2011 FONR IMPACT ASSESSMENT AND HABITAT AND RARE PLANT SPECIES SURVEY RESULTS OPERABLE UNIT 1 FORMER FORT ORD, CALIFORNIA

Prepared for:

U.S. Army Corps of Engineers
Sacramento District
1325 J Street
Sacramento, CA 95814-2922

Contract No. DACA45-03-D-0029
Delivery Order CM01

Prepared by:

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February 2012

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TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS

ACL	aquifer cleanup level
COC	contaminant of concern
DD&A	Denise Duffy and Associates, Inc.
FDA	Fire Drill Area
FONR	Fort Ord Natural Reserve
GIS	geographic information system
GPS	global positioning system
GWETS	groundwater extraction and treatment system
ft^2	square feet
HGL	HydroGeoLogic, Inc.
LTM	long-term monitoring
NWTS	Northwest Treatment System
OU	operable unit
ROD	Record of Decision
RTE	rare, threatened, or endangered
TCE	trichloroethene
UCNRS	University of California Natural Reserve System
UCSC	University of California at Santa Cruz
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service

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2011 FONR IMPACT ASSESSMENT AND HABITAT AND RARE PLANT SPECIES SURVEY RESULTS OPERABLE UNIT 1 FORMER FORT ORD, CALIFORNIA

1.0 INTRODUCTION

HydroGeoLogic, Inc. (HGL) was contracted by the U.S. Army Corps of Engineers (USACE)–Sacramento District to conduct a Fixed-Price Remediation with Insurance scope of work for Operable Unit (OU)-1 at the former U.S. Army Base Fort Ord located in Monterey County, California. This work was contracted in December 2003 by the USACE–Omaha District, under Contract Number DACA45-03-D-0029, and was administered through the USACE–Sacramento District. The overall goal of this effort is to achieve the primary remediation objectives specified in the Record of Decision (ROD) signed in July of 1995 by the U.S. Army, U.S. Environmental Protection Agency, and the California Environmental Protection Agency (U.S. Army, 1995) as follows:

- Establish hydraulic control and contain contaminated groundwater.
- Extract and treat groundwater exceeding aquifer cleanup levels (ACLs).

A groundwater extraction and treatment system (GWETS) was constructed in 1988 to remediate TCE and other groundwater contaminants.

A key factor affecting the design and implementation of the groundwater cleanup is that the area including and surrounding the OU-1 contaminant plume the groundwater plume is part of the University of California Natural Reserve System (UCNRS) designated as the Fort Ord Natural Reserve (FONR). The FONR area potentially impacted by the construction of OU-1 remediation facilities and activities is approximately 130 acres. Therefore, the project has the additional constraint that activities undertaken to achieve the OU-1 cleanup adequately protect and maintain the critical habitat and protected species found within the FONR. The FONR is managed by staff at the University of California Santa Cruz (UCSC).

Figure 1.1 illustrates the location of Former Fort Ord and the OU-1 source area. The source area was the former Fort Ord Fritzsche Army Airfield Fire Drill Area (FDA). Activities conducted at the FDA between 1962 and 1985 resulted in contaminants being released to soils and groundwater. Although 10 volatile organic compounds have been identified as contaminants of concern (COCs) in groundwater underlying the FDA, trichloroethene (TCE) is the contaminant detected at the highest concentrations and across the greatest extent of the affected aquifer. Data show that the footprint of the TCE plume encompasses the extent of contamination contributed by the other nine COCs. Figure 1.2 shows the estimated extent of the TCE plume in October 2011.

The U.S. Army consulted with the U.S. Fish and Wildlife Service (USFWS) in 1998 to assess potential impacts to the sand gilia (*Gilia tenuiflora ssp. arenaria*) and Monterey spineflower (*Chorizanthe pungens var. pungens*) populations resulting from groundwater investigation and remediation activities within the FONR. The opinion was issued on March 30, 1999. The Army

consulted the USFWS again in 2002 and 2007 to address impacts to Monterey spineflower Critical Habitat and the California tiger salamander (*Ambystoma californiense*) (USFWS, 2002 and 2007). Various mitigation measures were identified as a result of these consultations and are implemented before, during and after work within the FONR.

Intermittent biological surveys were conducted within the OU-1 area by others since 1998 (Harding Lawson Associates, 1998). During the execution of delivery order CM01, HGL conducted annual biological surveys focusing on mapping the extent and population of federally protected rare, threatened, or endangered (RTE) plant species within the FONR, including the endangered sand gilia and the threatened Monterey spineflower. The findings of these surveys were submitted in the following reports:

- Appendix A of the *Draft Remedial System Modification Plan, Operable Unit 1, Fritzsche Army Airfield Fire Drill Area, Former Fort Ord, California* (HGL, 2004a)
- *Results of 2004 Monterey Spineflower and Sand Gilia Surveys, OU-1, Former Ft. Ord, California* (HGL, 2004b)
- *Results of 2005 Monterey Spineflower and Sand Gilia Surveys, OU-1, Former Ft. Ord, California* (HGL, 2005)
- *Final 2006 FONR Impact Assessment and Habitat and Rare Plant Species Survey Results* (HGL 2007a)
- *2007 FONR Impact Assessment and Habitat and Rare Plant Survey Results* (HGL, 2008)
- *2008 FONR Impact Assessment and Habitat and Rare Plant Species Survey Results* (HGL, 2009a)
- *2009 FONR Impact Assessment and Habitat and Rare Plant Species Survey Results* (HGL, 2009b)
- *2010 FONR Impact Assessment and Habitat and Rare Plant Species Survey Results* (HGL, 2010a

This document presents the results of the 2011 rare plant survey and discusses the potential impact to date on those plants associated with the OU-1 remediation activities conducted since 2004. The 2011 rare plant survey was conducted by Denise Duffy and Associates (DD&A) under subcontract to HGL; DD&A completed the surveys in 2006 through 2010 as well. The following information is also included in this report:

- A description of the FONR site and overview of past activities,
- Descriptions of the actions taken and site management protocols implemented to minimize adverse impacts to the FONR habitat,
- A summary of the site activities conducted by HGL during 2011 and planned future activities, and
- Results of the 2011 rare plant survey and interim impact assessment.

1.1 SITE DESCRIPTION

Fort Ord was established in 1917 as a military training base for infantry troops. In January 1991, the Secretary of Defense announced the downsizing/closure of the base. In August 1994, portions of the property were transferred to UCSC and the FONR was established in June 1996.

The former Fort Ord is located near Monterey Bay, approximately 80 miles south of San Francisco. The base consists of approximately 28,000 acres near the cities of Seaside, Sand City, Monterey, Del Rey Oaks, and Marina. Monterey Bay marks the western boundary of the former Fort Ord. Toro Regional Park borders the base to the southeast and land use to the east is primarily agricultural.

OU-1 occupies approximately 590 acres of the FONR in the southwestern corner of the former Fritzsche Army Airfield, west of Imjin Road and north of Reservation Road. The dominant habitats within the OU-1 portion of the FONR are coast live oak woodland, coastal scrub, maritime chaparral and annual grassland. The maritime chaparral is considered a rare habitat by the California Department of Fish and Game. The overall former Fort Ord area contains large areas of maritime chaparral habitat.

Several federally protected RTE species are known or suspected to be present within the FONR. These include the endangered sand gilia, the threatened Monterey spineflower, and the threatened California tiger salamander. Several plant and animal species of concern are also present in the FONR. Other plant species of concern include coast wallflower (*Erysimum ammophilum*), Eastwood's ericameria (*Ericameria fasciculata*), Monterey ceanothus (*Ceanothus cuneatus* var. *rigidus*), Sandmat manzanita (*Arctostaphylos pumila*), and Toro manzanita (*A. montereyensis*). The California black legless lizard (*Anniella pulchra nigra*), California coast horned lizard (*Phrynosoma coronatum*), and the Monterey ornate shrew (*Sorex ornatus salarius*) are animal SOC.

The northern boundary of OU-1 is adjacent to a large expanse of privately owned, non-native grassland. Transmission of non-native grass species into OU-1 is accelerated by the prevailing southern winds, which blow the seeds into the OU-1 area (Fusari, 2004). Non-native grasses and weedy forbs are already present throughout much of the OU-1 area. Significant expansion of the non-native grasses could result in population declines of federally listed plants.

Sand gilia appears to be less tolerant of competing plant cover than the Monterey spineflower. This hypothesis is based on the observation that numerous small Monterey spineflower populations were identified within the dense grassland habitat bordering the main FONR habitat to the east and north or on the roadways bordering this grassland in the initial 1998 survey. Subsequent rare plant surveys conducted between 2004 and 2007 also observed Monterey spineflower in this region. Although sand gilia was not detected in this region during the 1998–2007 surveys, sand gilia populations were observed in 2007 within a small "island" of grassland species within the more extensive oak woodland habitat near the OU-1 plume source area. Figure A3.4 in Appendix A of the 2007 FONR Impact Report (HGL, 2008) illustrates the location of this 'island' and its relative location to the FDA. The small open area in which the sand gilia population was observed is bordered by grasses that are surrounded by oak woodland and understory habitat. Several Monterey spineflower populations were also observed thriving within dense patches of non-native grasses in the same vicinity.

1.2 OVERVIEW OF OU-1 REMEDIATION ACTIVITIES WITHIN THE FONR

Numerous wells and soil borings were constructed within the FONR as part of the investigative effort to define the extent of environmental contamination and remediate contamination. Table

1.1 lists the wells that have been installed within the OU-1 portion of the FONR. Table 1.2 lists the soil borings that were drilled within the FONR portion of OU-1 between 2004 and 2011 without constructing a well. Table 1.2 also lists the wells that were destroyed during that period. Figure 1.3 illustrates the OU-1 well and soil boring locations. No new wells or soil borings have been constructed by HGL within the FONR since 2006. In September 2011, 54 wells were destroyed within the FONR. Figure 1.4 illustrates the layout and components of the OU-1 groundwater remediation system within the FONR as of December 31, 2011.

Note that typical well identification formats—"MW-" prefix for monitoring wells, "EW-" prefix for extraction wells, and "IW-" prefix for injection wells—do not correspond to well function in all cases. The boundaries of the contaminated groundwater zone in OU 1 were refined as the remedial design progressed. The pilot test of system performance and other field tests provided data describing potential pumping rates for several wells. These data were used during design of the FONR component. The formulation and evaluation of design alternatives showed that the most effective OU 1 remedy required that some wells be used for different purposes than originally intended. Consequently, some wells that were intended and named as monitoring wells (MW-OU1-46-AD, MW-OU1-85-A, and MW-OU1-87-A) became extraction wells. Conversely, numerous wells with the EW- prefix have been used only for monitoring groundwater quality. Only the following EW- prefix wells have been used for groundwater extraction:

EW-OU1-60-A	EW-OU1-63-A	EW-OU1-71-A
EW-OU1-62-A	EW-OU1-66-A	

Several wells were named as potential injection well sites but only two (IW-OU1-73-A and IW-OU1-74-A) were connected to the NWTS for this purpose. The rest of the "IW-" prefix wells have been used only for monitoring groundwater quality, with one exception: well IW-OU1-10-A was converted to an extraction well in October 2010.

1.3 SUMMARY OF SITE ACTIVITIES

In 1987, about 4,000 cubic yards of contaminated soils were excavated and replaced with clean fill. The OU-1 ROD (U.S. Army, 1995) indicated that remediation of the contaminated soils at the FDA was complete; the ROD also defined groundwater extraction and treatment as the selected remedial action for OU-1 groundwater. A GWETS was constructed in 1988 to remediate TCE and other related groundwater contaminants. The 1988 GWETS consisted of extraction wells EW-OU1-17-A and EW-OU1-18-A and was located a short distance downgradient (north) of the FDA. Extracted groundwater was piped to a treatment building located at the former FDA, where it was treated through granular activated carbon vessels. The treated effluent was spray-irrigated in the southern portion of the FDA.

Despite a steady overall decline in contaminant levels within the groundwater capture zone of the 1988 GWETS, COCs were subsequently detected at concentrations above ACLs in groundwater downgradient from the capture zone. Additional wells installed between 1997 and 2001 (MW-OU1-21-A through MW-OU1-46-A) revealed that TCE exceeded the ACL as far as 2,100 feet downgradient from the existing capture zone. Groundwater modeling showed that contaminated groundwater north and west of extraction well EW-OU1-17A was not captured by the extraction system (AHTNA, 2003).

The HGL remediation contract was awarded in December 2003. A draft design to expand the original GWETS was presented in the *Draft Remedial System Modification Plan* (HGL, 2004a). New wells were installed and aquifer testing began in 2004 and continued through 2007. The draft GWETS expansion design was adjusted as data from the newly installed wells and aquifer testing were processed; the final design was issued in the three-volume Final Engineering Design Report in 2006 (HGL, 2006a; 2006b; and 2006c).

Construction of the first component of the GWETS expansion, the *Hydraulic Control Pilot Project* (HGL, 2006d), was initiated and completed in 2006. Four additional extraction wells (the FONR system) were constructed from July through September 2007 to further expand the GWETS. These construction activities are described in detail in the *Final Hydraulic Control Pilot Project Construction Report* (HGL, 2007b) and the *Draft FONR System Construction Report* (HGL, 2008a). Additional details concerning the GWETS expansion and a summary of OU-1 site activities conducted during 2007 relating to habitat monitoring and impacts were provided in the *2007 FONR Impact Assessment and Habitat and Rare Plant Survey Results* (HGL, 2008).

Activities conducted by HGL during 2010 within the FONR habitat area included sampling activities and constructing an underground pipeline and underground power line to connect IW-OU1-10-A to the terminus of the existing remediation system (at extraction well MW-OU1-87-A). The underground piping was laid within the existing roadway to minimize environmental impacts to the surrounding habitat. Converting IW-OU1-10-A to an extraction well will accelerate the overall groundwater cleanup. The design parameters for this expansion are described in the Remediation System Expansion Design Technical Memorandum (HGL, 2010). The 2010 construction activities and associated environmental monitoring are described in the *Draft IW-OU1-10-A System Expansion Construction Report* (HGL, 2011b).

HGL conducted the following activities during 2011 within the FONR habitat area:

- Collected performance monitoring samples from the northwest treatment system (NWTS; samples taken from eight extraction wells and the treatment plant),
- Collected samples from the wells comprising the OU-1 groundwater long-term monitoring (LTM) network,
- Performed the 2011 rare plant survey, and
- Destroyed 55 monitoring wells (54 of which are located within the FONR).

Only light-duty vehicles (pick-up trucks or sedans) were used for sampling activities, and travel routes were limited to established roadways. Light-duty vehicles, a trailer to haul equipment, and a drilling rig were used during well destruction activity. All vehicles traveled only on existing roadways to the well sites.

In addition to the HGL activities listed above, UCSC performed weed control activities in selected areas (see Appendix B). Descriptions of the 2011 activities and the 2011 rare plant survey are presented in the following sections.

1.3.1 2011 Rare Plant and Habitat Surveys

Surveys for sand gilia and Monterey spineflower were conducted by DD&A on April 28 and 29, 2011. The timing of the survey was intended to correspond with the peak blooming period (late April to early May) and was determined through communications with UCSC natural resource staff and by observing Monterey spineflower and sand gilia populations in the reference area near the FONR. The 2011 rare plant survey covered three areas:

- The reference area near the intersection of Reservation Road and Imjin Parkway,
- The roadway and access route leading to well IW-OU1-10-A where construction occurred during 2010, and
- Those well sites within the FONR habitat area where the well was scheduled to be destroyed in September 2011.

An overview of the biological survey results is presented in Section 2.0 of this report and a detailed description is included in Appendix A.

1.3.2 2011 Sampling Activities

No drilling, construction, or aquifer testing activity was conducted by HGL within OU-1 during 2011. Groundwater samples were collected during 2011 from many of the existing wells within the FONR as part of the OU-1 groundwater LTM program. As the remediation effort progresses, the number of wells included in the LTM network decreases and the monitoring frequency is reduced at others. In the past, wells included in the LTM network were typically sampled on a quarterly, semiannual, or annual basis. The quarterly sampling usually occurred in March, June, September, and December of each year. In 2009 the LTM sampling program was modified; samples from individual wells are now collected only on a semiannual or annual basis. Performance monitoring samples originally were collected at the NWTS on a bimonthly basis, but in 2010 the sampling frequency was decreased to quarterly.

In 2011, LTM samples were collected in March and September, and NWTS performance samples were collected from the treatment system and operating extraction wells in March, June, September, and December. Table 1.3 summarizes the 2011 LTM and NWTS sampling events conducted at each of the OU-1 wells. At some wells only water level measurements are taken.

Previous results from the groundwater quality monitoring program showed that cleanup targets within the capture zone of the original GWETS extraction wells (Figure 1.4) were achieved during 2005. Groundwater pumping and treatment from the existing GWETS area was suspended in February 2006 as part of the rebound evaluation. A rebound evaluation to assess if the improved groundwater quality could be sustained without additional remediation was completed during 2007. The *Draft Rebound Evaluation Report* (HGL, 2007c) was submitted for regulatory review and it was agreed that the groundwater sampling frequency in this region can be greatly reduced. Sampling from selected groundwater monitoring wells in this region will continue for some wells, though at a reduced frequency.

Groundwater elevations are measured quarterly at most wells within the OU-1 LTM network and are taken either concurrently with or within a few days of sample collection. Groundwater measurements collected from wells that are no longer sampled are also listed in Table 1.3.

1.3.3 2011 Well Destruction Activities

During September of 2011, HGL destroyed 54 wells within the FONR; this effort is described in the *Draft Well Destruction Report* (HGL, 2011c). DD&A provided environmental field support for the destruction activity. All well destruction activities were conducted with an emphasis on minimizing impact to the existing habitat. Recommendations and requirements from DD&A and UCSC staff provided a baseline for well destruction activities at FONR OU-1 and were followed by all personnel. The well destruction methods and field procedures employed to minimize habitat impact are described in the *Recommended Well Destruction Technical Memorandum* (HGL, 2011d).

1.4 IMPACT PREVENTION AND MITIGATION MEASURES

Activities conducted within the FONR are limited to those that are essential to achieving the remediation goals for the project. The remedial design and construction as well as the ongoing operation of the remedial system have been and will continue to be consistent with the various biological opinions and guidance regarding mitigation measures to reduce and avoid impacts to RTE species of concern on the project site. Guidance for the remedial design and action(s) includes the following:

- The March 30, 1999, *Biological and Conference Opinion on the Closure and Reuse of Fort Ord, Monterey County, California (1-8-99-F/C-39R) and supporting documentation, such as Enclosure 2 to the request for consultation* (Harding Lawson Associates, 1998)
- The October 22, 2002, *Biological Opinion on the Closure and Reuse of Fort Ord, Monterey County, California, as it affects Monterey spineflower Critical Habitat*, (USFWS, 2002)
- The March 14, 2005, *Biological Opinion on the Cleanup and Reuse of Former Fort Ord, Monterey County, California, as it affects California Tiger Salamander and Critical Habitat for Contra Costa Goldfields* (USFWS, 2005)
- The June 1, 2007, *Amendment to Biological Opinion 1-8-04-F-25R, Cleanup and Reuse of Former Fort Ord, Monterey County, California, as it affects California Tiger Salamander and Critical Habitat for Contra Costa Goldfields* (USFWS, 2007)
- Guidance and direction from UCNRS staff
- *Installation-Wide Multispecies Habitat Management Plan* (U.S. Army, 1997)

To avoid or minimize impact to the FONR during ecologically sensitive periods (defined as the rainy season, typically ranging between November and April), construction is sequenced to avoid this time frame as possible within the overall project constraints. The final FONR system construction, for example, began in July 2007 and was completed in September 2007 before the seasonal rains began. Likewise, the well destruction activities were performed in September and completed before the rainy season began.

In addition to compliance with the above guidance, beginning in 2007 HGL subcontracted with UCSC to implement manual and mechanical weed control measures at selected locations within the OU-1 portion of the FONR. The weed control program has been implemented by UCSC through 2011 using annual contract renewals. UCSC staff began weed control treatments on April 19, 2011, and continued through July 19, 2011. Each area included in the weed control program received between one and three treatments (using a weed-eater and hand pulling) depending on site-specific phenology, observed response to past treatments, and species composition. UCSC staff also surveyed well sites to identify the composition of the plant population in the immediate vicinity of the wells. UCSC prepared a report that describes and summarizes their efforts regarding weed control and plant surveys—the report describing the 2011 weed control program is included as Appendix B.

The objectives of the weed control activities are:

- Cut down or remove undesirable vegetation from areas disturbed by past OU-1 construction activities—particularly those completed during 2004 through 2006—before such vegetation released seeds into the environment.
- Prevent or reduce the expansion of non-native plants into areas disturbed by construction related to OU-1 activities.
- Prevent the occurrence of unacceptable impacts to the Monterey spineflower and sand gilia populations within that portion of the FONR affected by OU-1 remediation activities.

Figure 1.5 illustrates the locations where weed control measures were performed. Weed control consisted of cutting the weeds using manual methods (hand pulling, clipping) and mechanical (such as powered string trimmers or similar, easily portable equipment) during 2011 (see Appendix B). Herbicides or similar poisons have not been used as part of this effort in any year. Disposal of cut weeds was dependent on both the plant species and the timing of the weed cutting episode. Cut weeds were left on the ground if there was no danger that the seeds would germinate and sprout after cutting; otherwise, the cut weeds were bagged and removed from the site for proper disposal. The species subject to weed control included plant species that are listed as a noxious weed by the California Department of Food and Agriculture, included on invasive plant lists maintained by the California Invasive Plant Council, or considered to be a problematic species by the UCSC FONR natural resource staff.

1.5 FUTURE ACTIVITIES

Based on the cleanup progress to date, HGL recommended to the regulatory agencies that the groundwater pumping and sampling efforts in 2012 be reduced at the interior portion of the OU-1 FONR area. Pumping and sampling along the northwest boundary will continue at the same rate and schedule. If the proposed recommendation for decreased pumping and sampling in the interior portion of the OU-1 FONR area is accepted and implemented, the number of site visits and vehicle miles traveled on FONR roads will be reduced, thereby reducing the potential impact to the FONR habitat.

Currently planned and potential activities for 2012 include the following:

- Cease pumping from OU-1 extraction wells within the interior portion of the FONR and continue pumping only from selected extraction wells on the northwest FONR boundary.
- Reduce the number of wells included in the semiannual groundwater LTM program.
- Reduce frequency of performance monitoring at the NWTS and extraction wells from quarterly to semiannual.
- Continue weed control measures by UCSC staff.
- Continue rare plant monitoring in the areas affected by the 2010 construction efforts associated with IW-OU1-10-A that are not bordered by grassland.
- Begin rare plant monitoring within sensitive habitat areas where wells were destroyed in 2011.
- If evaluations show it is cost-effective, construct groundwater injection and monitoring wells in the area around MW-OU1-61-A (approximately one-half acre would be affected). After the wells are installed, injection and monitoring activities would be performed.

The effectiveness of implementing additional remediation measures around well MW-OU1-61-A on the northwest boundary is being evaluated. Depending on the results of this evaluation, it is possible that additional borings and wells would be installed in this area. The new wells would be used as injection and monitoring points to accelerate groundwater cleanup in this region. The additional work would proceed within an area of approximately one acre including both grassland and habitat where Monterey spineflower has been found frequently in past surveys. Figure 1.6 shows the potential project location. If injection wells are installed, it will be necessary to clear some vegetation to provide access to drilling sites. HGL and UCSC staff jointly inspected the potential project site to identify issues and discuss measures to mitigate impacts. If this project goes forward, HGL will continue coordinating with UCSC to plan and implement the necessary work with as little impact as possible.

Except for the potential remediation effort around well MW-OU1-61-A, no new wells within OU-1 at FONR are planned at this time. To date, sampling has been suspended at 62 monitoring wells at OU-1. Suspension of sampling will be proposed for an additional 16 wells during 2012. If the proposed sampling schedule is accepted by the regulators, the 2012 LTM and performance monitoring will comprise 17 existing wells sampled either semiannually (14 wells) or annually (3 wells). More frequent sampling (at least quarterly) will be performed at any new wells installed near MW-OU1-61-A. Groundwater levels will be measured at 44 wells on a semiannual basis.

After the ACLs established in the ROD have been attained and verified, the monitoring wells and treatment facilities will be abandoned. The timetable for this milestone is not yet established.

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2.0 OVERVIEW OF 2011 RARE PLANT SURVEY RESULTS

The objectives of the 2011 rare plant survey and habitat inventory were to:

1) identify locations and estimate rare plant populations at an identified reference site and at each site where well destruction or construction for the remediation system took place since 2010, and
2) map Monterey spineflower and sand gilia populations for comparison to past surveys and to facilitate planning if future construction or maintenance activities are needed.

The reference site encompasses approximately one-half acre located approximately 3,000 feet southeast of the former OU-1 source area. This site has been used by DD&A biologists for several years to identify the peak of the blooming period for Monterey spineflower and sand gilia. Initiation of rare plant surveys at former Fort Ord and other locations has been based in part on observations of plants within the reference area to ensure that such surveys are conducted at appropriate times.

Coast live oak woodland is the dominant habitat in the reference area. Grassland and coast live oak woodland is adjacent to the reference site on the northwestern boundary. All other sides of the reference area are bordered by developed roads (Reservation Road, Mbest Drive, and University Drive). Non-native grasses and weedy forbs are already present throughout much of the reference area.

The rare plant survey was conducted at the reference site, along the IW-OU1-10-A pipeline route, and at 35 well sites within OU-1. This section presents a summary of the key findings from those surveys. The complete survey report is presented in Appendix A.

Surveys for sand gilia and Monterey spineflower were conducted on April 28 and 29, 2011, by a DD&A biologist and a DD&A technician using a global positioning system (GPS). The survey was timed to coincide with the peak blooming period insofar as possible. The peak blooming period was determined through communications with UCSC FONR natural resource management staff and by observing a known occurrence of sand gilia at the reference site near the FONR.

Each of the rare plant surveys was conducted along existing or proposed roadways and access routes. In the absence of rare plants, the width of the survey area was approximately 10 feet beyond the edge of the roadway on either side. If a rare plant was identified, the survey in that area was extended to the boundary of the population encountered.

2.1 RARE PLANT SURVEY METHODS

Large areas of Monterey spineflower and sand gilia were mapped as polygons, using a Trimble Pathfinder ProXH GPS unit. Smaller plant groups and individuals were mapped as points with attributes to identify the number of individuals at each location. When a rare plant was identified, the survey in that area was extended to the boundary of the population encountered.

Individual counts were made for all sand gilia populations whether they were mapped as points (population less than 10) or polygons (population greater than 10). The polygon boundary was drawn to include all plants identified as a distinct population. However, Monterey spineflower were only counted as individuals when groups of less than five were mapped. For larger populations Monterey spineflower were mapped as polygons and characterized according to the percent of cover—the percentage of the polygon covered by the Monterey spineflower divided by the total area enclosed within the polygon. The cover classes are defined as follows:

- Very Sparse (corresponding to an absolute cover of less than 3 percent),
- Sparse (3 to 25 percent),
- Medium Low (26 to 50 percent),
- Medium (51 to 76 percent),
- Medium High (76 to 97 percent), and
- Very High (greater than 97 percent).

GPS data were exported to shapefile format for use in a geographic information system (GIS) (ESRI ArcGIS) and mapped on high-resolution aerial photography. These maps are presented in Appendix A (Figures A3.1, A3.2, and A3.3).

2.2 SAND GILIA SURVEY RESULTS

Sand gilia was observed and mapped at the DD&A reference site and at 11 of the 35 well sites. A total of 65 populations (52 points and 13 polygons) of sand gilia were mapped within the 2011survey area (see Appendix A Table A3.1 and Figures A3.1, A3.2, and A3.3). A total of 1,580 individual plants were mapped at the 65 populations.

2.3 MONTEREY SPINEFLOWER SURVEY RESULTS

A total of 46 populations (12 points and 34 polygons) of Monterey spineflower were mapped at the reference site and at 28 of the 35 well sites within the FONR (Table A3.2 and Figures A3.1, A3.2 and A3.3 in Appendix A). Because Monterey spineflower population size estimates are not as easily quantified as the sand gilia populations, individual Monterey spineflower plants were not counted within the GIS polygons. Populations of Monterey spineflower were estimated as a percentage of the overall ground cover using visual estimation. Of the 34 populations of Monterey spineflower that were mapped as polygons, one population had a Medium High cover class (76 to 97 percent cover), one population had a Medium cover class (51 to 76 percent cover), and five populations had a Medium Low cover class (26 to 50 percent). The remaining 27 populations had a Sparse cover class (3 to 25 percent).

3.0 IMPACT ASSESSMENT

Data collected during the 2011 rare plant survey were evaluated in conjunction with other observations to identify impacts to the FONR habitat resulting from OU-1 activities. This annual impact assessment represents current conditions only and will be considered along with future data in the overall impact assessment to be conducted upon completion of the OU-1 remedial action. As noted earlier, the 2011 rare plant survey area overlapped the previous surveys only at those wells that were destroyed later in 2011. Most of these wells were installed before the year 2000 and were not disturbed during the construction efforts completed from 2004 through 2010. Rare plant surveys have not been conducted since 2007 at the locations surveyed in 2011. Consequently, the discussion in this section is limited to comparisons of the reference plot surveys of 2010 and 2011 and to a brief overview of the 2011 results at the well locations. The comparison to the entire dataset is presented in Section 4.

The footprint of a completed monitoring well is approximately 4 feet by 4 feet. Much of the footprint is concrete. During well construction the area potentially disturbed by the drill rig, support vehicles and material stockpile is approximately 30 feet in diameter, centered on the well borehole. Discussions comparing survey results in this report assume that a plant population or polygon is attributed to a given well site if any part of the population or polygon is within the potentially disturbed area.

3.1 SAND GILIA

Within the FONR area surveyed, sand gilia populations were observed in more locations than Monterey spineflower populations for the first time since OU-1 specific rare plant surveys were initiated in 2004. The increased number of sand gilia populations in the 2011 survey is attributed to the larger survey area as compared to 2007 and to presumably better environmental conditions (precipitation, temperature and other factors) than were present in 2007. Precipitation, for example, differed significantly. In 2007, 7.9 inches of precipitation was measured at the adjacent Marina Airport during the period (October 2006 through March 2007) that preceded the spring survey. This was the lowest total for any October through March period before the 2004 through 2011 OU-1 rare plant surveys conducted by HGL or the 1998 survey performed by UCSC. The average precipitation during this period for these survey years was 14.7 inches. In contrast, 17.3 inches of rain was measured from October 2010 through March 2011. Because of the significant differences in rainfall and in the respective survey areas between the 2007 and 2011 efforts it is not possible to make direct comparisons of sand gilia populations.

In 2010, 14 populations of sand gilia (7 polygons and 7 points) were mapped within the DD&A reference area. A total of 1,086 individual plants were mapped at the 14 populations. In 2011, 16 populations of sand gilia (12 polygons and 4 points) were mapped within the reference area. A total of 318 individual plants were mapped at the 16 populations. Table 3.1 summarizes the results for years 2010 and 2011. The sand gilia polygons covered approximately 1,714.7 ft^2 in 2010 and approximately 1,409.5 square feet (ft^2) in 2011, a difference of 338.2 ft^2. The most significant change in sand gilia cover was located on the southeastern end of the reference area (see Figure A3.1 in Appendix A). This area is an open hillside with less protective cover (coast live oak and chaparral habitat) when compared to the rest of the reference area. Disturbance from wind and water erosion may account for the loss of sand gilia cover from 2010 to 2011.

The October through March rainfall preceding each survey was similar (16.9 inches in 2010 versus 17.3 inches in 2011). With only two survey years to compare it is difficult to make any definitive statements about the sand gilia population at this reference area. However, the fluctuations in sand gilia population in an area not subject to human disturbance with similar precipitation illustrates the natural variations that are possible in this population.

3.2 MONTEREY SPINEFLOWER

Previous rare plant surveys conducted by DD&A indicate that populations of Monterey spineflower were often observed in areas with sparse to moderately abundant non-native annual grass cover, suggesting that this species may be somewhat more tolerant of annual grass cover than sand gilia. As noted earlier, the significant differences in antecedent rainfall and in the respective survey areas between the 2007 and 2011 efforts preclude direct comparisons between the survey results.

A total of two populations (two polygons: one Medium Low and one Sparse) of Monterey spineflower were mapped at the reference site in 2010. One Monterey spineflower polygon (Sparse) was mapped within the reference area in 2011. Table 3.1 summarizes the results for the two years. The Monterey spineflower polygons covered approximately 2846.1 ft^2 in 2010 and approximately 2865.4 ft^2 in 2011, a difference of 19.3 $ft^{2.}$ Although the total area covered by Monterey spineflower is nearly identical from 2010 to 2011 (differing by less than one percent), the polygon located at the southeast corner of the reference area was a lower cover class than the rest of the site (Sparse compared to Medium Low). This is the same open hillside with less protective cover where the decline in sand gilia populations was observed. The fact that the Monterey spineflower cover class also decreased supports the hypothesis that the lack of protective cover (coast live oak and chaparral habitat) negatively affected both rare plant populations. Again, with only two years to compare it is difficult to make any definitive statements in regard to the rare plant populations at this reference site. The survey results, however, indicate that Monterey spineflower populations do not seem as equally affected by the same environmental factors as sand gilia.

3.3 EROSION

HGL staff conducted visual reconnaissance surveys to detect erosion resulting from construction activity along the roadways used to access the construction areas and the monitoring well network. These erosion surveys are conducted routinely during the quarterly groundwater monitoring events and on occasion during routine system maintenance. Erosion was observed on the FONR roadways during 2011 (see Figure 3.1) in some of the areas where construction occurred in 2010 and where the drill rig and support vehicles traveled during the 2011 well destruction effort. The affected roadways will be repaired in 2012 after discussions with UCSC to determine scheduling and when weather conditions are appropriate.

4.0 CONCLUSIONS

Construction efforts were undertaken by HGL during the 2004 through 2011 time period to remediate contaminated groundwater within the OU-1 portion of the FONR. Construction included:

- Drilling soil borings;
- Constructing extraction, injection, and monitoring wells;
- Installing water conveyance pipelines;
- Installing infiltration trenches;
- Constructing a groundwater treatment facility;
- Converting IW-OU1-10-A from a monitoring well to an extraction well; and
- Destroying 54 wells within the FONR.

Figure 4.1 illustrates the areas in which construction occurred during 2004 through 2011. The locations of wells destroyed in 2011 are shown on Figure 4.2.

A critical concern throughout the project has been the protection of the rare plant species within the FONR. To that end, direct impacts of construction activities within the footprint of known populations of Monterey spineflower or sand gilia were minimized through use of pre-construction surveys to delineate population locations. The results of the surveys were used to adjust the location of remediation facilities to avoid previously identified rare plant locations wherever possible. As discussed below, this strategy enabled the construction activity to avoid overlapping known rare plant populations except in a few cases as described in Section 4.1.1.

UCSC staff responsible for the management of the FONR expressed a significant concern that construction activities would cause indirect impacts to the rare plant species through alteration of the habitat in the work areas. They were concerned that the practice of clearing existing native vegetation to enable equipment access for well or pipeline construction may have provided a pathway for non-native, invasive plant species from the surrounding areas to encroach farther into the FONR. The UCSC concern is that such encroachment may result in declining rare plant populations as the non-native newcomers out-compete the existing plants and come to dominate the overall species distribution. To address this concern, HGL has conducted annual rare plant surveys from 2004 through 2011 (through subcontractors) and conducted habitat surveys in 2006 and 2007. The data gathered through these efforts and evaluated annually has not shown significant impact to rare plant populations.

In addition, HGL has contributed funding to support manual and mechanical weed control efforts by UCSC from 2007 through 2011. The most recent effort is described in detail in Appendix B. UCSC is confident that the weed abatement efforts are having a positive impact on reducing weed populations on the OU-1 cleanup sites and, very importantly, have removed a large portion of the invasive weed seed source for the 2012 growing season.

Table 4.1 summarizes the rare plant populations observed at the well sites for those wells constructed during 2004 through 2008 and Table 4.2 summarizes the rare plant populations observed at the well sites for those wells constructed before 2004. To date, the survey results

show that the impact-minimization and abatement efforts and proactive construction management techniques employed throughout the construction effort to mitigate impacts have been successful in minimizing the impact to rare plant populations. The data from Tables 4.1 and 4.2 are discussed in detail below.

4.1 OPERABLE UNIT 1 IMPACTS ON MONTEREY SPINEFLOWER

4.1.1 Wells Constructed in 2004 Through 2006

Forty-five new OU-1 wells were constructed within the FONR between 2004 and 2006. Previously existing Monterey spineflower populations were identified at only 12 of these locations (see Table 4.1). For the purpose of discussing survey results, the two new wells MW-OU1-46-AD and PZ-OU1-46-AD2 are counted as a single location because they are within 30 feet of each other. At 8 of the 12 locations where previously existing Monterey spineflower populations were identified, the wells were constructed along the roadways bordering the adjacent grasslands to the north and east. The habitat/rare plant populations in these areas are considered of marginal value (HGL, 2006b). HGL discussed the proposed well locations with UCSC management staff before construction began to confirm that the potential disruption of these plant populations was an acceptable approach and would not present a significant impact. These eight well locations were:

EW-OU1-49-A	PZ-OU1-49-A1	MW-OU1-56-A	MW-OU1-57-A
EW-OU1-60-A	MW-OU1-61-A	MW-OU1-65-A	EW-OU1-66-A

Only wells EW-OU1-49-A and PZ-OU1-49-A1 were surveyed in 2004. Plant surveys had not been completed at these eight well sites since 2007, except at EW-OU1-60A and MW-OU1-61-A, which were surveyed in 2008. Annual rare plant surveys at these wells were stopped because three years of monitoring had been completed and the results showed no discernible impact on rare plant populations. Monterey spineflower was not detected at these locations during the pre-construction survey conducted in 2004, or during the surveys completed in 2005, 2006, and 2007. Consequently, it is not possible to conclude that the absence of these marginal populations since their detection in 1998 is the result of the construction activity. Natural variables, including precipitation factors, may be responsible for the lack of detected populations in recent years. During the October through March period, for example, total precipitation was as follows:

Year	**October – March Rainfall (inches)**
1998	22.36
2004	10.32
2005	21.73
2006	14.18
2007	7.88
2008	9.71
2009	11.89
2010	16.85
2011	17.29
Average	**14.69**

In any case, these populations are of marginal value given that they are present within the edge of the grassland habitat.

The remaining four wells with a construction footprint that overlapped the population boundary are discussed below.

- MW-OU1-46-AD and PZ-OU1-46-AD2. Well MW-OU1-46-AD was constructed in 2004 and PZ-OU1-46-AD2 was constructed in 2005. These wells have not been surveyed since 2009. As before, annual rare plant surveys at these wells were stopped because three years of monitoring had been completed and the results showed no discernible impact on rare plant populations. Because these wells are located within 15 feet of each other they are considered as a single location when evaluating rare plant survey results. These wells were located within the boundary of a narrow, north-south oriented Monterey spineflower population identified in 1998 (Figure 4.3). Monterey spineflower was not observed at the well site during the 2004 pre-construction survey, or during the surveys completed in 2005, 2006, or 2007. The 2006 survey did show the presence of a Very Sparse Monterey spineflower population (#70 in the 2006 survey [HGL, 2007a]) that extended approximately 200 feet along the access road to these wells and terminated approximately 30 feet to the east of the well sites. Given the scale of the 1998 maps available for comparison, it is possible that one or both of the wells are located outside the plant population boundary observed in 1998. In 2008, however, this population boundary shifted to the west and overlapped the MW-OU1-46-AD well site and a single plant was observed at PZ-OU1-46-AD2. In addition, the population density in 2008 improved to Sparse population density. In 2009, this population area slightly retreated from MW-OU1-46-AD but increased to Medium population density. These occurrences, in both wet (2006) and dry (2008) spring rainfall patterns, support the assertion that there have not been any significant negative impacts to the rare plant population at this location. These well locations were not surveyed in 2011.
- EW-OU1-53-A and IW-OU1-01-A. Neither of these wells was surveyed after 2007 because both were constructed in 2004 and the three-year survey window ended in 2007. No rare plant impacts were detected during the 2005 through 2007 surveys. In both cases, the results of the rare plant surveys from 2004 through 2007 were the same. Monterey spineflower was detected in 1998 but not in 2004. Although absent in 2005, Monterey spineflower was present in both locations in the 2006 and 2007 surveys. The 2004 through 2007 data suggest that the well construction activity did not significantly impact the rare plant population. Well IW-OU1-01-A was destroyed in September 2011. Consequently, it was surveyed in April 2011. The well site was within an extensive Monterey spineflower population polygon with Medium Low population density (see Figure A3.2 in Appendix A). The 2006 and 2007 polygons were categorized as Sparse density. The 2011 survey results reinforce the conclusion that the well construction activity did not significantly impact the rare plant population.

Monterey spineflower was identified in one or more post-construction surveys between 2005 and 2007 at five well locations, although that species was not detected in either the 1998 or 2004 surveys: EW-OU1-54-A, IW-OU1-05-A, IW-OU1-24-A, MW-OU1-59-A, and IW-OU1-74-A. Three of these wells (EW-OU1-54-A, IW-OU1-05-A, and IW-OU1-24-A) were destroyed in 2011 and were therefore included in the April 2011 survey area. Monterey spineflower was again

present at each site. In addition, the population densities at IW-OU1-05-A and IW-OU1-24-A improved to Sparse in 2011 as compared to the Very Sparse classification in 2007. The 2011 survey showed two additional well sites besides those listed above where Monterey spineflower was detected but was absent in both the 1998 and 2004 surveys—EW-OU1-55-A and IW-OU1-25-A. The overall results at these seven sites suggest a possible temporary or long-term beneficial impact of ground disturbance associated with construction activity relative to the Monterey spineflower population.

4.1.2 Wells Constructed Before 2004 and Destroyed in 2011

Thirty-one wells or piezometers located in the southern portion of the FONR and constructed during 2003 or earlier were destroyed in September 2011. Each of these locations was surveyed in 2011 (see Table 4.2 for detailed results). The overall results were as follows:

- At 6 locations Monterey spineflower was not detected in any survey. Three of these locations were within the footprint of the former FDA. The native soils in the FDA were removed as part of the soil remediation in 1987 and replaced with clean soil from an off-site source.
- At 2 locations Monterey spineflower was identified in one or both of the pre-construction surveys (1998 and 2004) but was not detected in the 2011 survey. Note that well EW-OU1-18-A and associated piezometer PZ-OU1-16-A are counted as one well in this case because they are within 30 feet of each other.
- At 12 locations Monterey spineflower was detected in one or both of the pre-construction surveys and also detected in the 2011 survey. Note that well EW-OU1-17-A and piezometers PZ-OU1-13-A and PZ-OU1-14-A are counted as one well in this case because they are very close to one another.
- At 7 locations Monterey spineflower was not detected in either of the pre-construction surveys but was detected in the 2011 survey. Co-located wells MW-OU1-32-A and MW-OU1-33-A are counted as one occurrence.

At 13 of the 14 locations where Monterey spineflower was detected in any previous survey, the 2011 populations confirmed the pre-construction results in that Monterey spineflower was again present. New Monterey spineflower populations were detected at 6 locations where no populations were detected in any previous surveys.

These results are consistent with those discussed in the preceding section and reinforce the conclusion that the OU-1 well construction activity did not significantly impact the Monterey spineflower population.

4.1.3 Reference Area Results

The total area covered by Monterey spineflower was nearly identical from 2010 to 2011 in the reference area. However, the polygon located at the southeast corner of the reference area was a lower density class than the rest of the site (Sparse compared to Medium Low). Continued monitoring of the reference area is needed to make definitive statements in regard to the rare plant populations.

4.2 OPERABLE UNIT 1 IMPACTS ON SAND GILIA

4.2.1 Wells Constructed in 2004 through 2006

Sand gilia was only detected during the 1998 or 2004 rare plant surveys at one of the well sites, IW-OU1-25-A constructed in 2004 or later (see Table 4.1). In the absence of multiple previously known populations, it is concluded that the construction activity did not adversely affect the sand gilia population. Further support for this conclusion is found in the 2006 survey results at well MW-OU1-59-A constructed in 2004. Although absent in previous surveys, the 2006 survey team encountered a population of 13 sand gilia plants surrounding the well site. The decrease in spring rainfall in 2007 (less than 25 percent of that which occurred in 2006 and approximately one-half of the average observed during the rare plant surveys listed in Table 4.1) may have negatively impacted sand gilia in the final survey at this location in 2007. This area was not surveyed in 2008 or 2009 because three years had passed since the well was constructed and no impacts on sand gilia populations were detected.

Six wells constructed during the 2004 through 2006 period were destroyed in late 2011 and were therefore included in the 2011 pre-destruction rare plant survey (see Table 4.1). Two sand gilia populations (total 11 plants) were detected across the roadway to the north of well EW-OU1-54-A. Sand gilia was not detected at any other well location.

4.2.2 Wells Constructed before 2004 and Destroyed in 2011

As noted in Section 4.1.2, each well slated for destruction in September 2011 was surveyed in 2011 (see Table 4.2 for detailed results). The overall results were:

- At 12 locations sand gilia was not detected in any survey. Note that wells EW-OU1-17-A and PZ-OU1-13-A are counted as one location in this case, as are co-located wells MW-OU1-32-A and MW-OU1-33-A.
- At 5 locations sand gilia was identified in one or both of the pre-construction surveys (1998 and 2004) but was not detected in the 2011 survey. Note that well EW-OU1-17-A and associated wells PZ-OU1-14-A and PZ-OU1-15-A are not included in this case because they are very close to each other and sand gilia was found at PZ-OU1-15-A in 2011.
- At 5 locations sand gilia was detected in one or both of the pre-construction surveys and also was detected in the 2011 survey. Note that wells EW-OU1-18-A, PZ-OU1-15-A and PZ-OU1-16-A are counted as one well in this case because they are very close to each other.
- At 3 locations sand gilia was not detected in either of the pre-construction surveys but was detected in the 2011 survey.

The comparison of 2011 results to previous results for sand gilia is more mixed than for Monterey spineflower. In general, sand gilia populations in OU-1 have been more variable and more sensitive to environmental conditions than Monterey spineflower throughout the OU-1 survey period. The 2011 results showed six locations (again counting EW-OU1-17-A and PZ-OU1-14-A as one location) where sand gilia was previously detected but absent in 2011 versus 3

locations (MW-OU1-09-A, MW-OU1-11-SVA, and MW-OU1-39-A) where the reverse is true. The fewer number of sand gilia populations in 2011 relative to the pre-construction surveys could be influenced by a variety of factors, as noted below. (Note: The location counts consider EW-OU1-17-A, PZ-OU1-13-A and PZ-OU1-14-A as one location; and EW-OU1-18-A, PZ-OU1-15-A and PZ-OU1-16-A as one location).

- At 5 locations sand gilia was detected in 1998 and the site was included in the 2004 survey. Sand gilia was not detected in 2004 at four of these sites. Sand gilia was found in both years only at the EW-OU1-18-A well group. Conversely, at two locations sand gilia was detected in 2004 but not in 1998. This illustrates the natural variability associated with this species even in the absence of significant human activity.
- Five of the six wells in the category where sand gilia was detected in 1998 or 2004 but not in 2011 were constructed before 1988. Thus, it is impossible to determine the construction impact with certainty.
- Precipitation during the 1998 rainy season was 8.2 inches above the average during the subsequent OU-1 surveys and may represent a biased basis for comparison.

Overall, the sand gilia comparisons are not as definitive as the Monterey spineflower data. However, in considering the variability of the sand gilia populations and the timing of the surveys relative to the well construction dates for the surveyed wells the following conclusions are derived:

- Sand gilia was not detected in any pre-construction survey for wells constructed during 2004 or later, but has been detected at two of these well locations since construction was completed: EW-OU1-54-A in 2011 and MW-OU1-59-A in 2006.
- At one well only (MW-OU1-44-A, constructed in 2000) sand gilia was detected in the 1998 pre-construction survey but not in subsequent surveys. However, this well was surveyed only in 1998 and 2011 so it is not possible to reach a definitive conclusion with only two surveys.
- Sand gilia has been detected at least once at 11 well locations constructed before the initial 1998 OU-1 rare plant survey.

The 2011 survey results therefore support the conclusion that the OU-1 well construction activity did not significantly impact the OU-1 sand gilia population.

4.2.3 Reference Area Results

With only two survey years to compare it is difficult to make any definitive statements about the sand gilia population at this reference area. However, the fluctuations in sand gilia populations in an area devoid of human disturbance with similar precipitation illustrates the natural variations that are possible in this population.

4.3 PREVIOUS OPERABLE UNIT 1 CONSTRUCTION VERSUS RARE PLANT OCCURRENCES

Only those wells that were scheduled for destruction in September 2011 were included in the 2011 rare plant survey. This section provides a brief summary of rare plant survey results for the pre-2004 OU-1 wells in their entirety.

Twenty-six OU-1 wells at 21 locations (counting MW-OU1-24-A and replacement well MW-OU1-24-AR as one location in addition to the EW-OU1-17-A and EW-OU1-18-A well groups) were installed by previous investigators between 1985 and 1997. As these wells pre-date the earliest available survey results from 1998, it is not known whether rare plants were present before the wells were constructed. These 21 locations have been included in at least one of the rare plant surveys from 1998 through 2011. Monterey spineflower was detected at 19 of the 21 sites in one or more rare plant surveys. One of the two sites where Monterey spineflower was absent in both surveys was part of the excavation to remove contaminated soils in the former FDA. The native soil in this area was replaced with clean fill imported from off site.

An additional 14 wells were constructed between the initial rare plant survey in 1998 and the next survey in 2004. Monterey spineflower was present at four of these sites in the 1998 rare plant survey and at only one well in both the 1998 and 2004 surveys. In 2011 Monterey spineflower was again found at 4 of these 14 locations; however, 3 of these sites showed new populations not seen in the 1998 or 2004 surveys. Nine of these 14 sites were not surveyed between 2004 and 2011 (see Table 4.2).

Of the 21 well locations installed before the initial 1998 plant survey, sand gilia was detected at 11 locations in one or more of the rare plant surveys. At the 14 well sites constructed between 1998 and 2004, sand gilia has been found at only 3. At MW-OU1-39-A sand gilia was found in 2011 but not in 1998 or 2004 (see Table 4.2). At MW-OU1-38-A it was observed in 1998 and 2011 but not in 2004 or 2007. Sand gilia was found at MW-OU1-44-A in 1998 but this location was not disturbed (except for groundwater sampling) after the well was constructed. Consequently, it was not surveyed again until 2011 and sand gilia was not detected.

4.4 SUMMARY

Data from the annual post-construction rare plant surveys for the expansion of the OU-1 groundwater remediation system was compared with the 1998 and 2004 pre-construction rare plant survey data to assess construction impacts on the FONR rare plant populations (Monterey spineflower and sand gilia). The results of that comparison indicate that the construction activity has not had significant adverse effects on those populations. The supporting observations for this conclusion were described in the preceding paragraphs and are summarized below:

- Neither Monterey spineflower nor sand gilia was detected in the 2004 pre-construction rare plant survey at any of the locations where wells were subsequently constructed. The absence of these plants before construction began is taken as one indication of the lack of construction impact.
- During planning discussions before well construction began, the UCSC FONR management staff characterized the 1998 rare plant survey as representing a “great year”

for Monterey spineflower and sand gilia (UCSC, 2006). Nonetheless, sand gilia was only detected in 1998 at one of the well sites, IW-OU1-25-A, where construction occurred during the 2004 through 2007 period. Monterey spineflower was detected in 1998 at only 11 of the 42 locations where wells were subsequently constructed between 2004 and 2007. These locations are summarized as follows:

  - At 8 of these 11 locations, the well sites were located at the edge of the grassland in areas already impacted by invasive species and outside the critical FONR habitat; potential construction impacts to these areas are not considered significant.
  - Wells MW-OU1-46-AD and PZ-OU1-46-AD2 were located within approximately 25 feet of each other and possibly overlapped with a Monterey spineflower population. Although that plant was not detected in subsequent surveys at the well sites in 2005, 2006, or 2007, the survey completed in 2008 showed that a sparse Monterey spineflower population overlapped the MW-OU1-46-AD well site and a single plant was observed at PZ-OU1-46-AD2 (HGL, 2009a). In 2009, the population near MW-OU1-46-AD had receded slightly but still overlapped and had increased to Medium population density. However, no individual plant cluster was identified near PZ-OU1-46-AD2. While not conclusive, this occurrence combined with the uncertainty regarding the boundary of the plant population in 1998 relative to the well locations suggests there have not been any long-term negative impacts to the rare plant population. Consequently, these wells have not been surveyed since 2009.
  - At the other two well sites (EW-OU1-53-A and IW-OU1-01-A) Monterey spineflower was detected in both the 2006 and 2007 surveys. Monterey spineflower was again detected at IW-OU1-10-A in 2011 (EW-OU1-53-A was not surveyed in 2011 and neither well was surveyed from 2008 through 2010 because the three-year post-construction surveys showed no impact on rare plant populations).

- The wells and access roads constructed as part of the expansion of the OU-1 groundwater remediation system were constructed between 2004 and 2006. At five of the well locations, Monterey spineflower was identified in one or more post-construction surveys in 2005, 2006, and 2007 although this species was not detected in either the 1998 or 2004 pre-construction surveys. The five well locations are EW-OU1-54-A, IW-OU1-05-A, IW-OU1-24-A, MW-OU1-59-A and IW-OU1-74-A (Table 4.1). Only well IW-OU1-74-A is located within the 2009 survey area and Monterey spineflower was detected with an increased population density (Medium Low) relative to 2007 (Very Sparse) and 2008 (Sparse) (HGL, 2008, 2009a, and 2009b). Three of these wells (EW-OU1-54-A, IW-OU1-05-A, and IW-OU1-24-A) were included in the 2011 survey area and Monterey spineflower was again present at each site. Two additional wells (EW-OU1-55-A and IW-OU1-25-A) were identified in 2011 where Monterey spineflower was found for the first time. These occurrences suggest a possible temporary and/or long-term beneficial impact to the rare plant population resulting from ground disturbance associated with construction activity.
- For 19 of the 21 wells constructed before 1998 in OU-1 FONR locations, Monterey spineflower was detected in one or more subsequent rare plant surveys. This represents a minimum recurrence rate of 90 percent under the most conservative assumption that this species was present at all 21 sites before construction began. Similarly, sand gilia was

detected at 11 of the 21 (52 percent) well sites in one or more subsequent rare plant surveys. The frequency of occurrence at individual well sites for sand gilia relative to Monterey spineflower in the completed surveys ranged from 25 percent to 67 percent. These results suggest that well construction activities resulted in no adverse impact to the sand gilia population.

- For those 14 wells constructed between 1998 and 2001, Monterey spineflower was detected in 1998 at 4 sites included in subsequent surveys and recurred at least once in 2 of those sites (MW-OU1-39-A and MW-OU1-44-A) during the 2004 through 2011 surveys. Monterey spineflower was detected in 2008 at MW-OU1-46-A (Table 4.2) for the first time and in 2009, the population density increased from Very Sparse to Medium. The MW-OU1-46-A area was not surveyed after 2009 because the three-year post-construction surveys showed no impact on rare plant populations. This species also was detected in 2006 for the first time at well MW-OU1-30-A and again in 2007. In 2011 Monterey spineflower was found at two other well sites where it was not found in 1998: co-located MW-OU1-32-A/MW-OU1-33-A and MW-OU1-38-A.
- At the 14 wells constructed between 1998 and 2001 sand gilia were observed at only two locations in 1998 (MW-OU1-38-A and MW-OU1-44-A) and recurred at one (MW-OU1-38-A) in subsequent surveys. Sand gilia was found in 2011 at MW-OU1-39-A where it had not previously been detected (see Table 4.2).

Manual and mechanical (non-chemical) weed control efforts were initiated throughout the UCSC in 2007 and continued through 2011 as a preventive measure (see Section 1.4 and Appendix B). Visual observations of the extent of the weed populations were made by UCSC field staff in 2011 to determine the effectiveness of the weed control program. UCSC stated that the weed control efforts significantly reduced the survivorship, seed production, and abundance of the target species (see Appendix B). Each year the weed control program removes a large portion of the invasive weed seed source for the subsequent year, thus building on the effectiveness of the program. The long-term effectiveness of the weed control program will continue to be evaluated in 2012.

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5.0 RECOMMENDATIONS AND FUTURE WORK

The annual rare plant monitoring shows thus far that the 2004 through 2007 construction activities associated with the expansion of the OU-1 groundwater remediation program have not significantly impacted rare plant populations within the FONR. The status of the OU-1 rare plant survey program and recommendations concerning 2012 rare plant monitoring are presented in this section.

As shown in Figure 4.1 and Figure 4.2, construction and well destruction activities were performed in the southern part of OU-1 within the FONR during 2010 and 2011. Consequently, the annual rare plant sampling program will continue in these areas in 2012. Rare plant surveys in the northern half of the FONR remain suspended because there has been no construction activity in the area for more than three years.

The well sites and roadways that border the adjacent grasslands to the north and east of the FONR represent marginal habitat for Monterey spineflower and sand gilia. Although isolated patches of Monterey spineflower are sometimes encountered in this area (sand gilia has not been detected), the predominant pre-construction population is weeds and invasive grasses. Consequently, the potential impact due to the construction activities is not significant and the HGL rare plant survey program will remain suspended in this region.

The recommended rare plant survey and mitigation measures for 2012 are as follows:

- Continue the weed control program in 2012. The areas in which weed control will be implemented and the methodology used will be the same as in 2011 (Figure 1.5).
- Minimize roadway traffic during quarterly groundwater sampling activities to the extent practical.
- If approved by regulatory stakeholders, reduce the sampling frequency from the groundwater monitoring well network to minimize road traffic wherever such reductions can be made consistent with remediation and performance monitoring objectives for the OU-1 cleanup.
- Continue rare plant monitoring at those locations affected by extending the groundwater remediation system to well IW-OU1-10-A in 2010.
- Continue rare plant monitoring at those wells within the FONR habitat that were destroyed in 2011.
- Repair roadways where erosion has become a current or potential problem (see Figure 3.1).
- Coordinate with UCSC staff regarding potential remediation activities around well MW-OU1-61-A.

The results of the recommended actions will be described in the 2012 Annual FONR Impact Assessment and Habitat and Rare Plant Survey Results report.

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Table 1.1
Wells Within the Fort Ord Natural Reserve

Wells Installed/Sampled Before 2004				Wells Installed for Enchanced Reductive Dechlorination Pilot Study		Wells Installed 2004 through 2006			
Identification	**Year Installed**	**Identification**	**Year Installed**	**Identification**	**Year Installed**	**Identification**	**Year Installed**	**Identification**	**Year Installed**
MW-B-10-A	1976	*MW-OU1-24-A**	1997	*IW-OU1-ERD-01-A*	2002	*IW-OU1-01-A*	2004	PZ-OU1-10-A1	2005
MW-OU1-01-A	1986	MW-OU1-24-AR	2003	*MW-OU1-ERD-01-A*	2002	IW-OU1-02-A	2004	PZ-OU1-46-AD2	2005
MW-OU1-02-A	1986	MW-OU1-25-A	1998	*IW-OU1-ERD-02-A*	2002	PZ-OU1-02-A1	2004		
MW-OU1-03-A	1986	MW-OU1-26-A	1998	*MW-OU1-ERD-02-A*	2002	*IW-OU1-05-A*	2004		
MW-OU1-04-A	1986	MW-OU1-27-A	1998	*IW-OU1-ERD-03-A*	2002	IW-OU1-10-A	2004	EW-OU1-60-A	2006
MW-OU1-05-A	1986	*MW-OU1-28-A*	1998	*MW-OU1-ERD-03-A*	2002	*IW-OU1-13-A*	2004	MW-OU1-61-A	2006
MW-OU1-06-A	1986	MW-OU1-29-A	1998	*IW-OU1-ERD-04-A*	2002	*IW-OU1-24-A*	2004	EW-OU1-62-A	2006
MW-OU1-07-A	1986	*MW-OU1-30-A*	1998	*MW-OU1-ERD-04-A*	2002	*IW-OU1-25-A*	2004	EW-OU1-63-A	2006
MW-OU1-08-A	1986	*MW-OU1-32-A*	1998	*MW-OU1-ERD-05-A*	2002	MW-OU1-46-AD	2004	MW-OU1-64-A1	2006
MW-OU1-09-A	1986	*MW-OU1-33-A*	1998	*MW-OU1-ERD-06-A*	2002	EW-OU1-47-A	2004	MW-OU1-64-A2	2006
MW-OU1-10-A	1987	*MW-OU1-34-A*	1998	*MW-OU1-ERD-07-A*	2002	*EW-OU1-48-A* *	2004	MW-OU1-65-A	2006
MW-OU1-11-SVA	1986	*PZ-OU1-35-A*	1998	MW-OU1-ERD-08-A	2002	EW-OU1-49-A	2004	EW-OU1-66-A	2006
MW-OU1-12-A *	1988	*MW-OU1-36-A*	1999			PZ-OU1-49-A1	2004	MW-OU1-67-A	2006
PZ-OU1-13-A	1988	*MW-OU1-37-A*	1999			MW-OU1-50-A	2004	MW-OU1-68-A	2006
PZ-OU1-14-A	1988	*MW-OU1-38-A*	1999			MW-OU1-51-A	2004	EW-OU1-71-A	2006
PZ-OU1-15-A	1988	*MW-OU1-39-A*	1999			EW-OU1-52-A	2004	EW-OU1-72-A	2006
PZ-OU1-16-A	1988	MW-OU1-40-A	1999			EW-OU1-53-A	2004	IW-OU1-73-A	2006
EW-OU1-17-A	1987	MW-OU1-41-A	2001			*EW-OU1-54-A*	2004	IW-OU1-74-A	2006
EW-OU1-18-A	1987	MW-OU1-43-A	2001			*EW-OU1-55-A*	2004	MW-OU1-82-A	2006
MW-OU1-19-A	1993	*MW-OU1-44-A*	2001			MW-OU1-56-A	2004	MW-OU1-83-A	2006
MW-OU1-20-A	1993	MW-OU1-45-A	2001			MW-OU1-57-A	2004	MW-OU1-84-A	2006
MW-BW-10-A	1997	MW-OU1-46-A	2001			MW-OU1-58-A	2004	MW-OU1-85-A	2006
MW-OU1-21-A	1997	*MW-OU1-01-180*	2000			MW-OU1-59-A	2004	MW-OU1-86-A	2006
MW-OU1-22-A	1997	*MW-OU1-02-180*	2000					MW-OU1-87-A	2006
MW-OU1-23-A	1997	*MW-OU1-03-180*	2000					MW-OU1-88-A	2006

Notes:

Well name in Italics indicates that well has been abandoned.

