UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
1445 ROSS AVENUE, SUITE 1200
DALLAS, TX 75202-2733

MAY 17 2012

MEMORANDUM

SUBJECT: Request for a Time-Critical Removal Action, at the Rio San Jose Radiation Site, Pueblo of Laguna, near Cibola County, New Mexico

FROM: Warren Zehner, On-Scene Coordinator
Removal Team (6SF-PR)

Jon Rinehart, On-Scene Coordinator
Removal Team (6SF-PR)

THRU: Ragan Broyles, Associate Director
Prevention and Response Branch (6SF-P)

TO: Pamela Phillips, Acting Division Director
Superfund Division (6SF)

I. PURPOSE

This memorandum requests approval for a time-critical removal action, pursuant to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 U.S.C. § 9601 et seq., at the 11 residential properties that compose the Rio San Jose Radiation Site (the "Site") located in the Villages of Laguna, Mesita, Paraje, and Seama, Pueblo of Laguna (POL) located in Cibola County, New Mexico. The proposed actions for this Site include the excavation, consolidation, and removal of radiologically contaminated soil/debris at 11 residential structures located on 11 residential properties within the boundaries of the aforementioned Villages.

As described in Section III of this memorandum, the factors described in Section 300.415 of the National Contingency Plan (NCP), 40 CFR § 300.415, have been considered, and, based on those factors, a determination has been made that a removal action at the Site is appropriate. This Removal Action is not expected to exceed the statutory twelve-month time limit, nor is it expected to exceed the statutory $2,000,000 cost ceiling.

II. SITE CONDITIONS AND BACKGROUND

CERCLIS ID:	NMN000607243
Category of Removal:	Time Critical
Site ID:	A6CR
Latitude:	35. 043110 N
Longitude:	-107. 473433 W

A. Site Description

1. Removal Site Evaluation

As part of the overall environmental assessment of the Grants Mineral Belt area of New Mexico, the Environmental Protection Agency, Region 6 Prevention and Response Branch (EPA PRB) received a verbal request for assistance in the evaluation of the POL for a potential removal action from the Laguna Environment Department (LED) in March 2009. Documentation provided by the LED indicated that the Villages of Paguate, Encinal, Laguna, Mesita, Paraje, and Seama are in the vicinity of the Jackpile Mine (JM), which is an underground and open pit uranium mine. The villages were thought to be potentially contaminated with uranium mine waste originating from the mining operations that occurred on the JM when it was operational from 1952 - 1982. Based on this request for assistance, the Superfund Technical and Response Team (START) III contractors were tasked by EPA PRB to conduct a Radiation Removal Assessment on the Site. As part of this radiological assessment a quality assurance sampling plan (QASP) was developed for the project documenting standard operating procedures (SOPs), assessment protocols, and data decisions tree consistent with current EPA guidance and other best management practices. Based on the results of the Radiation Removal Assessment, the LED made a written request to the PRB for assistance in conducting a removal action on the affected residential properties in the Villages of Laguna, Mesita, Paraje, and Seama on August 6, 2011 (*See* Attachment 2).

The elevated concentrations of several radio-isotopes and their associated progeny in various uranium mine waste streams are contaminants of concern on this Site primarily from gamma and other forms of ionizing radiation associated with these radio-isotopes. Uranium mine waste streams include, but are not limited to: overburden, sub-economic ore, and broken/replaced infrastructure/mechanical elements, and/or soil/debris that have become contaminated with radioactive waste materials ("waste materials"). Principally, contaminants of concern include radium-226 (^{226}Ra, hereafter to mean isotope and progeny) and radon-222 (^{222}Rn, hereafter to mean the isotope and progeny) primarily from the mining operations and/or subsequent mine closure operations conducted in the Laguna Sub-District of the Grants Mineral Belt. In addition to ^{226}Ra and ^{222}Rn contamination, uranium-238 (^{238}U, hereafter to mean, all the isotopes and their progeny) generated from the various uranium mining operations are also contaminants of concern. These radio-isotopes have been potentially dispersed by the aforementioned uranium mining operations in the Laguna Sub-District, including the JM during its previous operational history and by various anthropogenic means throughout the Site. The anthropogenic activities include, but are not limited to the utilization of waste materials in residential landscaping (rock borders, rock gardens, etc.), re-use of contaminated materials (i.e. salvaged piping used in a residential irrigation system) and re-use as construction materials on the residential properties (i.e. foundations). The elevated concentrations of radio-isotopes and associated radioactivity above normal background levels, expressed in counts per minute (CPM) and micro-roentgens per hour (μR/hr) present on the residential properties on this Site appear to be the direct result of the mining operations, and/or the utilization of waste materials generated

during the uranium mining and/or milling operations conducted in the Laguna Sub-District of the Grants Mineral Belt.

The fine and sandy/dusty texture of the contaminated soils on the Site makes it easy for these waste materials to adhere to humans and animals that come into direct contact with them. For humans and especially children, the wastes may be subsequently ingested during normal hand-to-mouth (or plaything-to-mouth) activity, or it may be inhaled. Moreover, the dry climate and sparse vegetative cover in these areas may cause the fine-grained waste materials to become wind-borne. Given the frequent dust storms taking place seasonally on the Site, the potential for exposure is greatly increased. These dust storms can also cause indoor contamination (the dust is so fine that it can blow through small cracks), increasing the likelihood that humans, and especially children, may be exposed. In addition, during the brief wet periods following precipitation events, contaminated mud may be tracked into residences and/or vehicles. When the mud dries and is disturbed during human activities, such as routine cleaning, the airborne fraction of the dust contributes to further inhalation exposure.

2. Physical Location

The Site is located within the geographic boundaries of the Villages of Laguna, Mesita, Paraje, and Seama, on the POL (*See* Attachment 3). These villages were settled in approximately 1699 and are predominantly Native Americans in demographics. Geomorphologically, the Site is in semi-arid grassland with some mixed piñon-juniper stands on the south and west sides of the Village, grading into rocky outcrops of the foothills of the San Mateo Mountains on the north and east sides. Density of vegetative cover is variable across the Site, with the areas of rocky outcropping having the least amount of cover vegetation. The Site is composed of 11 residential structures located on 11 residential homesites within the boundaries of the Village(s) (*See* Attachment 4).

3. Site Characteristics

The EPA has completed investigating the extent of residential radiological contamination on this Site. Based on the Removal Assessment, it appears that the source of the radiological contamination on this Site is waste material salvaged from the historic uranium mining operations at the JM and/or the other uranium mines located within the Laguna Sub-District of the Grants Mineral Belt.

The Laguna Sub-District is a small sub-district of the Grants Mineral Belt located within the boundaries of the POL and the Cebolleta Spanish Land Grant in Cibola County, New Mexico. Based on the review of federal and State government regulatory records, there were three uranium mining operations and one uranium mill operating in the sub-district from the early 1950s until 2002, with most active operations ceasing in the 1980s (*See* Attachment 5). These mines and mill were the main source of employment in the area, with the Jackpile Mine being the single largest employer on the POL.

As part of the overall operations at the mines and mill in the Laguna Sub-District, the mines maintained overburden and/or sub-economic ore waste piles and at least one waste/debris area for general infrastructure/ mechanical wastes. It appears based on several conversations with POL residents and former mine workers throughout the Removal Assessment study areas on the POL that "salvage" of the aforementioned waste piles and/or waste storage areas for residential re-utilization was common and if not approved by the mine operators, it was condoned. Reportedly, no warning signs or potential health impact information about the use of these waste materials were present in these waste areas during the operational history of the mines. Since the various uranium mines, including the JM, in the Laguna Sub-District were the largest employers in the POL for a significant number of years, a disproportionally large fraction of the adult residents of the POL villages had easy and ready access to the various aforementioned waste storage areas in the Laguna Sub-District. Several examples of residential re-utilization of radioactive waste materials were observed during the Removal Assessment on the Site, including but not limited to building materials, fill, landscaping (rock gardens), and souvenirs.

During the course of the Removal Assessment the EPA OSCs had discussions with numerous residents in the Villages of Laguna, Mesita, Paraje, and Seama regarding the residential re-utilization of various mine and mine operations wastes streams on their residences. Some residents freely admitted to the various source mines of the contaminated materials, others stated they had no knowledge of the source since it was brought to the residence by a parent or other relative.

As mentioned above, the EPA has completed the surface soil and structural (indoor) Removal Assessment on the Site. Surface radiological surveys were conducted on 185 residences utilizing a 2"x 2" gamma scintillation detector. Gamma radiations levels around and near the residences were as high as 338,632 CPM, as compared to the specific background of 11,148 CPM in Seama, 8,289 CPM in Paraje, 8,244 CPM in Laguna, and 6,460 CPM in Mesita (*See* Interim Status Report, Attachment 6).

4. Release or Threatened Release Into the Environment of a Hazardous Substance, Pollutant or Contaminant

Uranium-238 and ^{226}Ra are also principal contaminants of concern on this Site based primarily on the gamma and other forms of ionizing radiation associated with these radio-isotopes. Radiological dose is measured in milli-rem per year (mrem/year). The *Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination*, August 22, 1997 (OSWER Directive 9200.4-18) established a general, maximum acceptable radiological dose level of 15 mrem/year above background level for non NRC licensed facilities. Further, this guidance document states that the total effective dose equivalent (TEDE) of 15 mrem/year represents an excess cancer risk of $3x10^{-4}$, and is considered essentially equivalent to the CERCLA presumptively protective excess cancer risk level of $1x10^{-4}$. The referenced risk calculation utilizes a 30-year exposure period per lifetime and a 24 hour/day exposure rate. The risk

calculation is based upon a risk conversion factor of 7% cancer incidence per 100 rem of exposure and comes from the National Academy of Sciences report on *The Biological Effects of Ionizing Radiation (BEIR V), 1990*. The *Protocol for Uranium Home Site Assessment, Grants Mineral Belt Uranium Project; Cibola and McKinley Counties, New Mexico, December 2009,* documents the regulatory consistency with EPA 1997, OSWER 9200.4-18 and the process used for conducting the radiological assessment on this property. The START III Certified Health Physicists (CHPs) have evaluated the radiological data from the Removal Assessment on the Site and have determined that the 11 residences on the Site have exceeded the acceptable TEDE of 15 mrem/year and the excess cancer risk level of $3x10^{-4}$ is exceeded by a similar factor.

As previously stated, the primary contaminants of concern at the Site, ^{238}U and ^{226}Ra and their associated progeny, including ^{222}Rn are hazardous substances as defined in Section 101(14) of CERCLA, 42 U.S.C. § 9601(14) and 40 CFR § 302.4. The following are the known health effects associated with exposure to the aforementioned hazardous substances on the Site.

Radium-226

Radium-226 is principally a source of alpha and gamma radiation, although some beta radiation is also produced during the decay process. According to the ATSDR *ToxFAQs for Radium* (July 1999) document, exposure to ^{226}Ra can cause adverse effects to the eyes (cataracts) and blood (anemia). Radium-226 has been identified by the EPA and the National Academy of Sciences as a known human carcinogen, being specifically linked to cancers of the bone, breast and also leukemia.

The exposure pathways of concern for Radium-226 at this Site are described below:

- The predominant exposure pathway related to ^{226}Ra was determined to be external gamma radiation, contributing over 90% of the total effective dose equivalent (TEDE) in the ResRad modeled scenario with ^{222}Rn removed.

- A significant amount of the surface area of the residences on this Site is contaminated with elevated concentrations of ^{226}Ra at or near the surface. The contaminated soils are fine grained and have a high probability of adherence to skin, clothing and fur as a result of direct contact. For humans, incidental ingestion of the contaminants adhering to skin or clothing can occur through normal hand-to-mouth activities such as play or mealtime.

- Inhalation is another exposure pathway at this Site. As discussed above a significant amount of the surface soils on this Site are contaminated with ^{226}Ra. The contaminated soils tend to be fine grained and dusty, are easily airborne after wind or mechanical disturbances, and subject to inhalation by humans or livestock. Inhalation and ingestion combined for a total of approximately 5% of the TEDE estimate in the ResRad modeled scenario for this Site.

Uranium

Uranium is a widespread mineral forming heavy metal that in nature is composed of three isotopes, ^{238}U, ^{235}U, and ^{234}U, with the ^{238}U isotope generally composing over 98% of the mixture. All of these isotopes are the same chemically, but they have different energy and decay properties. According to the ATSDR *ToxFAQs for Uranium* (October 1999) document, U is an alpha ionizing radiation emitter and in general, weakly radioactive. Exposure to excess levels of U can cause human tissue damage, primarily in the kidneys. Cancer risk from exposure to excess U levels appears to be low to none. The primary risk on this Site from U is cancer caused by exposure to the progeny generated by its decay.

5. NPL Status

This Site is not presently on the NPL. However, should the Site rank on the NPL, the current removal action will be consistent with any subsequent remedial activities that might be taken due to the fact that the proposed actions constitute source control measures.

6. Maps, Pictures and Other Graphic Presentations

Attachment 1 - Enforcement Addendum (Enforcement Confidential/FOIA Exempt)
Attachment 2 - LED Removal Action Assistance Letter
Attachment 3 - Site Location Map
Attachment 4 - Site Sketch
Attachment 5 - Laguna Sub-District Historic Mine Locations
Attachment 6 - Interim Status Report, Non-Paguate Structural Removal Assessment, October 13, 2011

B. Other Actions to Date

1. Previous Actions

No previous response actions have occurred on this Site to date.

2. Current Actions

Based on the Removal Assessment data and the health based dose calculations utilizing the ResRad model and a ration of dose to excess cancer risk assumed at the TEDE of 15 mrem/year level per risk of $3x10^{-4}$ discussed above, in Section II.A.4, the EPA has determined that current conditions on this Site pose an unacceptable health risk to the residents residing on the specific properties found within the Site.

C. Tribal and Local Authorities' Roles

1. Tribal and Local Actions to Date

The Pueblo of Laguna, through the LED has been involved in the previous and current regulatory activities associated with the JM. EPA has coordinated all Removal Assessment activities in the POL with LED. After completion of this action memorandum, this site will be referred back to the Pueblo for any operations and maintenance.

2. Potential for Continued Tribal/Local Response

The POL will not be able to provide a response action to physically address the actions described in this memorandum.

III. THREAT TO PUBLIC HEALTH OR WELFARE OR THE ENVIRONMENT

A. Threats to Public Health

The factors described in Section 300.415 of the National Contingency Plan (NCP), 40 CFR § 300.415, have been considered, and, based on those factors, a determination has been made that a removal action is appropriate to address the hazardous substances present in the contaminated wastes at the Site. Any or all of these factors may be present at a site yet any one of these factors may determine the appropriateness of a removal action.

1. Actual or Potential Exposure to Nearby Human Populations, Animals, or the Food Chain from Hazardous Substances or Pollutants or Contaminants. 40 CFR § 300.415(b)(2)(i).

As discussed above, in Section II.A.3-4, the Removal Assessment identified levels of ionizing gamma radiation in the soils/debris surrounding or in close proximity to the 11 residential structures on the Site in excess of the referenced EPA acceptable exposure, dose and/or risk limits..

2. High Levels of Hazardous Substances or Pollutants or Contaminants in Soils Largely at or Near the Surface That May Migrate. 40 CFR § 300.415(b)(2)(iv).

As discussed above, and in the results of the Interim Status Report, Non-Paguate Structural Removal Assessment (*see* Attachment 5) indicates high levels of radiological contamination in the surface and near surface soils (< 12 inches) on a significant portion of the residential properties composing this Site.

3. Weather Conditions that May Cause Hazardous Substances or Pollutants or Contaminants to Migrate or Be Released. 40 CFR § 300.415(b)(2)(v).

As referenced above, the Site is located on the Pueblo of Laguna which routinely experiences severe weather of varying degrees of intensity during the Spring and Summer. Given that the referenced radiological contamination is located at or near the surface of the Site, and because the Site is located in semi-arid area, with limited vegetative cover, there is a high potential for off-site migration of hazardous substances in surface soils from the Site via the flash flooding rains in the Summer and/or strong wind storms that are associated with strong low pressure systems in the Spring.

4. The Availability of Other Appropriate Federal or State Response Mechanisms to Respond to the Release. 40 CFR § 300.415 (b)(2)(vii).

At this time, there are no other mechanisms available to respond to actions described in this memorandum in a timely manner so as to effectively reduce the imminent and substantial endangerment to public health posed by the hazardous substances located on the Site. The Tribal officials do not have the resources available to address the current dangerous conditions at the Site. If other mechanisms become available during the conduct of this response action, the EPA will evaluate those mechanisms as appropriate.

B. Threats to the Environment

The actions taken during this response are designed solely to address a public health threat resulting from the hazardous substances present on the Site derived from waste materials that appear to have originated from the historic uranium mining in the Laguna Sub-District of the Grants Mineral Belt.

IV. ENDANGERMENT DETERMINATION

Actual or threatened releases of hazardous substances, pollutants or contaminants from the Site, if not addressed by implementing the response action selected in this Action Memorandum, will continue to present an imminent and substantial endangerment to public health or welfare or the environment.

V. PROPOSED ACTIONS AND ESTIMATED COSTS

A. Proposed Actions

1. Action Description

a. Action Levels and Clean-up Levels

The EPA uses the term "action level" to mean the contaminant concentration level in soil or groundwater at which a response action in question will be taken. Wastes that meet the definition of a hazardous waste under the RCRA statute not found in a soil or groundwater matrix (such as drummed wastes found on a site) is usually not subject to a specific action level. They are simply removed to prevent actual or potential exposures. Action levels should not be confused with "cleanup levels." The cleanup level is the contaminant concentration level which the response action is designed to meet. That is, once EPA has identified a contaminated medium which contains concentrations of a contaminant which exceed the action level, the removal action calls for continued response until the concentration of the contaminant in the contaminated medium are below the established cleanup level.

For this removal action, both the action level and cleanup level is 3.5 pCi/gram of Radium-226 in the contaminated waste materials and soils. This concentration value is the equivalent of a $3x10^{-4}$ excess cancer rate as calculated by the aforementioned ResRad model and EPA's PRG calculator using site specific data where possible. Further, this concentration value is also the equivalent of a 15 mrem/yr dose rate for ionizing gamma radiation generated from the decay of the aforementioned radioisotopes and their associated daughter progeny in the contaminated re-purposed materials and soils.

In developing the action levels and cleanup levels for the Site, EPA Region 6 considered the *Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination*, August 22, 1997 (OSWER Directive 9200.4-18), EPA Region 9 Navajo Nation Radiological Structure Assessment data and procedures, and consulted with NMED to determine whether there were potential state Applicable or Relevant and Appropriate Requirements (ARARs) within the meaning of CERCLA Section 121, 42 U.S.C. § 9621. After the action levels and cleanup levels for this Site were reviewed and found to be consistent with historic action levels and cleanup levels used by the EPA on similar sites, the OSC decided to utilize the aforementioned ionizing radiation concentration of 3.5 pCi/g of Radium-226 and the equivalent dose rate as the action level and cleanup level for the radiological contamination on this Site.

b. Rio San Jose Radiation Site

The EPA proposes to mitigate the imminent and substantial threats to human health, welfare, or the environment by taking steps to prevent the release of radium-226, uranium and external ionizing radiation from the sources on this Site. The removal action will include the following objectives to prevent direct human contact and excessive ionizing radiation exposure from the contaminated soils/debris and contaminated re-purposed materials present on the Site:

- Remove the identified surficial residential radiological soil contamination (approximately 723 cubic yards) from the Site by excavating to a level below the cleanup level.
- Consolidate, transport and dispose of the radiologically contaminated soil, debris, and any

other contaminated materials into an approved off-site facility.

- Replace excavated soils with clean fill and restore to pre-removal grade.
- Conduct confirmation radiological scanning, sampling, and analysis to ensure that the ionizing radiation exposure is below established EPA cleanup levels.

c. Certain Contaminated Materials Will Be Taken Off-site

The contaminated soils excavated during the removal action will be consolidated with the contaminated materials and taken off-site for disposal. The contamination found at the Site and discussed in this memorandum stems from waste material salvaged from the historic mining operations conducted within the Laguna Sub-District. The contaminated wastes described above are a solid waste, but not a hazardous waste under the Resource Conservation and Recovery Act (RCRA), because they are derived from the extraction, beneficiation, and processing of ores and minerals within the meaning of 40 CFR § 261.4 (b)(7). Since the aforementioned materials are not a hazardous waste under RCRA, EPA does not consider the RCRA hazardous waste management requirements to be applicable or relevant and appropriate (See Section V 4(c) below). Although these wastes are not considered hazardous wastes under RCRA regulations, they are determined to be CERCLA hazardous substances.

The off-site disposal of the CERCLA wastes generated from this removal will be in conformance with EPA's procedures for planning and implementing off-site response action, 40 CFR § 300.440. All off-site transportation of hazardous waste will be performed in conformance with applicable U.S. Department of Transportation (USDOT) requirements. Other requirements under the Occupational Safety and Health Act (OSHA) of 1970, 29 U.S.C. § 651 et seq., and under the laws of States with plans approved under section 18 of the State's OSHA laws, as well as other applicable safety and health requirements, will be followed. Federal OSHA requirements include, among other things, Hazardous Materials Operation, 29 CFR Part 1910.120, as amended by 54 Fed. Reg. 9317 (March 5, 1989), all OSHA General Industry (29 CFR Part 1910) and Construction (29 CFR Part 1926) standards wherever they are relevant, as well as OSHA recordkeeping and reporting regulations, and other EPA policies/guidelines relating to the conduct of work at Superfund sites

2. Contribution to Remedial Performance

The actions described above for the Site will contribute to any presumed remedial cleanup alternative given that the response actions to be taken will constitute contaminant source removal.

3. Description of Alternative Technologies

At this time, there are no other proven alternative technologies that could be feasibly applied at this Site. The appropriate action is to conduct the removal action on the Site as described in this memorandum. If an equally protective and less expensive technology is later

identified, it may be considered.

4. Applicable or Relevant and Appropriate Requirements (ARARs)

The proposed removal action will be conducted to eliminate the actual or potential exposure to hazardous substances pursuant to CERCLA, in a manner not inconsistent with the NCP. As per 40 CFR Section 300.415(j), Superfund-financed removal actions under CERCLA § 104 and § 106 shall, to the extent practicable considering the exigencies of the situation, attain the applicable or relevant and appropriate requirements (ARARs) under Federal environmental law.

a. Chemical-specific ARARs - There were no chemical-specific Federal or State ARARs identified that were applicable or relevant and appropriate to this removal action.

b. Location-specific ARARs - All proposed activities at the Site are compliant with any location-specific ARARs including the requirements of, the National Historical Preservation Act 16 USC Section 470 *et seq*. and its implementing regulations found at 36 CFR Part 800, Native American Graves Protection and Repatriation Act, 25 USC Section 3001 *et seq*. and its implementing regulations, 43 CFR Part 10, Archeological Resources Protection Act of 1979, 16 USC Section 47000 *et seq*. and its implementing regulations, 43 CFR Part 7 and the American Indian Religious Freedom Act, 42 USC Section 1996 *et seq*.

c. Action-specific ARARs - The uranium, radium-226 and related daughter progeny contamination in the demolition materials and related soil/debris is from the mining of uranium which is a solid waste, but not a hazardous waste under the Resource Conservation and Recovery Act (RCRA), because it is solid waste from the extraction, beneficiation, and processing of ores and minerals within the meaning of 40 CFR § 261.4 (b)(7). Since the materials are not a hazardous waste under RCRA, EPA does not consider RCRA hazardous waste management requirements to be applicable, relevant or appropriate, including without limitation the waste analysis requirements found at 40 CFR §§ 261.20 and 261.30, the RCRA manifesting requirements found at 40 CFR § 262.20 and the RCRA packaging and labeling requirements found at 40 CFR § 262.30. Since the removal action involves no on-site storage of hazardous wastes, storage requirements found at 40 CFR Part 265 are not applicable or relevant and appropriate.

Although the hazardous substances which are the subject of this removal action are solid waste and not hazardous waste under RCRA because they are solid waste from the extraction, beneficiation, and processing of ores and minerals, according to 40 CFR § 261.4(b)(7), it is useful in this Site-specific situation for EPA to use certain RCRA requirements to control and track waste sent off-site. Accordingly, RCRA waste analysis requirements found at 40 CFR §§ 261.20 and 261.30, RCRA manifesting requirements found at 40 CFR § 262.20, and RCRA packaging and labeling requirements found at 40

CFR § 262.30 are not deemed to be relevant and appropriate requirements, but will be used for off-site disposal of wastes and other contaminated material generated during this removal action. Because on-site storage of repackaged hazardous wastes is not expected to exceed ninety (90) days, specific storage requirements found at 40 CFR Part 265 are neither applicable nor relevant and appropriate. See 40 CFR § 262.34.

d. To-be-considered (TBCs) - In addition to ARARs, other advisories, criteria, or guidance that may be useful in developing the remedy were, as appropriate, identified and considered. An action that was considered was to leave the radiation contaminated soil in place. This action would be an unacceptable risk to the residents.

5. Project Schedule

The proposed actions for this time critical removal action are expected to be completed in six months.

B. Estimated Costs

Extramural Costs

Removal Contractors.....	$ 600,000
START III Contractors.....	$ 200,000
Subtotal, Extramural Costs	$ 800,000
Extramural Costs Contingency (20%)	$ 160,000
TOTAL, EXTRAMURAL COSTS.....	**$ 960,000**

VI. EXPECTED CHANGE IN THE SITUATION SHOULD NO ACTION BE TAKEN OR ACTION BE DELAYED

Should the actions described in this Action Memorandum be delayed or not taken, the elevated gamma radiation dose/excess cancer risk from the Uranium, Radium-226 and associated daughter products will continue to pose a significant threat to the residents located in the 11 homes associated with this Site.

VII. OUTSTANDING POLICY ISSUES

There are no outstanding policy issues associated with this removal action.

VIII. ENFORCEMENT

EPA Region 6 has initiated the enforcement process on this Site. (*See* Enforcement Confidential Attachment #1, for additional details). The total cost to EPA for this removal action, consisting of the excavation and disposal of the contaminated soil/debris is **$1,618,851.**

(Direct Cost) + (Other Direct) + (42.63% of Total Direct {Indirect Cost}) = Estimated EPA Cost for a Removal Action

$960,000 + $175,000 + (42.63% x $1,135,000) = **$1,618,851.**

Direct costs include direct extramural costs and direct intramural costs. Indirect costs are calculated based on an estimated indirect cost rate expressed as a percentage of site-specific direct costs, consistent with the full cost accounting methodology effective October 2, 2002. These estimates do not include pre-judgment interest, do not take into account other enforcement costs, including Department of Justice costs, and may be adjusted during the course of a removal action.

IX. RECOMMENDATION

This decision document represents the selected removal action for the Rio San Jose Radiation Site (CERCLA), 42 U.S.C. § 9601 et seq., and is not inconsistent with the National Contingency Plan (NCP), 40 CFR Part 300. This decision is based on the administrative record for the Site.

Conditions at the Site meet the NCP Section 300.415 (b) (2), 40 CFR § 300.415 (b)(2) criteria for a time-critical removal action. We recommend your approval of the proposed time-critical removal action request. The total estimated EPA cost for the removal is $1,618,851. Of this, an estimated $960,000 comes from regional funds.

APPROVED: _____ DATE: 5/17/12
Pamela Phillips, Acting Division Director
Superfund Division (6SF)

MEMORANDUM

SUBJECT: Request for a Time-Critical Removal Action, at the Rio San Jose Radiation Site, Pueblo of Laguna, near Cibola County, New Mexico

FROM: Warren Zehner, On-Scene Coordinator
Removal Team (6SF-PR)

Jon Rinehart, On-Scene Coordinator
Removal Team (6SF-PR)

THRU: Ragan Broyles, Associate Director
Prevention and Response Branch (6SF-P)

TO: Pamela Phillips, Acting Division Director
Superfund Division (6SF)

I. PURPOSE

This memorandum requests approval for a time-critical removal action, pursuant to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 U.S.C. § 9601 et seq., at the 11 residential properties that compose the Rio San Jose Radiation Site (the "Site") located in the Villages of Laguna, Mesita, Paraje, and Seama, Pueblo of Laguna (POL) located in Cibola County, New Mexico. The proposed actions for this Site include the excavation, consolidation, and removal of radiologically contaminated soil/debris at 11 residential structures located on 11 residential properties within the boundaries of the aforementioned Villages.

As described in Section III of this memorandum, the factors described in Section 300.415 of the National Contingency Plan (NCP), 40 CFR § 300.415, have been considered, and, based on those factors, a determination has been made that a removal action at the Site is appropriate. This Removal Action is not expected to exceed the statutory twelve-month time limit, nor is it expected to exceed the statutory $2,000,000 cost ceiling.

CERCLIS ID:	NMN000607243
Category of Removal:	Time Critical
Site ID:	A6CR
Latitude:	35. 043110 N
Longitude:	-107. 473433 W

Webster	Broyles/Petersen	Nixon	Johnson	Travis/Hernandez/Pletan	Peycke
6SF-PR	6SF-P	6SF-TE	6SF-TE	6RC-S	6RC-S

ATTACHMENT 1

ENFORCEMENT ATTACHMENT TO THE ACTION MEMORANDUM FOR the "Rio San Jose Radiation Superfund Site" IS ENFORCEMENT SENSITIVE/FOIA EXEMPT

Note: **This document has been withheld as Enforcement Confidential and is located in Separate "CONFIDENTIALITY FILING" at U.S. EPA, Region 6**

Attachment 2

LED Removal Action Assistance Letter

ITEM # 2 – EPA JACK PILE URANIUM MINE UPDATE

Presenter(s) Ladonna Turner EPA Region #6, Warren Zehner, EPA Region # 6 & Jon Rinehart, EPA Region #6.

Ms. Turner gave Council a brief overview on the Jackpile Uranium Mine;

Superfund Site Assessment Activities
A formal Tribal Consultation with Laguna Pueblo began October 13, 2009. The EPA conducted a sampling event for the Site Inspection on March 1, 2009. The Pueblo of Laguna submitted a Resolution #10-10 supporting the listing of Jackpile Uranium Mine to the Nation Priorities list (NPL). In the process a Memorandum of Understanding (MOU) was signed on June 22, 2010.

A ground water Conceptual Site Model was developed in January 2011, the EPA conducted a sampling event for the Expanded Site Inspection in April, 2011. The Laguna Environmental Department had several years of surface water data that documented elevated levels of Isotopic Uranium. The EPA documented elevated levels of Isotopic Uranium in the surface and ground water, field and lab data suggested that 3 backfilled pits had a much higher rate.

The next steps that the EPA will take are;
- To review revised ground water Conceptual Site Model;
- To review draft Expanded Site Inspection (ESI) report;
- The aid of a Letter or Resolution from the Pueblo supporting NPL listing in 2012, this is needed by December 1, 2011.
- To submit a package to EPA Headquarters on the Jackpile Uranium Mine site to the National Priorities List (NPL)

The next presentation was presented by Warren Zehner and Jon Rinehart they gave a brief overview on;

EPA Structure Assessment Project Grants Mineral Belt
There have been some over flights made and this established the presence or absence of gross widespread of radiological contamination in residential study areas, there has also been detected elevate radiation in some residential areas as well. Assessments have been conducted in 2 phases:
- **Exterior (Phase I) which consist of Gamma Radiation and Elemental Uranium**
- **Interior (Phase II) which consist of Alpha Radiation, Gamma Radiation (Meter readings and Pressurized Ion Chamber – PIC)**
- **Radon**

The Primary targets were traditionally built houses or those houses incorporating material from the mines in the home structure, no resident was turned down for Phase I, regardless of home type. Established local backgrounds were a wide range of back levels throughout the Pueblo which comprised of 6 backgrounds, 1 for each of the primary villages.

In Phase I: there were 516 residences that were contacted, 355 that agreed and 62 residences that exceeded dose concentration.

In Phase II: there were 82 residences contacted, 61 that agreed and 53 residences that exceeded the total equivalent dose estimate, (which is the general EPA acceptable exposure limit for radiological sites).

Radon Sampling Data: There were 7 day samples; 144 residences sampled, 107 residences were below the acceptable maximum exposure levels for radon and 37 residences were above the acceptable maximum exposure level for radon.

91 day samples: There were 32 residences that were sampled and 23 residences were above the acceptable maximum exposure level for radon.

Final QA/QC check on all data and final report preparation, the estimated time of submittal is the Fall of 2011. The goal of EPA is to notify the residence of Phase II indoor and risk summary results based on Phase I, Phase II and Radon assessments and in addition notify the Pueblo of Laguna Environmental Department and appropriate Staff Officers of results from special interest areas.

In Summary;

- EPA is in the process of developing mitigation options and discuss with Governor, Council and Residents
  - Homes that exceed acceptable exposure rates in soil: (53)
    - **excavation/disposal/backfill/response related damages**
  - Homes that exceed acceptable radon exposure levels: (23)
    - **Installation of radon abatement system**
    - **Resident will be responsible for the cost of electricity to operate (est. $5-7 per month)**
  - Homes that need to be demolished due to contaminated structural materials: (1)
    - **Replace with functionally equivalent modular home that meets applicable building codes**
      OR
    - **Cash out settlement with the structure owner**
  - Repatriation of radiation waste from Pueblo of Laguna back to the Jackpile Mine disposal area
  - Implement the mitigation procedures

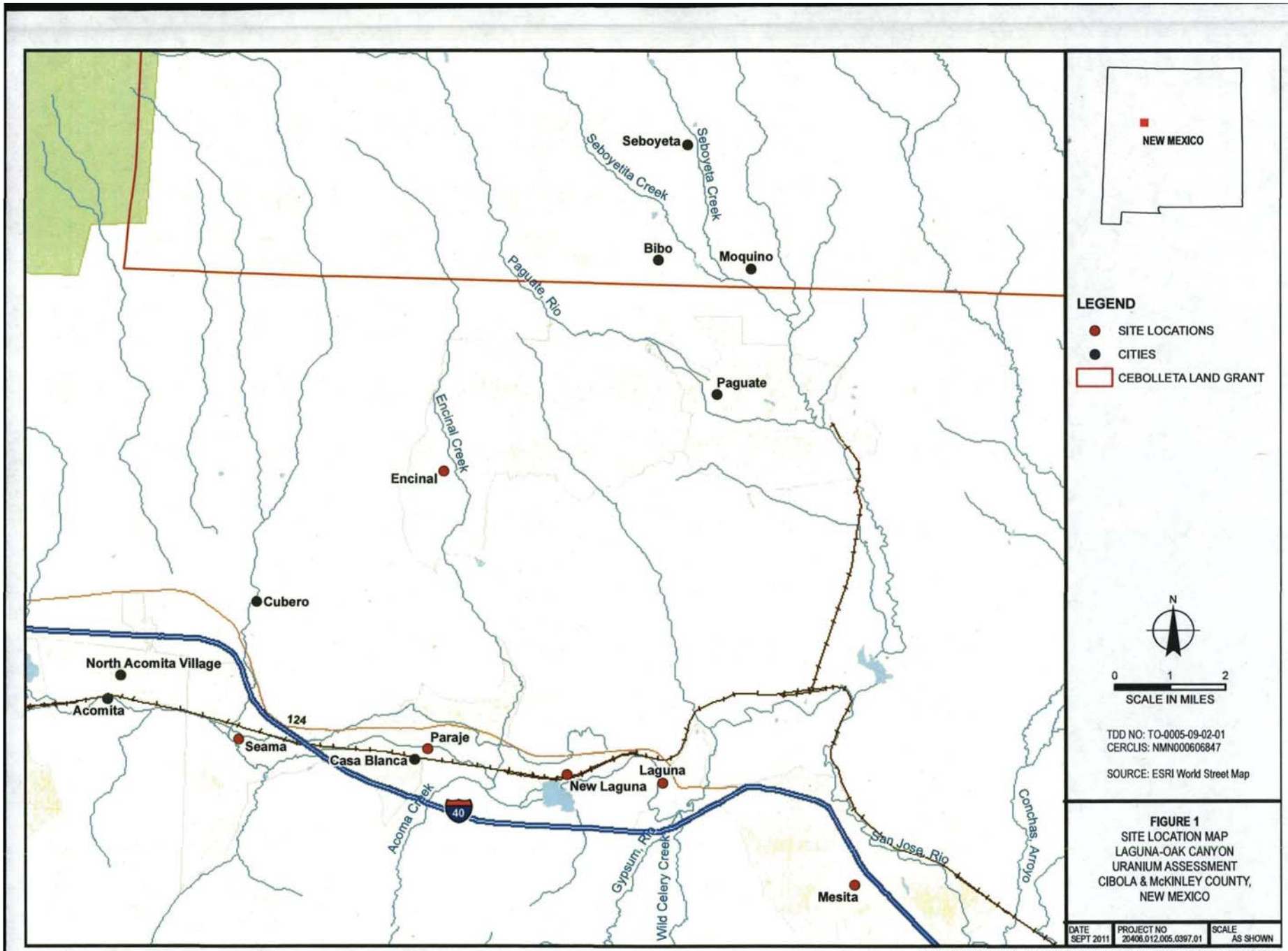
After some discussion the following issues/concerns were raised by Council;

- It was suggested that the Mitigation Plan refer to those particular homes that high exceeded the acceptable exposure rates in soil and radon exposure levels. It was stated that some home owners didn't want to participate in the survey but it was recommended by Council that the community have a second chance to take part.
- Council agreed that more information and education needs to be given to the community, village meetings is one resource of disseminating the information and the local new paper is another means of communication to the general public.
- Some Council members were concerned of how the waste was going to be disposed? Mr. Zehner stated that excavation/disposal/ and backfill.
- The responsible party is the Bureau of Indian Affairs, the Department of Interior doesn't want to pay for the ground water survey.

