	80.39	1532.24	--
MCF-08A	4	1578.43	1581.24	350	370	371.50	artesian	artesian	--
MCF-09A	4	1693.00	1695.77	270	290	286.70	38.47	1657.30	--
MCF-10A	4	1612.38	1615.86	365	385	385.95	8.40	1607.46	--
MCF-12A	4	1713.68	1716.16	349.5	369.5	371.20	54.80	1661.36	--
MCF-16A	4	1689.67	1691.66	364.5	384.5	393.94	47.82	1643.84	--
MCF-27	4	1786.85	1789.38	361.5	381.5	384.80	14.50	1774.88	--
<b>Proposed Deep Wells</b>									
MCF-17A	4	--	--	352	372	373	--	--	Characterization west of artesian well MCF-08A; forms east-west line with MCF-08A-R and MCF-18A
MCF-18A	4	--	--	352	372	373	--	--	Characterization between COH Northern RIBs and WRF; forms east-west line with MCF-17A and MCF-08A-R
MCF-19A	4	--	--	352	372	373	--	--	Characterization at western property line; forms east-west line with MCF-06A-R, MCF-20A, and MCF-12A
MCF-20A	4	--	--	352	372	373	--	--	Characterization downgradient of relatively high TDS and perchlorate detections; forms east-west line with MCF-19A, MCF-06A-R, and MCF-12A
MCF-21A	4	--	--	352	372	373	--	--	Characterization at western property line; forms east-west line with MCF-22-A and MCF-16A
MCF-22A	4	--	--	352	372	373	--	--	Characterization within former spray wheel area; forms east-west line with MCF-21-A and MCF-16A
MCF-23A	4	--	--	352	372	373	--	--	Characterization within COH Southern RIBs; forms east-west line with MCF-09A and MCF-04
<b>Proposed Replacement Wells</b>									
MCF-06A-R	4	--	--	373.5	393.5	394.5	--	--	Relocation of well MCF-06A onto BRC property
MCF-08B-R	4	--	--	107.5	137.5	139.3	--	--	Replacement for intermediate-zone well MCF-08B (bentonite reported in purge water). Note that this is an intermediate zone well.
<b>NDEP Proposed Wells</b>									
A	--	--	--	--	--	--	--	--	BRC cannot locate well offsite on plant property. Existing wells MCF-01A and proposed well MCF-25A are downgradient. No additional well proposed.
B	--	--	--	--	--	--	--	--	BRC cannot locate well offsite on plant property. Existing well MCF-01A is downgradient. No additional well proposed.
C	--	--	--	--	--	--	--	--	Premature to define background location at this point. Existing deep well SNWA LG230 may provide useful data in this area.
D	--	--	--	--	--	--	--	--	Premature to define background location at this point. Thus, no well proposed in this area at this time.
E	--	--	--	--	--	--	--	--	Located within first 8 rows of upper ponds where re-grading is planned. Well MCF-25A proposed west of this area where accessible to evaluate upgradient groundwater quality.
F	--	--	--	--	--	--	--	--	Located within first 8 rows of upper ponds where re-grading is planned. No wells proposed for this area; proposed wells MCF-23A, MCF-24A and existing well MCF-16A are approximately downgradient.
G	--	--	--	--	--	--	--	--	Well MCF-24A proposed at this location to evaluate former spray wheel area.
H	--	--	--	--	--	--	--	--	Well MCF-23A proposed at this location to evaluate upgradient groundwater quality.
I	--	--	--	--	--	--	--	--	Well MCF-19A proposed at this location to evaluate offsite/crossgradient groundwater quality.
J	--	--	--	--	--	--	--	--	Well MCF-20A proposed at this location to evaluate groundwater quality downgradient of former ponds and spray wheel area.
K	--	--	--	--	--	--	--	--	Offsite within inaccessible property. Existing deep wells MCF-07 and SNWA LG232 and proposed replacement well MCF-06A-R provide data in this area. No additional well proposed.
L	--	--	--	--	--	--	--	--	Offsite within inaccessible property. Relocated onsite to proposed location MCF-21A upgradient to further characterize TDS data downgradient of MCF-16A.
M	--	--	--	--	--	--	--	--	Offsite within inaccessible property. Relocated onsite to proposed location MCF-22A just upgradient to further characterize TDS data downgradient of MCF-16A.
N	--	--	--	--	--	--	--	--	Located within first 8 rows of upper ponds where re-grading is planned. No wells proposed for this area; Proposed well MCF-24A and existing well MCF-16A are approximately downgradient.
O	--	--	--	--	--	--	--	--	Located within first 8 rows of upper ponds where re-grading is planned. No wells proposed for this area; Proposed well MCF-21A and existing well MCF-12A are downgradient.
P	--	--	--	--	--	--	--	--	Well MCF-17A proposed at this location to further characterize artesian conditions and TDS data in this area.
Q	--	--	--	--	--	--	--	--	Well MCF-18A proposed south of this location to evaluate potential hydraulic effects of COH WRF and northern RIBs and to characterize deep groundwater quality in this area.