ERD - enhanced reduction dechlorination

EW - extraction well

IW - injection well

MW - monitoring well

OU1 - Operable Unit 1

PZ - piezometer

SVA - Salinas Valley Acquiclude

Table 1.2
Soil Borings and Wells Destroyed 2004 - 2011
within the Fort Ord Natural Reserve

Identification	Year Abandoned	Identification	Year Abandoned	Identification	Year Abandoned
SB-OU1-2004-I	2004	MW-BW-10-A	2011	MW-OU1-32-A	2011
SB-OU1-2004-J	2004	MW-OU1-01-180	2011	MW-OU1-33-A	2011
SB-OU1-2004-K	2004	MW-OU1-01-A	2011	MW-OU1-34-A	2011
SB-OU1-2004-L	2004	MW-OU1-02-180	2011	MW-OU1-36-A	2011
SB-OU1-2004-M	2004	MW-OU1-02-A	2011	MW-OU1-37-A	2011
SB-OU1-46-AD1	2005	MW-OU1-03-180	2011	MW-OU1-38-A	2011
SB-OU1-60-A	2005	MW-OU1-03-A	2011	MW-OU1-39-A	2011
EW-OU1-48-A	2006	MW-OU1-04-A	2011	MW-OU1-42-A	2011
EW-OU1-17-A	2011	MW-OU1-05-A	2011	MW-OU1-44-A	2011
EW-OU1-18-A	2011	MW-OU1-06-A	2011	MW-OU1-ERD-01-A	2011
EW-OU1-54-A	2011	MW-OU1-07-A	2011	MW-OU1-ERD-02-A	2011
EW-OU1-55-A	2011	MW-OU1-08-A	2011	MW-OU1-ERD-03-A	2011
IW-OU1-01-A	2011	MW-OU1-09-A	2011	MW-OU1-ERD-04-A	2011
IW-OU1-05-A	2011	MW-OU1-10-A	2011	MW-OU1-ERD-05-A	2011
IW-OU1-13-A	2011	MW-OU1-11-SVA	2011	MW-OU1-ERD-06-A	2011
IW-OU1-24-A	2011	MW-OU1-19-A	2011	MW-OU1-ERD-07-A	2011
IW-OU1-25-A	2011	MW-OU1-20-A	2011	PZ-OU1-13-A	2011
IW-OU1-ERD-01-A	2011	MW-OU1-21-A	2011	PZ-OU1-14-A	2011
IW-OU1-ERD-02-A	2011	MW-OU1-28-A	2011	PZ-OU1-15-A	2011
IW-OU1-ERD-03-A	2011	MW-OU1-30-A	2011	PZ-OU1-16-A	2011
IW-OU1-ERD-04-A	2011	MW-OU1-31-A	2011	PZ-OU1-35-A	2011

Notes:

OU-1- operable unit 1
EW - extraction well
SB - soil boring
MW- monitoring well
PZ- piezometer
IW- injection well

Table 1.3
Summary of 2011 Groundwater Long-Term Monitoring Program

Well Identification	Groundwater Sampling Events*					
	Mar-11	Jun-11	Jul-11	Sep-11	Oct-11	Dec-11
MW-OU1-46-AD	X	X	--	X	--	--
EW-OU1-60-A	X	X	--	X	--	X
EW-OU1-62-A	--	--	--	--	--	--
EW-OU1-63-A	--	--	--	--	--	--
EW-OU1-66-A	X	X	--	X	--	X
EW-OU1-71-A	X	X	--	X	--	X
MW-OU1-85-A	X	X	--	X	--	--
MW-OU1-87-A	X	X	--	X	--	X
IW-OU1-10-A	X	X	--	X	--	X
IW-OU1-01-A	X	--	--	--	--	--
MW-OU1-01-A	no longer sampled					
IW-OU1-02-A	X	--	--	X	--	--
MW-OU1-02-A	no longer sampled					
MW-OU1-03-A	no longer sampled					
MW-OU1-04-A	X	--	--	--	--	--
MW-OU1-05-A	water level only					
MW-OU1-06-A	no longer sampled					
MW-OU1-07-A	no longer sampled					
MW-OU1-08-A	--	X	--	--	--	--
MW-OU1-09-A	X	--	--	--	--	--
MW-OU1-10-A	no longer sampled					
PZ-OU1-10-A1	X	X	--	X	X	X
MW-OU1-11-SVA	no longer sampled					
IW-OU1-13-A	no longer sampled					
EW-OU1-17-A	no longer sampled					
EW-OU1-18-A	no longer sampled					
MW-OU1-19-A	X	--	--	--	--	--
MW-OU1-20-A	X	--	--	--	--	--
MW-OU1-21-A	no longer sampled					
MW-OU1-22-A	--	--	--	X	--	--
MW-OU1-23-A	X	--	--	X	--	--
IW-OU1-24-A	no longer sampled					
MW-OU1-24-AR	water level only					
IW-OU1-25-A	no longer sampled					
MW-OU1-25-A	--	--	--	--	--	--
MW-OU1-26-A	X	X	--	X	--	--
MW-OU1-27-A	X	--	--	--	--	--
MW-OU1-28-A	water level only					
MW-OU1-29-A	water level only					
MW-OU1-30-A	no longer sampled					
MW-OU1-31-A	no longer sampled					

Table 1.3
Summary of 2011 Groundwater Long-Term Monitoring Program

Well Identification	Groundwater Sampling Events*					
	Mar-11	Jun-11	Jul-11	Sep-11	Oct-11	Dec-11
MW-OU1-32-A	no longer sampled					
MW-OU1-33-A	no longer sampled					
MW-OU1-34-A	no longer sampled					
PZ-OU1-35-A	no longer sampled					
MW-OU1-36-A	no longer sampled					
MW-OU1-37-A	no longer sampled					
MW-OU1-38-A	no longer sampled					
MW-OU1-39-A	--	X	--	--	--	--
MW-OU1-40-A	water level only					
MW-OU1-41-A	water level only					
MW-OU1-42-A	no longer sampled					
MW-OU1-43-A	water level only					
MW-OU1-44-A	no longer sampled					
MW-OU1-45-A	water level only					
MW-OU1-46-A	water level only					
EW-OU1-47-A	water level only					
EW-OU1-48-A	no longer sampled					
EW-OU1-49-A	water level only					
PZ-OU1-49-A1	X	--	--	X	--	--
MW-OU1-50-A	X	--	--	X	--	--
MW-OU1-51-A	water level only					
EW-OU1-52-A	X	X	--	X	--	--
EW-OU1-53-A	X	X	--	X	--	--
EW-OU1-54-A	no longer sampled					
EW-OU1-55-A	no longer sampled					
MW-OU1-56-A	water level only					
MW-OU1-57-A	X	--	--	X	--	--
MW-OU1-58-A	X	--	--	X	--	--
MW-OU1-59-A	water level only					
MW-OU1-61-A	X	X	--	X	X	X
MW-OU1-64-A1	water level only					
MW-OU1-64-A2	water level only					
MW-OU1-65-A	water level only					
MW-OU1-67-A	--	--	--	X	--	--
MW-OU1-68-A	water level only					
MW-OU1-69-A2	X	--	--	X	--	--
MW-OU1-70-A	X	--	--	X	--	--
EW-OU1-72-A	X	--	--	X	X	--
IW-OU1-73-A	water level only					
IW-OU1-74-A	water level only					
MW-OU1-82-A (MW-G)	X	--	--	X	--	--

Table 1.3
Summary of 2011 Groundwater Long-Term Monitoring Program

Well Identification	Groundwater Sampling Events*					
	Mar-11	Jun-11	Jul-11	Sep-11	Oct-11	Dec-11
MW-OU1-83-A (MW-F)	--	--	--	X	--	--
MW-OU1-84-A (MW-E)	--	--	--	X	--	--
MW-OU1-86-A (MW-C)	X	--	--	X	--	--
MW-OU1-88-A (MW-A)	X	X	--	X	--	X
MW-BW-10-A	--	--	X	--	--	--
MW-OU1-ERD-01-A	no longer sampled					
MW-OU1-ERD-02-A	no longer sampled					
MW-OU1-ERD-03-A	no longer sampled					
MW-OU1-ERD-04-A	no longer sampled					
MW-OU1-ERD-05-A	no longer sampled					
MW-OU1-ERD-06-A	no longer sampled					
MW-OU1-ERD-07-A	no longer sampled					
MW-OU1-ERD-08-A	water level only					
IW-OU1-ERD-01-A	no longer sampled					
IW-OU1-ERD-02-A	no longer sampled					
IW-OU1-ERD-03-A	no longer sampled					
IW-OU1-ERD-04-A	no longer sampled					

Notes:

* includes sampling of extraction wells

Italicized well name indicates the well is not located within the Fort Ord Natural Reserve.

Identification in parantheses indicates temporary well name used in early planning documents.

X - sample collected

-- no sample collected

ERD - enhanced reductive dechlorination

EW - extraction well

IW - injection well

SVA - Salinas Valley Aquiclude

OU1 - Operable Unit 1

MW - monitoring well

PZ - piezometer

Table 3.1
Rare Plant Survey Results for Reference Plot - 2010 through 2011

Sand Gilia					
Year Surveyed	**Number of Point Populations**	**Number of Individuals at Point Populations**	**Number of Polygon Populations**	**Number of Individuals at Polygon Populations**	**Total Number of Individuals**
2010	7	18	7	1068	1086
2011	12	40	4	278	318

Monterey Spineflower								
Year Surveyed	**Number of Populations with < 5 Individual Plants**	**Total Number of Individual Plants**	**Number of Populations with > 5 Individual Plants**	**Plant Cover Density Summary for Areas With > 5 Individual Plants**				
				Sparse	**Medium-Low**	**Medium**	**Medium-High**	**Very High**
2010	0	0	2	1	1	0	0	0
2011	1	4	1	0	1	0	0	0

Monterey spineflower Plant Cover Density Categories Based on Percentage of Plant Cover of Total Ground Area

Very Sparse (less than 3 percent),

Sparse (3 to 25 percent),

Medium Low (26 to 50 percent),

Medium (51 to 76 percent),

Medium High (76 to 97 percent),

Very High (greater than 97 percent).

Table 4.1
Rare Plant Survey Results Relative to 2004 - 2008 OU-1 Well Locations

Well Identification	New Access Cleared to Install Well	2008 RP/HS Segment ID	1998	2004	2005	2006	2007	2008	2009	2010	2011	Remarks Regarding Results for Given Year							
												2004	2005	2006	2007	2008	2009	2010	2011
Wells Installed in 2004 After the Rare Plant Survey																			
MW-OU1-46-AD	No	4	MS	N	N	N	N	MS	MS	--	--					MS#34[VS]	MS#27[M]		
EW-OU1-47-A	No	3	N	N	N	N	N	--	N	--	--	Located in grassland east of FONR.							
EW-OU1-48-A	No	3	N	N	N	N	N	--	--	--	--	Located in grassland east of FONR.							
EW-OU1-49-A	No	3	MS	N	N	N	N	--	--	--	--								
EW-OU1-52-A	No	11A	N	N	N	N	N	--	--	--	--								
EW-OU1-53-A	Yes	11B	MS	N	N	MS, SG	MS,SG	--	--	--	--			MS#92[S]; SG#21-#25 & 30	SG#24[16]; MS#52[VS]; MS#53 [VS]				
EW-OU1-54-A*	No	Well Site	N	N	MS	N	N	--	--	--	SG, MS		MS#126[VS]						MS#72[4]; MS#96[S]; MS#97[S]; SG#13 & #14 nearby
EW-OU1-55-A*	No	Well Site	N	N	N	N	N	--	--	--	MS								MS#90[S]
IW-OU1-01-A*	No	12	MS	N	N	MS, SG	MS	--	--	--	MS			MS#46[S]; and SG#2-6 nearby	MS#50[S]				MS#91[ML]
IW-OU1-02-A	Yes	Well Site	N	N	--	N	N	--	--	--	--								
IW-OU1-05-A*	No	13	N	N	--	MS	MS	--	--	--	MS			MS#49[VS]	MS#46[VS]				MS#86[S]
IW-OU1-10-A	Yes	Well Site	N	N	--	N	N	--	--	--	--								
IW-OU1-13-A*	No	--	--	--	--	--	--	--	--	--	--	Located in grassland east of FONR.							
IW-OU1-24-A*	No	Well Site	N	N	--	N	MS	--	--	--	MS				MS#35[VS]				MS#104[S]
IW-OU1-25-A*	No	Well Site	N	MS, SG	N	N	N	--	--	--	MS	MS#135[5];and SG#30 [2]							MS#73[4]; MS#74[4]; MS#75[4]
MW-OU1-51-A	No	4	N	N	N	N	N	N	N	--	--								
PZ-OU1-49-A1	No	3	MS	N	N	N	N	--	--	--	--								

Table 4.1
Rare Plant Survey Results Relative to 2004 - 2008 OU-1 Well Locations

Well Identification	New Access Cleared to Install Well	2008 RP/HS Segment ID	1998	2004	2005	2006	2007	2008	2009	2010	2011	Remarks Regarding Results for Given Year							
												2004	2005	2006	2007	2008	2009	2010	2011
Wells Installed in 2004 in Area Not Surveyed																			
MW-OU1-50-A	Yes	9	MS	--	MS	N	MS	MS	MS	--	--		MS#21[MD]		MS#61[ML]	MS#49[ML]; and MS#50[S]	MW#36[S]; MW#4[2]; MW#5[2]		
MW-OU1-56-A	No	1	MS	--	N	MS	N	--	--	--	--		MS#146[1] nearby	MS#76[VS] nearby					
MW-OU1-57-A	No	1	MS	--	N	N	N	--	--	--	--								
MW-OU1-58-A	No	1	N	--	N	N	N	--	--	--	--								
MW-OU1-59-A	Yes	Well Site	N	--	MS	SG	N	--	--	--	--		MS#153[2]	SG#26[13]					
Staging Areas Used in 2004																			
Area # 1	No	Area 1	MS	N	N	SG; MS	MS	--	--	--	--			SG#7[1]; MS#50[S]; and MS#52[S]	MS#9[3]; MS#39[VS]; MS#40[S]				
Area # 2	No	Area 2	SG; MS	SG	SG; MS	SG; MS	SG; MS	--	--	--	--	SG#011[10]	SG#045[1]; MS#047[S]	SG#35[110]; SG#37[80]; and MS#54[S]	SG#18[36]; MS#8[1]; MS#36[S]; MS#37[S]				
Area # 3	No	Area 3	SG[1]	N	N	MS	MS	--	--	--	--			MS#39[1]; MS#56[VS]; and MS#57[VS]	MS#41[S]				
Wells Installed in 2005 After the Rare Plant Survey																			
PZ-OU1-10-A1	No	Well Site	N	N	--	N	N	--	--	--	--								
PZ-OU1-46-AD2	No	4	MS	N	--	N	N	MS	N	--	--					MS#4[1]			
HCPP Wells Installed Along Northwest Boundary Road in 2006 Before the Rare Plant Survey																			
EW-OU1-60-A	No	1	MS	--	N	N	N	N	--	--	--								
EW-OU1-62-A	No	1	N	--	N	N	N	--	--	--	--								
EW-OU1-63-A	No	1	N	--	N	N	N	--	--	--	--								
EW-OU1-66-A	No	1	MS	--	N	N	N	--	--	--	--								
MW-OU1-61-A	No	1	MS	--	N	N	N	N	--	--	--								
MW-OU1-64-A1	No	1	N	--	N	N	N	--	--	--	--								
MW-OU1-64-A2	No	1	N	--	N	N	N	--	--	--	--								
MW-OU1-65-A	No	1	MS	--	N	N	N	--	--	--	--								
MW-OU1-67-A	No	1	N	--	N	N	N	--	--	--	--								
MW-OU1-68-A	No	1	N	--	N	N	N	--	--	--	--								

Table 4.1
Rare Plant Survey Results Relative to 2004 - 2008 OU-1 Well Locations

Well Identification	New Access Cleared to Install Well	2008 RP/HS Segment ID	1998	2004	2005	2006	2007	2008	2009	2010	2011	Remarks Regarding Results for Given Year							
												2004	2005	2006	2007	2008	2009	2010	2011
Wells Installed in 2006 After the Rare Plant Survey																			
EW-OU1-71-A	Yes	6	N	N	--	N	N	MS	N	--	--					MS#42[S]			
EW-OU1-72-A	Yes	7	N	N	N	N	N	N	N	--	--								
IW-OU1-73-A	Yes	4	N	--	N	N	N	N	N	--	--								
IW-OU1-74-A	No	4	N	--	N	N	MS	MS	MS	--	--				MS#60[VS]	MS#39[S]	MS#41[S]; MS#33[ML]		
MW-OU1-82-A	Yes	9	N	--	N	N	N	MS	MS	--	--					MS#51[ML]	MS#10[2]		
MW-OU1-83-A	Yes	8	N	N	N	N	N	MS	MS	--	--					MS#26[1]; and MS#46[S] adjacent	MW#23[2]; MW#24[2]; MW#25[1]		
MW-OU1-84-A	No	4	N	--	N	N	N	MS	MS	--	--				MS#58 across the road	MS#37[ML]; and MS#36[ML] across road	MS#28[M]; MS#15[3]		
MW-OU1-85-A	Yes	7	N	N	N	N	N	N	N	--	--								
MW-OU1-86-A	Yes	6	N	N	--	N	N	N	N	--	--								
MW-OU1-87-A	No	Well Site	N	N	N	N	N	N	N	--	--								
MW-OU1-88-A	Yes	Well Site	N	N	--	N	N	N	N	--	--								

Notes:

No new wells have been installed since 2006.

*This well has been abandoned.

-- not surveyed

EW - extraction well

FONR - Fort Ord Natural Reserve

HCCP - Hydraulic Control Pilot Project

ID - identification

IW - injection well

MD - medium high

ML - medium low

MS - Monterey spineflower

MS#49[VS] - population ID # [density category or number of plants]

SG[1] - Given map scale, it is possible that the observed sand gilia population was just outside the northwest boundary of the staging area.

#49 - indicates population ID number assigned in corresponding annual rare plant survey; [13] indicates number of plants.

SG - Sand gilia

SG#26[13] - population ID # [number of plants]

S - sparse

VS - very sparse

MW - monitoring well

N - area was surveyed; but no rare plants were detected.

OU1 - operable unit 1

PZ - piezometer

RP/HS - rare plant/habitat survey; population ID# & segment identification refers to Figures A3.1 through A3.3 in Appendix A.

Table 4.2
Rare Plant Survey Results for OU-1 Wells Constructed before 2004

Well Identification	Year Installed	Appendix A Figure #	1998	2004	2005	2006	2007	2008	2009	2010	2011	Remarks Regarding Results for Given Year							
												2004	2005	2006	2007	2008	2009	2010	2011
Wells Installed Before 1998																			
EW-OU1-17-A*	1987	A3.2	SG; MS	N	--	N	N	--	--	--	MS								MS#91[ML]; MS#92[S] nearby
EW-OU1-18-A*	1987	A3.2	SG; MS	SG; MS	--	N	SG	--	--	--	SG	SG#07[100]; MS#07[1000]			SG#22[75]				SG#35[4]; SG#36[2]
PZ-OU1-13-A*	1988	A3.2	MS	MS	--	MS	N	--	--	--	MS	MS#216[100]		MS#46[S]					MS#91[ML]
PZ-OU1-14-A*	1988	A3.2	SG; MS	N	--	N	MS	--	--	--	MS				MS#49[VS]				MS#91[ML]; MS#92[S] nearby
PZ-OU1-15-A*	1988	A3.2	SG; MS	SG; MS	--	N	N	--	--	--	MS, SG	SG#07[100]; MS#07[1000]							MS#109[S]; SG#[35]; SG#[38]; SG#[37]
PZ-OU1-16-A*	1988	A3.2	SG; MS	SG; MS	--	N	SG	--	--	--	SG	SG#07[100]; MS#07[1000]			SG#22[75]				SG#37[9]; SG#38[3]; SG#39[2]
MW-BW-10-A*	1993	A3.3	N	--	N	N	N	--	--	--	MS	MS#166, 167 & 215 nearby							MS#[78]; MS# [67], MS#[66]
MW-OU1-01-A*	1985	A3.3	SG; MS	--	--	--	--	--	--	--	MS								MS#68[1]; MS#79[S]; MS#80[S]; MS#81[S]
MW-OU1-02-A*	1985	A3.3	SG; MS	--	--	--	--	--	--	--	SG, MS								SG#11[2]; SG#7[3]; SG#8[3]; SG#9[1]; SG#10[4]; MS#111[ML]; SG#12, 54, 55, 56, 57, & 58 nearby
MW-OU1-03-A*	1985	A3.2	MS	SG; MS	N	N	SG; MS	--	--	--	SG, MS	SG#07[100]; MS#07[1000]			SG#21[100]; MS#44[S]				MS#99[S]; SG#34[5]
MW-OU1-04-A*	1985	A3.2	N	N	--	--	--	--	--	--	MS								MS#70[2]; MS#71[5]
MW-OU1-05-A*	1985	A3.2	MS	SG	N	N	N	--	--	--	MS	SG#261[25]							MS#69[1]; MS#88[S]
MW-OU1-06-A*	1985	A3.3	SG	--	--	--	--	--	--	--	MS								MS#82[S]; MS#83[M], MS#84 & 85 across street
MW-OU1-07-A*	1985	NA	N	N	N	--	N	--	--	--	N								
MW-OU1-08-A*	1986	A3.2	SG	MS	--	--	--	--	--	--	MS	MS#20[100]							MS#103[ML]
MW-OU1-09-A*	1986	A3.2	MS	MS	MS	--	--	--	--	--	MS, SG	MS#20[100]	MS#82[S]						MS#94[ML]; SG#1-6 along access road
MW-OU1-10-A*	1987	A3.2	MS	N	N	--	--	--	--	--	N								
MW-OU1-11-SVA*	1986	A3.2	MS	MS	--	--	SG, MS	--	--	--	SG, MS	MS#220[1000]; extends far beyond well			SG#20; MS#42				SG#27[3]; SG#28[1]; SG#29[2]; SG#30[2]; SG#40[1]; SG#61[18]; MS#100[S]

Table 4.2
Rare Plant Survey Results for OU-1 Wells Constructed before 2004

Well Identification	Year Installed	Appendix A Figure #	1998	2004	2005	2006	2007	2008	2009	2010	2011	Remarks Regarding Results for Given Year							
												2004	2005	2006	2007	2008	2009	2010	2011
Wells Installed Before 1998 (Continued)																			
MW-OU1-12-A*	1984	A3.3	N	--	--	--	--	--	--	--	--	Well destroyed in 2002							
MW-OU1-19-A*	1993	A3.2	SG; MS	MS	--	SG; MS	--	--	--	--	SG, MS	MS#57[1000]; extends far beyond well		SG#33[375]; MS#45[S]					SG#53[697]; MS#89[S]
MW-OU1-20-A*	1993	A3.2	N	N	MS	--	--	--	--	--	MS		MS#126[VS]						MS#95[S]
MW-OU1-21-A*	1997	A3.2	N	--	N	--	--	--	--	--	MS								MS#102[S]
MW-OU1-22-A	1997	NA	N	MS	N	N	N	--	--	--	--	MS#90[1000]; extends far beyond well							
MW-OU1-23-A	1997	A3.2	MS	N	--	--	--	--	--	--	--								
MW-OU1-24-A	1997	NA	MS	--	--	--	--	--	--	--	--	Well destroyed in 2003; see replacement well MW-24-AR							
MW-OU1-24-AR	2003	NA	MS	N	N	MS	N	--	--	--	--			MS#59[VS]					
Wells Installed from 1998 - 2001																			
MW-OU1-25-A	1998	A3.2	MS	N	--	--	--	--	--	--	--								
MW-OU1-26-A	1998	NA	N	N	--	N	N	--	--	--	--								
MW-OU1-30-A*	1998	NA	N	N	--	MS	MS	--	--	--	N			MS#79[S]	MS#26[S]				
MW-OU1-32-A*	1998	A3.2	N	N	--	--	--	--	--	--	MS								MS#76[1]; MS#101[S]
MW-OU1-33-A*	1998	NA	N	N	--	--	--	--	--	--	MS								MS#76[1]; MS#101[S]
MW-OU1-36-A*	1999	A3.3	N	--	--	--	--	--	--	--	N								
MW-OU1-37-A*	1999	A3.3	N	N	--	--	--	--	--	--	N								
MW-OU1-38-A*	1999	A3.2	SG	N	--	--	N	--	--	--	MS, SG								MS#105[S]; MS#106, 107, & 108, SG#31, 32, & 33 nearby
MW-OU1-39-A*	1999	A3.2	MS	MS	--	--	--	--	--	--	SG, MS	MS#220[1000]; extends far beyond well							SG#17[5]; SG#18[2]; SG#15[1]; SG#16[4]; MS#98[MD]

Table 4.2
Rare Plant Survey Results for OU-1 Wells Constructed before 2004

Well Identification	Year Installed	Appendix A Figure #	1998	2004	2005	2006	2007	2008	2009	2010	2011	Remarks Regarding Results for Given Year							
												2004	2005	2006	2007	2008	2009	2010	2011
Wells Installed from 1998 - 2001 (Continued)																			
MW-OU1-39-A west access road	--	A3.2	MS	SG, MS	--	--	--	--	--	--	SG, MS	MS#220 [1000]; SG#003 [50]; MS#002 [100]							MS#98[MH]; SG#59[66]; SG#19[1], SG#20[4]; SG#21[2]; SG#22[1]; SG#23[1]; SG#60[41]
MW-OU1-39-A east access road	--	A3.2	MS	MS	--	--	--	--	--	--	MS, SG	MS#220[1000]							MS#98[MH]; SG#24[2]; SG#25[4]; SG#26[1]
MW-OU1-40-A	1999	A3.2	MS	N	N	--	--	--	--	--	--								
MW-OU1-44-A*	2000	NA	SG; MS	--	--	--	--	--	--	--	MS								MS#[87]
MW-OU1-45-A	2001	NA	N	--	N	N	N	--	--	--	--								
MW-OU1-46-A	2001	NA	MS	N	N	N	N	MS	MS	MS	--					MS#34[VS]	MS#27[M]		
MW-OU1-01-180*	2000	A3.3	N	--	--	--	--	--	--	--	N								
MW-OU1-02-180*	2000	A3.3	N	--	--	--	--	--	--	--	N								
MW-OU1-03-180*	2000	A3.2	N	N	N	N	--	--	--	--	N								

Notes:

-- not surveyed

#49 - indicates population identification number assigned in corresponding annual rare plant survey.

[13] indicates number of plants

EW - extraction well

IW - injection well

M - medium

MD - medium high

ML - medium low

MS - Monterey spineflower

MW - monitoring well

N - area was surveyed; but no rare plants were detected.

OU1 - operable unit 1

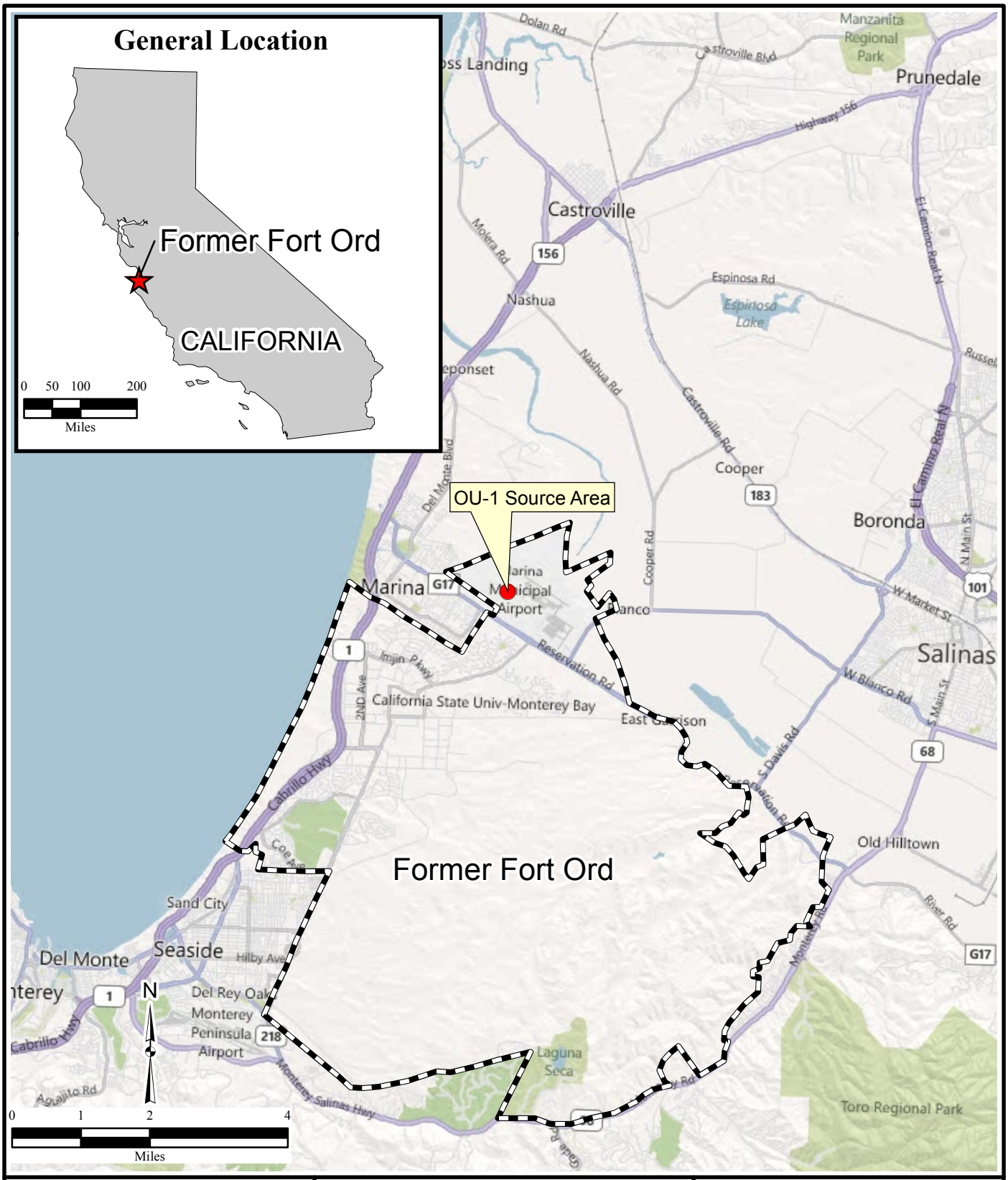
PZ - piezometer

SG - Sand gilia

S - sparse

VS - very sparse

* Well destroyed in 2011 except as follows: MW-OU1-12-A (2002), MW-OU1-24-A (2003), and EW-OU1-48-A (2006)



\\gst-srv-01\hglgis\Ft-Ord_MSIW\IA_Survey_Report_2011\(1-01)location_map.mxd
2/7/2012 CNL
Source: HGL
ESRI Online Bing Maps Road Map

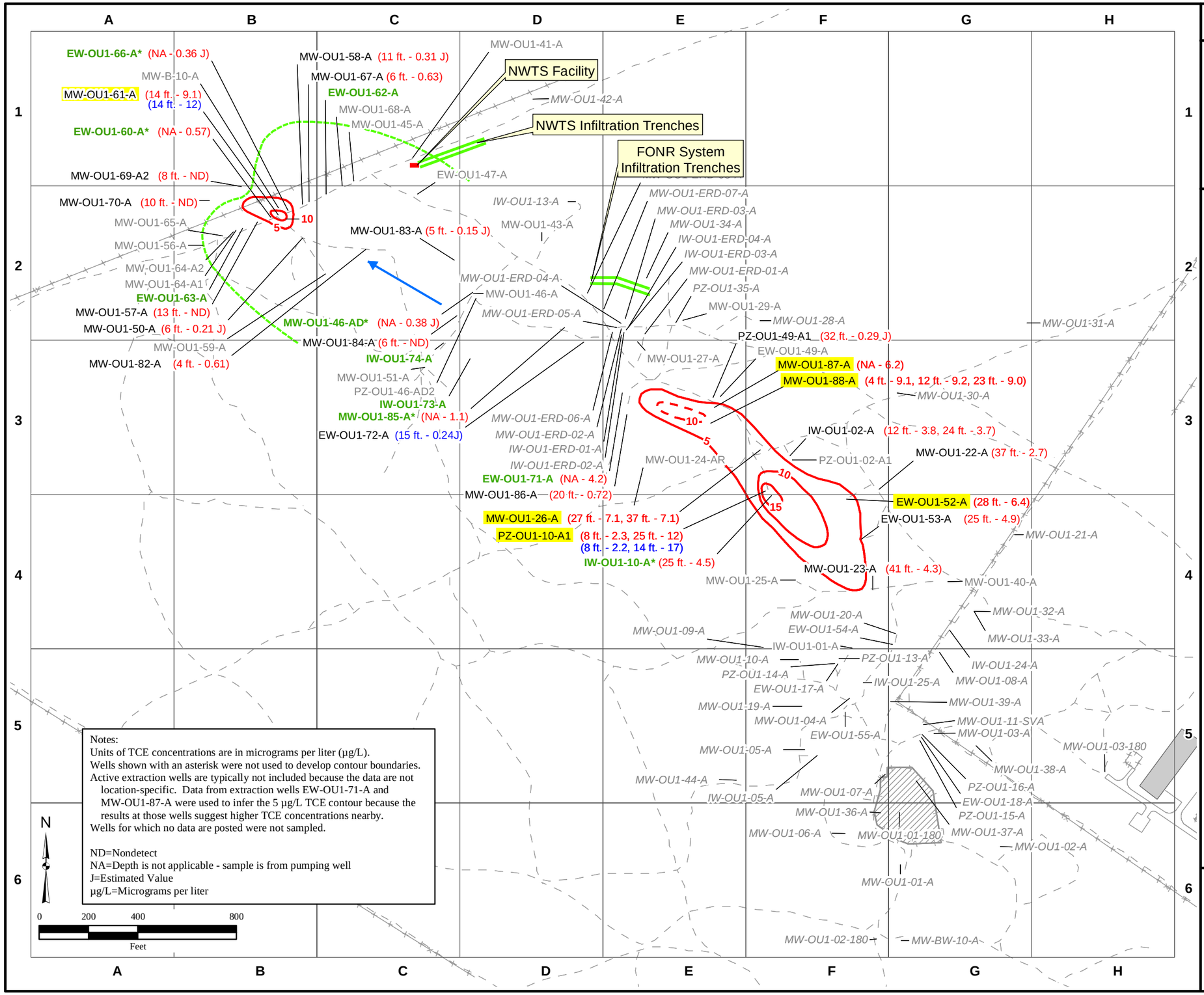
Legend

- OU-1 Source Area
- Former Fort Ord

Figure 1.1
Former Fort Ord

HGL HydroGeoLogic, Inc

Figure 1.2
OU-1 FONR
TCE Concentrations in Groundwater
September and October 2011



Notes:
Units of TCE concentrations are in micrograms per liter (µg/L).
Wells shown with an asterisk were not used to develop contour boundaries.
Active extraction wells are typically not included because the data are not location-specific. Data from extraction wells EW-OU1-71-A and MW-OU1-87-A were used to infer the 5 µg/L TCE contour because the results at those wells suggest higher TCE concentrations nearby.
Wells for which no data are posted were not sampled.

ND=Nondetect
NA=Depth is not applicable - sample is from pumping well
J=Estimated Value
µg/L=Micrograms per liter

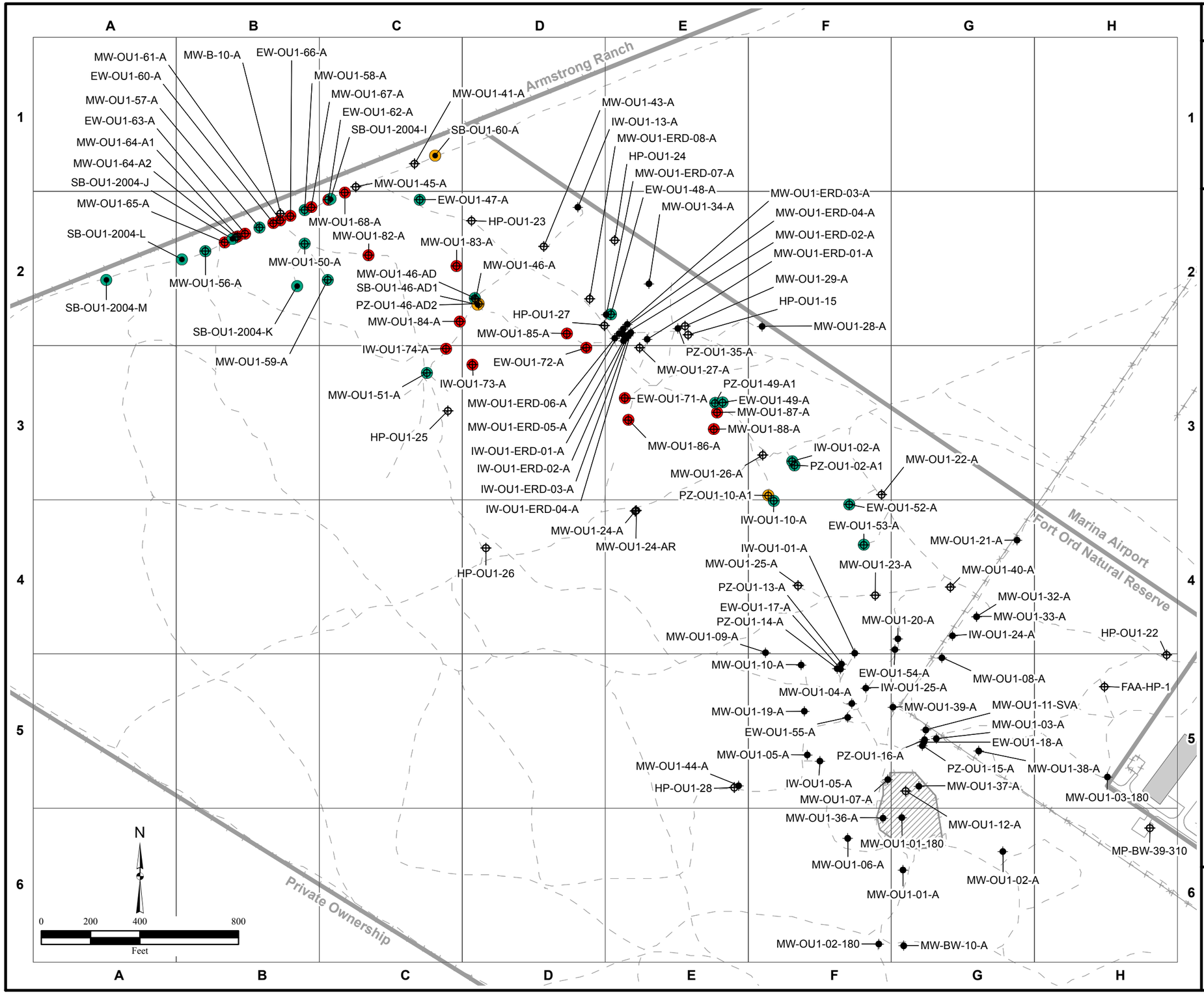
Legend

- Monitoring Well
- Extraction Well — **Bold green** font indicates active well
- Injection Well — **Bold green** font indicates active well
- Piezometer
- MW-OU1-88-A — Locations with TCE Concentrations at or Above ACL (5 µg/L)
- *MW-OU1-31-A* — Well Destroyed 2011
- MW-OU1-88-A — Well ID
  (4 ft. - 7.0) — September 2011 TCE Result (µg/L)
  (14 ft. - 12) — October 2011 TCE Result (µg/L)
  Sample Elevation (feet above mean sea level)
- 5 — TCE Contour (µg/L) Based on September and October 2011 Data (dashed where inferred)
- Trail/Unimproved Road
- Fence
- Treated Water Infiltration Trench
- Estimated Northwest Treatment System Capture Zone
- General Direction of Groundwater Flow
- Former Fire Drill Area
- Building

\\Gst-srv-01\hglgis\Ft_Ord_MSIW\IA_Survey_Report_2011
(1-02)TCE_in_GW_September_2011.mxd
3/1/2012 CNL
Source: HGL

HGL HydroGeoLogic, Inc

Figure 1.3
OU-1 Soil Borings, Wells, and Piezometers Constructed within the FONR



Legend

- Well/Piezometer Drilled Before 2004
- Abandoned Soil Boring
- Well Destroyed September 2011
- 2004 Well/Piezometer
- 2004 Soil Boring
- 2005 Well/Piezometer
- 2005 Soil Boring
- 2006 Well/Piezometer
- MW-OU1-21-A — Well or Boring ID
- Trail/Unimproved Road
- Fence
- Property Boundary
- Former Fire Drill Area
- Building

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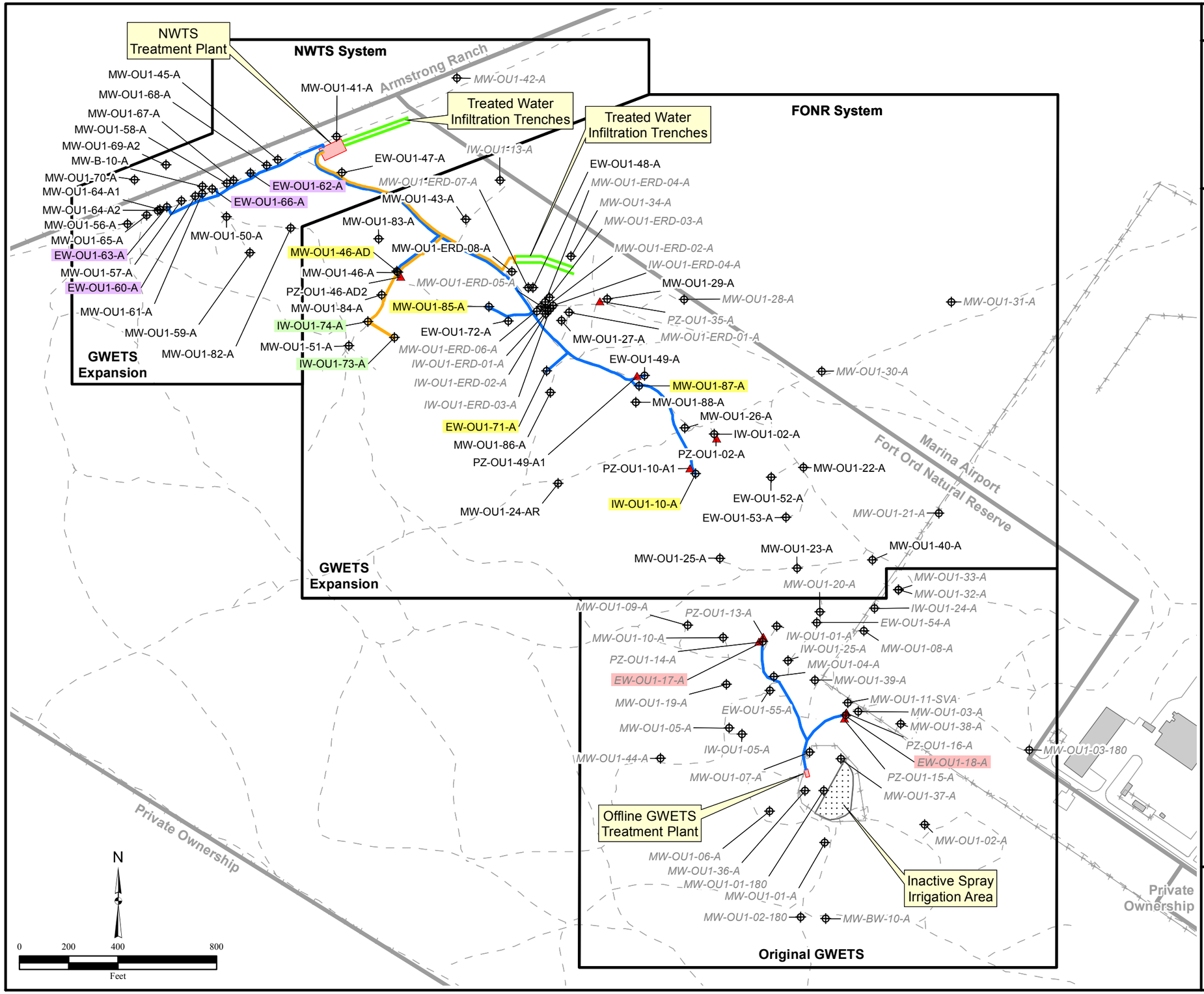
2/7/2012 CNL
Source: HGL

HydroGeoLogic, Inc

Figure 1.4
OU-1 FONR
Remediation System Areas



Legend

- Monitoring Well
- Piezometer
- EW-OU1-18-A — Original GWETS Extraction Well
- IW-OU1-74-A — FONR Injection Well
- MW-OU1-46-AD — FONR Extraction Well
- EW-OU1-63-A — NWTS Extraction Well
- *MW-OU1-31-A* — Well Abandoned September 2011
- Trail/Unimproved Road
- Fence
- Extraction Pipeline
- Treated Water Pipeline
- Treated Water Infiltration Trench
- Property Boundary
- Treatment Plant
- Inactive Spray Irrigation Area
- Building

Notes:
The treated water and extraction water pipelines are located in separate trenches within or near the existing roadway. The separation shown in this figure is exaggerated for clarity.

NWTS=Northwest Treatment System
FONR=Fort Ord Natural Reserve
GWETS=Groundwater Extraction and Treatment System

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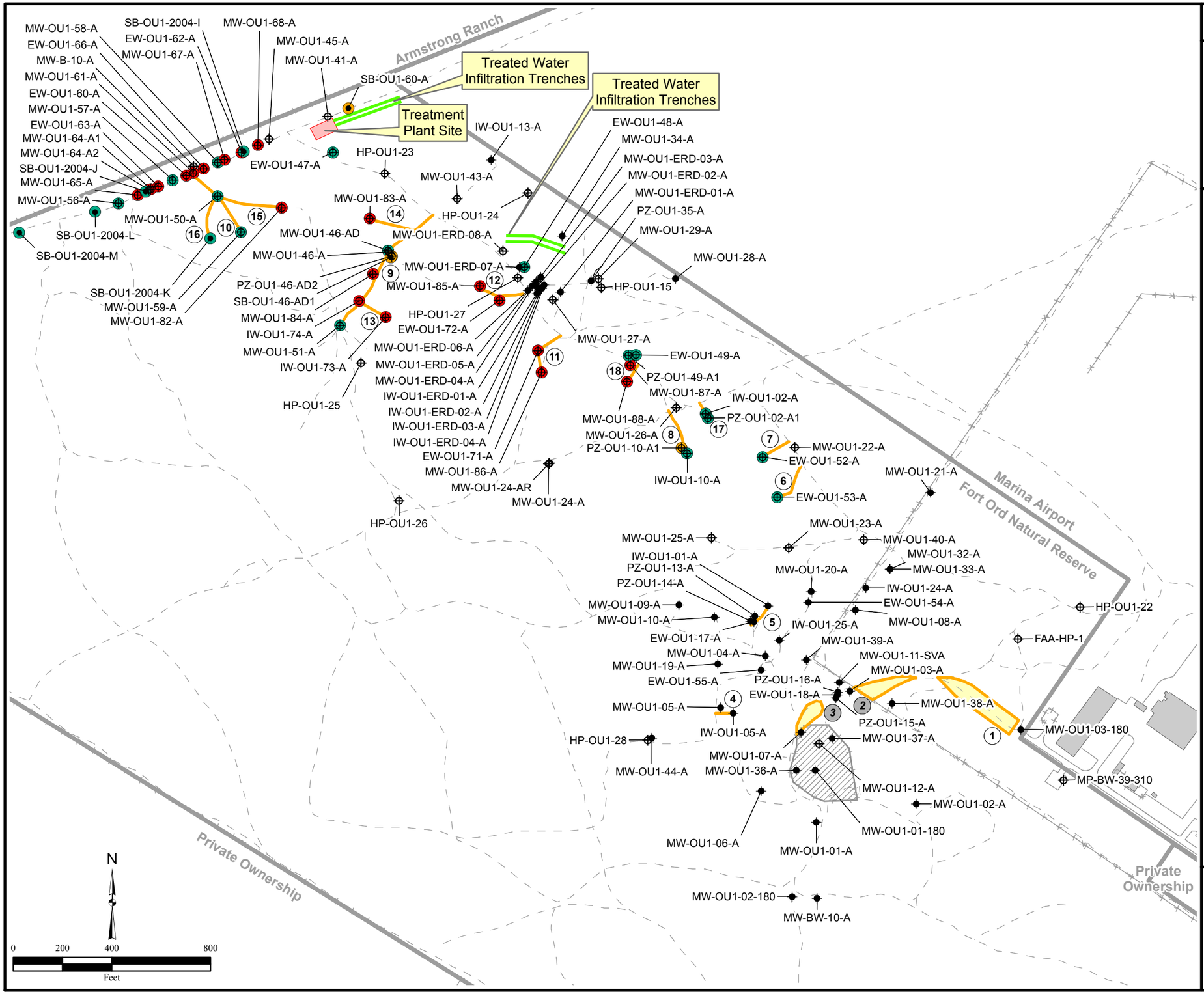
(1-04)GW_Remediation _Sys.mxd
2/7/2012 CNL
Source: HGL

HGL HydroGeoLogic, Inc

Figure 1.5
Year 2011
OU-1 Weed Control Segment Locations



Legend

- Well/Piezometer Drilled Before 2004
- Abandoned Soil Boring
- Well Destroyed September 2011
- 2004 Well/Piezometer
- 2004 Soil Boring
- 2005 Well/Piezometer
- 2005 Soil Boring
- 2006 Well/Piezometer
- MW-OU1-21-A — Well or Boring ID
- Weed Control Segment
- 1 — Active Weed Control Segment Identification Number
- 2 — Inactive Weed Control Segment Addressed in Previous Years
- Trail/Unimproved Road
- Fence
- Property Boundary
- Southern Staging Area in 2004
- Treatment Plant
- Building
- Former Fire Drill Area

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2/7/2012 CNL
Source: HGL

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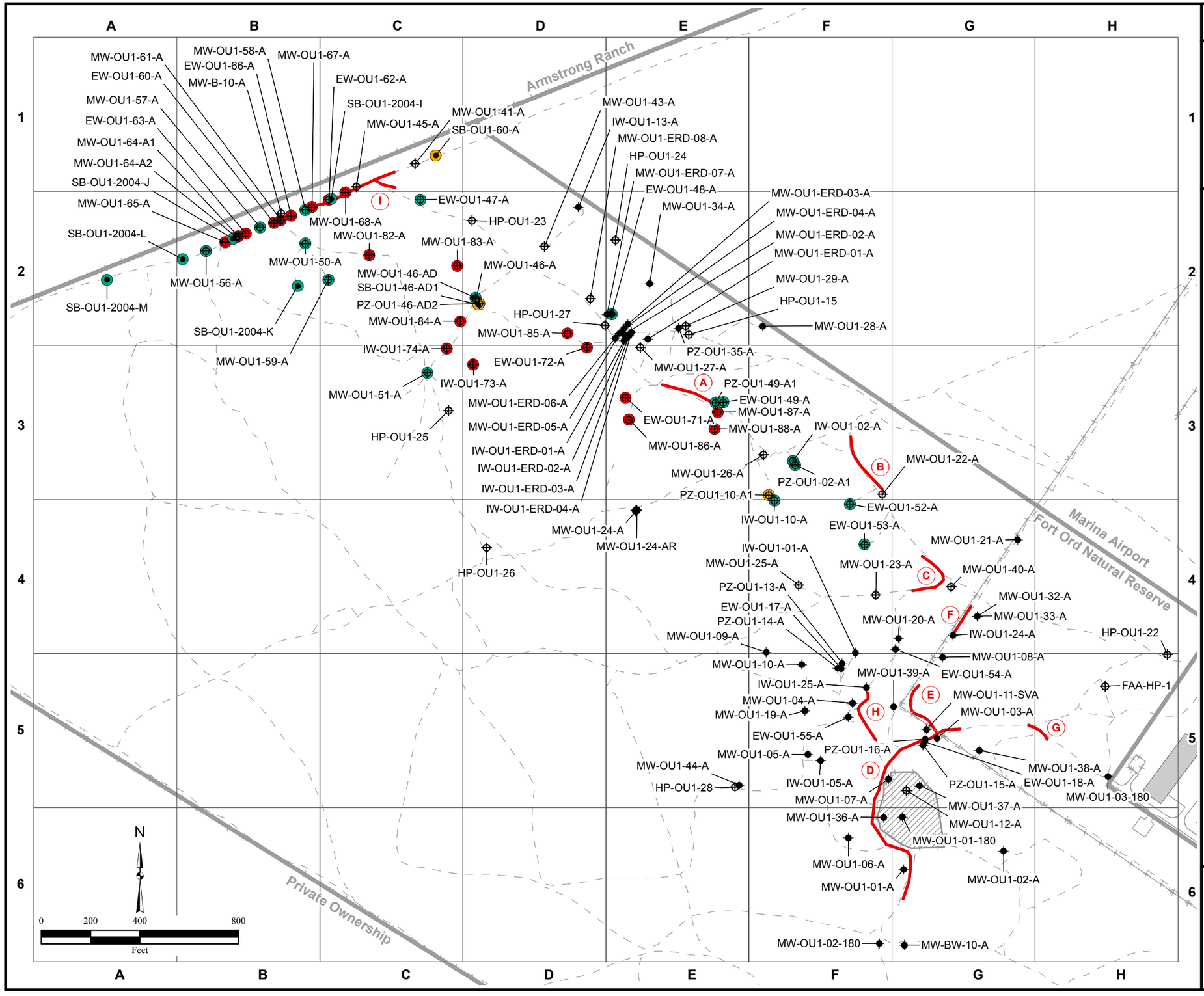
\\gst-srv-01\hglgis\Ft_Ord_MSIW\IA_Survey_Report_2011\(1-06)MW-OU1-61A.mxd
2/7/2012 CNL
Source: HGL
ArcGIS Online Bing Maps aerial

Legend

- Monitoring Well
- Extraction Well
- Area of Potential Disturbance

Figure 1.6
Potential MW-OU1-61-A Project Area

Figure 3.1
Locations of OU-1 Roadway Areas for Potential Erosion Repairs



Legend

- Well/Piezometer Drilled Before 2004
- Abandoned Soil Boring
- Well Destroyed September 2011
- 2004 Well/Piezometer
- 2004 Soil Boring
- 2005 Well/Piezometer
- 2005 Soil Boring
- 2006 Well/Piezometer
- MW-OU1-21-A — Well or Boring ID
- Trail/Unimproved Road
- Fence
- Potential Erosion Repair Area
- A — Roadway Segment Identifier
- Property Boundary
- Former Fire Drill Area
- Building

Note:
OU-1=Operable Unit 1

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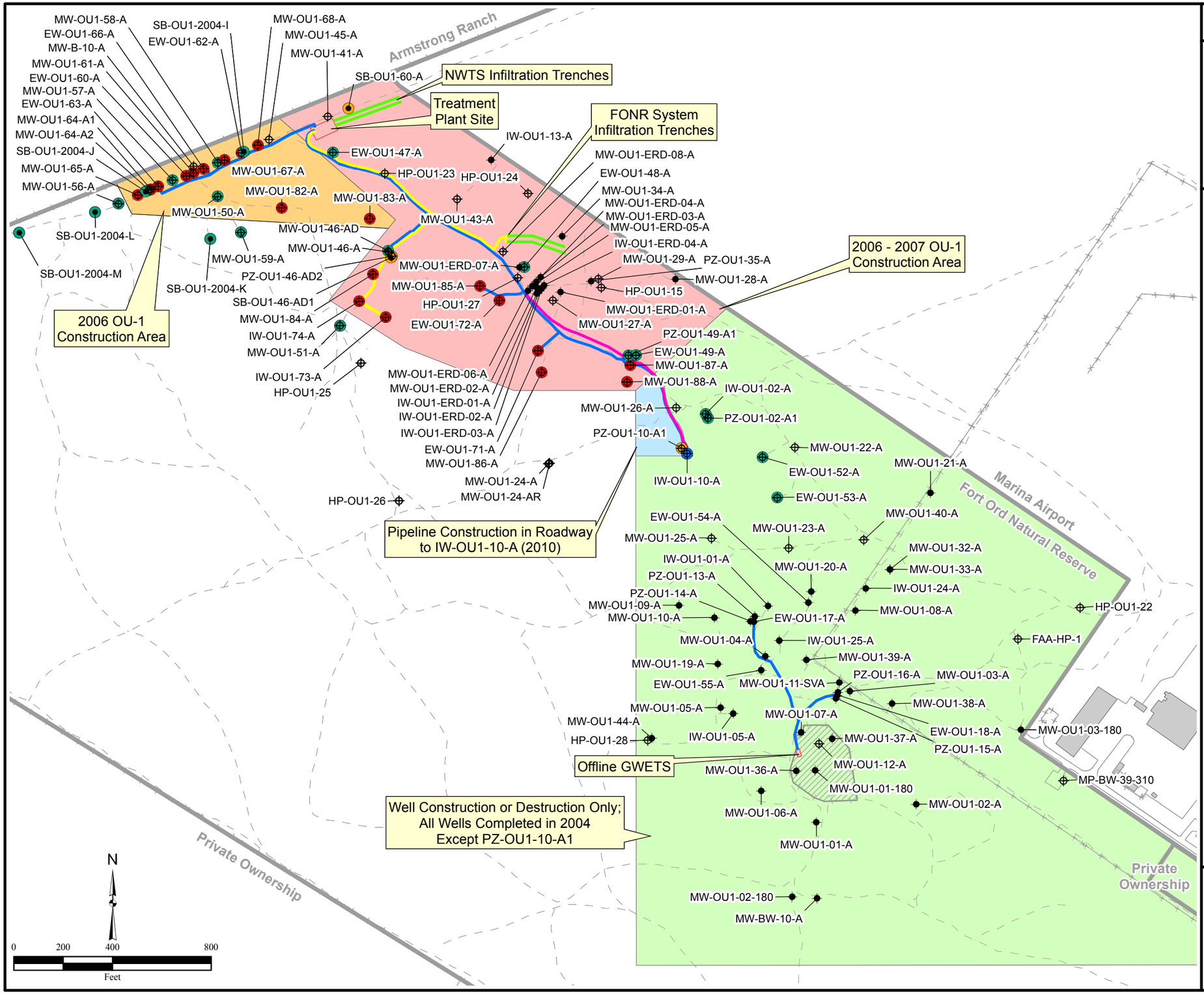
2/13/2012 CNL
Source: HGL

HydroGeoLogic, Inc

Figure 4.1
OU-1 Construction Activities
2004-2011



Legend

- Well/Piezometer Drilled Before 2004
- Abandoned Soil Boring
- Well Destroyed September 2011
- 2004 Well/Piezometer
- 2004 Soil Boring
- 2005 Well/Piezometer
- 2005 Soil Boring
- 2006 Well/Piezometer
- Existing Well Modified in 2010
- MW-OU1-21-A — Well or Boring ID
- IW-OU1-10-A Pipeline Route
- Extraction Pipeline
- Infiltration Trench
- Treated Water Pipeline
- Trail/Unimproved Road
- Fence
- Property Boundary
- Treatment Plant
- Building
- Former Fire Drill Area

Note:
FONR=Fort Ord Natural Reserve
NWTS=Northwest Treatment System
The treated water and extraction water pipelines are located in separate trenches within or near the existing roadway. The separation shown in this figure is exaggerated for clarity.

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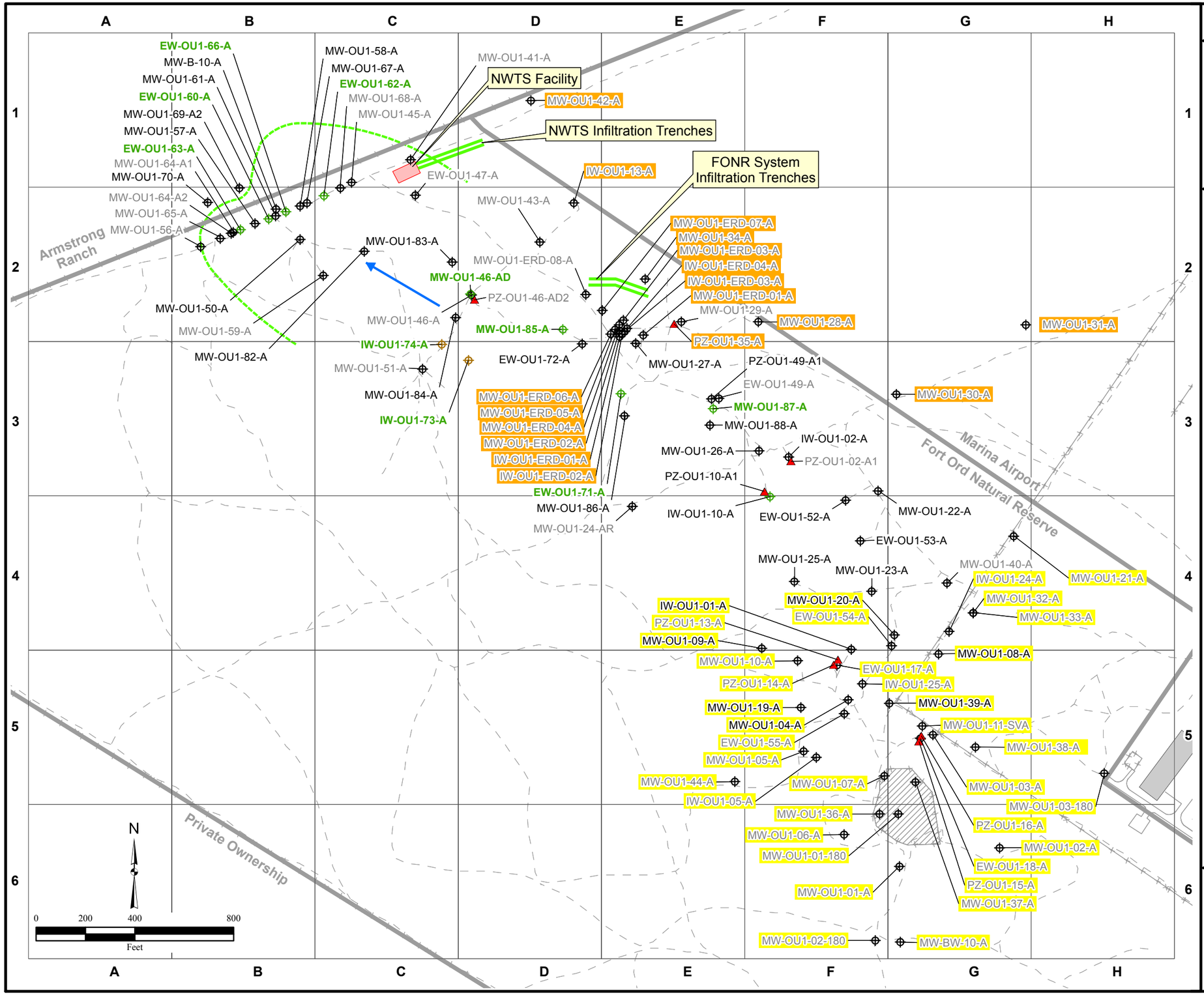
2/7/2012 CNL
Source: HGL

HydroGeoLogic, Inc

Figure 4.2
Former Fort Ord OU-1
Wells Destroyed in 2011



Legend

- Monitoring Well
- Extraction Well (bold green font indicates active well)
- Injection Well (bold green font indicates active well)
- Piezometer
- MW-OU1-88-A — Well ID
- MW-OU1-30-A — Well destroyed in grassland or northwest boundary road
- MW-OU1-02-A — Well destroyed within FONR habitat area
- Trail/Unimproved Road
- Fence
- Treated Water Infiltration Trench
- Estimated Northwest Treatment System Capture Zone
- General Direction of Groundwater Flow
- Property Boundary
- Treatment Plant
- Building
- Former Fire Drill Area

Note:
Well names appearing in gray were not included in OU-1 Groundwater Monitoring Program.