Council Action:
Council voted 18 in favor 0 opposed to request another survey for the general public who weren't able to participated in the first survey, secondly to repatriate of radiation waste from the Pueblo of Laguna back to the Jackpile mine, **this concluded Item # 2.**

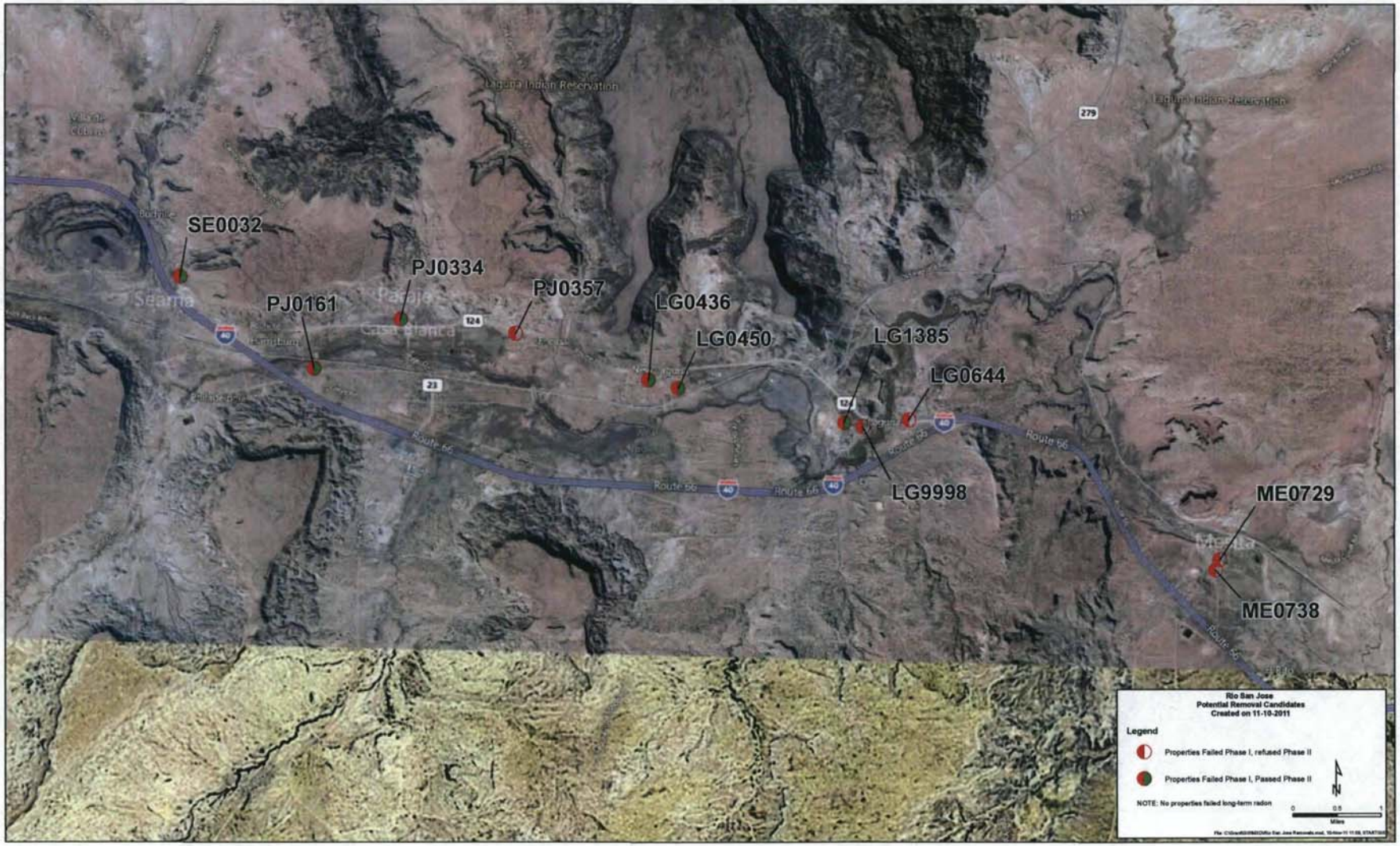
Attachment 3

Site Location Map


Seboyeta
Seboyetita Creek
Seboyeta Creek
Bibo
Moquino
Paguate Rio
Paguate
Encinal Creek
Encinal
Cubero
North Acomita Village
Acomita
124
Seama
Paraje
Casa Blanca
Laguna
New Laguna
40
Acoma Creek
Gypsum, Rio
Wild Celery Creek
San Jose, Rio
Conchas, Arroyo
Mesita
NEW MEXICO
LEGEND
SITE LOCATIONS
CITIES
CEBOLLETA LAND GRANT
N
0 1 2
SCALE IN MILES
TDD NO: TO-0005-09-02-01
CERCLIS: NMN000606847
SOURCE: ESRI World Street Map
FIGURE 1
SITE LOCATION MAP
LAGUNA-OAK CANYON
URANIUM ASSESSMENT
CIBOLA & McKINLEY COUNTY,
NEW MEXICO
DATE
SEPT 2011
PROJECT NO
20406.012.005.0397.01
SCALE
AS SHOWN
File: C:\Grant\GIS\MXD\FIGURE_1_SITE_LOCATION_MAP - LAGUNA-OAK CANYON.mxd, 08-Sep-11 14:40, STARTGIS

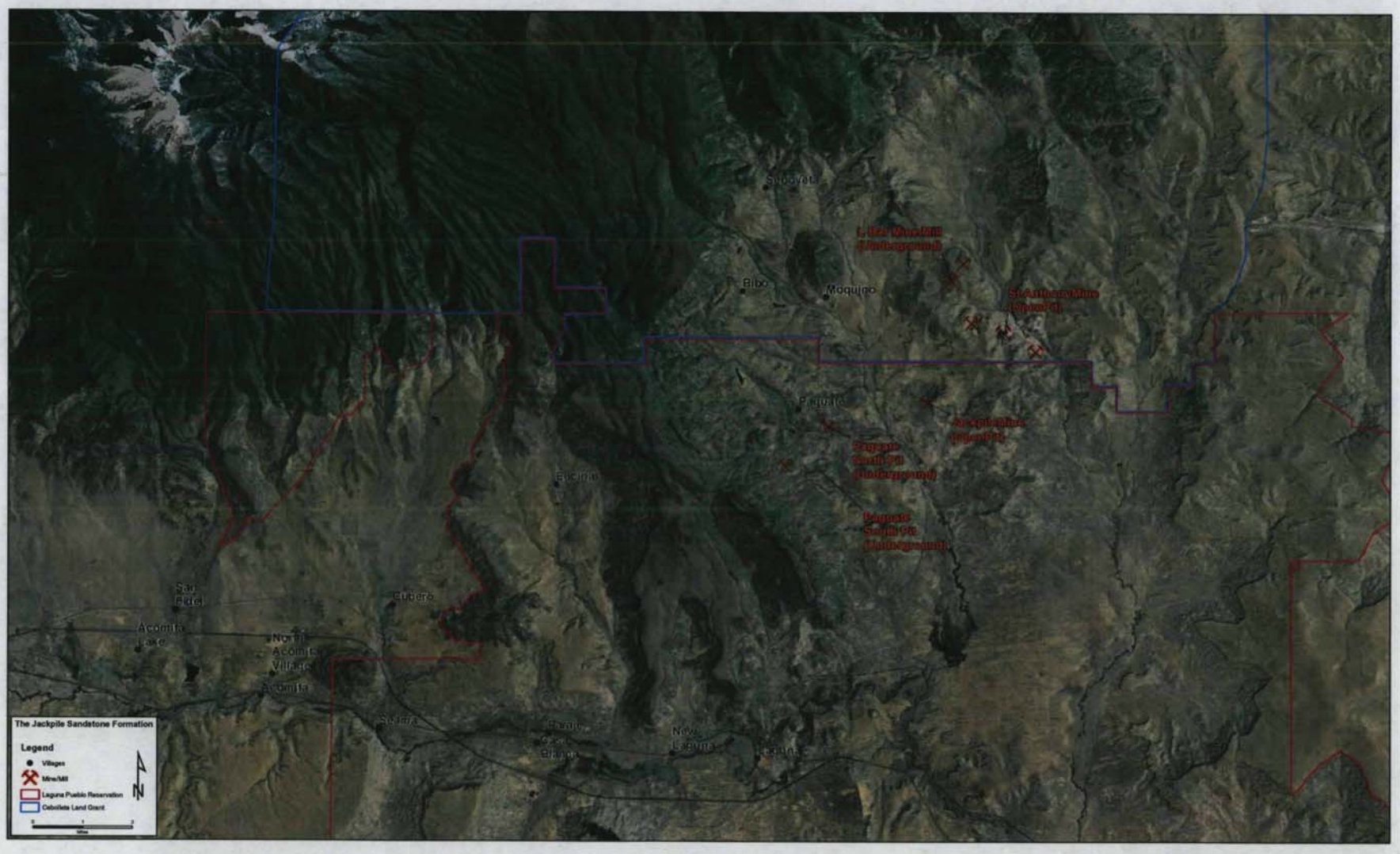
Attachment 4

Site Sketch


SE0032
PJ0334
PJ0357
PJ0161
LG0436
LG0450
LG1385
LG0644
LG9998
ME0729
ME0738
Laguna Indian Reservation
Seama
Casa Blanca
Route 66
279
124
23
40
Rio San Jose
Potential Removal Candidates
Created on 11-10-2011
Legend
Properties Failed Phase I, refused Phase II
Properties Failed Phase I, Passed Phase II
NOTE: No properties failed long-term radon
Miles

Attachment 5

Laguna Sub-District Historic Mine Locations



File: C:\Grant\GIS\MXD\JACKPILE SANDSTONE.mxd, 10-Nov-11 12:09, STARTGIS

Attachment 5

SITE STATUS REPORT

FOR

OAK CANYON (LAGUNA PUEBLO)
NON-PAGUATE REMOVAL ASSESSMENT
(VILLAGES OF ENCINAL, LAGUNA, MESITA, PARAJE, AND SEAMA)
MULTIPLE PROPERTIES
SAN MATEO, CIBOLA COUNTY, NEW MEXICO

Prepared for

U.S. Environmental Protection Agency Region 6
Linda Carter, Project Officer
1445 Ross Avenue
Dallas, Texas 75202

Contract No. EP-W-06-042
Technical Direction Document No. TO-0005-10-03-01
WESTON Work Order No. 20406.012.005.0538.01
NRC No. N/A
CERCLIS No. NMN000607170
FPN N/A
EPA OSC: Warren Zehner/Jon Rinehart
START-3 PTL: Robert Sherman

Prepared by

Weston Solutions, Inc.
Robert Beck, VP, P.E., Program Manager
70 N.E. Loop 410, Suite 600
San Antonio, Texas 78216
(210) 308-4300

November 2011

TABLE OF CONTENTS

LIST OF APPENDICES

1. INTRODUCTION

The Pueblo of Laguna, located in Cibola County, consists of the villages of Encinal, Laguna, Mesita, Paguate, Paraje, and Seama. The Village of Paguate will be addressed in a separate interim status report. The Village of Encinal (Latitude 35° 07' 02", Longitude 107° 27' 53") is located in a canyon approximately 5 miles north of NM Highway 124 (old Route 66) on Indian Service Route 47. The Village of Laguna (Latitude 35° 02' 05", Longitude 107° 23' 16") is located on NM Highway 124, at Interstate Highway 40 (I-40) Exit 114. Administratively, the Village of Laguna includes the settlement of New Laguna (Latitude 35° 02' 38", Longitude 107° 25' 35"). The Village of Mesita (Latitude 35° 01' 04", Longitude 107° 18' 50") is located approximately 1 mile north of I-40 at Exit 117, on Indian Service Route 53. The Village of Paraje (Latitude 35° 03' 19", Longitude 107° 28' 33") is located on NM Highway 124 approximately 1 mile north of I-40 at Exit 108, due south of the Village of Encinal. Administratively, the Village of Paraje includes the settlement of Casa Blanca (Latitude 35° 02' 42", Longitude 107° 28' 14"). The Village of Seama (Latitude 35° 02' 21", Longitude 107° 31' 28") is located on NM Highway 24 approximately 1 mile south of I-40 at Exit 104 on the western border of the Pueblo of Laguna. Administratively, the Village of Seama includes the settlements of New York (Latitude 35° 03' 292", Longitude 107° 31' 39"), Harrisburg (Latitude 35° 02' 58", Longitude 107° 30' 11"), and Philadelphia (Latitude 35° 02' 23", Longitude 107° 30' 38"). The locations of the villages are shown in Figure 1.

Due to results of the EPA Airborne Spectral Photometric Environmental Collection Technology (ASPECT) survey flown in October 2009, which revealed elevated gamma readings from the Jackpile Uranium Mine located within the boundaries of the Pueblo of Laguna, EPA conducted Phase 1 outdoor assessments of residential properties and selected non-residential properties on the Laguna Pueblo as part of the San Mateo Creek Basin Uranium project. EPA conducted 20 Phase 1 outdoor assessments of residential properties only in Encinal, 87 Phase 1 outdoor assessments of residential and non-residential properties in Laguna, 40 Phase 1 outdoor assessments of residential and non-residential properties in Mesita, 37 Phase 1 outdoor assessments of residential properties only in Paraje, and 20 Phase 1 outdoor assessments of residential properties only in Seama. The outdoor assessments at non-residential properties in

the Village of Laguna included three schools, two cultural buildings, one cultural area, one agricultural field, and one community center. The outdoor assessments at non-residential properties in the village of Mesita included four agricultural fields. EPA conducted one additional Phase 1 outdoor assessment at a residential property in Laguna (LG0452) that has been addressed in a separate report (Appendix I). EPA obtained a signed Access Agreement from each property owner prior to commencement of work on the subject properties.

2. PHASE 1 OUTDOOR ASSESSMENTS - RESIDENTIAL, SCHOOLS, CULTURAL BUILDINGS, COMMUNITY CENTER

The Phase 1 Outdoor Assessments conducted at residences, schools, cultural buildings, and the community center consisted of the following activities:

a) Performance of a walking, ground-level gamma scan (2-3 feet per second; 15 inches above ground surface) of residential soils utilizing a Model 44-10 2"x2" NaI probe attached to a Model 2210 count-meter, a laptop computer and a global positioning system (together referred to as the [Rapid Assessment Tool] RAT system) all mounted in a modified baby buggy.

b) Collection of 20 stationary, 1-minute gamma measurements uniformly spaced throughout the assessment area utilizing the RAT system.

c) Collection of grab, 'hot spot,' surface soil samples for laboratory analysis of Radium-226 where gamma scan readings exceeded the screening level (the derived concentration guideline level [DCGL]) of 3,648 counts per minute (cpm) above background.

d) Collection of stationary, 1-minute gamma measurements at the 'hot spot' surface soil sample locations utilizing the RAT system.

e) Attainment of a residential data information sheet detailing residents' work relationship with local uranium mines and mills; and structural elements of the residence and other buildings; and consumption of home-grown produce.

f) Collection of two 10-point, composite, surface soil samples (from the 20 stationary, 1-minute gamma measurement locations) for laboratory analysis of elemental Uranium (non-radiological/ non-carcinogenic).

Only those parts of yards that were used by residents on a regular basis, up to a maximum area of 40,000 square feet, were assessed. EPA calculated property-specific DCGLs for three properties in Laguna (LG0429, LG0451, LG1243) and one in Mesita (ME0765) [see Table 1 footnotes for specifics] due to higher consumption of home-grown produce than the project default value. See Appendix A for the DCGL re-calculations.

After initial Phase 1 Outdoor Assessments, the Pueblo of Laguna removed petrified wood artifacts from four properties (ME0738, PJ0324, PJ0357, SE0032) which appeared to be the cause of elevated gamma measurements as detected by the RAT system. Subsequently, EPA conducted a second Phase 1 Outdoor Assessment at three of the properties (PJ0357 homeowner was unresponsive). The results of the second Phase 1 Assessment are presented in this report.

Each assessed property was subjected subsequently to up to four statistical tests, in general

accordance with Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) guidelines (EPA is not required to adhere strictly to MARSSIM), to determine if the property exceeded the DCGL (3,648 counts per minute [cpm] or 2.5 pico Curies per gram [pCi/g] above background, or the property-specific DCGL) and warranted a Phase 2 Indoor Assessment. A separate village-specific background was collected for each of the villages. The background assessment included collection of 20 stationary, 1-minute gamma measurements uniformly spaced throughout the assessment area utilizing the RAT system and collection of 20 five-minute, gamma measurements utilizing a Pressurized Ionization Chamber (PIC) and 20 grab, surface soil samples for laboratory analysis of Radium-226 at the same 20 locations. See Table 1 for a summary of Phase 1 Assessment and statistical results, including background results and the corresponding properties to which they were compared. Graphic illustrations of walking gamma scan results (RAT Maps) for each property are presented in Appendix B.

The village-specific backgrounds as measured by the RAT system were as follows:

- Encinal – 10,019 counts per minute (cpm)
- Laguna – 8,244 cpm
- Mesita – 6,461 cpm
- Paraje – 8,289 cpm
- Seama – 11,149 cpm

The village-specific backgrounds as measured by laboratory analysis were as follows:

- Encinal – 0.92 pCi/g
- Laguna – 0.73 pCi/g
- Mesita – 0.48 pCi/g
- Paraje – 0.70 pCi/g
- Seama – 1.17 pCi/g

No properties in Encinal, 5 properties in Laguna, 2 properties in Mesita, 3 properties in Paraje, and 1 property in Seama (shaded in Table 1) exhibited Phase 1 Assessment results that **exceeded** the DCGL above the respective background measurements. The dynamic (walking) RAT survey, scaler readings, "hot spot" surface soil sample results and MARSSIM results for the 11 properties are presented in the following paragraphs.

The dynamic (walking) RAT survey conducted on the 11 properties had the following results:

- The Laguna walking, gamma scan property averages ranged from 7,290 - 9,695 cpm (0 – 1,451cpm above background). The highest standard deviation was 13,147 cpm.
- The Mesita walking, gamma scan property averages ranged from 8,793 - 10,850 cpm (2,332 – 4,389 cpm above background). The highest standard deviation was 7,794 cpm.
- The Paraje walking, gamma scan property averages ranged from 8,583 - 9,797 cpm (294 – 1,508 cpm above background). The highest standard deviation was 1,612 cpm.
- The Seama walking, gamma scan property average was 10,186 cpm (0 cpm above background). The standard deviation was 7,097 cpm.

The scaler readings of 20 stationary, 1-minute gamma measurements uniformly spaced throughout the assessment areas on the 11 properties had the following results:

- The Laguna property averages ranged from 7,151 – 9,676 cpm (0 – 1,432 cpm above background). The highest standard deviation was 3,767 cpm.
- The Mesita property averages ranged from 8,521 – 8,837 cpm (2,060 – 2,376 cpm above background). The highest standard deviation was 5,359 cpm.
- The Paraje property averages ranged from 8,662 – 9,741 cpm (373 – 1,452 cpm above background). The highest standard deviation was 968 cpm.
- The Seama stationary, 1-minute gamma measurement property average was 8,854 cpm (0 cpm above background). The standard deviation measured 972 cpm.

The collection of grab, 'hot spot,' surface soil samples for laboratory analysis of Radium-226 where gamma scan readings exceeded the screening level on the 11 properties had the following results:

- The Laguna 'hot spot,' surface soil sample laboratory results for Radium-226 ranged from 0.60 – 29.5 pCi/g (0.00 – 28.8 pCi/g above background).

  Associated stationary, 1-minute gamma measurements taken at 'hot spot,' sample locations ranged from 12,127 – 159,550 cpm (3,883 – 151,306 cpm above background).
- The Mesita 'hot spot,' surface, soil sample laboratory results for Radium-226 ranged from 3.55–321.00 pCi/g (3.063 – 320. pCi/g above background).

  Associated stationary, 1-minute gamma measurements taken at 'hot spot,' sample locations ranged from10,472–159,664 cpm (4,011 – 153,203 cpm above background).
- The Paraje 'hot spot,' surface, soil sample laboratory results for Radium-226 ranged from 0.97 – 16.2 pCi/g (0.27 – 15.5 pCi/g above background).

  Associated stationary, 1-minute gamma measurements taken at 'hot spot,' sample locations ranged from 11,962 – 36,034 cpm (3,673 – 27,745 cpm above background).
- The Seama 'hot spot,' surface, soil sample laboratory results for Radium-226 ranged from 1.55-35.3 pCi/g (0.38 – 34.1 pCi/g above background).

The associated stationary, 1-minute gamma measurements taken at 'hot spot' sample locations ranged from 15,635 – 89,634 cpm (4,486 – 78,485 cpm above background).

- MARSSIM Test 1 (the difference between the lowest background, stationary, 1-minute gamma measurement and the highest property gamma scan reading must be less than the DCGL for a property to PASS and negate a need for additional MARSSIM Tests 2-4):

  All 11 properties failed.

- MARSSIM Test 2 (the difference between the property gamma scan average and the background and the property's 20 stationary, 1-minute gamma measurements average and the background must both be less than the DCGL for a property to PASS. Only a FAIL result negates a need for additional MARSSIM Tests 3 and 4):

  One property in Mesita failed; the remaining 10 properties passed.

- MARSSIM Test 3 (an application of the Wilcoxon Rank Sum test; a definition is supplied as Appendix C) Only a FAIL result negates a need for the additional MARSSIM Test 4):

  10 properties passed; the one remaining property failed the previous MARSSIM Test 2.

- MARSSIM Test 4 (Elevated Measurement Comparison/Unity Rule; conducted only if concentrated, elevated 'hot spot(s)' are present on a property. The Unity ratio represents the fraction of the DCGL above background that a property's contamination exhibits, and must be less than 1.0 for a property to PASS. Note that in cases where the Unity ratio is greater than 1.0, this may not reflect all 'hot spot' contamination present on a property. Additional 'hot spot' areas were not included once the Unity ratio reached 1.0 or higher):

  10 properties failed; the one remaining property failed the previous MARSSIM Test 2 and was thus not subjected to MARSSIM Test 4.

Twenty properties in Encinal; 81 properties in Laguna including three schools, two cultural areas and the community center; 34 properties in Mesita; 34 properties in Paraje; and 19 properties in Seama (non-shaded in Table 1) exhibited Phase 1 Assessment results that **did not exceed** the DCGL above the respective background measurements. The dynamic (walking) RAT survey, scaler readings, "hot spot" surface soil sample results, and MARSSIM results for the 81 properties are presented in the following paragraphs.

The dynamic (walking) RAT survey conducted on the 81 properties had the following results:

- The Encinal walking, gamma scan property averages ranged from 7,245 - 9,857 cpm (0 cpm above background). The highest standard deviation was 2,081 cpm.
- The Laguna walking, gamma scan property averages ranged from 5,299 - 9,829 cpm (0 – 1,585 above background). The highest standard deviation was 1,280 cpm.
- The Mesita walking, gamma scan property averages ranged from 5,297 – 8,057 cpm (0 – 1,596 cpm above background). The highest standard deviation was 1,126 cpm.

- The Paraje walking, gamma scan property averages ranged from 7,264 – 10,274 cpm (0 – 1,985 cpm above background). The highest standard deviation was 1,282 cpm.
- The Seama walking, gamma scan property average ranged from 6,907 – 12,169 cpm (0 – 1,020 cpm above background). The highest standard deviation was 1,144 cpm.

The scaler reading of 20 stationary, 1-minute gamma measurements uniformly spaced throughout the assessment areas on the 81 properties had the following results:

- The Encinal property averages ranged from 7,127 – 9,846 cpm (0 cpm above background). The highest standard deviation was 881 cpm.
- The Laguna property averages ranged from 5,701 – 9,758 cpm (0 – 1,514 cpm above background). The highest standard deviation was 1,436 cpm.
- The Mesita property averages ranged from 5,284 – 8,109 cpm (0 – 1,648 cpm above background). The highest standard deviation was 850 cpm.
- The Paraje property averages ranged from 7,217 – 10,427 cpm (0 – 2,138 cpm above background). The highest standard deviation was 1,137 cpm.
- The Seama property averages ranged from 7,149 – 12,441 cpm (0 – 2,137 cpm above background). The highest standard deviation was 1,292 cpm.

The collection of grab, 'hot spot,' surface, soil samples for laboratory analysis of Radium-226 where gamma scan readings exceeded the screening level on the 81 properties had the following results:

- The Encinal 'hot spot,' surface, soil sample laboratory results for Radium-226 ranged from 0.64 – 16.2 pCi/g (0 – 15.3 pCi/g above background).

  Associated stationary, 1-minute gamma measurements taken at 'hot spot,' sample locations ranged from 11,081 – 21,168 cpm (1,062 – 11,149 cpm above background).
- The Laguna 'hot spot,' surface, soil sample laboratory results for Radium-226 ranged from 0.45 – 1.29 pCi/g (0 – 0.56 pCi/g above background).

  Associated stationary, 1-minute gamma measurements taken at 'hot spot,' sample locations ranged from 9,054 – 32,211 cpm (810 – 23,967 cpm above background).
- The Mesita 'hot spot,' surface, soil sample laboratory results for Radium-226 ranged from 0.50 – 10.6 pCi/g (0.01 – 10.1 pCi/g above background).

  Associated stationary, 1-minute gamma measurements taken at 'hot spot,' sample locations ranged from 7,881 – 16,319 cpm (1420 – 9,858 cpm above background).
- The Paraje 'hot spot,' surface, soil sample laboratory results for Radium-226 ranged from 0.56 – 1.32 pCi/g (0 – 0.62 pCi/g above background).

  Associated stationary, 1-minute gamma measurements taken at 'hot spot,' sample locations ranged from 9,324 – 17,231 cpm (1,035 – 8,942 cpm above background).

- The Seama 'hot spot,' surface, soil sample laboratory results for Radium-226 ranged from 0.85-1.75 pCi/g (0 – 0.58 pCi/g above background).

  The associated stationary, 1-minute gamma measurements taken at 'hot spot' sample locations ranged from 12,247 – 18,089 cpm (1,098 – 6,940 cpm above background).

- MARSSIM Test 1 (the difference between the lowest background, stationary, 1-minute gamma measurement and the highest property gamma scan reading must be less than the DCGL for a property to pass and negate a need for additional MARSSIM Tests 2-4):

  16 Encinal, 65 Laguna, 9 Mesita, 13 Paraje, and 15 Seama residential properties passed.

- MARSSIM Test 2 (the difference between the property gamma scan average and the background and the property's 20 stationary, 1-minute gamma measurements average and the background must both be less than the DCGL for property to pass):

  All properties in each village requiring the test passed.

- MARSSIM Test 3 (an application of the Wilcoxon Rank Sum test; a definition is supplied as Appendix C):

  All properties in each village requiring the test passed.

- MARSSIM Test 4 (Elevated Measurement Comparison/Unity Rule; Test 4 was conducted only if concentrated, elevated 'hot spot(s)' were present on a property. The Unity ratio represents the fraction of the DCGL above background that a property's contamination exhibits):

  18 Encinal properties did not require Test 4; the remaining 2 properties passed. The Unity Rule ratio on these 2 properties ranged from 0.43 - 0.57.

  71 Laguna properties did not require Test 4; the remaining 9 properties passed. The Unity Rule ratio on these 9 properties ranged from 0.03 - 0.61.

  12 Mesita properties did not require Test 4; the remaining 22 properties passed. The Unity Rule ratio on these 22 properties ranged from 0.02 - 0.88.

  19 Paraje properties did not require Test 4; the remaining 15 properties passed. The Unity Rule ratio on these 15 properties ranged from 0.02 - 0.89.

  16 Seama properties did not require Test 4; the remaining 3 properties passed. The Unity Rule ratio on these 3 properties ranged from 0.24 - 0.27.

Uranium Soil Sample Analysis

All 204 properties in the Pueblo of Laguna outside of Paguate exhibited elemental Uranium results significantly less than the EPA removal action-level of 230 mg/kg (parts per million [ppm]). Prior to September 2010, the composite surface samples were screened using a hand-held x-ray fluorescence (XRF) analyzer, with 10 percent of these submitted for laboratory analysis. After September 2010, samples were sent for laboratory analysis in lieu of XRF screening. Elemental uranium results are listed in Table 1, with XRF results in black and laboratory results in red.

Residential Data Sheets

According to data sheets filled out by residents, 48 properties in the villages included in this report believed that materials from mines or mills may have been brought to their properties. This includes 5 residences in Encinal, 23 residences in Laguna, 6 residences in Mesita, 8 residences in Paraje, and 6 residences in Seama.

According to data sheets filled out by residents, 13 properties in the villages included in this report believed that materials from mines or mills may have been used to build their houses. This includes 10 residences in Laguna, 2 residences in Paraje, 1 residence in Seama, and no residences in Encinal or Mesita.

3. PHASE 1 OUTDOOR ASSESSMENTS - AGRICULTURAL

The Phase 1 Outdoor Assessments conducted at agricultural fields in the Villages of Mesita (4 fields) and Laguna (1 field) consisted of the following activities:

a) Performance of a walking, ground-level gamma scan (2-3 feet per second; 15 inches above ground surface) of agricultural soils utilizing a Model 44-10 2"x2" NaI probe attached to a Model 2210 count-meter, a laptop computer, and a global positioning system (together referred to as the [Rapid Assessment Tool] RAT system) all mounted in a modified baby buggy.

b) Collection of 20 stationary, 1-minute gamma measurements uniformly spaced throughout the assessment area utilizing the RAT system.

c) Collection of 20 grab, surface soil samples at the 20 stationary, 1-minute gamma measurement locations at one agricultural field (ME9999).

d) Collection of grab, soil samples at depths of 6-12 inches, 12-18 inches, and 18-24 inches at 5 locations co-located with 5 grab, surface soil samples at ME9999.

e) Collection of grab, 'hot spot,' surface soil samples for laboratory analysis of Radium-226 where gamma scan readings exceeded the screening level (the derived concentration guideline level [DCGL]) of 3,648 counts per minute (cpm) above background.

f) Collection of stationary, 1-minute gamma measurements at the 'hot spot' surface soil sample locations utilizing the RAT system.

g) Collection of two 10-point, composite, surface soil samples (from the 20 stationary, 1-minute gamma measurement locations) for laboratory analysis of elemental Uranium (non-radiological/ non-carcinogenic).

EPA calculated an agricultural fields-specific DCGL of 1.44 pCi/g, assuming the consumption by one person of 160 kilograms per year (kg/yr) of produce, direct exposure to the agricultural field soils for 40 hours per week for 7 months per year on a 0.9 hectare (2.22 acres) plot, and irrigation. See Appendix D for the Residual Radiation (RESRAD)-calculated output. EPA also conducted a regression analysis using the 20 surface-soil sample results and the corresponding 20 stationary, 1-minute gamma measurements from both agricultural field ME9999 and the Mesita village background (Appendix E). From the resulting regression formula, EPA then calculated 20 surface-soil sample 'results' for the remaining three Mesita agricultural fields based on each field's 20 stationary, 1-minute gamma measurements.

Each Mesita agricultural field was subjected subsequently to up to four statistical tests, in general accordance with Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)

guidelines, to determine if the property exceeded the DCGL of 1.44 pCi/g above background. The Laguna agricultural field was not subjected to the MARSSIM statistical tests (see below). The same village-specific background assessment in Mesita used for residential properties was utilized for the agricultural fields. See Table 1 for a summary of the Phase 1 Assessment and statistical results of the Mesita and Laguna agricultural fields. Graphic illustrations of walking gamma scan results (RAT Maps) for the agricultural fields are presented in Appendix B.

The four Mesita fields exhibited Phase 1 Assessment results that did not exceed the DCGL above the background measurement averages. The properties had the following results:

- The walking, gamma-scan field averages ranged from 9,845 – 10,328 cpm (3,385 – 3,868 cpm above background). The highest standard deviation was 771 cpm.
- The stationary, 1-minute, gamma field averages ranged from 8,582 – 10,475 cpm (2,122 – 4,015 cpm above background). The highest standard deviation measured 413 cpm.
- The 20 grab, surface soil samples at ME9999 and the 20 regression-formula-derived 20 surface soil 'samples' at the three remaining fields ranged from 0.59 – 1.42 pCi/g (0.102 – 0.932 pCi/g above background).
- The 'hot spot,' surface, soil sample laboratory results for Radium-226 ranged from 0.725 – 1.497 pCi/g (0.237 – 1.011 pCi/g above background).

  Associated stationary, 1-minute gamma measurements taken at 'hot spot' sample locations ranged from 8,803 – 11,212 cpm (2,343 – 4,752) cpm above background).
- MARSSIM Test 1 (the difference between the lowest background, surface soil sample and the highest agricultural field surface soil sample (actual and regression-derived) must be less than the DCGL for a property to pass and negate a need for additional MARSSIM Tests 2-4):

  All 4 Mesita agricultural fields passed.

The Laguna agricultural field, LG9992, was deemed to also exhibit Phase 1 Assessment results that did **not exceed** the DCGL above background measurement averages, based on the fact that all 4 Mesita agricultural fields did **not exceed** the DCGL above background measurement averages. The property had the following results:

- The walking, gamma-scan field average reading was 10,229 cpm (1,985 cpm above background). The standard deviation was 706 cpm.
- The stationary, 1-minute, gamma field average reading was 10,672 cpm (2,428 cpm above background). The standard deviation measured 463 cpm.
- The 'hot spot,' surface, soil sample laboratory results for Radium-226 ranged from 0.89 – 1.07 pCi/g (0.34 – 0.16 pCi/g above background).

- Associated stationary, 1-minute gamma measurements taken at 'hot spot' sample locations ranged from 11,002 – 11,367 cpm (2,758 – 3,123 cpm above background).

- MARSSIM Tests 1 - 4 *The Laguna agricultural field was not subjected to the MARSSIM statistical tests. LG9992 was deemed to pass by the Certified Health Physicist based on the Mesita agricultural fields results.*

4. PHASE 1 OUTDOOR ASSESSMENT – OUTDOOR CULTURAL AREA

EPA conducted a modified Phase 1 Assessment of a non-residential cultural area near the Village of Laguna that had no buildings or structures (LG9993). Due to geographical and cultural considerations, EPA did not conduct a dynamic (walking) RAT survey. EPA collected 1-minute scaler readings with the Model 44-10 2"x2" NaI detector and 5-minute readings with the PIC at various locations throughout the site. EPA did not compare the site to the DCGL because the assumptions and models used to develop the DCGL for residences did not apply to this site. Additionally, EPA did not apply the four previously referenced MARSSIM statistical tests because the data collected was not comparable to the 20 scaler readings collected as the Village of Laguna background data. See Table 1 for a summary of the modified Phase 1 Assessment results. EPA provided the Pueblo of Laguna Tribal Council with specific recommendations for people using this site in a report that is included as Appendix F.

5. PHASE 2 INDOOR ASSESSMENTS

EPA conducted Phase 2 Indoor assessments on properties where Phase 1 assessment results exhibited residual gamma radioactivity in surface soils greater than the DCGL or where the residential data sheet indicated that materials from the mines or mills may have been used in the construction of the house or was otherwise brought onto the property.

The complete Phase 2 Indoor Assessments consisted of the following activities:

a) Collection of two short-term (6-day minimum; 7-day maximum) radon gas samples, utilizing activated charcoal adsorbent canisters, in two separate locations of each residence for laboratory analysis of Radon-222 (10 percent of sample canister locations had a third, duplicate canister placed in the home).

b) Collection of two long-term (91-day minimum; no maximum) radon gas samples for laboratory analysis of Radon-222, utilizing track etch detectors in the two short-term detector locations of each residence where short-term Radon-222 results exceeded the EPA and Center for Disease Control (CDC) acceptable exposure level of 4.0 pico Curies per liter (pCi/L) (10 percent of the sample detector locations had a third, duplicate detector placed in the home), as well as an interior home gamma survey.

c) Collection of 5-minute, stationary gamma measurements utilizing a PIC in the center of a minimum of the two most-often occupied rooms of a residence.

d) Performance of a walking, gamma scan of the floor and walls of each room in a residence utilizing a Model 44-10 2"x2" NaI probe attached to a Model 2210 count-meter.

e) Collection of wipe samples for 'alpha tray counter' analysis in locations where gamma scan readings exceeded a residence-specific screening level (quick, 'whole-house' scan average plus 1,900 cpm).

f) Collection of additional 5-minute stationary gamma measurements utilizing a PIC in the center of each room where wipe sample(s) were collected.

Each assessed property then had an annual *indoor gamma dose above background* calculated (conservatively using the highest room average as the entire residential average) assuming default values of 12 hours per day and 365 days per year spent indoors. The annual indoor gamma dose was converted from milli-Roentgens per year (mR/yr) to milli-Roentgens equivalent-in-man per year (mrem/yr) [1.5 R = 1 rem, determined by MicroShield Analysis provided as Appendix G] to determine if the indoor assessment results exceeded the EPA action-level Total Effective Dose Equivalent (TEDE) above background of 15 mrem/yr. The same village-specific background locations that were utilized for Phase 1 assessment results were used

for comparison to the Phase 2 results. See Table 2 for a summary of all Phase 2 Assessment results.

- The radon sampling had the following results:
  - Short-term radon sampling was conducted at one home in Encinal with one sample above 4 pCi/L. Short-term radon concentrations were 3.7 and 4.7 pCi/L. EPA attempted to conduct long-term radon sampling, but the residents were non-responsive. Although five residences in Encinal provided answers for the residential data sheets that suggested that materials from the mines may have been brought to the homes, the residents of the other four homes either declined radon sampling or were non-responsive.
  - Short-term radon sampling was conducted at seven homes in Laguna with no samples above 4 pCi/L. Short-term radon concentrations ranged from 0.4 – 3.8 pCi/L among Laguna properties. Long-term radon sampling was conducted at one home in Laguna with no samples above 4 pCi/L. Long-term radon concentrations ranged from 3.1 – 3.3 pCi/L. Twenty-four residences in Laguna provided answers for the residential data sheets that suggested that materials from the mines may have been brought to the homes or used for construction of the homes. Five of those homes were sampled for radon. The residents of the other nineteen homes either declined radon sampling or were non-responsive. Six homes in Laguna failed Phase 1. Four of those homes were sampled for radon. The other two homes either declined radon sampling or were non-responsive.
  - Short-term radon sampling was conducted at one home in Mesita with no samples above 4 pCi/L. Short-term radon concentrations were 0.6 and 1.0 pCi/L. Long-term radon sampling was not conducted at any homes in Mesita. Six residences in Mesita provided answers for the residential data sheets that suggested that materials from the mines may have been brought to the homes. One of those homes was sampled for radon (reported above). The residents of the other five homes either declined radon sampling or were non-responsive. Two homes in Mesita failed Phase 1. The residents in those two homes either declined radon sampling or were non-responsive.
  - Short-term radon sampling was conducted at four homes in Paraje with no samples above 4 pCi/L. Short-term radon concentrations ranged from 1.2 – 3.9 pCi/L. Long-term radon sampling was not conducted at any homes in Paraje. Eight residences in Paraje provided answers for the residential data sheets that suggested that materials from the mines may have been brought to the homes. Two of those homes were sampled for radon; the residents of the other six homes either declined radon sampling or were non-responsive. Three homes in Paraje failed Phase 1. One of those homes was sampled for radon. The residents of the other two homes either declined radon sampling or were non-responsive. One home was sampled for radon at the request of the homeowner.
  - Short-term radon sampling was conducted at one home in Seama with concentrations of 4.6 and 5.3 pCi/L. Long-term radon sampling was conducted at that home with radon results of 2.9 and 3.4 pCi/L. Six residences in Seama provided answers for the

residential data sheets that suggested that materials from the mines may have been brought to the homes. Residents at those homes either declined radon sampling or were non-responsive. One home in Seama failed Phase 1 and was sampled for radon (reported above).

- The interior gamma home surveys had the following results:
  - An interior gamma home survey was conducted at one home in Encinal. Walking gamma scans of the floors and walls ranged from 7,100 – 12,300 cpm. No wipe samples were collected.
  - An interior gamma home survey was conducted at 10 homes in Laguna. Walking gamma scans of the floors and walls for the 10 homes ranged from 4,500 – 16,500 cpm. At least one wipe sample was collected from four of the homes. A total of six wipe samples were collected from those four homes. Alpha count results on all six samples were 0.00 disintegrations per minute (dpm).
  - An interior gamma home survey was conducted at one home in Mesita. Walking gamma scans of the floors and walls ranged from 5,200 – 12,000 cpm. Two wipe samples were collected. Alpha count results on both samples were 0.00 dpm.
  - An interior gamma home survey was conducted at five homes in Paraje. Walking gamma scans of the floors and walls ranged from 6,300 – 13,700 cpm. At least one wipe sample was collected from three of the homes. A total of seven wipe samples were collected from those three homes. Alpha count results on the seven samples were 0.0 dpm.
  - An interior gamma home survey was conducted at one home in Seama. Walking gamma scans of the floors and walls ranged from 5,200 – 16,900 cpm. Two wipe samples were collected. Alpha count results on both samples were 0.00 dpm.

No properties in Encinal, Laguna, Mesita, Paraje, and Seama exhibited an annual indoor TEDE above background that **met or exceeded** 15mrem/yr. The calculated TEDEs ranged from 0.0 – 10.7 mrem/yr.

No properties where wipe samples were collected exceeded the EPA action-level of 20 disintegrations per minute (dpm).

No properties in Encinal, Laguna, Mesita, Paraje, and Seama exhibited walking scan gamma results that exceeded a second EPA action-level of three times the corresponding background average.

Maps illustrating the locations of all assessed properties, color-coded to reflect exceedances of Phase 1, Phase 2 and long-term radon action-levels, are provided as Appendix H.