-- = Data not applicable or not yet available

## Figures



BMI Site  
Henderson, Nevada

FIGURE 1

SITE LOCATION AND  
TOPOGRAPHIC MAP

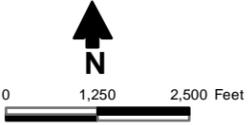
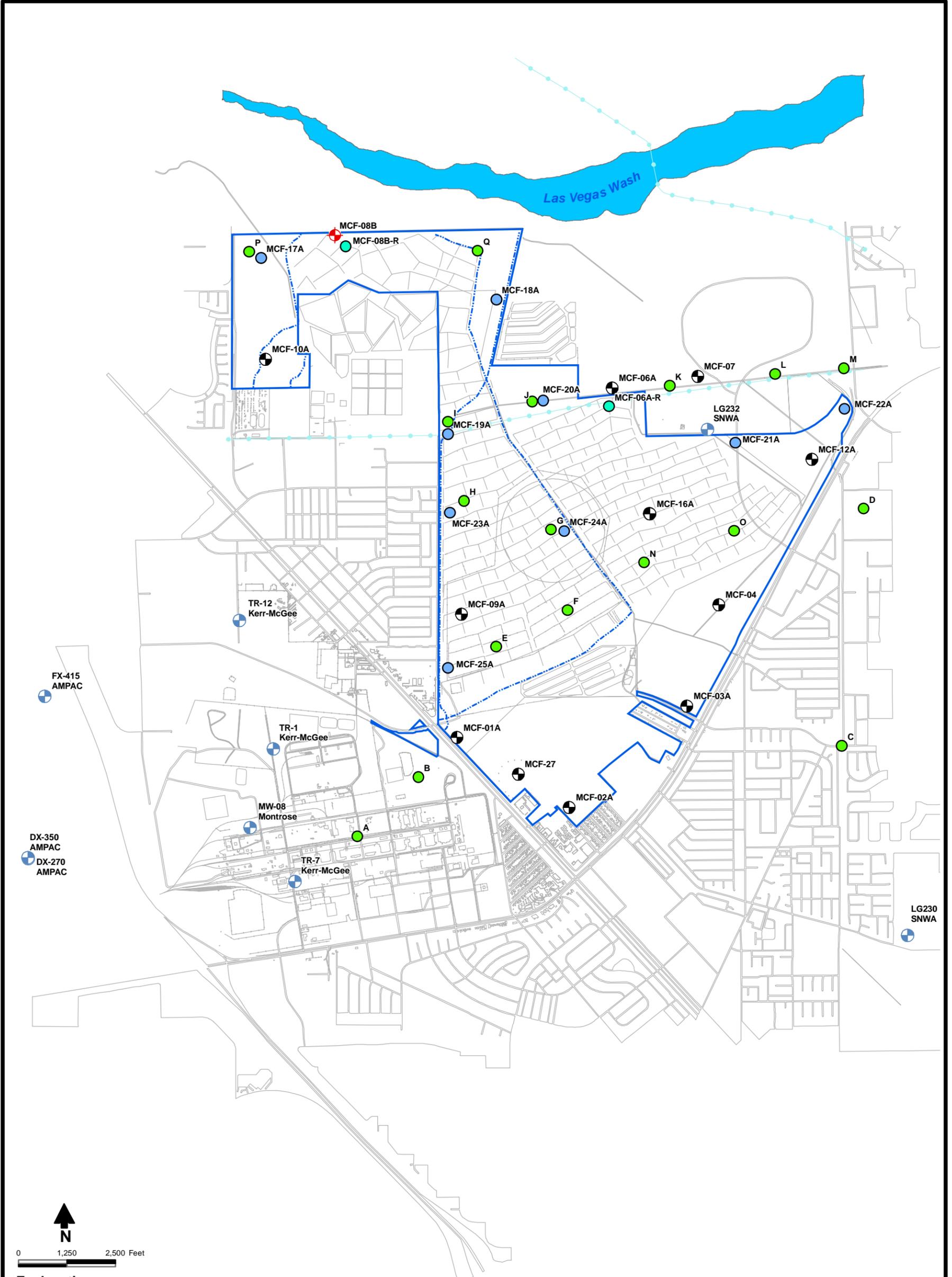


Nevada-Clark Co. 7.5 Minute Series (Topographic)  
Henderson, Nevada SE, Boulder City NW, and Sloan NE Quadrangles

Prepared by:  
MKJ

Date  
09/28/06

JOB No. 1881262  
FILE: GIS/BRC/BKGD\_FIGURE1.MXD



**Explanation**

- BRC deep well
- Offsite deep well
- BRC intermediate well
- NDEP proposed well
- Proposed deep well
- Proposed replacement well
- Site AOC3 boundary
- Ditches
- Laterals

BMI Common Areas (Eastside) Henderson, Nevada	
<b>FIGURE 2</b>	
<b>EXISTING AND PROPOSED WELLS</b>	
Prepared by: CRF (DBS&A)	Date: 1-25-08