\\gst-srv-01\hglgis\Ft_Ord_MSIW\IA_Survey_Report_2011\(4-02)wells_destroyed_2011.mxd
2/7/2012 CNL
Source: HGL

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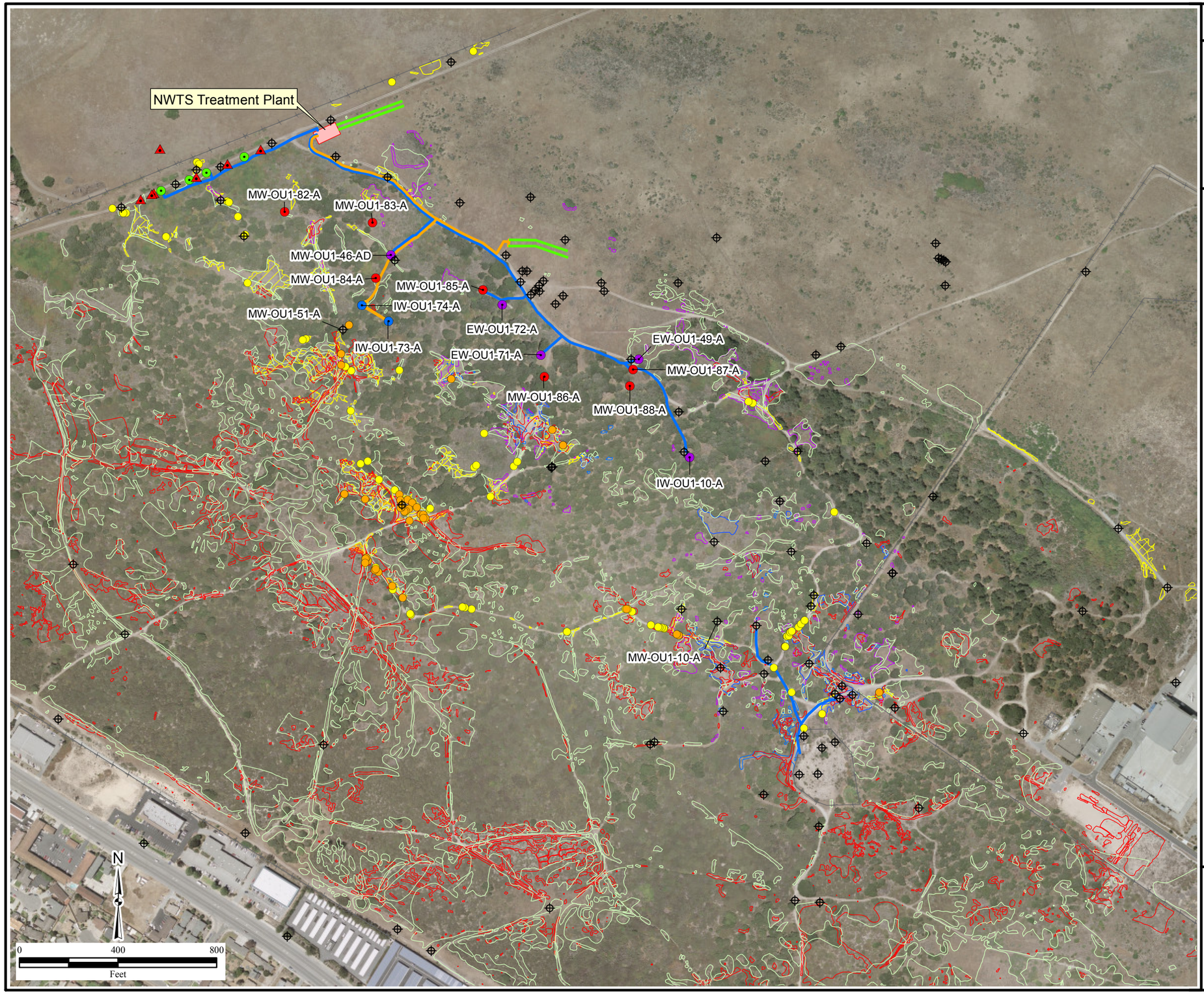
Figure 4.3
Summary
of Rare Plant Survey Results
1998 - 2005



Legend

- Monitoring Well
- Northwest Treatment System Extraction Well
- Northwest Treatment System Performance Monitoring Well
- FONR OU-1 Monitoring Well
- FONR OU-1 Extraction Well
- FONR OU-1 Injection Well
- Extraction Pipeline Route
- Infiltration Trench
- Treated Water Pipeline Route
- Fence

1998 RARE PLANT SURVEY
(University of California Santa Cruz)

- 1998 sand gilia
- 1998 Monterey spineflower

2004 RARE PLANT SURVEY (CH2MHill)

- Monterey spineflower
- Sand gilia

2005 RARE PLANT SURVEY (CH2MHill)

- Sand gilia
- Monterey spineflower
- Sand gilia
- Monterey spineflower - High Density
- Monterey spineflower - Medium Density
- Monterey spineflower - Sparse Density
- Monterey spineflower - Very Sparse Density

\\gst-srv-01\hglgis\Ft_Ord_MSIW\IA_Survey_Report_2011
(4-03)98-05_Plant_Survey.mxd
2/7/2012 CNL
Source: HGL, CH2MHill, UC Santa Cruz

HydroGeoLogic, Inc

2011 FONR IMPACT ASSESSMENT AND HABITAT AND RARE PLANT SPECIES SURVEY RESULTS OPERABLE UNIT 1 FORMER FORT ORD, CALIFORNIA

Appendix A
Results of 2011 Monterey Spineflower and Sand Gilia Surveys

Results of 2011 Monterey Spineflower and Sand Gilia Surveys

DD&A Reference Site and FONR-OU1, California

Prepared for HydroGeoLogic Inc.

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TABLE OF CONTENTS

List of Figures

List of Tables

Acronym List

DD&A	Denise Duffy and Associates, Inc.
CDFG	California Department of Fish and Game
CNDDB	California Natural Diversity Database
FDA	Fire Drill Area
FONR	Fort Ord Natural Reserve
Ft^2	Square Feet
GIS	Geographic Information System
GPS	Global Positioning System
GWETS	Groundwater Extraction and Treatment System
HGL	HydroGeoLogic, Inc.
OU	Operable Unit
TCE	trichloroethene
UCNRS	University of California Natural Reserve System
USACE	United States Army Corps of Engineers
VOC	volatile organic compound

A1.0 Introduction

HydroGeoLogic, Inc. (HGL) is executing a groundwater remediation project at Operable Unit (OU)-1 at the former Fort Ord U.S. Army Base located in Monterey County, California (Figure A1.1). This work was awarded in December 2003 by the U.S. Army Corps of Engineers (USACE)-Sacramento District under Contract Number DACA45-03-D-0029; it is being administered by the USACE-Sacramento District.

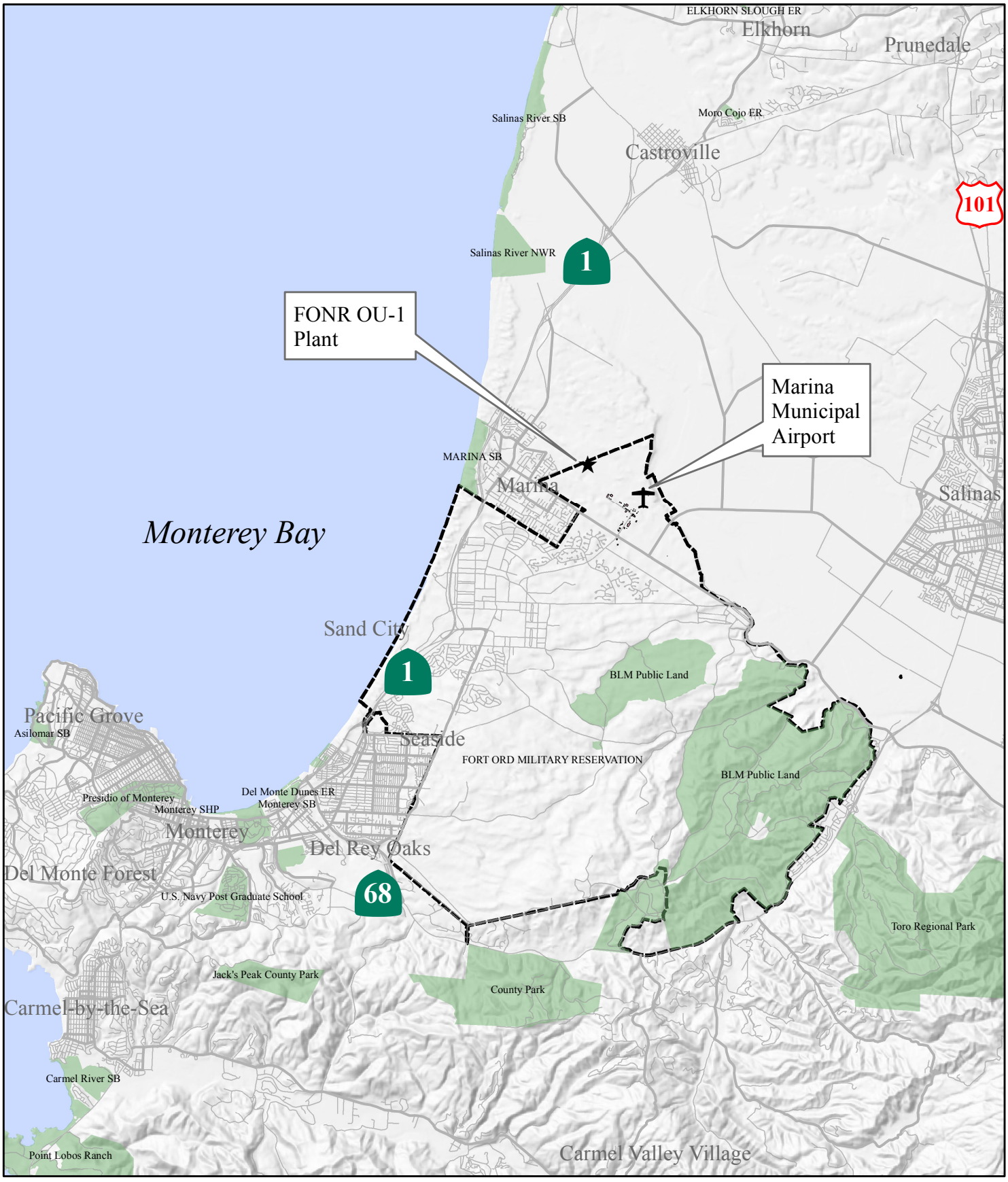
Fort Ord was established in 1917 as a military training base for infantry troops. In January 1991, the Secretary of Defense announced the downsizing/closure of the base. In August 1994, portions of the property were transferred to the University of California and the Fort Ord Natural Reserve (FONR) was established in June 1996. The former Fort Ord is located near Monterey Bay approximately 80 miles south of San Francisco (Figure A1.1). The base consists of approximately 28,000 acres near the cities of Seaside, Sand City, Monterey, Del Rey Oaks, and Marina. Monterey Bay marks the western boundary, Toro Regional Park borders the base to the southeast and land use east is primarily agricultural.

Activities conducted at the former Fort Ord Fritzsche Army Airfield Fire Drill Area (FDA) (i.e., OU-1) between 1962 and 1985 resulted in the release of contaminants to soils and groundwater. Although 10 separate volatile organic compounds (VOCs) were identified as contaminants of concern in groundwater underlying OU-1, trichloroethene (TCE) is the contaminant that was detected at the highest concentrations and across the greatest extent of the affected aquifer. A groundwater extraction and treatment system (GWETS) was constructed in 1988 to remediate TCE and other groundwater contaminants.

A key factor affecting the design and implementation of the groundwater cleanup is the fact the groundwater plume lies beneath a part of the University of California Natural Reserve System (UCNRS) designated as the FONR. The FONR area potentially impacted by the construction of OU-1 remediation facilities is approximately 130 acres. Therefore, the project has the additional constraint that activities undertaken to achieve the OU-1 cleanup adequately protect and maintain the special-status species found within the FONR, specifically two federally listed plant species, Monterey spineflower (*Chorizanthe pungens* var. *pungens*) and sand gilia (*Gilia tenuiflora* ssp. *arenaria*).

A1.1 Survey Objectives

The objectives of the 2011 rare plant survey were to: 1) identify locations and estimate rare plant populations at an identified reference site utilized by Denise Duffy and Associates (DD&A) biologists to determine the blooming period for Monterey spineflower and sand gilia; 2) indentify locations where wells will be dismantled by HGL on FONR property; and 3) to map Monterey spineflower and sand gilia. The DD&A reference site location is shown on Figure A1.2. The well sites planned for dismantling that were surveyed for Monterey spineflower and sand gilia are shown on Figure A1.3.



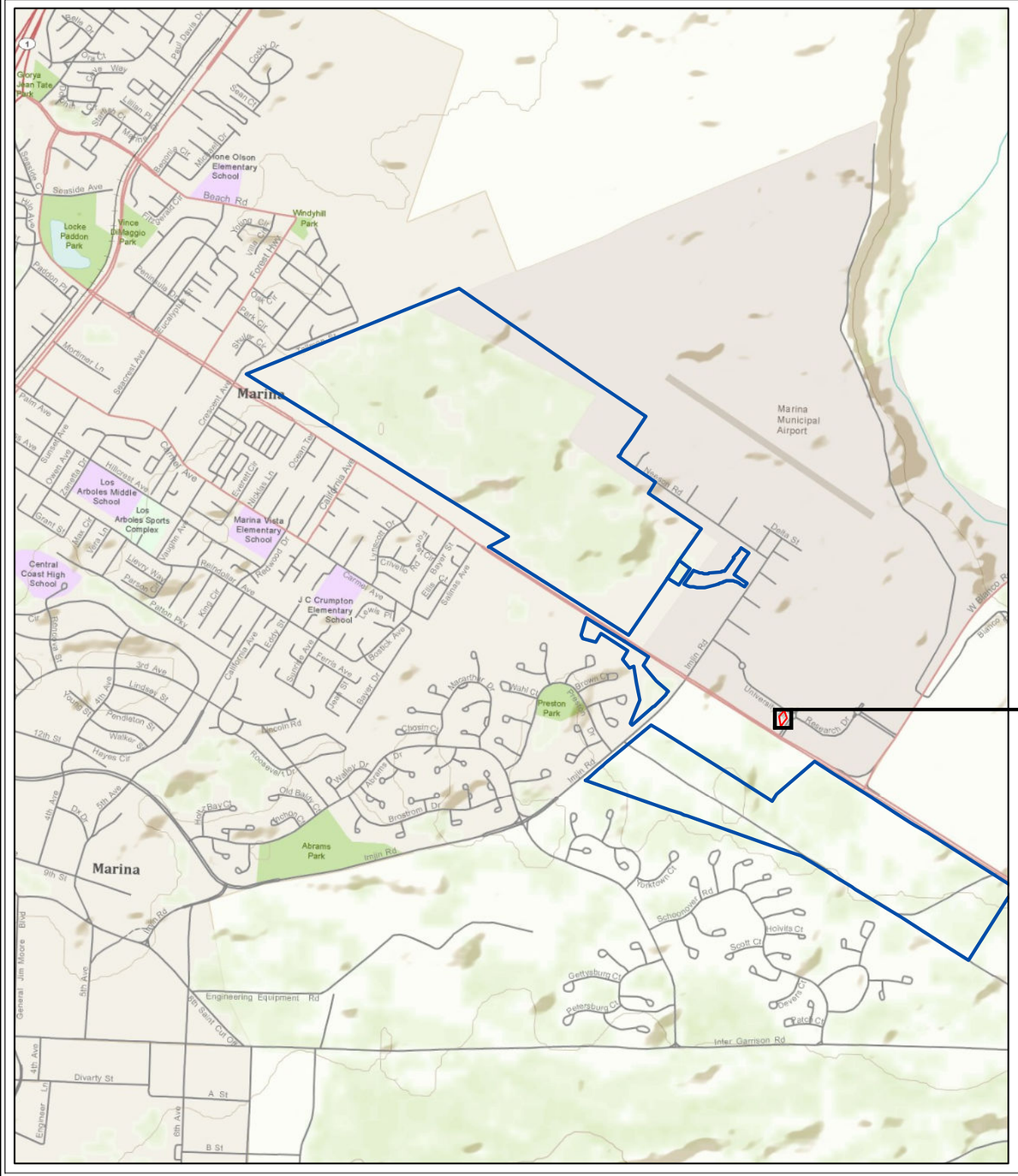
N

0 1.25 2.5 5 Miles

0 2.5 5 10 Kilometers

Figure A1.1

Projecy Vicinity Map

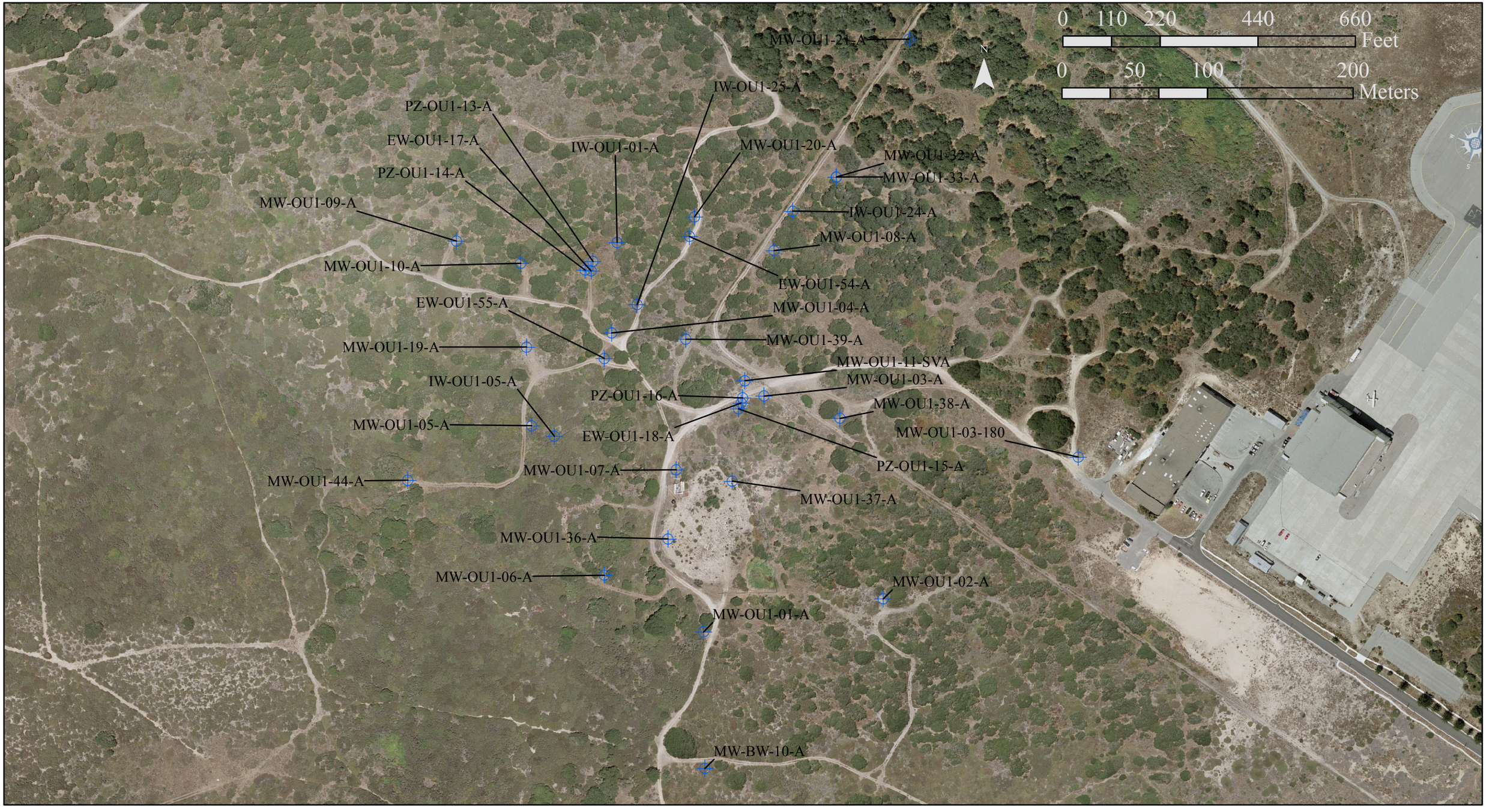


Survey Area

UC FONR Boundary

Figure A1.2

DD&A Reference Site Map



Wells Planned for Dismantling

Figure A1.3

2011 FONR-OU1

Wells Planned for Dismantling

A1.2 Site Location and Description

The dominant habitats in the area surrounding the well sites include coast live oak woodland, maritime chaparral, coastal scrub, disturbed/developed land and annual grassland. Several special-status plant and wildlife species occur within the FONR, including sand gilia and Monterey spineflower. The northern and eastern boundary of OU-1 is adjacent to a large expanse of non-native grassland. Transmission of non-native grass species into OU-1 is accelerated by the prevailing winds, which blow seeds south and into the OU-1 area (Fusari 2004). Non-native grasses and weedy forbs are already present throughout much of the OU-1 area. The spread of non-native, invasive species into newly disturbed areas might result in population declines of Monterey spineflower and, especially, sand gilia, which is less tolerant of plant cover than Monterey spineflower.

Coast live oak woodland is the dominant habitat in the reference area. Grassland and coast live oak woodland is adjacent to the reference site on the northwestern boundary. All other sides of the reference area are bordered by paved roadways (Reservation Road, MBEST Drive and University Drive). Non-native grasses and weedy forbs are already present throughout much of the reference area.

A1.1.1 Sand Gilia

Sand gilia is a small annual in the phlox family (Polemonaceae). Plants range in height from two to six inches with a small, basal rosette of leaves. The lower branches of the stem are generally densely glandular. Plants typically bloom from April through June and have funnel-shaped flowers with narrow, purple to pinkish petal lobes and a purple throat. This species occurs in open sandy soils in dune scrub, coastal sage scrub, and maritime chaparral habitats. Sand gilia is endemic to Monterey Bay and the peninsular dune complexes. A search of the California Natural Diversity Database (CNDDB) revealed that there are 28 occurrences within Monterey County, including the occurrences at Fort Ord (CDFG 2011). It is likely that some of these occurrences are no longer present and the exact number of extant (still in existence) occurrences are unknown.

A1.1.2 Monterey Spineflower

Monterey spineflower is a small, prostrate annual in the buckwheat family (Polygonaceae) that blooms from April to June. The white to rose floral tube of Monterey spineflower distinguishes it from the more common, but closely related diffuse spineflower (*Chorizanthe diffusa*), which has a lemon-yellow floral tube. This species typically occurs on open sandy or gravelly soils in coastal dune, coastal scrub, and maritime chaparral habitats. There are 24 records of Monterey spineflower within Monterey County in the CNDDB (CDFG 2011); however, it is not known how many of these are extant.

A2.0 Methods

The survey area consisted of the DD&A reference site outlined in Figure A1.2 and all well sites scheduled for dismantling on the FONR property as shown in Figure A1.3. The area was surveyed for rare plants Monterey spineflower and sand gilia completely on one survey effort conducted on April 28 and 29, 2011.

A2.1 Rare Plant Surveys

Monterey spineflower and sand gilia were mapped for all well sites within FONR-OU1 scheduled for dismantling in 2011. When either rare plant was identified, the survey in that area was extended to the boundary of the population encountered.

Mapping of rare plant species was done using a Trimble Pathfinder ProXH GPS unit. Large areas of Monterey spineflower and sand gilia were mapped as polygons; smaller groups and individuals were mapped as points with attributes to identify the number of individuals at each location.

Individual counts were made for all sand gilia populations whether they were mapped using points (population < 10) or polygons (population ≥ 10). However, Monterey spineflower were only counted as individuals when groups of less than five were mapped. Monterey spineflower mapped as polygons were characterized according to the percent of cover. The categories ranged from Very Sparse (corresponding to an absolute cover of less than 3 percent), Sparse (3-25 percent), Medium Low (26-50 percent), Medium (51-76 percent), and Medium High (76-97 percent) to Very High (>97-100 percent). GPS data was exported to shapefile format for use in a Geographic Information System (ESRI ArcGIS) and mapped on high resolution aerial photography. The map is represented in Figures A3.1, A3.2 and A3.3.

A3.0 Results

A3.1 Rare Plant Survey Results

A3.1.1 Sand Gilia

Sand gilia was observed and mapped at DD&A reference site. A total of 65 populations (52 points and 13 polygons) of sand gilia were mapped within the DD&A reference area survey boundaries (Table A3.1 and Figures A3.1-A3.3). A total of 1580 individual plants were mapped at the 65 populations.

A3.1.2 Monterey Spineflower

A total of 46 populations (12 points and 34 polygons) of Monterey spineflower were mapped at the DD&A reference site (Table A3.2 and Figures A3.1-A3.3). Because population size estimates are not as easily quantified as the sand gilia populations, individual Monterey spineflower plants were not counted within the GIS polygons. As mentioned in the methods section of this document, populations of Monterey spineflower were given a percentage of cover using visual estimation. Of the 34 populations of

Monterey Spineflower Patches
- Sparse
- Medium-Low
- Medium
- Medium-High

- Sand Gilia Points
- Monterey Spineflower Points
- Sand Gilia Patches
- Survey Area

Figure A3.1

2011 Rare Plant Survey Results
DD&A Reference Area

N

0 90 180 360 Feet

1 inch = 110 feet

EW-OU1-53-A

MW-OU1-21-A

102

MW-OU1-25-A

MW-OU1-40-A

MW-OU1-23-A

101

MW-OU1-33-A

76

104

IW-OU1-24-A

13 95

MW-OU1-20-A

72

EW-OU1-54-A

1

2

3

4

5

6

MW-OU1-09-A

94

91

IW-OU1-01-A

103

MW-OU1-08-A

96

97

14

MW-OU1-10-A

PZ-OU1-13-A

PZ-OU1-14-A

EW-OU1-17-A

92

74

IW-OU1-25-A

75

73

17

18

15

71

MW-OU1-04-A

MW-OU1-39-A

16

59

MW-OU1-19-A

70

EW-OU1-55-A

53

89

90

98

60

20

19

21

22

23

24

25

26

29

28

27

PZ-OU1-16-A

MW-OU1-11-SVA

99

30

61

100

34

MW-OU1-03-A

EW-OU1-18-A

PZ-OU1-16-A

PZ-OU1-15-A

40

35

39

109

38

37

36

33

32

107

108

MW-OU1-38-A

105

31

106

69

MW-OU1-05-A

88

IW-OU1-05-A

86

White labels correspond with special-status plant population ID's from Tables A3.1 & A3.2

Monterey Spineflower Patches

Sparse

Medium-Low

Medium

Medium-High

Sand Gilia Patches

Sand Gilia Points

Monterey Spineflower Points

DD&A

Figure A3.2

2011 Rare Plant Survey Results
North FONR-OU1

Monterey Spineflower Patches

- Sparse
- Medium-Low
- Medium
- Medium-High
- Sand Gilia Patches
- Sand Gilia Points
- Monterey Spineflower Points

Figure A3.3

2011 Rare Plant Survey Results
South FONR-OU1

Table A3.1 Sand Gilia Populations Identified During 2011 Survey

Population #	Number of Individuals	GIS Feature Type	Survey Date	Figure Number
1	4	Point	4/28/2011	**A3.2**
2	2	Point	4/28/2011	**A3.2**
3	2	Point	4/28/2011	**A3.2**
4	4	Point	4/28/2011	**A3.2**
5	3	Point	4/28/2011	**A3.2**
6	1	Point	4/28/2011	**A3.3**
7	3	Point	4/28/2011	**A3.3**
8	3	Point	4/28/2011	**A3.3**
9	1	Point	4/28/2011	**A3.3**
10	4	Point	4/28/2011	**A3.3**
11	2	Point	4/28/2011	**A3.3**
12	5	Point	4/28/2011	**A3.3**
13	5	Point	4/28/2011	**A3.2**
14	6	Point	4/28/2011	**A3.2**
15	1	Point	4/28/2011	**A3.2**
16	4	Point	4/28/2011	**A3.2**
17	5	Point	4/28/2011	**A3.2**
18	2	Point	4/28/2011	**A3.2**
19	1	Point	4/28/2011	**A3.2**
20	4	Point	4/28/2011	**A3.2**
21	2	Point	4/28/2011	**A3.2**
22	1	Point	4/28/2011	**A3.2**
23	1	Point	4/28/2011	**A3.2**
24	2	Point	4/28/2011	**A3.2**
25	4	Point	4/28/2011	**A3.2**
26	1	Point	4/28/2011	**A3.2**
27	3	Point	4/28/2011	**A3.2**
28	1	Point	4/28/2011	**A3.2**
29	2	Point	4/28/2011	**A3.2**
30	2	Point	4/28/2011	**A3.2**
31	5	Point	4/29/2011	**A3.2**
32	5	Point	4/29/2011	**A3.2**
33	5	Point	4/29/2011	**A3.2**
34	5	Point	4/29/2011	**A3.2**
35	4	Point	4/29/2011	**A3.2**
36	2	Point	4/29/2011	**A3.2**
37	9	Point	4/29/2011	**A3.2**
38	3	Point	4/29/2011	**A3.2**
39	2	Point	4/29/2011	**A3.2**
40	1	Point	4/29/2011	**A3.2**
41	3	Point	4/29/2011	**A3.1**
42	1	Point	4/29/2011	**A3.1**
43	1	Point	4/29/2011	**A3.1**
44	5	Point	4/29/2011	**A3.1**
45	6	Point	4/29/2011	**A3.1**

Population #	Number of Individuals	GIS Feature Type	Survey Date	Figure Number
46	3	Point	4/29/2011	**A3.1**
47	5	Point	4/29/2011	**A3.1**
48	4	Point	4/29/2011	**A3.1**
49	8	Point	4/29/2011	**A3.1**
50	2	Point	4/29/2011	**A3.1**
51	1	Point	4/29/2011	**A3.1**
52	1	Point	4/29/2011	**A3.1**
53	697	Polygon	4/28/2011	**A3.2**
54	46	Polygon	4/28/2011	**A3.3**
55	16	Polygon	4/28/2011	**A3.3**
56	187	Polygon	4/28/2011	**A3.3**
57	36	Polygon	4/28/2011	**A3.3**
58	33	Polygon	4/28/2011	**A3.3**
59	66	Polygon	4/28/2011	**A3.2**
60	41	Polygon	4/28/2011	**A3.2**
61	18	Polygon	4/28/2011	**A3.2**
62	26	Polygon	4/29/2011	**A3.1**
63	72	Polygon	4/29/2011	**A3.1**
64	160	Polygon	4/29/2011	**A3.1**
65	20	Polygon	4/29/2011	**A3.1**

Table A3.2 Monterey Spineflower Populations Identified During 2011 Survey

Population #	Number of Individuals or Percent Cover	Cover Class	Survey Date	Figure Number
66	5	N/A	4/28/2011	**A3.3**
67	2	N/A	4/28/2011	**A3.3**
68	1	N/A	4/28/2011	**A3.3**
69	1	N/A	4/28/2011	**A3.2**
70	2	N/A	4/28/2011	**A3.2**
71	5	N/A	4/28/2011	**A3.2**
72	4	N/A	4/28/2011	**A3.2**
73	4	N/A	4/28/2011	**A3.2**
74	4	N/A	4/28/2011	**A3.2**
75	4	N/A	4/28/2011	**A3.2**
76	1	N/A	4/29/2011	**A3.2**
77	4	N/A	4/29/2011	**A3.1**
78	15%	Sparse	4/28/2011	**A3.3**
79	5%	Sparse	4/28/2011	**A3.3**
80	5%	Sparse	4/28/2011	**A3.3**
81	3%	Sparse	4/28/2011	**A3.3**
82	20%	Sparse	4/28/2011	**A3.3**
83	65%	Medium	4/28/2011	**A3.3**
84	15%	Sparse	4/28/2011	**A3.3**
85	5%	Sparse	4/28/2011	**A3.3**
86	15%	Sparse	4/28/2011	**A3.2**
87	25%	Sparse	4/28/2011	**A3.3**
88	5%	Sparse	4/28/2011	**A3.2**
89	10%	Sparse	4/28/2011	**A3.2**
90	5%	Sparse	4/28/2011	**A3.2**
91	35%	Medium-Low	4/28/2011	**A3.2**
92	5%	Sparse	4/28/2011	**A3.2**
93	25%	Sparse	4/28/2011	**A3.2**
94	30%	Medium-Low	4/28/2011	**A3.2**
95	10%	Sparse	4/28/2011	**A3.2**
96	5%	Sparse	4/28/2011	**A3.2**
97	10%	Sparse	4/28/2011	**A3.2**
98	70%	Medium-High	4/28/2011	**A3.2**
99	25%	Sparse	4/28/2011	**A3.2**
100	10%	Sparse	4/28/2011	**A3.2**
101	20%	Sparse	4/29/2011	**A3.2**
102	15%	Sparse	4/29/2011	**A3.2**
103	30%	Medium-Low	4/29/2011	**A3.2**
104	25%	Sparse	4/29/2011	**A3.2**
105	15%	Sparse	4/29/2011	**A3.2**
106	5%	Sparse	4/29/2011	**A3.2**
107	20%	Sparse	4/29/2011	**A3.2**
108	10%	Sparse	4/29/2011	**A3.2**
109	10%	Sparse	4/29/2011	**A3.2**
110	30%	Medium-Low	4/29/2011	**A3.1**
111	30%	Medium-Low	4/28/2011	**A3.3**

Monterey spineflower that were mapped as polygons, one population had Medium-High (76-97 percent) cover class, one population had Medium (51-76 percent) cover class, five populations had Medium-Low (26-50 percent) cover class and 27 populations had a Sparse cover class (3-25 percent).

A4.0 Conclusions

Sand gilia populations were observed in more locations than Monterey spineflower populations (65 locations versus 46 locations of Monterey spineflower). DD&A conducted rare plant surveys from 2006-2011 within the FONR OU-1 property, and the 2011 rare plant survey was the first year sand gilia populations outnumbered Monterey spineflower populations.

Sand gilia at the FONR OU-1 site have historically shown fluctuation due to natural variation. For example, the 2006 survey found 40 sand gilia plants in 5 areas at the west end of Survey Site 6 yet none in subsequent years. Based on this finding in 2006, HGL avoided activity in this area and re-located the originally proposed well approximately 180 feet to the east. The data illustrate population fluctuations in an area that was not impacted by human disturbance. Relatively abundant Monterey spineflower populations do not seem as equally affected by the same constraints as sand gilia. Previous rare plant surveys conducted by DD&A also indicate that populations of Monterey spineflower were often observed in areas with sparse to moderately abundant non-native annual grass cover, suggesting that this species may be somewhat more tolerant of annual grass cover than sand gilia.

A5.0 Comparisons

In 2010, DD&A did not survey rare plants on FONR-OU1; rare plant surveys were only conducted in the DD&A reference area. This section will compare the results of the 2011 rare plant survey within the DD&A reference area with the 2010 survey within the same area. However, since DD&A did not survey FONR-OU1 during 2010, the 2011 rare plant surveys for the FONR-OU1 property will be compared with surveys conducted in 2007.

A5.1 DD&A Reference Area

In 2010, 14 populations of sand gilia (seven polygons and seven points) were mapped within the DD&A reference area. A total of 1086 individual plants were mapped at the 14 populations. In 2011, 16 populations of sand gilia (12 polygons and four points) were mapped within the DD&A reference area. A total of 318 individual plants were mapped at the 16 populations. The sand gilia polygons covered approximately 1714.7 ft^2 in 2010 and approximately 1409.5 ft^2 in 2011, a difference of 338.2 ft^2. The most significant change in sand gilia cover was located on the southeastern end of the reference area. This area is an open hillside with less protective cover (coast live oak and chaparral habitat) when compared to the rest of the reference area. Disturbance from wind and water erosion may account for the loss of sand gilia cover from 2010 to 2011. With only

two survey years to compare it is difficult to make any definitive statements about the sand gilia population at this reference area.

A total of two populations (two polygons, one Medium-Low and one Sparse) of Monterey spineflower were mapped at the DD&A reference site in 2010. One Monterey spineflower polygon (Sparse) was mapped within the DD&A reference area in 2011. The Monterey spineflower polygons covered approximately 2846.1 ft^2 in 2010 and approximately 2865.4 ft^2 in 2011, a difference of 19.3 $ft^{2.}$ Although the total area covered by Monterey spineflower is relatively the same from 2010 to 2011, the polygon located at the southeast corner of the reference area was a lower class than the rest of the site (Sparse compared to Medium-Low). This is the same area mentioned above when discussing the decline in sand gilia. This observation supports the hypothesis that the lack of cover resulted in an increase in the amount of disturbance which negatively affected both rare plat populations. Again, with only two years to compare it is difficult to make any definitive statements in regard to the rare plant populations at this reference site.

A5.2 FONR-OU1

During the 2007 rare plant surveys well locations EW-OU1-54-A, IW-OU1-24-A, IW-OU1-01-A, IW-OU1-25-A, EW-OU1-55-A, and IW-OU1-05-A were al surveyed. The 2007 rare plant survey also included staging areas adjacent to well locations MW-OU1-11-SVA, MW-OU1-03-A, PZ-OU1-16-A, EW-OU1-18-A, PZ-OU1-15-A, PZ-OU1-16-A and MW-OU1-38-A. All of these well locations were surveyed during the 2011 rare plant surveyed and dismantled during the 2011 construction effort.

Twelve polygons of Monterey spineflower (all Sparse cover class) totaling 4357.2 ft^2 were recorded during the 2007 rare plant surveys at the locations described above. Four points of Monterey spineflower totaling six individual plants were also recorded. In 2011, the same survey areas resulted in nine polygons of Monterey spineflower (one Medium-High, one Medium-Low and seven Sparse cover class) totaling 10433.6 ft^2, an increase of 6,076.4 ft^2. Six points of Monterey spineflower totaling 23 individuals were also recorded.

Five polygons of sand gilia totaling 634.4 ft^2 (260 individuals) were recorded during the 2007 rare plant surveys at the locations described above. Five points of Monterey spineflower totaling nine individual plants were also recorded. In 2011, the same survey areas resulted in one polygon of sand gilia totaling 30.9 ft^2 (18 individuals). Sixteen points of sand gilia totaling 52 individuals were also recorded.

Monterey spineflower and sand gilia at these survey locations both survived the first construction effort; continued monitoring at these locations will determine whether the 2011 construction effort has had an effect on these rare plant populations.

A6.0 References

California Natural Diversity Database, 2011. Biogeographic Data Branch, Department of Fish and Game

2011 FONR IMPACT ASSESSMENT AND HABITAT AND RARE PLANT SPECIES SURVEY RESULTS OPERABLE UNIT 1 FORMER FORT ORD, CALIFORNIA

Appendix B
Report on Weed Control Segment Treatments Spring 2011

OPERABLE UNIT 1 (OU-1)

2011 WEED CONTROL SEGMENT TREATMENT REPORT

UNIVERSITY OF CALIFORNIA - FORT ORD NATURAL RESERVE

SPRING 2011

Prepared for:

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TABLE OF CONTENTS

TABLES

ATTACHMENTS

Introduction

Weed control efforts continued on HydroGeoLogic, Inc. (HGL) work sites within the Operable Unit 1 (OU-1) portion of the Fort Ord Natural Reserve (FONR) in 2011. Weed control work was similar to the 2010 efforts and emphasized control of non-native grasses before they were able to establish in habitat disturbed by groundwater clean-up activities. Comprehensive vegetation surveys (e.g. species composition and cover data) of Weed Control Segments (WCS) were not conducted in 2011, which is consistent with the 2008- 2010 weed control efforts. It is our opinion that these comprehensive vegetation surveys are not necessary each year. Rather, vegetation surveys are intended to evaluate success of WCS treatments, which might not be evident within one year. This report summarizes the 2011 weed control efforts, data collection and survey results.

Methods

WCS treatments began 19 April 2011 and continued through 19 July 2011. Each WCS received between 1-3 treatments (weedeater and hand pulling) depending on site-specific phenology, response to treatments, and species composition. Five WCS were treated three times (8A, 11A, 11B, 12B, 14A), sixteen WCS were treated twice (1A, 2A, 4A, 5A, 6A, 7A, 9A, 9B, 10A, 10B, 12A, 13A, 15A, 16A, 17A, 18A), and three WCS (3A, 9C, 9D) received only one treatment. Prior to the initial treatment, rare plant surveys were conducted within each WCS. In addition, pre-treatment photos were taken from photo stations within each WCS. After performing a treatment, a WCS treatment record and a WCS treatment diagram were completed. The WCS treatment record includes: treatment date, treatment method(s), species treated, treatment duration, photo stations, and any additional notes about the site or treatment. The WCS treatment diagram includes the extent of the treatment and the species treated within the site. These diagrams, although not drawn to scale, also show the spatial extent, well location, well site/road boundaries, and photo stations/points for each

WCS. After performing the final treatment of the season, post-treatment photos were taken from appropriate photo stations within each WCS.

Results

The 2011 weed control program significantly reduced the survivorship, abundance, and seed production of target species in areas disturbed by OU-1 cleanup activities. Pre-treatment rare plant surveys (Attachment 2) identified locations of rare plants prior to treatments. Thus, we were able to avoid areas with protected species and ensure they were not negatively impacted by treatments. The results of the rare plant surveys (Table 3) show that sand gilia (*Gilia tenuiflora ssp. arenaria*) were present in 2 WCS (5A, 6A) and Monterey spineflower (*Chorizanthe pungens var. pungens*) were present in 14 WCS. Treatment details for each WCS are summarized in Tables 1 & 2. Along with this report, we have included the following documentation as attachments:

- treatment diagrams (described above; Attachment 1)
- rare plant survey data (Attachment 2)
- rare plant survey diagrams (Attachment 3)
- detailed photo log (Attachment 4)
- pre- & post treatment photos (Attachment 5)
    - Powerpoint file with photos formatted for printing
    - Original digital photo files (.jpgs) included on compact disc)

Discussion

Early spring implementation enabled us to effectively utilize mechanical methods to control non-native annual grasses and forbs. Both mechanical and hand control methods were utilized making the weed control efforts more effective, broad scale and sensitive to rare species habitat.

Multiple treatments were focused on high priority sites, with prioritization based on habitat type, rare plant presence, and weed species composition. Pre-treatment rare plant surveys identified 31 m^2 of sand gilia occupied habitat and 617 m^2 of Monterey spineflower occupied habitat. These pre-treatment surveys are essential to ensure mechanical weed treatments do not have a negative impact on protected species. Because weed control efforts were initiated at the appropriate time, we were able reduce seed production of a significant portion of non-native annual grasses in locations where control was critical (i.e. within or adjacent to chaparral and scrub habitat). The continued removal of invasive forbs resulted in a reduction of thousands of invasive weeds from the well sites that may have otherwise expanded their distribution into FONR and increased their seed bank in areas disturbed by OU-1 clean-up activities. It is difficult to determine with measureable certainty if the relatively low weed abundance observed this year is a result of annual variation, climate conditions, or effective weed control. However, we are confident the weed abatement efforts are having a positive impact on reducing weed populations on the OU-1 cleanup sites. As a result, our efforts have reduced the number of invasive plants and, very importantly, removed a large portion of the invasive weed seed source for 2011.

Table 1. Summary of Weed Control Segment (WCS) treatments, spring 2011.

WCS	Well ID	# of Treatments	Time (hrs)	Treatment Method	Species Treated	Rare Plants Present	WCS of High Concern**
1A	NA – Staging Area	2	3.5	weedeater	aica, brdi, brimax, brmaru, hysp, vusp,	N	
2A	NA – Staging Area	2	4.2	weedeater	brdi, brmaru, hysp	N	
3A	NA – Staging Area	1	1.2	weedeater	aica, brdi, brmaru, hysp, vusp	N	
4A	IW-OU1-05-A	2	2.5	weedeater	brdi, brmaru, hysp, vusp	N	*
5A	IW-OU1-01-A	2	6.2	weedeater, hand pull	aica, avsp, brdi, brmaru, ersp, hysp, vusp,	Y	*
6A	EW-OU1-53-A	2	7.3	weedeater, hand pull	aica, brdi, hysp, vusp	Y	*
7A	EW-OU1-52-A	2	2.7	weedeater	brdi, brimax, brmaru, hysp, vusp,	Y	
8A	IW-OU1-10-A, PZ-OU1-10-A2	3	4.2	weedeater, hand pull	aica, avsp, brdi, brimax, ceme, coma, hysp	N	
9A	MW-OU1-46-A MW-OU1-46-AD PZ-OU1-46-AD2	2	3.8	weedeater, hand pull	aica, brdi, brmaru, brimax, hysp, vusp	Y	
9B	MW-OU1-84-A	2	5.2	weedeater, hand pull	aica, avsp, brdi, brmaru, coma, hysp, vusp,	Y	
9C	MW-OU1-50-A	1	3.6	weedeater	aica, avsp, brdi, brmaru, hysp,	Y	*
9D	MW-OU1-51-A	1	2.2	weedeater	aica, brdi, brmaru, coma, hysp,	Y	*
10A	MW-OU1-50-A	2	2.7	weedeater	avsp, brdi, brimax, brmaru, capy, hysp, vusp,	Y	
10B	MW-OU1-59-A	2	4.5	weedeater, hand pull	aica, avsp, brdi, brimax, brmaru, capy, hysp, vusp	Y	
11A	IW-OU1-71-A	3	5.6	weedeater	aica, brdi, brimax, brmaru, vusp,	N	
11B	EW-OU1-86-A	3	4.2	weedeater	brdi, brimax, ersp, hysp, oxpe, vusp,	N	
12A	EW-OU1-72-A	2	5.5	weedeater	brdi, brimax, brmaru, ersp, hysp,	N	

WCS	Well ID	# of Treatments	Time (hrs)	Treatment Method	Species Treated	Rare Plants Present	WCS of High Concern**
12B	MW-OU1-85-A	3	4.5	weedeater, hand pull	aica, avsp, brdi, brimax, brmaru, capy, ceme, hysp, ruac, vusp	Y	
13A	IW-OU1-73-A	2	4.5	weedeater	avsp, brdi, brmaru, hysp, vusp	Y	*
14A	MW-OU1-83-A	3	4.5	weedeater	brdi, brmaru, hysp, vusp	Y	*
15A	MW-OU1-82-A	2	3.5	weedeater, hand pull	avsp, brdi, brimax, brmaru, hysp, vusp	Y	*
16A	SB-OU1-2004-K	2	5.2	weedeater, hand pull	brdi, brimax, brmaru, capy, vusp	Y	*
17A	PZ-OU1-02-A IW-OU1-02-A	2	2.2	weedeater	avsp, brdi, brmaru, hysp, vusp	N	
18A	MW-OU1-88A	2	3.7	weedeater	avsp, brdi, brimax, ersp hysp, vusp	N	

** **WCS of High Concern**– this classification represents a subjective judgment based on a number of factors, including (among others) the number and frequency of treatments, observed response to treatments, and the species composition of the site.

Table 2. Invasive species treated within the 22 Weed Control Segments (WCS), spring 2011.

Genus	Species	Code	Common Name
Aira	*caryophyllea*	aica	slivery hair-grass
Anaglis	*arvensis*	anar	scarlet pimpernel
Anthriscus	*caucalis*	anca	bur-chervil
Avena	species	avsp	wild oat species (Note: species not identified – avsp includes both *Avena barbata* and *A. fatua*)
Briza	*maxima*	brimax	rattlesnake grass
Bromus	*catharticus*	brca	prairie grass
Bromus	*diandrus*	brdi	ripgut grass
Bromus	*hordeaceus*	brho	soft chess
Bromus	*madritensis ssp. rubens*	brmaru	red brome
Carpobrotus	*edulis*	caed	iceplant, hottentot fig
Carduus	*pycnocephalis*	capy	Italian thistle
Conium	*maculatum*	coma	poison hemlock
Erodium	species	ersp	Erodium species (Note: species not identified – ersp includes *Erodium botrys, Erodium brachycarpum, Erodium cicutarium* and *Erodium moschatum*)
Hordeum	*vulgare*	hovu	common barley
Hypochaeris	species	hysp	cats ear species (Note: species not identified – hysp includes both *Hypochaeris glabra* and *H. radicata)*
Oxalis	*pes-caprae*	oxpe	Bermuda buttercup
Rumex	*acetosella*	ruac	sheep sorrel
Silybum	*marianum*	sima	milk thistle
Sonchus	*oleraceus*	sool	common sowthistle
Vulpia	species	vusp	fescue species (Note: species not identified – vusp includes *Vulpia bromoides, V. myuros var. hirsute,* and *V. myuros var. myuros*)

Table 3. Summary Weed Control Segment (WCS) rare plant surveys, spring 2011.

WCS	Well ID	Rare Plant Species Present	# Patches within WCS	Total Occupied Area (m^2)	Patch Density/Coverage & Patch Area Sub-total
5A	IW-OU1-01-A	*Gilia tenuiflora ssp. arenaria*	3	3	3 patches – Very Low / 1 m^2
		Chorizanthe pungens var. *pungens*	28	103	11 patches – Sparse / 69 m^2 17 patches Very Sparse / 34 m^2
6A	EW-OU1-53-A	*Gilia tenuiflora ssp. arenaria*	16	76	1 patch – Very High / 1 m^2 1 patch – High / 2 m^2 2 patches – Medium / 2 m^2 6 patches – Low / 7 m^2 16 patches Very Low / 16 m^2
		Chorizanthe pungens var. *pungens*	26	28	2 patches Medium / 14.5 m^2 6 patches - Sparse / 47.5 m^2 8 patches - Very Sparse / 14 m^2
7A	EW-OU1-52-A	*Chorizanthe pungens* var. *pungens*	5	12	5 patches - Very Sparse / 12 m^2
9A	MW-OU1-46-A MW-OU1-46-AD PZ-OU1-46-AD2	*Chorizanthe pungens* var. *pungens*	16	67	1 patch – Medium / 8 m^2 6 patches - Sparse / 41 m^2 9 patches - Very Sparse / 18 m^2
9B	MW-OU1-84-A	*Chorizanthe pungens* var. *pungens*	13	36	1 patch – Medium / 5 m^2 4 patches - Sparse / 18 m^2 8 patches - Very Sparse / 13 m^2
9C	MW-OU1-50-A	*Chorizanthe pungens* var. *pungens*	5	70	2 patches – Medium / 50 m^2 3 patches - Sparse / 20 m^2
9D	MW-OU1-51-A	*Chorizanthe pungens* var. *pungens*	3	12	1 patch - Sparse / 10 m^2 2 patches - Very Sparse / 2 m^2
10A	MW-OU1-50-A	*Chorizanthe pungens* var. *pungens*	1	75	1 patch – Medium / 75 m^2
10B	MW-OU1-59-A	*Chorizanthe pungens* var. *pungens*	3	38	1 patch – Medium / 24 m^2 2 patches - Sparse / 14 m^2
12B	MW-OU1-85-A	*Chorizanthe pungens* var. *pungens*	2	9	1 patch - Sparse / 8 m^2 1 patch - Very Sparse / 1 m^2
13A	IW-OU1-73-A	*Chorizanthe pungens* var. *pungens*	3	5	3 patches - Very Sparse / 5 m^2

WCS	Well ID	Rare Plant Species Present	# Patches within WCS	Total Occupied Area (m^2)	Patch Density/Coverage & Patch Area Sub-total
14A	MW-OU1-83-A	*Chorizanthe pungens* var. *pungens*	16	92	2 patches - High / 14 m^2 2 patches – Medium / 10 m^2 7 patches - Sparse / 62 m^2 5 patches - Very Sparse / 6 m^2
15A	MW-OU1-82-A	*Chorizanthe pungens* var. *pungens*	3	12	2 patches - Sparse / 9 m^2 1 patch - Very Sparse / 3 m^2
16A	SB-OU1-2004-K	*Chorizanthe pungens* var. *pungens*	1	10	1 patch - Sparse / 10 m^2

Attachment 1

‘TREATMENT DIAGRAMS 2011’

The attached diagrams show the extent of the treatment and the species treated within each Weed Control Segment (WCS) for the 2011 weed control program within the Operable Unit 1 portion of the FONR. These diagrams (not drawn to scale) also show the spatial extent, well location, well site/road boundaries, and photo stations/points for each Weed Control Segment.

Well Site/Road Diagram

Well ID: N/A

Date 5-19-11

WCS Sub Group WS 1

Surveyor AFM

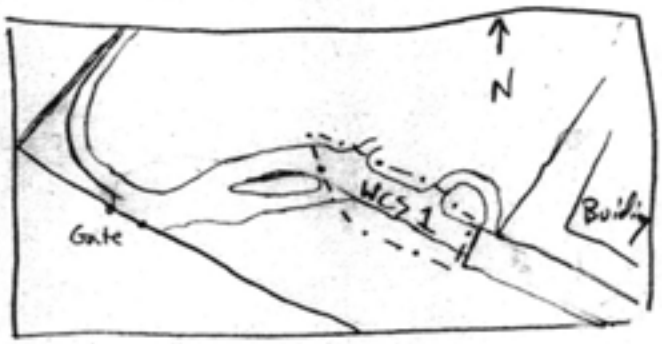
Total Aprox. Area 2,480 (m^2)

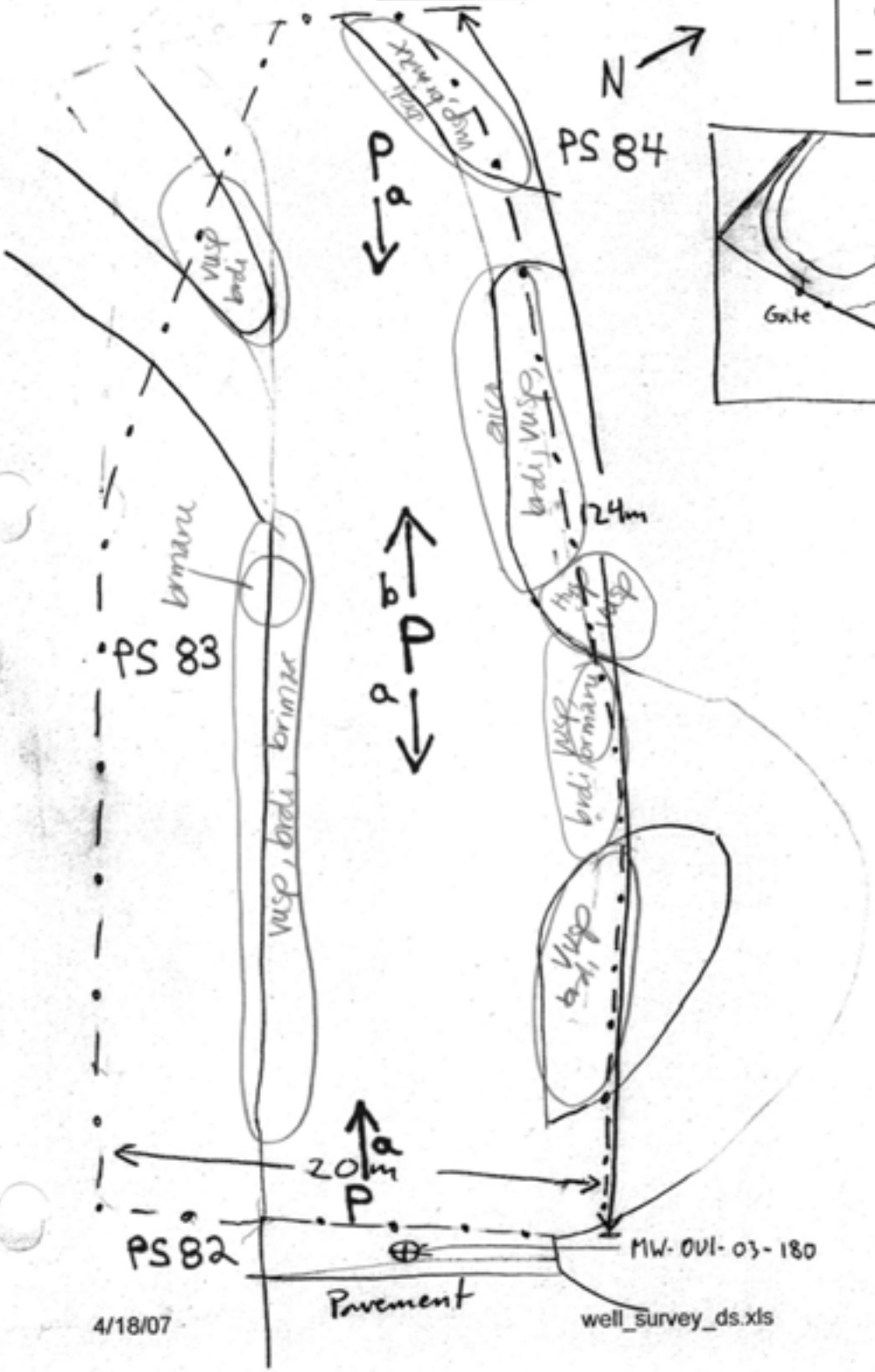
Well Rd. Area (m^2)

Well Site Area N/A (m^2)

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary





1st Treatment

Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well Site/Road Diagram

Well ID: N/A

WCS Sub Group: WS 1

Total Aprox. Area: 2,480 (m^2)

Well Rd. Area: (m^2)

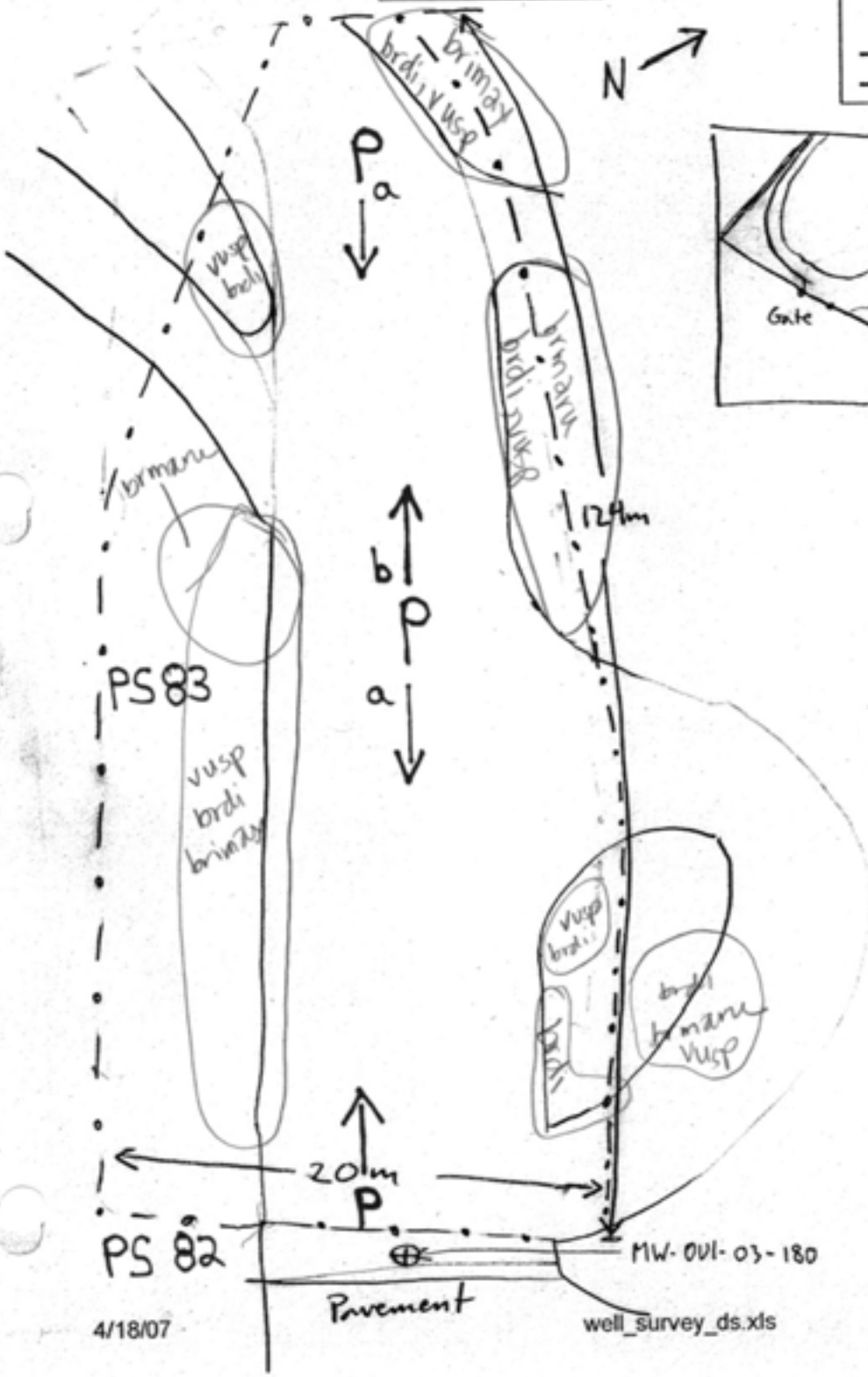
Well Site Area: N/A (m^2)

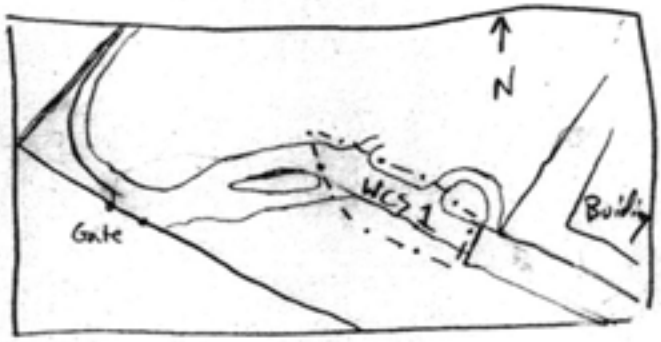
Date: 7-5-11

Surveyor: AFM

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary





2nd Treatment

Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well Site/Road Diagram

Well ID: N/A

WCS Sub Group 2

Total Aprox. Area 418 (m^2)

Well Rd. Area N/A (m^2)