TABLE 1
Summary of Phase 1 Field Screening, Laboratory Analytical Results and MARSSIM Statistical Tests for Oak Canyon Settlement
Grants Mineral Belt Structures Assessment
Cibola County, New Mexico
May 2010 - October 2011

Property ID	Residential Info. Sheet (Mine/Mill Material Used to Build House, or Kept Indoors?)	Gamma Scan Avg. (CPM)	Highest Gamma Scan Measurement (CPM)	Standard Deviation: Gamma Scan	20 One-Minute Stationary Measurements Avg. (CPM)	Highest One-Minute Stationary Measurement (CPM)	Standard Deviation: 20 One-Minute Stationary Measurements	'Hot Spot' Surface Soil Sample Results [Radium-226] (pCi/g)[1]	'Hot Spot' Surface Soil Sample Location One-Minute Stationary Measurement (CPM)	MARSSIM Test 1[2]	MARSSIM Test 2[2]	MARSSIM Test 3[2]	MARSSIM Test 4[2]	Elemental Uranium (mg/kg)[3]
EN-BKGD-01	n/a	n/a	n/a	n/a	10019 Avg. + DCGL = 13,667	10,556	326	0.92 (non-'hot') (Avg. of 20)	n/a	n/a	n/a	n/a	n/a	0.347 0.358/0.371
EN1133	Unable to procure information	8,897	12,158	689	8,867	9,527	312	n/a	n/a	PASS	n/a	n/a	n/a	11.0 11.6
EN1163	Yes	8,681	11,484	779	9,062	9,770	395	n/a	n/a	PASS	n/a	n/a	n/a	9.6 9.4
EN1176	Unable to procure information	8,987	12,051	807	9,160	9,828	419	n/a	n/a	PASS	n/a	n/a	n/a	11.6 0.417 10.0
EN1190	No	9,395	15,652	1,019	9,274	1,110	633	0.64 - 16.2 (5 samples)	11081 - 21168	FAIL	PASS	PASS	0.57 (PASS)	12.4 11.6 0.427
EN1193	Yes	9,857	13,780	919	9,846	10,957	685	n/a	n/a	FAIL	PASS	PASS	n/a	15.2 0.545 11.0
EN1196	No	8,890	12,363	716	9,045	9,814	416	n/a	n/a	PASS	n/a	n/a	n/a	10.4 10.8
EN1197	Yes	8,986	13,453	820	8,671	9,388	416	n/a	n/a	FAIL	PASS	PASS	n/a	9.0 11.0
EN1199	Unable to procure information	7,835	12,339	1,007	7,895	9,721	714	n/a	n/a	PASS	n/a	n/a	n/a	9.6 9.8
EN1201	No	8,149	11,251	813	8,253	8,795	428	n/a	n/a	PASS	n/a	n/a	n/a	9.0 9.6
EN1207	No	8,489	11,577	826	8,513	9,888	628	n/a.	n/a	PASS	n/a	n/a	n/a	10.2 9.6
EN1208	No	8,491	22,633	2,081	7,992	8,904	547	.76 - .78 (2 samples)	13948 - 15167	FAIL	PASS	PASS	0.43 (PASS)	11 0.325 10.4
EN1210	No	7,346	10,994	909	7,127	8,805	881	n/a	n/a	PASS	n/a	n/a	n/a	12 0.3 10.0
EN1211	Unable to procure information	7,579	10,643	819	7,504	8,581	529	n/a	n/a	PASS	n/a	n/a	n/a	12.0 10.0
EN1212	No	7,876	10,972	919	7,727	8,840	635	n/a	n/a	PASS	n/a	n/a	n/a	10.8 9.2
EN1214	No	8,914	11,722	728	9,022	9,741	573	n/a	n/a	PASS	n/a	n/a	n/a	10.6 10.0
EN1215	Yes	7,818	10,374	784	7,930	9,041	523	n/a	n/a	PASS	n/a	n/a	n/a	9.6 9.4

TABLE 1
Summary of Phase 1 Field Screening, Laboratory Analytical Results and MARSSIM Statistical Tests for Oak Canyon Settlement
Grants Mineral Belt Structures Assessment
Cibola County, New Mexico
May 2010 - October 2011
(Continued)

Property ID	Residential Info. Sheet (Mine/Mill Material Used to Build House, or Kept Indoors?)	Gamma Scan Avg. (CPM)	Highest Gamma Scan Measurement (CPM)	Standard Deviation: Gamma Scan	20 One-Minute Stationary Measurements Avg. (CPM)	Highest One-Minute Stationary Measurement (CPM)	Standard Deviation: 20 One-Minute Stationary Measurements	'Hot Spot' Surface Soil Sample Results [Radium-226] (pCi/g)[1]	'Hot Spot' Surface Soil Sample Location One-Minute Stationary Measurement (CPM)	MARSSIM Test 1[2]	MARSSIM Test 2[2]	MARSSIM Test 3[2]	MARSSIM Test 4[2]	Elemental Uranium (mg/kg)[3]
EN1381	Unable to procure information	8,267	11,655	812	8,168	9,074	502	n/a	n/a	PASS	n/a	n/a	n/a	9.2 9.2
EN1454	No	9,005	11,820	673	8,895	9,283	206	n/a	n/a	PASS	n/a	n/a	n/a	11.6 10.4
EN1559	Yes	8,572	11,598	675	8,558	9,447	410	n/a	n/a	PASS	n/a	n/a	n/a	11.0 11.4
EN1571	No	7,245	10,737	761	7,257	8,359	579	n/a	n/a	PASS	n/a	n/a	n/a	10.2 9.4
LG-BKGD	n/a	n/a	n/a	n/a	8244 Avg. + DCGL = 11,892	8,871	353	0.73 (non-'hot') (Avg. of 20)	n/a	n/a	n/a	n/a	n/a	9.0 9.4
LG0001	No	6,518	10,150	688	6,131	6,527	435	n/a	n/a	PASS	n/a	n/a	n/a	9.2 8.4
LG0002	No	6,979	9,676	652	6,728	7,529	371	n/a	n/a	PASS	n/a	n/a	n/a	9.2 9.2
LG0003	No	7,408	10,546	549	7,431	8,720	498	n/a	n/a	PASS	n/a	n/a	n/a	9.4 9.0
LG0004	No	6,900	10,301	863	6,938	8,578	792	n/a	n/a	PASS	n/a	n/a	n/a	9.4 9.8
LG0010	Yes	5,957	8,452	599	6,142	6,843	372	n/a	n/a	PASS	n/a	n/a	n/a	8.4 9.0
LG0011	No	7,066	10,318	714	6,785	8,108	694	n/a	n/a	PASS	n/a	n/a	n/a	9.6 9.0
LG0012	No	8,016	11,532	992	8,208	9,791	960	n/a	n/a	FAIL	PASS	PASS	n/a	10.8 9.6
LG0017	Unable to procure information	6,929	8,640	298	7,095	8,243	394	n/a	n/a	PASS	n/a	n/a	n/a	10.2 9.2
LG0018	No	7,156	9,328	660	7,374	8,240	668	n/a	n/a	PASS	n/a	n/a	n/a	10.0 8.4
LG0020	No	7,177	10,042	731	6,792	7,137	217	n/a	n/a	PASS	n/a	n/a	n/a	9.0 8.6
LG0024	No	7,744	11,058	768	7,548	8,519	500	n/a	n/a	PASS	n/a	n/a	n/a	9.2 9.6
LG0026	Unable to procure information	7,963	10,308	493	8,157	8,550	252	n/a	n/a	PASS	n/a	n/a	n/a	9.8 9.6
LG0429	No	9,159	11,903	654	9,285	9,611	196	n/a	n/a	FAIL	PASS	PASS	n/a	12.8 10.4

TABLE 1
Summary of Phase 1 Field Screening, Laboratory Analytical Results and MARSSIM Statistical Tests for Oak Canyon Settlement
Grants Mineral Belt Structures Assessment
Cibola County, New Mexico
May 2010 - October 2011
(Continued)

Property ID	Residential Info. Sheet (Mine/Mill Material Used to Build House, or Kept Indoors?)	Gamma Scan Avg. (CPM)	Highest Gamma Scan Measurement (CPM)	Standard Deviation: Gamma Scan	20 One-Minute Stationary Measurements Avg. (CPM)	Highest One-Minute Stationary Measurement (CPM)	Standard Deviation: 20 One-Minute Stationary Measurements	'Hot Spot' Surface Soil Sample Results [Radium-226] (pCi/g)[1]	'Hot Spot' Surface Soil Sample Location One-Minute Stationary Measurement (CPM)	MARSSIM Test 1[2]	MARSSIM Test 2[2]	MARSSIM Test 3[2]	MARSSIM Test 4[2]	Elemental Uranium (mg/kg)[3]
LG0436	No	9,490	29,169	2,252	9,066	12,879	1,054	.77 - 29.5 (2 samples)	28496 - 32849	FAIL	PASS	PASS	3.43 (FAIL)	10.0 9.6
LG0437	No	9,829	12,634	765	9,758	10,585	522	n/a	n/a	FAIL	PASS	PASS	0.61 (PASS)	10.0 10.8
LG0438	No	9,387	11,773	609	9,596	10,310	367	n/a	n/a	FAIL	PASS	PASS	n/a	10.2 9.2
LG0450	Yes	9,695	20,906	912	9,676	10,611	364	1.3 - 8.94 (3 samples)	26017 - 42264	FAIL	PASS	PASS	6.11 (FAIL)	1.01 U 0.998 U
LG0451	Yes	9,230	10,787	466	9,341	9,849	332	n/a	n/a	PASS	n/a	n/a	n/a	9.8 9.2
LG0452	Yes	8,967	33,576	1,475	8,877	11,065	635	.72 - 1.21 (4 samples)	12127 - 24095	FAIL	PASS	PASS	1.54 (FAIL)	10.2 9.4
LG0454	No	8,155	10,289	652	8,191	9,438	544	n/a	n/a	PASS	n/a	n/a	n/a	9.4 10.0
LG0459	Yes	8,955	13,514	648	9,025	11,652	719	.80 - 1.24 (2 samples)	9896 - 11885	FAIL	PASS	PASS	0.44 (PASS)	10.0 9.8
LG0486	Yes	9,153	12,416	743	9,081	9,889	400	0.68 (1 sample)	17,910	FAIL	PASS	PASS	0.36 (PASS)	10.8 0.543 10.4
LG0489	No	9,134	13,179	833	8,722	10,671	873	.94 - 1.29 (2 samples)	11974 - 14195	FAIL	PASS	PASS	0.24 (PASS)	9.0 10.0
LG0612	Yes	7,661	10,125	649	7,748	8,379	282	n/a	n/a	PASS	n/a	n/a	n/a	1.0 U 1.01 U
LG0619	No	8,274	10,869	536	8,443	8,906	299	n/a	n/a	PASS	n/a	n/a	n/a	9.8 9.0
LG0620	Unable to procure information	6,935	9,390	678	6,744	7,960	424	n/a	n/a	PASS	n/a	n/a	n/a	9.0 9.8
LG0626	No	7,313	9,918	476	7,473	8,038	246	n/a	n/a	PASS	n/a	n/a	n/a	9.8 9.0
LG0627	Yes	6,806	8,950	632	7,002	7,787	317	n/a	n/a	PASS	n/a	n/a	n/a	9.4 9.2
LG0628	No	7,398	13,029	571	7,151	7,615	200	n/a	n/a	FAIL	PASS	PASS	0.07 (PASS)	9.4 9.0
LG0644	Unable to procure information	8,711	338,632	13,147	8,485	22,840	3,767	1.08 - 1.69 (2 samples)	108094 - 159550	FAIL	PASS	PASS	20.01 (FAIL)	0.962 U 1.02 U
LG0645	Yes	6,970	8,595	569	6,949	8,587	705	n/a	n/a	PASS	n/a	n/a	n/a	9.2 8.6
LG0655	No	6,407	9,692	815	6,380	9,067	1,006	n/a	n/a	PASS	n/a	n/a	n/a	10.8 0.41 U 9.8

TABLE 1
Summary of Phase 1 Field Screening, Laboratory Analytical Results and MARSSIM Statistical Tests for Oak Canyon Settlement
Grants Mineral Belt Structures Assessment
Cibola County, New Mexico
May 2010 - October 2011
(Continued)

Property ID	Residential Info. Sheet (Mine/Mill Material Used to Build House, or Kept Indoors?)	Gamma Scan Avg. (CPM)	Highest Gamma Scan Measurement (CPM)	Standard Deviation: Gamma Scan	20 One-Minute Stationary Measurements Avg. (CPM)	Highest One-Minute Stationary Measurement (CPM)	Standard Deviation: 20 One-Minute Stationary Measurements	'Hot Spot' Surface Soil Sample Results [Radium-226] (pCi/g)[1]	'Hot Spot' Surface Soil Sample Location One-Minute Stationary Measurement (CPM)	MARSSIM Test 1[2]	MARSSIM Test 2[2]	MARSSIM Test 3[2]	MARSSIM Test 4[2]	Elemental Uranium (mg/kg)[3]
LG0694	Yes	7,190	9,101	511	7,277	8,041	333	n/a	n/a	PASS	n/a	n/a	n/a	9.4 10.2
LG1228	No	5,928	6,656	275	6,031	6,589	367	n/a	n/a	PASS	n/a	n/a	n/a	9.6 10.0
LG1229	Resident not sure	6,247	7,216	507	6,292	7,132	588	n/a	n/a	PASS	n/a	n/a	n/a	9.4 9.2
LG1230	No	6,014	10,615	565	6,760	8,140	625	0.45 (1 sample)	32,211	PASS	n/a	n/a	n/a	11.2 0.409 8.4
LG1233	Yes	7,229	10,553	995	7,596	9,037	939	n/a	n/a	PASS	n/a	n/a	n/a	9.6 9.0
LG1235	No	6,809	8,515	513	6,786	7,678	378	n/a	n/a	PASS	n/a	n/a	n/a	9.2 9.2
LG1236	Probably	7,551	8,120	221	7,118	7,606	295	n/a	n/a	PASS	n/a	n/a	n/a	10.0 8.2
LG1240	Yes	6,843	10,336	738	6,883	8,645	545	n/a	n/a	PASS	n/a	n/a	n/a	9.8 9.0
LG1243	Yes	6,879	15,740	794	6,872	7,592	349	n/a	n/a	FAIL	PASS	PASS	0.11 (PASS)	9.4 0.436 9.4
LG1244	No	6,774	9,673	822	6,962	7,962	674	n/a	n/a	PASS	n/a	n/a	n/a	9.2 9.2
LG1245	No	6,463	8,666	749	6,538	7,416	584	n/a	n/a	PASS	n/a	n/a	n/a	9.6 8.6
LG1248	No	6,591	8,638	576	6,893	7,502	388	n/a	n/a	PASS	n/a	n/a	n/a	10.8 9.4
LG1250	Yes	6,146	9,402	674	6,084	6,768	418	n/a	n/a	PASS	n/a	n/a	n/a	8.8 9.0
LG1251	Yes	7,279	10,620	728	7,479	9,317	779	n/a	n/a	PASS	n/a	n/a	n/a	10.4 8.2
LG1253	Unable to procure information	6,233	9,426	762	6,242	7,092	480	n/a	n/a	PASS	n/a	n/a	n/a	9.8 9.4
LG1254	Yes	7,122	10,414	658	7,289	8,518	541	n/a	n/a	PASS	n/a	n/a	n/a	8.8 9.4
LG1256	Yes	7,331	9,817	672	7,330	8,439	588	n/a	n/a	PASS	n/a	n/a	n/a	9.6 9.4
LG1257	No	8,307	10,818	707	6,728	7,529	371	n/a	n/a	PASS	n/a	n/a	n/a	10.0 11.4
LG1260	No	7,719	11,654	1,010	7,736	9,101	503	n/a	n/a	FAIL	PASS	PASS	n/a	8.8 n/a

TABLE 1
Summary of Phase 1 Field Screening, Laboratory Analytical Results and MARSSIM Statistical Tests for Oak Canyon Settlement
Grants Mineral Belt Structures Assessment
Cibola County, New Mexico
May 2010 - October 2011
(Continued)

Property ID	Residential Info. Sheet (Mine/Mill Material Used to Build House, or Kept Indoors?)	Gamma Scan Avg. (CPM)	Highest Gamma Scan Measurement (CPM)	Standard Deviation: Gamma Scan	20 One-Minute Stationary Measurements Avg. (CPM)	Highest One-Minute Stationary Measurement (CPM)	Standard Deviation: 20 One-Minute Stationary Measurements	'Hot Spot' Surface Soil Sample Results [Radium-226] $(pCi/g)_1$	'Hot Spot' Surface Soil Sample Location One-Minute Stationary Measurement (CPM)	MARSSIM Test 1_2	MARSSIM Test 2_2	MARSSIM Test 3_2	MARSSIM Test 4_2	Elemental Uranium $(mg/kg)_3$
LG1261	Unable to procure information	5,730	8,273	746	5,715	6,612	708	n/a	n/a	PASS	n/a	n/a	n/a	not collected
LG1263	No	7,764	9,660	606	7,953	8,884	607	n/a	n/a	PASS	n/a	n/a	n/a	10.4 9.0
LG1265	No	6,283	12,260	800	6,172	7,316	726	n/a	n/a	FAIL	PASS	PASS	0.05 (PASS)	11.4 0.384 U 9.8
LG1267	Yes	6,570	11,270	949	6,604	8,403	791	n/a	n/a	PASS	n/a	n/a	n/a	10.2 9.0
LG1272	No	5,499	8,413	791	5,928	7,276	813	n/a	n/a	PASS	n/a	n/a	n/a	9.4 8.2
LG1275	No	5,299	8,694	596	5,701	6,694	458	n/a	n/a	PASS	n/a	n/a	n/a	8.2 8.2
LG1277	No	6,030	8,632	662	5,949	6,897	436	n/a	n/a	PASS	n/a	n/a	n/a	8.6 10.0
LG1284	No	6,522	7,880	391	6,415	8,181	509	n/a	n/a	PASS	n/a	n/a	n/a	9.8 9.8
LG1290	Yes	7,114	10,422	1,280	7,411	9,223	1,368	n/a	n/a	PASS	n/a	n/a	n/a	10.4 0.616 9.8
LG1300	No	6,099	10,107	1,120	6,642	8,732	1,087	n/a	n/a	PASS	n/a	n/a	n/a	9.4 1.28 10.2
LG1306	Yes	7,673	11,000	1,124	7,657	8,736	774	n/a	n/a	PASS	n/a	n/a	n/a	11.4 10.0
LG1313	Unable to procure information	7,593	10,058	685	7,354	8,776	586	n/a	n/a	PASS	n/a	n/a	n/a	10.8 9.4
LG1316	No	7,120	9,445	816	7,354	8,316	517	n/a	n/a	PASS	n/a	n/a	n/a	8.8 9.6
LG1317	Unable to procure information	7,837	9,998	790	7,777	8,917	740	n/a	n/a	PASS	n/a	n/a	n/a	9.2 8.8
LG1321	No	6,617	9,588	951	6,759	8,022	811	n/a	n/a	PASS	n/a	n/a	n/a	9.8 12.2
LG1367	Unable to procure information	7,071	9,510	709	7,106	8,217	520	n/a	n/a	PASS	n/a	n/a	n/a	9.0 9.0
LG1385	No	7,290	31,969	1,184	7,151	8,170	512	0.60 - 1.04 (2 samples + 1 duplicate)	22249 - 27741	FAIL	PASS	PASS	1.02 (FAIL)	9.0 9.0
LG1389	No	6,844	8,682	672	6,878	8,023	567	n/a	n/a	PASS	n/a	n/a	n/a	10.6 0.38 U 10.0

TABLE 1
Summary of Phase 1 Field Screening, Laboratory Analytical Results and MARSSIM Statistical Tests for Oak Canyon Settlement
Grants Mineral Belt Structures Assessment
Cibola County, New Mexico
May 2010 - October 2011
(Continued)

Property ID	Residential Info. Sheet (Mine/Mill Material Used to Build House, or Kept Indoors?)	Gamma Scan Avg. (CPM)	Highest Gamma Scan Measurement (CPM)	Standard Deviation: Gamma Scan	20 One-Minute Stationary Measurements Avg. (CPM)	Highest One-Minute Stationary Measurement (CPM)	Standard Deviation: 20 One-Minute Stationary Measurements	'Hot Spot' Surface Soil Sample Results [Radium-226] (pCi/g)[1]	'Hot Spot' Surface Soil Sample Location One-Minute Stationary Measurement (CPM)	MARSSIM Test 1[2]	MARSSIM Test 2[2]	MARSSIM Test 3[2]	MARSSIM Test 4[2]	Elemental Uranium (mg/kg)[3]
LG1510	No	6,687	9,181	906	6,863	8,095	661	n/a	n/a	PASS	n/a	n/a	n/a	9.8 9.0
LG1635	No	5,973	7,943	548	6,055	6,749	314	n/a	n/a	PASS	n/a	n/a	n/a	n/a
LG4297	No	9,189	13,068	918	8,910	10,144	725	0.66 - 0.99 (3 samples)	9054 - 9310	FAIL	PASS	PASS	0.44 (PASS)	1.01 U 1.01 U
LG4922	No	6,764	11,965	975	7,084	12,777	1,436	n/a	n/a	FAIL	PASS	PASS	0.03 (PASS)	9.6 8.8
LG6791	No	8,270	11,330	1,044	8,408	9,596	1,055	n/a	n/a	PASS	n/a	n/a	n/a	1.01 U 1.0 U
LG6848	Yes	6,479	8,984	765	6,640	8,765	684	n/a	n/a	PASS	n/a	n/a	n/a	n/a
LG7777	Unable to procure information	7,594	11,060	628	7,378	8,012	375	n/a	n/a	PASS	n/a	n/a	n/a	10.6 9.4
LG8285	No	7,688	10,986	765	7,736	9,339	603	n/a	n/a	PASS	n/a	n/a	n/a	1.02 U 0.987 U
LG9060	No	6,499	9,080	646	6,482	7,135	265	n/a	n/a	PASS	n/a	n/a	n/a	9.2 0.998 U 8.8
LG9990	No	7,881	10,286	551	7,949	8,916	434	n/a	n/a	PASS	n/a	n/a	n/a	10.2 9.6
LG9991	Unable to procure information	7,665	10,061	699	7,659	8,660	446	n/a	n/a	PASS	n/a	n/a	n/a	9.0 9.6
LG9992	No	10,229	12,956	706	10,672	11,372	463	.89 - 1.07 (5 samples)	11,002 - 11,367	FAIL	PASS	PASS	n/a	0.98 U/1.02 U 1.01 U
LG9993[3]	N/A	n/a	n/a	n/a	12,692	19,523	2,306	1.45 - 3.5 (4 samples + 1 laboratory duplicate)	11635 - 19523	n/a	FAIL	FAIL	n/a	1.06
LG9994	Yes	6,746	9,431	540	6,706	7,518	486	n/a	n/a	PASS	n/a	n/a	n/a	9.4 9.8
LG9995	No	7,185	9,144	491	7,113	8,004	364	n/a	n/a	PASS	n/a	n/a	n/a	9.8 10.6
LG9996	Yes	6,552	9,649	569	6,701	7,593	491	n/a	n/a	PASS	n/a	n/a	n/a	8.4 8.6
LG9997	Yes	7,589	13,068	718	7,465	8,930	513	n/a	n/a	FAIL	PASS	PASS	n/a	8.8 9.2
LG9998	Unable to procure information	8,022	20,493	1,442	7,802	9,843	646	4.41 - 11.6 (5 samples)	12145 - 15506	FAIL	PASS	PASS	1.10 (FAIL)	8.6 0.416 9.0

TABLE 1
Summary of Phase 1 Field Screening, Laboratory Analytical Results and MARSSIM Statistical Tests for Oak Canyon Settlement
Grants Mineral Belt Structures Assessment
Cibola County, New Mexico
May 2010 - October 2011
(Continued)

Property ID	Residential Info. Sheet (Mine/Mill Material Used to Build House, or Kept Indoors?)	Gamma Scan Avg. (CPM)	Highest Gamma Scan Measurement (CPM)	Standard Deviation: Gamma Scan	20 One-Minute Stationary Measurements Avg. (CPM)	Highest One-Minute Stationary Measurement (CPM)	Standard Deviation: 20 One-Minute Stationary Measurements	'Hot Spot' Surface Soil Sample Results [Radium-226] (pCi/g)[1]	'Hot Spot' Surface Soil Sample Location One-Minute Stationary Measurement (CPM)	MARSSIM Test 1[2]	MARSSIM Test 2[2]	MARSSIM Test 3[2]	MARSSIM Test 4[2]	Elemental Uranium (mg/kg)[3]
LG9999	Unable to procure information	7,460	11,827	930	7,392	8,341	491	n/a	n/a	FAIL	PASS	PASS	n/a	9.2 9.6
ME-BKGD	n/a	n/a	n/a	n/a	6461 Avg. + DCGL = 10109	6,827	148	0.48 (non-'hot') (Avg. of 20)	n/a	n/a	n/a	n/a	n/a	8.8 9.0
ME0718	No	6,904	11,700	1,000	6,996	7,990	553	n/a	n/a	FAIL	PASS	PASS	0.24 (PASS)	10.0 9.8
ME0721	No	6,092	8,425	594	6,172	6,988	370	n/a	n/a	PASS	n/a	n/a	n/a	10.0 n/a
ME0723	No	6,479	9,997	754	6,475	7,806	592	n/a	n/a	FAIL	PASS	PASS	n/a	9.2 9.2
ME0727	No	7,297	11,402	921	7,152	8,397	559	n/a	n/a	FAIL	PASS	PASS	0.37 (PASS)	10.8 10.0
ME0729	No	10,850	86,965	6,621	8,521	13,417	2,230	(7 samples + 1 laboratory duplicate)	14691 - 35896	FAIL	FAIL	PASS	n/a	10.0 9.4
ME0731	No	6,600	11,186	858	6,551	7,274	326	n/a	n/a	FAIL	PASS	PASS	0.16 (PASS)	10.6 10.0
ME0733	Unable to procure information	6,174	10,537	765	6,260	6,986	387	n/a	n/a	FAIL	PASS	PASS	0.02 (PASS)	9.8 10.2
ME0734	No	6,434	11,273	869	6,561	7,763	503	n/a	n/a	FAIL	PASS	PASS	0.06 (PASS)	9.6 9.6
ME0735	Yes	6,623	12,173	884	6,906	8,322	481	n/a	n/a	FAIL	PASS	PASS	0.19 (PASS)	9.6 9.8
ME0736	No	6,949	11,631	989	7,053	8,536	658	n/a	n/a	FAIL	PASS	PASS	0.32 (PASS)	10.2 9.4
ME0737	No	6,286	10,038	809	6,558	7,738	614	n/a	n/a	FAIL	PASS	PASS	n/a	10.4 9.8
ME0738	Yes	8,793	106,272	7,794	8,837	30,504	5,359	3.55 - 321 (4 samples)	10,472 - 159,664	FAIL	PASS	PASS	57.69 (FAIL)	9.8 9.8
ME0739	No	6,340	11,880	869	6,706	7,661	533	n/a	n/a	FAIL	PASS	PASS	0.07 (PASS)	10.2 9.8
ME0740	Unable to procure information	8,057	10,845	813	7,786	8,646	432	n/a	n/a	FAIL	PASS	PASS	0.49 (PASS)	12.0 10.2
ME0743	No	7,957	12,620	957	7,772	8,817	538	.70 - .95 (4 samples)	7881 - 9632	FAIL	PASS	PASS	n/a	9.4 9.8
ME0755	No	6,903	8,812	613	6,809	7,849	393	n/a	n/a	PASS	n/a	n/a	n/a	9.6 10.2

TABLE 1
Summary of Phase 1 Field Screening, Laboratory Analytical Results and MARSSIM Statistical Tests for Oak Canyon Settlement
Grants Mineral Belt Structures Assessment
Cibola County, New Mexico
May 2010 - October 2011
(Continued)

Property ID	Residential Info. Sheet (Mine/Mill Material Used to Build House, or Kept Indoors?)	Gamma Scan Avg. (CPM)	Highest Gamma Scan Measurement (CPM)	Standard Deviation: Gamma Scan	20 One-Minute Stationary Measurements Avg. (CPM)	Highest One-Minute Stationary Measurement (CPM)	Standard Deviation: 20 One-Minute Stationary Measurements	'Hot Spot' Surface Soil Sample Results [Radium-226] (pCi/g)[1]	'Hot Spot' Surface Soil Sample Location One-Minute Stationary Measurement (CPM)	MARSSIM Test 1[2]	MARSSIM Test 2[2]	MARSSIM Test 3[2]	MARSSIM Test 4[2]	Elemental Uranium (mg/kg)[3]
ME0756	No	7,676	10,767	1,003	8,109	9,446	844	n/a	n/a	FAIL	PASS	PASS	0.41 (PASS)	n/a
ME0760	No	7,463	10,142	899	7,411	8,759	757	n/a	n/a	FAIL	PASS	PASS	0.30 (PASS)	11 0.451 11.4
ME0765	No	6,495	8,079	590	6,507	7,061	297	n/a	n/a	PASS	n/a	n/a	n/a	none collected
ME0767	No	5,899	8,801	493	6,074	7,124	411	n/a	n/a	PASS	n/a	n/a	n/a	9.8 9.0
ME0769	No	6,580	11,013	911	6,912	8,561	451	n/a	n/a	FAIL	PASS	PASS	0.12 (PASS)	10.4 0.39 U 9.2 0.394 U
ME0770	No	5,297	6,763	481	5,284	6,165	443	n/a	n/a	PASS	n/a	n/a	n/a	9.4 n/a
ME0774	Unable to procure information	7,344	13,298	1,126	7,222	8,541	650	n/a	n/a	FAIL	PASS	PASS	0.50 (PASS)	11.4 9.8
ME0776	No	6,627	11,448	995	6,499	7,839	667	n/a	n/a	FAIL	PASS	PASS	0.30 (PASS)	10.0 10.2
ME0777	Yes	6,246	9,450	832	6,243	8,180	850	n/a	n/a	PASS	n/a	n/a	n/a	11.8 0.41 9.6
ME0778	Yes	7,075	14,164	936	7,119	8,474	499	n/a	n/a	FAIL	PASS	PASS	0.47 (PASS)	9.2 10.2
ME0787	No	7,056	8,528	408	7,221	7,938	380	n/a	n/a	PASS	n/a	n/a	n/a	8.8 9.0
ME0797	No	7,022	9,422	598	6,998	7,832	339	n/a	n/a	PASS	n/a	n/a	n/a	8.8 9.4
ME0804	No	6,618	10,491	836	6,700	8,226	605	n/a	n/a	FAIL	PASS	PASS	0.06 (PASS)	8.8 8.8
ME0809	Yes	6,596	13,981	848	6,522	7,884	771	0.55 (1 sample)	10,202	FAIL	PASS	PASS	0.33 (PASS)	10.0 9.0
ME0810	No	6,238	12,391	819	6,297	8,597	775	10.6 (1 sample)	10,316	FAIL	PASS	PASS	0.47 (PASS)	9.6 9.4
ME0822	Unable to procure information	6,302	10,757	791	6,348	6,992	311	n/a	n/a	FAIL	PASS	PASS	0.11 (PASS)	11 0.399 U 10.2
ME0826	No	7,021	12,250	995	6,983	7,983	566	n/a	n/a	FAIL	PASS	PASS	0.45 (PASS)	9.8 8.8
ME0832	No	7,328	11,677	945	7,300	8,369	441	n/a	n/a	FAIL	PASS	PASS	0.58 (PASS)	9.8 10.6
ME0852	No	7,567	12,773	668	7,413	8,402	361	0.5 (1 sample)	16,319	FAIL	PASS	PASS	0.88 (PASS)	9.4 9.2
ME0893	Yes	6,195	8,923	528	6,256	6,637	216	n/a	n/a	PASS	n/a	n/a	n/a	0.993 U 0.975 U

TABLE 1
Summary of Phase 1 Field Screening, Laboratory Analytical Results and MARSSIM Statistical Tests for Oak Canyon Settlement
Grants Mineral Belt Structures Assessment
Cibola County, New Mexico
May 2010 - October 2011
(Continued)

Property ID	Residential Info. Sheet (Mine/Mill Material Used to Build House, or Kept Indoors?)	Gamma Scan Avg. (CPM)	Highest Gamma Scan Measurement (CPM)	Standard Deviation: Gamma Scan	20 One-Minute Stationary Measurements Avg. (CPM)	Highest One-Minute Stationary Measurement (CPM)	Standard Deviation: 20 One-Minute Stationary Measurements	'Hot Spot' Surface Soil Sample Results [Radium-226] (pCi/g)[1]	'Hot Spot' Surface Soil Sample Location One-Minute Stationary Measurement (CPM)	MARSSIM Test 1[2]	MARSSIM Test 2[2]	MARSSIM Test 3[2]	MARSSIM Test 4[2]	Elemental Uranium (mg/kg)[3]
ME9996	N/A	9,845	11,955	644	9,879	10,172	199	0.82-0.98 (2 samples) 1.02 -1.14 (20 regression-derived 'samples')	9,889 - 10,032	PASS	n/a	n/a	n/a	1.01 U 1.02 U
ME9997	N/A	10,328	13,066	744	10,475	11,304	337	0.92-1.50 (8 samples) 1.11 - 1.33 (20 regression-derived 'samples')	10,033 - 11,212	PASS	n/a	n/a	n/a	0.98 U 0.982 U
ME9998	N/A	8,845	11,964	692	8,582	9,124	291	(5 samples) 0.76 - 0.96 (20 regression-derived 'samples')	8,803 - 9,162	PASS	n/a	n/a	n/a	1.02 U 0.968 U
ME9999	N/A	10,075	12,545	771	10,395	11,151	413	0.91 - 1.42 (6 'hot spot' samples) 0.59 - 1.42 (20 non-'hot' samples)	10,394 - 11,129	PASS	n/a	n/a	n/a	10.2 0.966 U/0.987 U 10.2 1.03 U
PJ-BKGD	n/a	n/a	n/a	n/a	8,289 Avg. + DCGL 11,937	11,482 (lowest)	257	0.70 (non-'hot') (Avg. of 20)	n/a	n/a	n/a	n/a	n/a	8.4 8.6 1.01 U
PJ0001	No	9,279	12,087	549	9,437	10,594	547	0.88 (1 sample)	14,383	FAIL	PASS	PASS	0.32 (PASS)	0.968 U 0.935 U
PJ0003	Yes	10,274	15,439	958	10,427	11,337	466	0.85-1.32 (3 samples)	9,324 - 10,793	FAIL	PASS	PASS	n/a	9.8 0.538 10.4 0.51
PJ0161	No	9,797	13,965	954	9,741	11,869	968	0.97-1.26 (3 samples)	11,962 - 12,637	FAIL	PASS	PASS	1.13 (FAIL)	10.6 11.2
PJ0164	No	9,282	11,660	506	9,295	10,090	343	n/a	n/a	FAIL	PASS	PASS	n/a	9.0 9.0
PJ0260	No	7,264	10,308	689	7,217	8,164	403	n/a	n/a	PASS	n/a	n/a	n/a	8.4 8.4
PJ0270	No	7,706	9,979	532	7,901	8,638	321	n/a	n/a	PASS	n/a	n/a	n/a	1.02 U 1.03 U
PJ0271	Unable to procure information	9,046	12,449	1,005	8,781	10,519	835	0.98-1.23 (2 samples + 1 duplicate)	10,559 - 11,175	FAIL	PASS	PASS	n/a	0.975 U 0.969 U
PJ0282	No	9,340	12,470	750	9,014	10,091	512	n/a	n/a	FAIL	PASS	PASS	0.33 (PASS)	9.2 10.0
PJ0285	No	7,701	10,095	663	7,467	7,996	308	n/a	n/a	PASS	n/a	n/a	n/a	9.0 8.4

TABLE 1
Summary of Phase 1 Field Screening, Laboratory Analytical Results and MARSSIM Statistical Tests for Oak Canyon Settlement
Grants Mineral Belt Structures Assessment
Cibola County, New Mexico
May 2010 - October 2011
(Continued)

Property ID	Residential Info. Sheet (Mine/Mill Material Used to Build House, or Kept Indoors?)	Gamma Scan Avg. (CPM)	Highest Gamma Scan Measurement (CPM)	Standard Deviation: Gamma Scan	20 One-Minute Stationary Measurements Avg. (CPM)	Highest One-Minute Stationary Measurement (CPM)	Standard Deviation: 20 One-Minute Stationary Measurements	'Hot Spot' Surface Soil Sample Results [Radium-226] (pCi/g)[1]	'Hot Spot' Surface Soil Sample Location One-Minute Stationary Measurement (CPM)	MARSSIM Test 1[2]	MARSSIM Test 2[2]	MARSSIM Test 3[2]	MARSSIM Test 4[2]	Elemental Uranium (mg/kg)[3]
PJ0291	No	8,271	12,263	873	8,344	9,408	484	n/a	n/a	FAIL	PASS	PASS	0.02 (PASS)	9.2 9.4
PJ0295	No	7,516	10,233	763	7,428	9,018	529	n/a	n/a	PASS	n/a	n/a	n/a	9.9 10.8 0.711
PJ0296	No	8,497	11,270	740	8,384	9,482	481	n/a	n/a	PASS	n/a	n/a	n/a	9.8 9.6
PJ0298	No	8,329	10,571	635	8,183	8,842	336	n/a	n/a	PASS	n/a	n/a	n/a	8.8 9.0
PJ0305	No	9,402	14,167	889	9,492	11,869	653	0,69 (1 sample)	13,445	FAIL	PASS	PASS	0.57 (PASS)	9.2 9.2
PJ0311	No	8,172	11,411	747	8,055	8,886	458	n/a	n/a	PASS	n/a	n/a	n/a	10.2 9.4
PJ0316	Yes	8,599	12,978	883	8,614	9,352	265	n/a	n/a	FAIL	PASS	PASS	0.17 (PASS)	9.6 9.0
PJ0317	No	8,476	12,560	927	8,369	9,141	405	n/a	n/a	FAIL	PASS	PASS	0.08 (PASS)	8.6 10.2
PJ0319	No	7,514	10,583	646	7,342	7,852	315	n/a	n/a	PASS	n/a	n/a	n/a	8.2 8.0
PJ0320	Unable to procure information	7,969	14,562	827	8,077	8,886	400	n/a	n/a	FAIL	PASS	PASS	0.03 (PASS)	10 0.363 8.4
PJ0321	Yes	8,805	12,425	847	8,731	9,861	500	n/a	n/a	FAIL	PASS	PASS	0.19 (PASS)	10.0 10.0
PJ0322	No	9,219	13,658	945	9,187	10,133	578	0.57-0.83 (2 samples)	13,434 - 13,767	FAIL	PASS	PASS	0.49 (PASS)	9.2 9.4
PJ0323	No	8,283	16,451	1,282	8,073	12,540	1,137	0.67-0.88 (2 samples + 1 duplicate)	12,127 - 17,231	FAIL	PASS	PASS	0.81 (PASS)	9.4 9.9 0.401
PJ0324	No	7,980	14,412	1,230	8,075	11,134	1,132	0.73-0.97 (4 samples + 1 duplicate)	13,030 - 14,650	FAIL	PASS	PASS	0.33 (PASS)	10.0 0.638 10.2
PJ0326	No	8,893	13,552	1,036	8,877	10,183	601	n/a	n/a	FAIL	PASS	PASS	0.37 (PASS)	10.0 10.0
PJ0327	No	7,671	10,498	847	7,662	9,037	653	n/a	n/a	PASS	n/a	n/a	n/a	10.0 9.6
PJ0328	No	8,424	11,467	779	8,449	9,527	544	n/a	n/a	PASS	n/a	n/a	n/a	10.6 10.0
PJ0329	No	8,093	12,488	832	8,192	8,886	398	n/a	n/a	FAIL	PASS	PASS	n/a	9.6 9.4
PJ0331	Yes	8,347	13,042	771	8,357	9,082	383	n/a	n/a	FAIL	PASS	PASS	n/a	9.2 9.6

TABLE 1
Summary of Phase 1 Field Screening, Laboratory Analytical Results and MARSSIM Statistical Tests for Oak Canyon Settlement
Grants Mineral Belt Structures Assessment
Cibola County, New Mexico
May 2010 - October 2011
(Continued)

Property ID	Residential Info. Sheet (Mine/Mill Material Used to Build House, or Kept Indoors?)	Gamma Scan Avg. (CPM)	Highest Gamma Scan Measurement (CPM)	Standard Deviation: Gamma Scan	20 One-Minute Stationary Measurements Avg. (CPM)	Highest One-Minute Stationary Measurement (CPM)	Standard Deviation: 20 One-Minute Stationary Measurements	'Hot Spot' Surface Soil Sample Results [Radium-226] (pCi/g)[1]	'Hot Spot' Surface Soil Sample Location One-Minute Stationary Measurement (CPM)	MARSSIM Test 1[2]	MARSSIM Test 2[2]	MARSSIM Test 3[2]	MARSSIM Test 4[2]	Elemental Uranium (mg/kg)[3]
PJ0334	No	8,885	40,212	1,612	8,662	10,428	593	1.32-16.2 (2 samples)	17,863 - 36,034	FAIL	PASS	PASS	1.35 (FAIL)	10.2 10.2 0.357
PJ0337	No	8,570	11,422	773	8,652	9,402	516	n/a	n/a	PASS	n/a	n/a	n/a	10.0 9.2
PJ0339	No	8,482	10,696	801	8,484	9,367	552	n/a	n/a	PASS	n/a	n/a	n/a	9.4 10.2
PJ0340	No	8,955	12,734	1,033	8,863	10,382	782	n/a	n/a	FAIL	PASS	PASS	0.28 (PASS)	10.0 10.2 0.287
PJ0344	Yes	8,806	11,951	781	8,961	9,939	482	0.77 (1 sample)	12,084	FAIL	PASS	PASS	0.16 (PASS)	9.8 9.6
PJ0357	Yes	8,583	27,370	987	8,703	9,746	571	2.76 (1 sample)	30,327	FAIL	PASS	PASS	2.27 (FAIL)	9.0 9.6
PJ0376	Yes	9,847	13,658	860	9,775	11,150	666	0.56-0.9 (2 samples + 1 duplicate)	11,792-12,149	FAIL	PASS	PASS	0.89 (PASS)	9.4 9.0
PJ1309	Yes	7,642	11,067	739	7,653	8,914	484	n/a	n/a	PASS	n/a	n/a	n/a	10.0 9.0
PJ1827	No	8,963	12,079	892	9,873	10,970	657	n/a	n/a	FAIL	PASS	PASS	n/a	10.0 10.8
SE-BKGD	n/a	n/a	n/a	n/a	11,149 Avg. + DCGL 14,797	10,190	405	1.17 (non-hot) (Avg. of 20)	n/a	n/a	n/a	n/a	n/a	10.8 0.71 11.4 0.812
SE0004	Yes	8,209	16,382	963	8,270	10,757	722	1.75 (1 sample)	18,089	FAIL	PASS	PASS	0.24 (PASS)	9.6 8.8
SE0011	Yes	8,831	13,593	926	8,846	9,837	402	n/a	n/a	PASS	n/a	n/a	n/a	8.4 0.319 8.9
SE0017	No	9,053	12,728	921	9,067	9,727	387	n/a	n/a	PASS	n/a	n/a	n/a	9.8 9.6
SE0032	Yes	10,186	89,950	7,097	8,854	11,121	972	1.55-35.3 (6 samples)	15,635 - 89,634	FAIL	PASS	PASS	3.91 (FAIL)	9.4 9.4
SE0037	No	8,879	12,391	856	8,978	10,203	665	n/a	n/a	PASS	n/a	n/a	n/a	9.2 9.2
SE0056	No	12,019	15,379	1,144	12,387	12,762	255	0.85-1.35 (5 samples + 1 duplicate)	12,369 - 12,747	FAIL	Pass	Pass	0.26 (PASS)	10.6 11.0
SE0064	No	12,169	15,061	1,004	12,441	13,295	623	0.98-1.13 (4 samples)	12,247 - 13,459	FAIL	Pass	Pass	n/a	10.8 10.6
SE0079	No	7,910	11,620	908	8,022	10,468	953	n/a	n/a	PASS	n/a	n/a	n/a	9.2 10.6 0.394
SE0088	Yes	7,706	10,259	776	8,073	9,013	588	n/a	n/a	PASS	n/a	n/a	n/a	10.8 0.398 9.8

TABLE 1
Summary of Phase 1 Field Screening, Laboratory Analytical Results and MARSSIM Statistical Tests for Oak Canyon Settlement
Grants Mineral Belt Structures Assessment
Cibola County, New Mexico
May 2010 - October 2011
(Continued)

Property ID	Residential Info. Sheet (Mine/Mill Material Used to Build House, or Kept Indoors?)	Gamma Scan Avg. (CPM)	Highest Gamma Scan Measurement (CPM)	Standard Deviation: Gamma Scan	20 One-Minute Stationary Measurements Avg. (CPM)	Highest One-Minute Stationary Measurement (CPM)	Standard Deviation: 20 One-Minute Stationary Measurements	'Hot Spot' Surface Soil Sample Results [Radium-226] (pCi/g)[1]	'Hot Spot' Surface Soil Sample Location One-Minute Stationary Measurement (CPM)	MARSSIM Test 1[2]	MARSSIM Test 2[2]	MARSSIM Test 3[2]	MARSSIM Test 4[2]	Elemental Uranium (mg/kg)[3]
SE0094	Yes	7,372	11,891	803	7,256	8,124	369	n/a	n/a	PASS	n/a	n/a	n/a	9.0 9.0
SE0096	No	7,281	10,570	656	7,381	9,058	507	n/a	n/a	PASS	n/a	n/a	n/a	8.8 9.2
SE0126	Unable to procure information	7,207	14,141	788	7,201	7,756	281	n/a	n/a	FAIL	PASS	PASS	0.27 (PASS)	8.8 8.6
SE0153	Yes	7,274	10,147	612	7,175	7,607	211	n/a	n/a	PASS	n/a	n/a	n/a	9.4 8.0
SE4089	No	8,102	11,981	1,079	8,100	9,943	804	n/a	n/a	PASS	n/a	n/a	n/a	9.6 8.8
SE5257	No	9,272	11,418	569	9,285	9,887	369	n/a	n/a	PASS	n/a	n/a	n/a	10.4 10.2 0.336
SE5586	No	9,385	12,192	615	9,552	10,549	413	n/a	n/a	PASS	n/a	n/a	n/a	9.2 9.0
SE6168	Yes	6,907	9,635	685	7,149	7,980	425	n/a	n/a	PASS	n/a	n/a	n/a	9.2 9.2
SE6245	No	7,213	10,105	662	7,874	9,271	805	n/a	n/a	PASS	n/a	n/a	n/a	8.8 9.0
SE8344	Unable to procure information	8,108	11,036	714	8,145	9,307	450	n/a	n/a	PASS	n/a	n/a	n/a	11.0 9.2
SE8996	Unable to procure information	7,965	10,063	628	7,807	8,325	284	n/a	n/a	PASS	n/a	n/a	n/a	9.4 8.6

[1] 'Hot Spot' Surface Samples were obtained if any walking, gamma scan measurements were greater than Background average of 20 one-minute, stationary measurements + DCGL (3,648 cpm).

[2] Results from XRF analysis are in black; results from laboratory analysis are in red. U = undetected.

[3] LG9993: due to geographical features, EPA was not able to conduct a gamma scan of this location. Also, MARSSIM tests were not able to be conducted. A report on this property is included at Appendix I.

TABLE 2
Summary of Phase 2 Laboratory Analytical Results and Field Measurements for Oak Canyon Settlement
Grants Mineral Belt Structures Assessment
Cibola County, New Mexico
May 2010 - October 2011

Property ID	Short-term (7-day) Indoor Radon (pCi/l)	Long-term (90-day) Indoor Radon (pCi/l)	PIC Indoor: Overall Home Avg. (µR/hr)	PIC Indoor: High Room Avg. (µR/hr)	PIC Indoor: Annual Dose Above Bkgd. - (Assumes 12 hrs. /day; 365 days/yr) (mrem/yr.)	Gamma Overall Indoor Scan (CPM)	Alpha Wipe Sample Results (DPM)
EN1215	3.7 4.7	not conducted	12.3	12.6	0.0	7,100-12,300	n/a
LG0010	n/a	n/a	10.3	10.5	0.0	5,000-9,600	n/a
LG0436	3.0 2.7	n/a	14.2	14.2	9.4	10,000-13,000	n/a
LG0450	2.2 3.4	n/a	14.2	14.7	10.7	9,300-15,000	0.00-0.00 (3 samples)
LG0452 [1]	3.8 (A) 3.1 (D) 3.3 (B) 3.6 (E)	3.3 3.1	11.4	12.2	3.3	7,400-35,000	0.00-3.23 (17 samples)
LG0486	n/a	n/a	10.4	11	0.0	6,300-16,500	0.00 (1 sample)
LG0627	<0.4 0.5	n/a	9.9	10.1	0.0	5,300-9,400	n/a
LG0694	n/a	n/a	11.8	11.9	2.6	5,600-9,600	n/a
LG1254	2.1 2.1	n/a	9.8	10.3	0.0	5,400-11,100	0.00 (1 sample)
LG1256	1.6 1.5	n/a	9.8	10	0.0	6,300-11,400	n/a
LG1385	2.8 1.6	n/a	12.9	13.7	7.8	6,800-13,200	0.00 (1 sample)
LG9989	1.0 0.7	n/a	11.3	11.4	1.2	4,500-8,300	n/a
ME0735	0.6 1.0	n/a	9.8	10.5	2.1	5,200-12,000	0.00-0.00 (2 samples)
PJ0003	2.1 2.7	n/a	12.2	12.5	5.3	6,700-13,700	0.00-0.00 (4 samples)
PJ0161	3.4 3.9	n/a	13.1	13.5	8.3	7,300-10,900	n/a
PJ0270	2.5 3.9	n/a	12.3	12.8	6.2	6,600-11,300	0.00-0.00 (2 samples)
PJ0331	1.2 1.5	n/a	10.7	10.8	0.6	6,300-10,200	n/a
PJ0334	n/a	n/a	12.2	12.3	4.9	6,800-11,500	0.00 (1 sample)
SE0032	4.6 5.3	2.9 3.4	10.4	10.9	0.0	5,200-16,900	0.00-0.00 (2 samples)

[1]LG0452: Four short term samples were collected due to structural features of the house described in Appendix H.

APPENDIX A

DCGL Revised Calculations for Homes with Vegetable Gardens

The LG0429 property homeowner stated on the Residential Information Sheet that he/she grows/ consumes vegetables and fruits from a vegetable garden and fruit trees. A conservative estimate concludes that these vegetables and fruits could add up to 65 kg/year, the lowest amount that would contribute a minimum of 10% towards the property DCGL, as demonstrated by RESRAD calculations detailed in the Site Assessment Protocol.

Therefore, a new property-specific DCGL will be calculated to assess the property as follows:

The property's Scan average is 9,159 cpm (915 **cpm** above bkgd.)

Committed dose from ingestion of 65 kg/yr = $\frac{\text{Property Scan Avg.}}{\text{1459 cpm/ pCi/g}}$ x .009 mrem / pCi/g / 1kg/yr of plant ingestion x 65 kg of plants/ yr

Committed dose = $\frac{915}{1459}$ x 0.009 x 65 = 0.366878 mrem

The EPA TEDE = 15 mrem/year
Therefore, all other pathways cannot contribute more than 15 - 0.366878 = 14.63312 mrem

RESRAD demonstrates that the dose from all pathways except plant ingestion is 5.9 mrem/yr per 1 pCi/g of Ra-226; therefore,

Revised DCGL = $\frac{14.633122}{5.9}$ x 1459 cpm per pCi/g = **3618.597** cpm

The ME0765 property homeowner stated on the Residential Information Sheet that he/she grows/ consumes fruits and vegetables from a vegetable garden and fruit trees. A conservative estimate concludes that these vegetables and fruits could add up to 65 kg/year, the lowest amount that would contribute a minimum of 10% towards the property DCGL, as demonstrated by RESRAD calculations detailed in the Site Assessment Protocol.

Therefore, a new property-specific DCGL will be calculated to assess the property as follows:

The property's Scan average is 6,495 cpm (**35 cpm** above bkgd.)

Committed dose from ingestion of 65 kg/yr = $\frac{\text{Property Scan Avg.}}{\text{1459 cpm/ pCi/g}}$ x .009 mrem / pCi/g / 1kg/yr of plant ingestion x 65 kg of plants/ yr

Committed dose = $\frac{35}{1459}$ x 0.009 x 65 = 0.014034 mrem

The EPA TEDE = 15 mrem/year

Therefore, all other pathways cannot contribute more than 15 - 0.014034 = 14.98597 mrem

RESRAD demonstrates that the dose from all pathways except plant ingestion is 5.9 mrem/yr per 1 pCi/g of Ra-226; therefore,

Revised DCGL = $\frac{14.98596642}{5.9}$ x 1459 cpm per pCi/g = **3705.852** cpm

The LG1243 property homeowner stated on the Residential Information Sheet that he/she grows/ consumes Peaches and vegetables from a vegetable garden. A conservative estimate concludes that these vegetables and fruits could add up to 65 kg/year, the lowest amount that would contribute a minimum of 10% towards the property DCGL, as demonstrated by RESRAD calculations detailed in the Site Assessment Protocol.

Therefore, a new property-specific DCGL will be calculated to assess the property as follows:

The property's Scan and 1-minute scaler averages are both below the offsite background level; therefore, the contribution towards the DCGL from the average concentration across the property is zero (0). The only contamination is from a 'hot spot' in the SW corner of the property. No samples were obtained from the property, but the avg. one-minute scaler reading of all 3 elevated Scan readings = **13,824** cpm (**6,952** above proxy bkgd. (property avg.

$$\text{Committed dose from ingestion of 65 kg/yr} = \frac{\text{Hot Spot Reading}}{\text{1459 cpm/ pCi/g}} \times \text{.009 mrem / pCi/g / 1kg/yr of plant ingestion} \times \text{65 kg of plants/ yr}$$

$$\text{Committed dose} = \frac{6{,}952}{1459} \times 0.009 \times 65 = 2.787471 \text{ mrem}$$

The EPA TEDE = 15 mrem/year

Therefore, all other pathways cannot contribute more than $15 - 2.787471 = 12.21253$ mrem

RESRAD demonstrates that the dose from all pathways except plant ingestion is 5.9 mrem/yr per 1 pCi/g of Ra-226; therefore,

$$\text{Revised DCGL} = \frac{12.21253}{5.9} \times \text{1459 cpm per pCi/g} = \mathbf{3020.014} \text{ cpm}$$

The LG0451 property homeowner stated on the Residential Information Sheet that he/she grows/ consumes corn, chiles, beans, watermelon, squash and tomatoes from a vegetable garden. A conservative estimate concludes that these vegetables and fruits could add up to 65 kg/year, the lowest amount that would contribute a minimum of 10% towards the property DCGL, as demonstrated by RESRAD calculations detailed in the Site Assessment Protocol.

Therefore, a new property-specific DCGL will be calculated to assess the property as follows:

The property's Scan average is 9,230 cpm (**986 cpm** above bkgd.)

$$\text{Committed dose from ingestion of 65 kg/yr} = \frac{\text{Property Scan Avg.}}{\text{1459 cpm/ pCi/g}} \times \text{.009 mrem / pCi/g / 1kg/yr of plant ingestion} \times \text{65 kg of plants/ yr}$$

$$\text{Committed dose} = \frac{986}{1459} \times 0.009 \times 65 = 0.395346 \text{ mrem}$$

The EPA TEDE = 15 mrem/year

Therefore, all other pathways cannot contribute more than $15 - 0.395346 = 14.60465$ mrem

RESRAD demonstrates that the dose from all pathways except plant ingestion is 5.9 mrem/yr per 1 pCi/g of Ra-226; therefore,

$$\text{Revised DCGL} = \frac{14.60465387}{5.9} \times \text{1459 cpm per pCi/g} = \mathbf{3611.558} \text{ cpm}$$

APPENDIX B

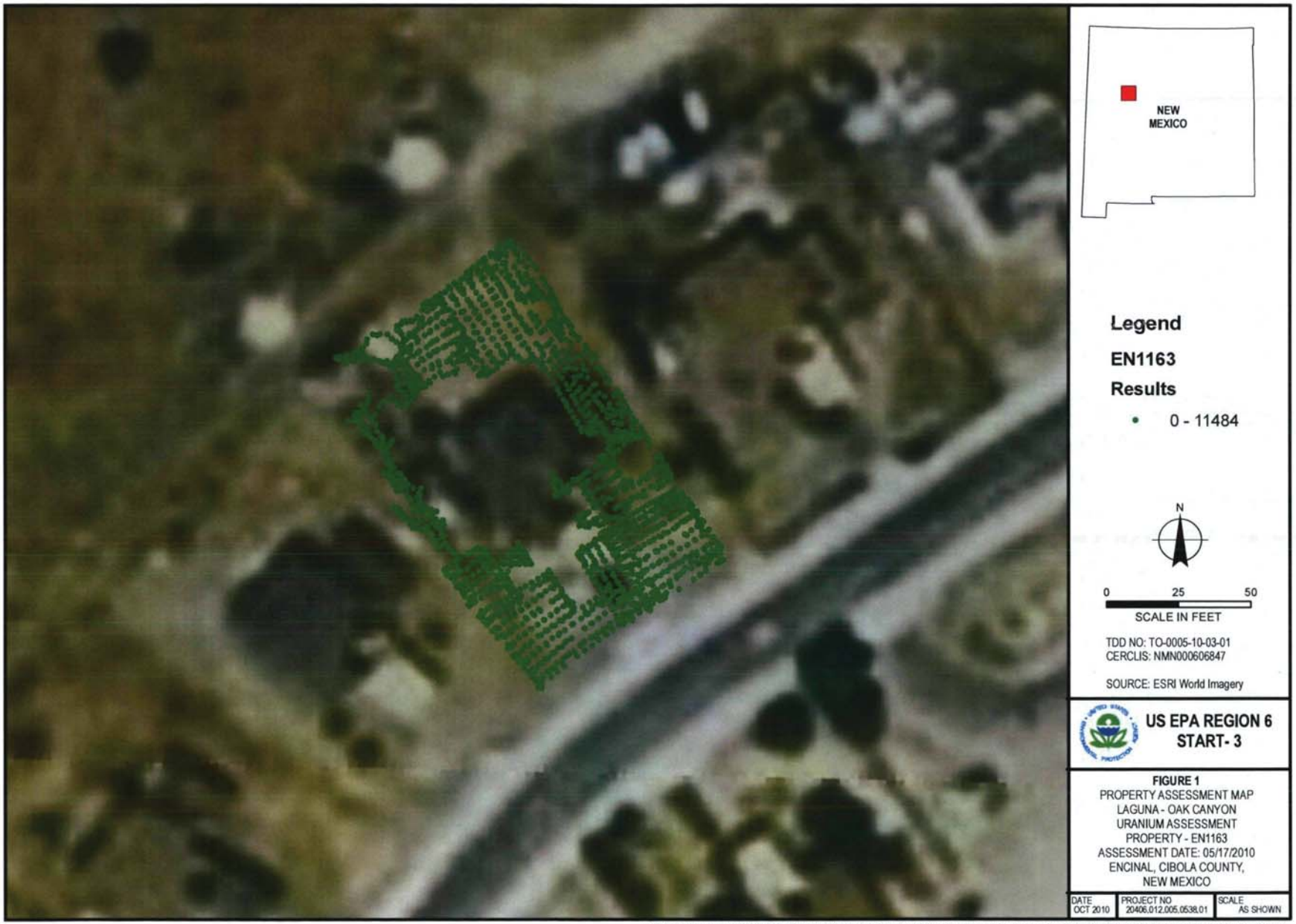
PART 1

Encinal RAT Maps

EN1133

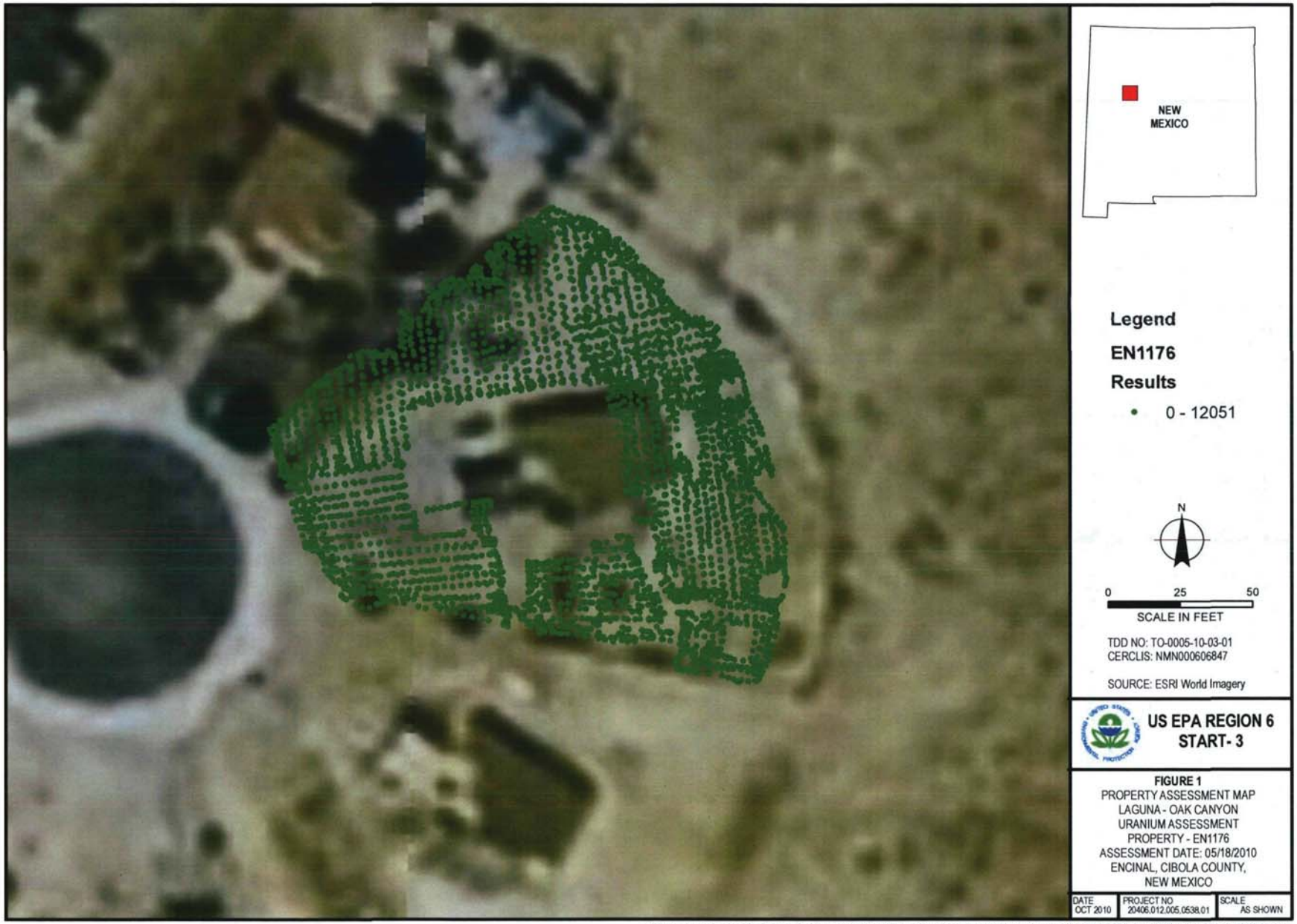
File: C:\Documents and Settings\busterp\Desktop\ENCINAL\EN1133\EN1133_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 21-Oct-10 08:22, busterp

EN1163



File: C:\Documents and Settings\buserp\Desktop\ENCINAL\EN1163\EN1163_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 21-Oct-10 09:09, buserp

EN1176



File: C:\Documents and Settings\busterp\Desktop\ENCINAL\EN1176\EN1176_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 21-Oct-10 09:33, busterp

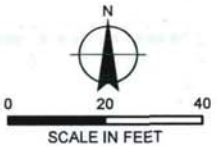
EN1190

Legend

EN1190

Results

- 0 - 12666
- 12667 - 13667
- 13668 - 13999
- 14000 - 14999
- 15000 - 15999



TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
SAN MATEO URANIUM ASSESSMENT
PROPERTY - EN1190
ASSESSMENT DATE: 5/17/2010
ENCINAL, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
AUG 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\ENCINAL\EN1190\EN1190_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 17-Aug-10 10:21, STARTGIS

EN1193

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\ENCINAL\EN1193\EN1193_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 27-Aug-10 16:19, STARTGIS

EN1196

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\ENCINAL\EN1196\EN1196_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 27-Aug-10 16:32, STARTGIS

EN1197

Legend

EN1197

Results

- 0 - 12664
- 12665 - 13453

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - EN1197
ASSESSMENT DATE: 5/19/2010
ENCINAL, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
AUG 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\ENCINAL\EN1197\EN1197_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 27-Aug-10 17:58, STARTGIS

EN1199

File: C:\Documents and Settings\busterp\Desktop\ENCINAL\EN1199\EN1199_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 21-Oct-10 13:42, busterp

EN1201

File: C:\Documents and Settings\busterp\Desktop\ENCINAL\EN1201\EN1201_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 21-Oct-10 14:17, busterp

EN1207

Legend

EN1207

Results

- 0 - 11577

N

0 20 40

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - EN1207
ASSESSMENT DATE: 5/13/2010
ENCINAL, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
AUG 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\ENCINAL\EN1207\EN1207_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 28-Aug-10 07:35, STARTGIS

EN1208

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\ENCINAL\EN1208\EN1208_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 17-Aug-10 11:50, STARTGIS

EN1210

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\ENCINAL\EN1210\EN1210_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 28-Aug-10 07:55, STARTGIS

EN1211

Legend

EN1211

Results

- 0 - 10643

N

0 20 40

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

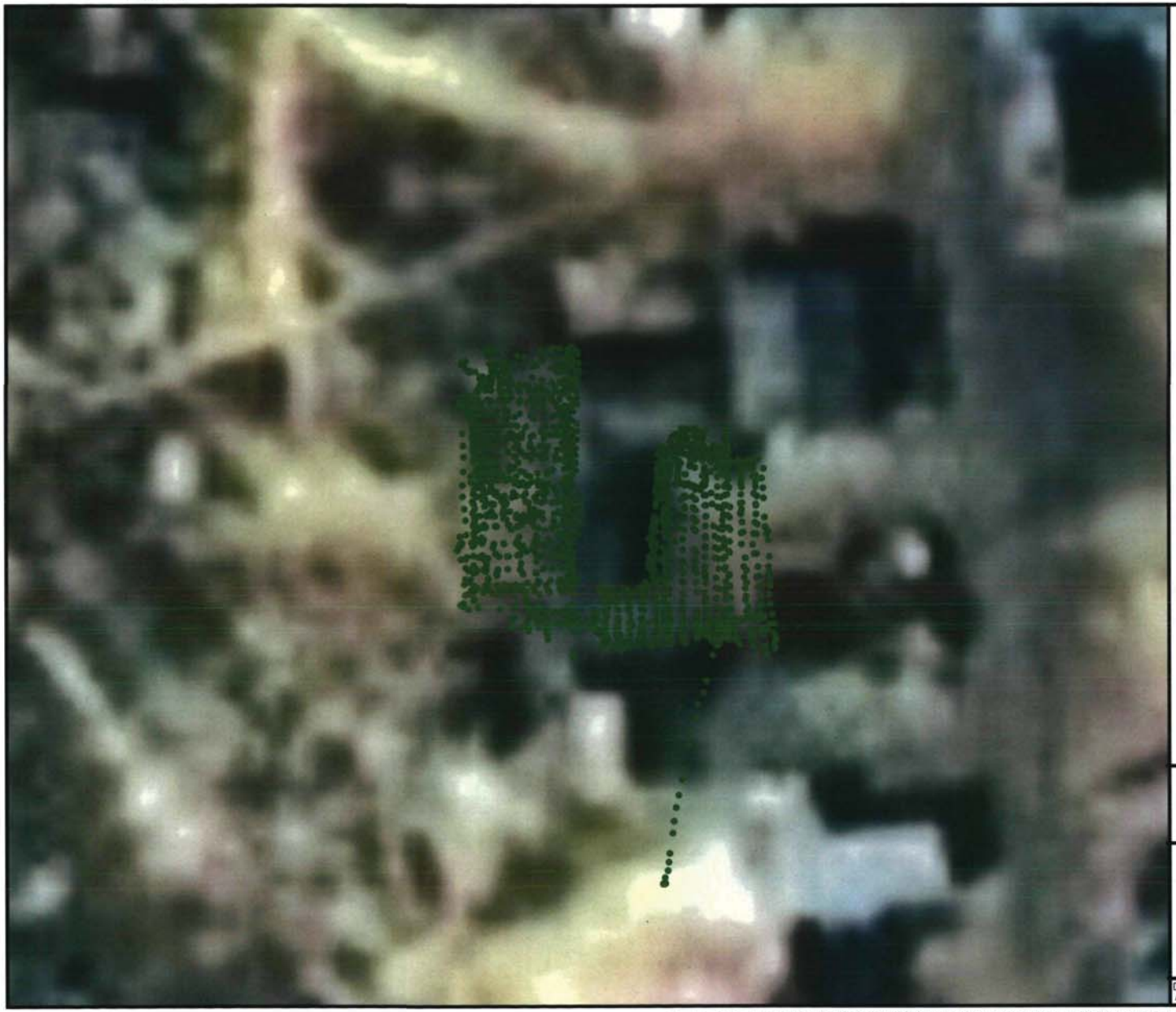
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - EN1211
ASSESSMENT DATE: 5/20/2010
ENCINAL, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
AUG 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\ENCINAL\EN1211\EN1211_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 28-Aug-10 08:03, STARTGIS

EN1212



Legend

Results

- 0 - 10972

N

0 20 40

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

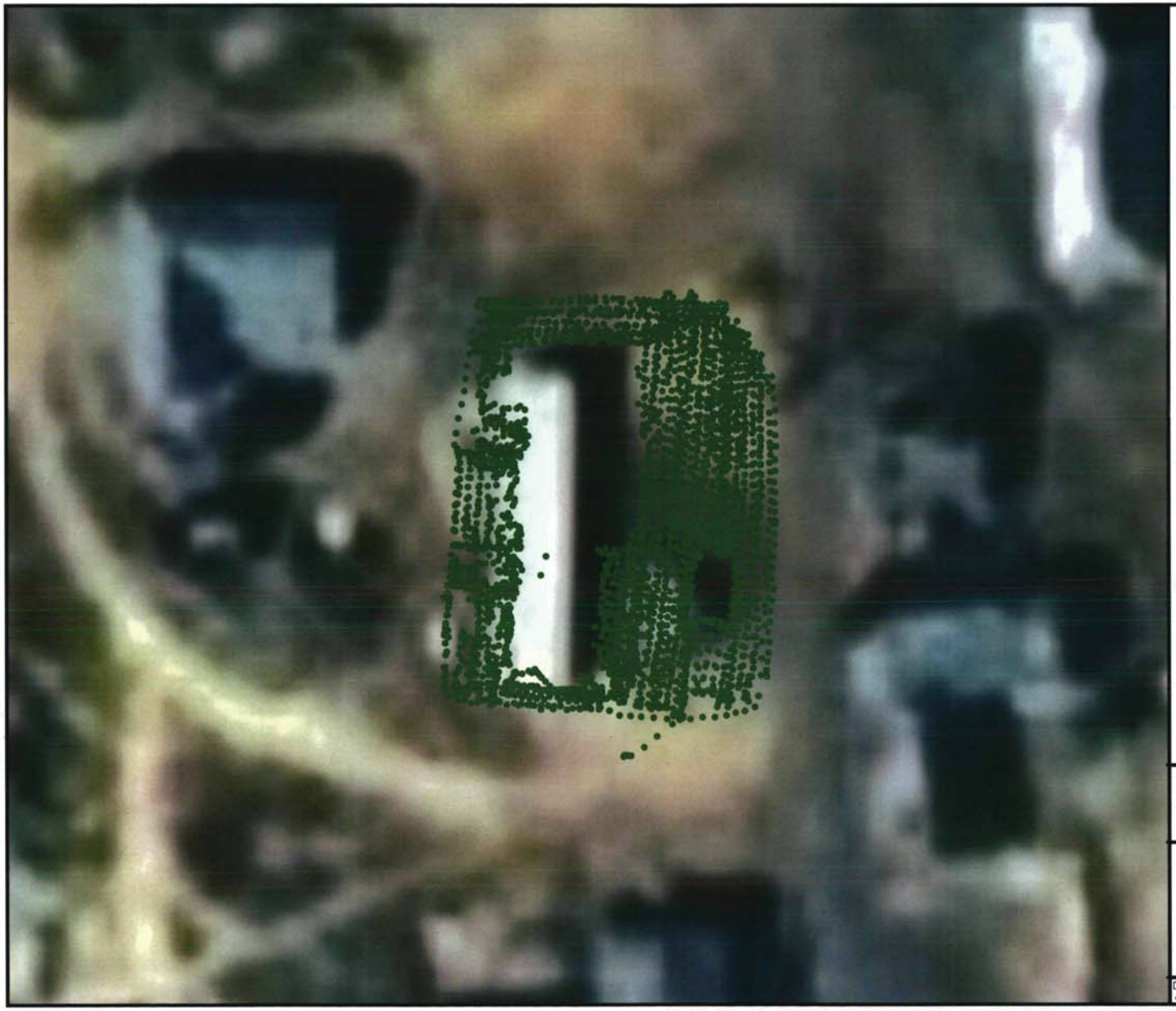
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - EN1212
ASSESSMENT DATE: 5/20/2010
ENCINAL, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
AUG 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\ENCINAL\EN1212\EN1212_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 28-Aug-10 08:10, STARTGIS

EN1214



Legend

EN1214

Results

• 0 - 11722

N

0 20 40

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - EN1214
ASSESSMENT DATE: 7/24/2010
ENCINAL, CIBOLA COUNTY,
NEW MEXICO

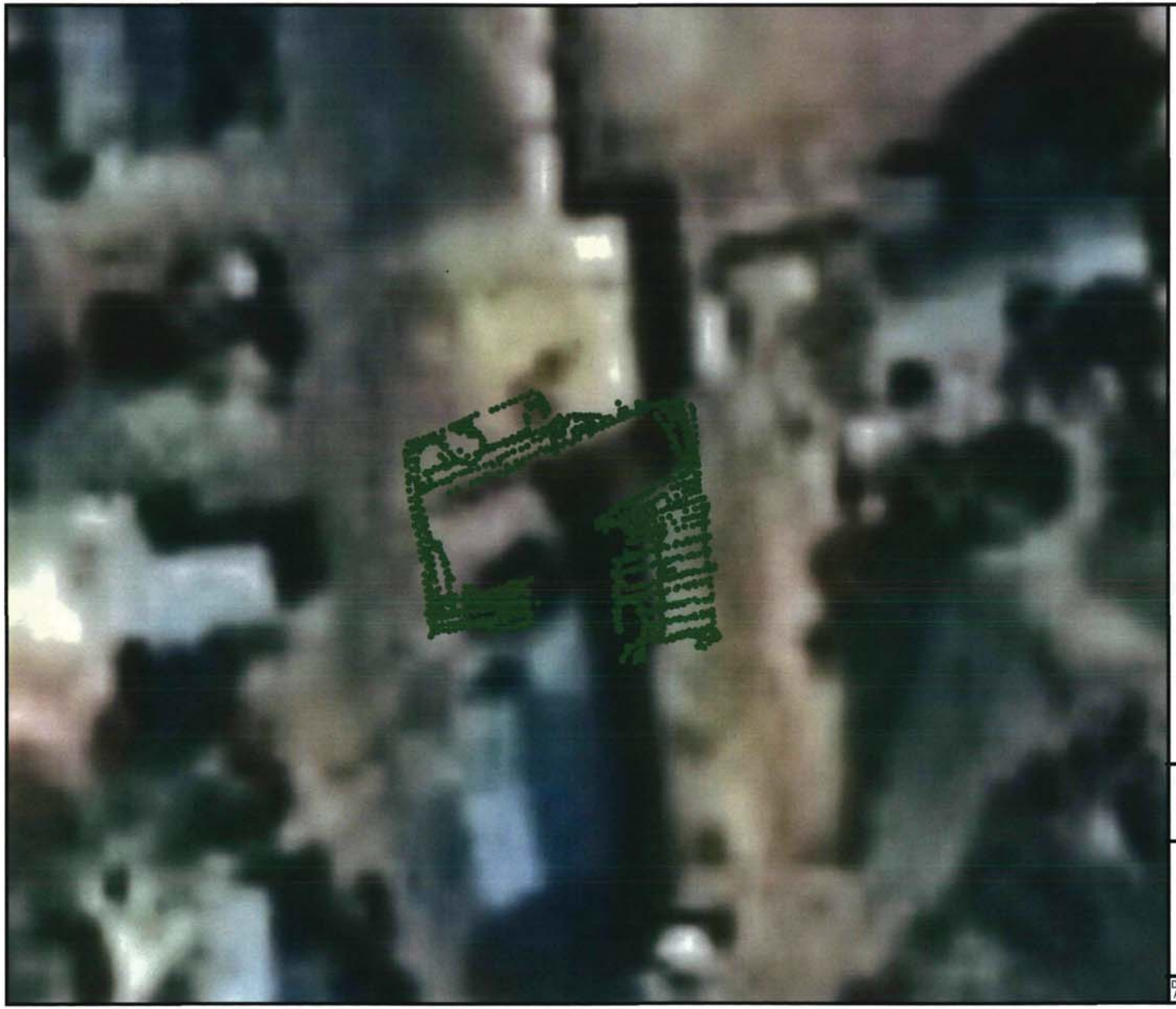
DATE	PROJECT NO	SCALE
AUG 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\ENCINAL\EN1214\EN1214_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 28-Aug-10 08:32, STARTGIS

EN1215

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\ENCINAL\EN1215\EN1215_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 28-Aug-10 08:43, STARTGIS

EN1381



Legend

EN1381

Results

- 0 - 11655

N

0 20 40

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - EN1381
ASSESSMENT DATE: 5/21/2010
ENCINAL, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
AUG 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\ENCINAL\EN1381\EN1381_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 28-Aug-10 08:52, STARTGIS

EN1454

Legend

EN1454

Results

- 0 - 11820

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

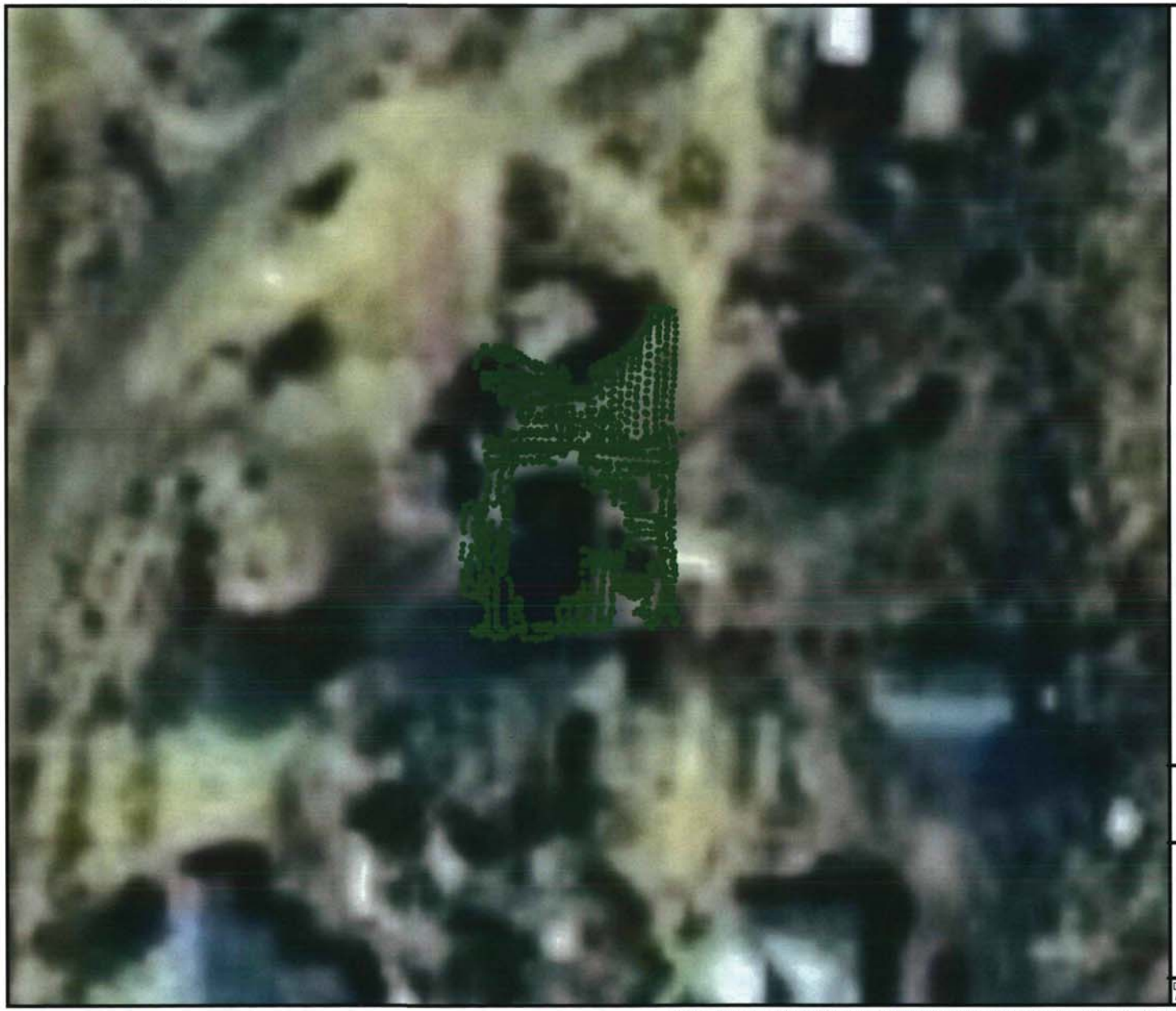
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - EN1454
ASSESSMENT DATE: 5/24/2010
ENCINAL, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
AUG 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\ENCINAL\EN1454\EN1454_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 28-Aug-10 09:01, STARTGIS

EN1559



Legend

EN1559

Results

- 0 - 11598

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

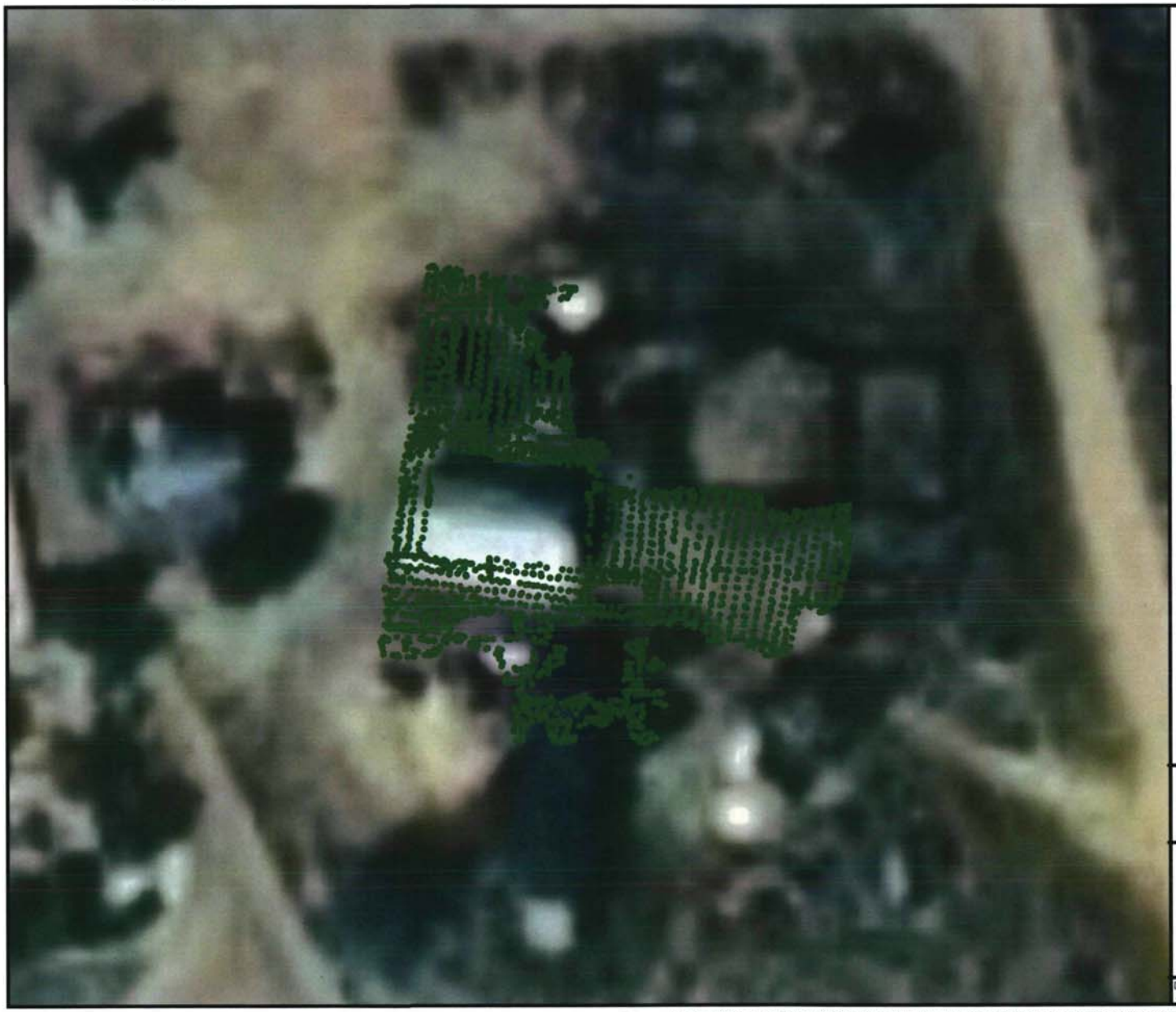
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - EN1559
ASSESSMENT DATE: 5/22/2010
ENCINAL, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
AUG 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\ENCINAL\EN1559\EN1559_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 28-Aug-10 11:29, STARTGIS

EN1571



Legend

EN1571

Results

- 0 - 10737

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - EN1571
ASSESSMENT DATE: 5/19/2010
ENCINAL, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
AUG 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\ENCINAL\EN1571\EN1571_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 28-Aug-10 11:35, STARTGIS

APPENDIX B

PART 2

Laguna RAT Maps

LG0001

File: C:\Users\bondp\Desktop\LAGUNA\LG0001\LG0001_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 02-Nov-10 07:56, bondp

)002

Legend

LG0002

Results

• 0 - 10890

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

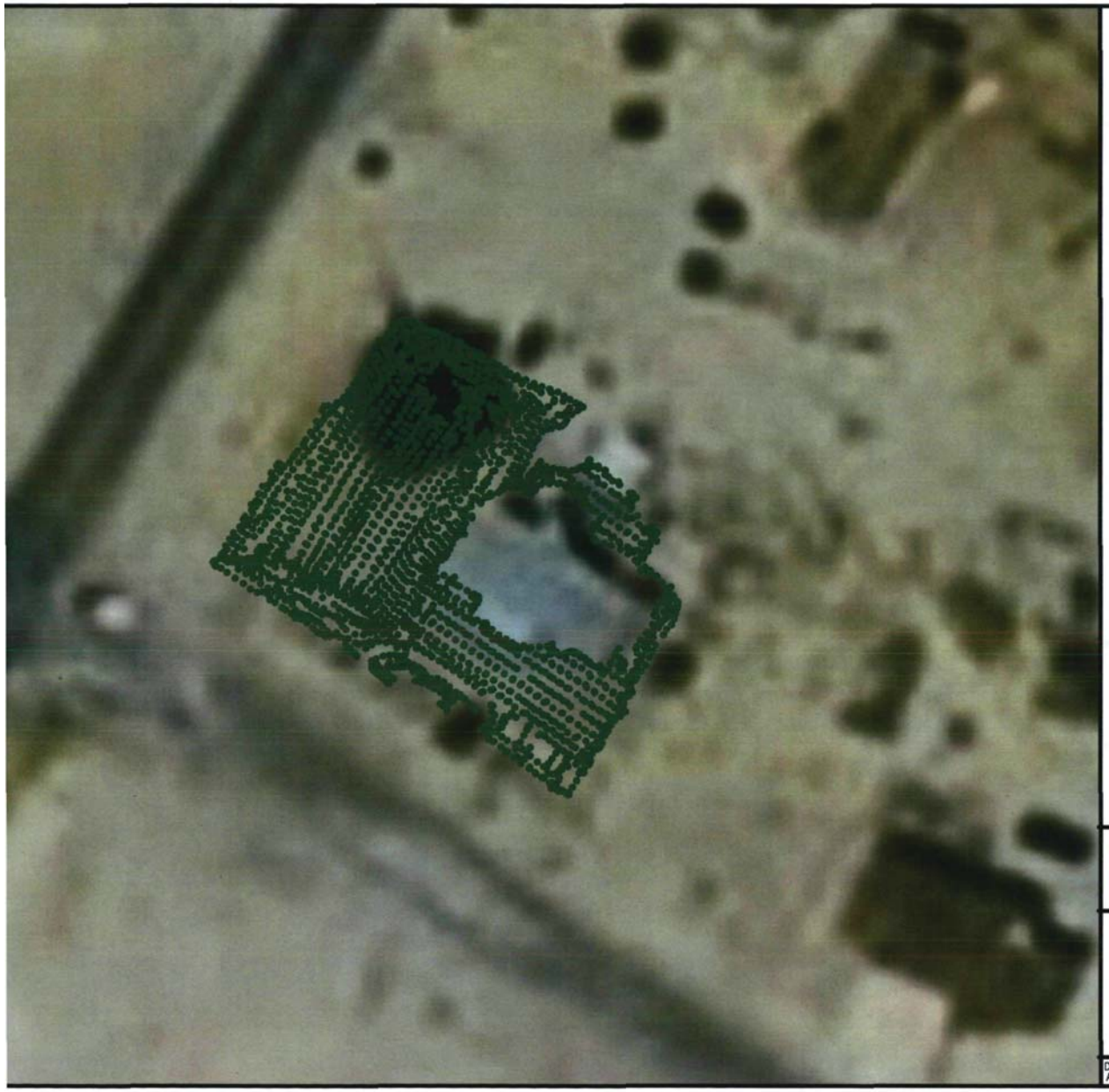
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG0002
ASSESSMENT DATE: 7/8/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
AUG 2010	20406.012.005.0538.01	AS SHOWN