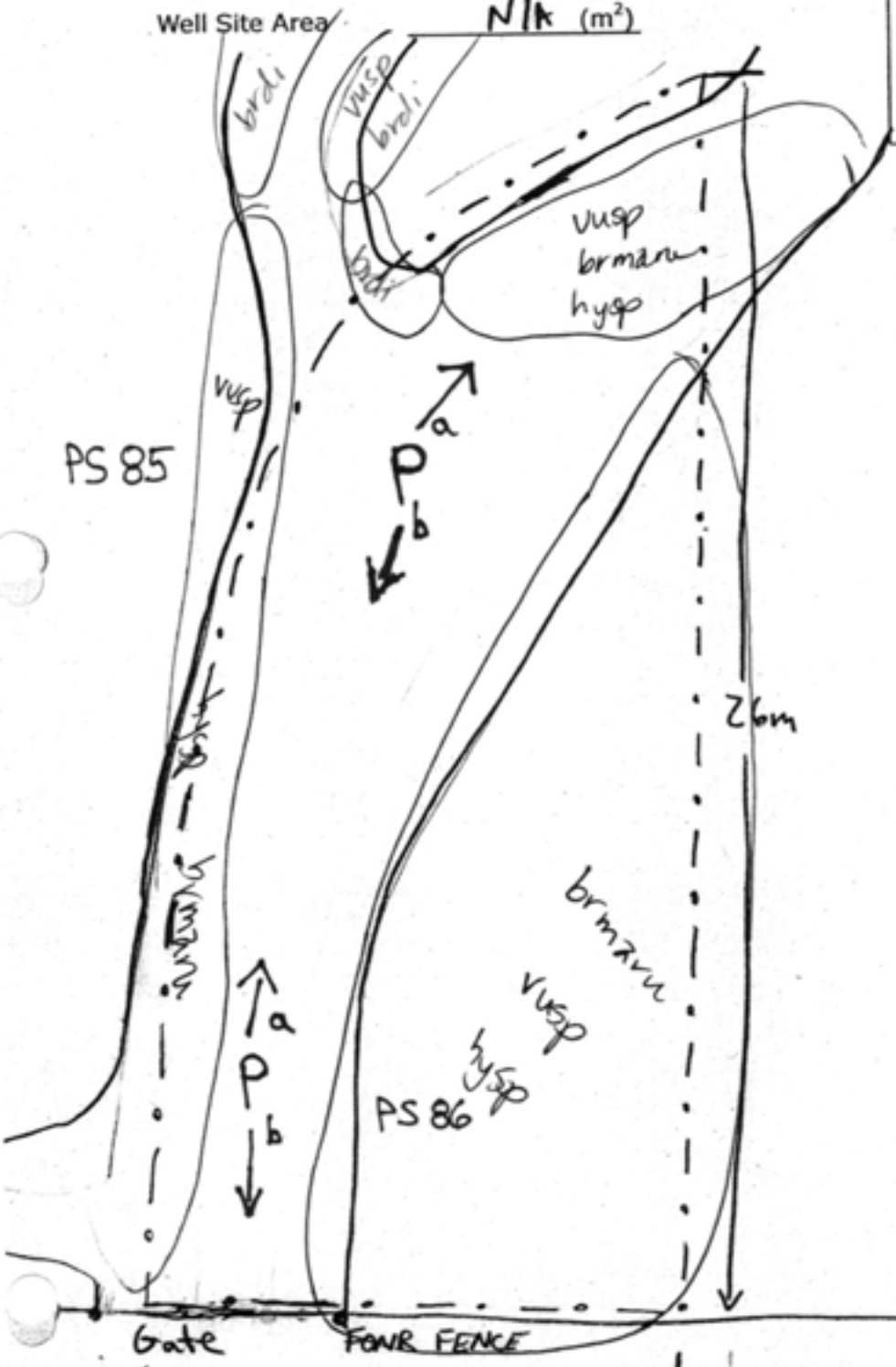
Well Site Area N/A (m^2)

Date 6-11-11

Surveyor AF

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary



Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well Site/Road Diagram

Well ID: N/A

Date 7-5-11

WCS Sub Group 2

Surveyor AFM

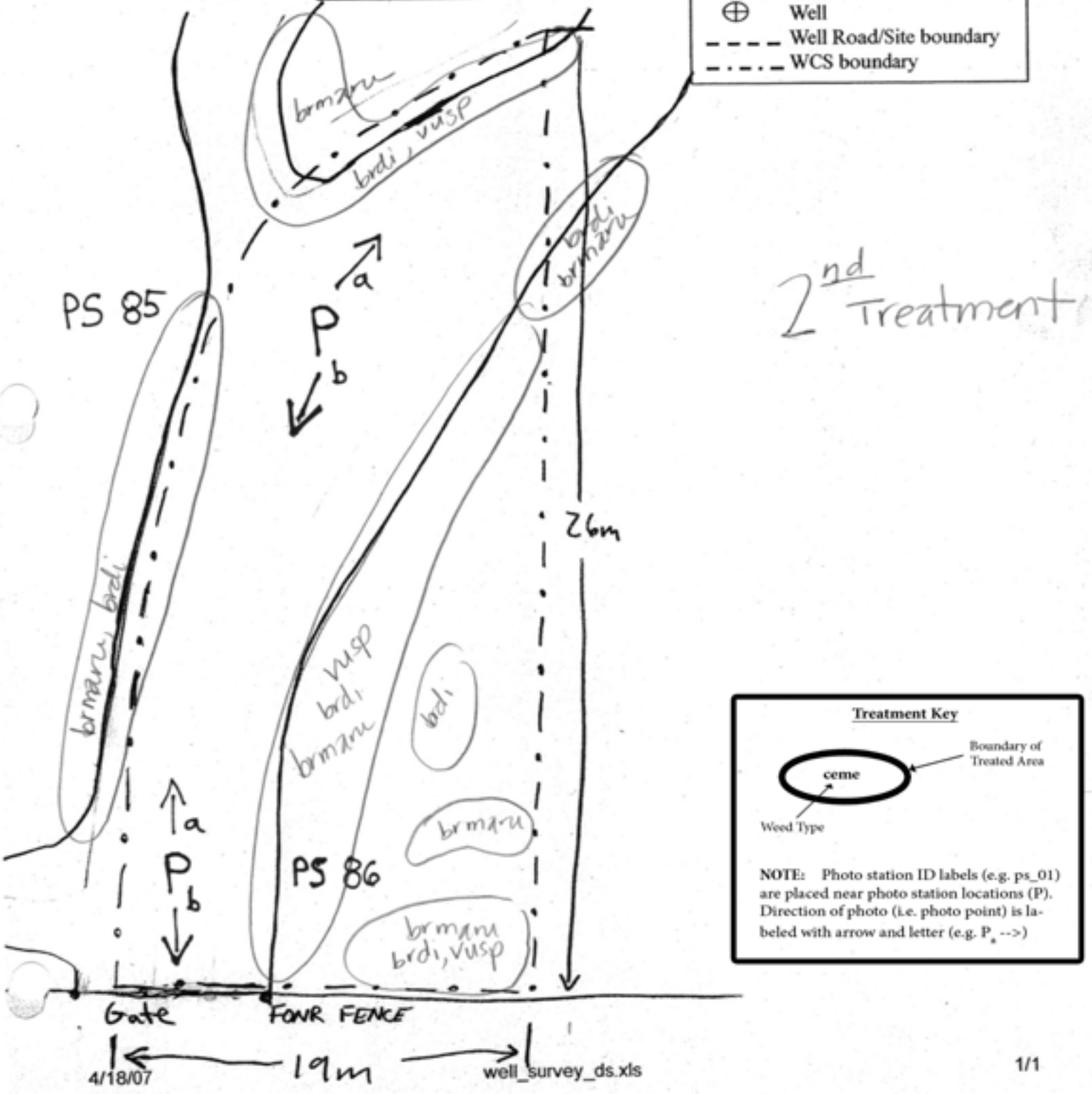
Total Aprox. Area 418 (m^2)

Well Rd. Area N/A (m^2)

Well Site Area N/A (m^2)

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary



Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well Site/Road Diagram

Well ID: N/A

WCS Sub Group 3

Total Aprox. Area 1,000 (m^2)

Well Rd. Area N/A (m^2)

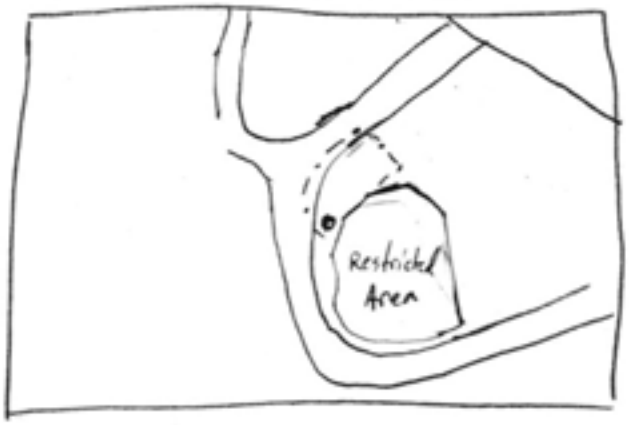
Well Site Area N/A (m^2)

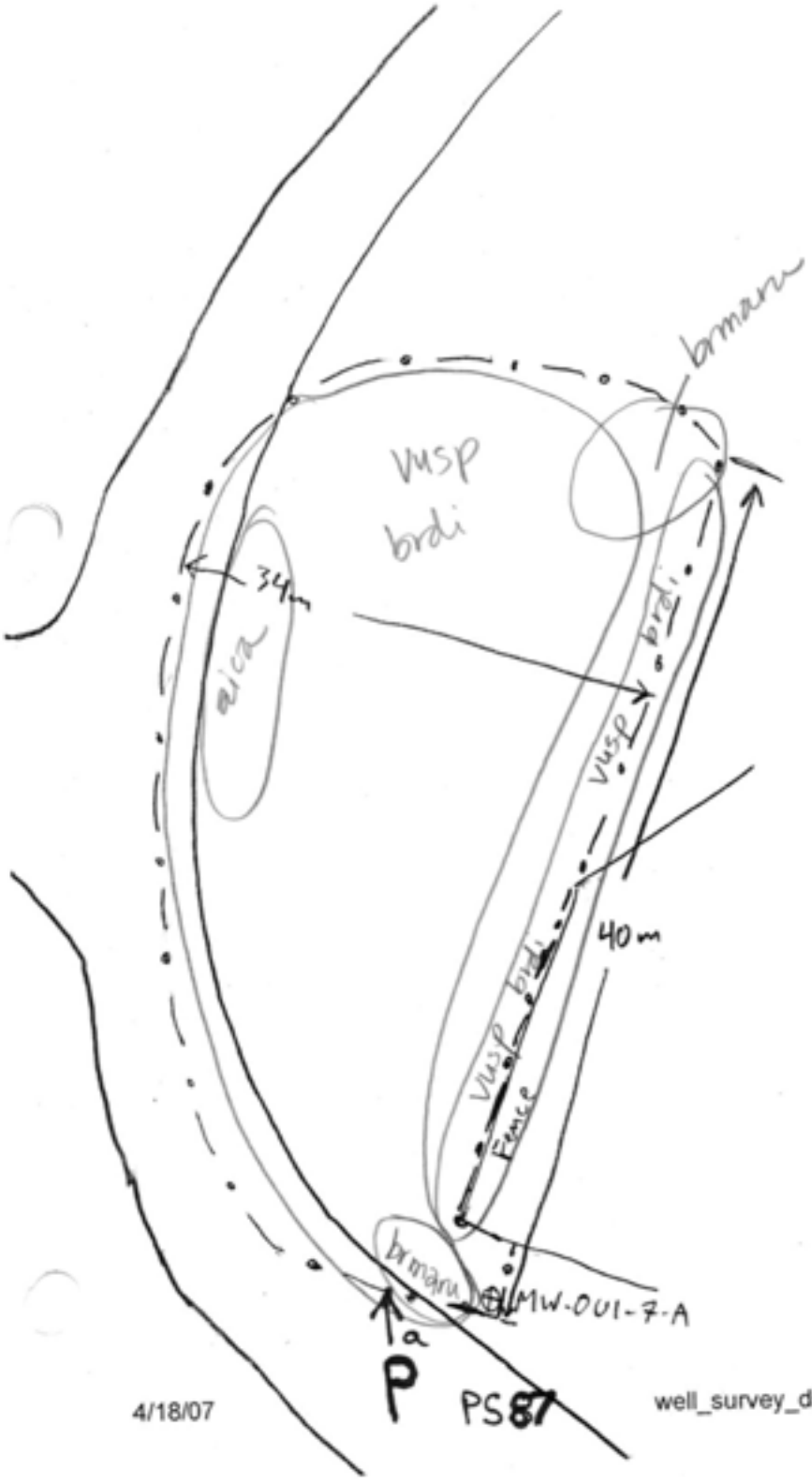
Date 7-15-11

Surveyor AFM

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary





1st Treatment

Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: IW-OU1-05-A

WCS Sub Group 4A

Total Aprox. Area 94 (m^2)

Well Rd. Area 48 (m^2)

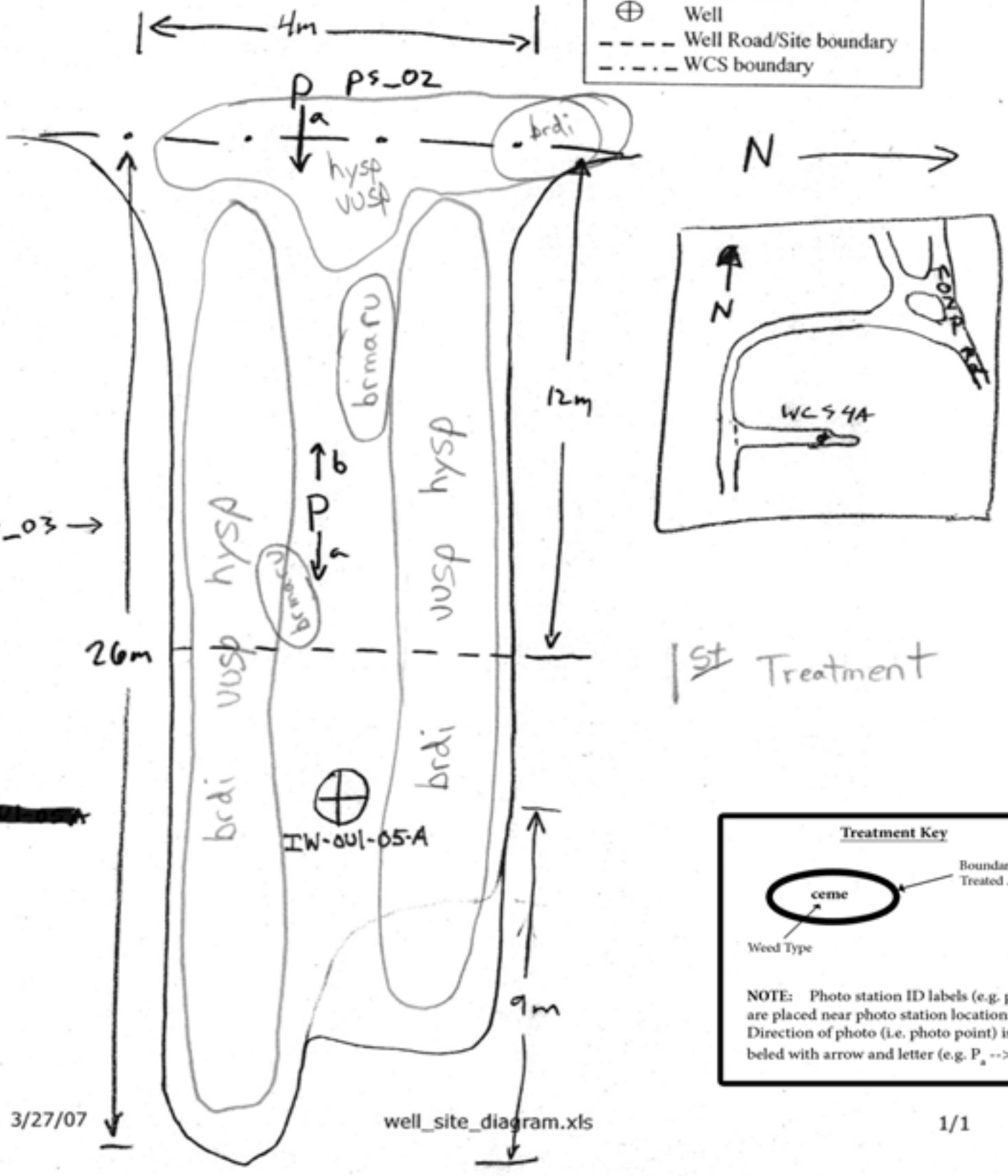
Well Site Area 46m (m^2)

Date 4-19-11

Surveyor AFM

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary



1st Treatment

Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: IW-OU1-05A

Date 6-8-11

WCS Sub Group 4A

Surveyor AFM

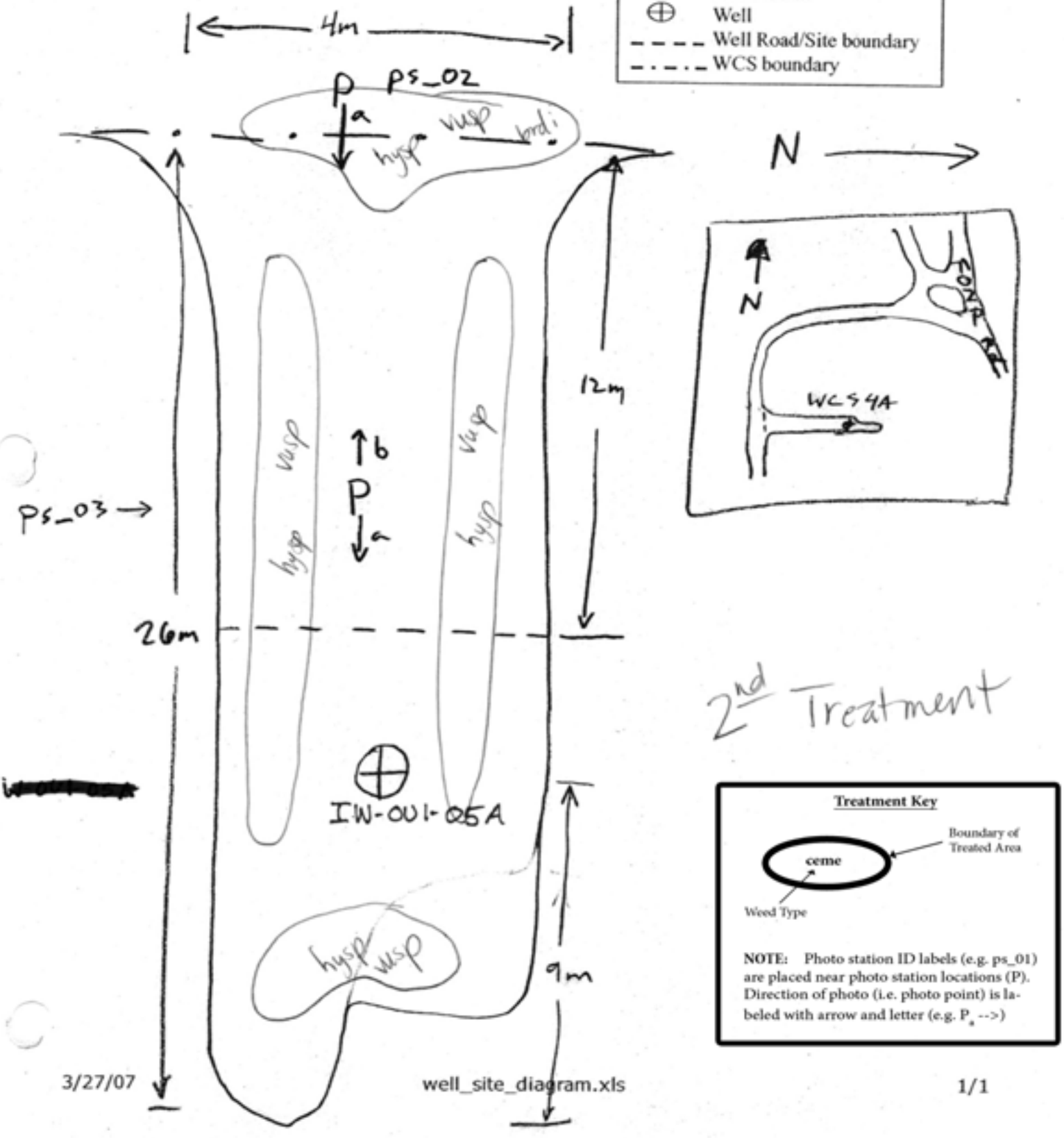
Total Aprox. Area 94 (m^2)

Well Rd. Area 48 (m^2)

Well Site Area 46m (m^2)

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary



2nd Treatment

Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: IW-OU1-01-A

WCS Sub Group: 5-A

Total Aprox. Area: 240 (m^2)

Well Rd. Area: 174 (m^2)

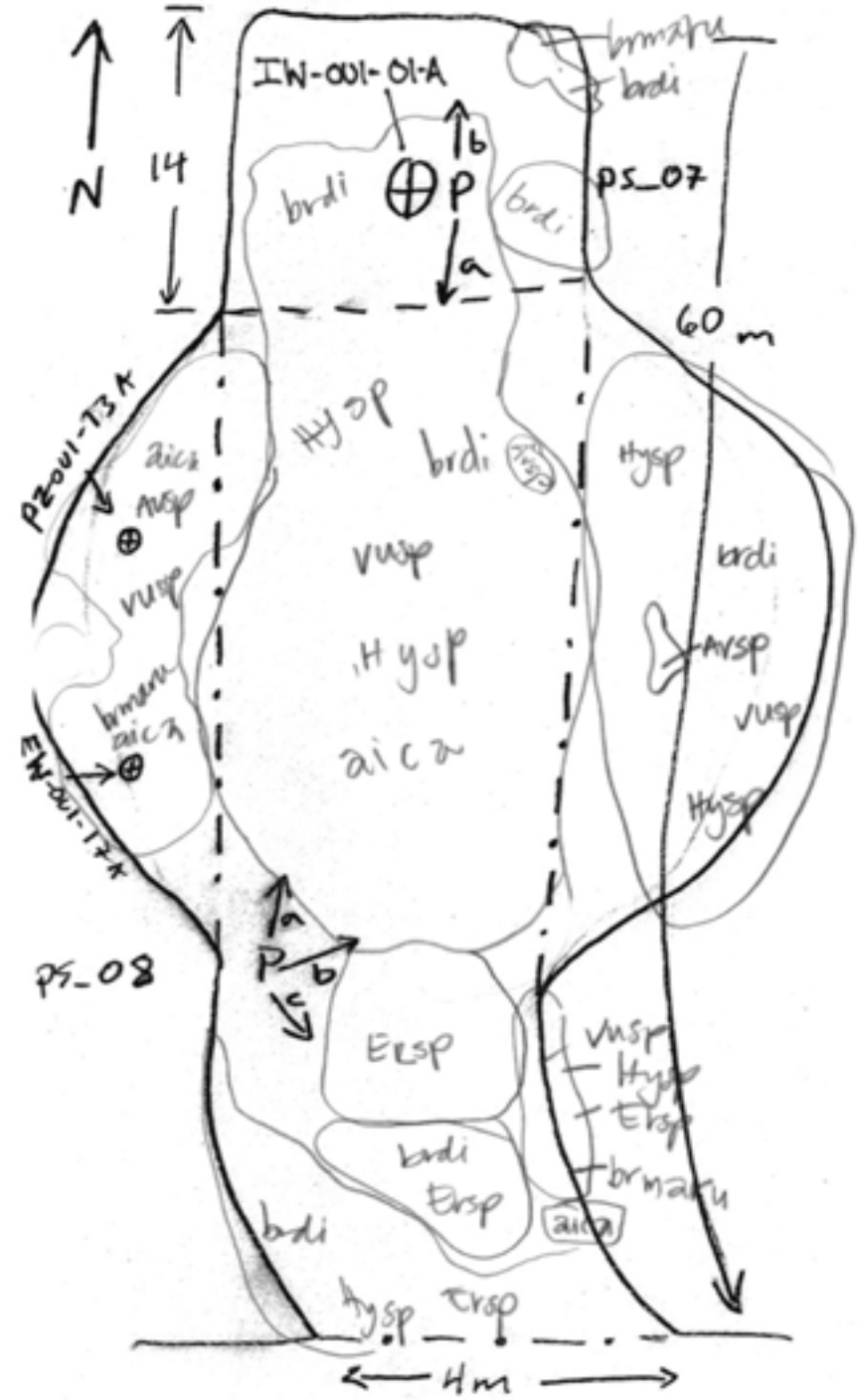
Well Site Area: 56 (m^2)

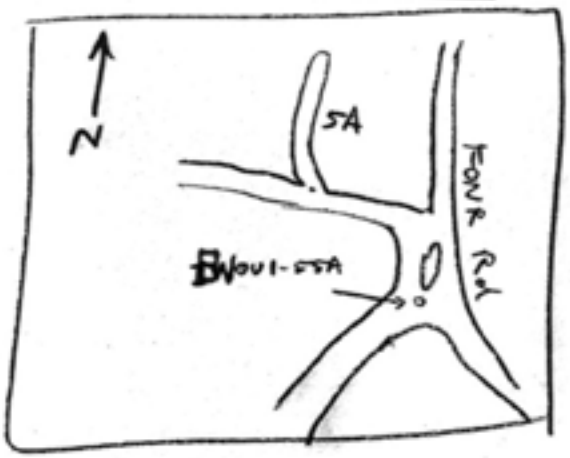
Date: 4-29-11

Surveyor: AFM

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary





1st Treatment

Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: IW-OU1-01-A

WCS Sub Group 5-A

Total Aprox. Area 240 (m^2)

Well Rd. Area 174 (m^2)

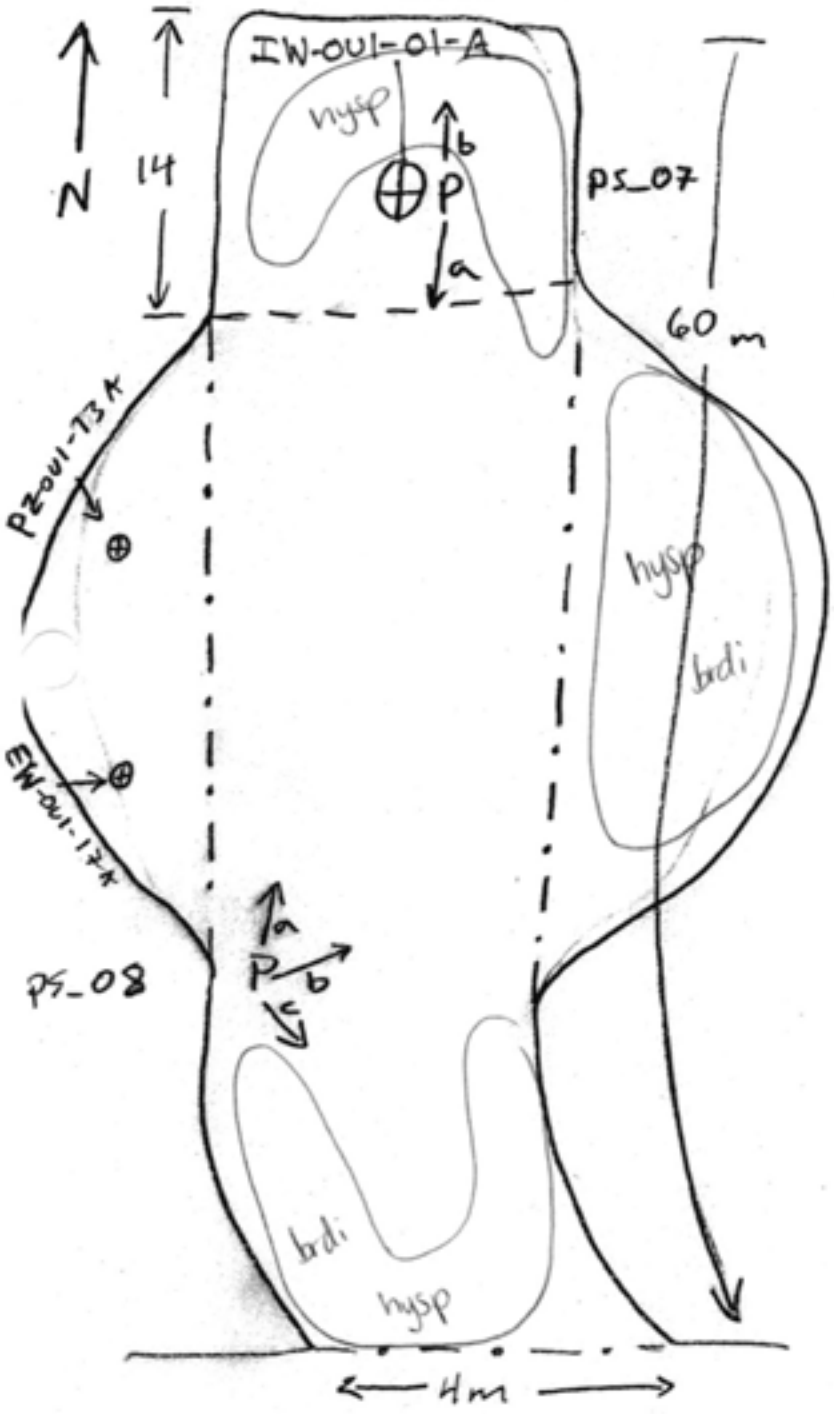
Well Site Area 56 (m^2)

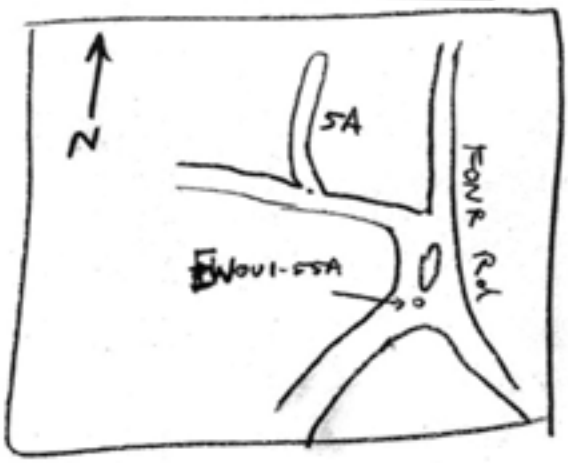
Date 6-8-11

Surveyor AFM

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary





2nd Treatment

Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: EW-OU1-53-A

Date 4/29/11

WCS Sub Group 6A

Surveyor AFM

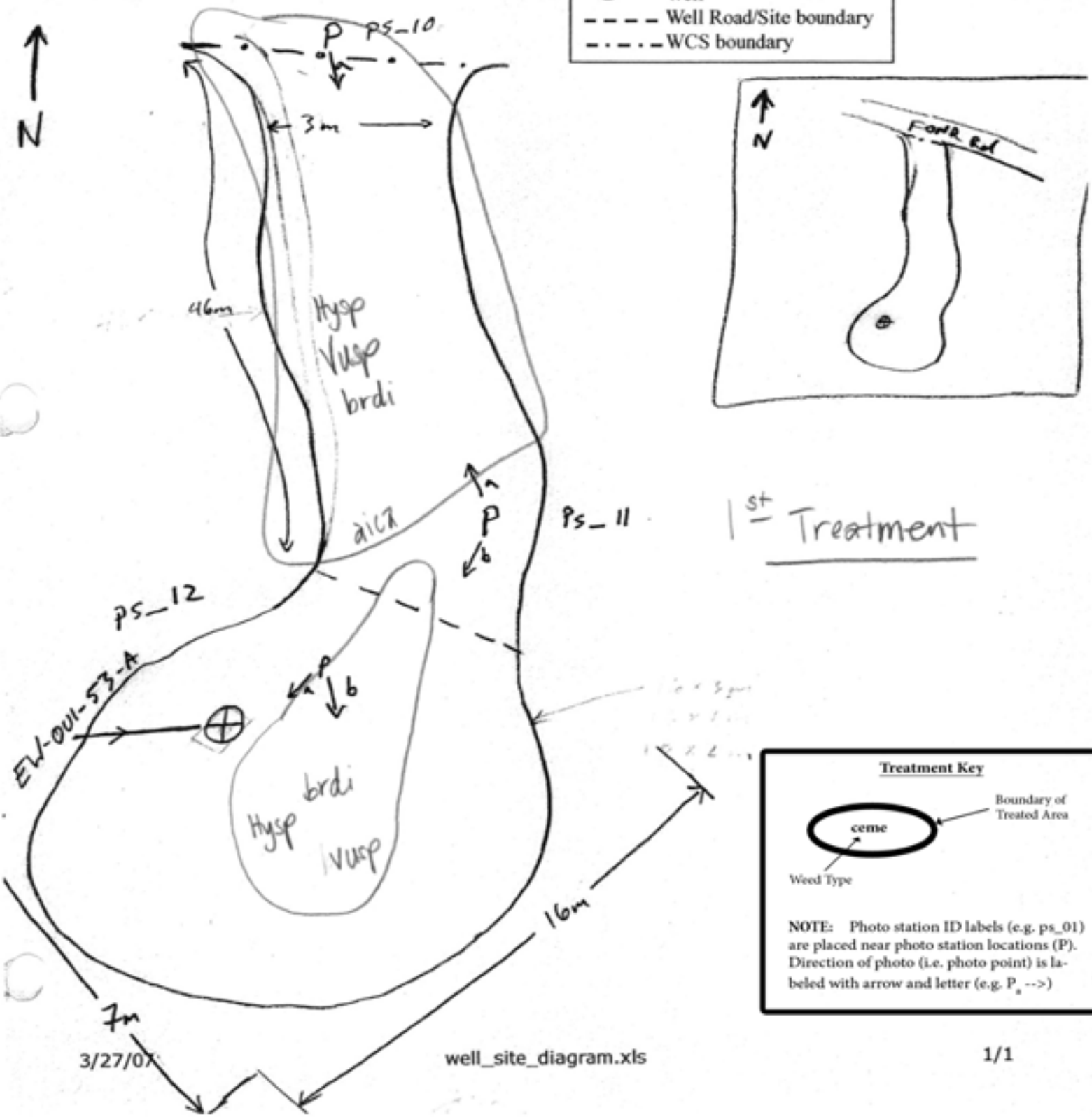
Total Aprox. Area 220 (m^2)

Well Rd. Area 138 (m^2)

Well Site Area 82 (m^2)

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- · - · -	WCS boundary



Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: EW-OU1-53-A

Date 6-7-11

WCS Sub Group 6A

Surveyor AFM

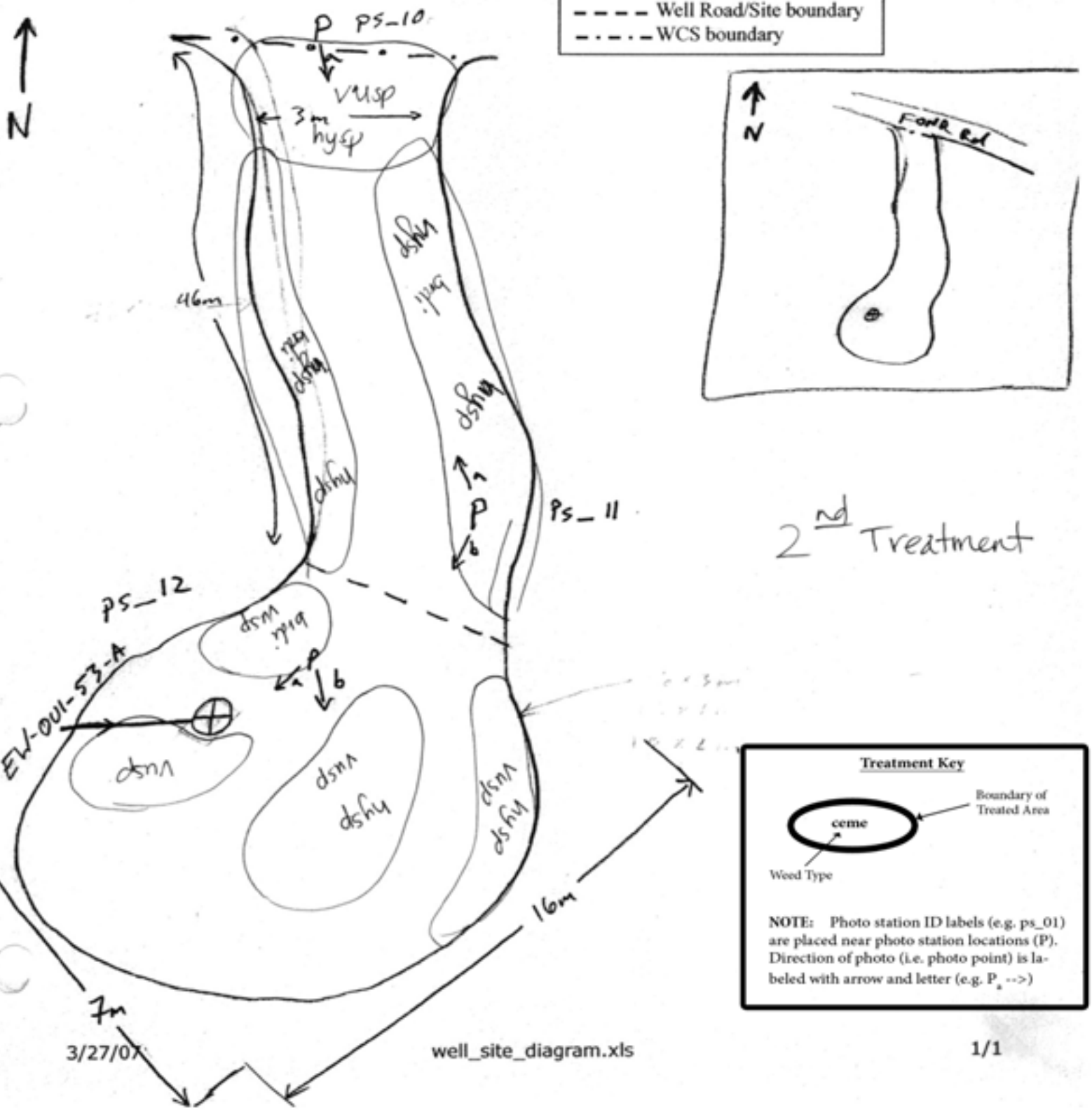
Total Aprox. Area 220 (m^2)

Well Rd. Area 138 (m^2)

Well Site Area 82 (m^2)

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- · - · -	WCS boundary



2nd Treatment

Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: EW-OU1-52A

WCS Sub Group 7A

Total Aprox. Area 164 (m^2)

Well Rd. Area 120 (m^2)

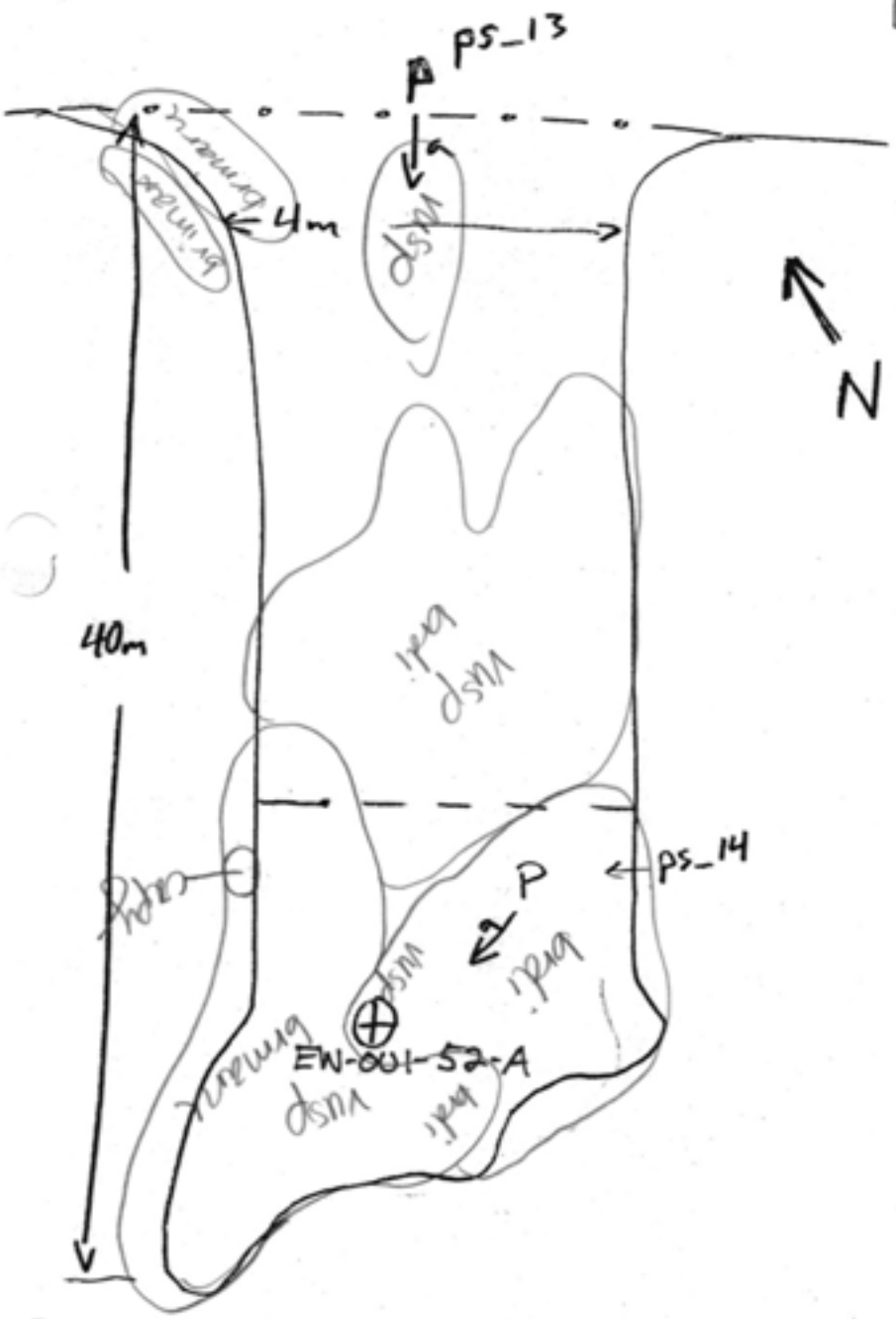
Well Site Area 44 (m^2)

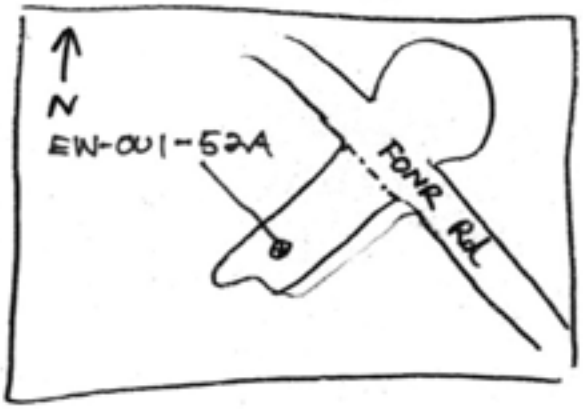
Date 5-14-11

Surveyor AFM

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- · - · -	WCS boundary





1st Treatment

Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: EW-OU1-52A

WCS Sub Group: 7A

Total Aprox. Area: 164 (m^2)

Well Rd. Area: 120 (m^2)

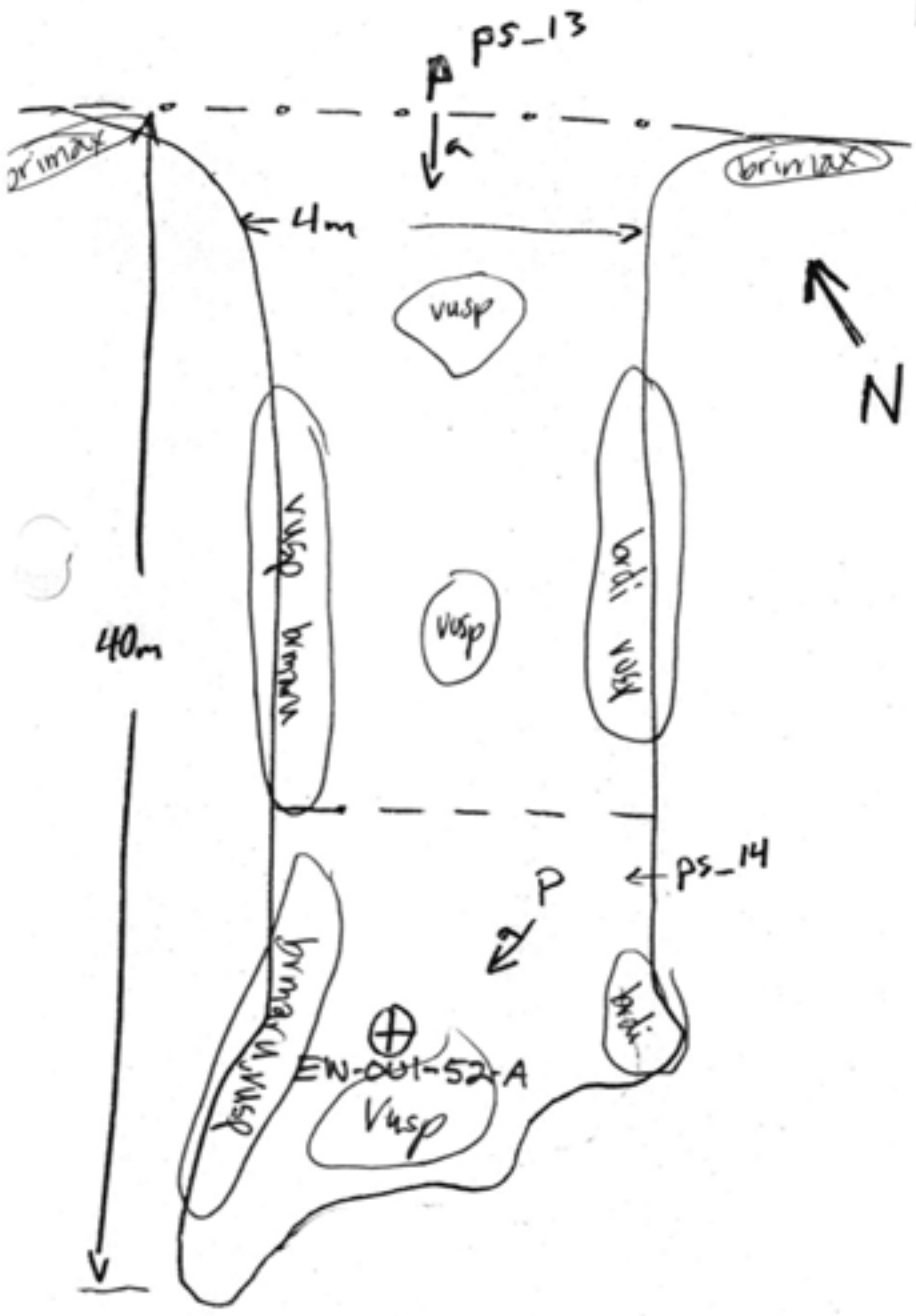
Well Site Area: 44 (m^2)

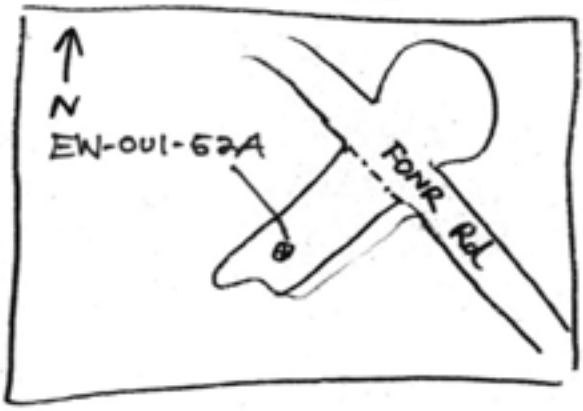
Date: 5-15-11

Surveyor: AFM

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- · - · -	WCS boundary





2nd Treatment

Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: PZ-OU1-10-A1 / IW-OU1-10-A

WCS Sub Group: 8A

Total Aprox. Area: 347 (m²)

Well Rd. Area: 137 (m²)

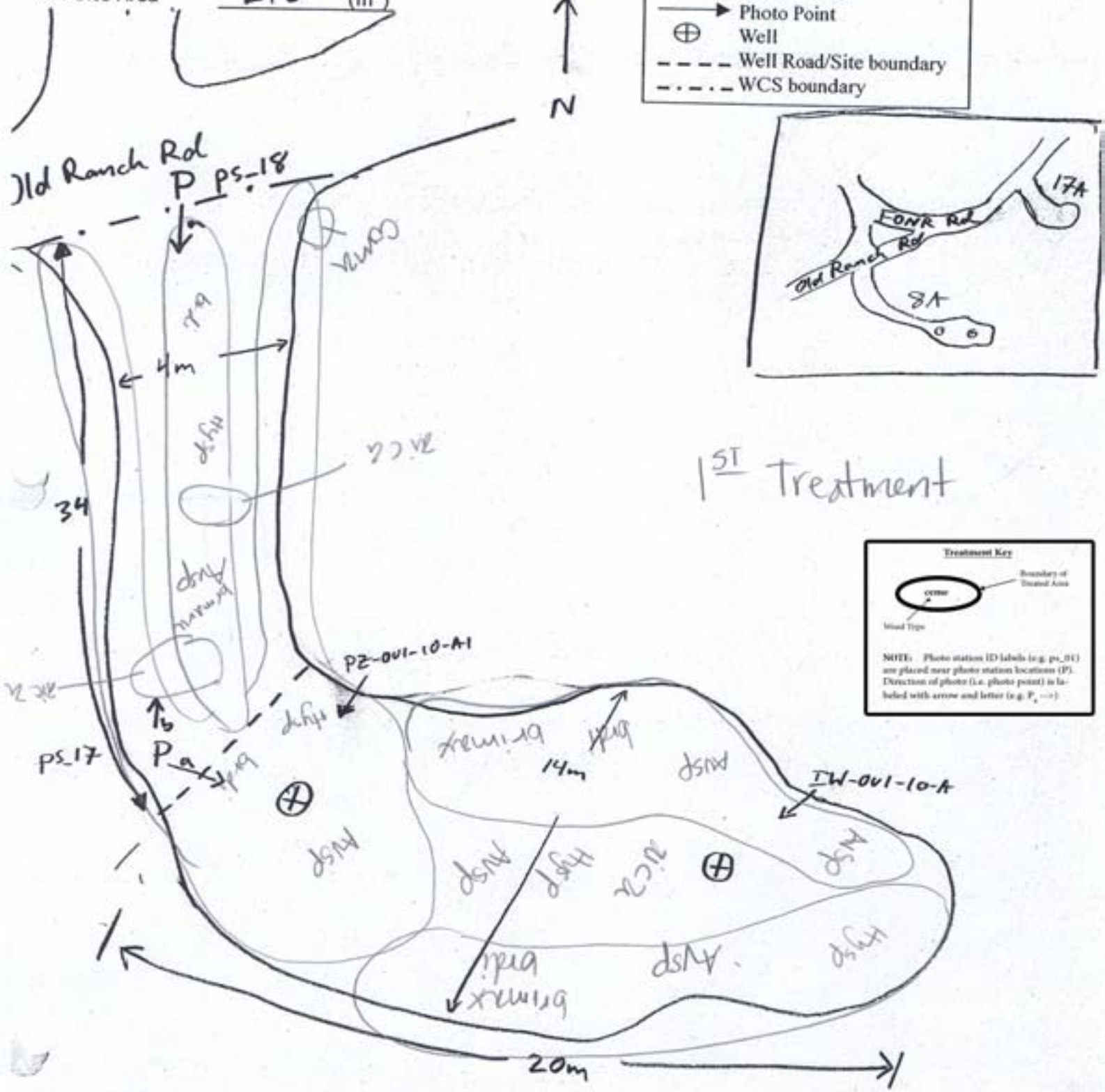
Well Site Area: 210 (m²)

Date: 5-13-11

Surveyor: AFM

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- · - · -	WCS boundary



Well ID: PZ-OU1-10-A1 / IW-OU1-10-A

WCS Sub Group: 8A

Date: 6-7-11

Surveyor: AFM

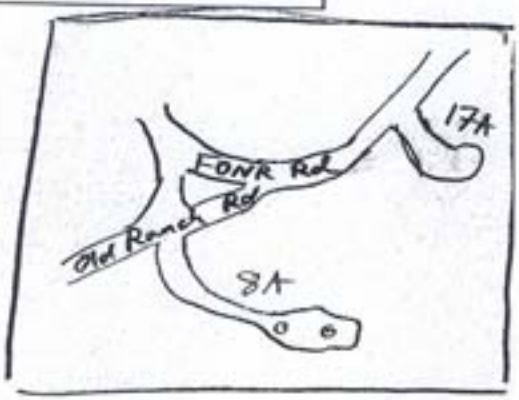
tal Aprox. Area: 347 (m^2)

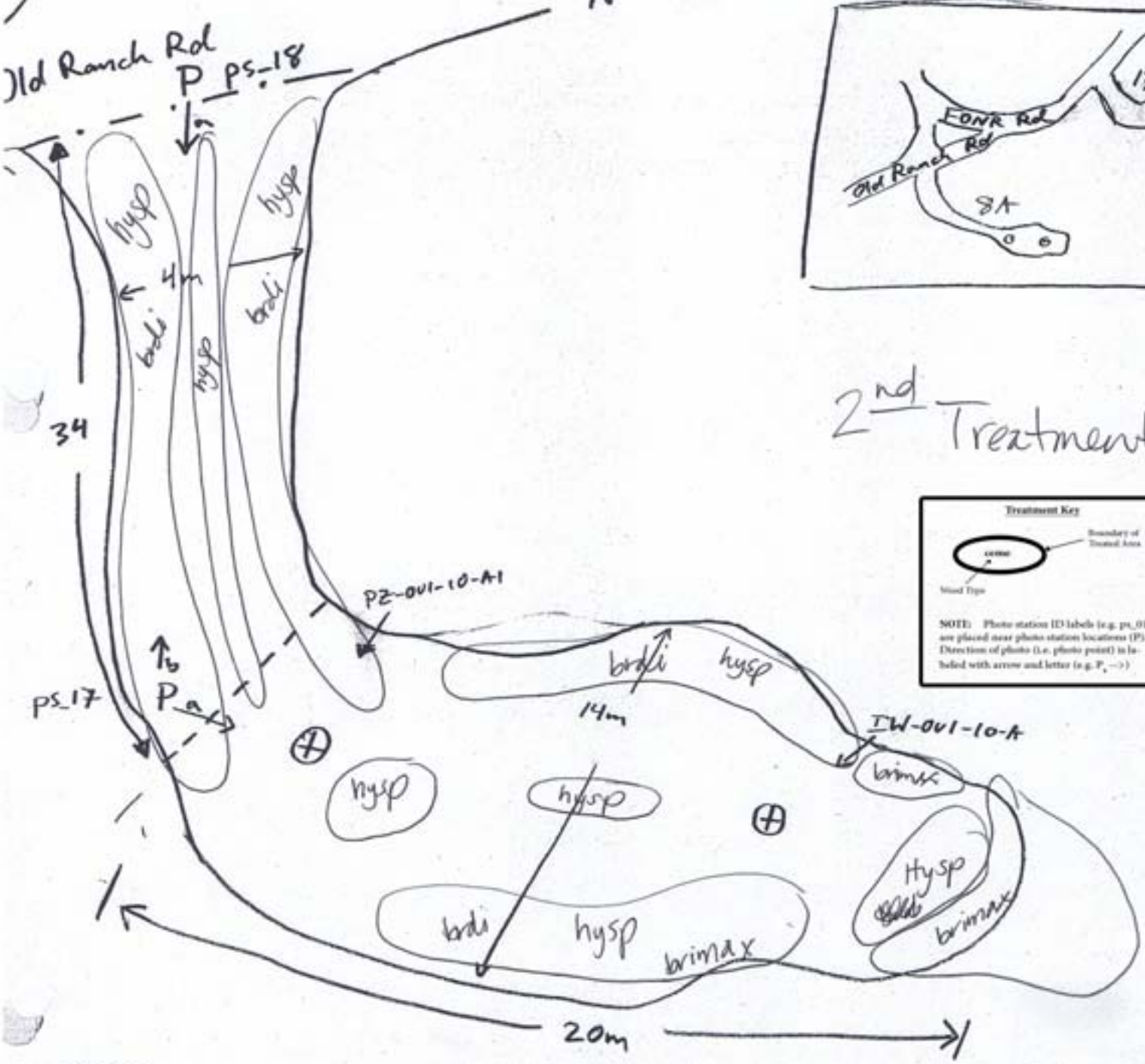
ell Rd. Area: 137 (m^2)

Well Site Area: 210 (m^2)

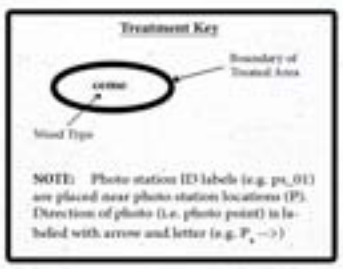
Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary





2nd Treatment



Well ID: PZ-OU1-10-A1 / IW-OU1-10-A

WCS Sub Group: 8A

Date: 7-1-11

Surveyor: AFM

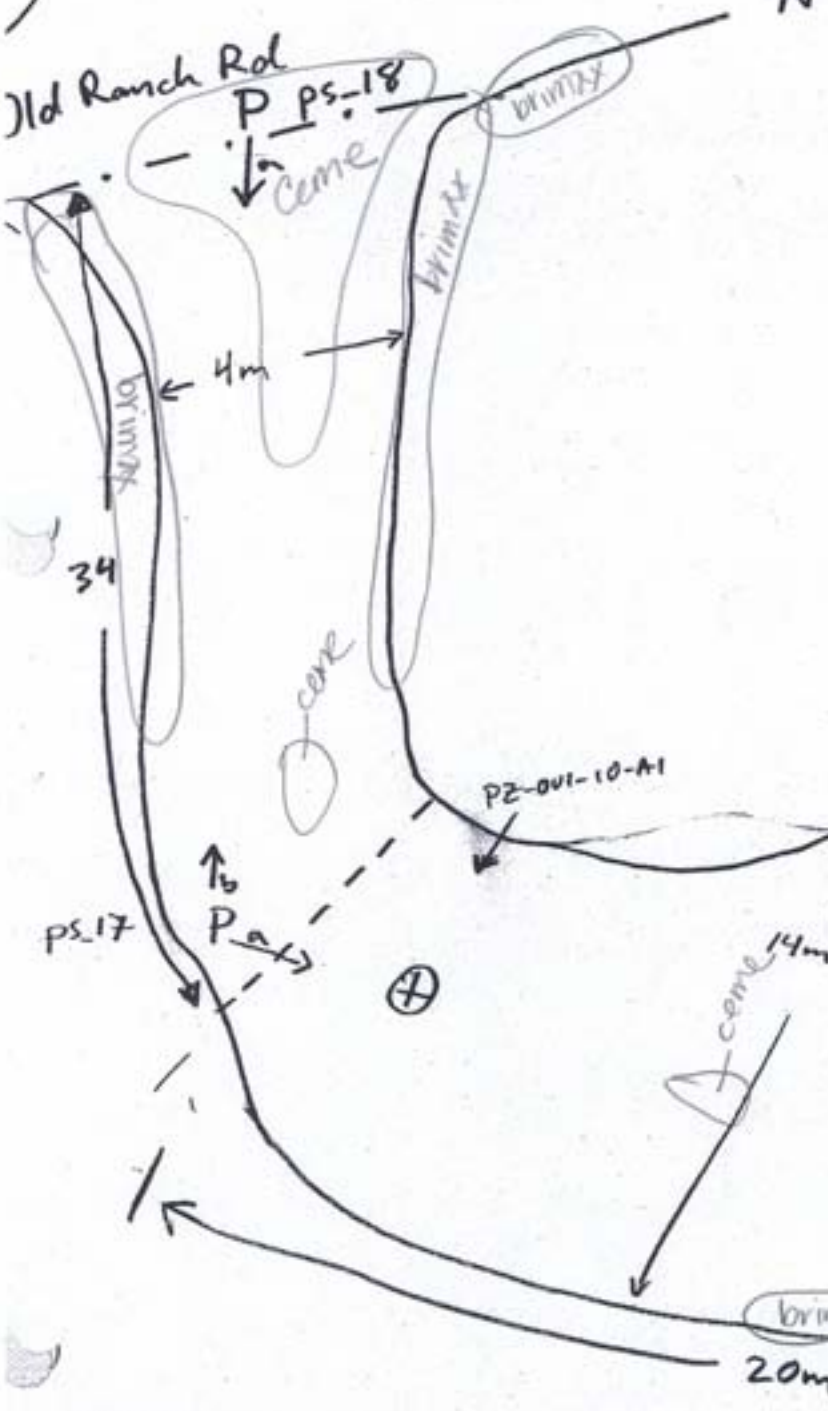
tal Aprox. Area: 347 (m²)

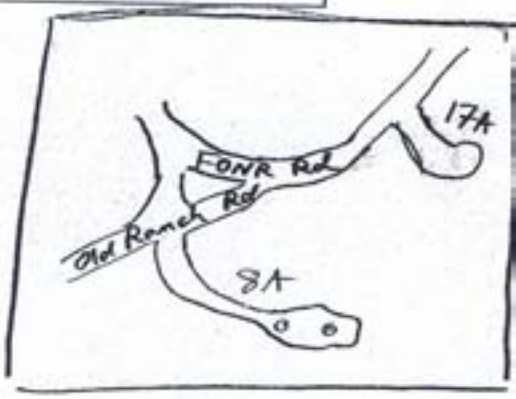
ell Rd. Area: 137 (m²)

Well Site Area: 210 (m²)

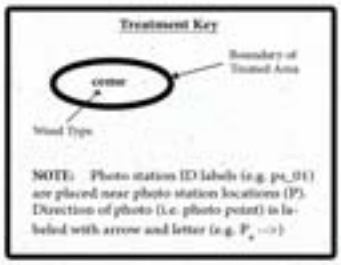
Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
-·-·-	WCS boundary





3rd Treatment



Well ID: MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A

WCS Sub Group: 9A

Total Aprox. Area: 369 (m²)

Well Rd. Area: 256 (m²)

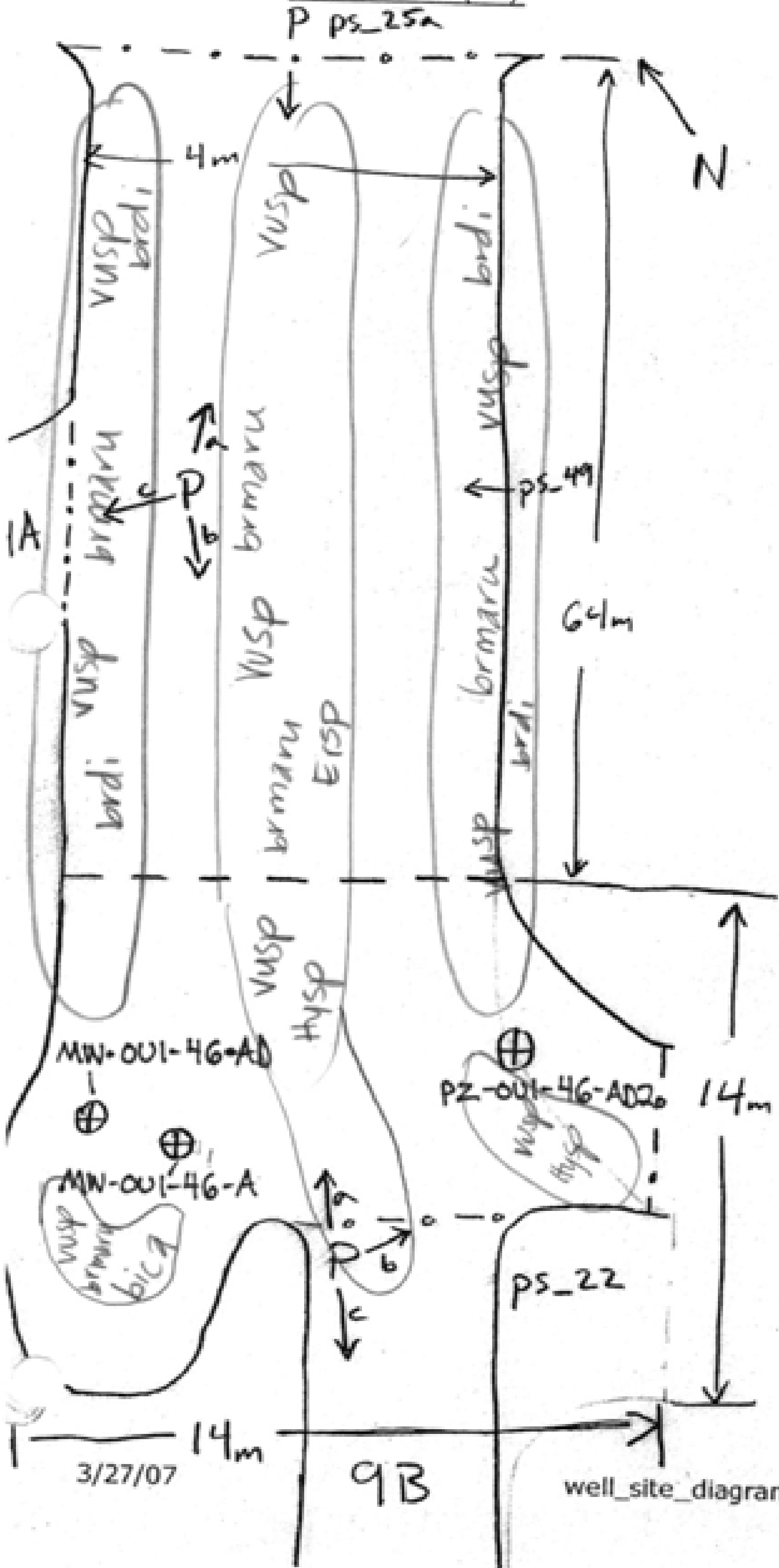
Well Site Area: 113 (m²)