File: C:\Users\bondp\Desktop\LAGUNA\LG0002\LG0002_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 02-Nov-10 13:56, bondp

)003



Legend

LG0003

Results

- 0 - 10546

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG0003
ASSESSMENT DATE: 8/2/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
AUG 2010	20406.012.005.0538.01	AS SHOWN

File: C:\Users\bondp\Desktop\LAGUNA\LG0003\LG0003_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 02-Nov-10 14:28, bondp

)004

Legend

LG0004

Results

- 0 - 10301

0 20 40

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG0004
ASSESSMENT DATE: 7/10/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
AUG 2010	20406.012.005.0538.01	AS SHOWN

File: C:\Users\bondp\Desktop\LAGUNA\LG0004\LG0004_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 02-Nov-10 15:49, bondp

LG0010

Legend

LG0010

Results

- 0 - 8452

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

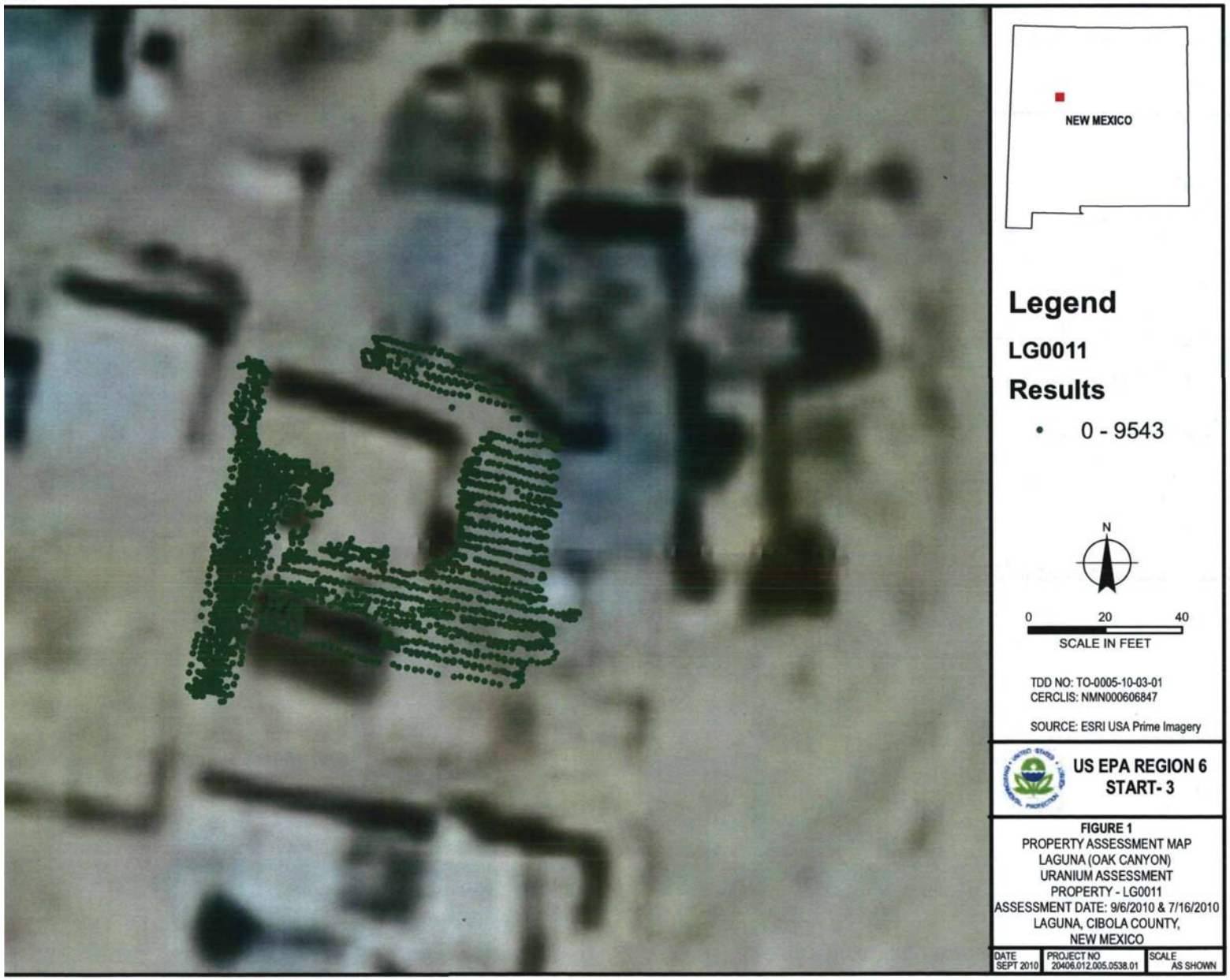
SOURCE: ESRI USA Prime Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG0010
ASSESSMENT DATE: 7/15/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
AUG 2010	20406.012.005.0538.01	AS SHOWN

File: C:\Users\bondp\Desktop\LAGUNA\LG0010\LG0010_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 03-Nov-10 14:17, bondp



File: C:\Users\bondp\Desktop\LAGUNA\LG0011\LG0011_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 03-Nov-10 15:13, bondp

Legend

LG0012

Results

- 0 - 10890
- 10891 - 11891

N

0 20 40

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG0012
ASSESSMENT DATE: 7/21/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
AUG 2010	20406.012.005.0538.01	AS SHOWN

File: C:\Users\bondp\Desktop\LAGUNA\LG0012\LG0012_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 03-Nov-10 15:38, bondp

)017

Legend

LG0017

- 0 - 8640

0 30 60

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

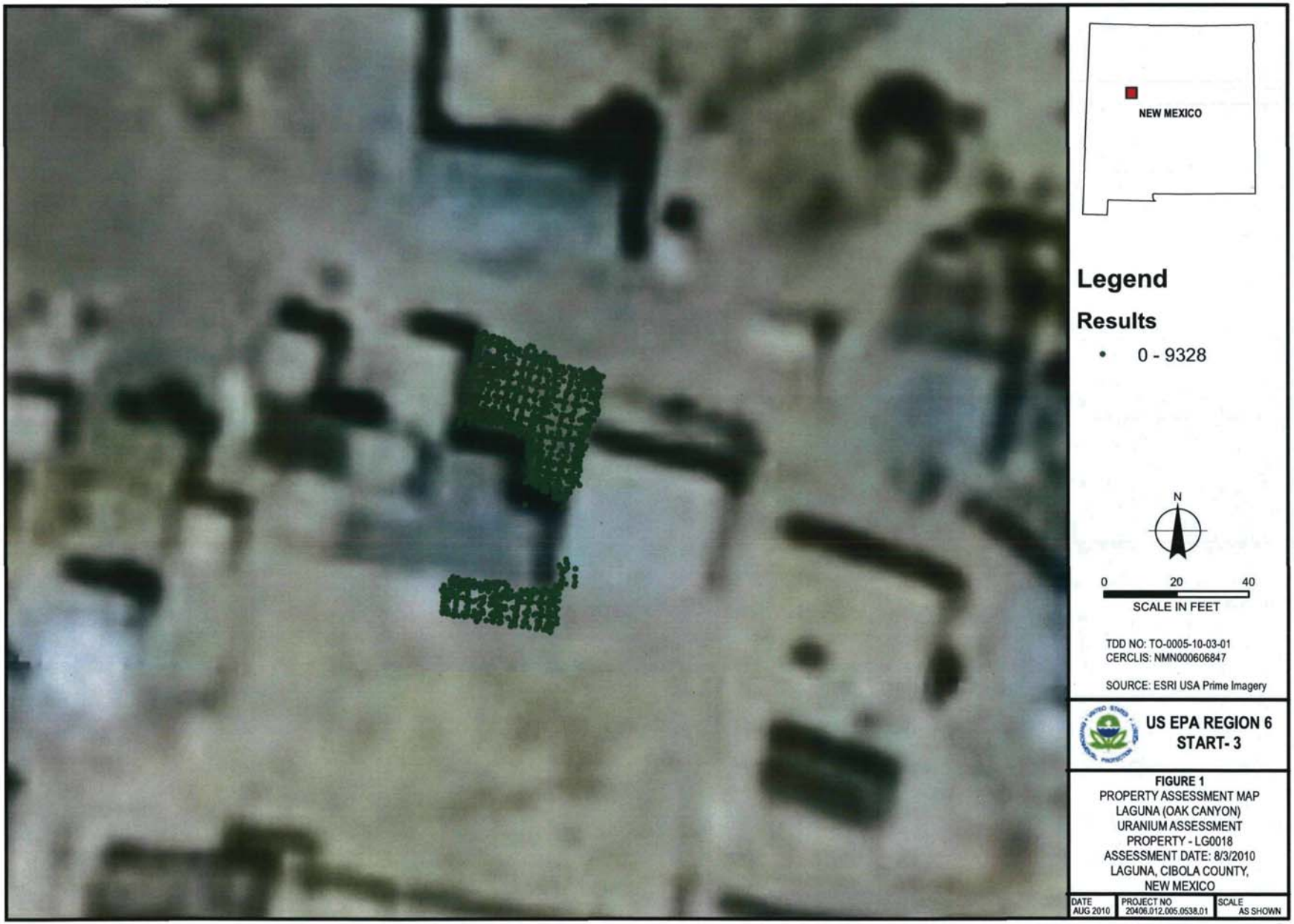
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG0017
ASSESSMENT DATE: 7/22/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: C:\Users\bondp\Desktop\LAGUNA\LG0017 (Catholic Center)\LG0017_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd 12/1/2010 11:44:54 AM bondp

LG0018



File: C:\Users\bondp\Desktop\LAGUNA\LG0018\LG0018_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd 12/1/2010 11:49:24 AM bondp

)020

Legend

LG0020

Results

- 0 - 10042

0 20 40

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG0020
ASSESSMENT DATE: 7/30/2010 & 9/6/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: C:\Users\bondp\Desktop\LAGUNA\LG0020\LG0020_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd 12/1/2010 12:12:29 PM bondp

LG0024

Legend

LG0024

Results

- 0 - 10890
- 10891 - 11891

0 20 40

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG0024
ASSESSMENT DATE: 7/21/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: C:\Users\bondp\Desktop\LAGUNA\LG0024\LG0024_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd 12/1/2010 12:22:50 PM bondp

)026

Legend

LG0026

Results

- 0 - 10308

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG0026
ASSESSMENT DATE: 8/12/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
AUG 2010	20406.012.005.0538.01	AS SHOWN

File: C:\Users\bondp\Desktop\LAGUNA\LG0026\LG0026_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd 12/1/2010 12:38:47 PM bondp

)429

Legend

LG0429

Results

- 0 - 10890
- 10891 - 11891
- 11903

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

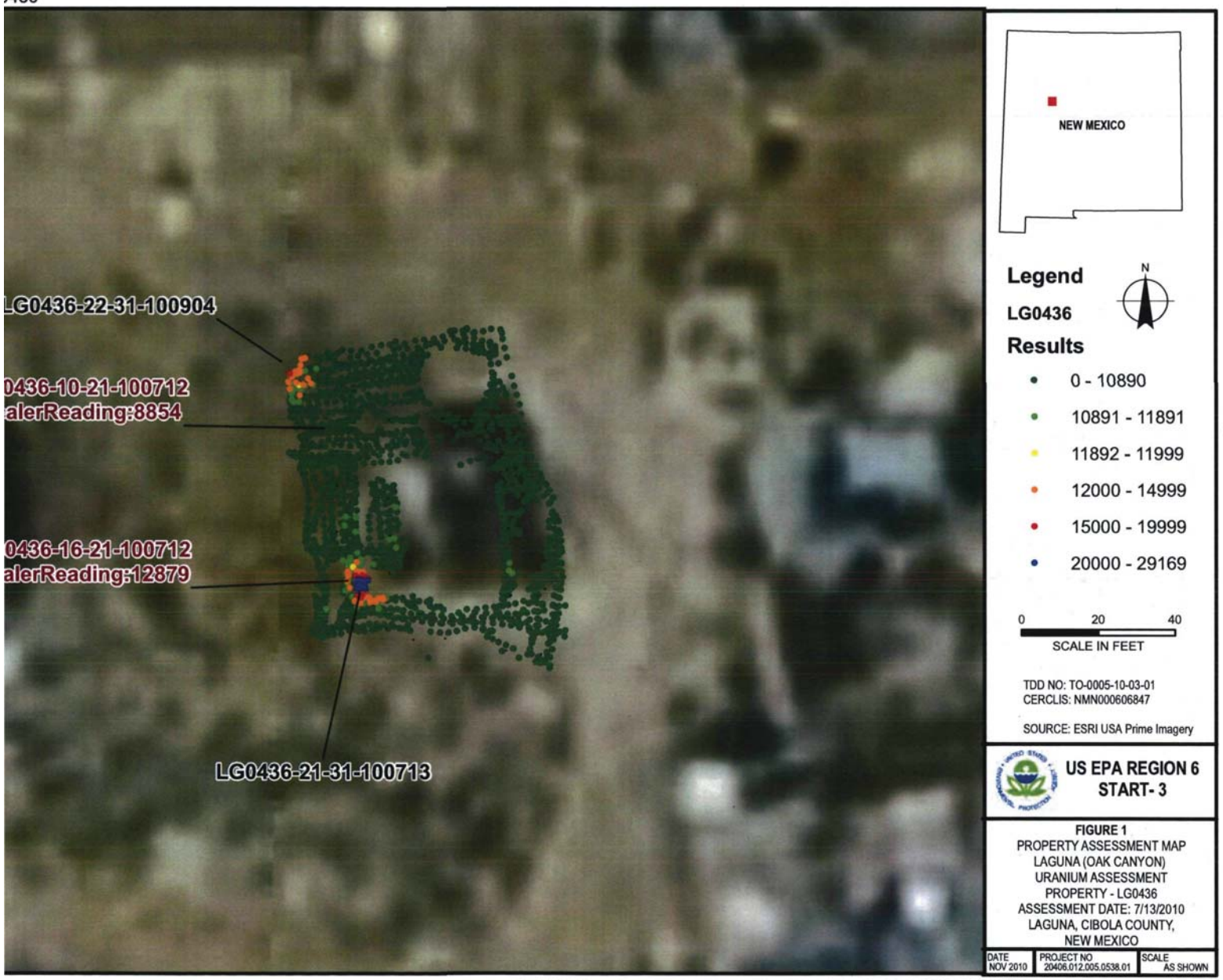
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG0429
ASSESSMENT DATE: 7/16/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: C:\Users\bondp\Desktop\LAGUNA\LG0429\LG0429_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd 12/2/2010 12:17:20 PM bondp

)436



File: \\FSNM01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG0436\LG0436_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 09-Nov-10 16:32, bondp

437

Legend

LG0437

Results

- 0 - 10890
- 10891 - 11891
- 11892 - 11999
- 12000 - 12634

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG0437
ASSESSMENT DATE: 7/12/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
AUG 2010	20406.012.005.0538.01	AS SHOWN

File: C:\Users\bondp\Desktop\LAGUNA\LG0437\LG0437_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd 12/2/2010 1:25:53 PM bondp

0438

Legend

LG0438

Results

- 0 - 10890
- 10891 - 11891

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

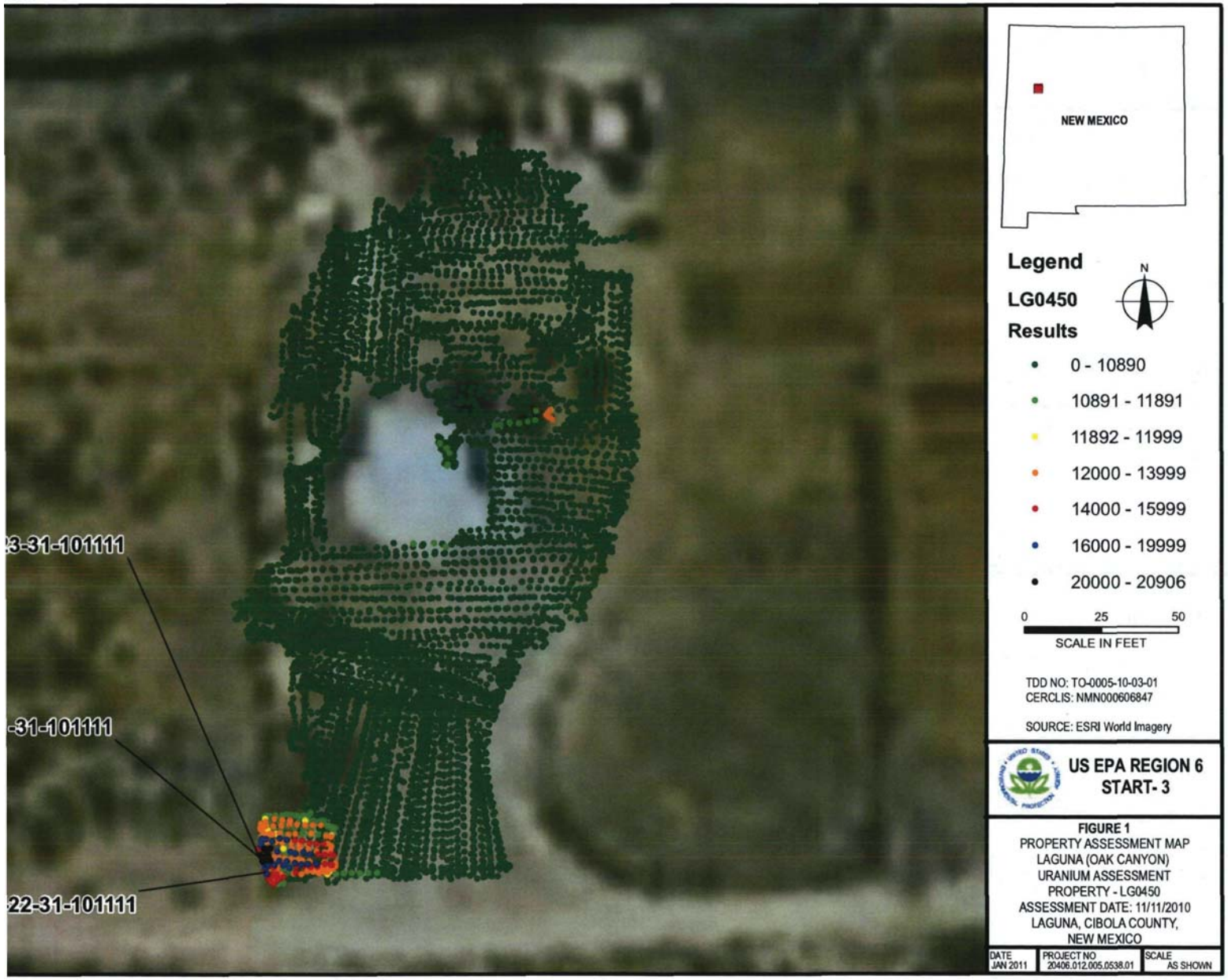
SOURCE: ESRI USA Prime Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG0438
ASSESSMENT DATE: 7/27/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

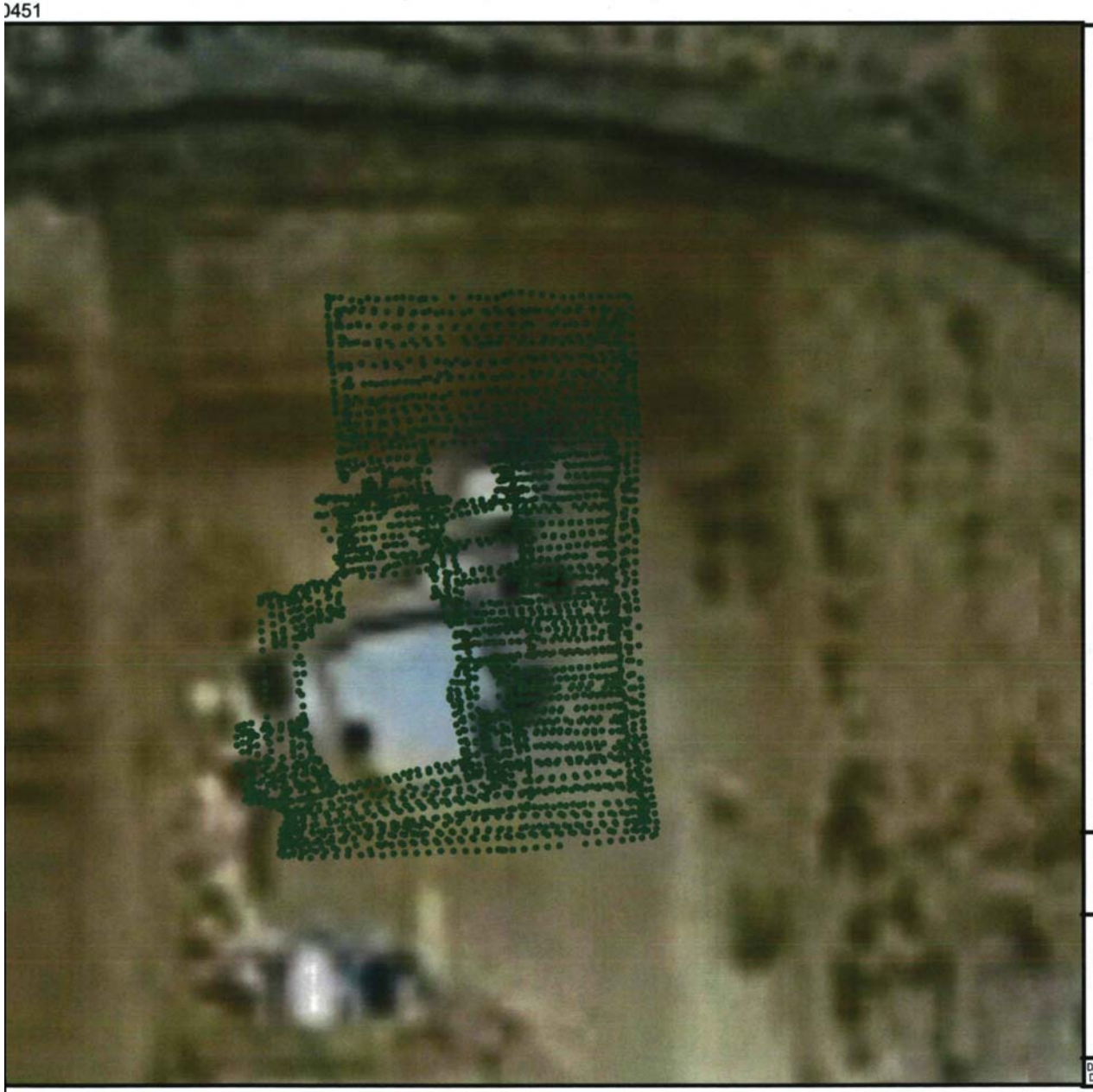
DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: C:\Users\bondp\Desktop\LAGUNA\LG0438\LG0438_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd 12/2/2010 1:51:29 PM bondp



File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG0450\LG0450_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 28-Jan-11 15:12, STARTGIS

)451



Legend

LG0451

Results

- 0 - 10787

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

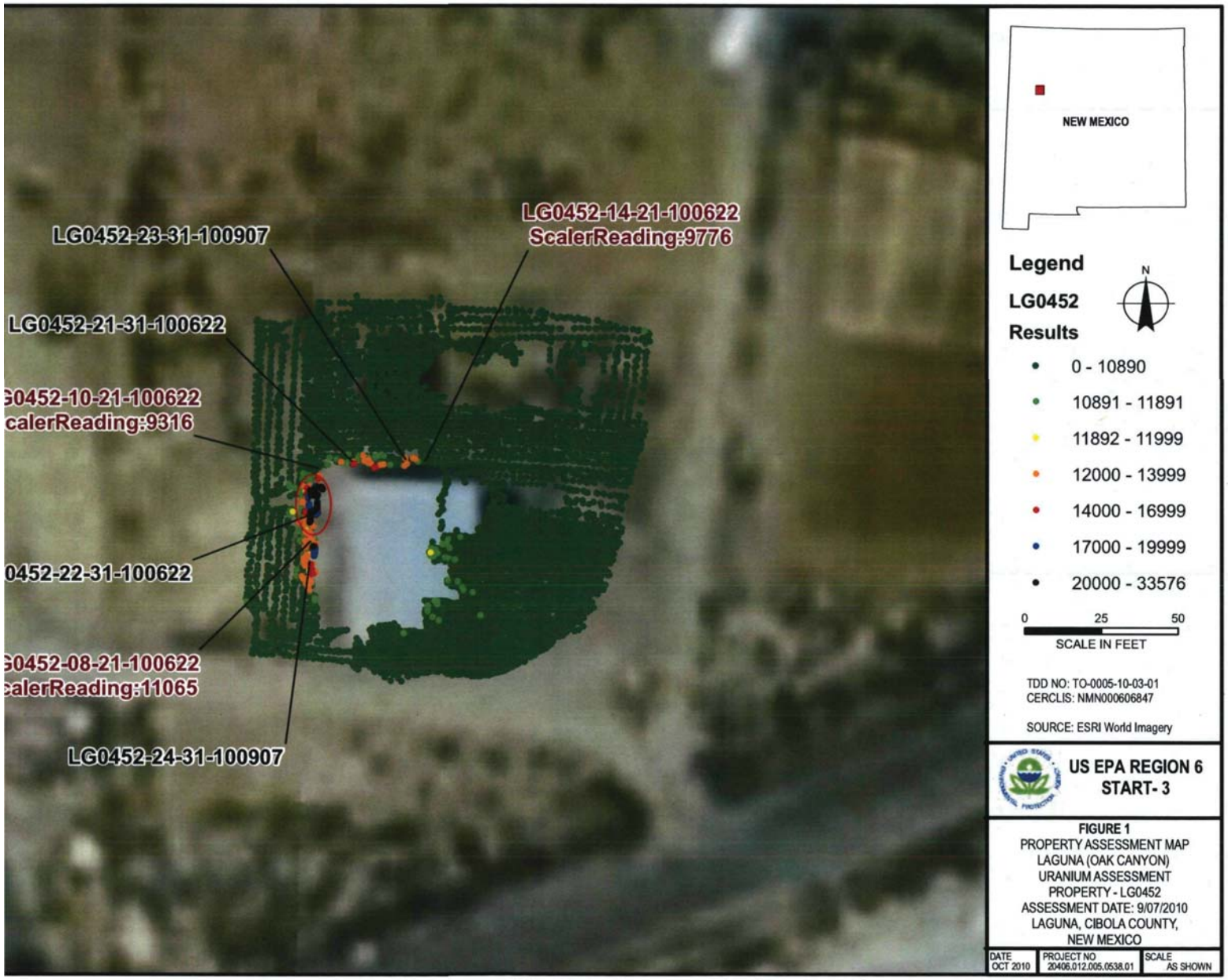
SOURCE: ESRI USA Prime Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG0451
ASSESSMENT DATE: 7/30/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

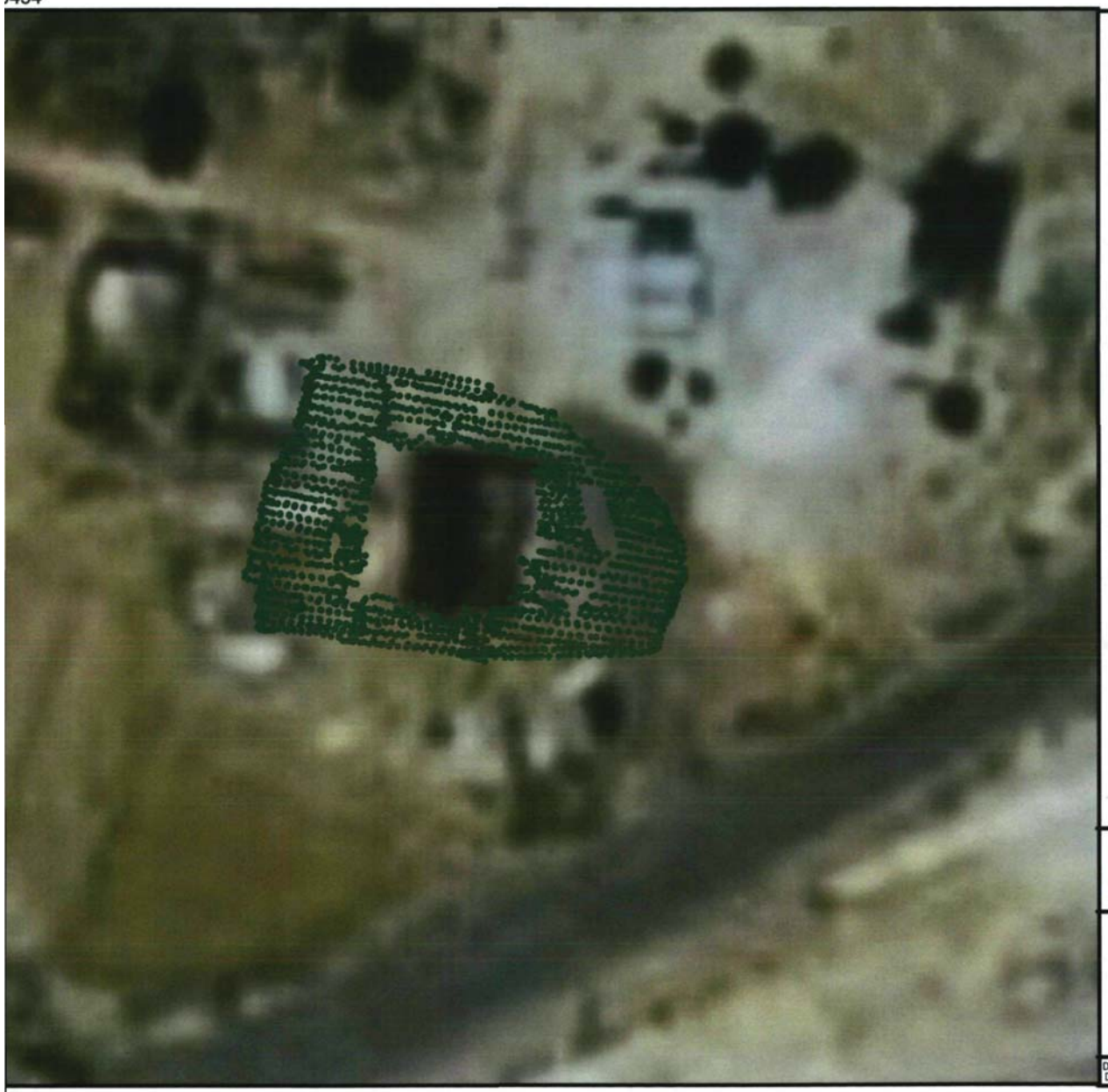
DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: C:\Users\bondp\Desktop\LAGUNA\LG0451\LG0451_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd 12/3/2010 10:39:58 AM bondp



File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG0452\LG0452_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 27-Oct-10 13:59, STARTGIS

)454



Legend

LG0454

Results

- 0 - 10289

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

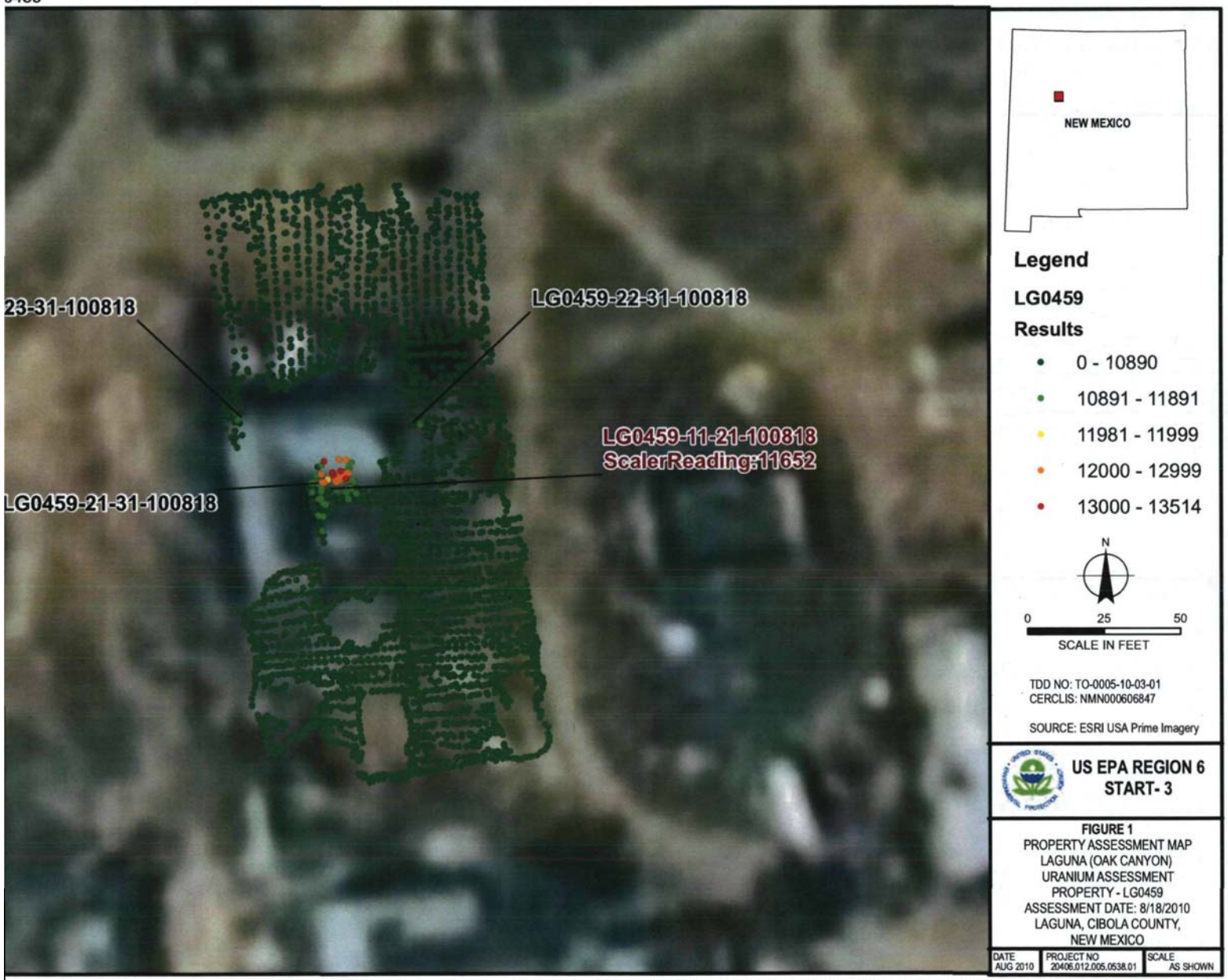
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG0454
ASSESSMENT DATE: 8/6/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

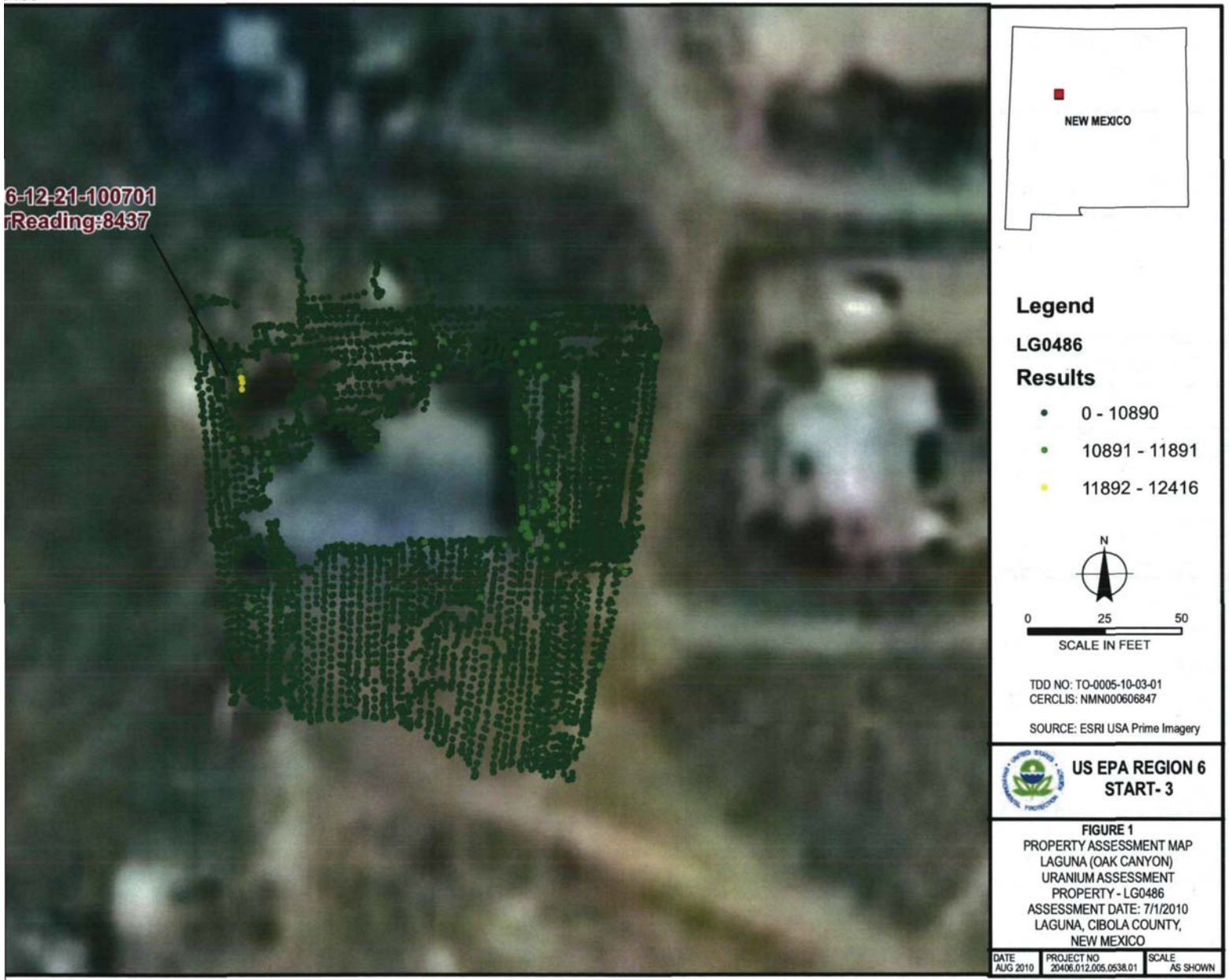
DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: C:\Users\bondp\Desktop\LAGUNA\LG0454\LG0454_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd 12/4/2010 1:47:44 PM bondp

0459

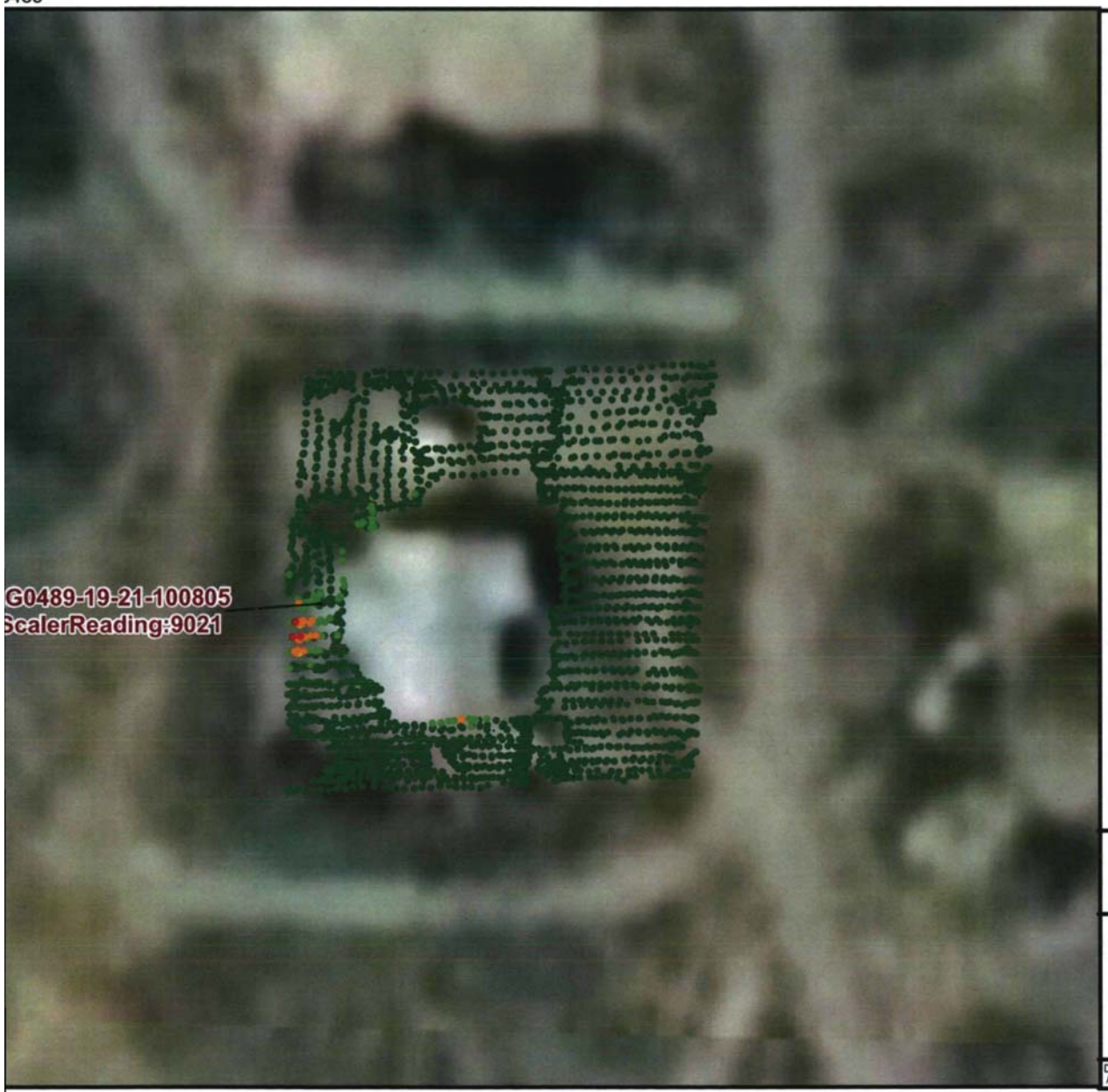


File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG0459\LG0459_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 31-Aug-10 15:48, STARTGIS



File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG0486\LG0486_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 31-Aug-10 16:33, STARTGIS

)489



Legend

LG0489

Results

- 0 - 10890
- 10891 - 11891
- 11892 - 11999
- 12000 - 12999
- 13000 - 13179

N

0 20 40

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG0489
ASSESSMENT DATE: 8/6/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

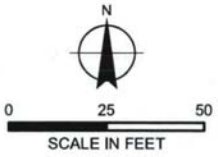
DATE	PROJECT NO	SCALE
AUG 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG0489\LG0489_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 31-Aug-10 17:46, STARTGIS

Legend

RESULTS

- 0 - 10125



TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG0612
ASSESSMENT DATE: 9/30/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: C:\Users\bondp\Desktop\LAGUNA\LG0612\LG0612_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd 12/4/2010 2:42:56 PM bondp

LG0619

Legend

LG0619

Results

- 0 - 10869

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG0619
ASSESSMENT DATE: 8/13/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG0619\LG0619_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 01-Sep-10 08:30, STARTGIS

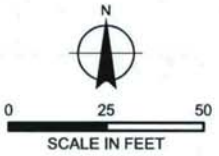
LG0620

Legend

LG0620

Results

- 0 - 9390



TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG0620
ASSESSMENT DATE: 7/8/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: C:\Users\bondp\Desktop\LAGUNA\LG0620\LG0620_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd 12/4/2010 3:17:11 PM bondp

LG0626

Legend

LG0626

Results

- 0 - 9918

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG0626
ASSESSMENT DATE: 8/11/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: C:\Users\bondp\Desktop\LAGUNA\LG0626\LG0626_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd 12/4/2010 3:34:01 PM bondp

LG0627

File: C:\Users\bondp\Desktop\LAGUNA\LG0627\LG0627_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd 12/4/2010 5:11:33 PM bondp

)628

Legend

LG0628

Results

- 0 - 10890
- 10891 - 11891
- 11892 - 11999
- 12000 - 12999
- 13029

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

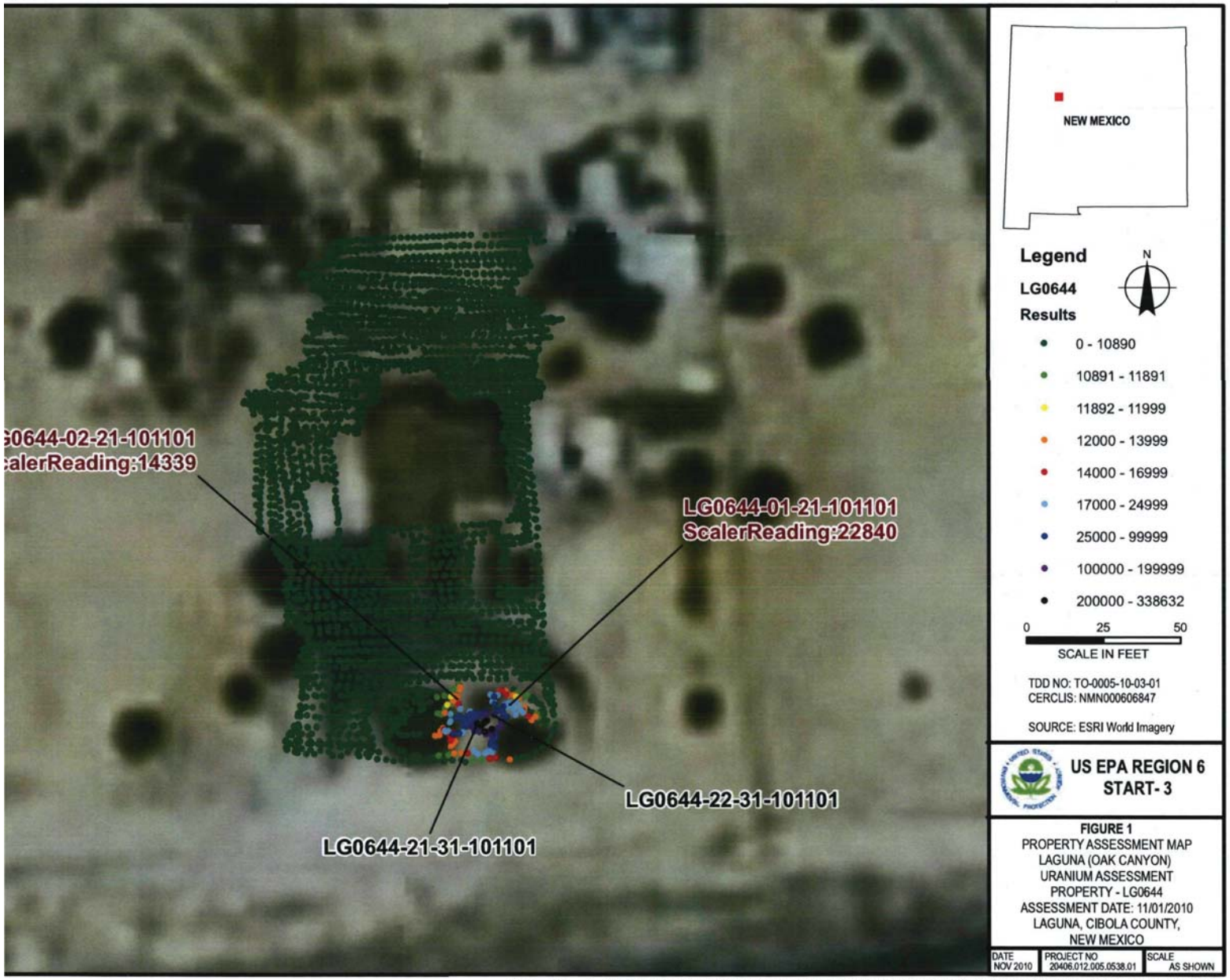
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG0628
ASSESSMENT DATE: 7/23/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

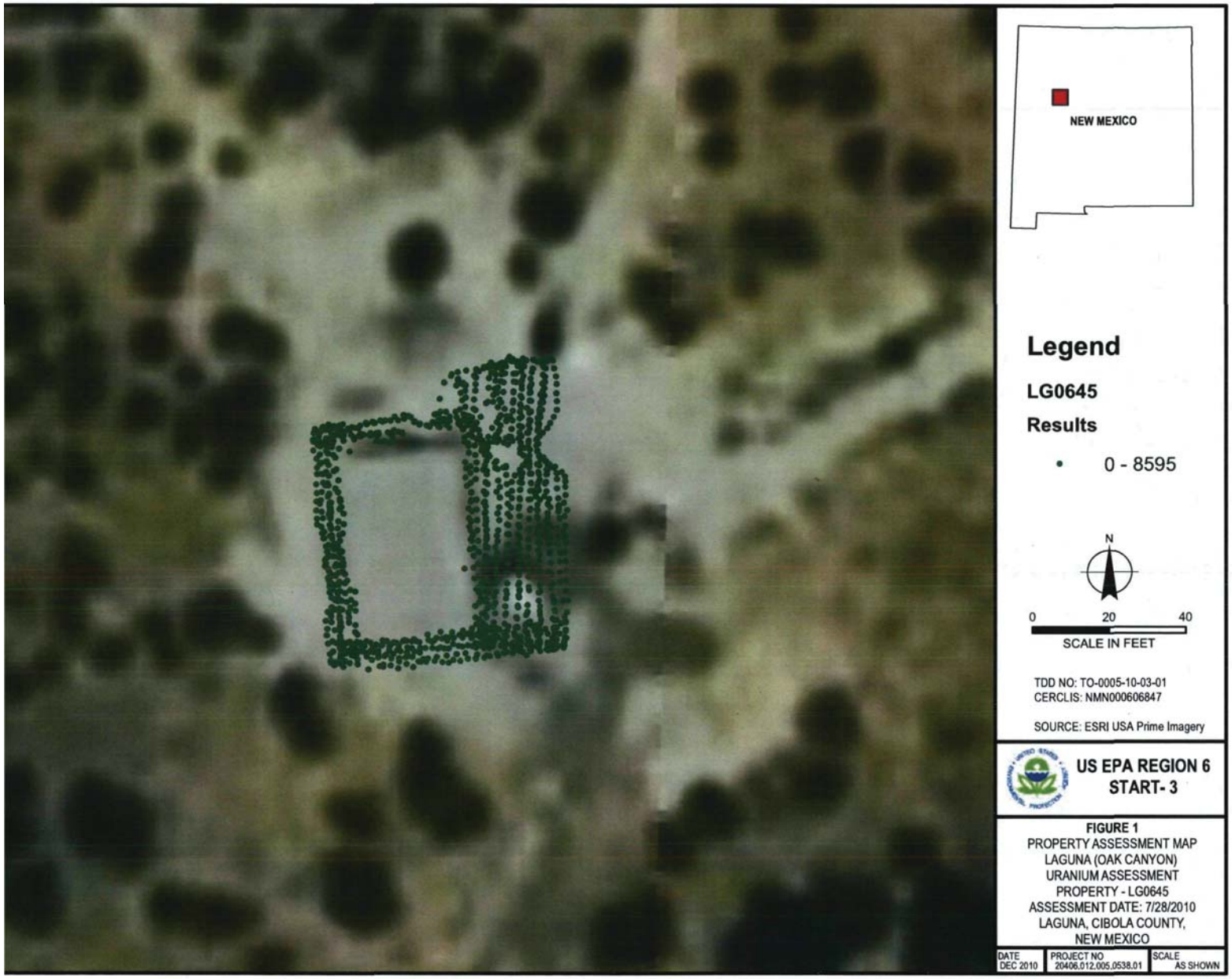
DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: C:\Users\bondp\Desktop\LAGUNA\LG0628\LG0628_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd 12/4/2010 6:40:09 PM bondp

)644



File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG0644\LG0644_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 15-Dec-10 16:16, STARTGIS



File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG0645\LG0645_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 01-Sep-10 09:50, STARTGIS

)655

Legend

LG0655

Results

- 0 - 9692

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG0655
ASSESSMENT DATE: 8/10/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: C:\Users\bondp\Desktop\LAGUNA\LG0655\LG0655_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd 12/5/2010 12:40:28 PM bondp

LG0694

Legend

LG0694

Results

- 0 - 9101

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG0694
ASSESSMENT DATE: 8/10/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG0694\LG0694_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 01-Sep-10 10:12, STARTGIS

LG1228

Legend

LG1228

Results

- 0 - 6656

N

0 20 40

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG1228
ASSESSMENT DATE: 7/20/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: C:\Users\bondp\Desktop\LAGUNA\LG1228\LG1228_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd 12/6/2010 11:02:25 AM bondp

LG1229

Legend

LG1229

Results

- 0 - 7216

N

0 20 40

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

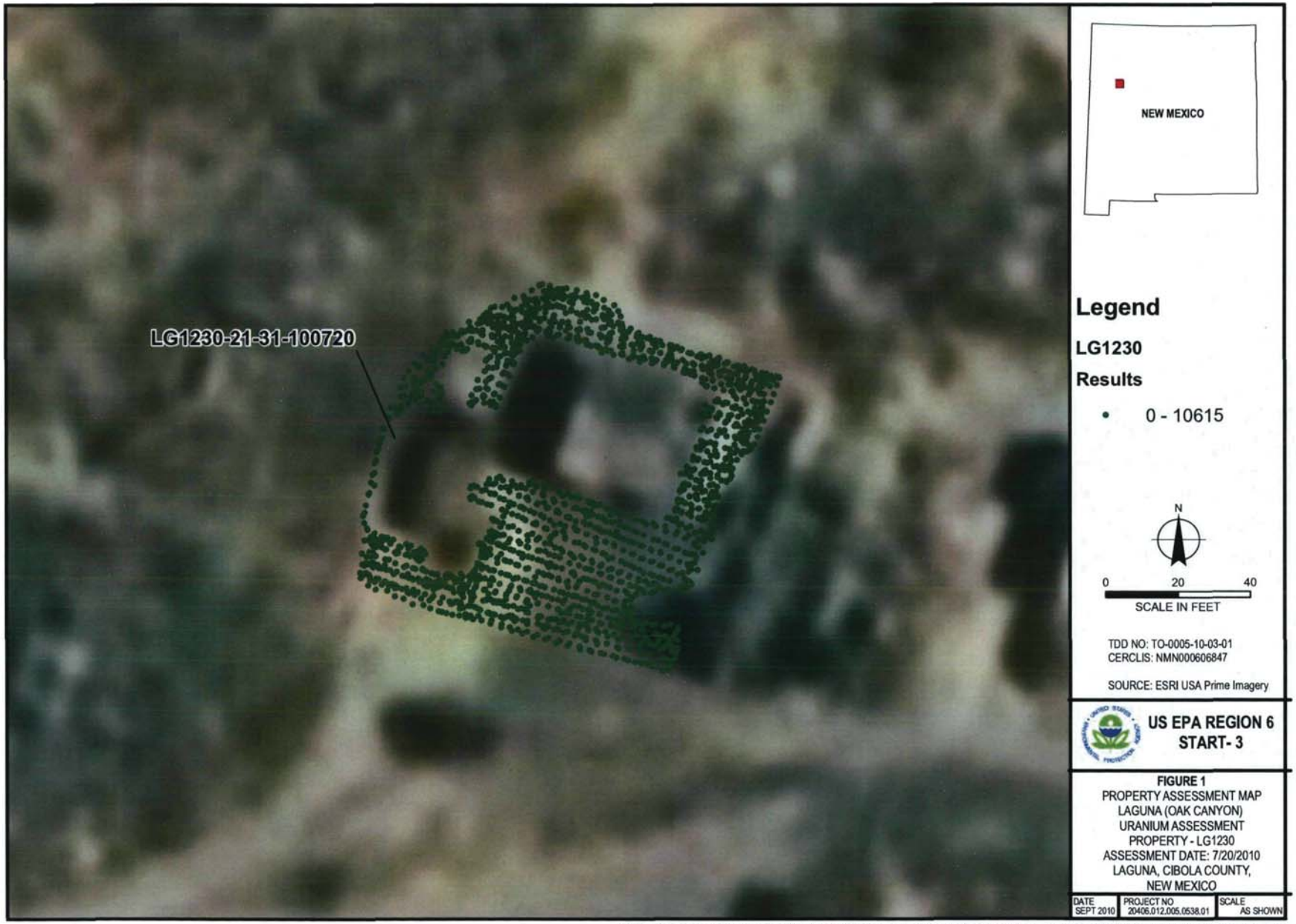
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG1229
ASSESSMENT DATE: 7/20/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: C:\Users\bondp\Desktop\LAGUNA\LG1229\LG1229_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd 12/6/2010 11:13:51 AM bondp

LG1230

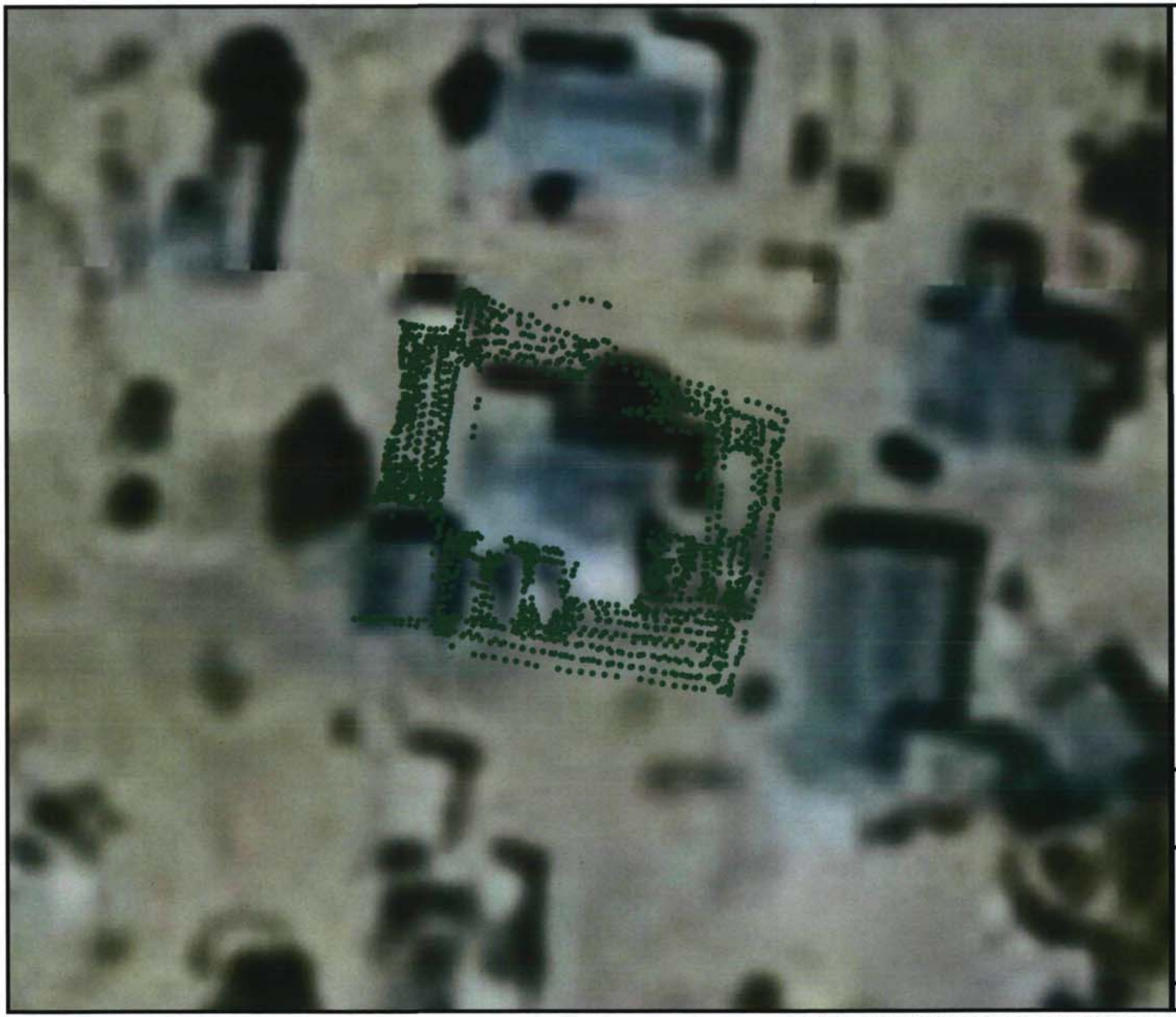


File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG1230\LG1230_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 01-Oct-10 16:57, STARTGIS

LG1230

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG1230\LG1230_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP2.mxd, 03-Nov-10 13:56, STARTGIS

LG1233



Legend

LG1233

Results

- 0 - 10553

N

0 20 40

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG1233
ASSESSMENT DATE: 7/14/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: C:\Users\bondp\Desktop\LAGUNA\LG1233\LG1233_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd 12/6/2010 12:58:38 PM bondp

LG1235

Legend

LG1235

Results

- 0 - 8515

N

0 20 40

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG1235
ASSESSMENT DATE: 8/17/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: C:\Users\bondp\Desktop\LAGUNA\LG1235\LG1235_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd 12/6/2010 1:12:47 PM bondp

LG1236

Legend

LG1236

Results

- 0 - 8120

N

0 20 40

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG1236
ASSESSMENT DATE: 7/19/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: C:\Users\bondp\Desktop\LAGUNA\LG1236\LG1236_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd 12/6/2010 1:22:52 PM bondp

LG1240

Legend

LG1240

Results

- 0 - 10336

N

0 20 40

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

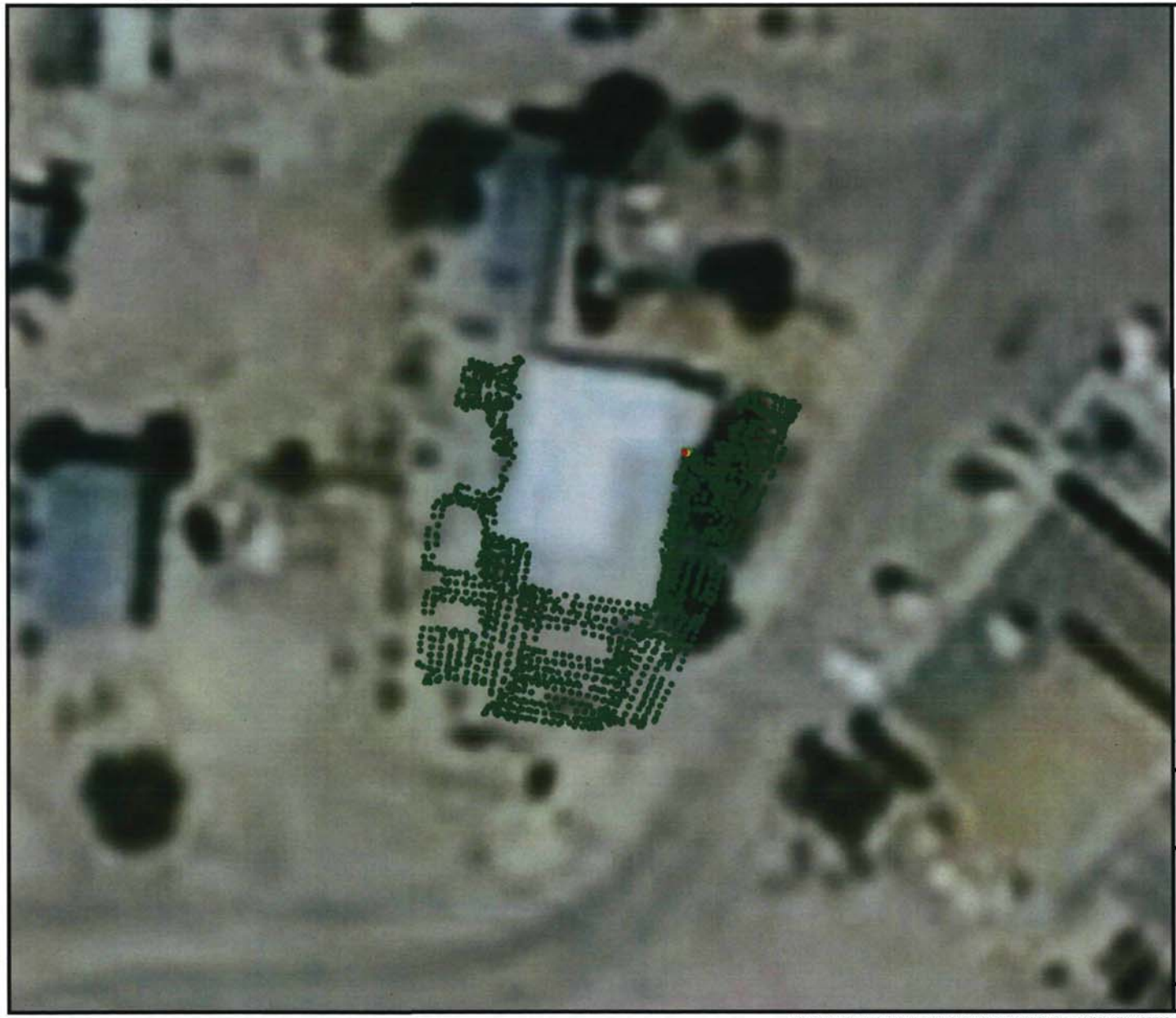
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG1240
ASSESSMENT DATE: 7/13/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: C:\Users\bondp\Desktop\LAGUNA\LG1240\LG1240_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd 12/6/2010 1:34:00 PM bondp

LG1243



Legend

LG1243

Results

- 0 - 10890
- 10891 - 11891
- 12321
- 13411
- 15740

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG1243
ASSESSMENT DATE: 7/14/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: C:\Users\bondp\Desktop\LAGUNA\LG1243\LG1243_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd 12/3/2010 11:14:44 AM bondp

LG1244

Legend

LG1244

Results

- 0 - 9673

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

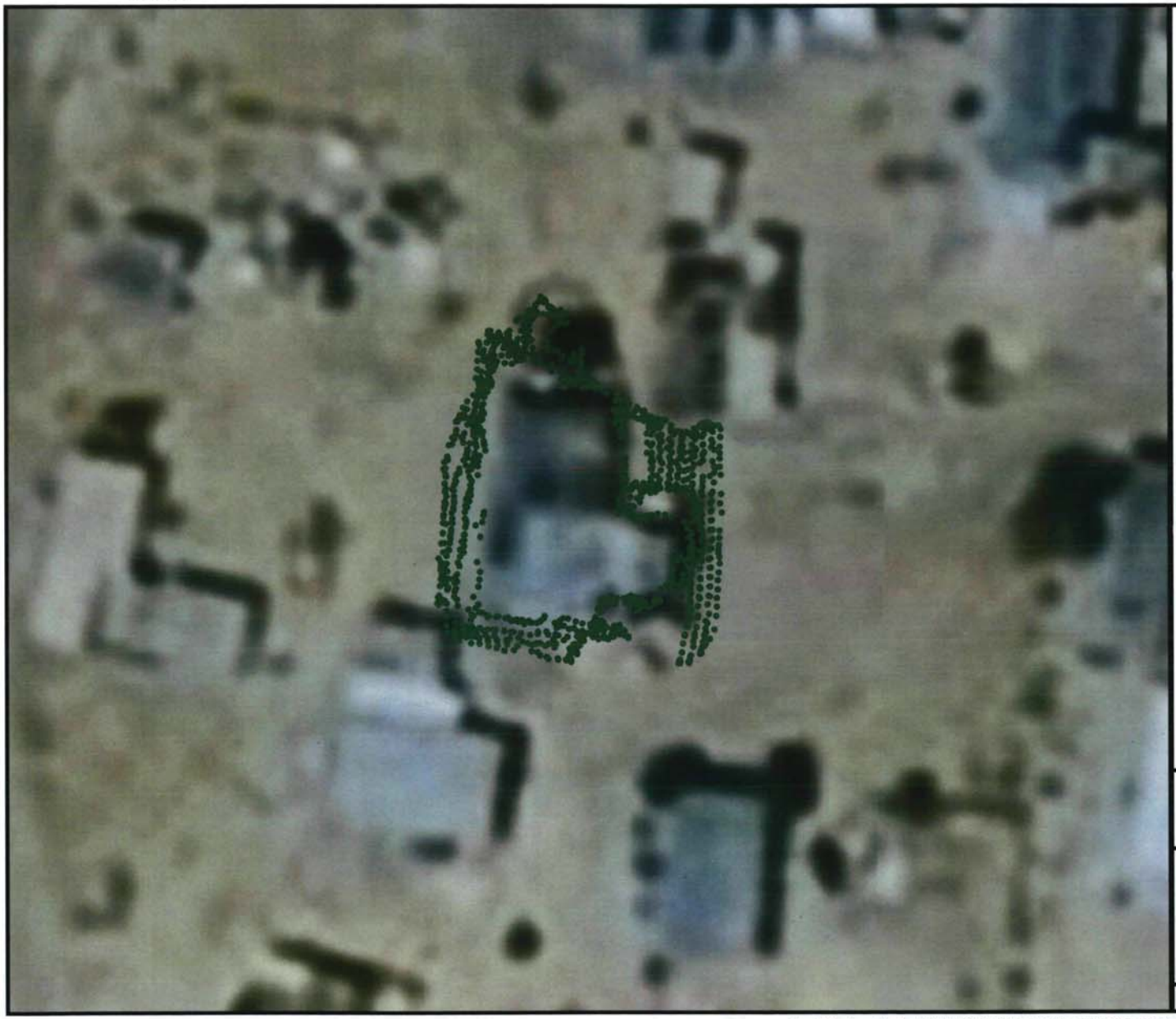
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG1244
ASSESSMENT DATE: 7/15/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: C:\Users\bondp\Desktop\LAGUNA\LG1244\LG1244_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd 12/6/2010 1:45:53 PM bondp

LG1245



Legend

LG1245

Results

- 0 - 8666

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

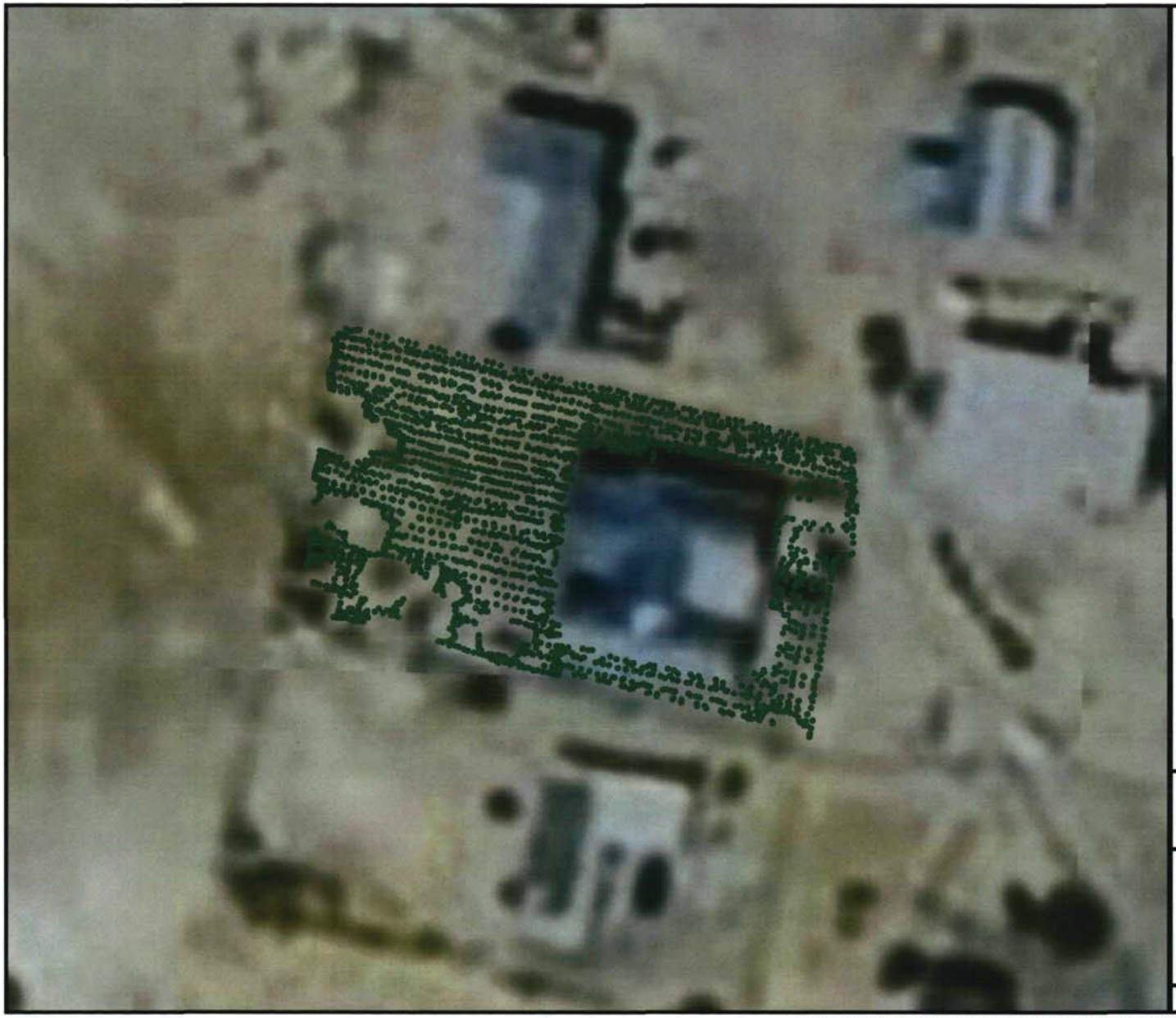
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG1245
ASSESSMENT DATE: 7/15/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: C:\Users\bondp\Desktop\LAGUNA\LG1245\LG1245_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd 12/6/2010 2:00:19 PM bondp

LG1248



Legend

LG1248

Results

- 0 - 8638

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG1248
ASSESSMENT DATE: 8/20/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: C:\Users\bondp\Desktop\LAGUNA\LG1248\LG1248_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd 12/6/2010 2:11:42 PM bondp

LG1250

Legend

LG1250

Results

- 0 - 9402

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG1250
ASSESSMENT DATE: 7/10/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: C:\Users\bondp\Desktop\LAGUNA\LG1250\LG1250_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd 12/6/2010 2:32:17 PM bondp

LG1251

Legend

LG1251

Results

- 0 - 10620

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG1251
ASSESSMENT DATE: 7/10/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: C:\Users\bondp\Desktop\LAGUNA\LG1251\LG1251_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd 12/6/2010 2:41:56 PM bondp

LG1253

Legend

LG1253

Results

- 0 - 9426

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG1253
ASSESSMENT DATE: 7/6/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: C:\Users\bondp\Desktop\LAGUNA\LG1253\LG1253_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd 12/6/2010 2:51:47 PM bondp

LG1254

Legend

LG1254

Results

- 0 - 10414

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG1254
ASSESSMENT DATE: 7/7/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: C:\Users\bondp\Desktop\LAGUNA\LG1254\LG1254_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd 12/7/2010 8:59:17 AM bondp

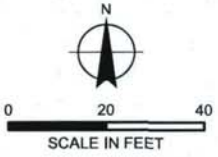
LG1256

Legend

LG1256

Results

- 0 - 9817



TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG1256
ASSESSMENT DATE: 8/3/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: C:\Users\bondp\Desktop\LAGUNA\LG1256\LG1256_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd 12/7/2010 2:12:21 PM bondp

LG1257

Legend

LG1257

Results

- 0 - 10818

0 20 40

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG1257
ASSESSMENT DATE: 7/8/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: C:\Users\bondp\Desktop\LAGUNA\LG1257\LG1257_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd 12/7/2010 2:30:05 PM bondp

LG1260

Legend

LG1260

Results

- 0 - 10890
- 10891 - 11891

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG1260
ASSESSMENT DATE: 7/10/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG1260\LG1260_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 07-Dec-10 13:37, STARTGIS

LG1261

Legend

Results

- 0 - 8273

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG1261
ASSESSMENT DATE: 6/15/2011
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
JUN 2011	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG1261\LG1261_FIGURE_1.mxd, 15-Jun-11 15:40, STARTGIS

LG1263

Legend

LG1263

Results

- 0 - 9660

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG1263
ASSESSMENT DATE: 7/12/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG1263\LG1263_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 07-Dec-10 12:58, STARTGIS

LG1265

Legend

LG1265

Results

- 0 - 10890
- 10891 - 11891
- 11892 - 11999
- 12260

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG1265
ASSESSMENT DATE: 7/9/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
SEPT 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG1265\LG1265_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 02-Sep-10 07:38, STARTGIS

LG1267

Legend

LG1267

Results

- 0 - 10890
- 10891 - 11891

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG1267
ASSESSMENT DATE: 7/10/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG1267\LG1267_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 07-Dec-10 12:01, STARTGIS

LG1272

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG1272\LG1272_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 07-Dec-10 11:45, STARTGIS

LG1275

Legend

LG1275

Results

- 0 - 8694

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG1275
ASSESSMENT DATE: 8/14/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG1275\LG1275_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 07-Dec-10 11:27, STARTGIS

LG1277

Legend

LG1277

Results

- 0 - 8632

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG1277
ASSESSMENT DATE: 8/21/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG1277\LG1277_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 07-Dec-10 11:07, STARTGIS

LG1284

Legend

LG1284

Results

- 0 - 7880

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG1284
ASSESSMENT DATE: 7/22/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG1284\LG1284_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 06-Dec-10 17:14, STARTGIS

LG1290

Legend

LG1290

Results

- 0 - 10422

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG1290
ASSESSMENT DATE: 7/17/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG1290\LG1290_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 06-Dec-10 16:57, STARTGIS

LG1300

Legend

LG1300

Results

- 0 - 10107

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG1300
ASSESSMENT DATE: 9/6/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG1300\LG1300_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 06-Dec-10 16:42, STARTGIS

LG1306

Legend

LG1306

Results

- 0 - 10890
- 10891 - 11891

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG1306
ASSESSMENT DATE: 7/21/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG1306\LG1306_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 06-Dec-10 16:24, STARTGIS

LG1313

Legend

LG1313

Results

- 0 - 10058

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG1313
ASSESSMENT DATE: 8/21/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG1313\LG1313_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 06-Dec-10 15:42, STARTGIS

LG1316

Legend

LG1316

Results

- 0 - 9445

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

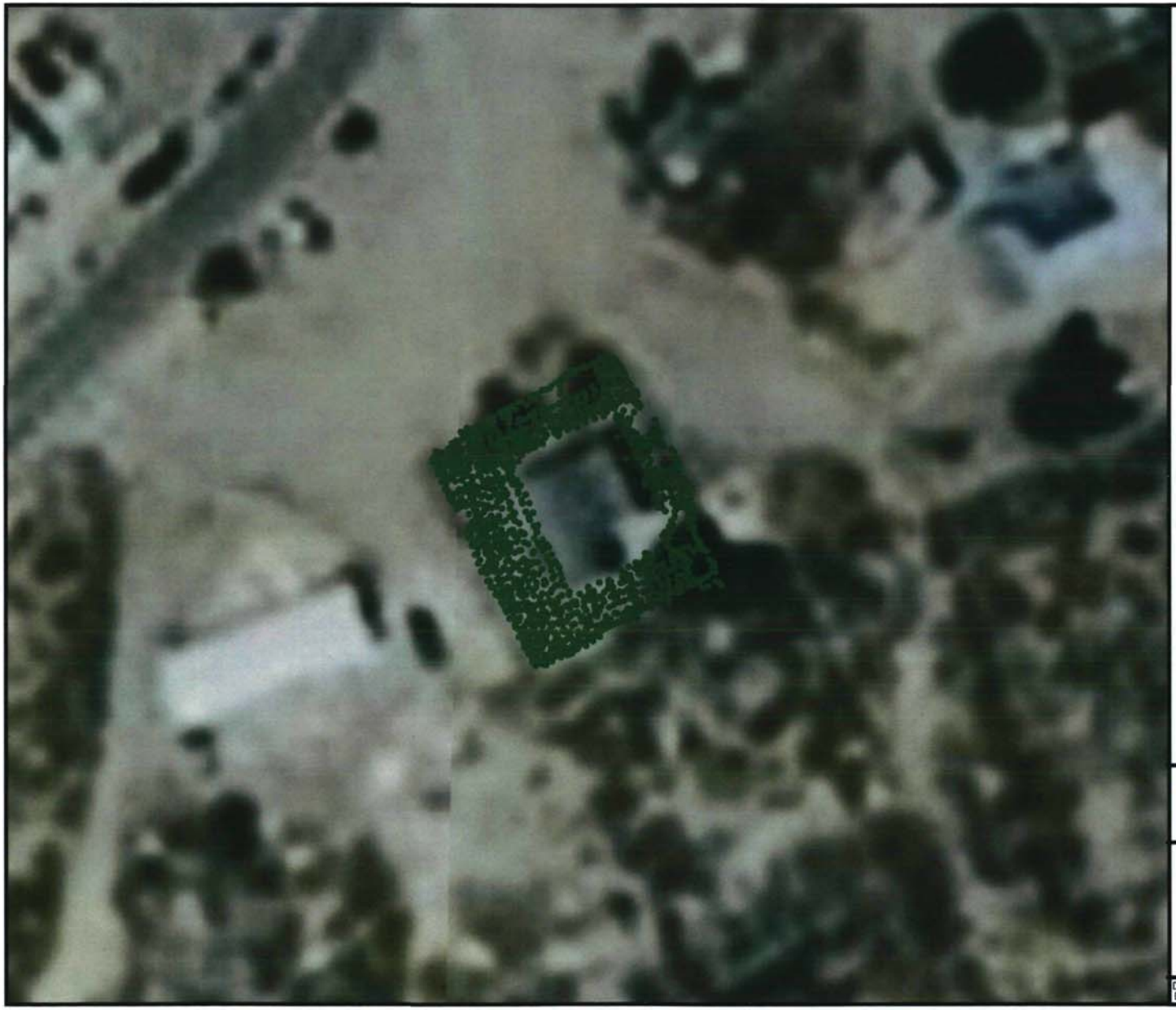
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG1316
ASSESSMENT DATE: 7/19/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG1316\LG1316_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 06-Dec-10 15:08, STARTGIS

LG1317



Legend

LG1317

Results

- 0 - 9998

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG1317
ASSESSMENT DATE: 7/19/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG1317\LG1317_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 06-Dec-10 14:48, STARTGIS

LG1321

Legend

LG1321

Results

- 0 - 9588

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG1321
ASSESSMENT DATE: 8/13/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG1321\LG1321_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 06-Dec-10 14:23, STARTGIS

LG1367

Legend

LG1367

Results

- 0 - 9510

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG1367
ASSESSMENT DATE: 8/2/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG1367\LG1367_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 06-Dec-10 13:09, STARTGIS

LG1385

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG1385\LG1385_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 02-Sep-10 12:24, STARTGIS

LG1389

Legend

LG1389

Results

- 0 - 8682

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG1389
ASSESSMENT DATE: 7/16/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG1389\LG1389_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 06-Dec-10 12:53, STARTGIS