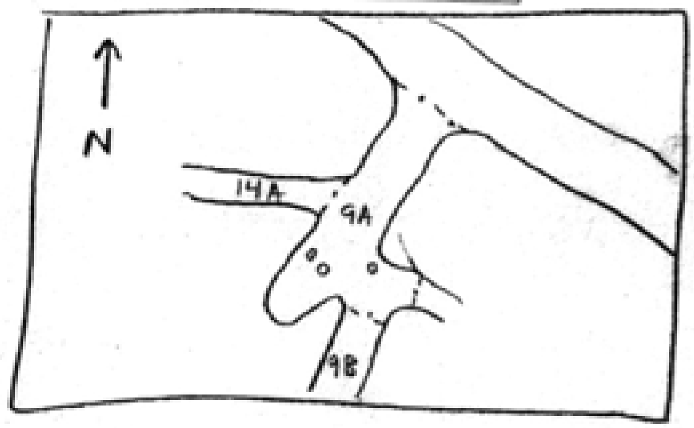
Date: 5-3-11

Surveyor: AFm

Legend

1A — # = WCS Sub Group
P — Photo Station
→ Photo Point
⊕ Well
- - - Well Road/Site boundary
-·-·- WCS boundary





1st Treatment

Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: MW-OUI-46AD / PZ-OUI-46-AD2, MW-OUI-46-A

WCS Sub Group: 9A

Total Aprox. Area: 369 (m^2)

Well Rd. Area: 256 (m^2)

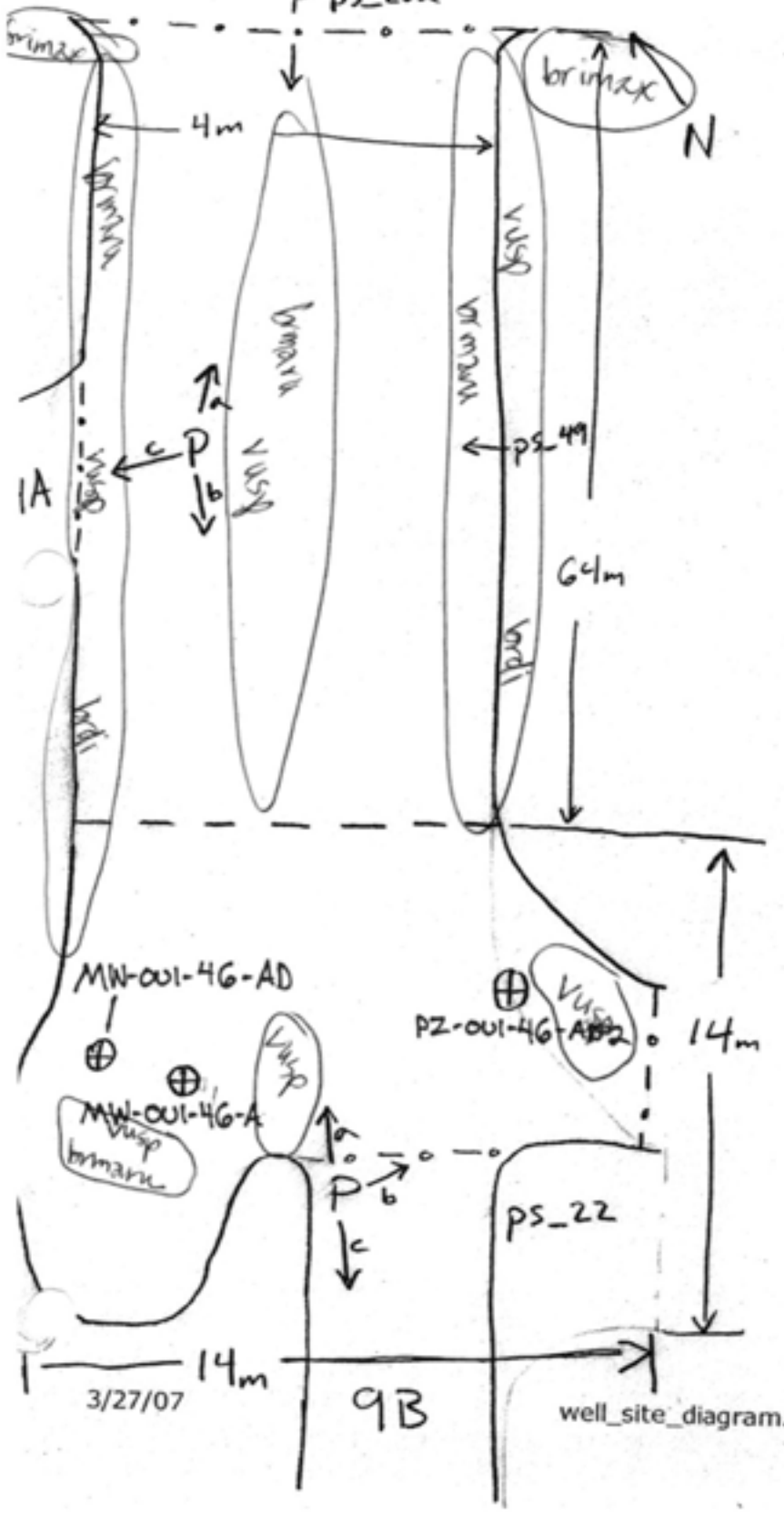
Well Site Area: 113 (m^2)

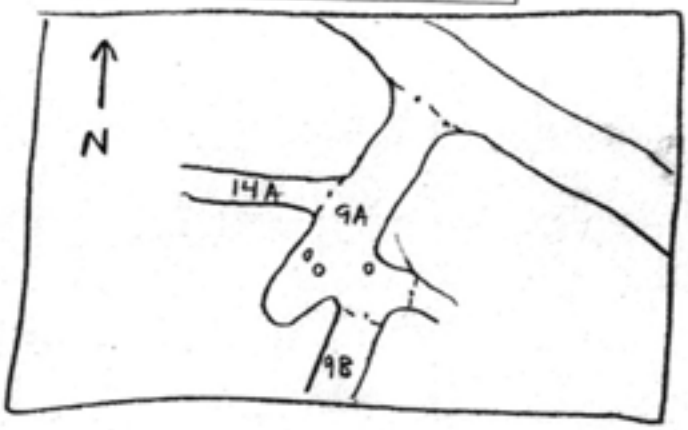
Date: 6-18-11

Surveyor: AFM

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- · - · -	WCS boundary





2nd Treatment

Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: MW-OU1-84A

WCS Sub Group 9B

Total Aprox. Area 304 (m^2)

Well Rd. Area 64 (m^2)

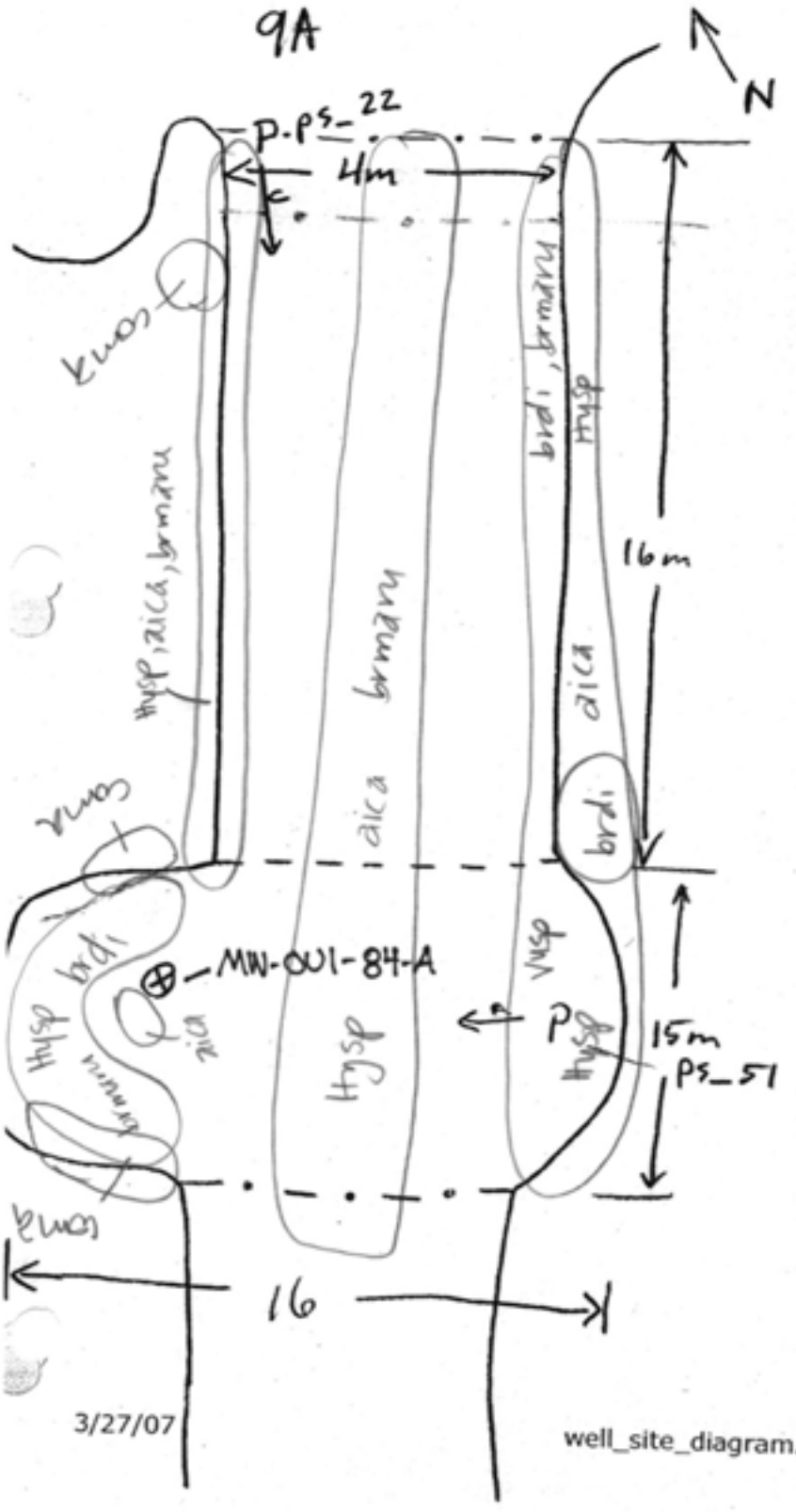
Well Site Area 240 (m^2)

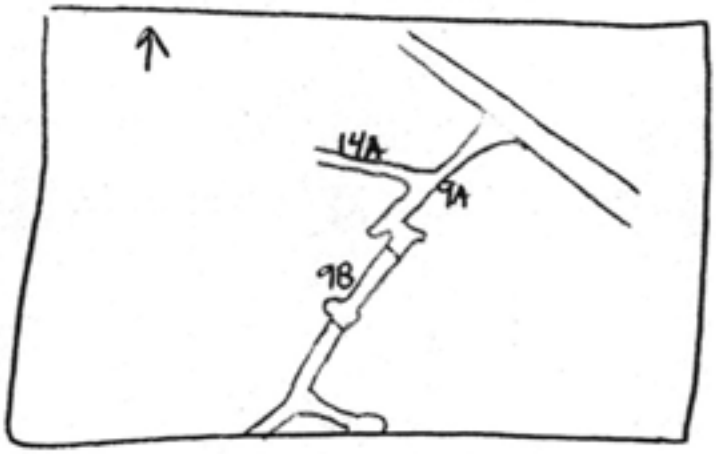
Date 5-3-11

Surveyor ATm

Legend

IA	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- · - · -	WCS boundary





1st Treatment

Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: IW-OU1-74A

WCS Sub Group: 9C

tal Aprox. Area: 198 (m^2)

Well Rd. Area: 144 (m^2)

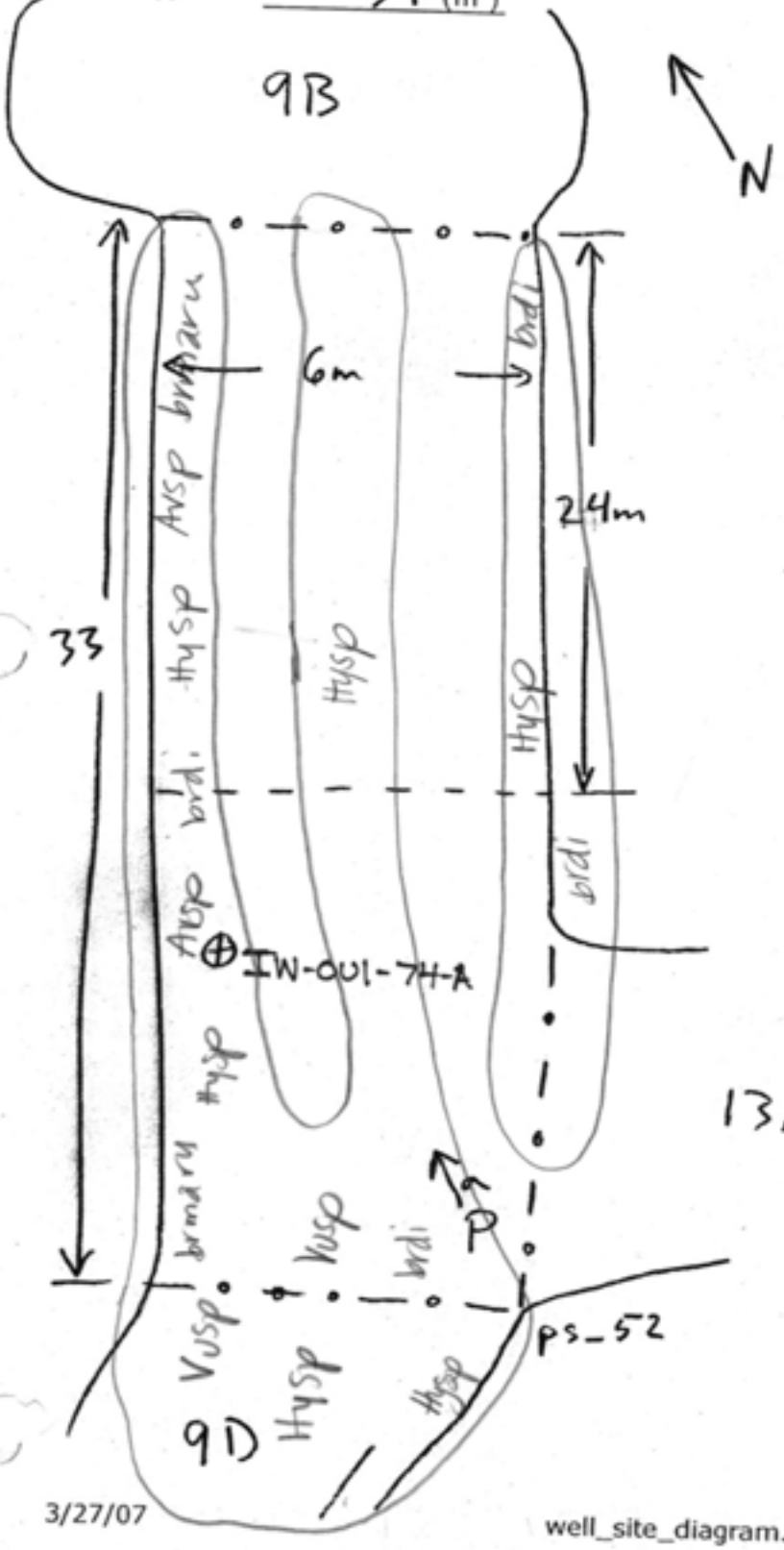
Well Site Area: 54 (m^2)

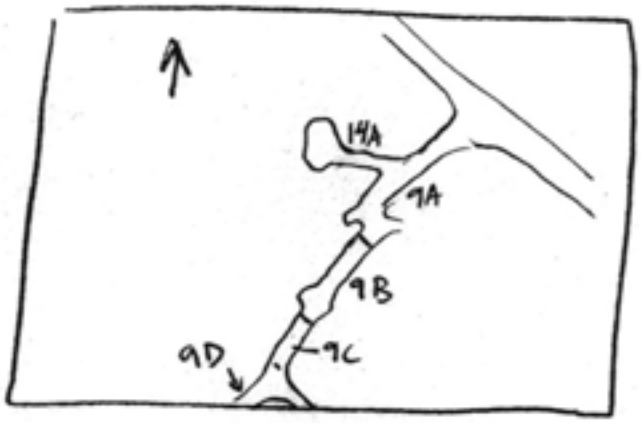
Date: 5-3-11

Surveyor: AFm

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- · - · -	WCS boundary





1st Treatment

Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: MW-OU1-51A

WCS Sub Group 9D

Total Aprox. Area 160 (m^2)

Well Rd. Area 104 (m^2)

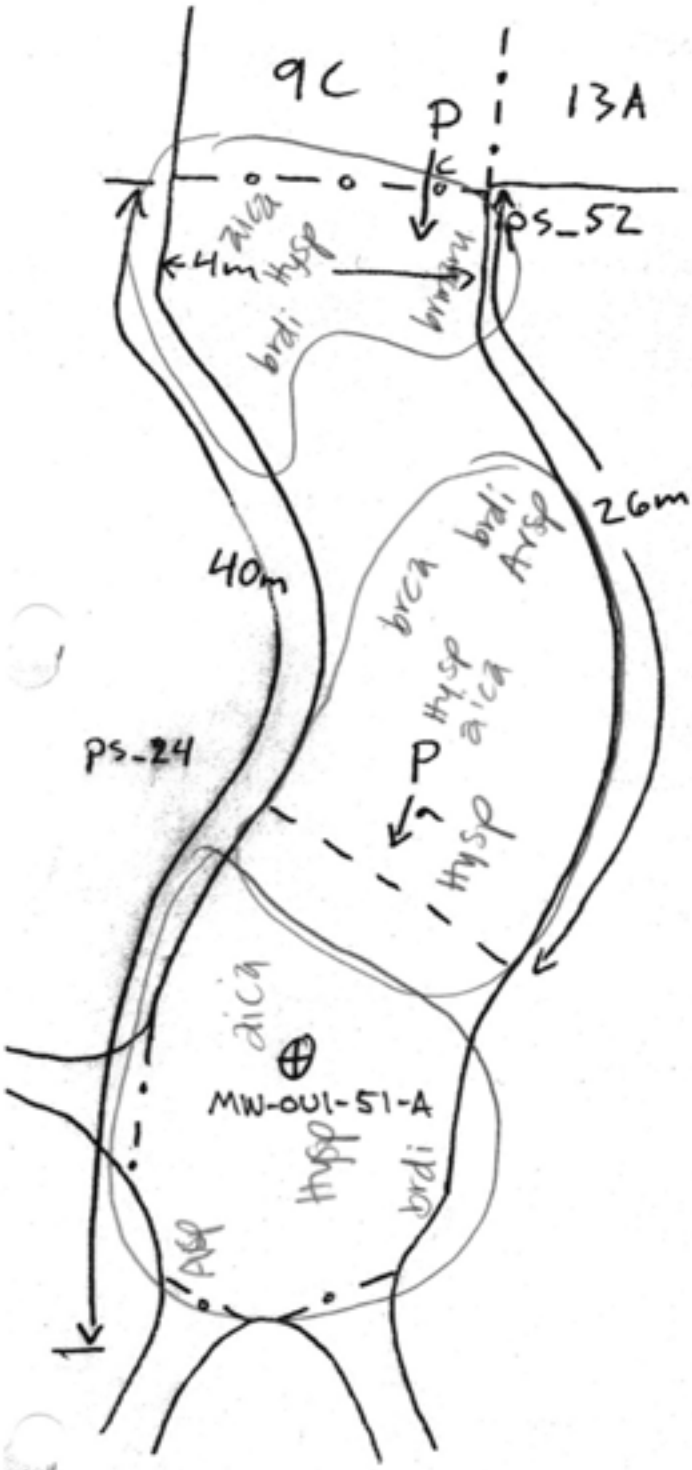
Well Site Area 56 (m^2)

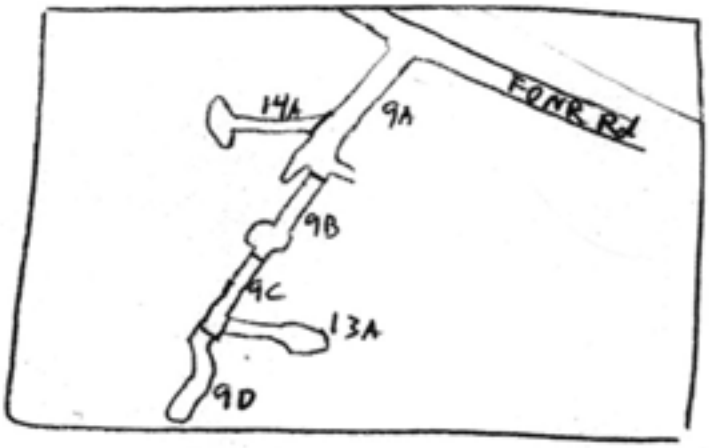
Date 5-3-11

Surveyor AFM

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- · - · -	WCS boundary





1st Treatment

Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: MW-OUI-50A

WCS Sub Group: 10A

Total Aprox. Area: 120 (m^2)

Well Rd. Area: 87 (m^2)

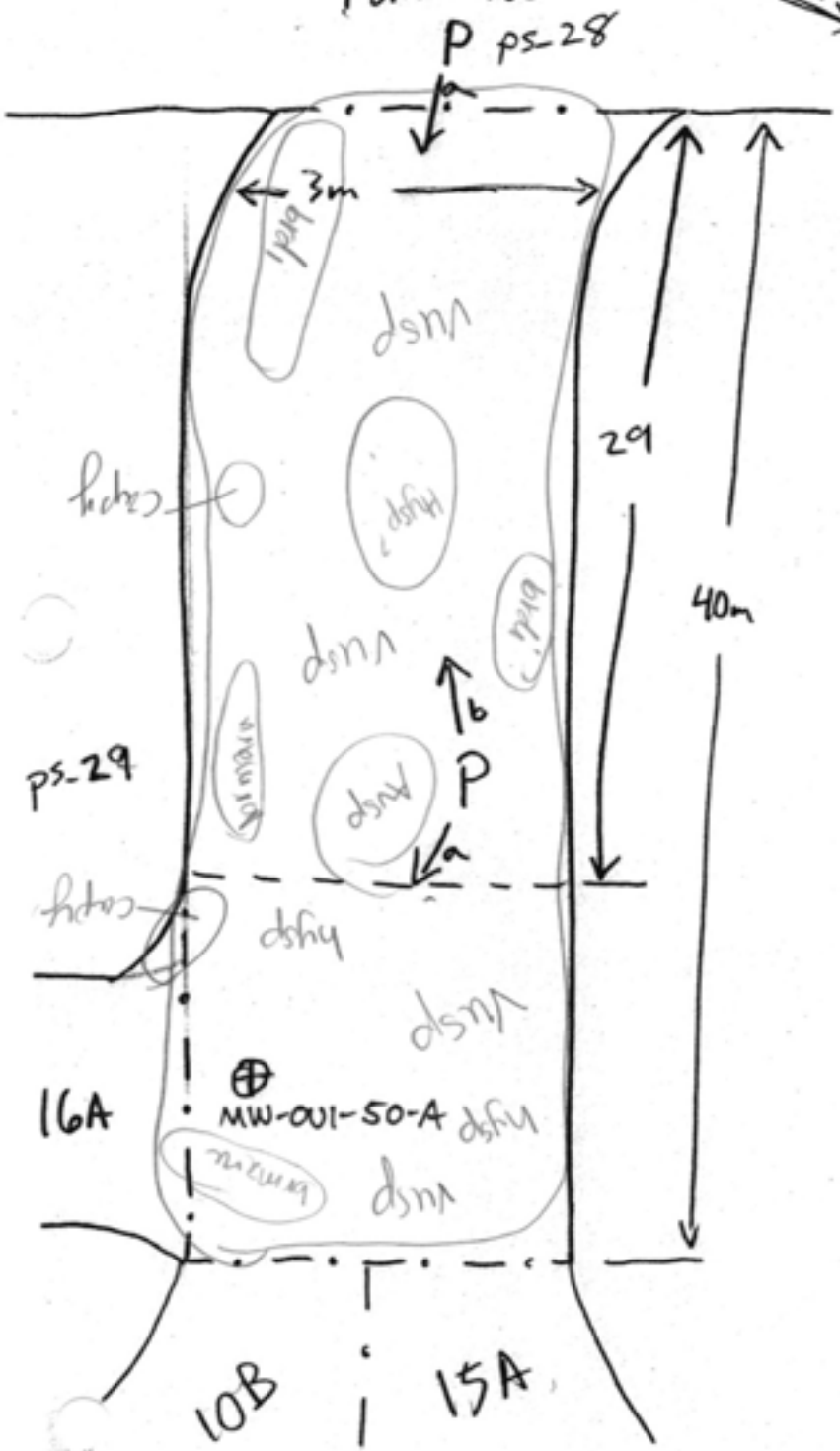
Well Site Area: 33 (m^2)

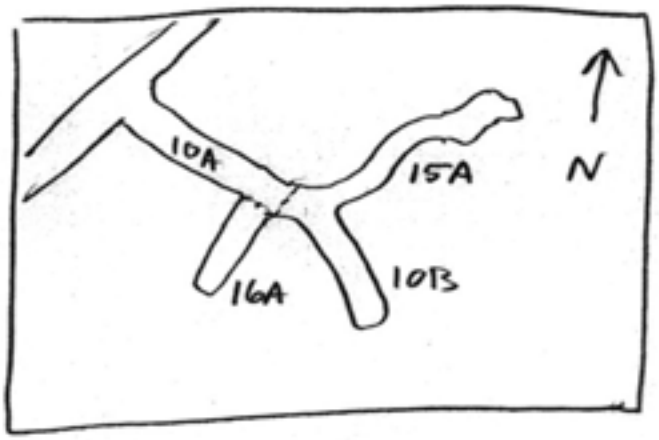
Date: 5-29-11

Surveyor: AFM

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary





1st Treatment

Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: MW-OU1-50A

WCS Sub Group: 10A

Total Aprox. Area: 120 (m^2)

Well Rd. Area: 87 (m^2)

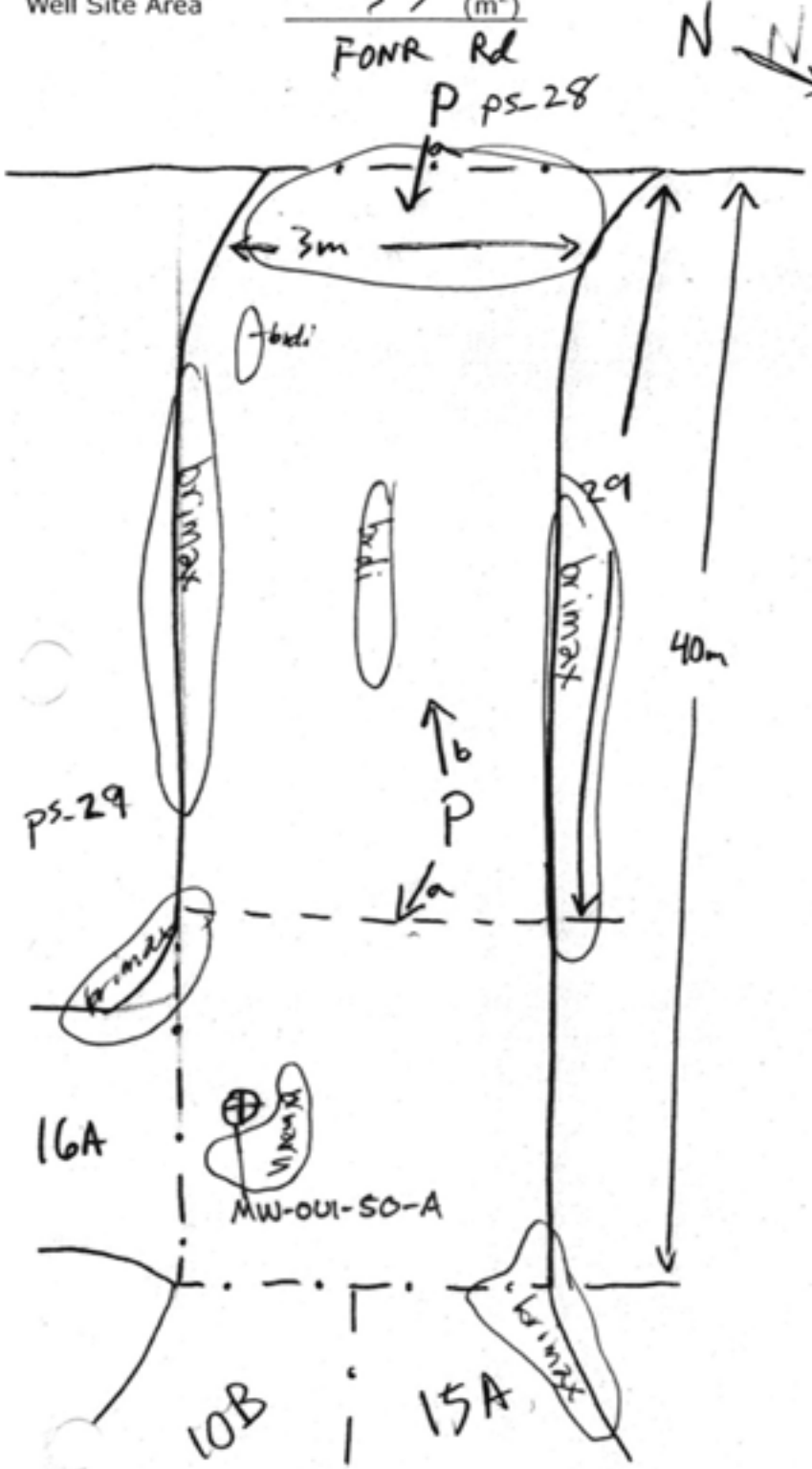
Well Site Area: 33 (m^2)

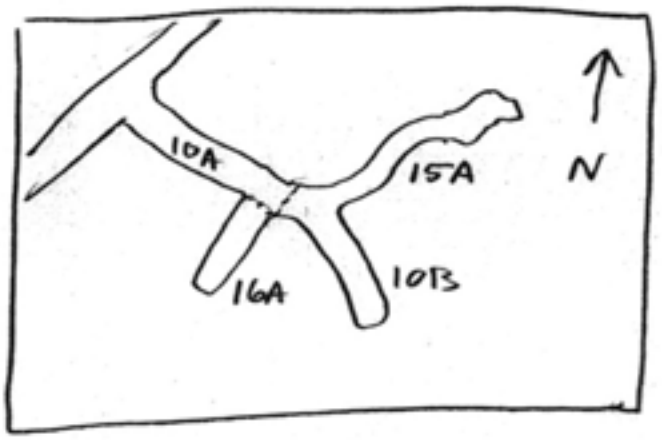
Date: 7-1-11

Surveyor: AG

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary





2nd Treatment

Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: MW-OUI-59A

Date 5-21-11

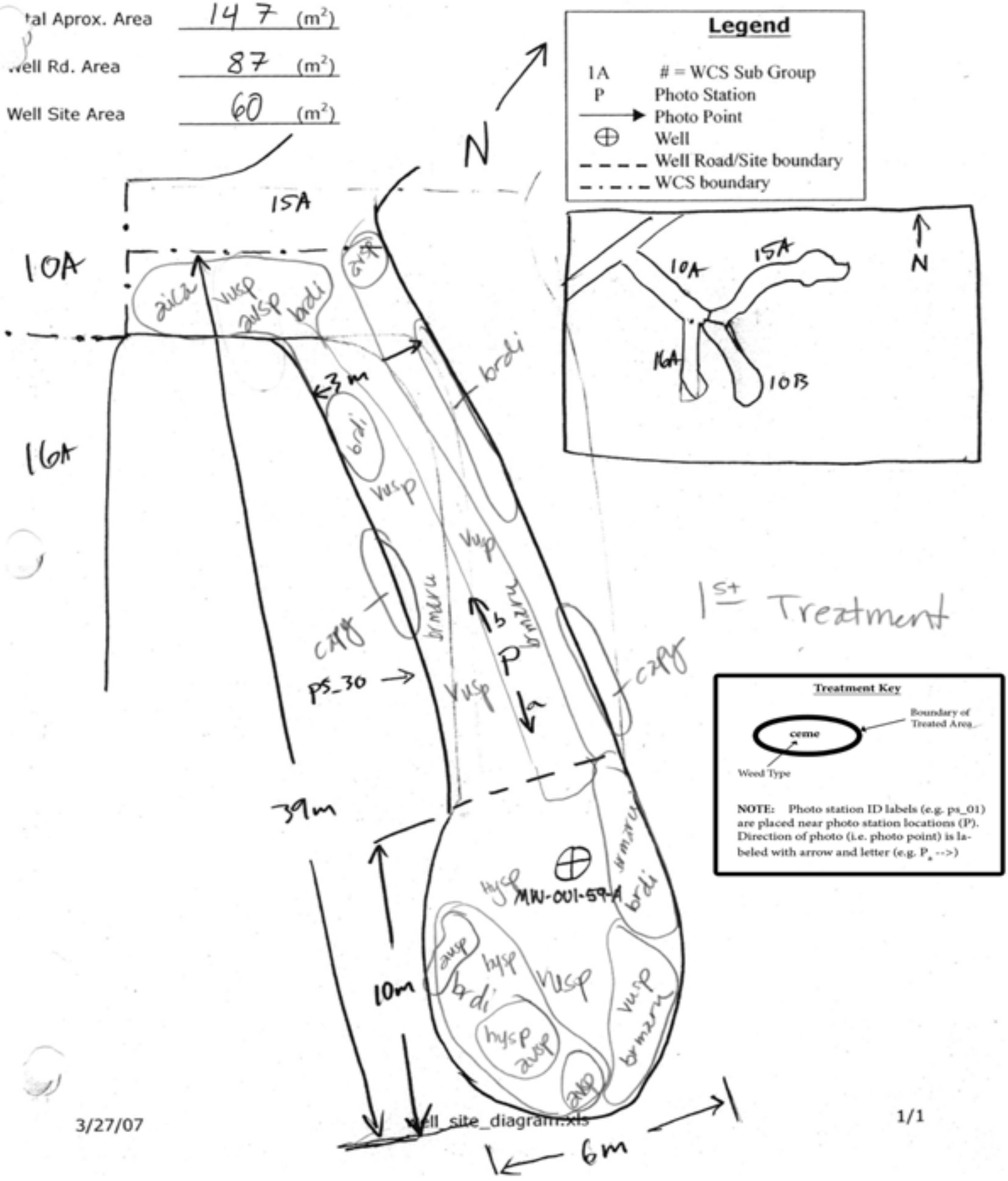
WCS Sub Group 10B

Surveyor AFM

tal Aprox. Area 147 (m^2)

Well Rd. Area 87 (m^2)

Well Site Area 60 (m^2)



Well ID: MW-OU1-59A

Date 7-1-11

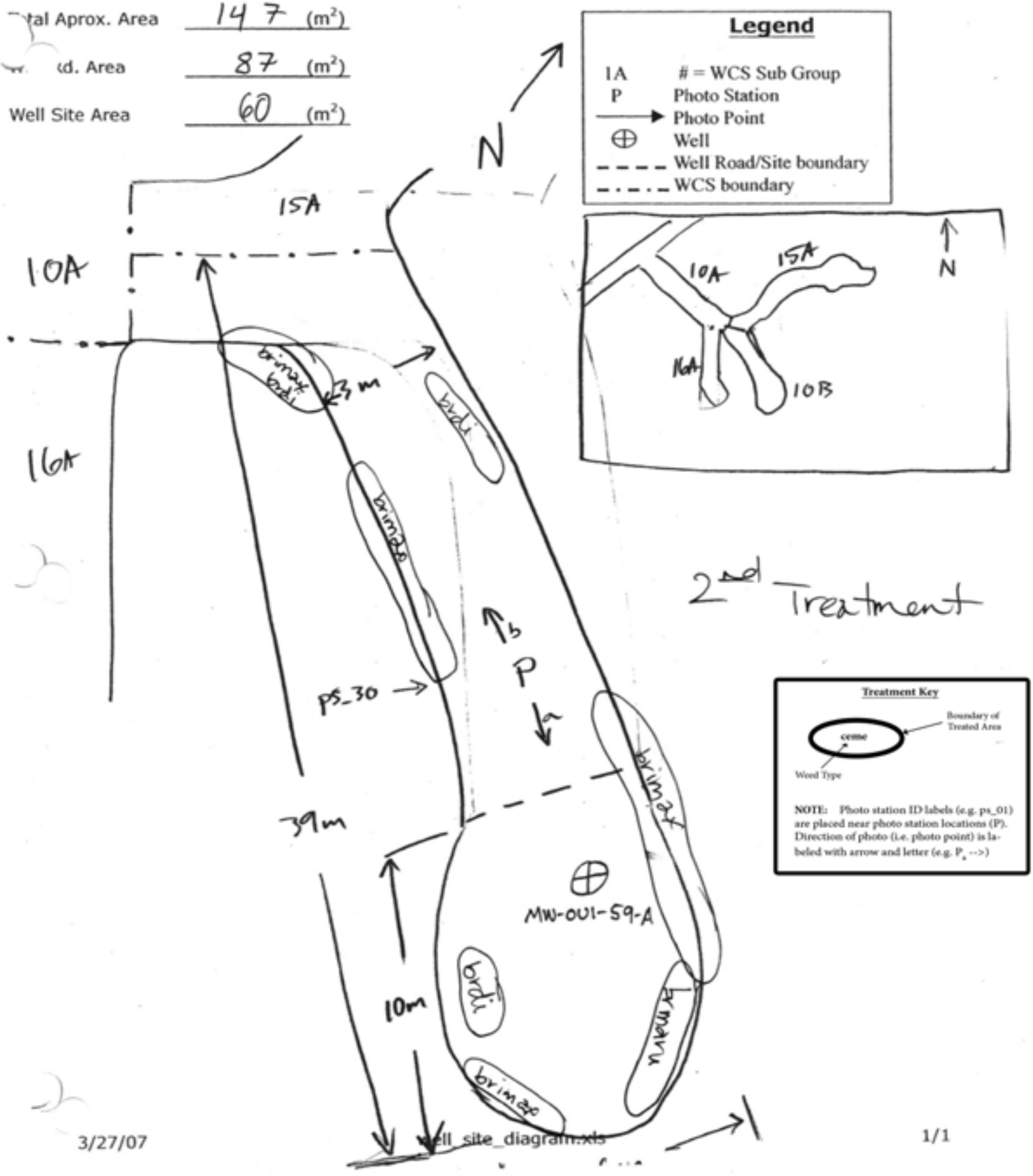
WCS Sub Group 10B

Surveyor AFM

Total Aprox. Area 147 (m^2)

Wetland Area 87 (m^2)

Well Site Area 60 (m^2)



Well ID: EW-OU1-71A

WCS Sub Group 11A

Date 5-10-11 & 5-13-11

Surveyor AFM

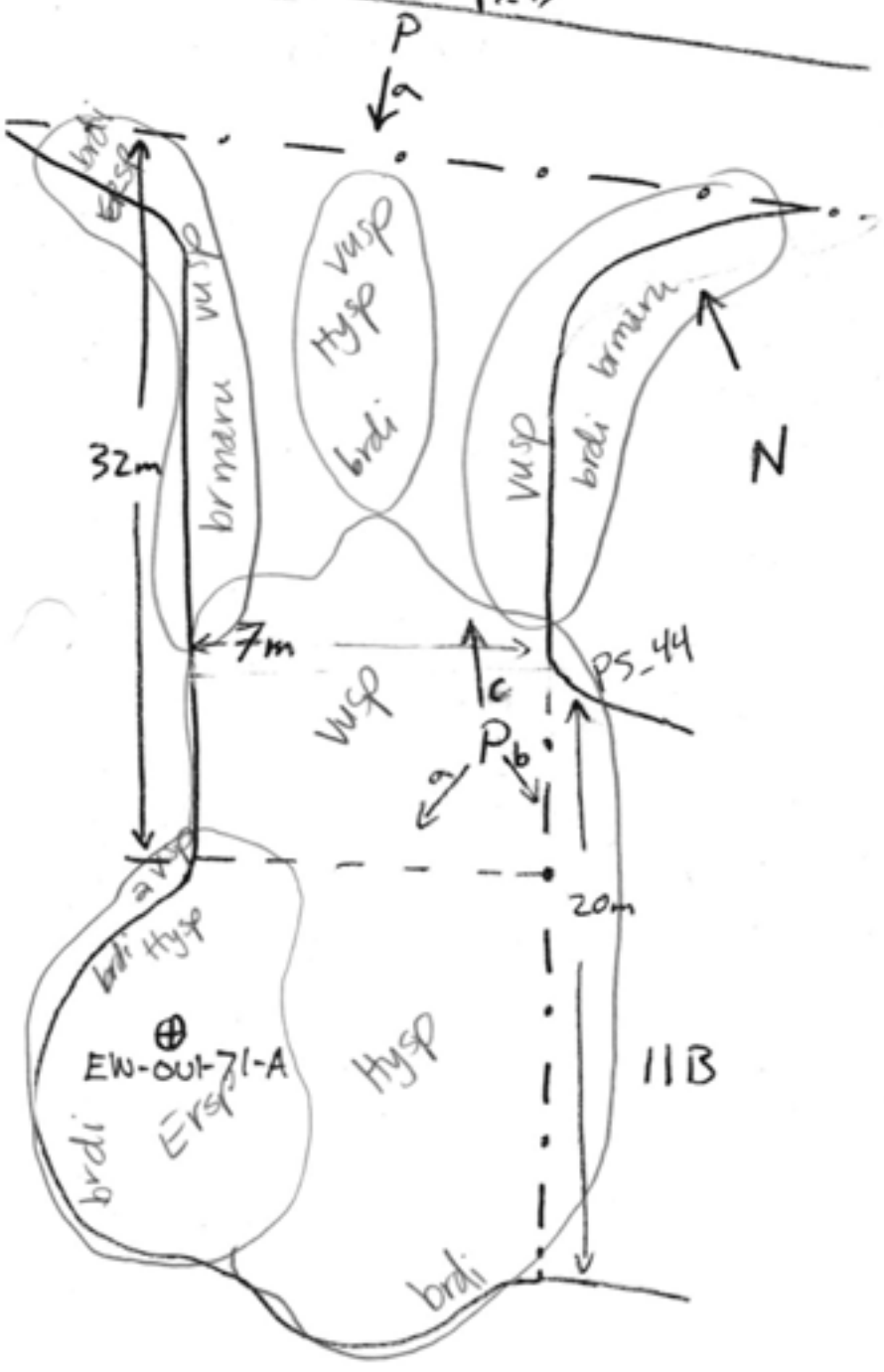
...al Aprox. Area 329 (m^2)

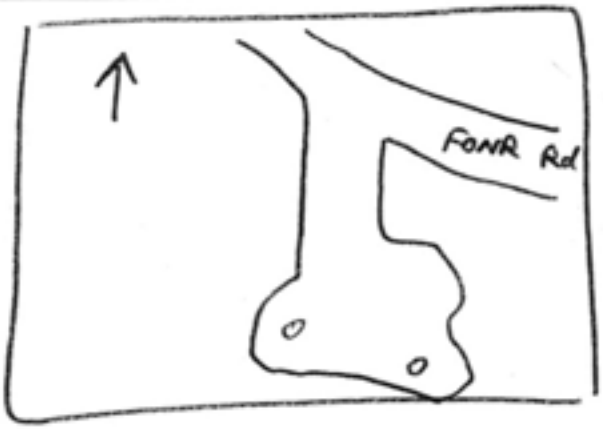
...ell Rd. Area 224 (m^2)

Well Site Area 105 (m^2)

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary





1ST Treatment

Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: EW-OU1-71A

Date 6-11-11

WCS Sub Group 11A

Surveyor AFM

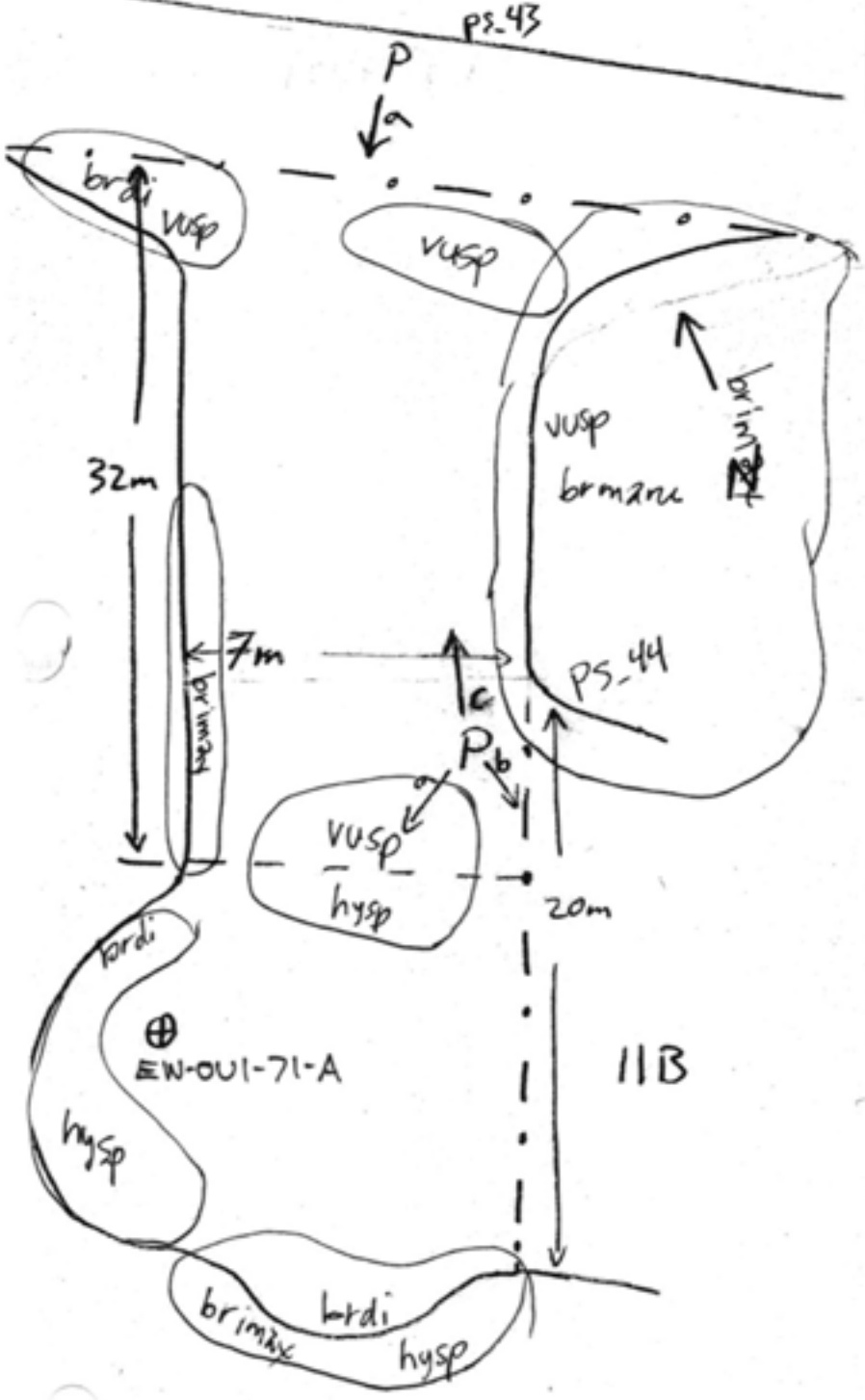
al Aprox. Area 329 (m^2)

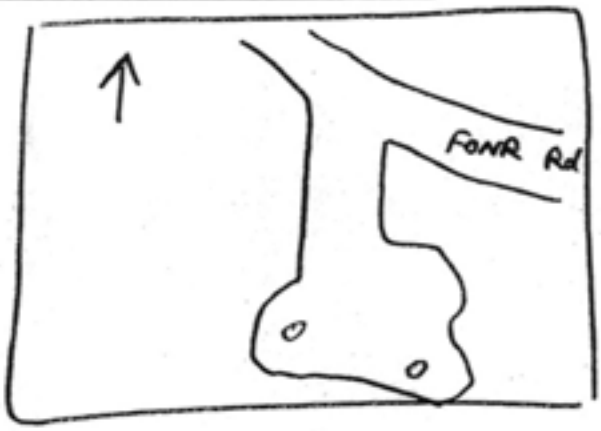
ell Rd. Area 224 (m^2)

Well Site Area 105 (m^2)

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- · - · -	WCS boundary





2nd Treatment

Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: EW-OUI-71A

Date 7-2-11

WCS Sub Group 11A

Surveyor AFM

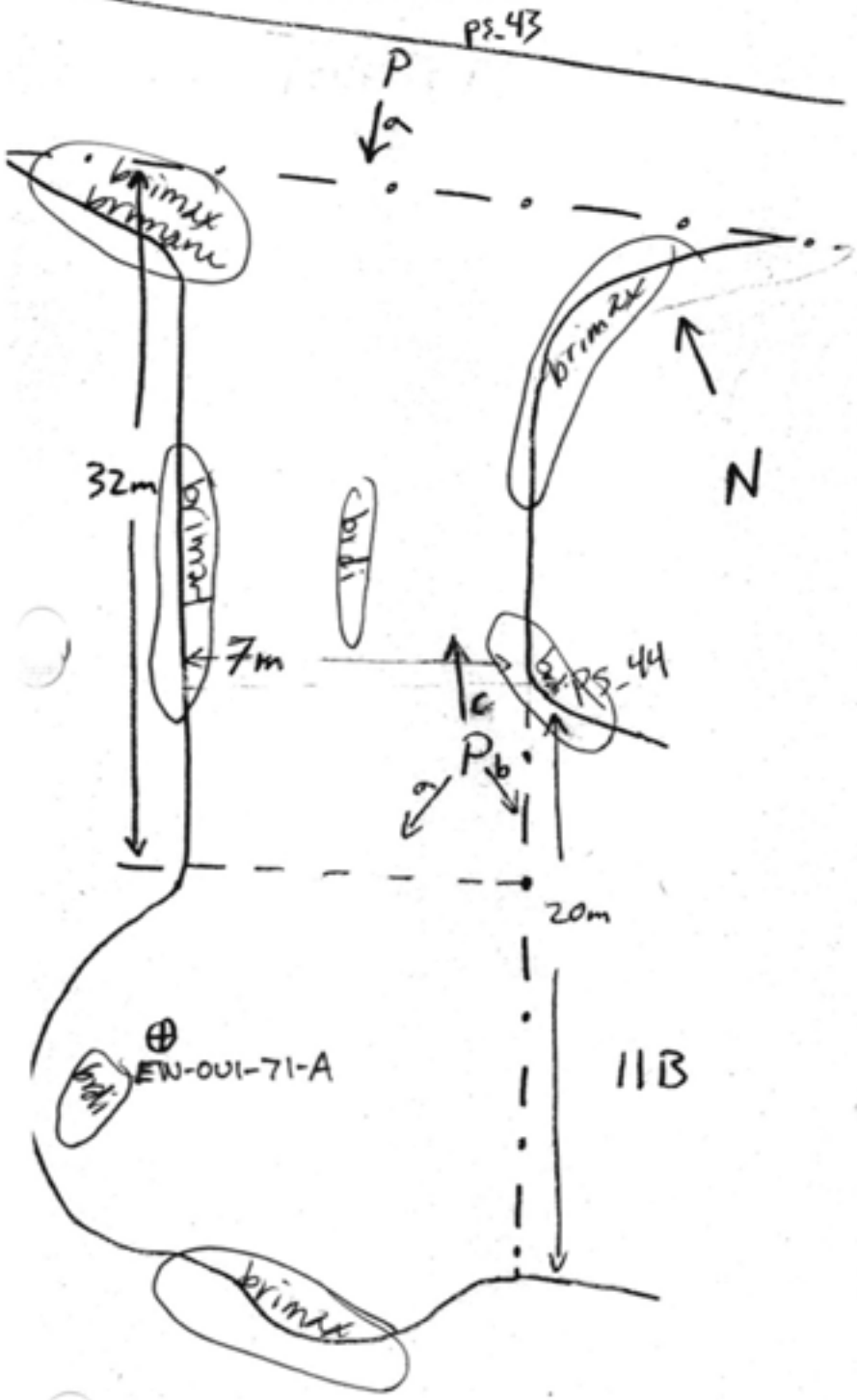
tal Aprox. Area 329 (m^2)

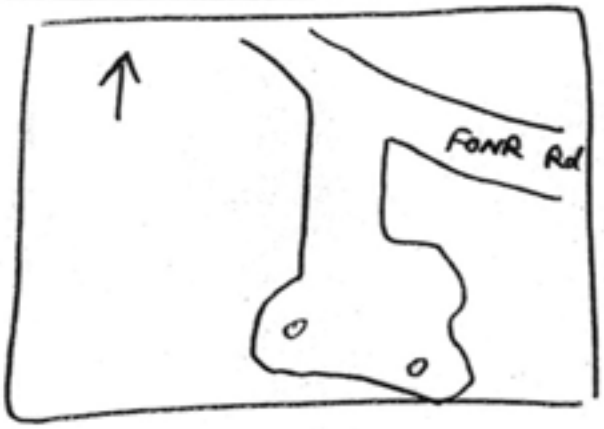
ell Rd. Area 224 (m^2)

Well Site Area 105 (m^2)

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary





3rd Treatment

Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: MW-OU1-86A

WCS Sub Group 11B

Date 5-10-11 & 5-13-11

Surveyor AFM

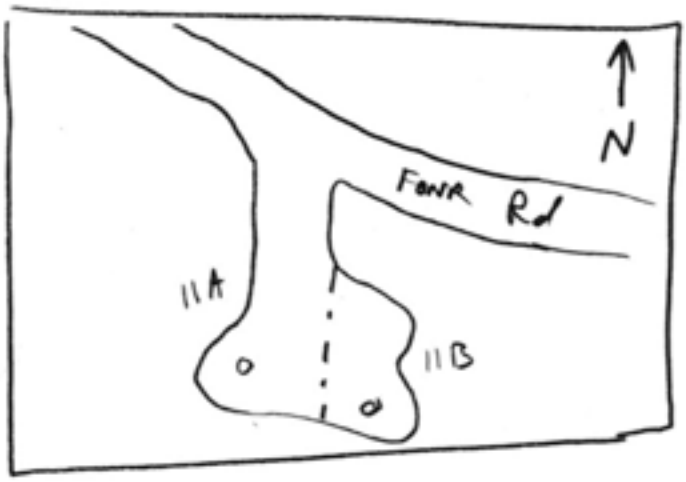
..tal Aprox. Area 390 (m^2)

..ell Rd. Area N/A (m^2)

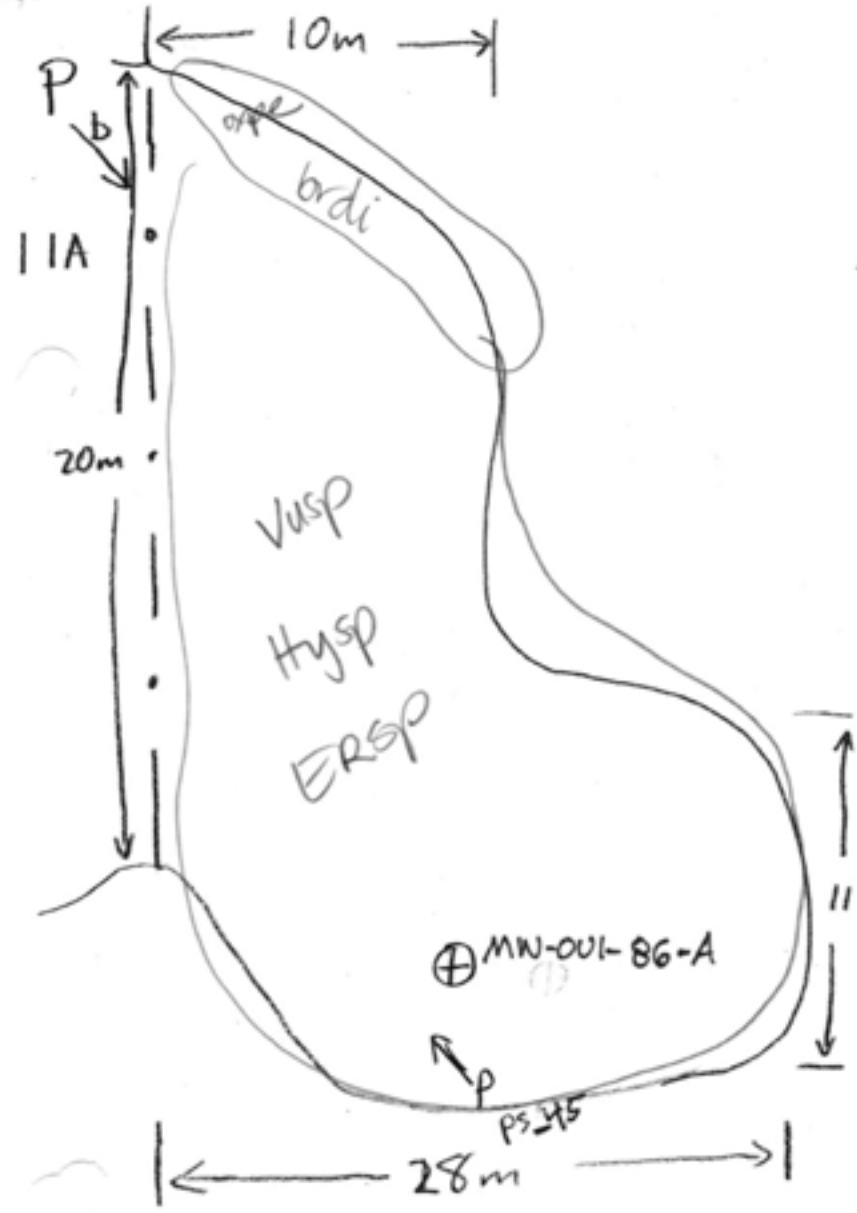
Well Site Area 390 (m^2)

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary



.s_44



1st Treatment

Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: MW-OU1-86A

WCS Sub Group 11B

Date 6-11-11

Surveyor AFM

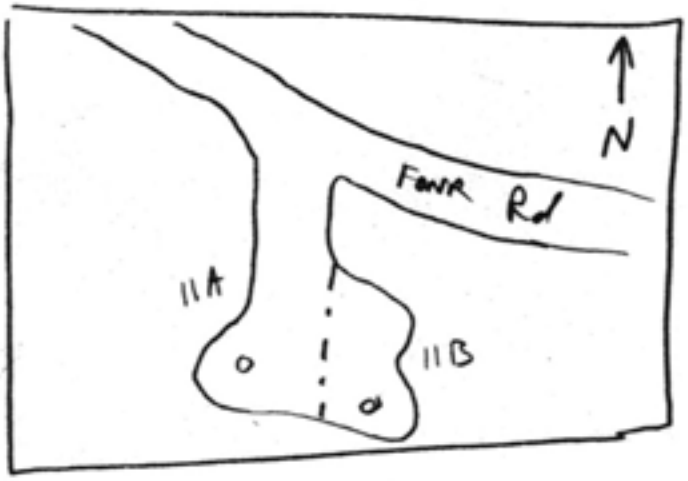
tal Aprox. Area 390 (m^2)

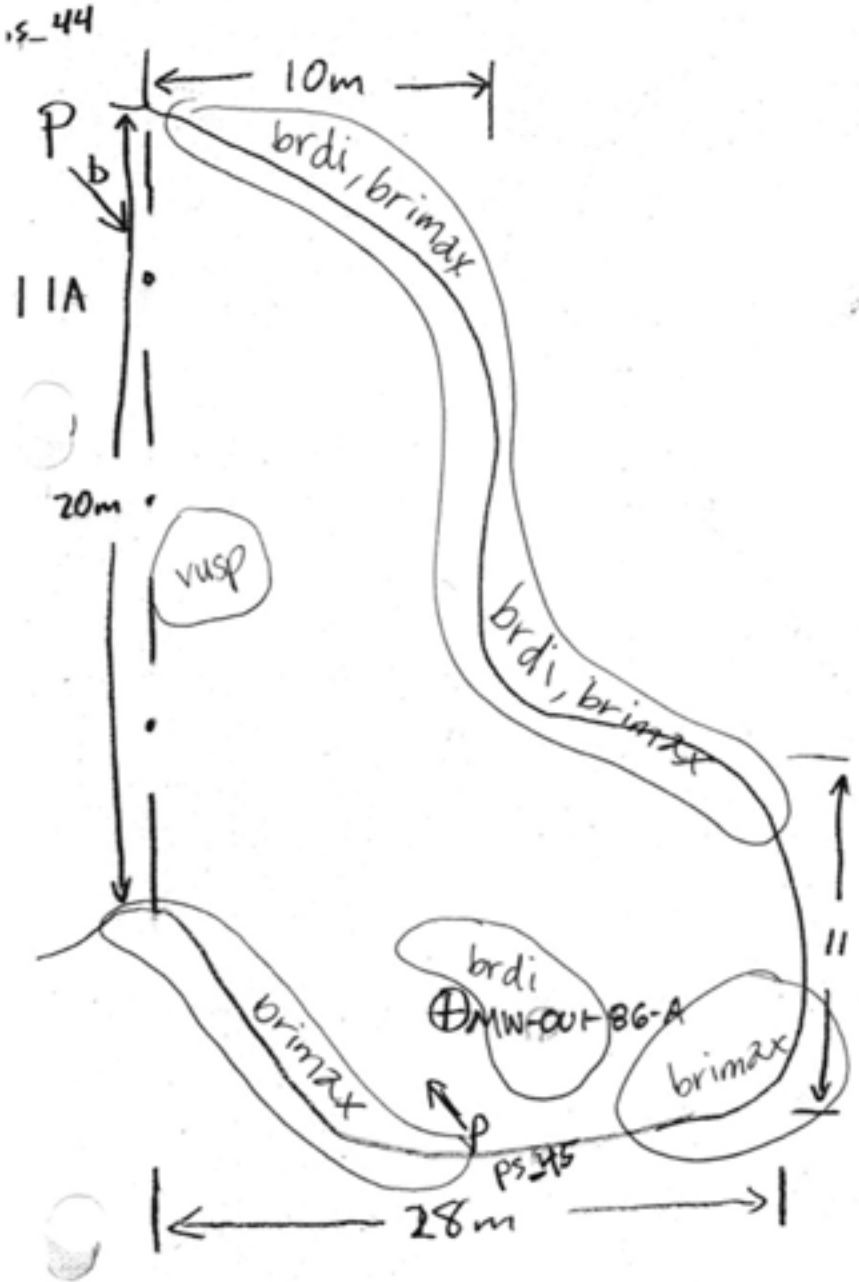
ell Rd. Area N/A (m^2)

Well Site Area 390 (m^2)

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary





2nd Treatment

Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: MW-OU1-86A

WCS Sub Group 11B

Date 7-2-11

Surveyor AFM

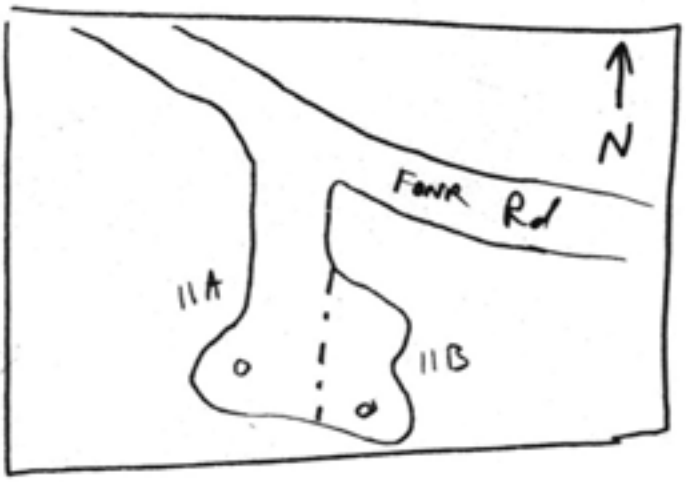
tal Aprox. Area 390 (m^2)

ell Rd. Area N/A (m^2)

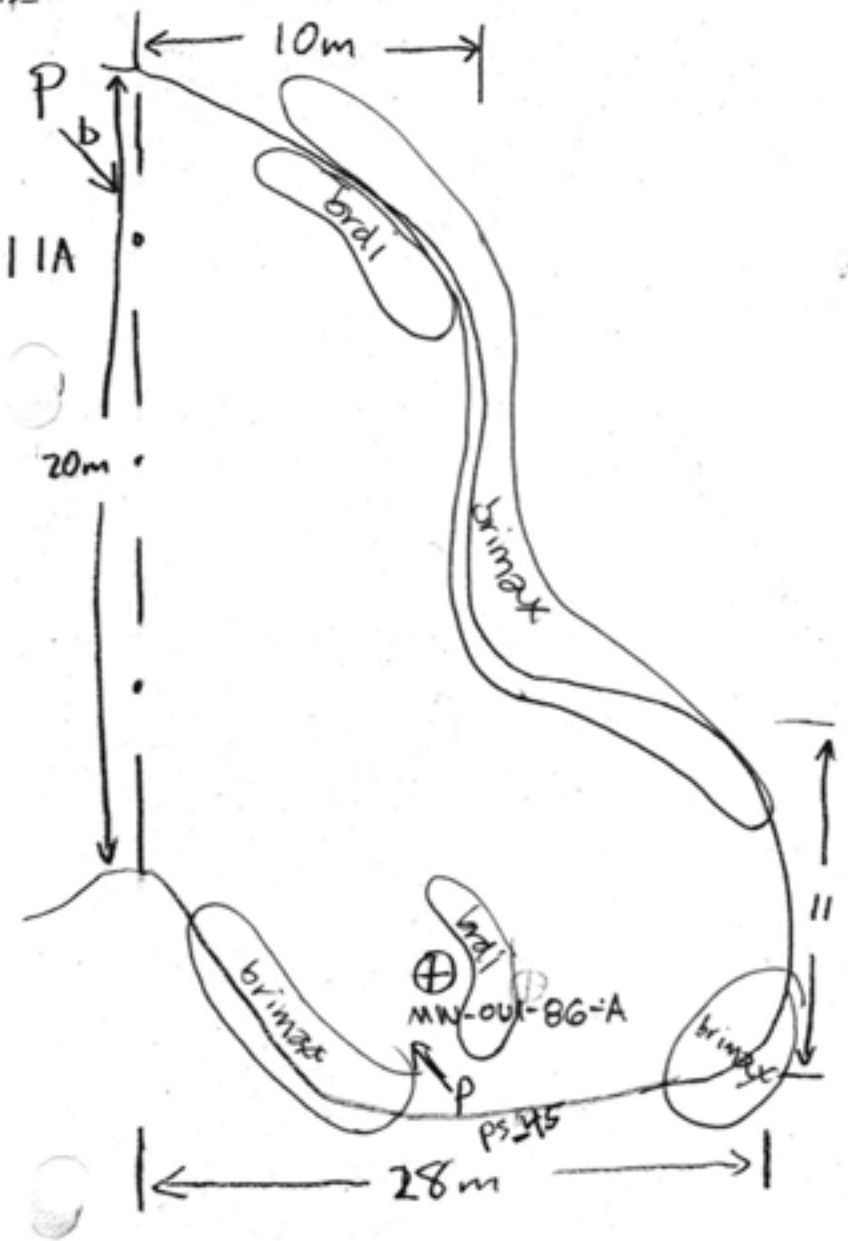
Well Site Area 390 (m^2)

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary



ps_44



3rd Treatment

Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: EW-OU1-72A

WCS Sub Group 12A

tal Aprox. Area 148 (m^2)

.ell Rd. Area 128 (m^2)

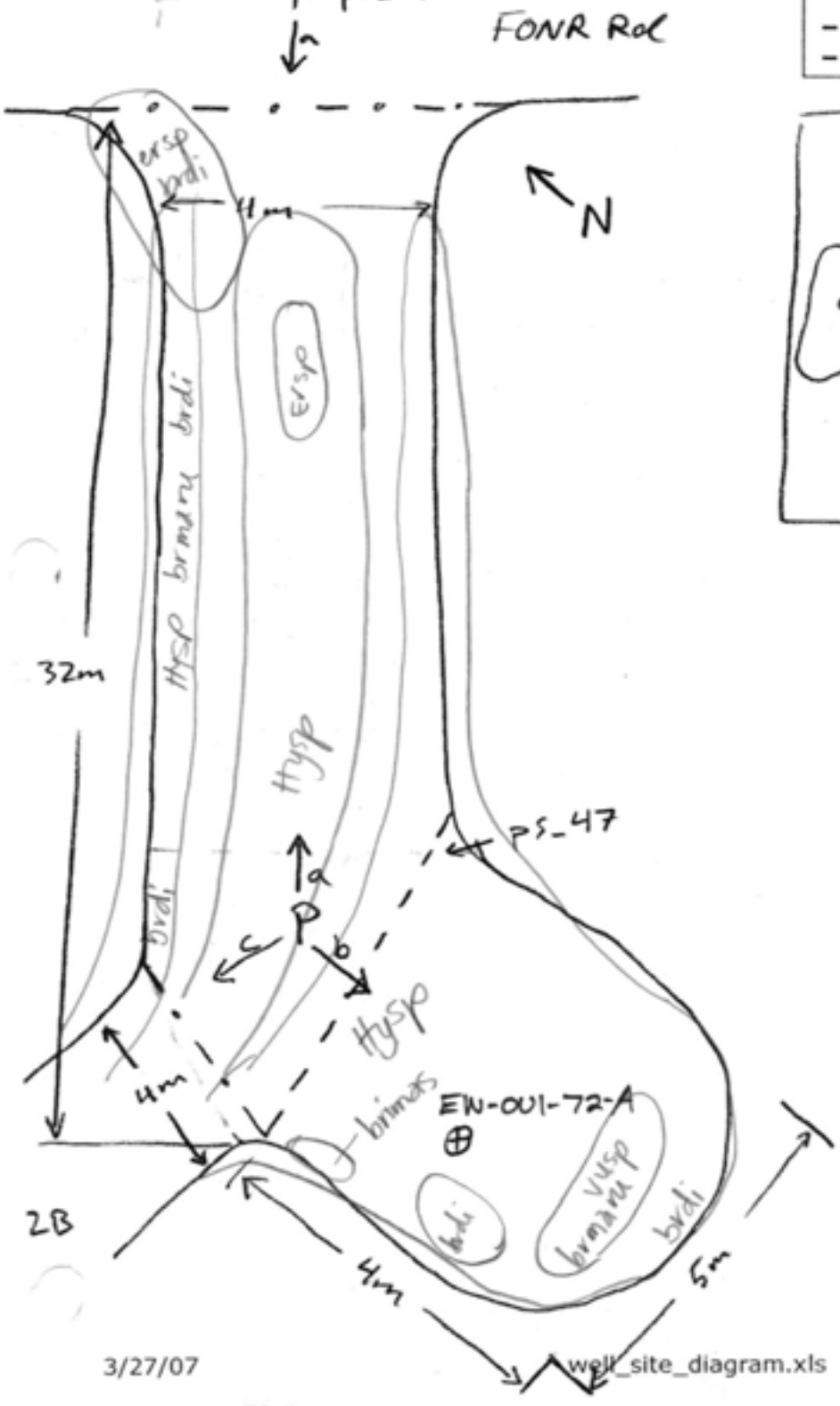
Well Site Area 20 (m^2)

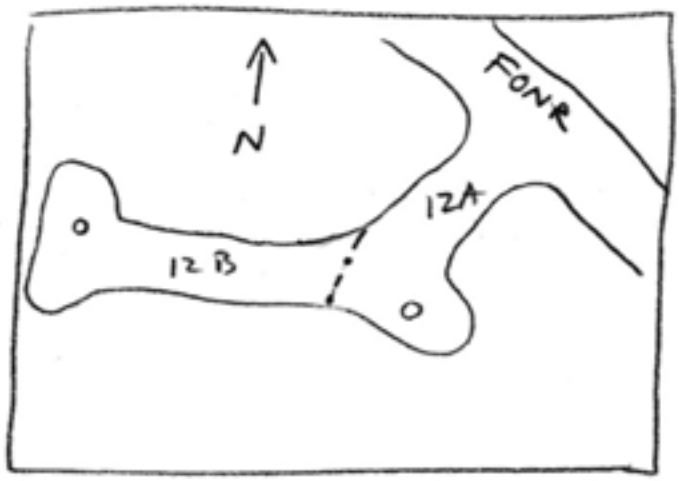
Date 5-13-11

Surveyor AFM

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary





1ST Treatment

Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: EW-001-72A

WCS Sub Group 12A

tal Aprox. Area 148 (m^2)

ell Rd. Area 128 (m^2)

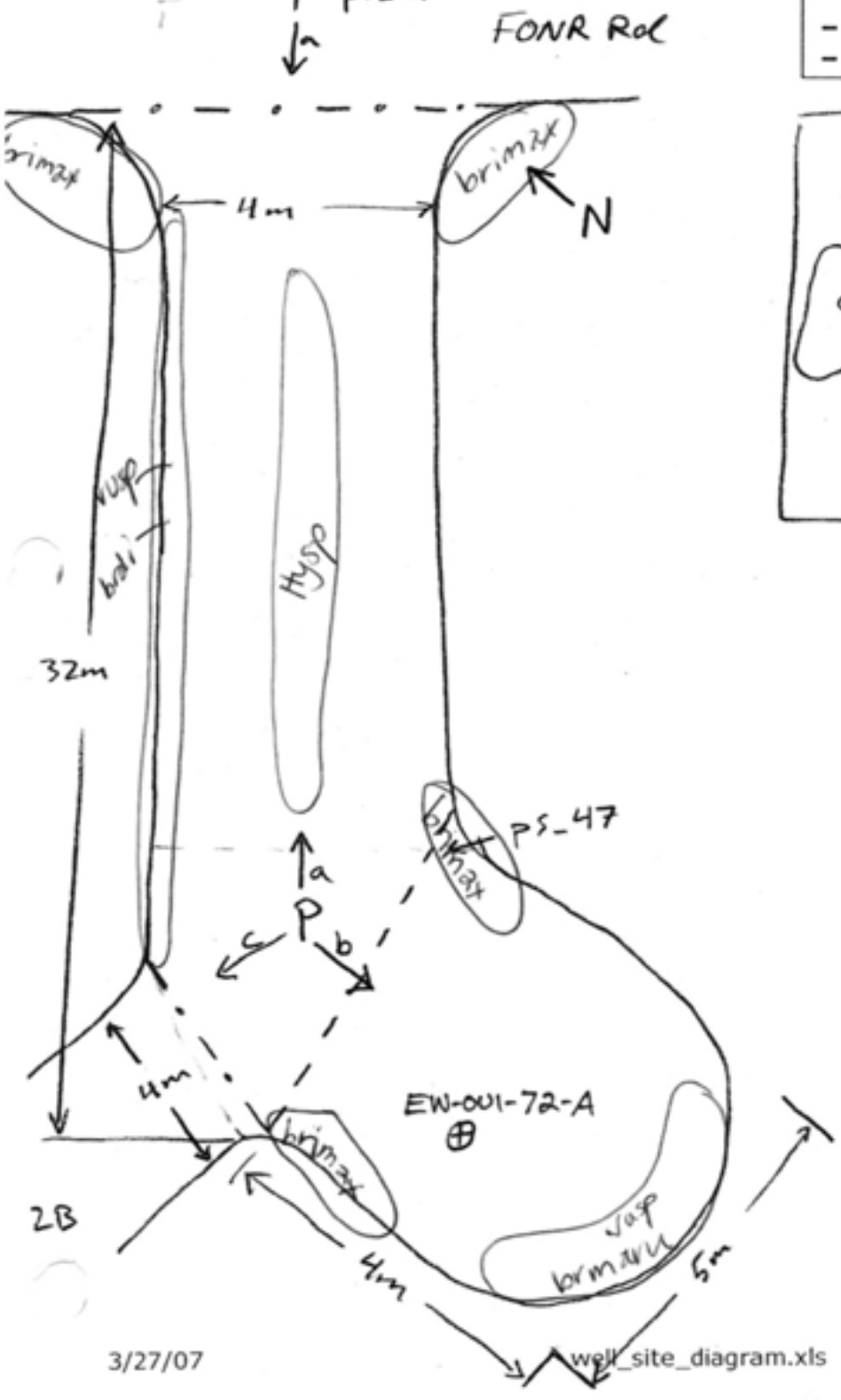
Well Site Area 20 (m^2)

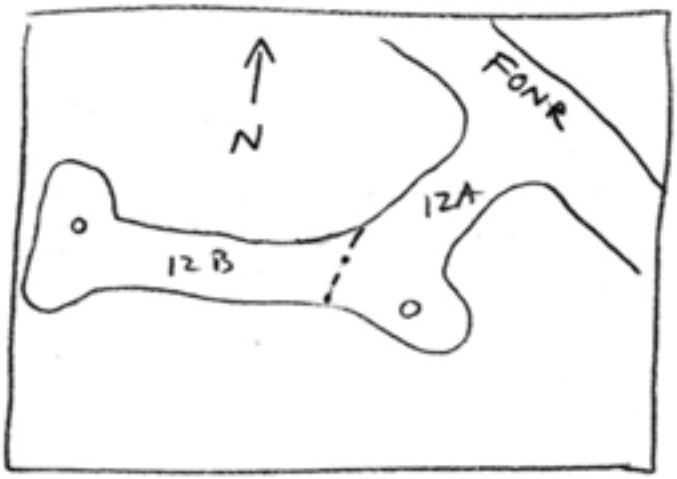
Date 6-17-11

Surveyor AFM

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary





2nd Treatment

Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: MW-OU1-85-A

WCS Sub Group 12B

tal Aprox. Area 164 (m^2)

.ell Rd. Area 76 (m^2)

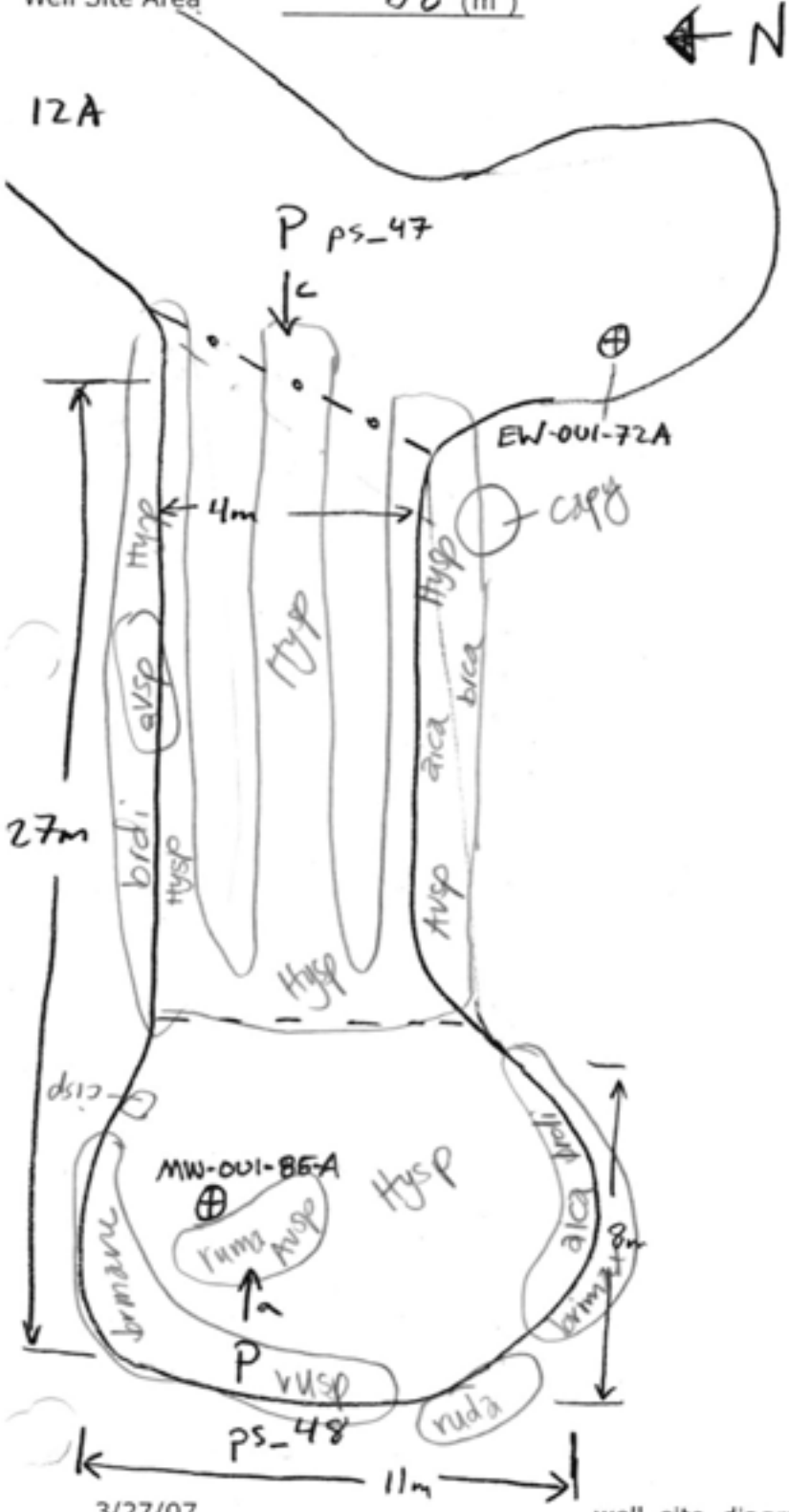
Well Site Area 88 (m^2)

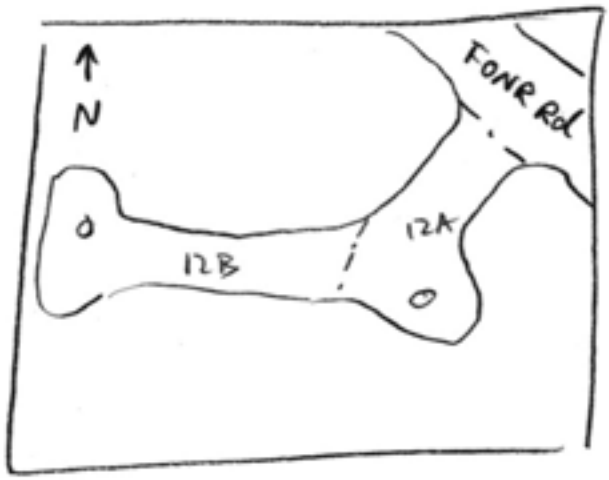
Date 5-14-11

Surveyor AFM

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary





1st Treatment

Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: MW-OU1-85-A

WCS Sub Group 12B

tal Aprox. Area 164 (m^2)

.ell Rd. Area 76 (m^2)

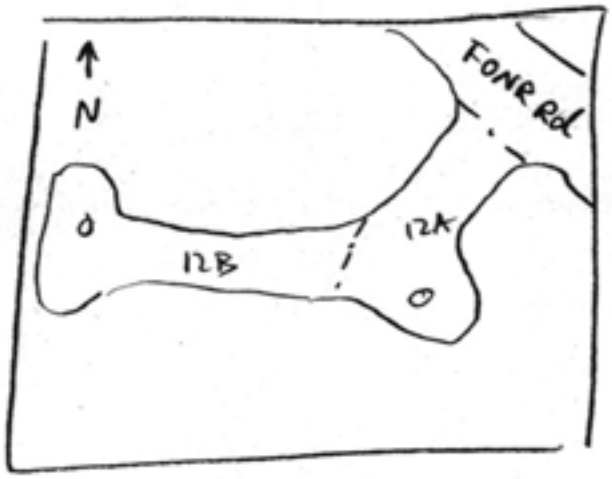
Well Site Area 88 (m^2)

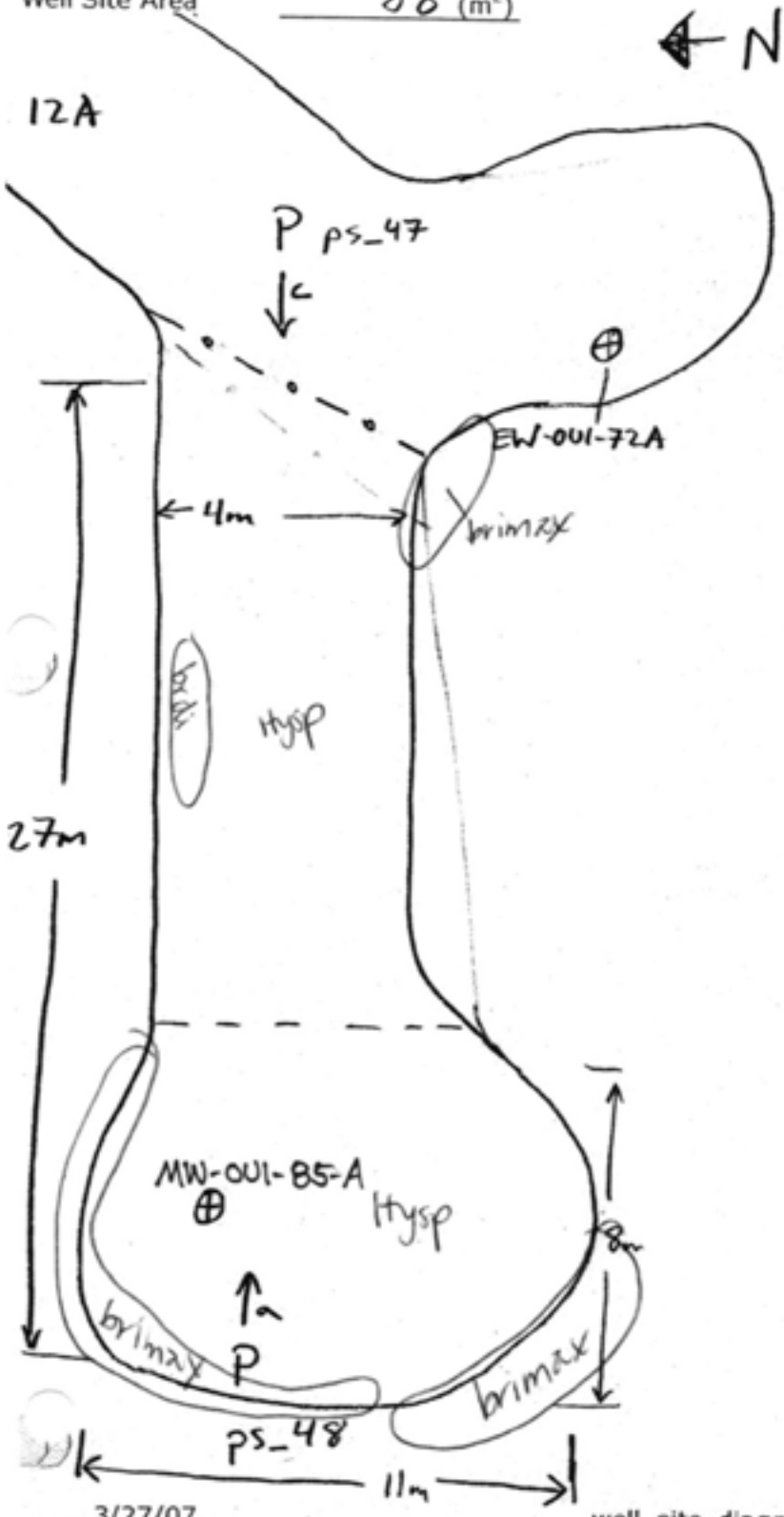
Date 6-18-11

Surveyor AFm

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary





2nd Treatment

Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: IW-001-73A

WCS Sub Group 13A

Date 5-3-11

Surveyor AFM

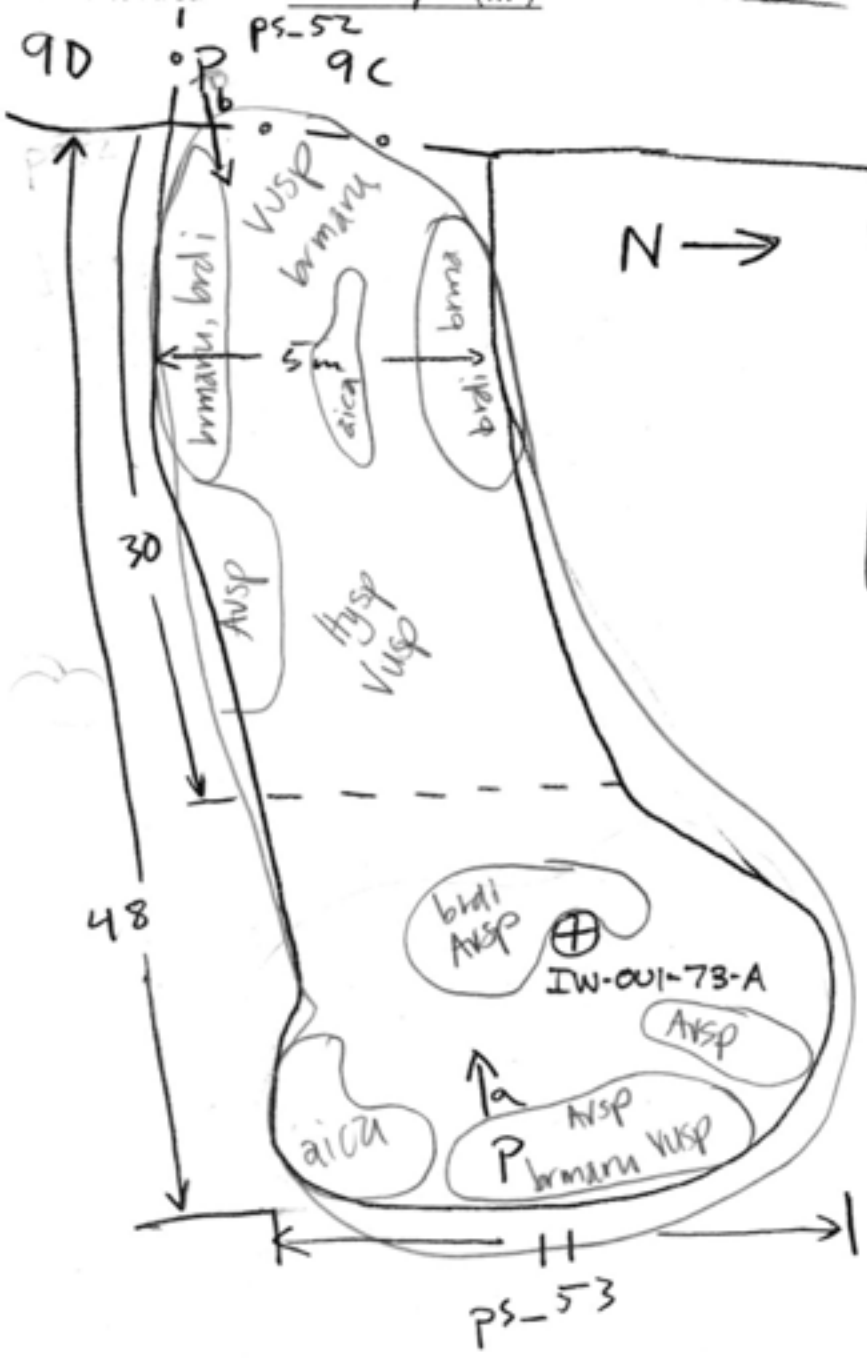
Total Aprox. Area 277 (m^2)

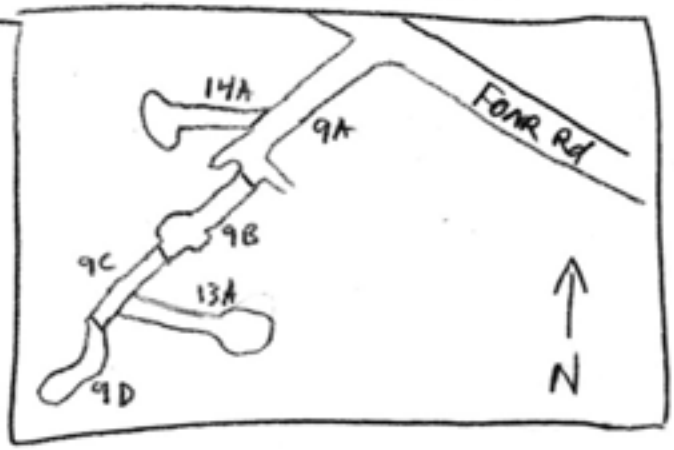
Treated Area 150 (m^2)

Well Site Area 127 (m^2)

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary





1st Treatment

Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: IW-001-73A

WCS Sub Group 13A

Date 6-17-11

Surveyor AFM

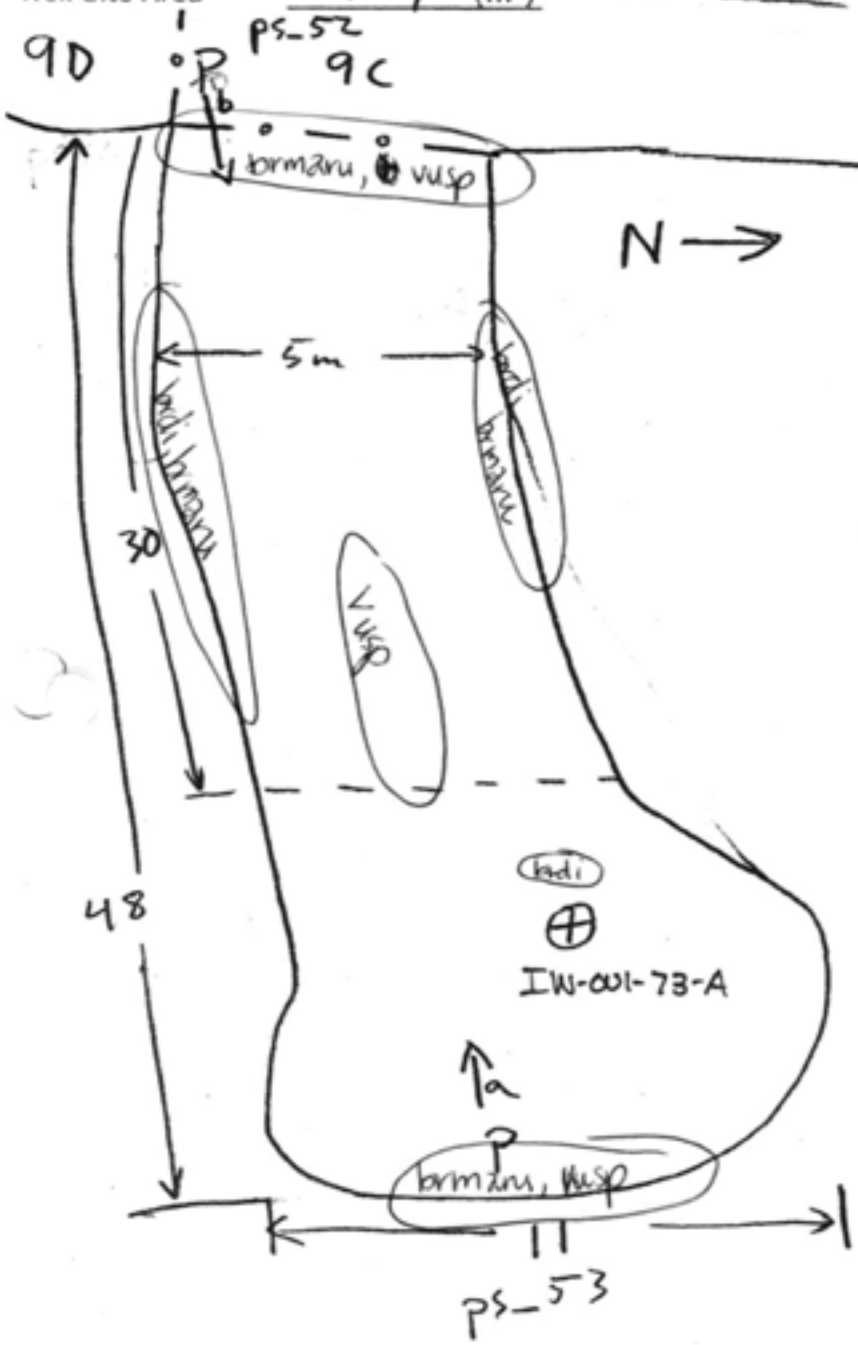
Total Aprox. Area 277 (m^2)

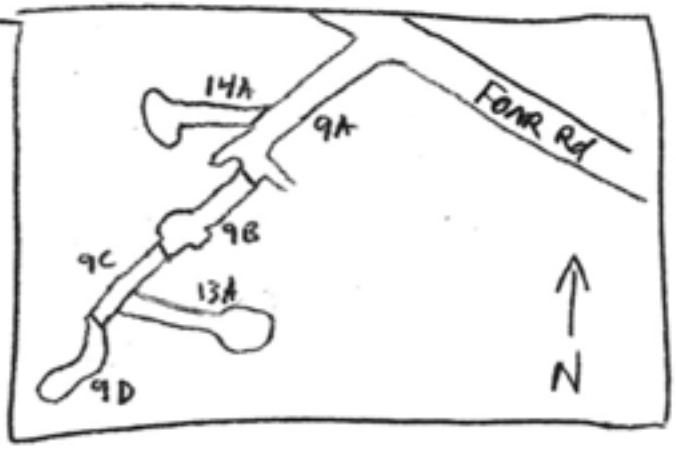
Fenced. Area 150 (m^2)

Well Site Area 127 (m^2)

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary





2nd Treatment

Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: MW-OU1-83A

WCS Sub Group 14A

tal Aprox. Area 327 (m^2)

ell Rd. Area 215 (m^2)

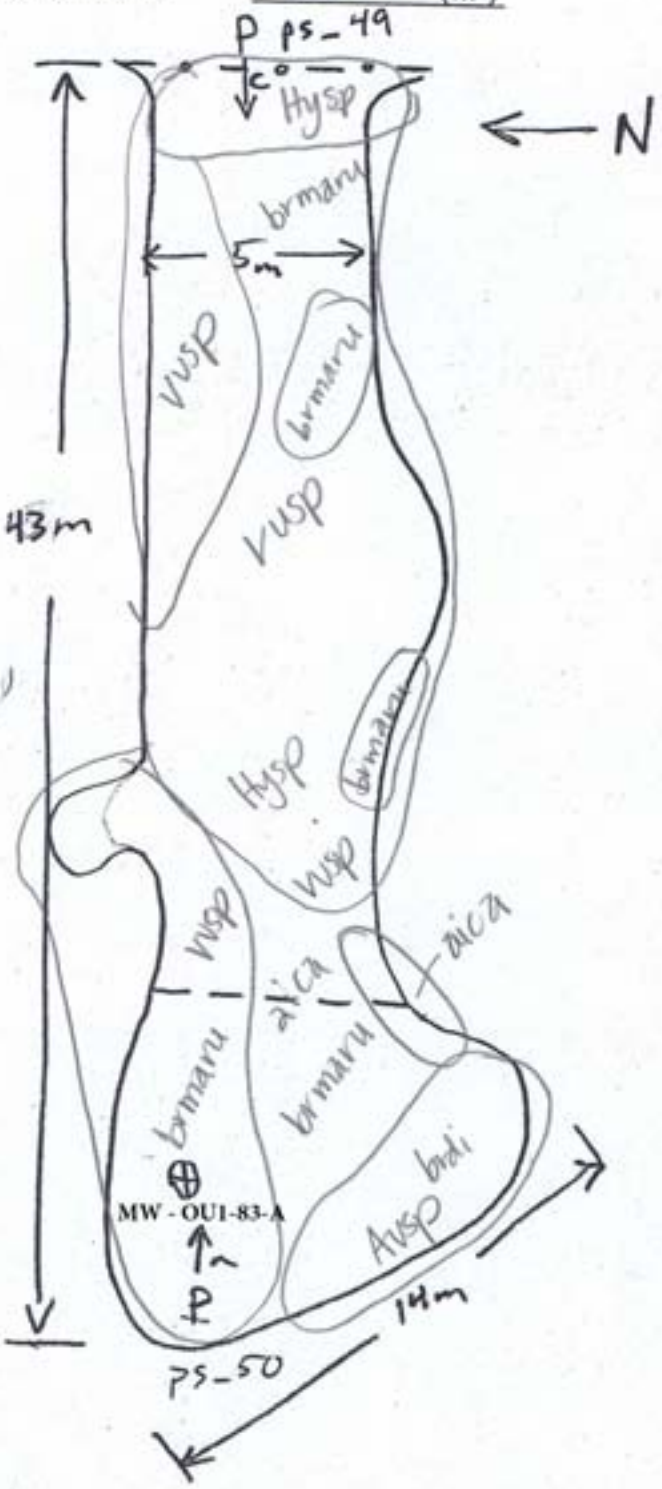
Well Site Area 112 (m^2)

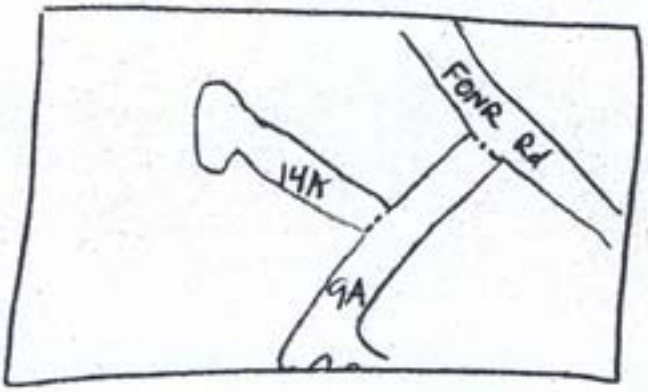
Date 5-3-11

Surveyor AFM

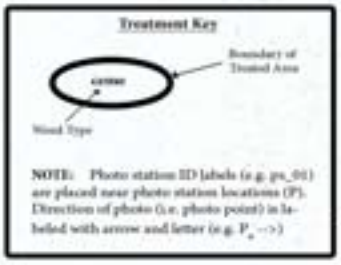
Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary





1st Treatment



Well ID: MW-OU1-83A

WCS Sub Group 14A

Total Aprox. Area 327 (m^2)

Well Rd. Area 215 (m^2)

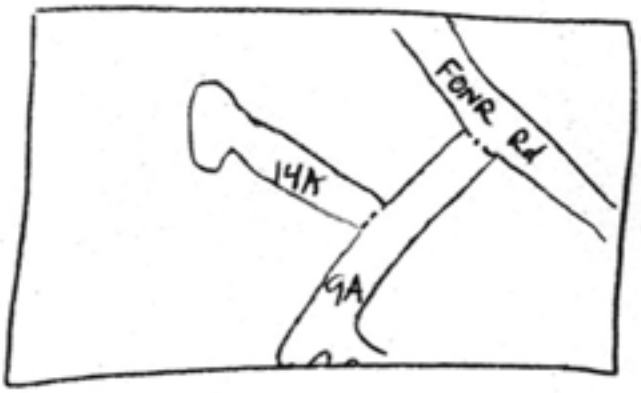
Well Site Area 112 (m^2)

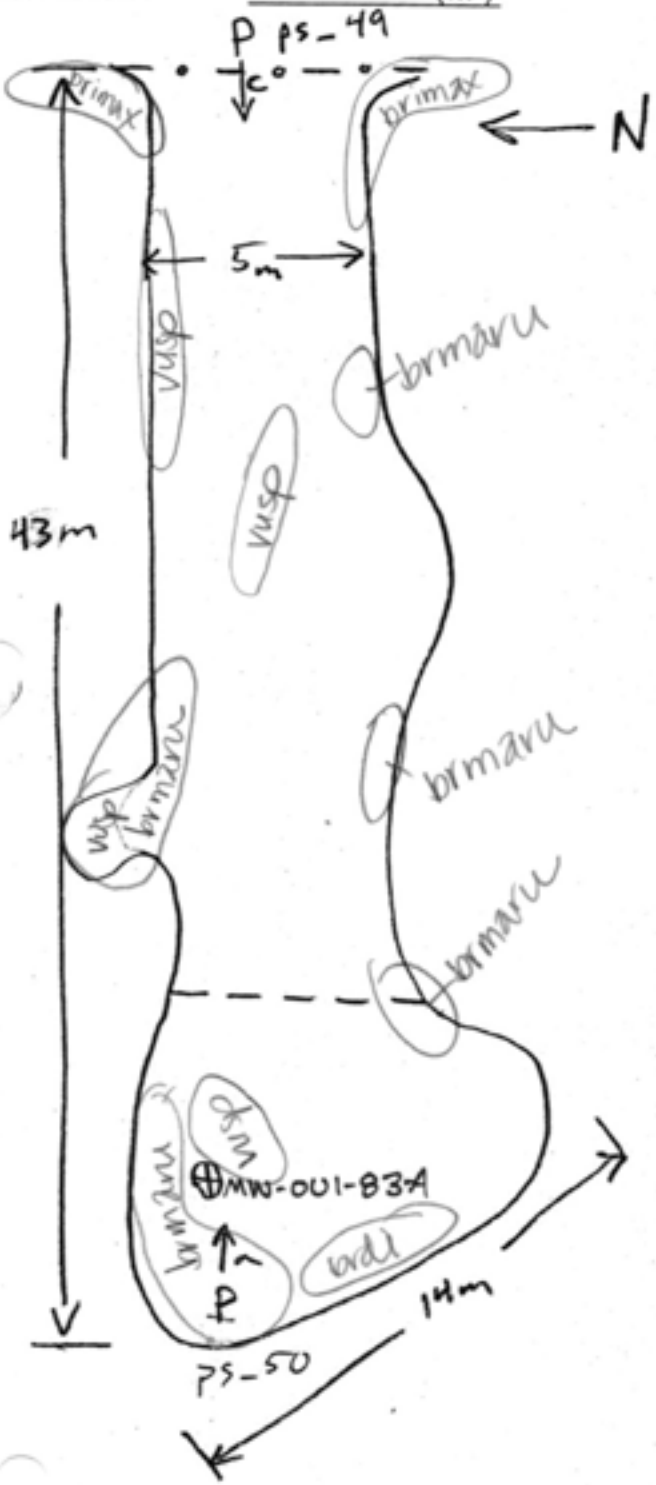
Date 6-24-11

Surveyor AFM

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- · - · -	WCS boundary





2nd Treatment

Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: MW-OU1-82A

WCS Sub Group 15A

Total Aprox. Area 326 (m^2)

Well Rd. Area 208 (m^2)

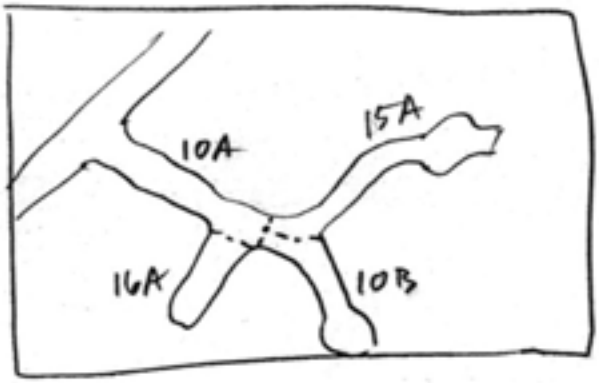
Well Site Area 118 (m^2)

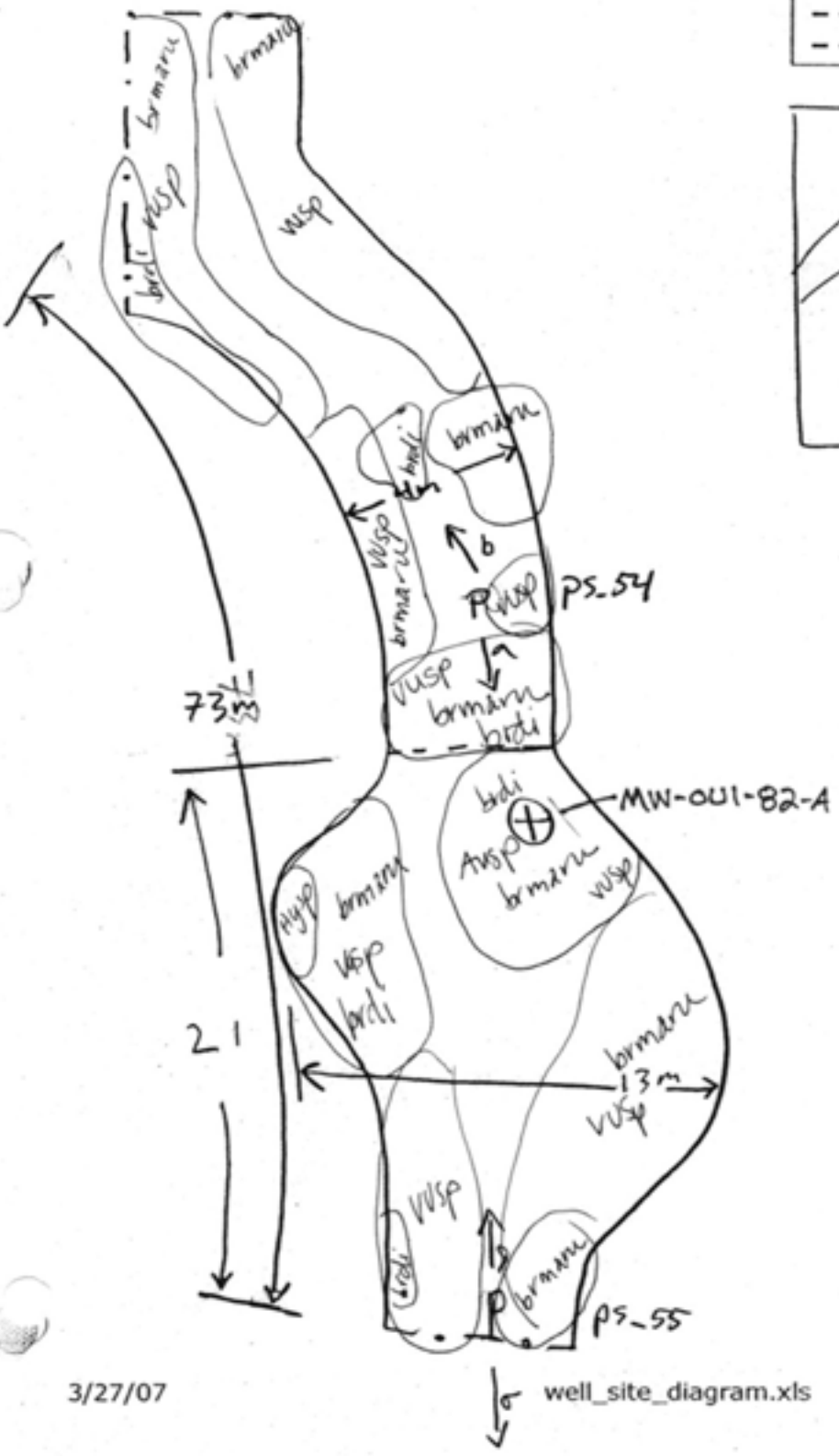
Date 6-7-11

Surveyor AFM

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary





1st Treatment

Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: MW-001-82A

Date 6-18-11

WCS Sub Group 15A

Surveyor AFM

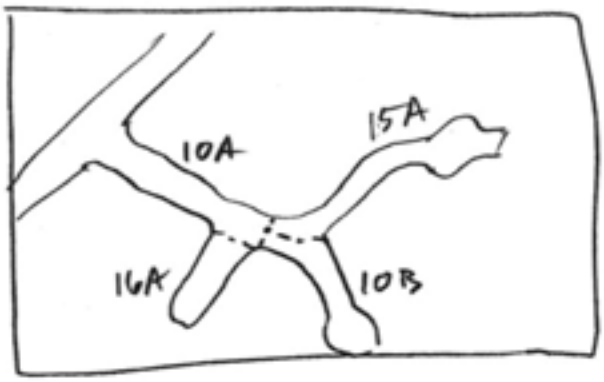
Total Aprox. Area 326 (m^2)

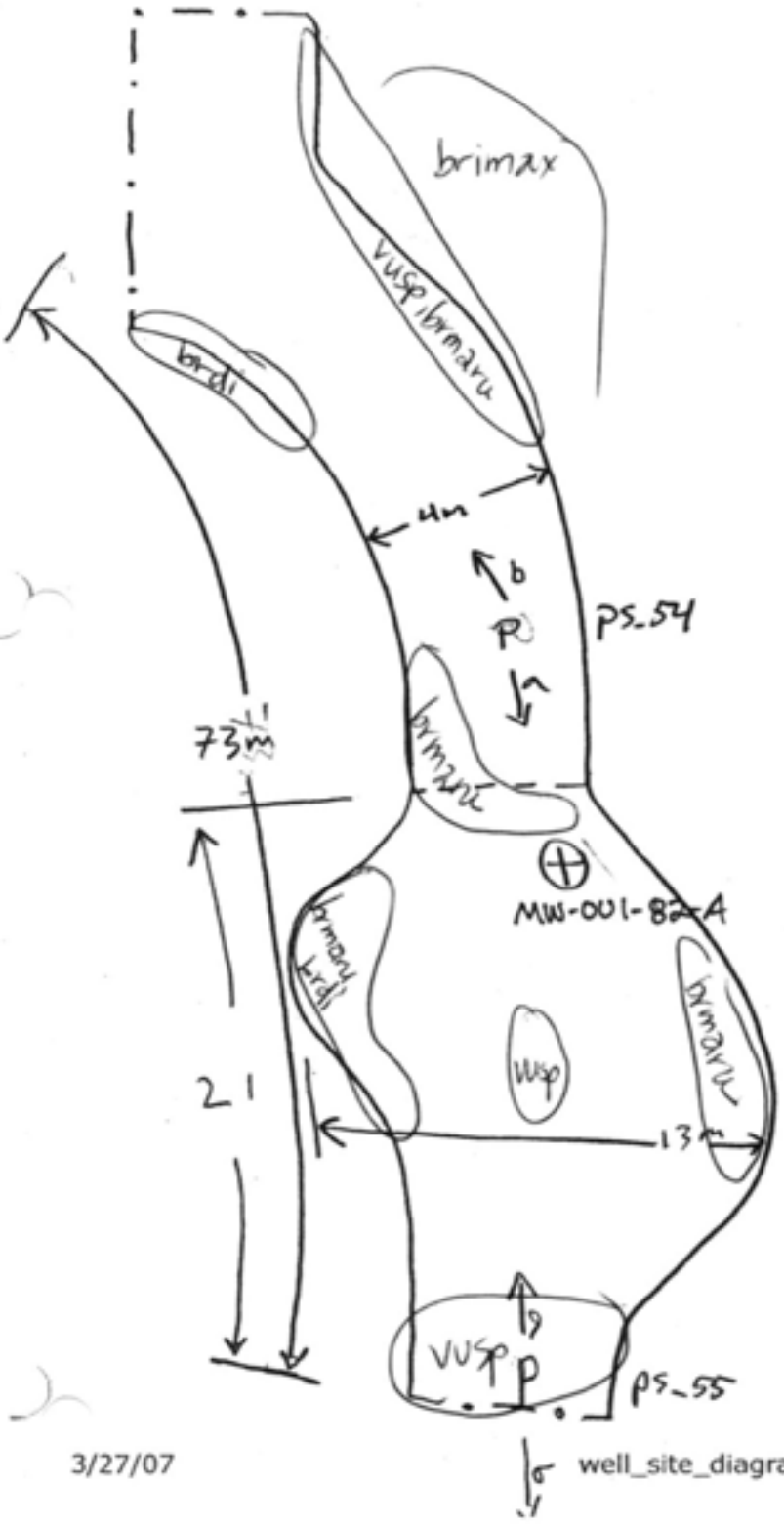
Ttl. Area 208 (m^2)

Well Site Area 118 (m^2)

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary





2nd Treatment

Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: SB-OU1-2004-K

WCS Sub Group 16A

Total Aprox. Area 300 (m^2)

Well Rd. Area 160 (m^2)

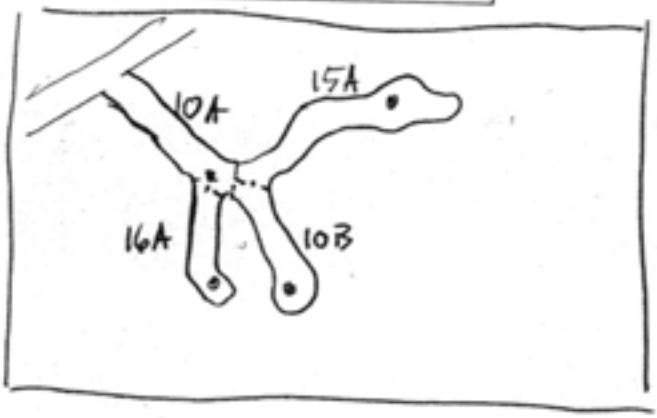
Well Site Area 140 (m^2)

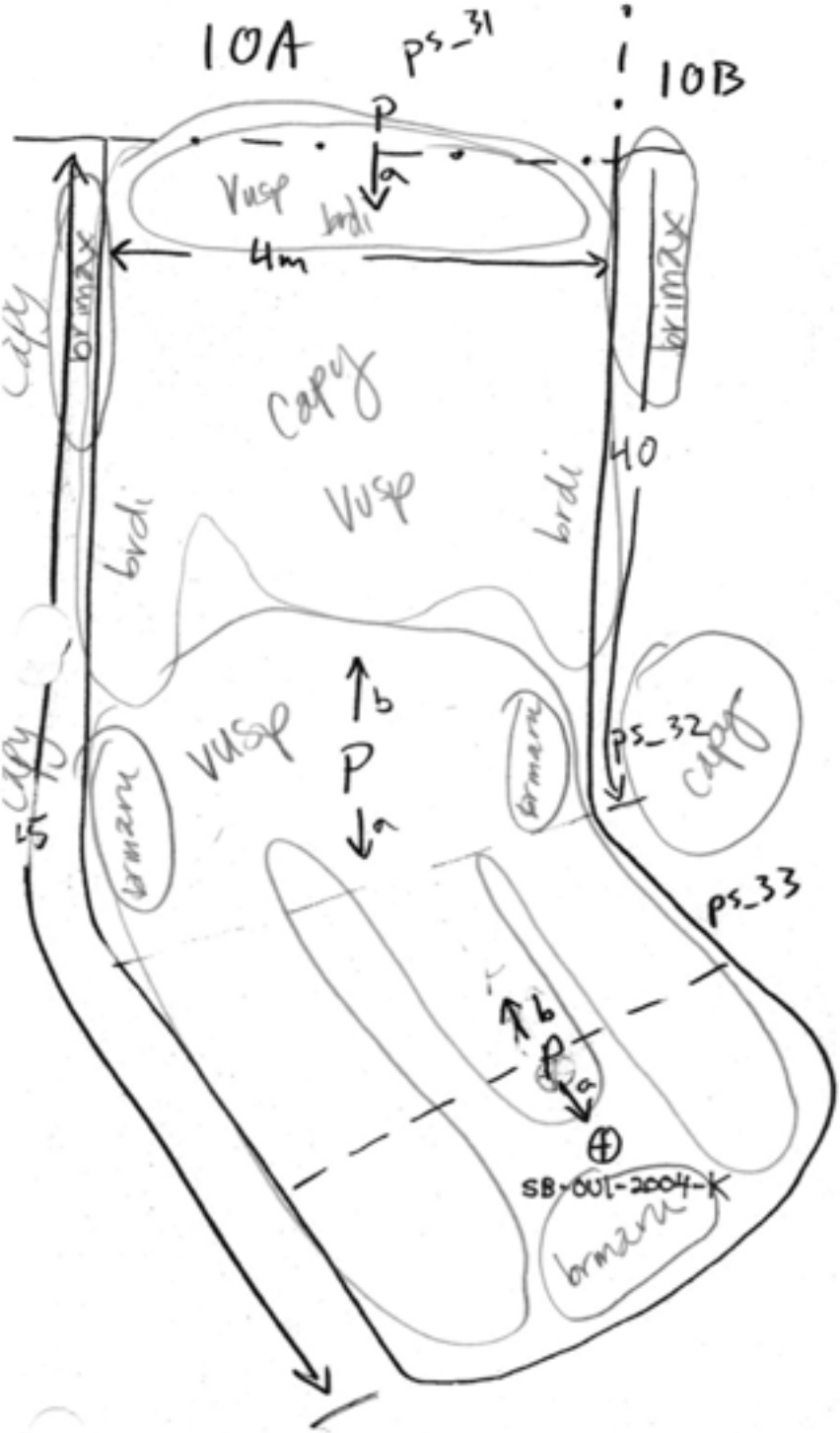
Date 5-24-11

Surveyor AFm

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - .	WCS boundary





1st Treatment

Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: SB-OU1-2004-K

WCS Sub Group 16A

Total Aprox. Area 300 (m^2)

Well Rd. Area 160 (m^2)

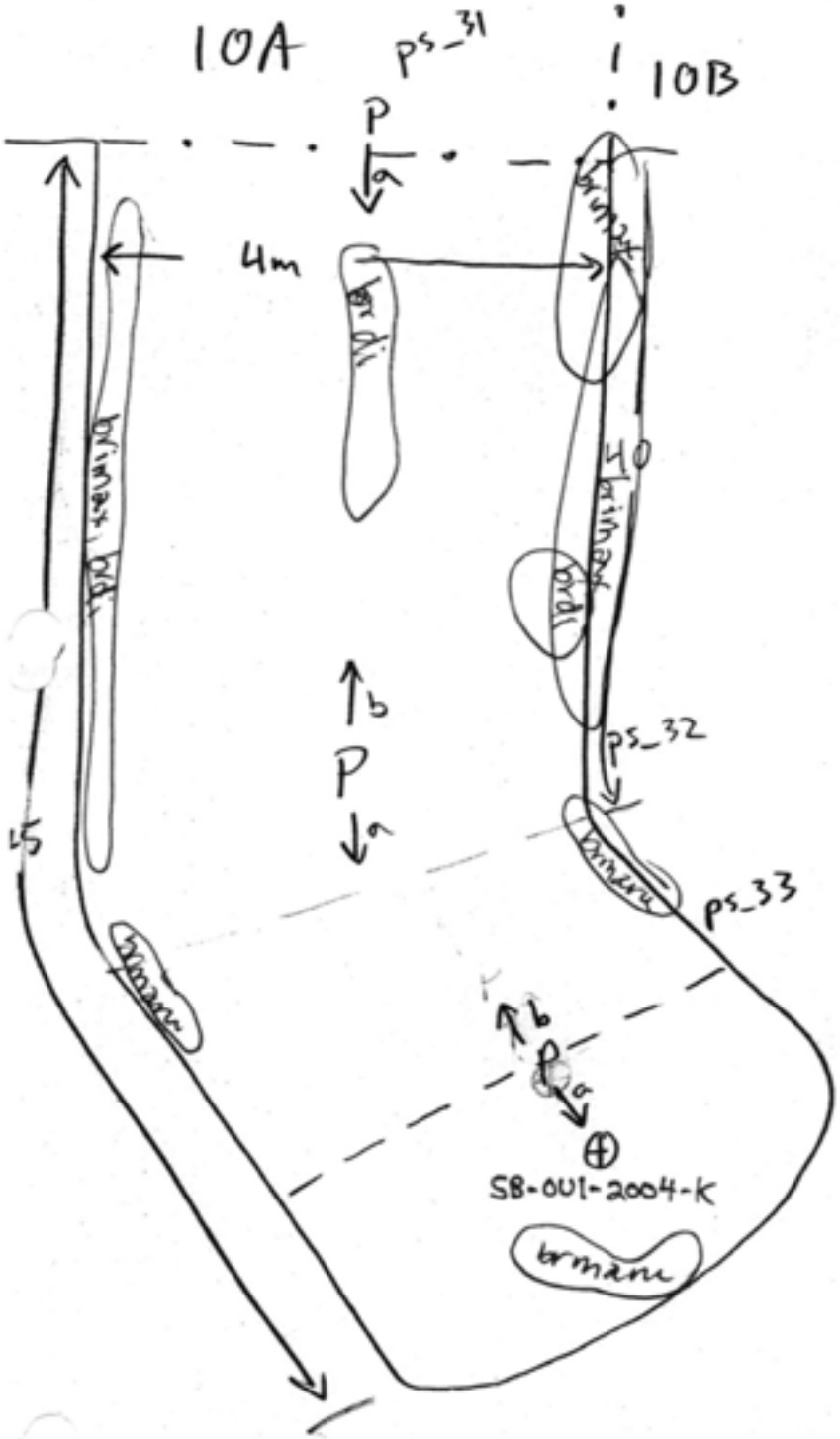
Well Site Area 140 (m^2)