LG1510

Legend

LG1510

Results

- 0 - 9181

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

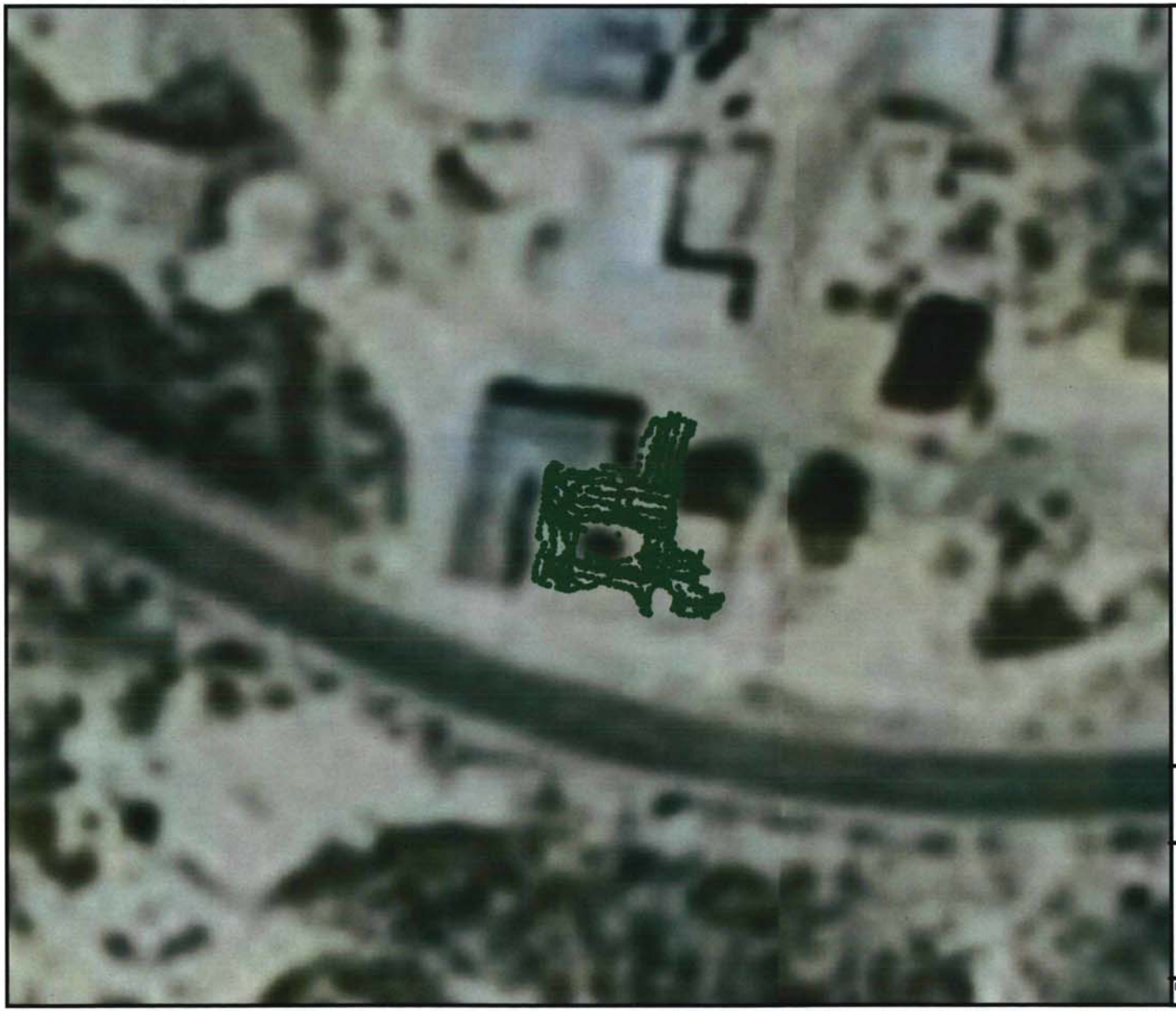
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG1510
ASSESSMENT DATE: 9/15/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG1510\LG1510_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 06-Dec-10 12:37, STARTGIS

LG1635



Legend

LG1635

Results

- 0 - 7943

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

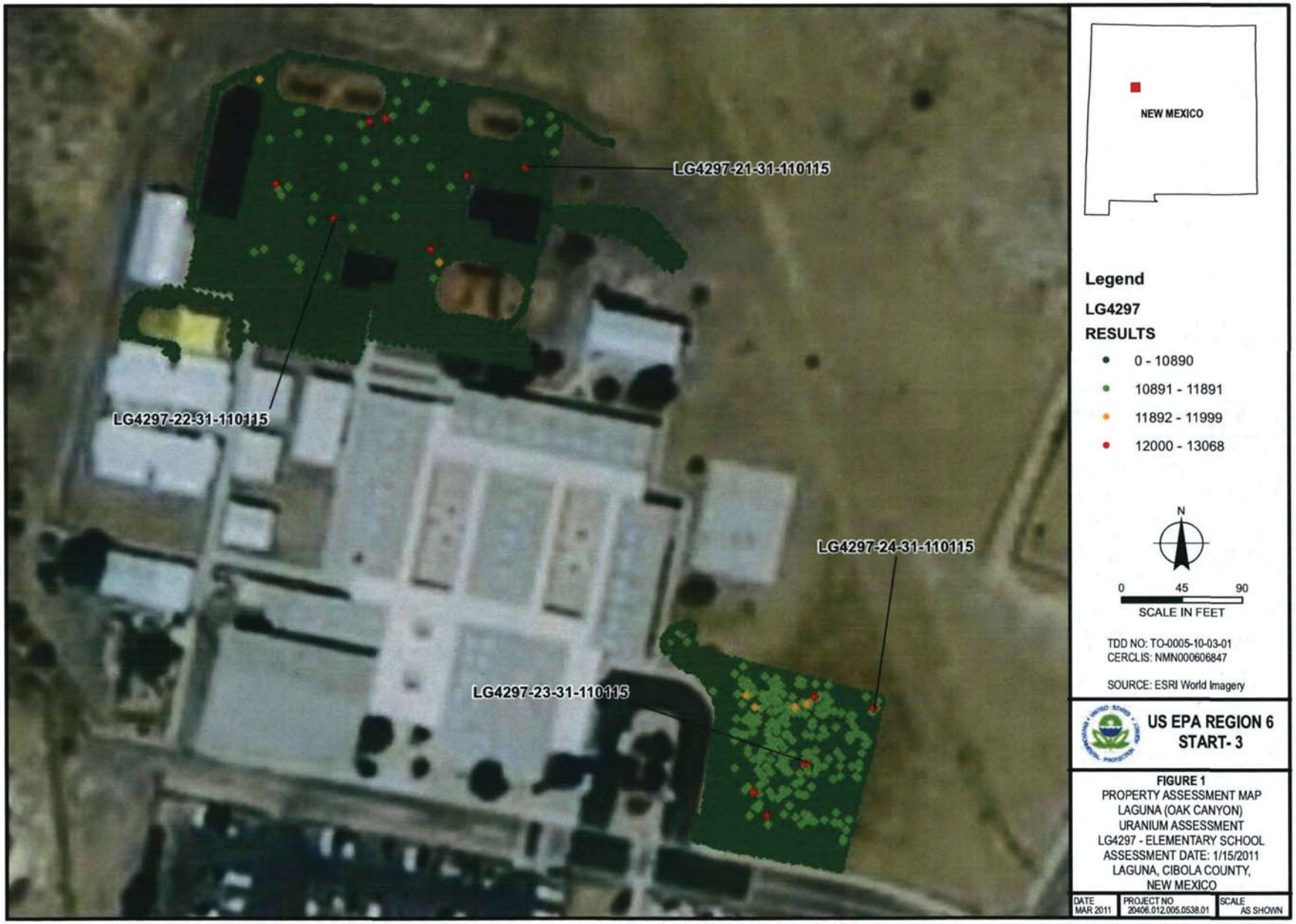
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG1635
ASSESSMENT DATE: 9/16/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG1635\LG1635_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 06-Dec-10 12:12, STARTGIS

LG4297



File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG4297 (School)\LG4297_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 08-Mar-11 11:04, STARTGIS

LG4922

Legend

LG4922

Results

- 0 - 10890
- 10981 - 11891
- 11892 - 11999

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

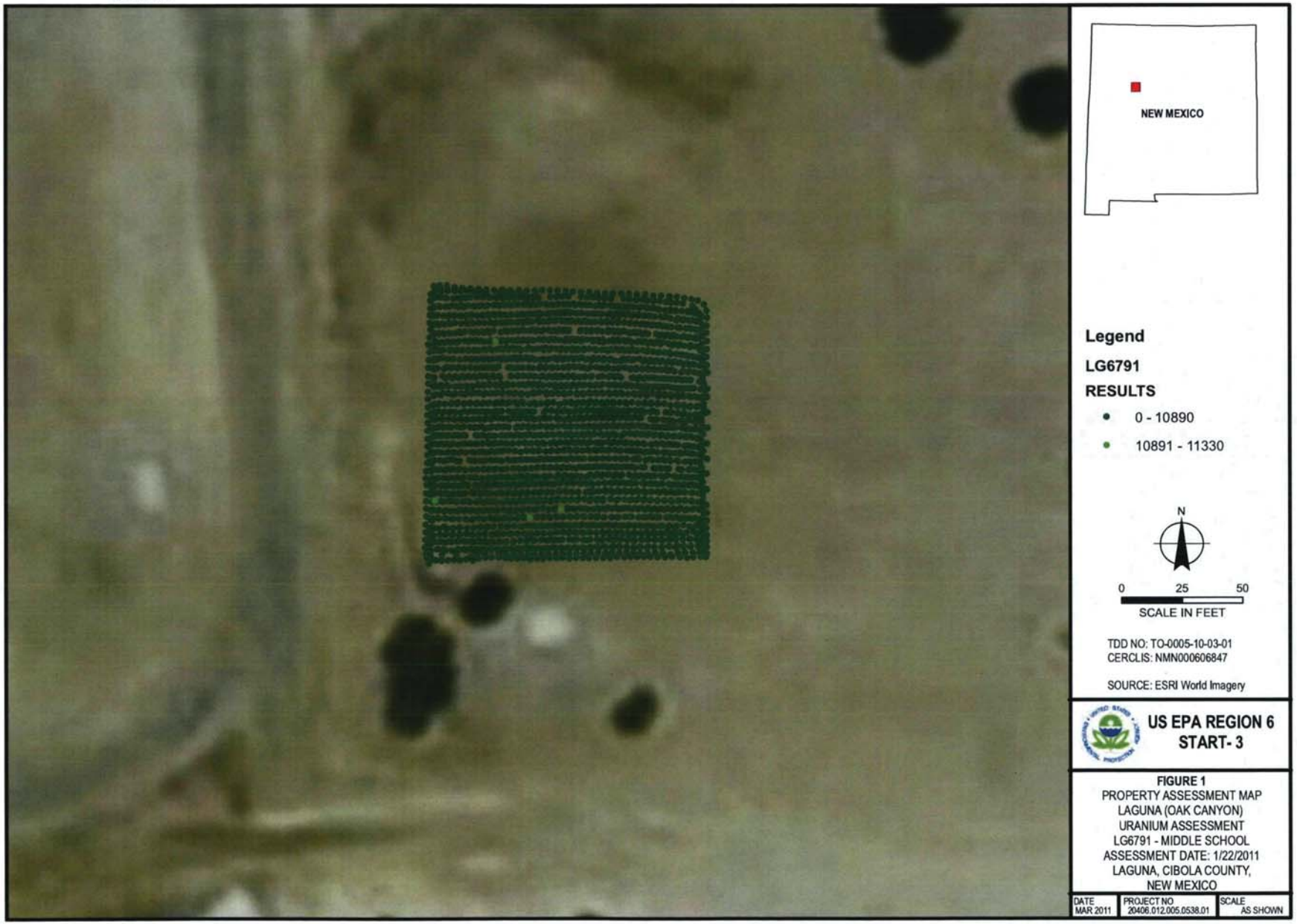
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG4922
ASSESSMENT DATE: 8/7/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

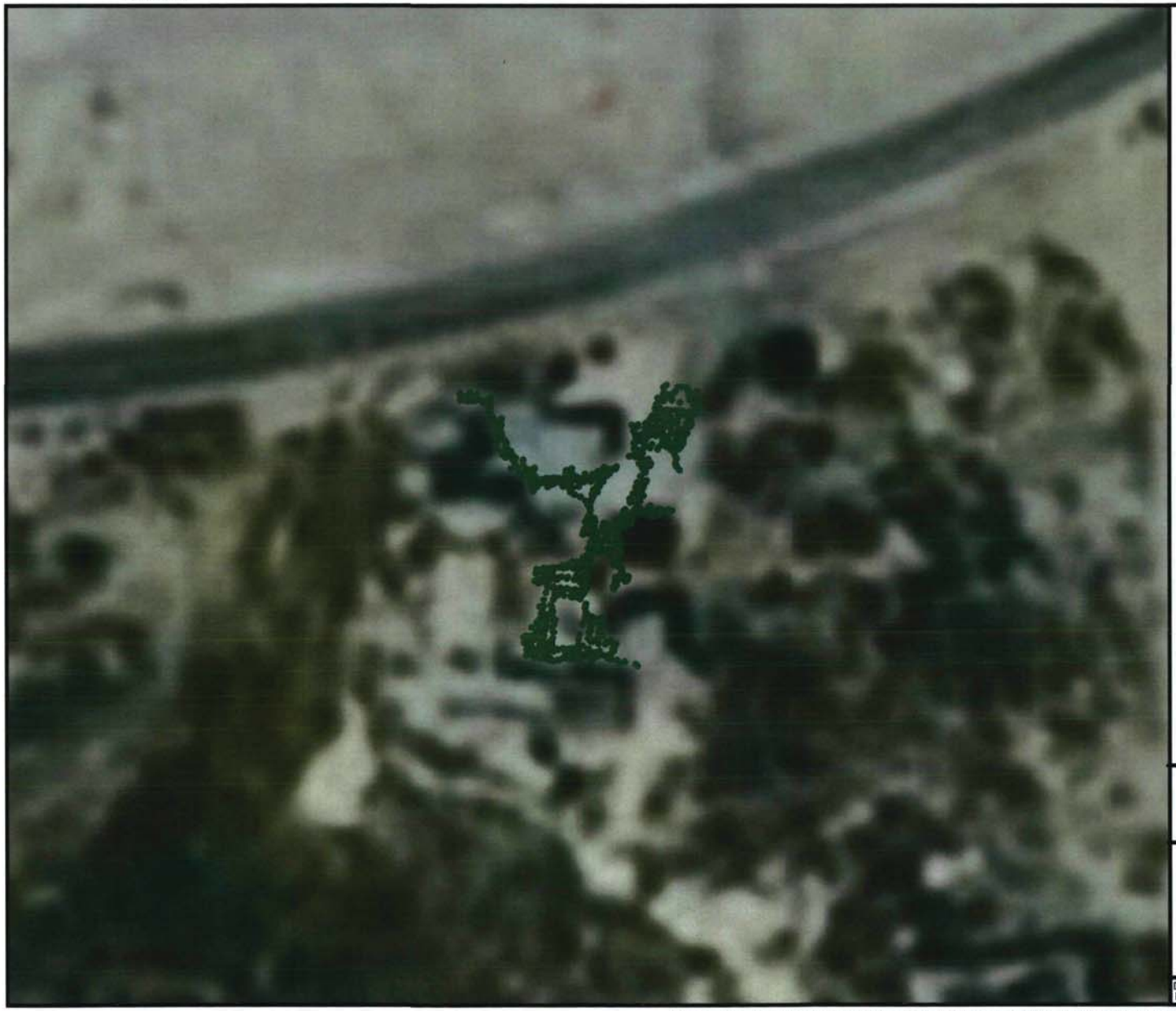
File: \\fsrm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG4922\LG4922_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 07-Dec-10 07:39, STARTGIS

LG6791



File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG6791 (School)\LG6791_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 08-Mar-11 11:05, STARTGIS

LG6848



Legend

LG6848

Results

- 0 - 8984

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG6848
ASSESSMENT DATE: 9/16/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\snm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG6848\LG6848_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 06-Dec-10 10:54, STARTGIS

LG7777

Legend

LG7777

Results

- 0 - 10890
- 10891 - 11891

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG7777
ASSESSMENT DATE: 8/17/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG7777 (Church)\LG7777_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 06-Dec-10 10:33, STARTGIS

LG8285

Legend

LG8285

RESULTS

- 0 - 10890
- 10891 - 10986

N

0 30 60

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

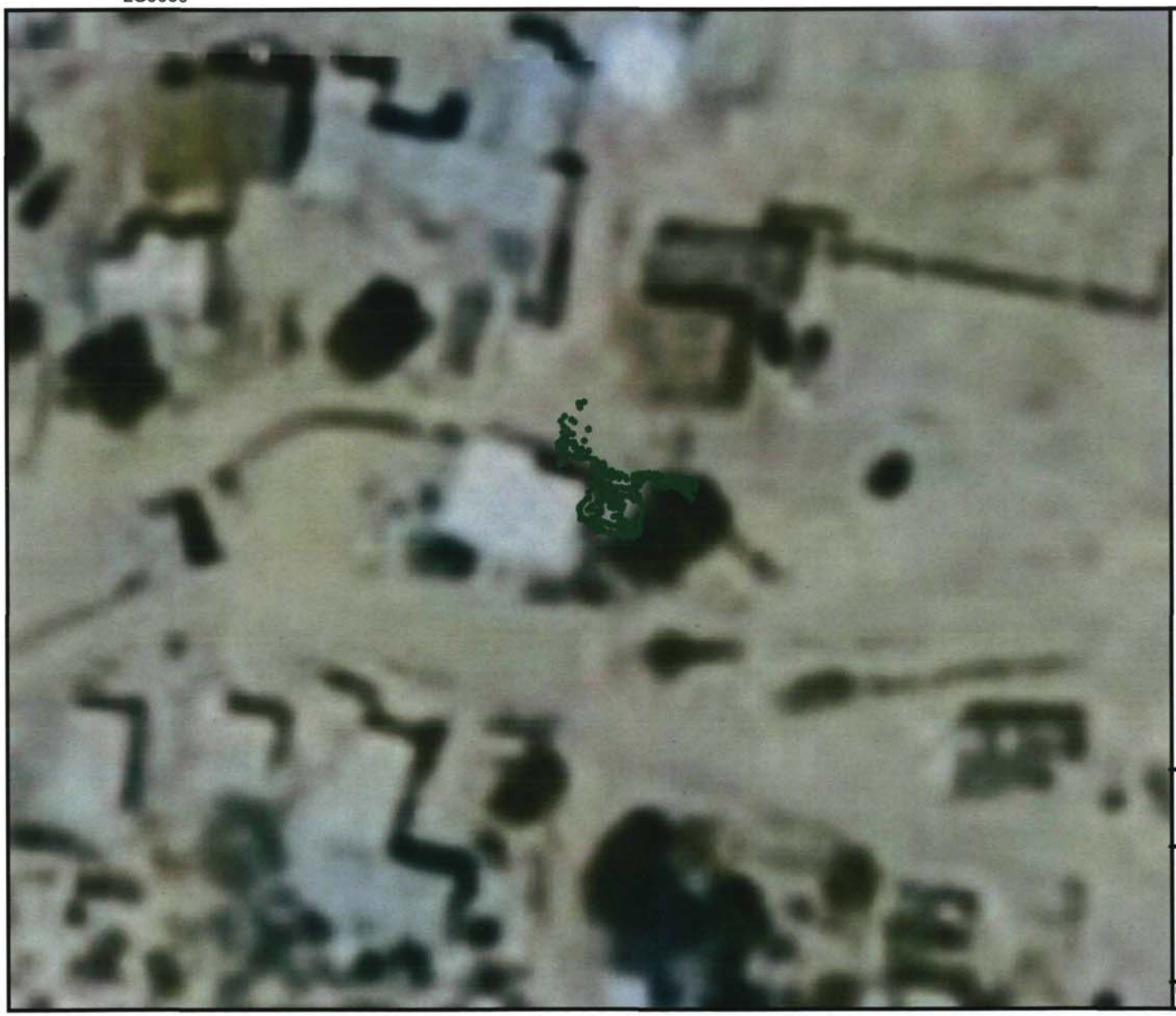
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
LG8285 - HEAD START
ASSESSMENT DATE: 1/17/2011
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
MAR 2011	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG8285 (School)\LG8285_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 08-Mar-11 11:06, STARTGIS

LG9060



Legend

LG9060

Results

- 0 - 9080

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

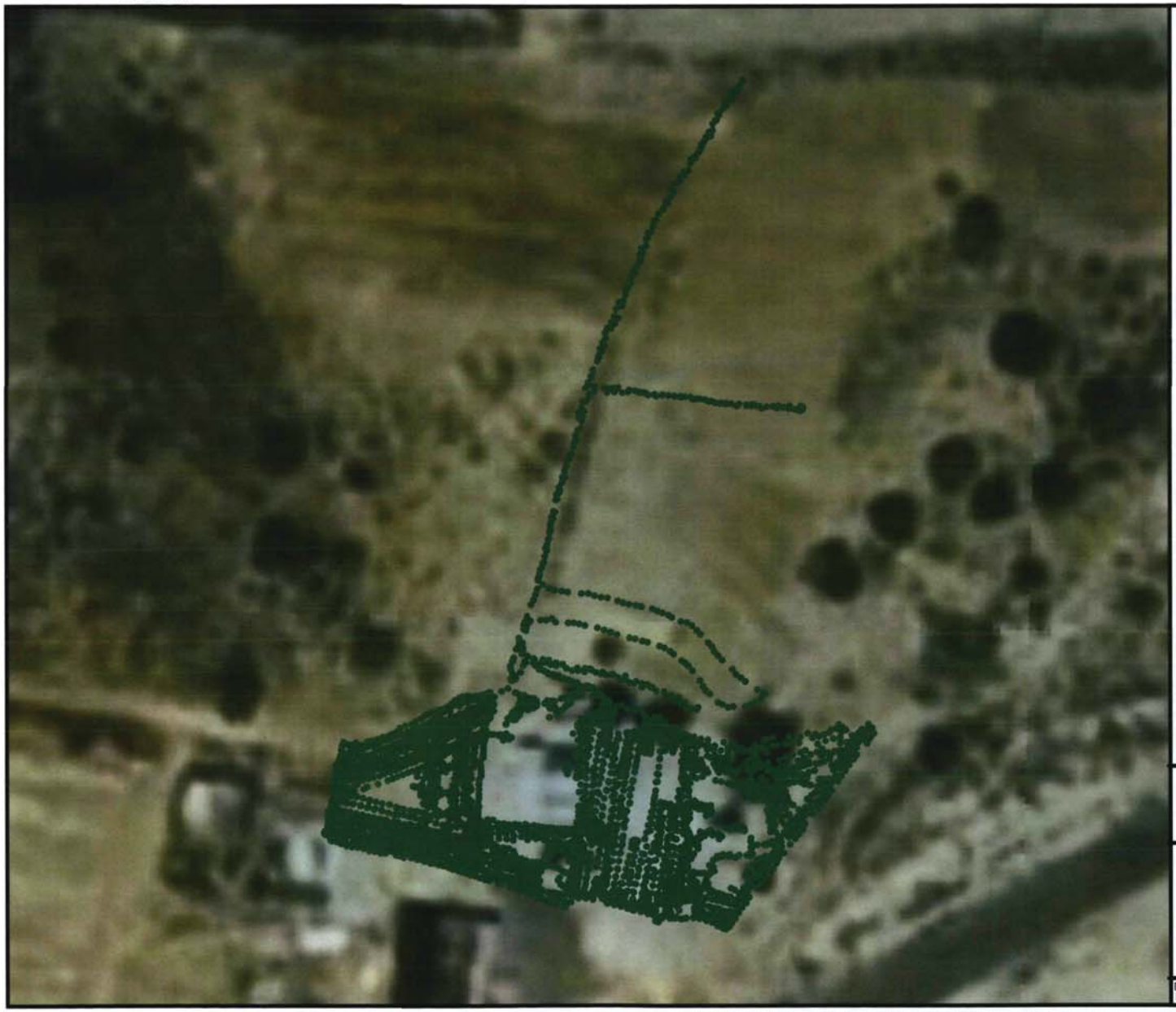
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG9060
ASSESSMENT DATE: 9/15/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG9060\LG9060_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 06-Dec-10 09:55, STARTGIS

LG9990



Legend

LG9990

Results

- 0 - 10286

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG9990
ASSESSMENT DATE: 8/7/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG9990\LG9990_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 06-Dec-10 09:37, STARTGIS

LG9991

Legend

LG9991

Results

- 0 - 10061

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

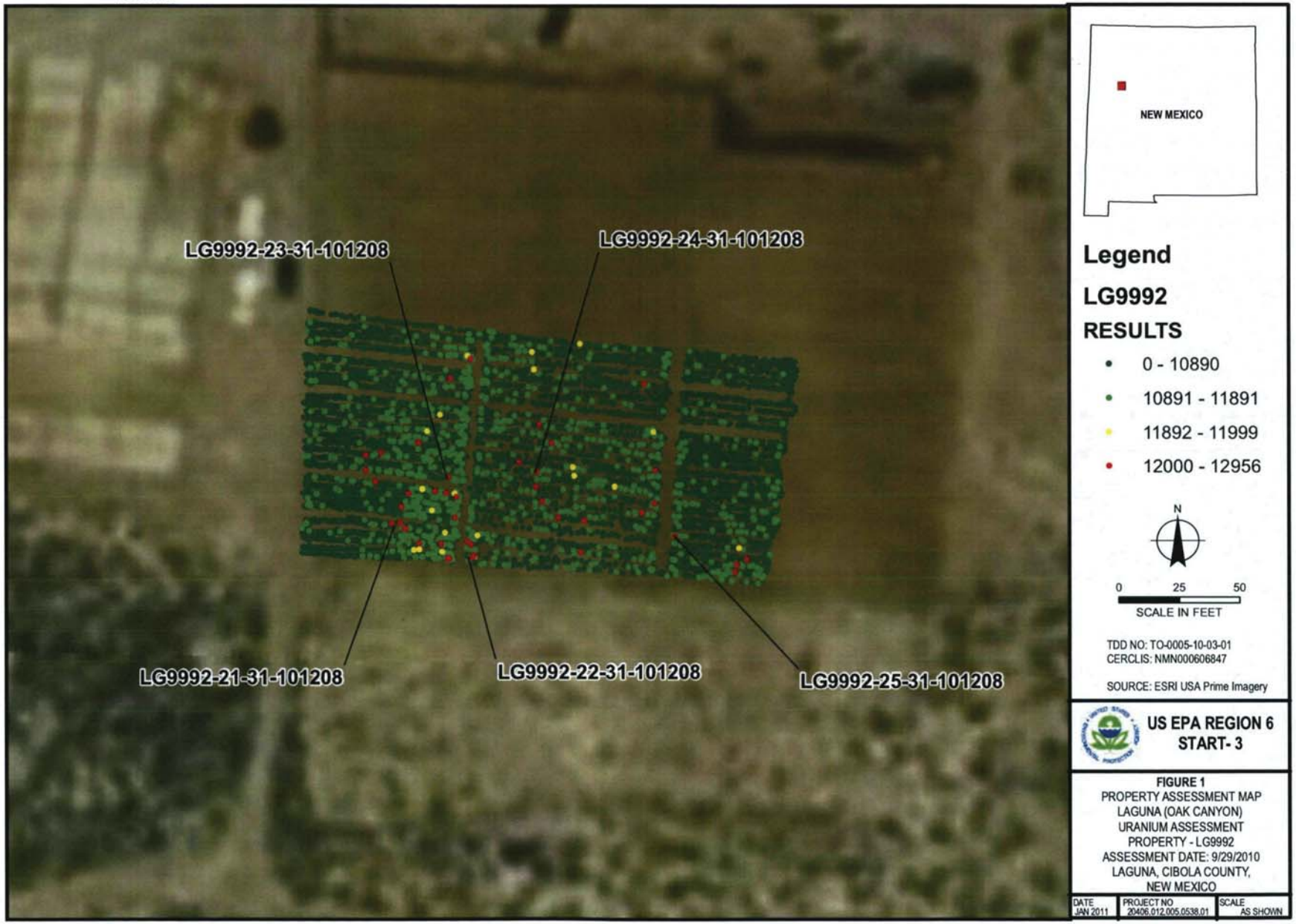
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG9991
ASSESSMENT DATE: 8/5/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG9991\LG9991_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 06-Dec-10 09:21, STARTGIS

LG9992



File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG9992\LG9992_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 26-Jan-11 14:01, STARTGIS

LG9994

Legend

LG9994

Results

- 0 - 9431

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG9994
ASSESSMENT DATE: 8/9/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG9994\LG9994_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 06-Dec-10 08:05, STARTGIS

LG9995

Legend

LG9995

Results

• 0 - 9144

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

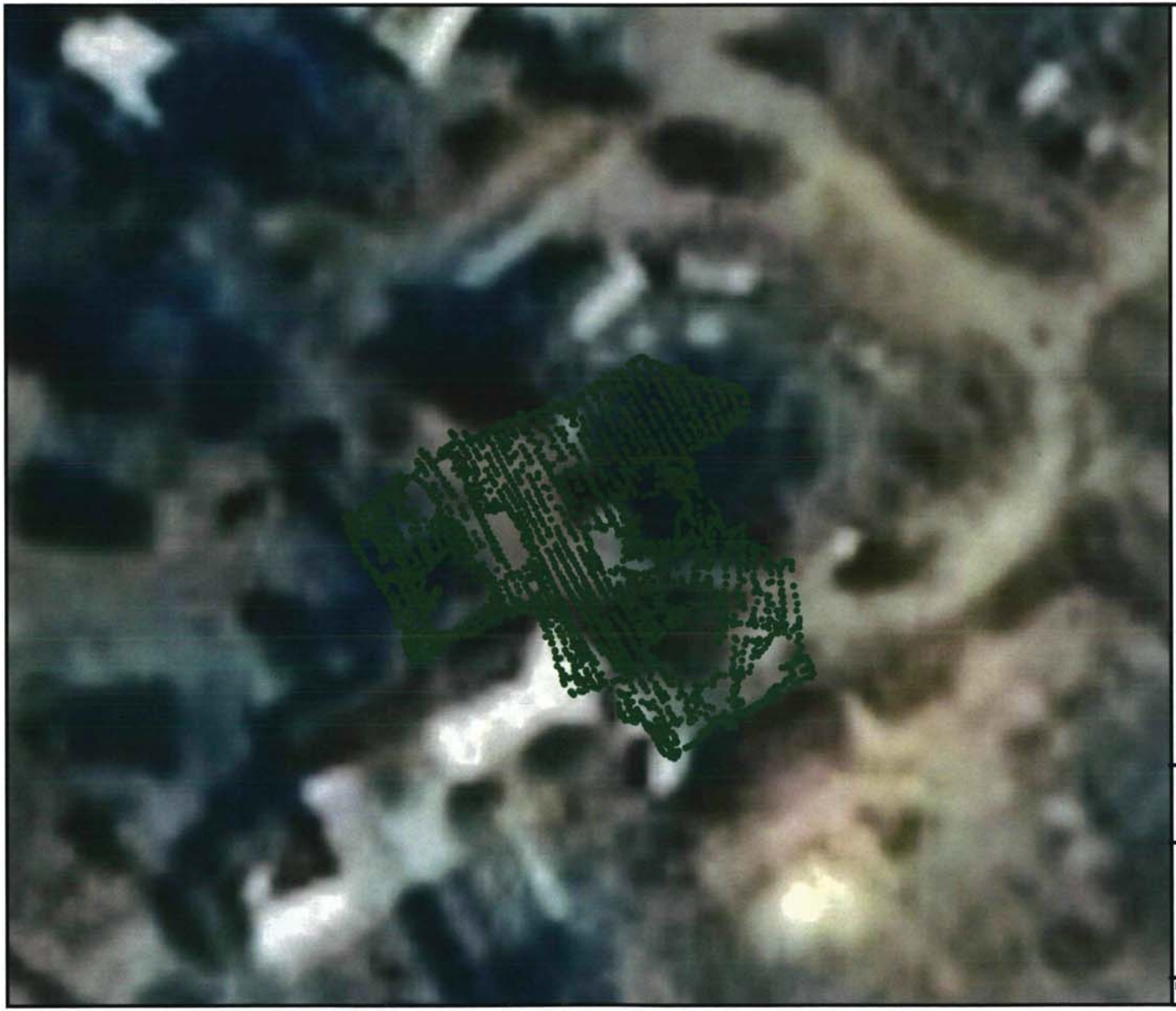
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG9995
ASSESSMENT DATE: 8/6/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
SEPT 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG9995\LG9995_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 02-Sep-10 15:13, STARTGIS

LG9996



Legend

LG9996

Results

- 0 - 9649

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

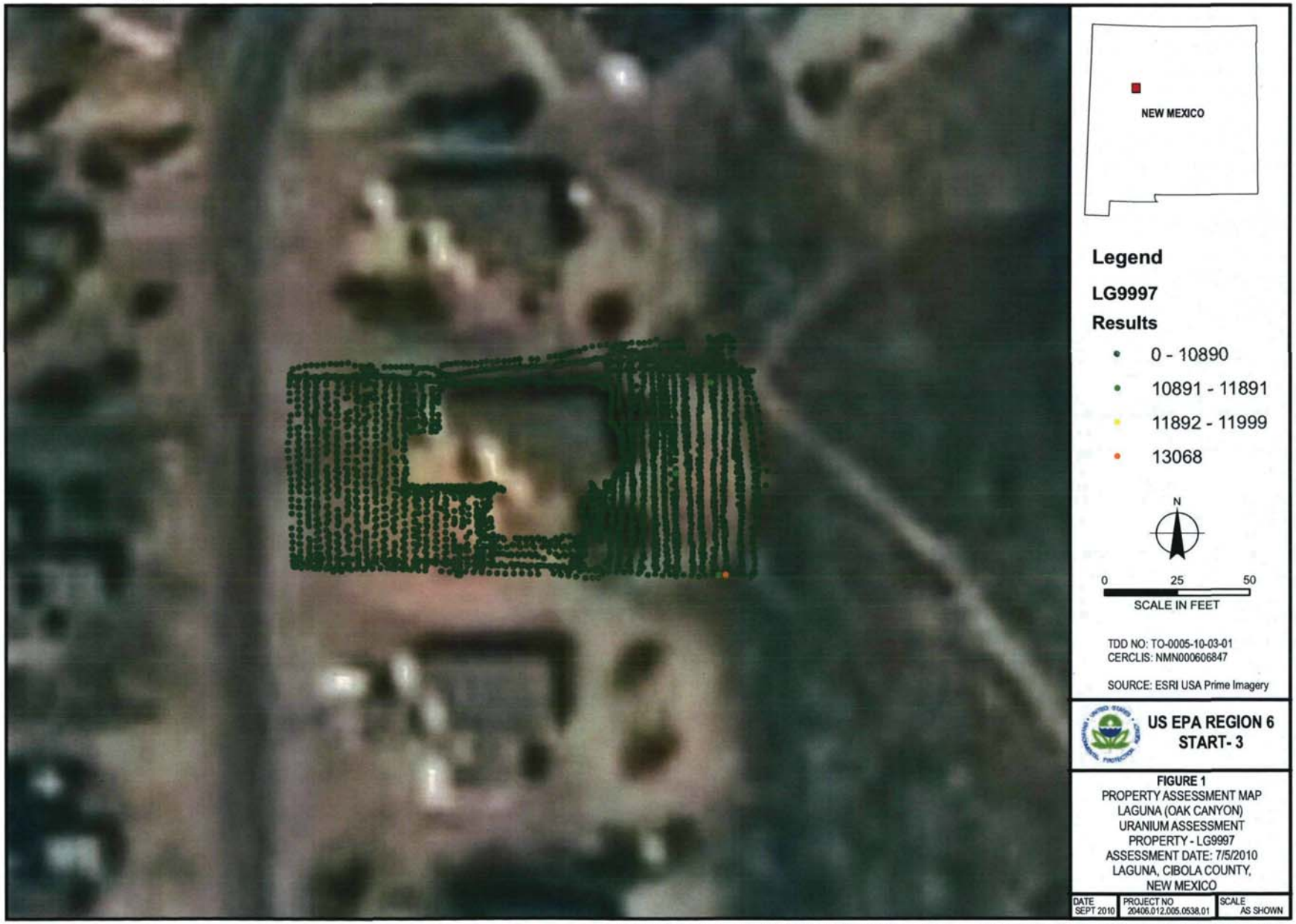
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG9996
ASSESSMENT DATE: 8/11/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
SEPT 2010	20406.012.005.0538.01	AS SHOWN

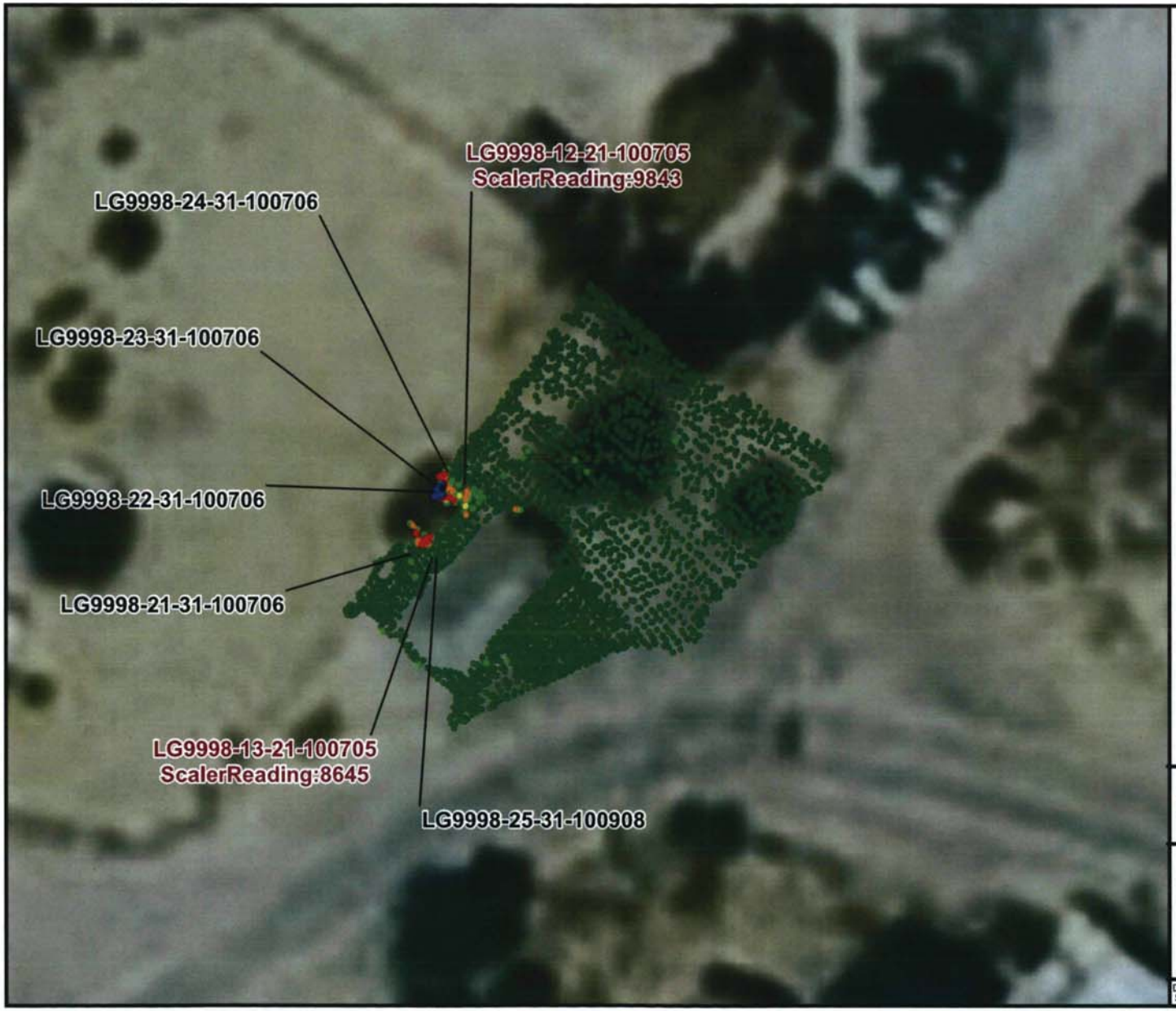
File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG9996\LG9996_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 02-Sep-10 15:36, STARTGIS

LG9997



File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG9997\LG9997_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 02-Sep-10 15:49, STARTGIS

LG9998



Legend

LG9998 Results

- 0 - 10890
- 10891 - 11891
- 11892 - 11999
- 12000 - 12999
- 13000 - 15999
- 16000 - 19999
- 20493

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

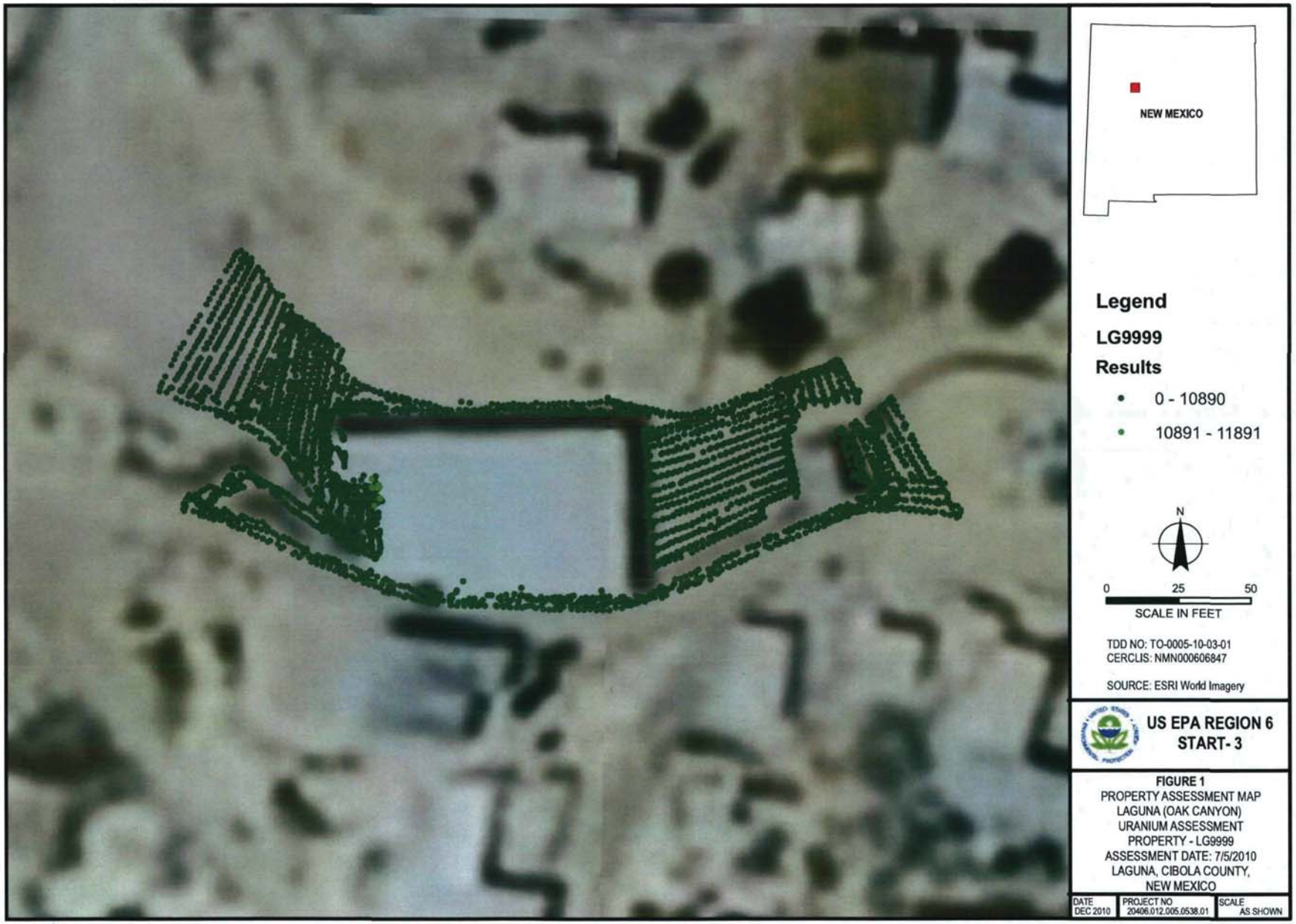
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG9998
ASSESSMENT DATE: 7/6/2010
LAGUNA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
SEPT 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG9998\LG9998_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 02-Sep-10 16:10, STARTGIS