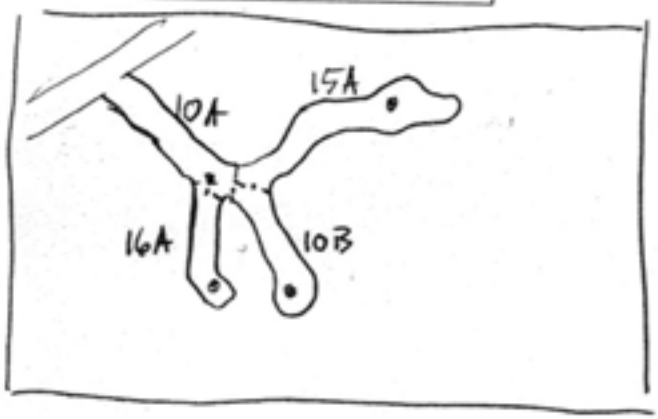
Date 7-2-11

Surveyor AFM

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary





2nd Treatment

Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: PZ-OU1-02-A / IW-OU1-02-A

Date 5-5-11

WCS Sub Group 17A

Surveyor AFM

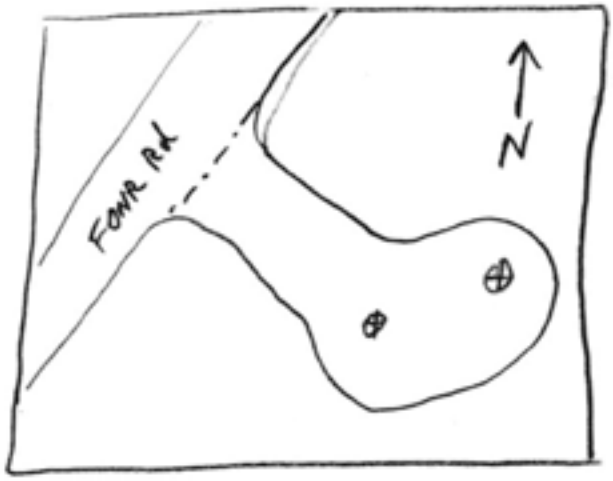
Total Aprox. Area 100 (m^2)

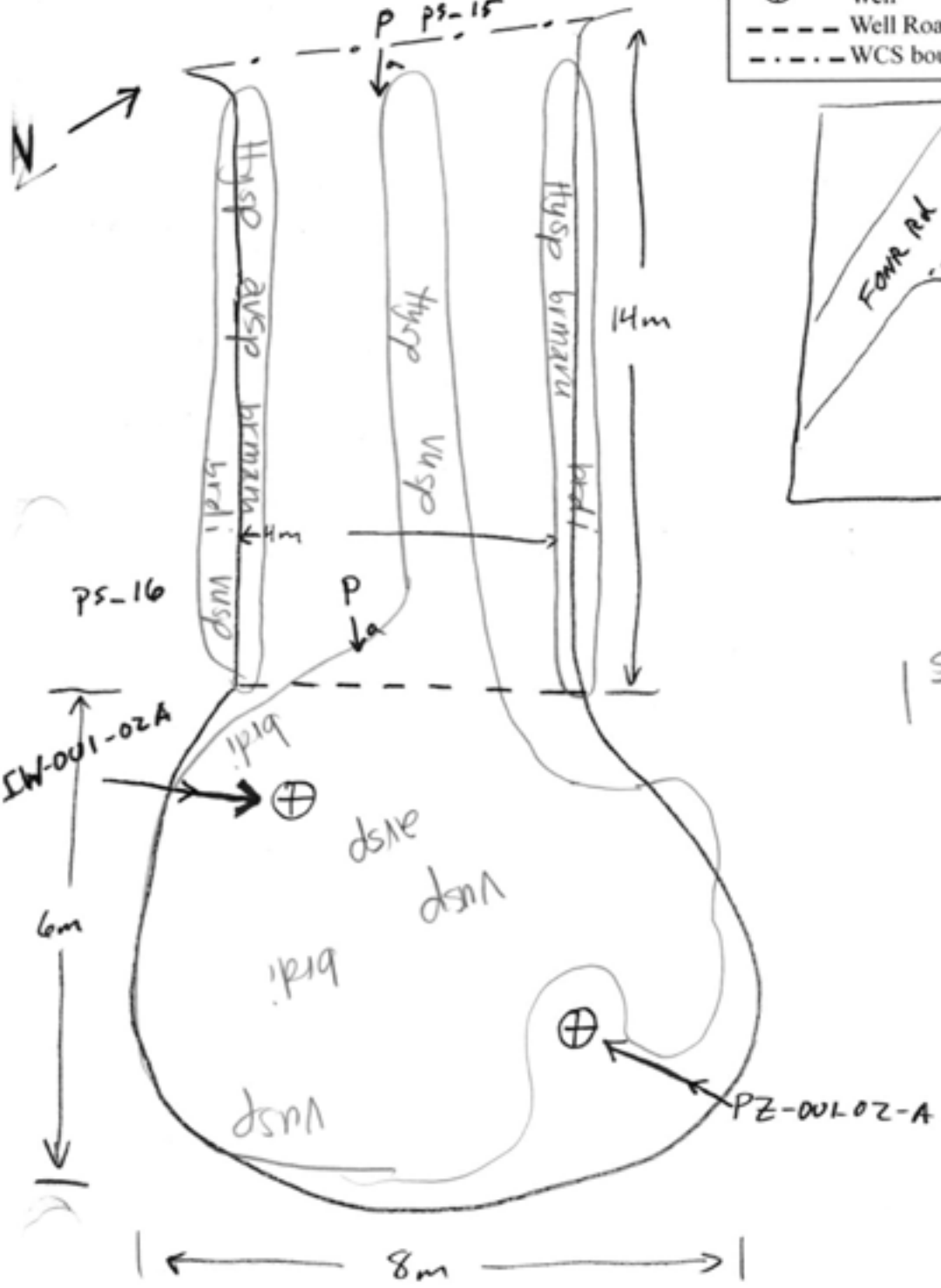
Well Rd. Area 48 (m^2)

Well Site Area 52 (m^2)

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- · - · -	WCS boundary





1st Treatment

Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: PZ-OU1-02-A / IW-OU1-02-A

Date: 7-2-11

WCS Sub Group: 17A

Surveyor: ATM

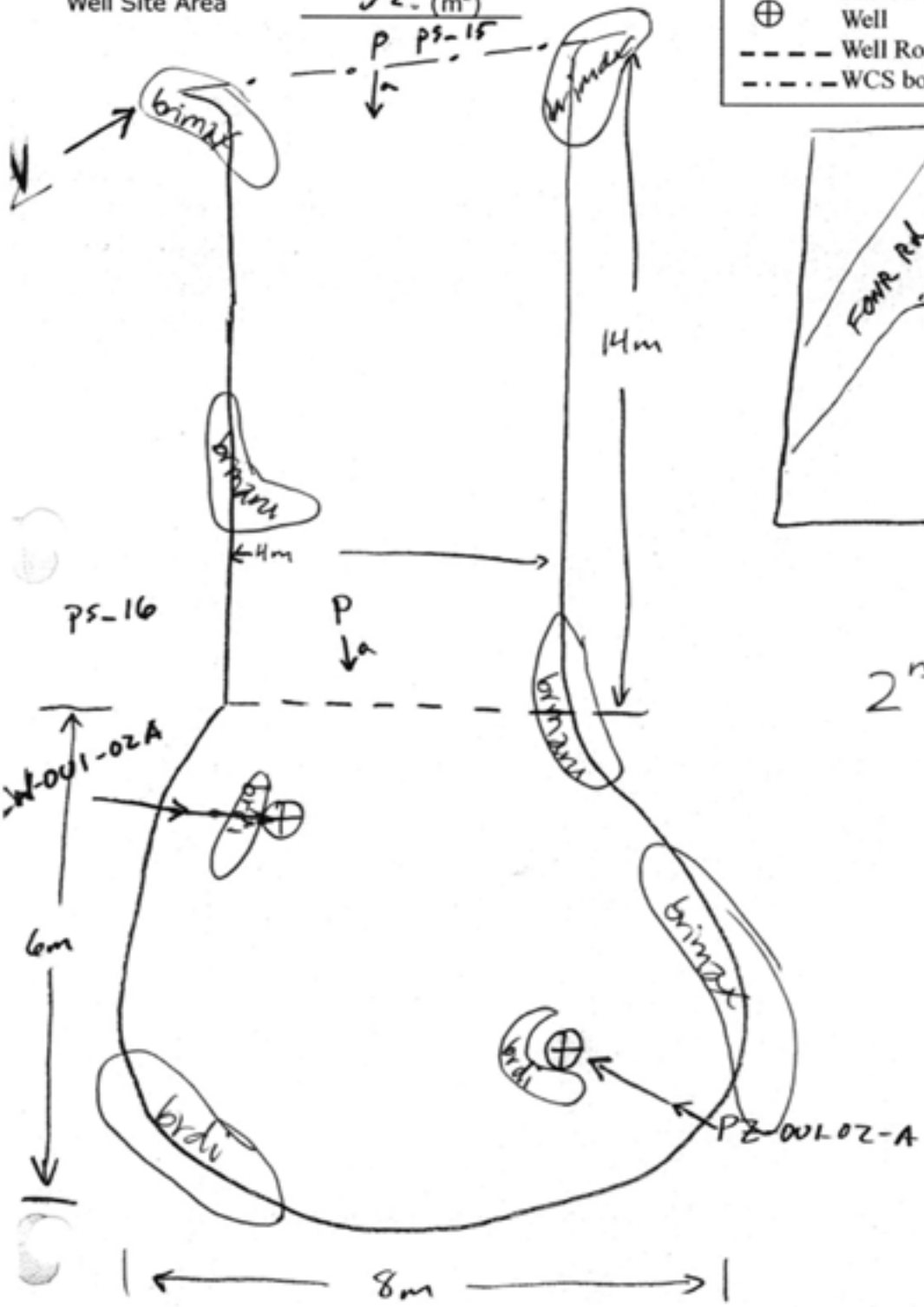
Total Aprox. Area: 100 (m^2)

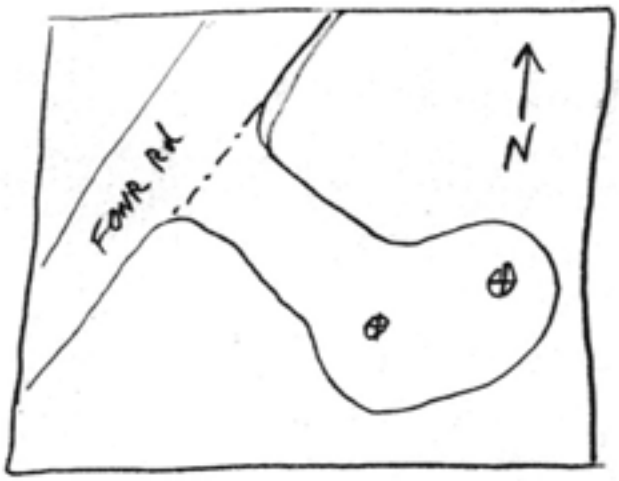
Well Rd. Area: 48 (m^2)

Well Site Area: 52 (m^2)

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- · - · -	WCS boundary





2nd Treatment

Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: MW-OU1-88-A

WCS Sub Group 18A

Total Aprox. Area 168 (m^2)

Well Rd. Area 56 (m^2)

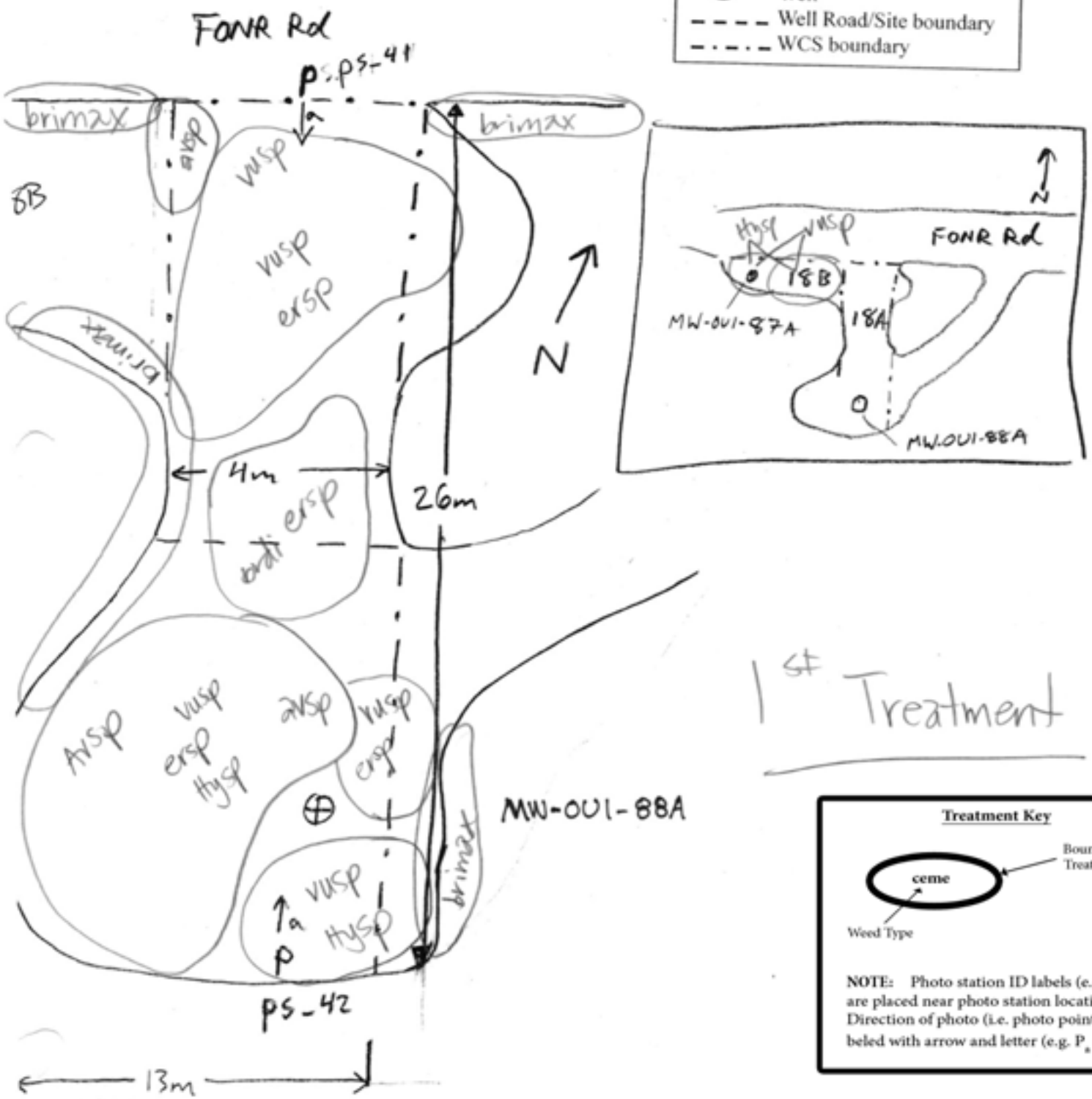
Well Site Area 112 (m^2)

Date 5-1A-11

Surveyor AFM

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- · - · -	WCS boundary



1st Treatment

Treatment Key

ceme — Boundary of Treated Area

Weed Type

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Well ID: MW-OUI-88-A

WCS Sub Group 18A

Total Aprox. Area 168 (m^2)

Well Rd. Area 56 (m^2)

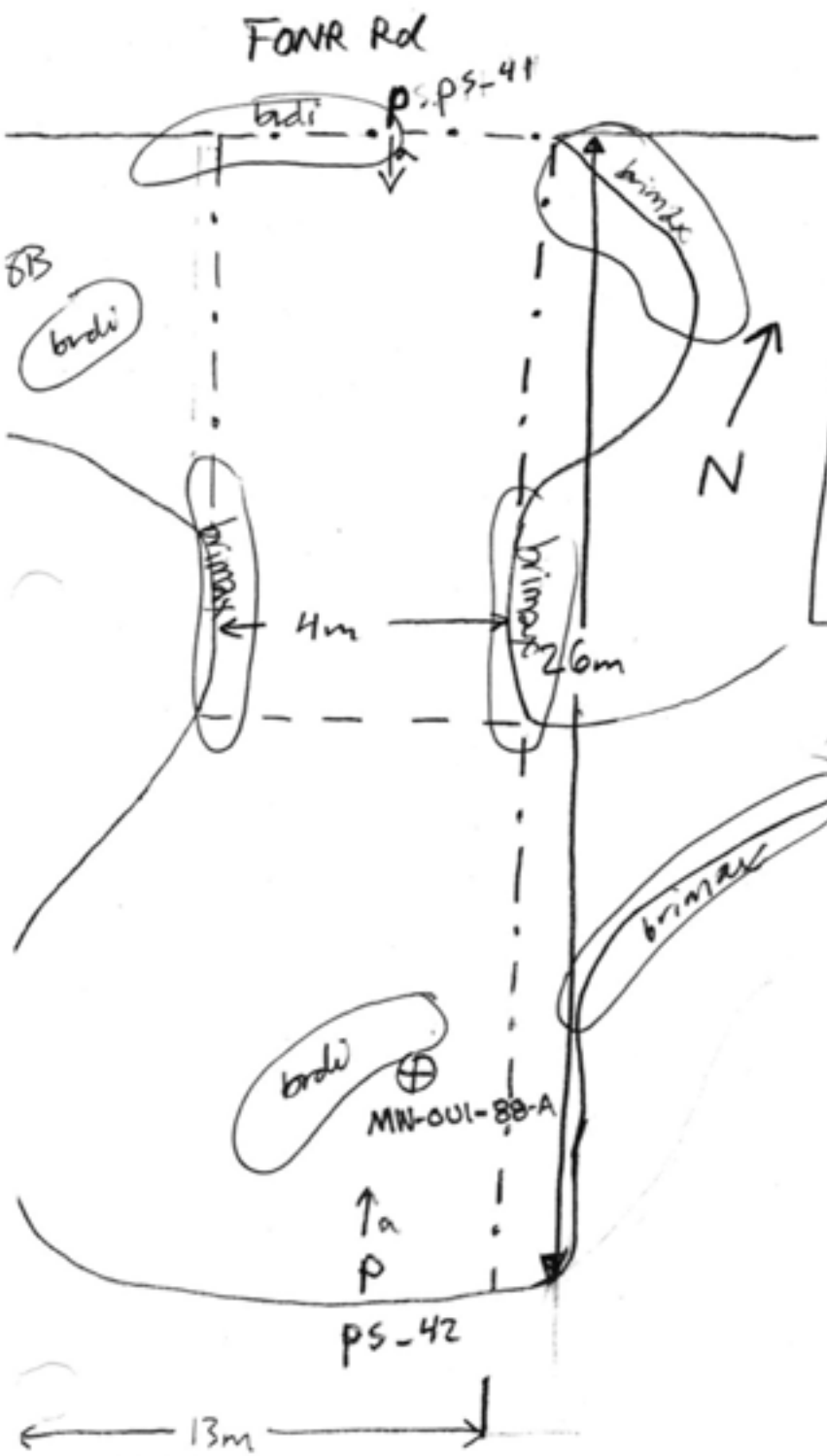
Well Site Area 112 (m^2)

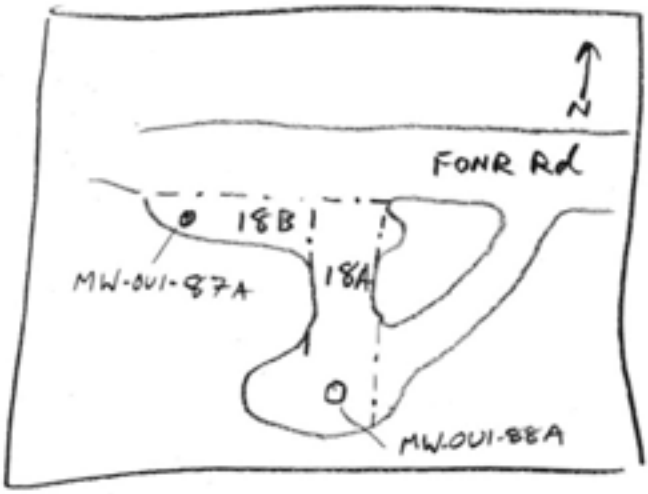
Date 7-2-11

Surveyor AFM

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary





2nd Treatment

Treatment Key

NOTE: Photo station ID labels (e.g. ps_01) are placed near photo station locations (P). Direction of photo (i.e. photo point) is labeled with arrow and letter (e.g. P_a -->)

Attachment 2

‘RARE PLANT SURVEY DATA 2011’

The attached spreadsheet (HGL_WCS_RarePlant_2011.xls) contains rare plant survey data from pre-treatment rare plant surveys within each Weed Control Segment (WCS) during the 2010 weed control program within the Operable Unit 1 portion of the FONR.

HGL - WCS Rare Plant Survey Data 2011

sand gilia (*Gilia tenuiflora ssp. arenaria*) patch count and density class summary pivot table

Count of Patch ID	Column Labels		
Row Labels	**5A**	**6A**	**Grand Total**
H		1	1
L		6	6
M		2	2
VH		1	1
VL	3	16	19
Grand Total	**3**	**26**	**29**

sand gilia (*Gilia tenuiflora ssp. arenaria*) patch area (m^2) and density class summary pivot table

Sum of Area (m2)	Column Labels		
Row Labels	**5A**	**6A**	**Grand Total**
H		2	2
L		7	7
M		2	2
VH		1	1
VL	3	16	19
Grand Total	**3**	**28**	**31**

HGL - WCS Rare Plant Survey Data 2011

Monterey spineflower (*Chorizanthe pungens var. pungens*) patch count and cover class summary pivot table

Count of Patch ID	Column Labels														
Row Labels	**05A**	**06A**	**07A**	**09A**	**09B**	**09C**	**09D**	**10A**	**10B**	**12B**	**13A**	**14A**	**15A**	**16A**	**Grand Total**
H												2			2
M		2		1	1	2		1	1			2			10
S	11	6		6	4	3	1		2	1		7	2	1	44
VS	17	8	5	9	8		2			1	3	5	1		59
Grand Total	**28**	**16**	**5**	**16**	**13**	**5**	**3**	**1**	**3**	**2**	**3**	**16**	**3**	**1**	**115**

Monterey spineflower (*Chorizanthe pungens var. pungens*) patch area (m^2) and cover class summary pivot table

Sum of Area (m2)	Column Labels														
Row Labels	**05A**	**06A**	**07A**	**09A**	**09B**	**09C**	**09D**	**10A**	**10B**	**12B**	**13A**	**14A**	**15A**	**16A**	**Grand Total**
H												14			14
M		14.5		8	5	50		75	24			10			186.5
S	69	47.5		41	18	20	10		14	8		62	9	10	308.5
VS	34	14	12	18	13		2			1	5	6	3		108
Grand Total	**103**	**76**	**12**	**67**	**36**	**70**	**12**	**75**	**38**	**9**	**5**	**92**	**12**	**10**	**617**

HGL - WCS Rare Plant Survey Data 2011
sand gilia (Gilia tenuiflora ssp. arenaria) survey data

AM = Adrienne Mages	Gilia Density: Very High (VH): > 51 / m2 High (H): 21-50 / m2 Medium (M): 11-20 / m2 Low (L) 3-10 / m2 Very Low (VL): 1-2 / m2

Date	WCS	Well ID	Surveyor	Patch ID	Density	Area (m^2)
4/22/2011	5A	IW-OUI-01A	AFM	AM69	VL	1
4/22/2011	5A	IW-OUI-01A	AFM	AM70	VL	1
4/22/2011	5A	IW-OUI-01A	AFM	AM71	VL	1
4/22/2011	6A	EW-OUI-53-A	AFM	AM04	VH	1
4/22/2011	6A	EW-OUI-53-A	AFM	AM06	VL	1
4/22/2011	6A	EW-OUI-53-A	AFM	AM08	VL	1
4/22/2011	6A	EW-OUI-53-A	AFM	AM09	VL	1
4/22/2011	6A	EW-OUI-53-A	AFM	AM11	L	1
4/22/2011	6A	EW-OUI-53-A	AFM	AM12	L	1
4/22/2011	6A	EW-OUI-53-A	AFM	AM13	M	1
4/22/2011	6A	EW-OUI-53-A	AFM	AM15	VL	1
4/22/2011	6A	EW-OUI-53-A	AFM	AM16	L	1
4/22/2011	6A	EW-OUI-53-A	AFM	AM17	VL	1
4/22/2011	6A	EW-OUI-53-A	AFM	AM18	L	1
4/22/2011	6A	EW-OUI-53-A	AFM	AM19	VL	1
4/22/2011	6A	EW-OUI-53-A	AFM	AM25	L	2
4/22/2011	6A	EW-OUI-53-A	AFM	AM27	VL	1
4/22/2011	6A	EW-OUI-53-A	AFM	AM28	VL	1
4/22/2011	6A	EW-OUI-53-A	AFM	AM31	H	2
4/22/2011	6A	EW-OUI-53-A	AFM	AM33	L	1
4/22/2011	6A	EW-OUI-53-A	AFM	AM33	VL	1
4/22/2011	6A	EW-OUI-53-A	AFM	AM34	VL	1
4/22/2011	6A	EW-OUI-53-A	AFM	AM36	VL	1
4/22/2011	6A	EW-OUI-53-A	AFM	AM37	VL	1
4/22/2011	6A	EW-OUI-53-A	AFM	AM38	VL	1
4/22/2011	6A	EW-OUI-53-A	AFM	AM39	VL	1
4/22/2011	6A	EW-OUI-53-A	AFM	AM40	VL	1
4/22/2011	6A	EW-OUI-53-A	AFM	AM41	M	1
4/22/2011	6A	EW-OUI-53-A	AFM	AM42	VL	1

HGL - WCS Rare Plant Survey Data 2011
Monterey spineflower (Chorizanthe pungens var. pungens) survey data

AM = Adrienne Mages

Chorizanthe Coverage:
Very High (VH): > 98 % coverage
High (H): 76-97 % coverage
Medium (M): 26-75 % coverage
Sparse (S) 3-25 % coverage

Date	WCS	Well ID	Surveyor	Patch ID-REV	Coverage	Area (m^2)
4/22/2011	05A	IW-OU1-01-A	AFM	AM43	S	3
4/22/2011	05A	IW-OU1-01-A	AFM	AM44	VS	1
4/22/2011	05A	IW-OU1-01-A	AFM	AM45	VS	1
4/22/2011	05A	IW-OU1-01-A	AFM	AM46	VS	1
4/22/2011	05A	IW-OU1-01-A	AFM	AM47	VS	1
4/22/2011	05A	IW-OU1-01-A	AFM	AM48	VS	1
4/22/2011	05A	IW-OU1-01-A	AFM	AM49	VS	1
4/22/2011	05A	IW-OU1-01-A	AFM	AM50	VS	1
4/22/2011	05A	IW-OU1-01-A	AFM	AM51	VS	1
4/22/2011	05A	IW-OU1-01-A	AFM	AM52	S	8
4/22/2011	05A	IW-OU1-01-A	AFM	AM53	VS	1
4/22/2011	05A	IW-OU1-01-A	AFM	AM54	VS	2
4/22/2011	05A	IW-OU1-01-A	AFM	AM55	S	10
4/22/2011	05A	IW-OU1-01-A	AFM	AM56	S	6
4/22/2011	05A	IW-OU1-01-A	AFM	AM57	S	5
4/22/2011	05A	IW-OU1-01-A	AFM	AM58	S	6
4/22/2011	05A	IW-OU1-01-A	AFM	AM59	VS	1
4/22/2011	05A	IW-OU1-01-A	AFM	AM60	VS	1
4/22/2011	05A	IW-OU1-01-A	AFM	AM61	S	4
4/22/2011	05A	IW-OU1-01-A	AFM	AM62	S	3
4/22/2011	05A	IW-OU1-01-A	AFM	AM63	S	8
4/22/2011	05A	IW-OU1-01-A	AFM	AM64	S	6
4/22/2011	05A	IW-OU1-01-A	AFM	AM65	VS	5
4/22/2011	05A	IW-OU1-01-A	AFM	AM66	VS	1
4/22/2011	05A	IW-OU1-01-A	AFM	AM67	VS	2
4/22/2011	05A	IW-OU1-01-A	AFM	AM68	S	10
4/22/2011	05A	IW-OU1-01-A	AFM	AM72	VS	8
4/22/2011	05A	IW-OU1-01-A	AFM	AM73	VS	5
4/22/2011	06A	EW-OU1-53-A	AFM	AM01	VS	2
4/22/2011	06A	EW-OU1-53-A	AFM	AM02	M	2.5
4/22/2011	06A	EW-OU1-53-A	AFM	AM05	VS	1
4/22/2011	06A	EW-OU1-53-A	AFM	AM07	VS	1
4/22/2011	06A	EW-OU1-53-A	AFM	AM10	VS	1
4/22/2011	06A	EW-OU1-53-A	AFM	AM14	M	12
4/22/2011	06A	EW-OU1-53-A	AFM	AM20	VS	2
4/22/2011	06A	EW-OU1-53-A	AFM	AM21	S	3
4/22/2011	06A	EW-OU1-53-A	AFM	AM22	VS	2
4/22/2011	06A	EW-OU1-53-A	AFM	AM23	S	5
4/22/2011	06A	EW-OU1-53-A	AFM	AM24	VS	1
4/22/2011	06A	EW-OU1-53-A	AFM	AM26	S	2.5
4/22/2011	06A	EW-OU1-53-A	AFM	AM30	S	10
4/22/2011	06A	EW-OU1-53-A	AFM	AM32	S	15
4/22/2011	06A	EW-OU1-53-A	AFM	AM35	S	12
4/22/2011	06A	EW-OU1-53-A	AFM	AM43	VS	4
5/14/2011	07A	EW-OU1-52A	AFM	AM152	VS	5

HGL - WCS Rare Plant Survey Data 2011
Monterey spineflower (Chorizanthe pungens var. pungens) survey data

Date	WCS	Well ID	Surveyor	Patch ID-REV	Coverage	Area (m^2)
5/14/2011	07A	EW-OU1-52A	AFM	AM153	VS	1
5/14/2011	07A	EW-OU1-52A	AFM	AM154	VS	2
5/14/2011	07A	EW-OU1-52A	AFM	AM155	VS	1
5/14/2011	07A	EW-OU1-52A	AFM	AM156	VS	3
4/22/2011	09A	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	AFM	AM74	VS	2
4/22/2011	09A	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	AFM	AM75	VS	1
4/22/2011	09A	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	AFM	AM76	VS	1
4/22/2011	09A	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	AFM	AM77	VS	1
4/22/2011	09A	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	AFM	AM78	VS	1
4/22/2011	09A	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	AFM	AM79	S	10
4/22/2011	09A	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	AFM	AM80	VS	3
4/22/2011	09A	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	AFM	AM81	S	6
4/22/2011	09A	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	AFM	AM82	S	4
4/22/2011	09A	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	AFM	AM83	S	5
4/22/2011	09A	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	AFM	AM84	VS	2
4/22/2011	09A	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	AFM	AM85	VS	3
4/22/2011	09A	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	AFM	AM86	VS	4
4/22/2011	09A	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	AFM	AM87	S	8
4/22/2011	09A	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	AFM	AM88	M	8
4/22/2011	09A	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	AFM	AM89	S	8

HGL - WCS Rare Plant Survey Data 2011
Monterey spineflower (Chorizanthe pungens var. pungens) survey data

Date	WCS	Well ID	Surveyor	Patch ID-REV	Coverage	Area (m^2)
4/29/2011	09B	MW-OU1-84A	AFM	AM107	VS	2
4/29/2011	09B	MW-OU1-84A	AFM	AM108	S	4
4/29/2011	09B	MW-OU1-84A	AFM	AM109	VS	3
4/29/2011	09B	MW-OU1-84A	AFM	AM110	S	8
4/29/2011	09B	MW-OU1-84A	AFM	AM111	VS	1
4/29/2011	09B	MW-OU1-84A	AFM	AM112	VS	1
4/29/2011	09B	MW-OU1-84A	AFM	AM113	S	1
4/29/2011	09B	MW-OU1-84A	AFM	AM114	VS	1
4/29/2011	09B	MW-OU1-84A	AFM	AM115	S	5
4/29/2011	09B	MW-OU1-84A	AFM	AM116	M	5
4/29/2011	09B	MW-OU1-84A	AFM	AM117	VS	1
4/29/2011	09B	MW-OU1-84A	AFM	AM118	VS	1
4/29/2011	09B	MW-OU1-84A	AFM	AM119	VS	3
4/29/2011	09C	IW-OU1-74A	AFM	AM122	M	30
4/29/2011	09C	IW-OU1-74A	AFM	AM123	M	20
4/29/2011	09C	IW-OU1-74A	AFM	AM124	S	5
4/29/2011	09C	IW-OU1-74A	AFM	AM125	S	12
4/29/2011	09C	IW-OU1-74A	AFM	AM126	S	3
4/29/2011	09D	MW-OUI-51A	AFM	AM128	VS	1
4/29/2011	09D	MW-OUI-51A	AFM	AM129	VS	1
4/29/2011	09D	MW-OUI-51A	AFM	AM130	S	10
5/21/2011	10A	MW-OUI-50A	AFM	AM200	M	75
5/20/2011	10B	MW-OUI-59A	AFM	AM202	S	8
5/20/2011	10B	MW-OUI-59A	AFM	AM203	M	24
5/20/2011	10B	MW-OUI-59A	AFM	AM205	S	6
5/13/2011	12B	MW-OU1-85A	AFM	AM150	VS	1
5/13/2011	12B	MW-OU1-85A	AFM	AM151	S	8
4/29/2011	13A	IW-OU1-73A	AFM	AM202	VS	2
4/29/2011	13A	IW-OU1-73A	AFM	AM203	VS	2
4/29/2011	13A	IW-OU1-73A	AFM	AM204	VS	1
4/22/2011	14A	MW-OU1-83A	AFM	AM90	S	15
4/22/2011	14A	MW-OU1-83A	AFM	AM91	S	3
4/22/2011	14A	MW-OU1-83A	AFM	AM92	VS	1
4/22/2011	14A	MW-OU1-83A	AFM	AM93	VS	1
4/22/2011	14A	MW-OU1-83A	AFM	AM94	VS	1
4/22/2011	14A	MW-OU1-83A	AFM	AM95	S	3
4/22/2011	14A	MW-OU1-83A	AFM	AM96	H	4
4/22/2011	14A	MW-OU1-83A	AFM	AM97	VS	1
4/22/2011	14A	MW-OU1-83A	AFM	AM98	M	4
4/22/2011	14A	MW-OU1-83A	AFM	AM99	M	6
4/22/2011	14A	MW-OU1-83A	AFM	AM100	H	10
4/22/2011	14A	MW-OU1-83A	AFM	AM101	S	4
4/22/2011	14A	MW-OU1-83A	AFM	AM102	S	3
4/22/2011	14A	MW-OU1-83A	AFM	AM103	S	4
4/22/2011	14A	MW-OU1-83A	AFM	AM104	VS	2
4/22/2011	14A	MW-OU1-83A	AFM	AM105	S	30
5/20/2011	15A	MW-OU1-82A	AFM	AM205	S	7
5/20/2011	15A	MW-OU1-82A	AFM	AM206	S	2
5/20/2011	15A	MW-OU1-82A	AFM	AM207	VS	3
5/20/2011	16A	SB-OU1-2004K	AFM	AM201	S	10

Attachment 3

‘RARE PLANT SURVEY DIAGRAMS 2011’

The attached diagrams show the distribution of rare plant species found during pre-treatment surveys within each Weed Control Segment (WCS) during the 2011 weed control program within the Operable Unit 1 portion of the FONR. These diagrams (not drawn to scale) also show the spatial extent, well location, well site/road boundaries, and photo stations/points for each WCS.

Well ID: IW-OU1-01-A

WCS Sub Group 5-A

tal Aprox. Area 240 (m^2)

Well Rd. Area 174 (m^2)

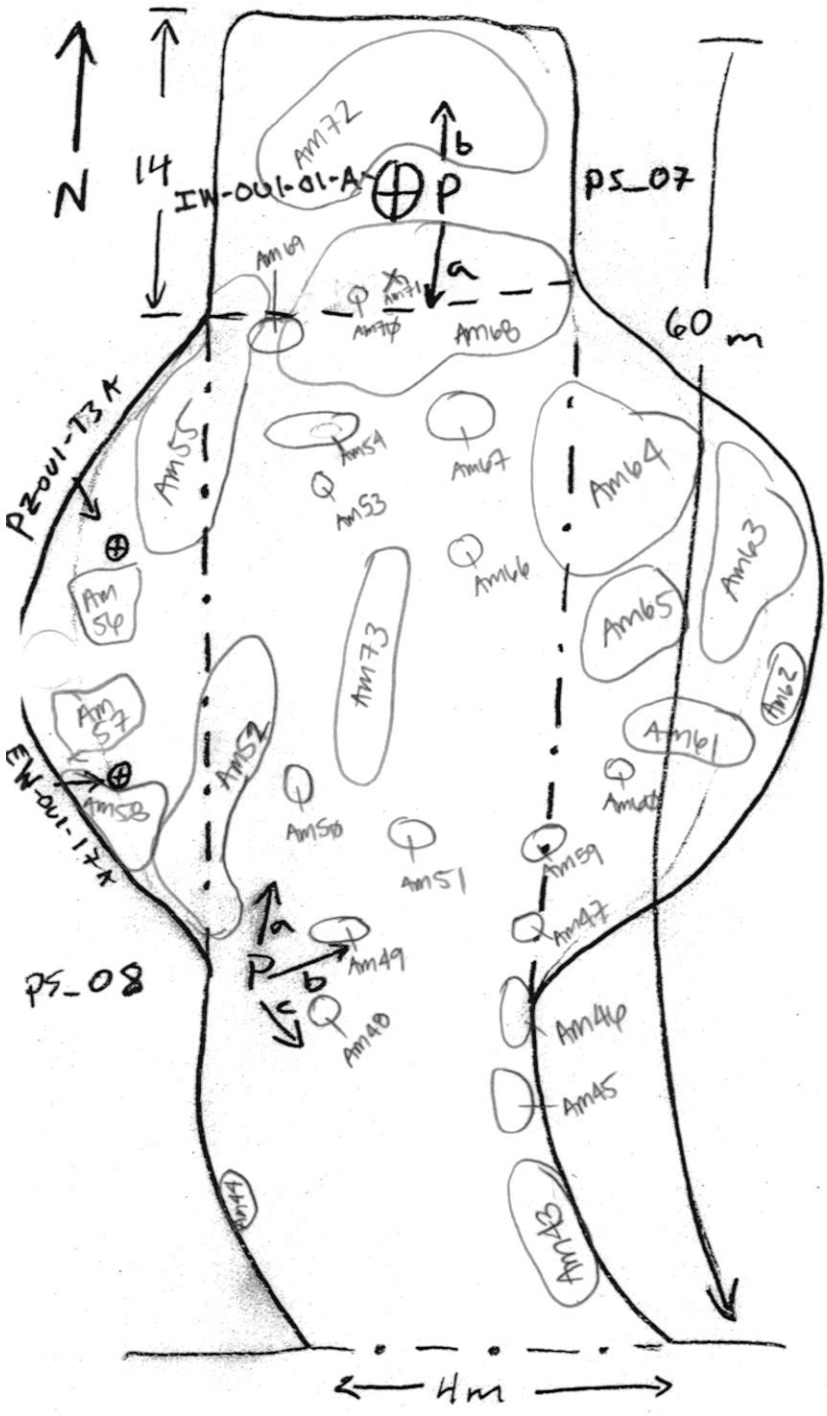
Well Site Area 56 (m^2)

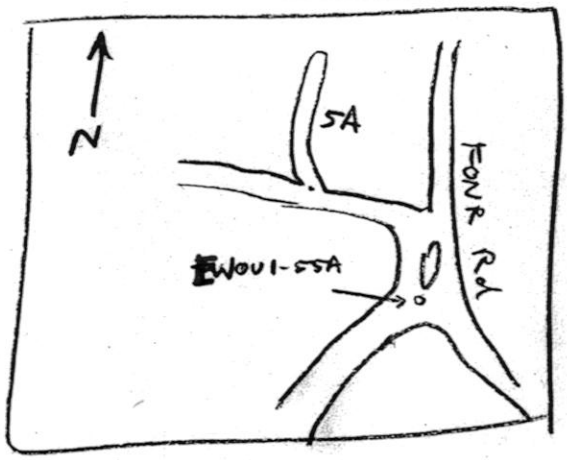
Date 4-22-11

Surveyor AFM

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- · - · -	WCS boundary





Rare Plant
Chorizanthe Spino Flower
& Sand Gilia (blue flagged)
Survey

Access Rd

Well ID: EW-OU1-53-A

Date 4-22-11

WCS Sub Group 6A

Surveyor AFm

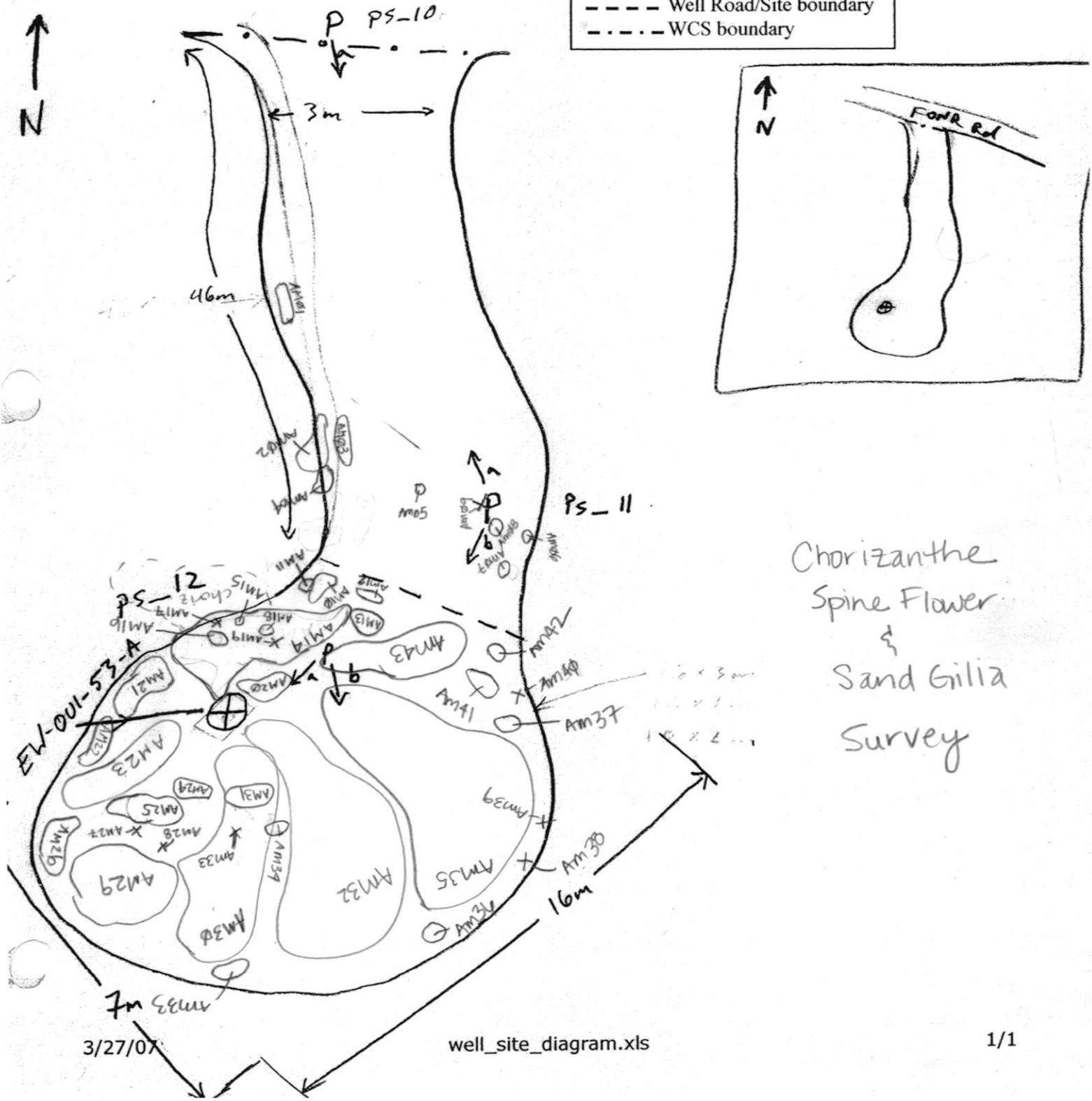
Total Aprox. Area 220 (m^2)

Well Rd. Area 138 (m^2)

Well Site Area 82 (m^2)

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- · - · -	WCS boundary



Chorizanthe Spine Flower & Sand Gilia Survey

Well ID: EW-001-52A

Date 5-14-11

WCS Sub Group 7A

Surveyor AFM

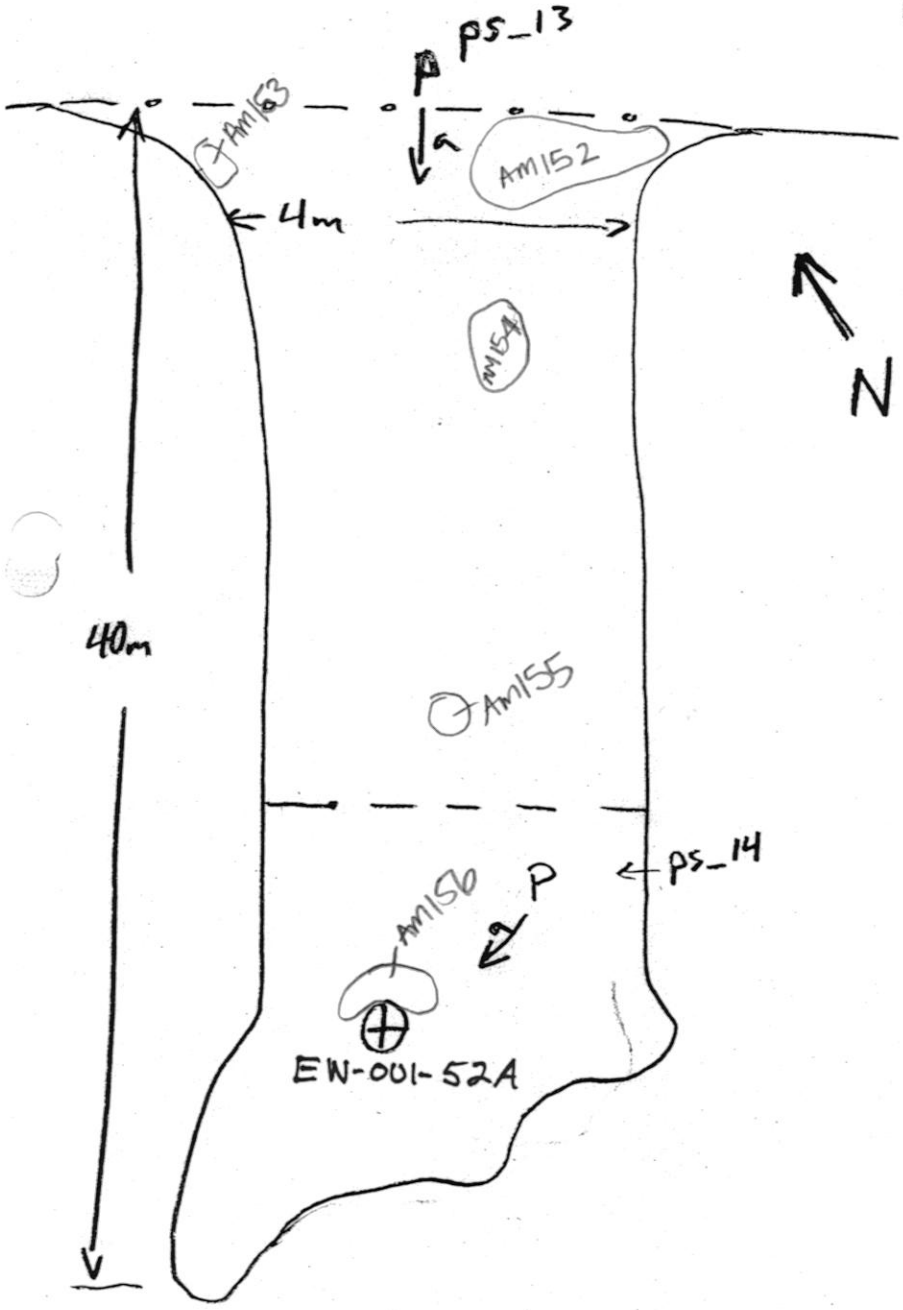
tal Aprox. Area 164 (m^2)

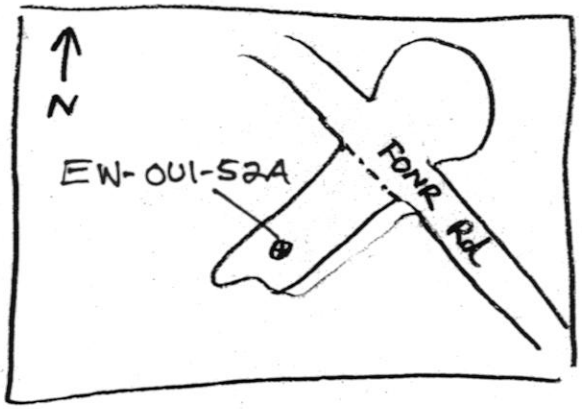
ell Rd. Area 120 (m^2)

Well Site Area 44 (m^2)

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- · - · -	WCS boundary





Rare Plant Survey
Chorizanthe

Well ID: MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A

WCS Sub Group: 9A

Total Aprox. Area: 369 (m^2)

Well Rd. Area: 256 (m^2)

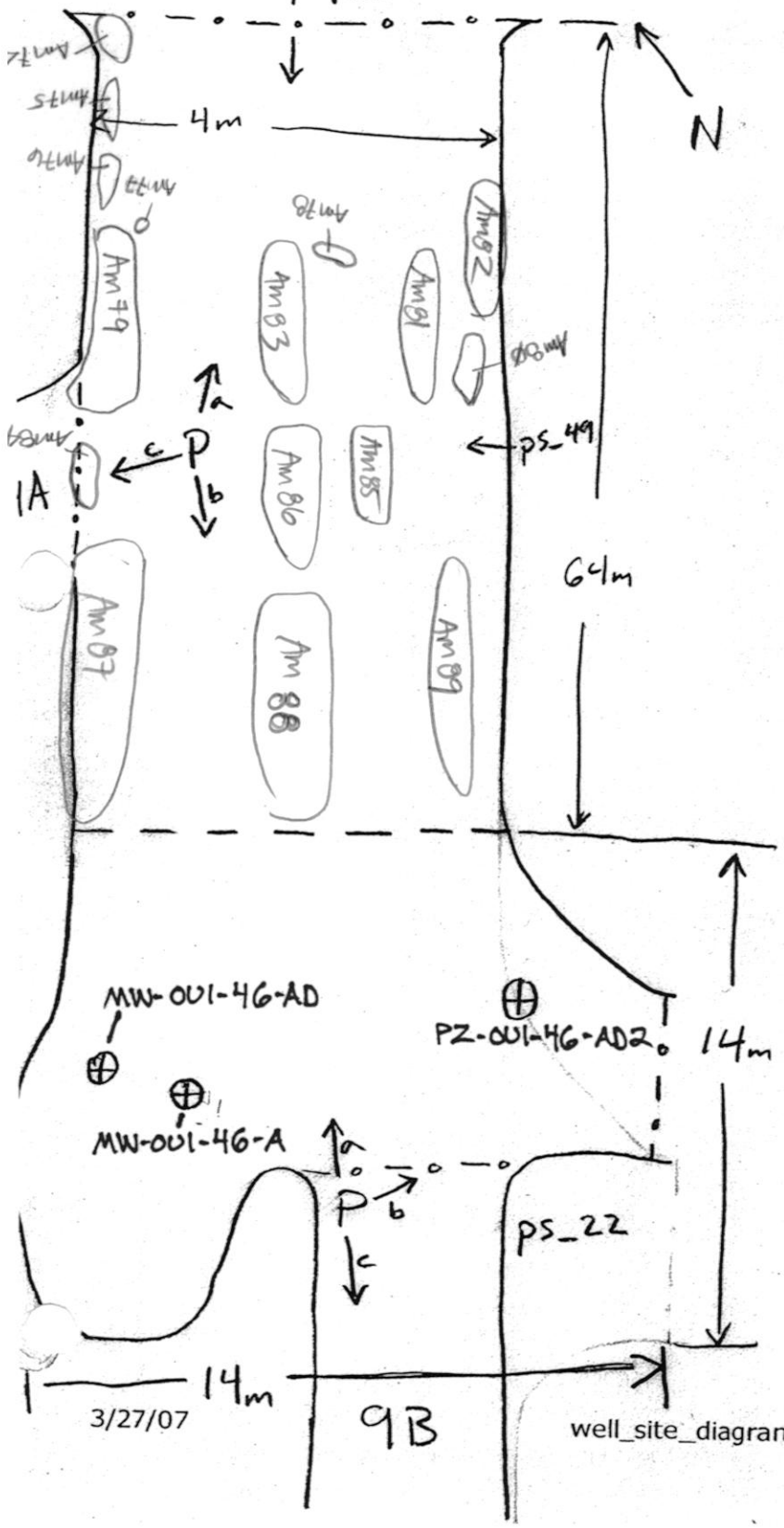
Well Site Area: 113 (m^2)

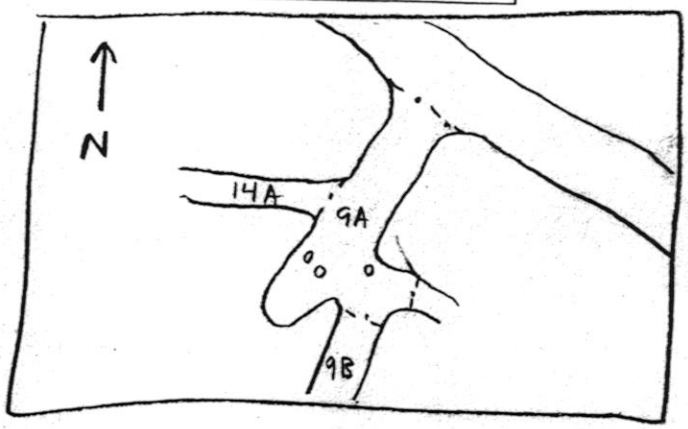
Date: 4-22-11

Surveyor: AFM

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- · - · -	WCS boundary





Rare Plant

Chorizanthe Spine Flower

&

Sand Gilia

Survey

Well ID: MW-OU1-84A

WCS Sub Group 9B

Date A-29-11

Surveyor AFM

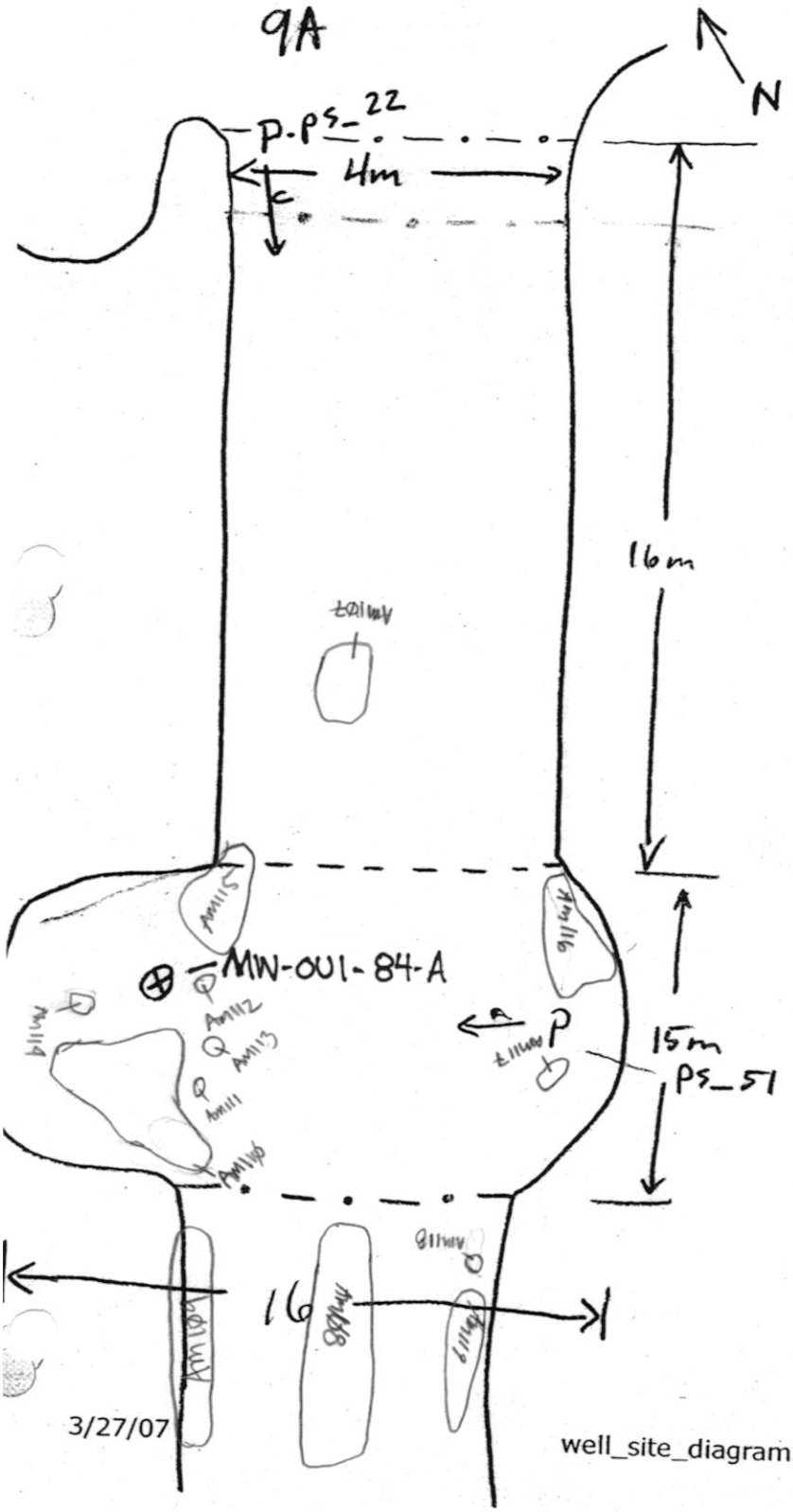
al Aprox. Area 304 (m^2)

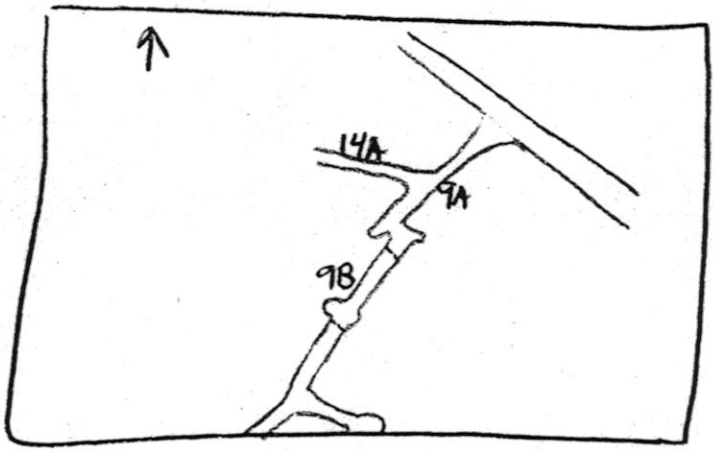
ell Rd. Area 64 (m^2)

Well Site Area 240 (m^2)

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- · - · -	WCS boundary





Rare Plant
Chorizanthe
& Sand Gilia Survey

Well ID: IW-OU1-74A

WCS Sub Group 9C

Total Aprox. Area 198 (m^2)

Well Rd. Area 144 (m^2)

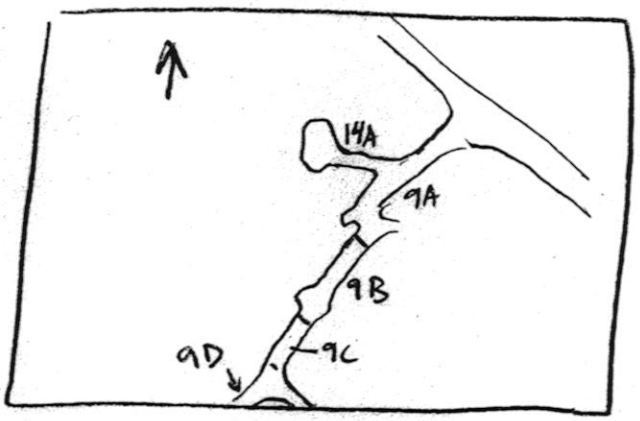
Well Site Area 54 (m^2)

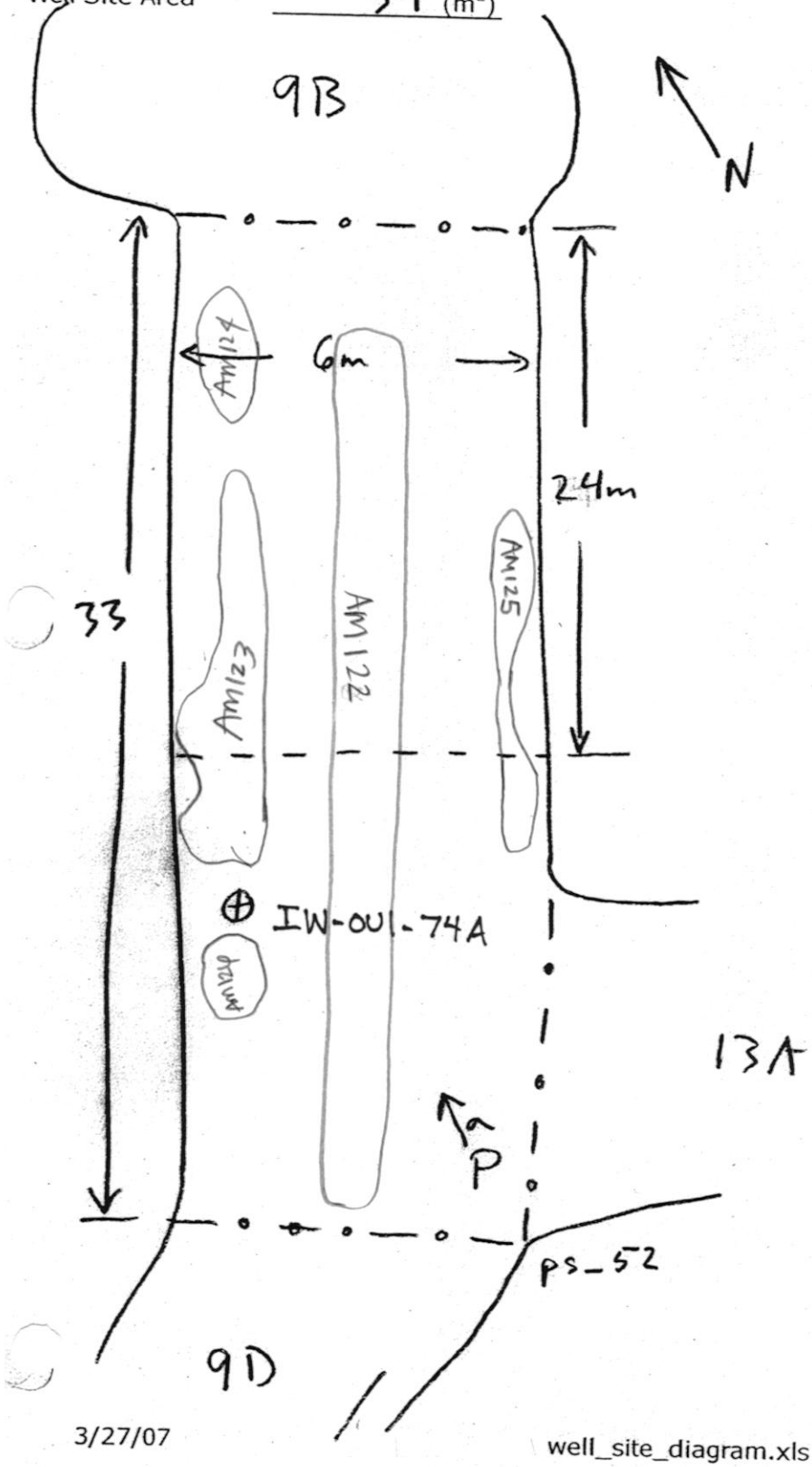
Date 4-29-11

Surveyor AFm

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- · - · -	WCS boundary





Rare Plant Chorizanthe Survey

Well ID: MW-OU1-51A

WCS Sub Group 9D

Total Aprox. Area 160 (m^2)

Well Rd. Area 104 (m^2)

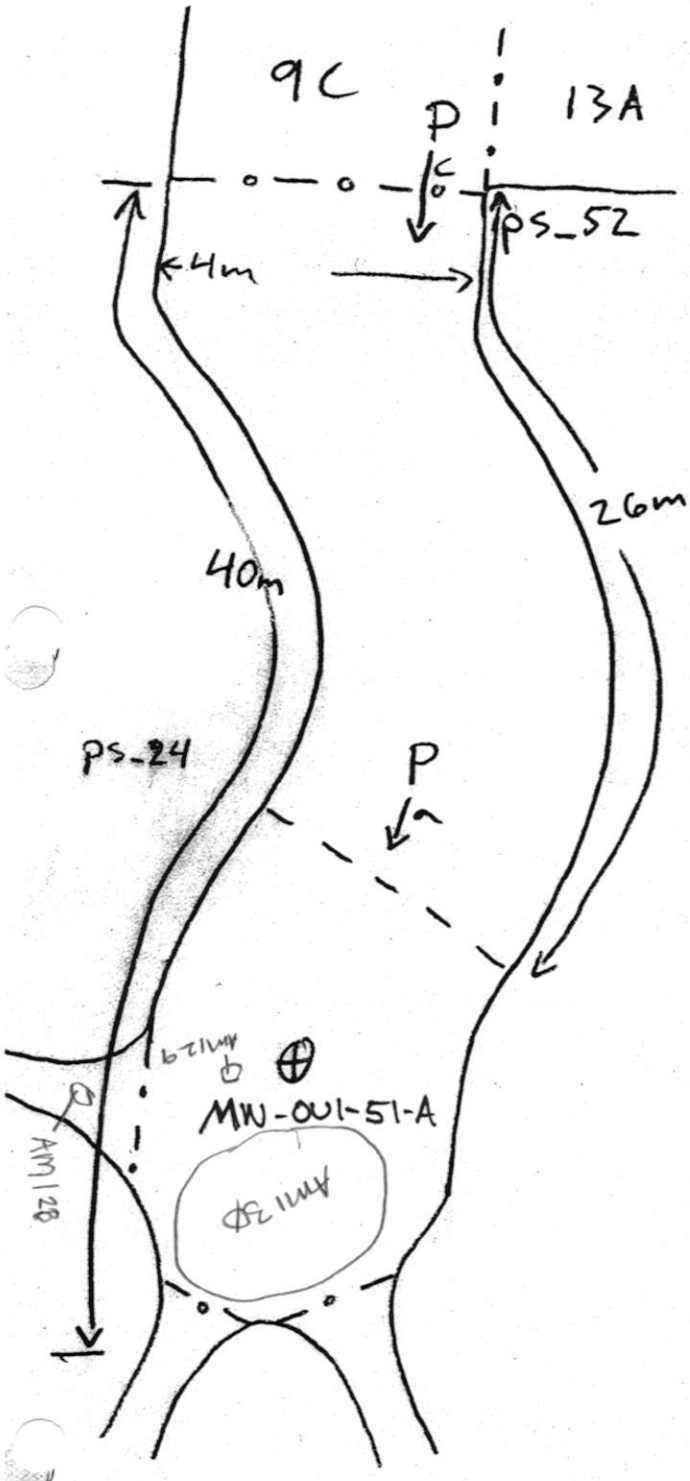
Well Site Area 56 (m^2)

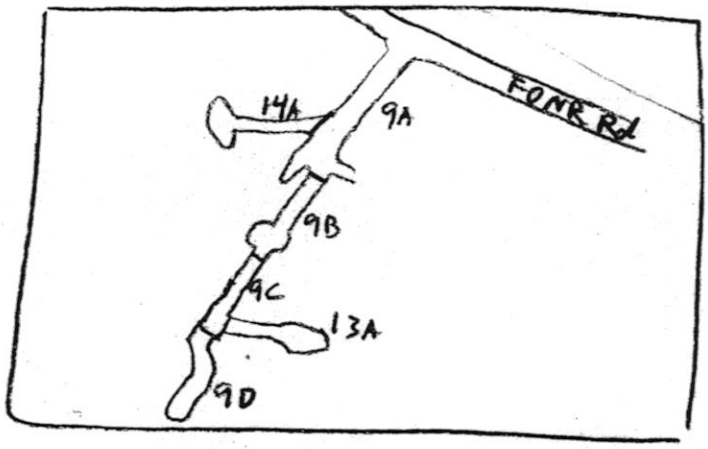
Date 4-29-11

Surveyor AFM

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- · - · -	WCS boundary





Rare Plant Chorizanthe Survey

Well ID: MW-OUI-50A

WCS Sub Group 10A

Total Aprox. Area 120 (m^2)

Well Rd. Area 87 (m^2)

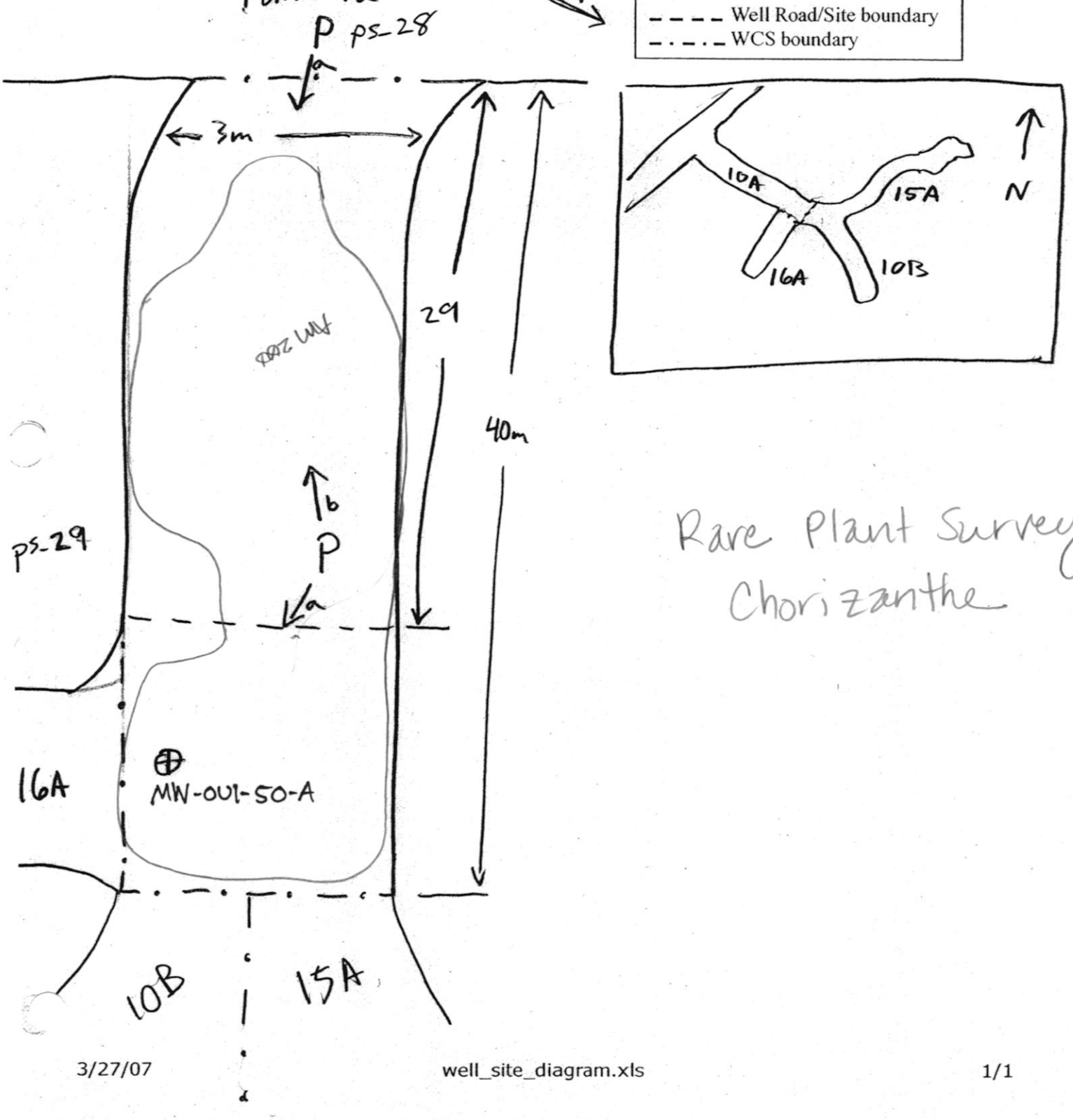
Well Site Area 33 (m^2)

Date 5-20-11

Surveyor AFM

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary



Rare Plant Survey
Chorizanthe

Well ID: MW-OU1-59A

WCS Sub Group 10B

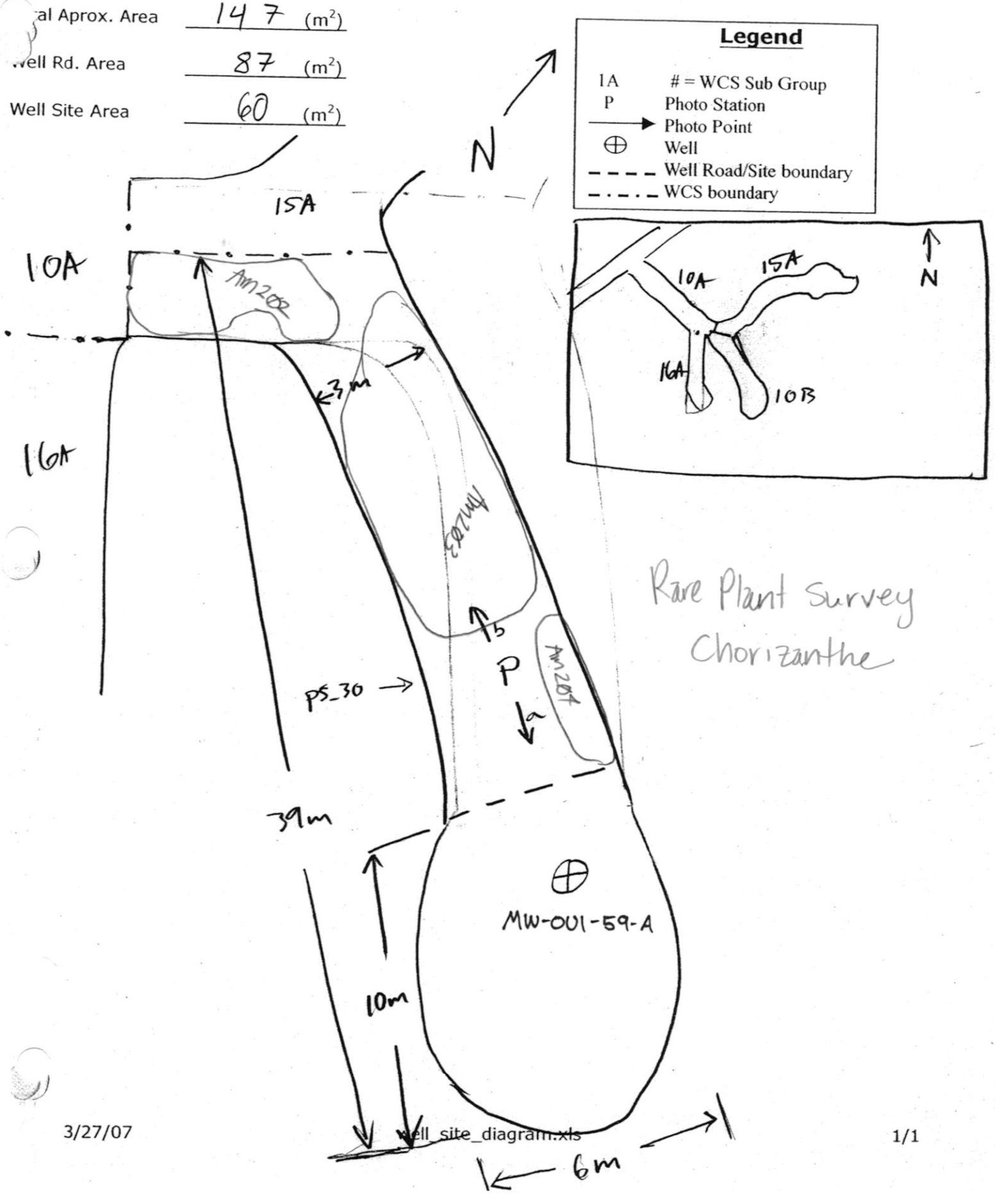
Total Aprox. Area 147 (m^2)

Well Rd. Area 87 (m^2)

Well Site Area 60 (m^2)

Date 5-27-11

Surveyor AFM



Rare Plant Survey
Chorizanthe

Well ID: MW-OU1-85-A

WCS Sub Group 12B

tal Aprox. Area 164 (m^2)

.ell Rd. Area 76 (m^2)

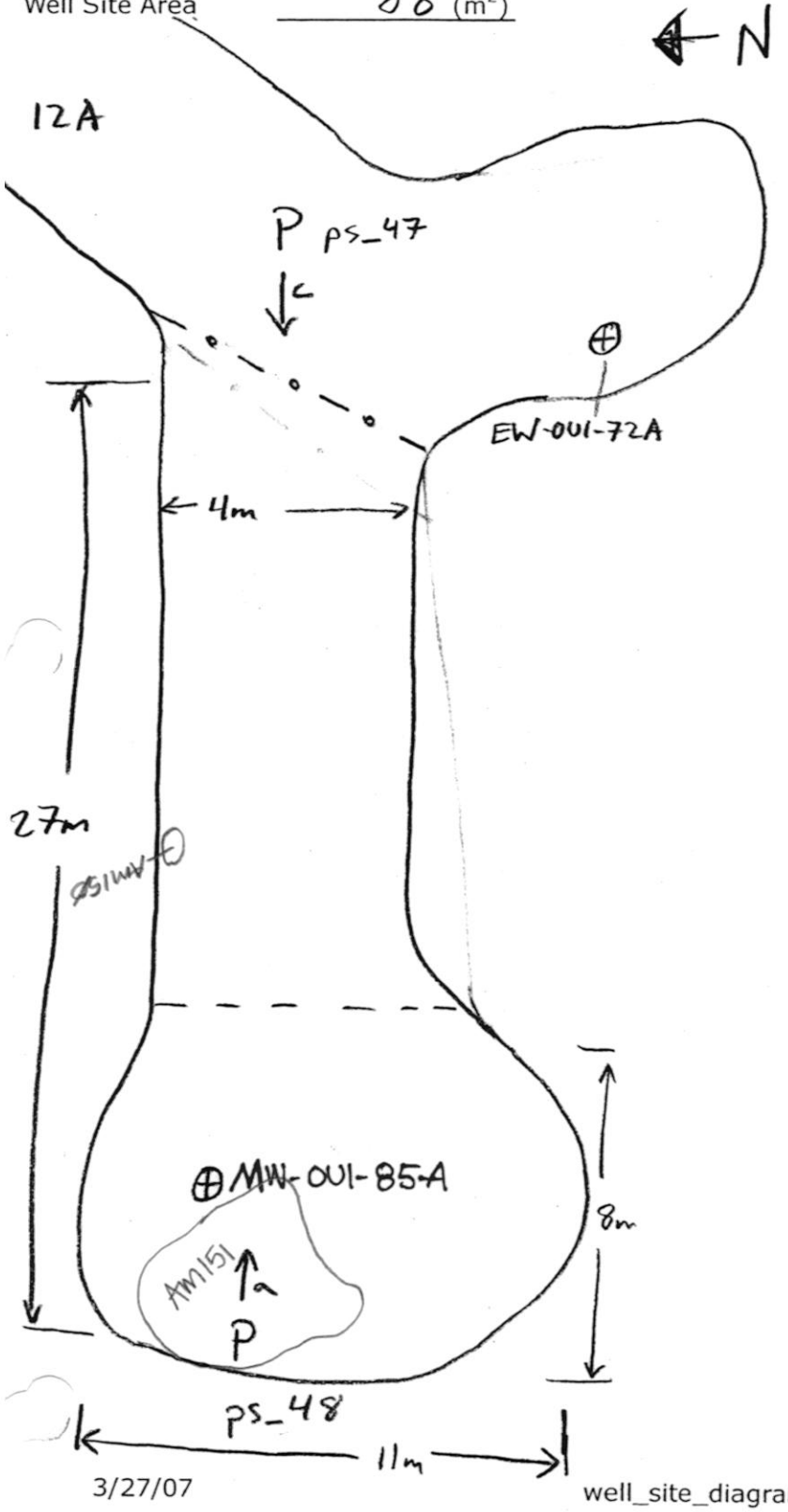
Well Site Area 88 (m^2)

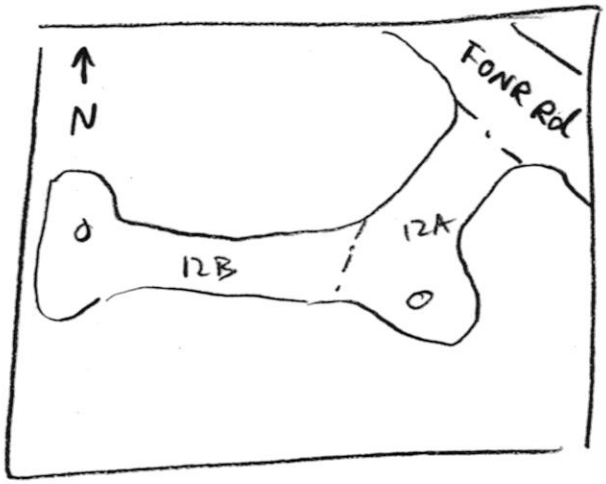
Date 5-13-11

Surveyor AFM

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary





Rare Plant Survey Chorizanthe

Well ID: IW-001-73A

WCS Sub Group 13A

Date 4-29-11

Surveyor AFM

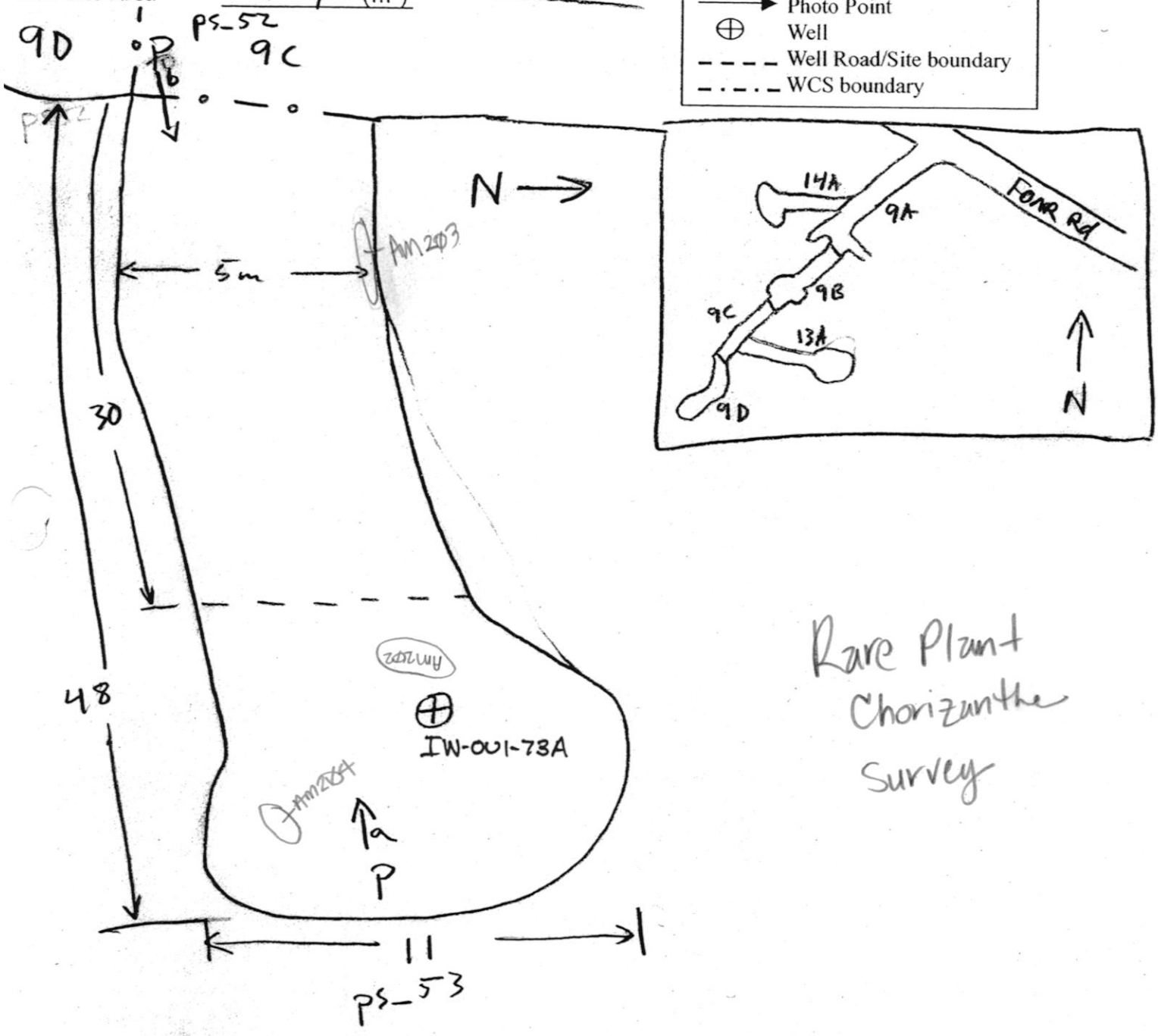
al Aprox. Area 277 (m^2)

ell Rd. Area 150 (m^2)

Well Site Area 127 (m^2)

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- · - · -	WCS boundary



Rare Plant Chorizanthe Survey

Well ID: MW-001-83A

WCS Sub Group 14A

Total Aprox. Area 327 (m^2)

Well Rd. Area 215 (m^2)

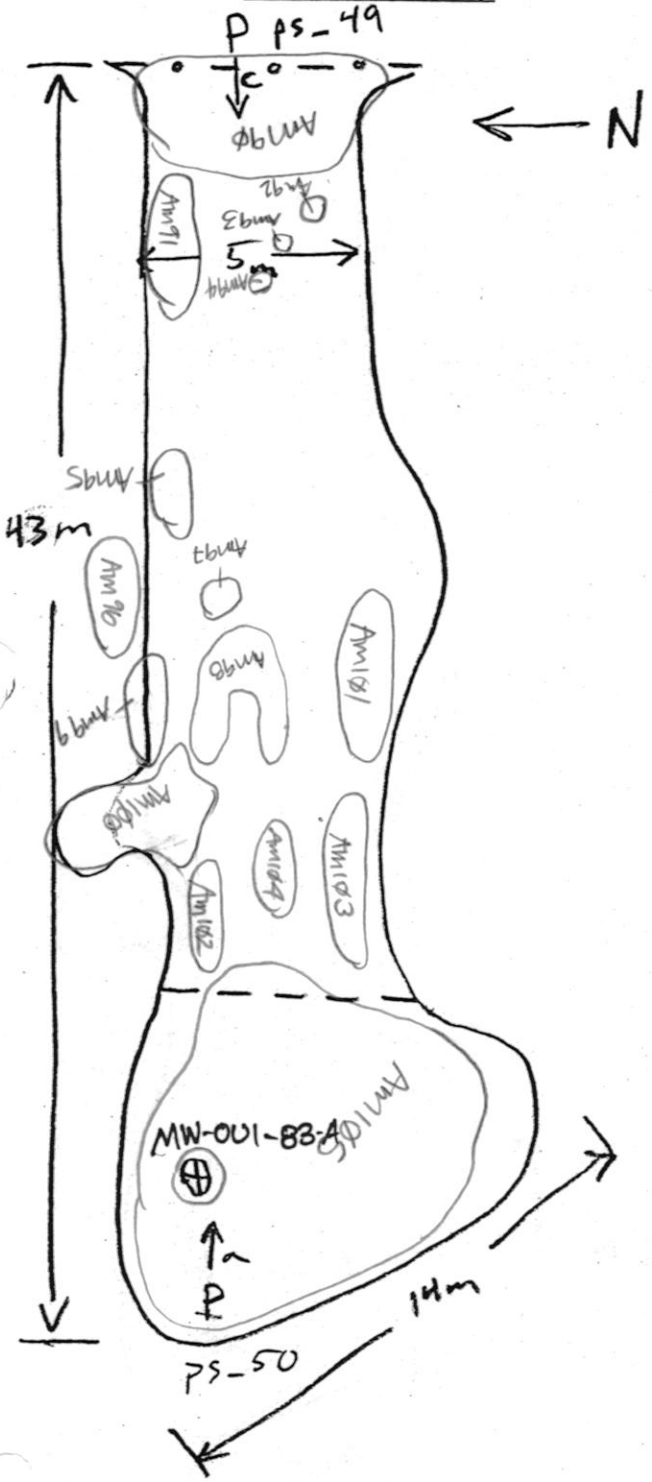
Well Site Area 112 (m^2)

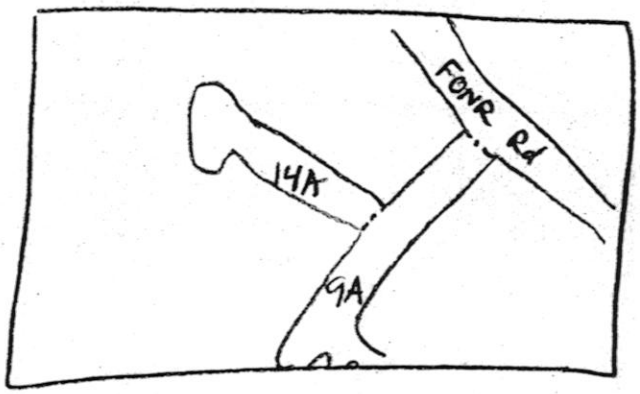
Date 4-22-11

Surveyor AFM

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- · - · -	WCS boundary





Rare Plant Chorizanthe Survey

Well ID: MW-OU1-82A

Date 5-20-11

WCS Sub Group 15A

Surveyor Afm

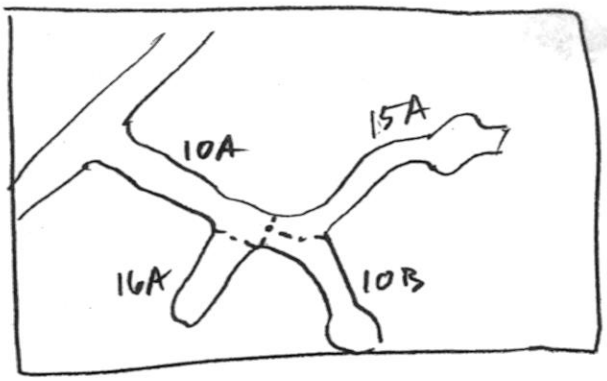
Total Aprox. Area 326 (m^2)

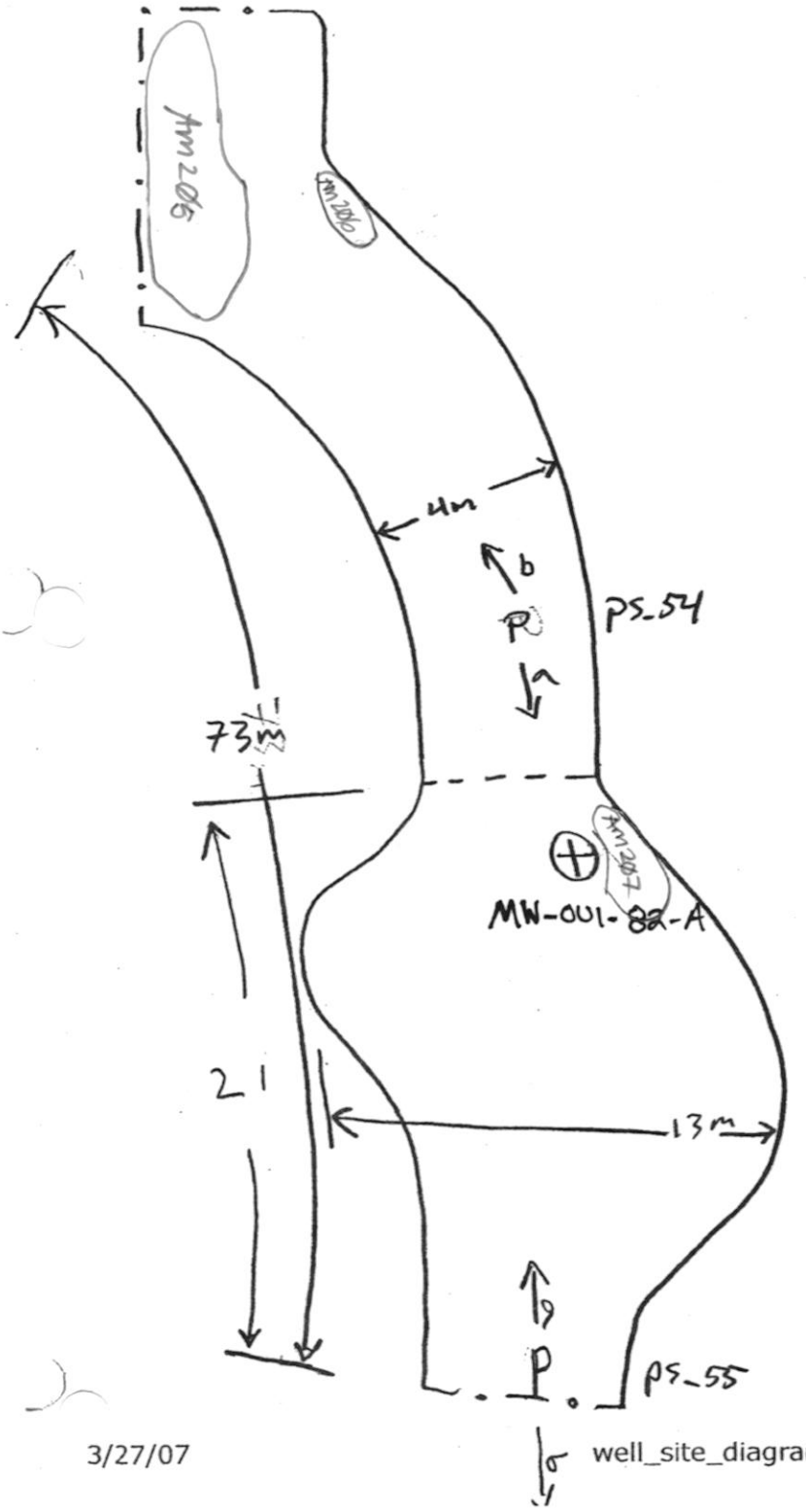
Fenced Area 208 (m^2)

Well Site Area 118 (m^2)

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary





Rare Plant Survey
Chorizanthe

Well ID: SB-OU1-2004K

WCS Sub Group 16A

Total Aprox. Area 300 (m^2)

Well Rd. Area 160 (m^2)

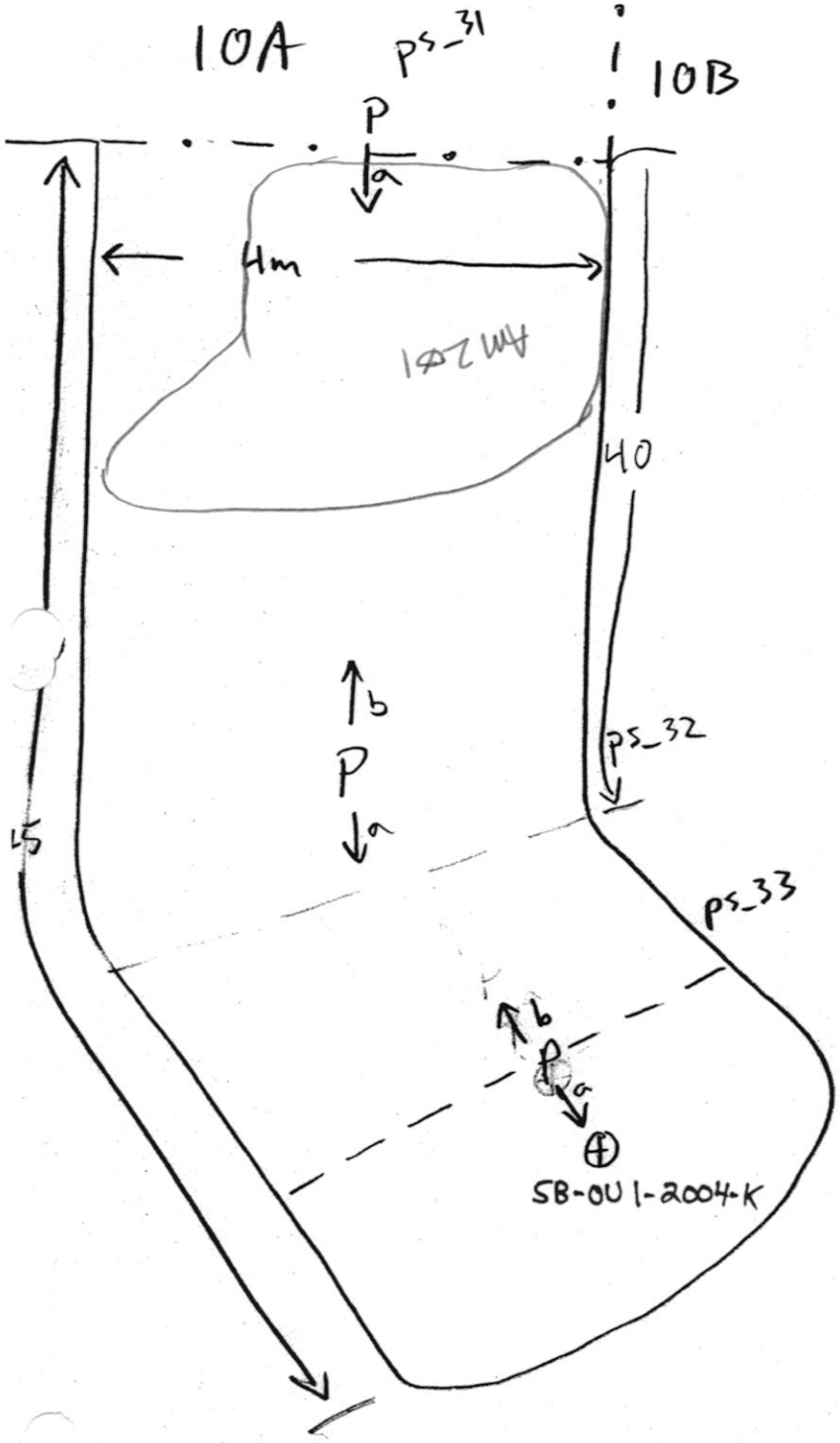
Well Site Area 140 (m^2)

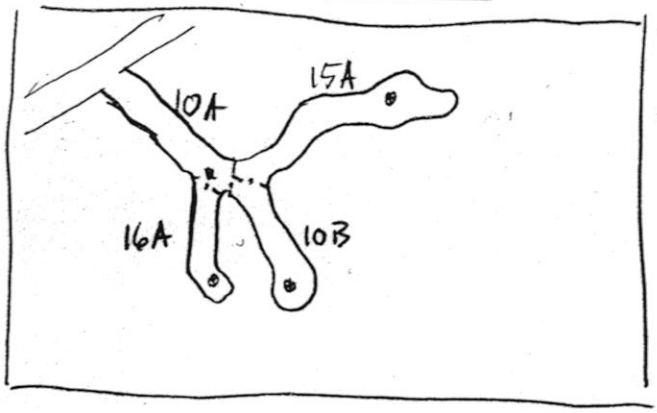
Date 5-20-11

Surveyor AFM

Legend

1A	# = WCS Sub Group
P	Photo Station
→	Photo Point
⊕	Well
- - - -	Well Road/Site boundary
- . - . -	WCS boundary





Rare Plant Survey
Chorizanthe

Attachment 4

‘WCS Photo Log 2011’

The attached spreadsheet (HGL_WCS_PhotoLog_2011.xls) contains a detailed log of all photographs (pre- and post-treatment) taken during the 2011 weed control program within the Operable Unit 1 portion of the FONR.

HGL - WCS 2011 - Photo Log

Date= photo treatment date
WCS= Weed Control Segment; HGL defined weed management area with corresponding wells.

Photo filenames:
All filenames given in following format: <fonr_ps_##x_year-mo-date>
where: ps= photo station ; ##= number; x= photo point; year= year four digit format (e.g., 2010);
mo= month (e.g., april=04); date= date (09 instead of 9); Photo dates are not always the same as treatment dates

Date	Photo #	WCS #	Photo Station	Photo Point	Well/Road #	Notes
4/19/2011	41	01A	82	a	N/A - Staging Area	Pre-Treatment Photos
4/19/2011	42	01A	83	a	N/A - Staging Area	Pre-Treatment Photos
4/19/2011	43	01A	83	b	N/A - Staging Area	Pre-Treatment Photos
4/19/2011	44	01A	84	a	N/A - Staging Area	Pre-Treatment Photos
4/19/2011	45	02A	85	a	N/A - Staging Area	Pre-Treatment Photos
4/19/2011	46	02A	85	b	N/A - Staging Area	Pre-Treatment Photos
4/19/2011	47	02A	86	a	N/A - Staging Area	Pre-Treatment Photos
4/19/2011	48	02A	86	b	N/A - Staging Area	Pre-Treatment Photos
4/19/2011	49	03A	87	a	N/A - Staging Area	Pre-Treatment Photos
4/19/2011	50	04A	2	a	IW-OU1-05-A	Pre-Treatment Photos
4/19/2011	51	04A	3	a	IW-OU1-05-A	Pre-Treatment Photos
4/19/2011	52	04A	3	b	IW-OU1-05-A	Pre-Treatment Photos
4/19/2011	53	05A	7	a	IW-OU1-01-A	Pre-Treatment Photos
4/19/2011	54	05A	7	b	IW-OU1-01-A	Pre-Treatment Photos
4/19/2011	55	05A	8	a	IW-OU1-01-A	Pre-Treatment Photos
4/19/2011	56	05A	8	b	IW-OU1-01-A	Pre-Treatment Photos
4/19/2011	57	05A	8	c	IW-OU1-01-A	Pre-Treatment Photos
4/19/2011	58	06A	10	a	EW-OU1-53-A	Pre-Treatment Photos
4/19/2011	59	06A	11	a	EW-OU1-53-A	Pre-Treatment Photos
4/19/2011	60	06A	11	b	EW-OU1-53-A	Pre-Treatment Photos
4/19/2011	61	06A	12	a	EW-OU1-53-A	Pre-Treatment Photos
4/19/2011	62	06A	12	b	EW-OU1-53-A	Pre-Treatment Photos
4/19/2011	63	07A	13	a	EW-OU1-52-A	Pre-Treatment Photos
4/19/2011	64	07A	14	a	EW-OU1-52-A	Pre-Treatment Photos
4/19/2011	66	08A	17	a	PZ-OU1-10-A1, IW-OU1-10A	Pre-Treatment Photos
4/19/2011	67	08A	17	b	PZ-OU1-10-A1, IW-OU1-10A	Pre-Treatment Photos
4/19/2011	65	08A	18	a	PZ-OU1-10-A1, IW-OU1-10A	Pre-Treatment Photos
4/19/2011	71	09A	22	a	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	Pre-Treatment Photos
4/19/2011	72	09A	22	b	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	Pre-Treatment Photos
4/19/2011	68	09A	25	a	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	Pre-Treatment Photos
4/19/2011	69	09A	49	a	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	Pre-Treatment Photos
4/19/2011	70	09A	49	b	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	Pre-Treatment Photos

HGL - WCS 2011 - Photo Log

Date	Photo #	WCS #	Photo Station	Photo Point	Well/Road #	Notes
4/19/2011	73	09B	22	c	MW-OU1-84A	Pre-Treatment Photos
4/19/2011	74	09B	51	a	MW-OU1-84A	Pre-Treatment Photos
4/19/2011	75	09C	52	a	IW-OU1-74A	Pre-Treatment Photos
4/19/2011	77	09D	24	a	MW-OU1-51A	Pre-Treatment Photos
4/19/2011	76	09D	52	c	MW-OU1-51A	Pre-Treatment Photos
4/19/2011	82	10A	28	a	MW-OU1-50A	Pre-Treatment Photos
4/19/2011	83	10A	29	a	MW-OU1-50A	Pre-Treatment Photos
4/19/2011	84	10A	29	b	MW-OU1-50A	Pre-Treatment Photos
4/19/2011	90	10B	30	a	MW-OU1-59A	Pre-Treatment Photos
4/19/2011	91	10B	30	b	MW-OU1-59A	Pre-Treatment Photos
4/19/2011	96	11A	43	a	EW-OU1-71A	Pre-Treatment Photos
4/19/2011	97	11A	44	a	EW-OU1-71A	Pre-Treatment Photos
4/19/2011	98	11A	44	b	EW-OU1-71A	Pre-Treatment Photos
4/19/2011	99	11A	44	c	EW-OU1-71A	Pre-Treatment Photos
4/19/2011	100	11B	45	a	MW-OU1-86A	Pre-Treatment Photos
4/19/2011	101	12A	46	a		Pre-Treatment Photos ? Duplicate?
4/19/2011	102	12A	46	a	EW-OU1-72A	Pre-Treatment Photos
4/19/2011	103	12A	47	a	EW-OU1-72A	Pre-Treatment Photos
4/19/2011	103	12A	47	b	EW-OU1-72A	Pre-Treatment Photos
4/19/2011	104	12B	47	c	EW-OU1-72A	Pre-Treatment Photos
4/19/2011	105	12B	48	a	MW-OU1-85A	Pre-Treatment Photos
4/19/2011	78	13A	52	b	IW-OU1-73A	Pre-Treatment Photos
4/19/2011	79	13A	53	a	IW-OU1-73A	Pre-Treatment Photos
4/19/2011	80	14A	49	c	MW-OU1-83A	Pre-Treatment Photos
4/19/2011	81	14A	50	a	MW-OU1-83A	Pre-Treatment Photos
4/19/2011	92	15A	54	a	MW-OU1-82A	Pre-Treatment Photos
4/19/2011	93	15A	54	b	MW-OU1-82A	Pre-Treatment Photos
4/19/2011	94	15A	55	a	MW-OU1-82A	Pre-Treatment Photos
4/19/2011	95	15A	55	b	MW-OU1-82A	Pre-Treatment Photos
4/19/2011	85	16A	31	a	SB-OU1-2004K	Pre-Treatment Photos
4/19/2011	86	16A	32	a	SB-OU1-2004K	Pre-Treatment Photos
4/19/2011	87	16A	32	b	SB-OU1-2004K	Pre-Treatment Photos
4/19/2011	88	16A	33	a	SB-OU1-2004K	Pre-Treatment Photos
4/19/2011	89	16A	33	b	SB-OU1-2004K	Pre-Treatment Photos
4/19/2011	108	17A	15	a	IW-OU1-02-A	Pre-Treatment Photos
4/19/2011	109	17A	16	a	IW-OU1-02-A	Pre-Treatment Photos
4/19/2011	106	18A	41	a	MW-OU1-88-A	Pre-Treatment Photos
4/19/2011	107	18A	42	a	MW-OU1-88-A	Pre-Treatment Photos
7/15/2011	575	01A	82	a	N/A - Staging Area	Post-Treatment Photos
7/15/2011	576	01A	83	a	N/A - Staging Area	Post-Treatment Photos
7/15/2011	577	01A	83	b	N/A - Staging Area	Post-Treatment Photos
7/15/2011	578	01A	84	a	N/A - Staging Area	Post-Treatment Photos
7/15/2011	579	02A	85	a	N/A - Staging Area	Post-Treatment Photos
7/15/2011	580	02A	85	b	N/A - Staging Area	Post-Treatment Photos
7/15/2011	581	02A	86	a	N/A - Staging Area	Post-Treatment Photos
7/15/2011	582	02A	86	b	N/A - Staging Area	Post-Treatment Photos
7/15/2011	583	03A	87	a	N/A - Staging Area	Post-Treatment Photos
7/15/2011	584	04A	2	a	IW-OU1-05-A	Post-Treatment Photos
7/15/2011	585	04A	3	a	IW-OU1-05-A	Post-Treatment Photos
7/15/2011	586	04A	3	b	IW-OU1-05-A	Post-Treatment Photos
7/15/2011	590	05A	7	a	IW-OU1-01-A	Post-Treatment Photos
7/15/2011	591	05A	7	b	IW-OU1-01-A	Post-Treatment Photos

HGL - WCS 2011 - Photo Log

Date	Photo #	WCS #	Photo Station	Photo Point	Well/Road #	Notes
7/15/2011	587	05A	8	a	IW-OU1-01-A	Post-Treatment Photos
7/15/2011	588	05A	8	b	IW-OU1-01-A	Post-Treatment Photos
7/15/2011	589	05A	8	c	IW-OU1-01-A	Post-Treatment Photos
7/15/2011	592	06A	10	a	EW-OU1-53-A	Post-Treatment Photos
7/15/2011	593	06A	11	a	EW-OU1-53-A	Post-Treatment Photos
7/15/2011	594	06A	11	b	EW-OU1-53-A	Post-Treatment Photos
7/15/2011	595	06A	12	a	EW-OU1-53-A	Post-Treatment Photos
7/15/2011	596	06A	12	b	EW-OU1-53-A	Post-Treatment Photos
7/15/2011	597	07A	13	a	EW-OU1-52-A	Post-Treatment Photos
7/15/2011	598	07A	14	a	EW-OU1-52-A	Post-Treatment Photos
7/15/2011	600	08A	17	a	PZ-OU1-10-A1, IW-OU1-10A	Post-Treatment Photos
7/15/2011	601	08A	17	b	PZ-OU1-10-A1, IW-OU1-10A	Post-Treatment Photos
7/15/2011	599	08A	18	a	PZ-OU1-10-A1, IW-OU1-10A	Post-Treatment Photos
7/15/2011	606	09A	22	a	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	Post-Treatment Photos
7/15/2011	607	09A	22	b	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	Post-Treatment Photos
7/15/2011	602	09A	25	a	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	Post-Treatment Photos
7/15/2011	603	09A	49	a	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	Post-Treatment Photos
7/15/2011	604	09A	49	b	MW-OU1-46AD, PZ-OU1-46-AD2, MW-OU1-46-A	Post-Treatment Photos
7/15/2011	608	09A	22	c	MW-OU1-84A	Post-Treatment Photos
7/15/2011	609	09B	51	a	MW-OU1-84A	Post-Treatment Photos
7/15/2011	610	09C	52	a	IW-OU1-74A	Post-Treatment Photos
7/15/2011	612	09D	24	a	MW-OU1-51A	Post-Treatment Photos
7/15/2011	611	09D	52	c	MW-OU1-51A	Post-Treatment Photos
7/19/2011	631	10A	28	a	MW-OU1-50A	Post-Treatment Photos
7/19/2011	632	10A	29	a	MW-OU1-50A	Post-Treatment Photos
7/19/2011	633	10A	29	b	MW-OU1-50A	Post-Treatment Photos
7/19/2011	639	10B	30	a	MW-OU1-59A	Post-Treatment Photos
7/19/2011	640	10B	30	b	MW-OU1-59A	Post-Treatment Photos
7/19/2011	621	11A	43	a	EW-OU1-71A	Post-Treatment Photos
7/19/2011	622	11A	44	a	EW-OU1-71A	Post-Treatment Photos
7/19/2011	623	11A	44	b	EW-OU1-71A	Post-Treatment Photos
7/19/2011	624	11B	44	c	EW-OU1-71A	Post-Treatment Photos
7/19/2011	625	11B	45	a	MW-OU1-86A	Post-Treatment Photos
7/15/2011	616	12A	46	a	EW-OU1-72A	Post-Treatment Photos
7/15/2011	617	12A	47	a	EW-OU1-72A	Post-Treatment Photos
7/15/2011	618	12A	47	b	EW-OU1-72A	Post-Treatment Photos
7/15/2011	619	12A	47	c	EW-OU1-72A	Post-Treatment Photos
7/15/2011	620	12B	48	a	MW-OU1-85A	Post-Treatment Photos
7/15/2011	613	13A	52	b	IW-OU1-73A	Post-Treatment Photos
7/15/2011	614	13A	53	a	IW-OU1-73A	Post-Treatment Photos

HGL - WCS 2011 - Photo Log

Date	Photo #	WCS #	Photo Station	Photo Point	Well/Road #	Notes
7/15/2011	605	14A	49	c	MW-OU1-83A	Post-Treatment Photos
7/15/2011	615	14A	50	a	MW-OU1-83A	Post-Treatment Photos
7/19/2011	641	15A	54	a	MW-OU1-82A	Post-Treatment Photos
7/19/2011	642	15A	54	b	MW-OU1-82A	Post-Treatment Photos
7/19/2011	643	15A	55	a	MW-OU1-82A	Post-Treatment Photos
7/19/2011	647	15A	55	b	MW-OU1-82A	Post-Treatment Photos
7/19/2011	638	16A	31	a	SB-OU1-2004K	Post-Treatment Photos
7/19/2011	636	16A	32	a	SB-OU1-2004K	Post-Treatment Photos
7/19/2011	637	16A	32	b	SB-OU1-2004K	Post-Treatment Photos
7/19/2011	634	16A	33	a	SB-OU1-2004K	Post-Treatment Photos
7/19/2011	635	16A	33	b	SB-OU1-2004K	Post-Treatment Photos
7/19/2011	629	17A	15	a	IW-OU1-02-A	Post-Treatment Photos
7/19/2011	630	17A	16	a	IW-OU1-02-A	Post-Treatment Photos
7/19/2011	627	18A	41	a	MW-OU1-88-A	Post-Treatment Photos
7/19/2011	628	18A	42	a	MW-OU1-88-A	Post-Treatment Photos

Attachment 5

‘HGL_WCS_Photos_2011’

The enclosed compact disc (CD) contains digital photographs taken during the 2011 weed control program performed by FONR staff. Photographs on the CD are organized in the folder 'HGL_WCS_Photos_2011_jpgs'. This folder contains photo files (.jpg format) with the file name designating the reserve (fonr), the photo station number (‘_ps#’), and the date the photo was taken (_year-month-day).

e.g. ‘fonr_ps13a_2011-04-19’
‘fonr_ps13a_2011-07-15’

Each photo station has at least two photos, one pre-treatment and one post-treatment, designated by date of photo. Refer to photo log (HGL_WCS_Photo_Log_2011.xls) for more detailed information.

In addition to the digital photograph files, the enclosed CD also contains an Adobe PDF file 'HGL_WCS_Photos_2011.pdf' with the pre-treatment and post-treatment photos for each WCS labeled and formatted on a standard letter (8.5" x 11") portrait layout.

WCS# 1A ps82a Staging Area Pre-Treatment 19 April 2011

WCS# 1A ps82a Staging Area Post-Treatment 16 July 2011

WCS# 1A ps83a Staging Area Pre-Treatment 19 April 2011

WCS# 1A ps83a Staging Area Post-Treatment 16 July 2011

WCS# 1A ps84a Staging Area Pre-Treatment 19 April 2011

WCS# 1A ps84a Staging Area Post-Treatment 16 July 2011

WCS# 2A ps85a Staging Area Pre-Treatment 19 April 2011

WCS# 2A ps85a Staging Area Post-Treatment 16 July 2011

WCS# 2A ps85b Staging Area Pre-Treatment 19 April 2011

WCS# 2A ps85b Staging Area Post-Treatment 16 July 2011

WCS# 2A ps86a Staging Area Pre-Treatment 19 April 2011

WCS# 2A ps86a Staging Area Post-Treatment 16 July 2011

WCS# 2A ps86b Staging Area Pre-Treatment 19 April 2011

WCS# 2A ps86b Staging Area Post-Treatment 16 July 2011

WCS# 3A ps87a Staging Area Pre-Treatment 19 April 2011

WCS# 3A ps87a Staging Area Post-Treatment 16 July 2011

WCS# 4A ps2a IW-OU1-05-A Pre-Treatment 19 April 2011

WCS# 4A ps2a IW-OU1-05-A Post-Treatment 16 July 2011

WCS# 4A ps3a IW-OU1-05-A Pre-Treatment 19 April 2011

WCS# 4A ps3a IW-OU1-05-A Post-Treatment 16 July 2011

WCS# 4A ps3b IW-OU1-05-A Pre-Treatment 19 April 2011

WCS# 4A ps3b IW-OU1-05-A Post-Treatment 16 July 2011

WCS# 5A ps7a IW-OU1-01-A Pre-Treatment 19 April 2011

WCS# 5A ps7a IW-OU1-01-A Post-Treatment 16 July 2011

WCS# 5A ps7b IW-OU1-01-A Pre-Treatment 19 April 2011

WCS# 5A ps7b IW-OU1-01-A Post-Treatment 16 July 2011

WCS# 5A ps8a IW-OU1-01-A Pre-Treatment 19 April 2011

WCS# 5A ps8a IW-OU1-01-A Post-Treatment 16 July 2011

WCS# 5A ps8b IW-OU1-01-A Pre-Treatment 19 April 2011

WCS# 5A ps8b IW-OU1-01-A Post-Treatment 16 July 2011

WCS# 5A ps8c IW-OU1-01-A Pre-Treatment 19 April 2011

WCS# 5A ps8c IW-OU1-01-A Post-Treatment 16 July 2011

WCS# 6A ps10a EW-OU1-53-A Pre-Treatment 19 April 2011

WCS# 6A ps10a EW-OU1-53-A Post-Treatment 16 July 2011

WCS# 6A ps11a EW-OU1-53-A Pre-Treatment 19 April 2011

WCS# 6A ps11a EW-OU1-53-A Post-Treatment 16 July 2011

WCS# 6A ps11b EW-OU1-53-A Pre-Treatment 19 April 2011

WCS# 6A ps11b EW-OU1-53-A Post-Treatment 16 July 2011

WCS# 6A ps12a EW-OU1-53-A Pre-Treatment 19 April 2011

WCS# 6A ps12a EW-OU1-53-A Post-Treatment 16 July 2011

WCS# 6A ps12b EW-OU1-53-A Pre-Treatment 19 April 2011

WCS# 6A ps12b EW-OU1-53-A Post-Treatment 16 July 2011

WCS# 7A ps13a EW-OU1-52-A Pre-Treatment 19 April 2011

WCS# 7A ps13a EW-OU1-52-A Post-Treatment 16 July 2011

WCS# 7A ps14a EW-OU1-52-A Pre-Treatment 19 April 2011

WCS# 7A ps14a EW-OU1-52-A Post-Treatment 16 July 2011

WCS# 8A ps17a IW-OU1-10-A Pre-Treatment 19 April 2011

WCS# 8A ps17a IW-OU1-10-A Post-Treatment 16 July 2011

WCS# 8A ps17b IW-OU1-10-A Pre-Treatment 19 April 2011

WCS# 8A ps17b IW-OU1-10-A Post-Treatment 16 July 2011

WCS# 8A ps18a IW-OU1-10-A Pre-Treatment 19 April 2011

WCS# 8A ps18a IW-OU1-10-A Post-Treatment 16 July 2011

WCS# 9A ps22a MW-OU1-46-A Pre-Treatment 19 April 2011

WCS# 9A ps22a MW-OU1-46-A Post-Treatment 16 July 2011

WCS# 9A ps22b MW-OU1-46-A Pre-Treatment 19 April 2011

WCS# 9A ps22b MW-OU1-46-A Post-Treatment 16 July 2011

WCS# 9A ps25a MW-OU1-46-A Pre-Treatment 19 April 2011

WCS# 9A ps25a MW-OU1-46-A Post-Treatment 16 July 2011

WCS# 9A ps49a MW-OU1-46-A Pre-Treatment 19 April 2011

WCS# 9A ps49a MW-OU1-46-A Post-Treatment 16 July 2011

WCS# 9A ps49b MW-OU1-46-A Pre-Treatment 19 April 2011

WCS# 9A ps49b MW-OU1-46-A Post-Treatment 16 July 2011

WCS# 9A ps49c MW-OU1-46-A Pre-Treatment 19 April 2011

WCS# 9A ps49c MW-OU1-46-A Post-Treatment 16 July 2011

WCS# 9B ps22c MW-OU1-84A Pre-Treatment 19 April 2011

WCS# 9B ps22c MW-OU1-84A Post-Treatment 16 July 2011

WCS# 9B ps51a MW-OU1-84A Pre-Treatment 19 April 2011

WCS# 9B ps51a MW-OU1-84A Post-Treatment 16 July 2011

WCS# 9C ps52a IW-OU1-74A Pre-Treatment 19 April 2011

WCS# 9C ps52a IW-OU1-74A Post-Treatment 16 July 2011

WCS# 9D ps24a MW-OU1-51-A Pre-Treatment 19 April 2011

WCS# 9D ps24a MW-OU1-51-A Post-Treatment 16 July 2011

WCS# 9D ps52c MW-OU1-51-A Pre-Treatment 19 April 2011

WCS# 9D ps52c MW-OU1-51-A Post-Treatment 16 July 2011

WCS# 10A ps28a MW-OU1-50-A Pre-Treatment 19 April 2011

WCS# 10A ps28a MW-OU1-50-A Post-Treatment 19 July 2011

WCS# 10A ps29a MW-OU1-50-A Pre-Treatment 19 April 2011

WCS# 10A ps29a MW-OU1-50-A Post-Treatment 19 July 2011

WCS# 10A ps29b MW-OU1-50-A Pre-Treatment 19 April 2011

WCS# 10A ps29b MW-OU1-50-A Post-Treatment 19 July 2011

WCS# 10B ps30a MW-OU1-59-A Pre-Treatment 19 April 2011

WCS# 10B ps30a MW-OU1-59-A Post-Treatment 19 July 2011

WCS# 10B ps30b MW-OU1-59-A Pre-Treatment 19 April 2011

WCS# 10B ps30b MW-OU1-59-A Post-Treatment 19 July 2011

WCS# 11A ps43a EW-OU1-71-A Pre-Treatment 19 April 2011

WCS# 11A ps43a EW-OU1-71-A Post-Treatment 16 July 2011

WCS# 11A ps44a EW-OU1-71-A Pre-Treatment 19 April 2011

WCS# 11A ps44a EW-OU1-71-A Post-Treatment 16 July 2011

WCS# 11A ps44b EW-OU1-71-A Pre-Treatment 19 April 2011

WCS# 11A ps44b EW-OU1-71-A Post-Treatment 16 July 2011

WCS# 11A ps44c EW-OU1-71-A Pre-Treatment 19 April 2011

WCS# 11A ps44c EW-OU1-71-A Post-Treatment 16 July 2011

WCS# 11B ps45a MW-OU1-86-A Pre-Treatment 19 April 2011

WCS# 11B ps45a MW-OU1-86-A Post-Treatment 16 July 2011

WCS# 12A ps46a EW-OU1-72-A Pre-Treatment 19 April 2011

WCS# 12A ps46a EW-OU1-72-A Post-Treatment 16 July 2011

WCS# 12A ps47a EW-OU1-72-A Pre-Treatment 19 April 2011

WCS# 12A ps47a EW-OU1-72-A Post-Treatment 16 July 2011

WCS# 12A ps47b EW-OU1-72-A Pre-Treatment 19 April 2011

WCS# 12A ps47b EW-OU1-72-A Post-Treatment 16 July 2011

WCS# 12A ps47c EW-OU1-72-A Pre-Treatment 19 April 2011

WCS# 12A ps47c EW-OU1-72-A Post-Treatment 16 July 2011

WCS# 12B ps48a MW-OU1-85-A Pre-Treatment 19 April 2011

WCS# 12B ps48a MW-OU1-85-A Post-Treatment 16 July 2011

WCS# 13A ps52b IW-OU1-73A Pre-Treatment 19 April 2011

WCS# 13A ps52b IW-OU1-73A Post-Treatment 16 July 2011

WCS# 13A ps53a IW-OU1-73A Pre-Treatment 19 April 2011

WCS# 13A ps53a IW-OU1-73A Post-Treatment 16 July 2011

WCS# 14A ps49c MW-OU1-83A Pre-Treatment 19 April 2011

WCS# 14A ps49c MW-OU1-83A Post-Treatment 16 July 2011

WCS# 14A ps50a MW-OU1-83A Pre-Treatment 19 April 2011

WCS# 14A ps50a MW-OU1-83A Post-Treatment 16 July 2011

WCS# 15A ps54a MW-OU1-82A Pre-Treatment 19 April 2011

WCS# 15A ps54a MW-OU1-82A Post-Treatment 19 July 2011

WCS# 15A ps54b MW-OU1-82A Pre-Treatment 19 April 2011

WCS# 15A ps54b MW-OU1-82A Post-Treatment 19 July 2011

WCS# 15A ps55a MW-OU1-82A Pre-Treatment 19 April 2011

WCS# 15A ps55a MW-OU1-82A Post-Treatment 19 July 2011

WCS# 15A ps55b MW-OU1-82A Pre-Treatment 19 April 2011

WCS# 15A ps55b MW-OU1-82A Post-Treatment 19 July 2011

WCS# 16A ps31a SB-OU1-2004K Pre-Treatment 19 April 2011

WCS# 16A ps31a SB-OU1-2004K Post-Treatment 19 July 2011

WCS# 16A ps32a SB-OU1-2004K Pre-Treatment 19 April 2011

WCS# 16A ps32a SB-OU1-2004K Post-Treatment 19 July 2011

WCS# 16A ps32b SB-OU1-2004K Pre-Treatment 19 April 2011

WCS# 16A ps32b SB-OU1-2004K Post-Treatment 19 July 2011

WCS# 16A ps33a SB-OU1-2004K Pre-Treatment 19 April 2011

WCS# 16A ps33a SB-OU1-2004K Post-Treatment 19 July 2011

WCS# 16A ps33b SB-OU1-2004K Pre-Treatment 19 April 2011

WCS# 16A ps33b SB-OU1-2004K Post-Treatment 19 July 2011

WCS# 17A ps15a IW-OU1-02-A Pre-Treatment 19 April 2011

WCS# 17A ps15a IW-OU1-02-A Post-Treatment 19 July 2011

WCS# 17A ps16a IW-OU1-02-A Pre-Treatment 19 April 2011

WCS# 17A ps16a IW-OU1-02-A Post-Treatment 19 July 2011

WCS# 18A ps41a MW-OU1-88-A Pre-Treatment 19 April 2011

WCS# 18A ps41a MW-OU1-88-A Post-Treatment 19 July 2011

WCS# 18A ps42a MW-OU1-88-A Pre-Treatment 19 April 2011

WCS# 18A ps42a MW-OU1-88-A Post-Treatment 19 July 2011