LG9999



File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG9999 (Kiva)\LG9999_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 05-Dec-10 14:20, STARTGIS

APPENDIX B

PART 3

Mesita RAT Maps

ME0718

Legend

ME0718

Results

- 0 - 9106
- 9107 - 10107
- 10108 - 10999
- 11000 - 11999

N

0 20 40

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

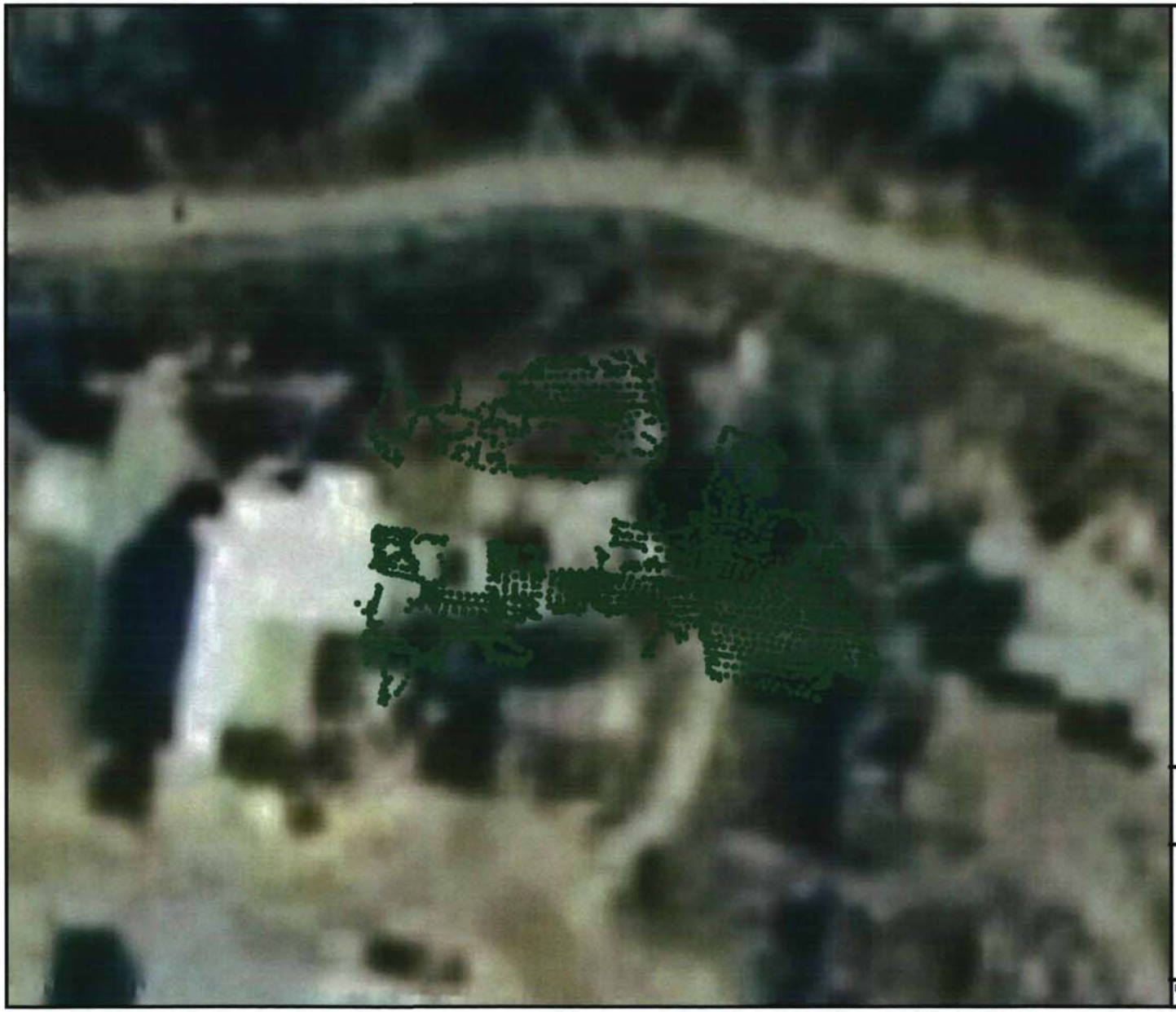
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - ME0718
ASSESSMENT DATE: 7/5/2010
MESITA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
AUG 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\MESITA\ME0718\ME0718_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 26-Aug-10 12:14, STARTGIS

ME0721



Legend

ME0721

Results

- 0 - 8425

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

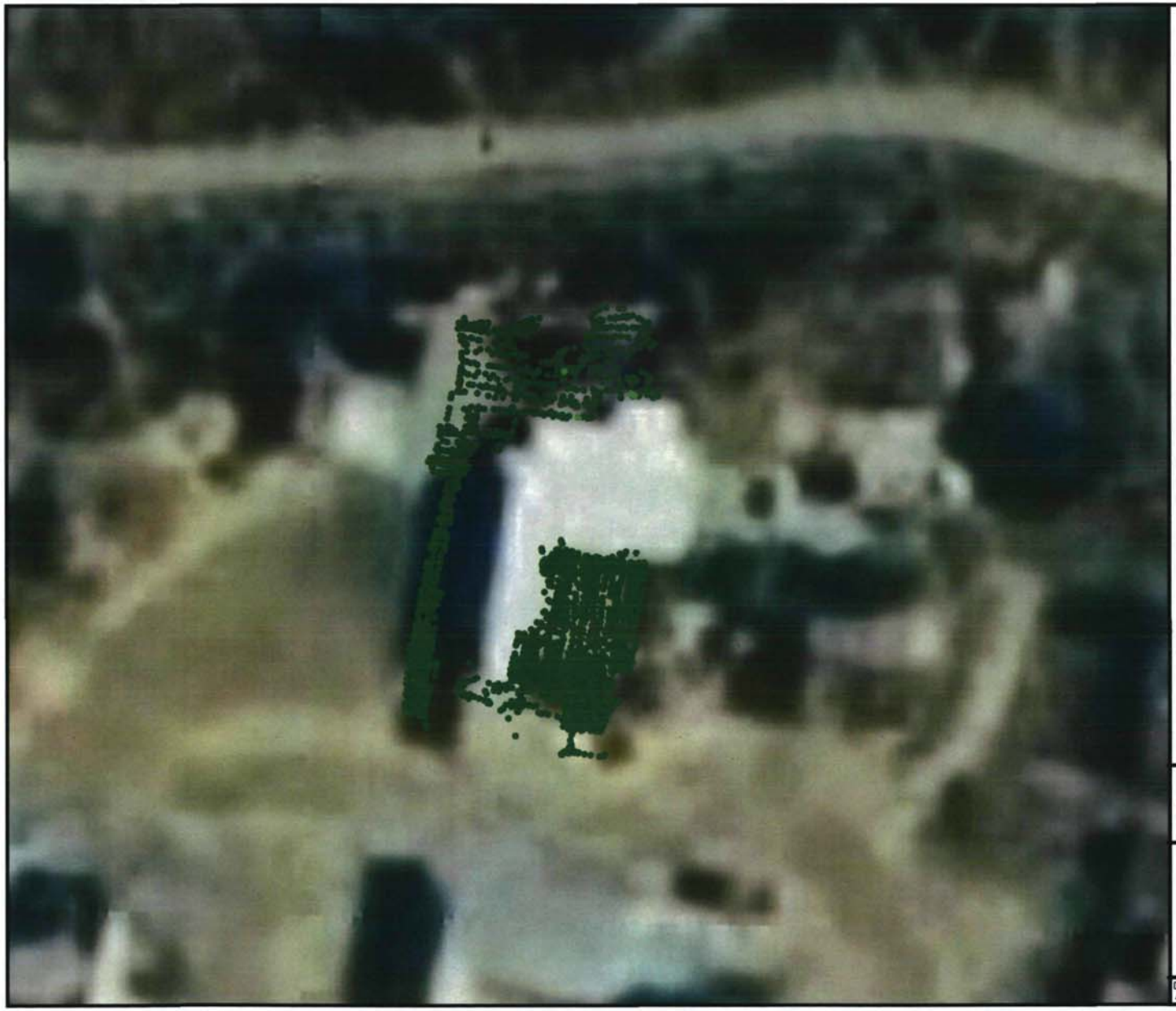
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - ME0721
ASSESSMENT DATE: 6/30/2010
MESITA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
AUG 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\MESITA\ME0721\ME0721_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 26-Aug-10 14:01, STARTGIS

ME0723



Legend

ME0723

Results

- 0 - 9106
- 9107 - 9997

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - ME0723
ASSESSMENT DATE: 6/24/2010
MESITA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
AUG 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\MESITA\ME0723\ME0723_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 26-Aug-10 14:22, STARTGIS

ME0727

Legend

ME0727

Results

- 0 - 9106
- 9107 - 10107
- 10108 - 10999
- 11000 - 11402

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

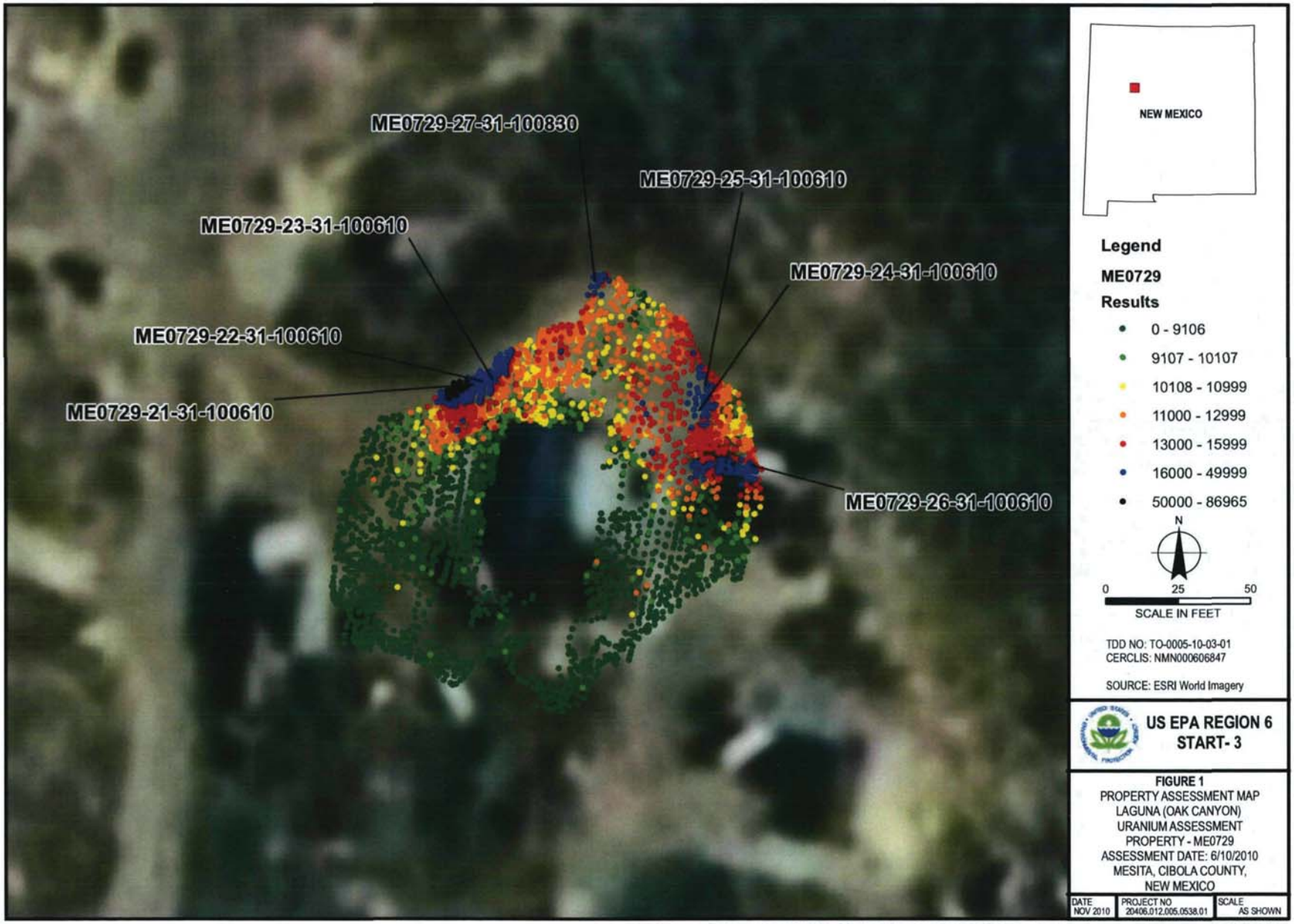
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - ME0727
ASSESSMENT DATE: 6/21/2010
MESITA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
AUG 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\MESITA\ME0727\ME0727_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 26-Aug-10 15:03, STARTGIS

ME0729



File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\MESITA\ME0729\ME0729_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 02-Nov-10 09:28, STARTGIS

ME0731

Legend

ME0731

Results

- 0 - 9106
- 9107 - 10107
- 10108 - 10999
- 11000 - 11186

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - ME0731
ASSESSMENT DATE: 6/28/2010
MESITA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
AUG 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\MESITA\ME0731\ME0731_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 26-Aug-10 15:51, STARTGIS

ME0733

Legend

ME0733

Results

- 0 - 9106
- 9107 - 10107
- 10537

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - ME0733
ASSESSMENT DATE: 6/30/2010
MESITA, CIBOLA COUNTY,
NEW MEXICO

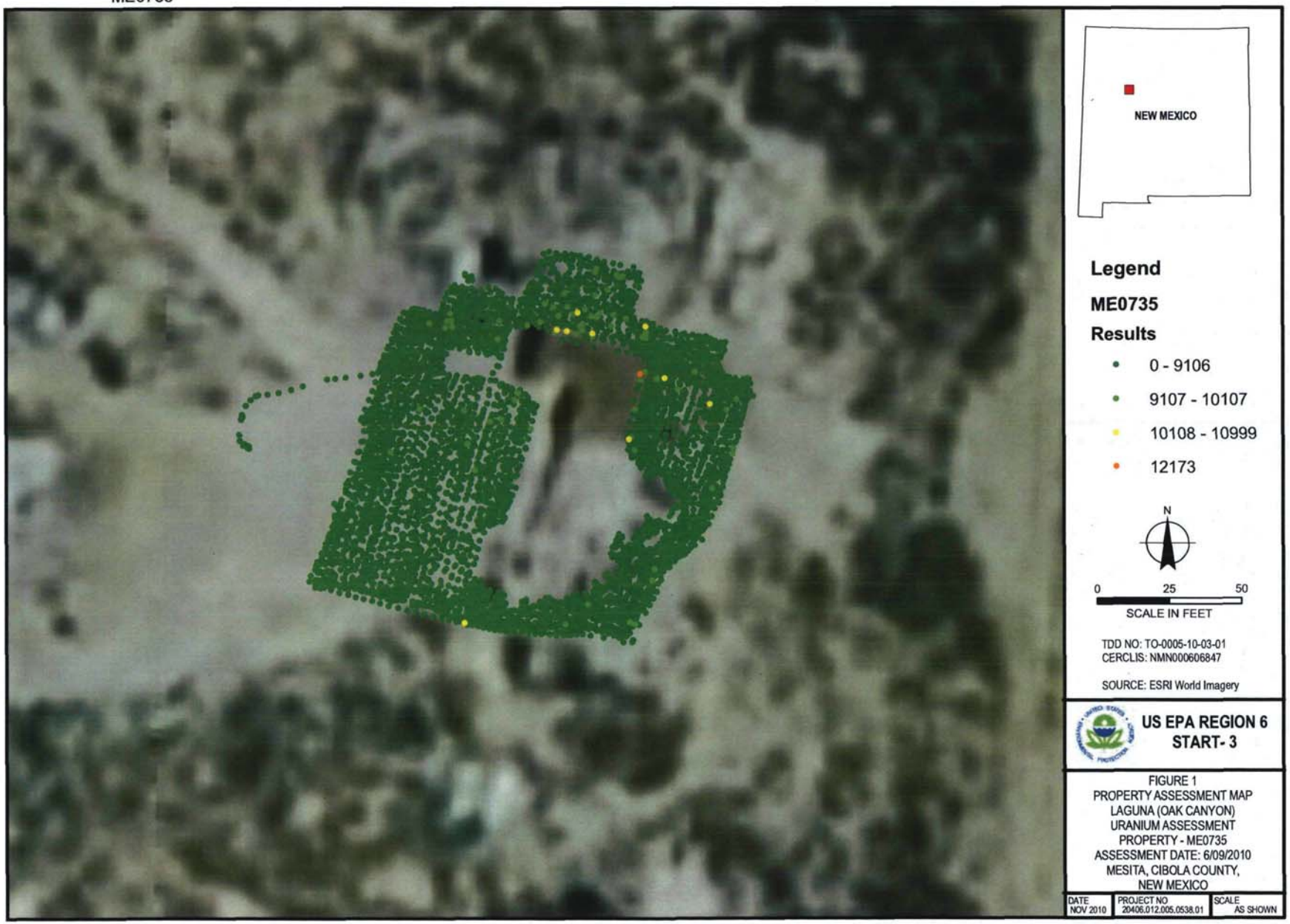
DATE	PROJECT NO	SCALE
AUG 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\MESITA\ME0733\ME0733_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 26-Aug-10 17:29, STARTGIS

ME0734

File: C:\Documents and Settings\busterp\Desktop\MESITA\ME0734\ME0734_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 19-Nov-10 08:56, busterp

ME0735



File: C:\Documents and Settings\busterp\Desktop\MESITA\ME0735\ME0735_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 19-Nov-10 09:59, busterp

ME0736

Legend

ME0736

Results

- 0 - 9106
- 9107 - 10107
- 10108 - 10999
- 11000 - 11631

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

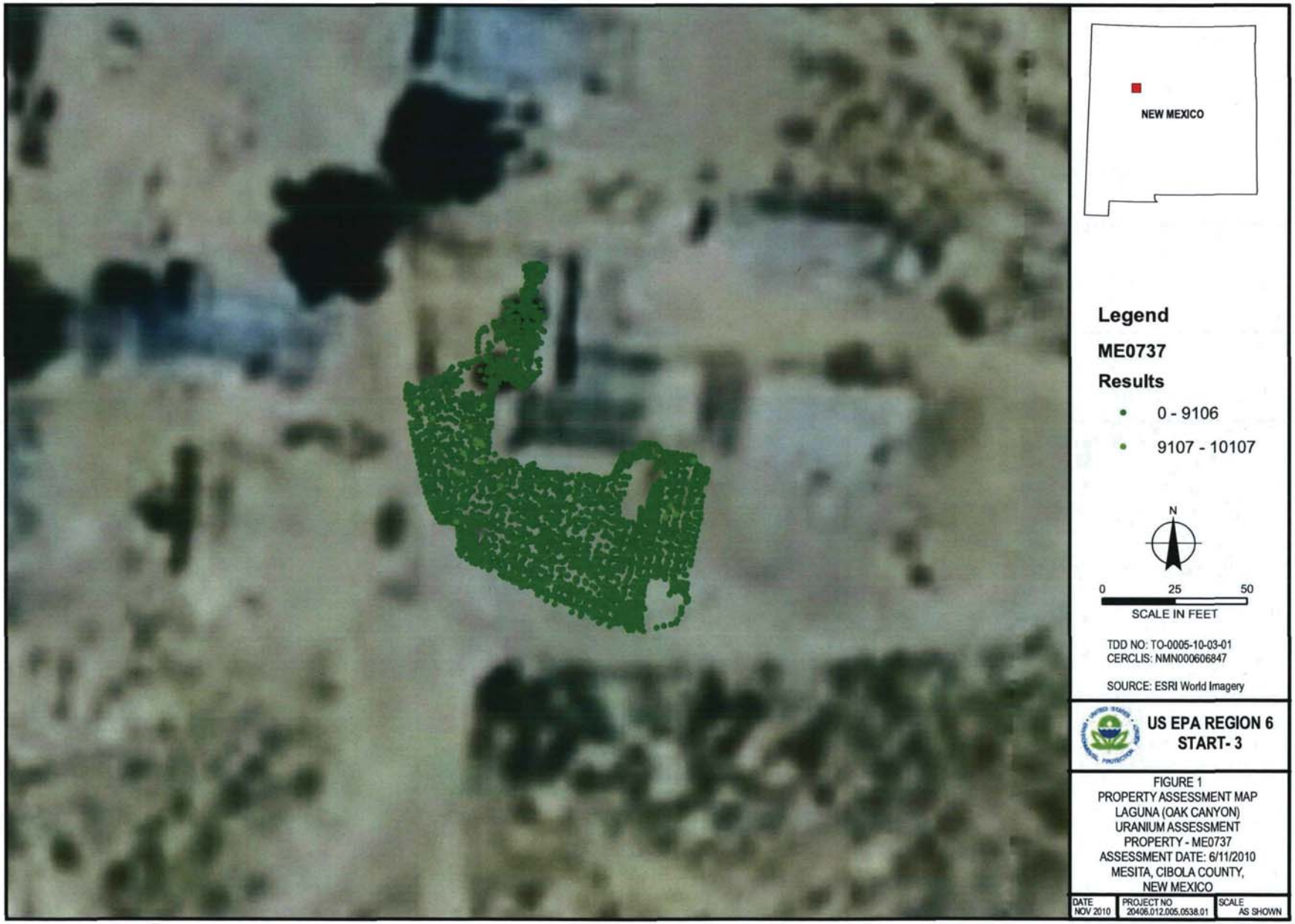
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - ME0736
ASSESSMENT DATE: 6/28/2010
MESITA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
NOV 2010	20406.012.005.0538.01	AS SHOWN

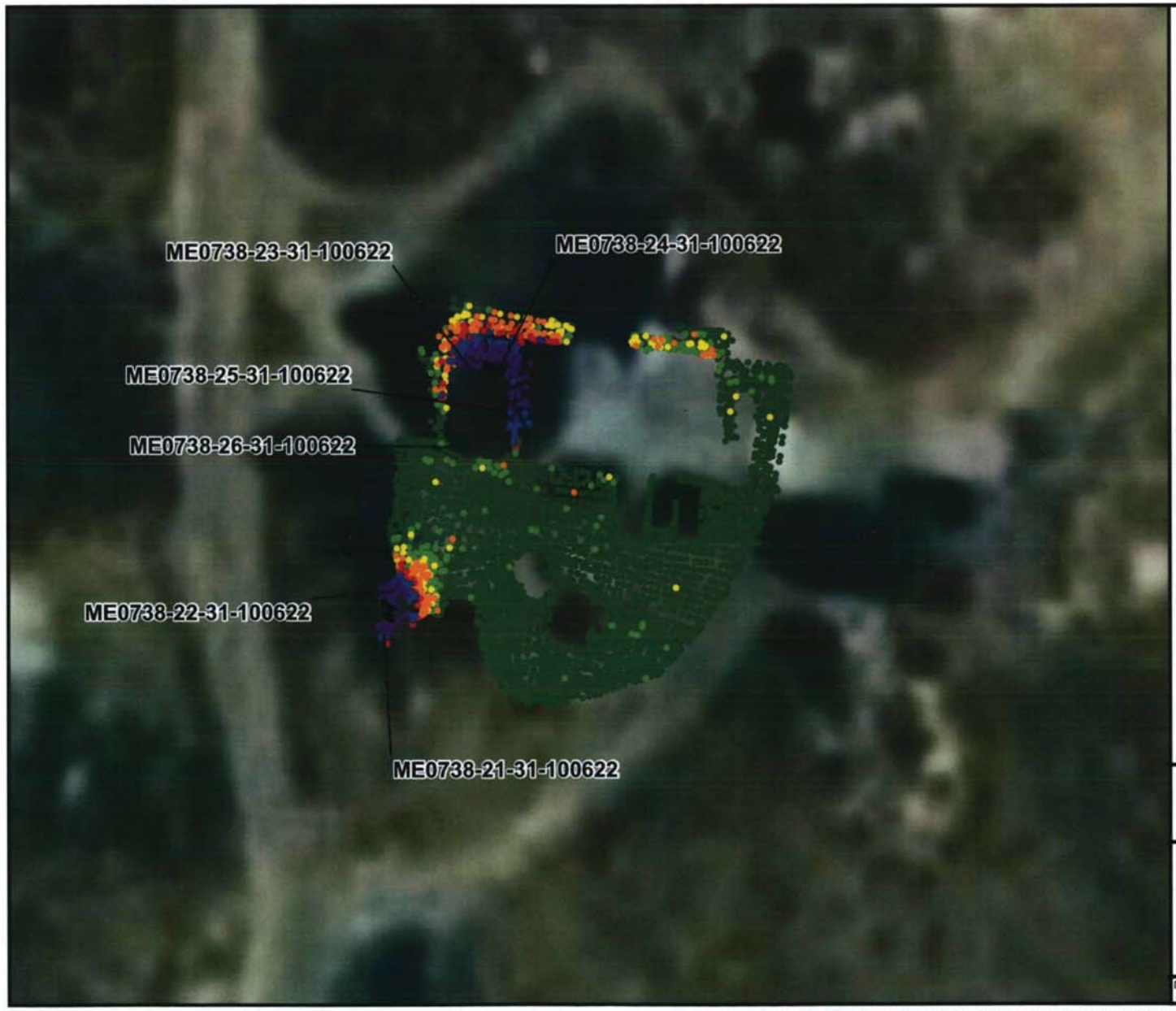
File: C:\Documents and Settings\buserp\Desktop\MESITA\ME0736\ME0736_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 19-Nov-10 10:45, buserp

ME0737



File: C:\Documents and Settings\busterp\Desktop\MESITA\ME0737\ME0737_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 19-Nov-10 11:35, busterp

ME0738



Legend

ME0738

Results

- 0 - 9106
- 9107 - 10107
- 10108 - 10999
- 11000 - 12999
- 13000 - 14999
- 15000 - 19999
- 20000 - 99999
- 100000 - 424763

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

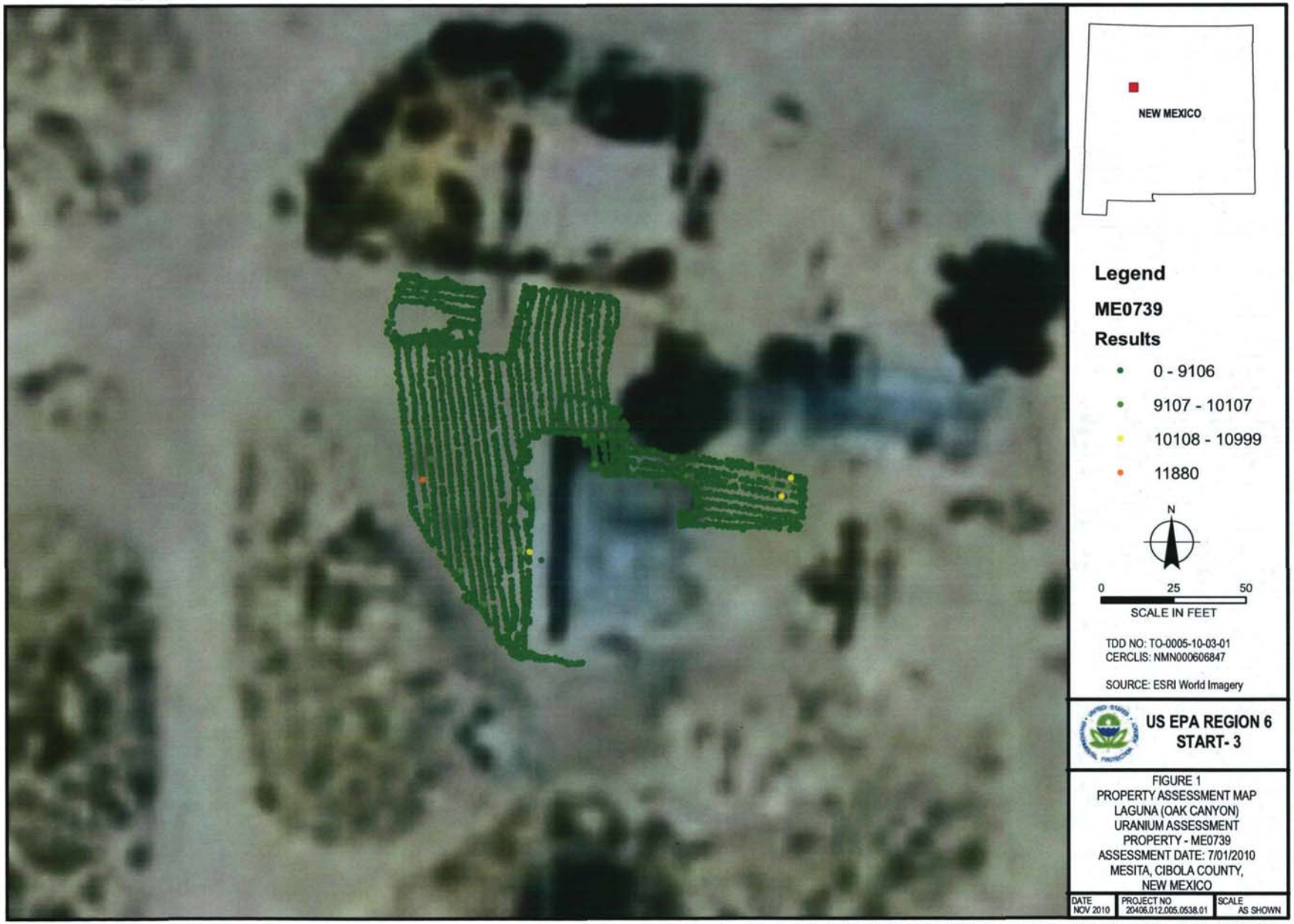
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - ME0738
ASSESSMENT DATE: 6/22/2010
MESITA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
AUG 2010	20406.012.005.0538.01	AS SHOWN

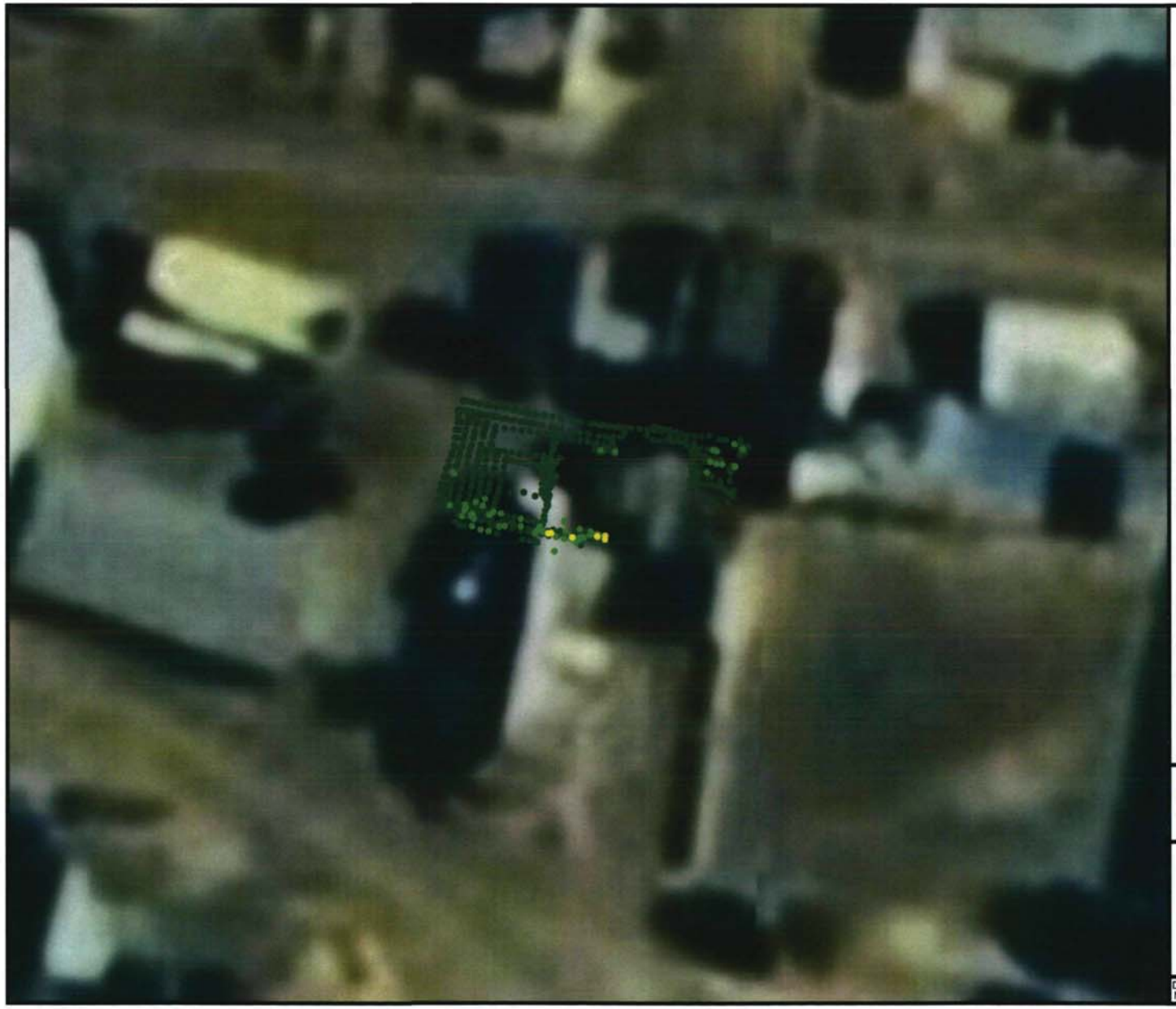
File: \\fsrvm01\Operations\Field Data\TDD-OAK CANYON\MESITA\ME0738\ME0738_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 04-Nov-10 11:08, STARTGIS

ME0739



File: C:\Documents and Settings\buserp\Desktop\MESITA\ME0739\ME0739_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 19-Nov-10 13:41, buserp

ME0740



Legend

ME0740

Results

- 0 - 9106
- 9107 - 10107
- 10108 - 10999

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - ME0740
ASSESSMENT DATE: 7/09/2010
MESITA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
NOV 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\MESITA\ME0740\ME0740_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 30-Nov-10 11:57, STARTGIS

ME0743

Legend

ME0743

Results

- 0 - 9106
- 9107 - 10107
- 10108 - 10999
- 11000 - 12620

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

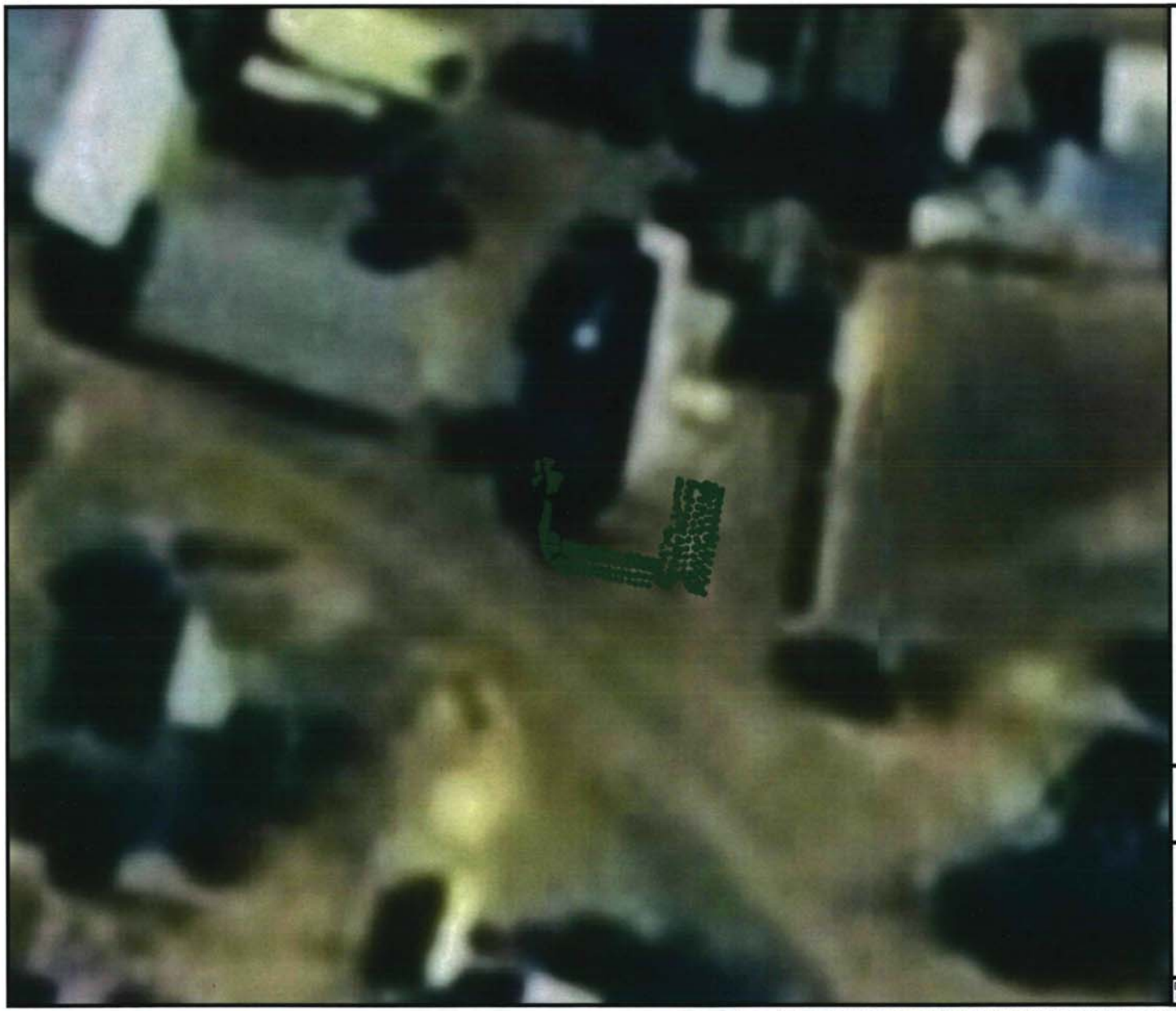
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - ME0743
ASSESSMENT DATE: 6/23/2010
MESITA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
JAN 2011	20406.012.005.0538.01	AS SHOWN

File: \\fusnm01\Operations\Field Data\TDD-OAK CANYON\MESITA\ME0743\ME0743_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 26-Jan-11 17:10, STARTGIS

ME0755



Legend

ME0755

Results

- 0 - 8812

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

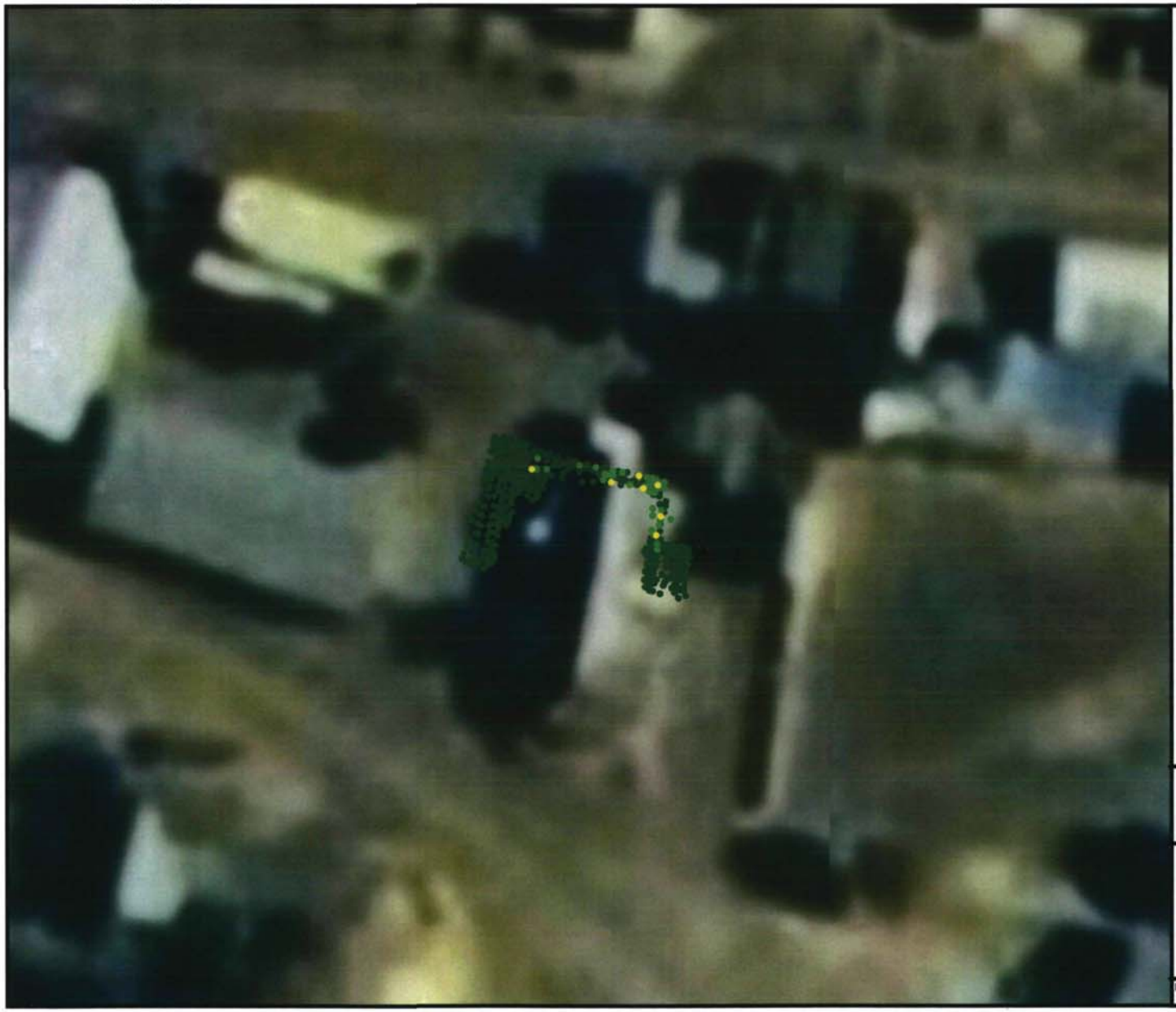
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - ME0755
ASSESSMENT DATE: 7/2/2010
MESITA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\furn01\Operations\Field Data\TDD-OAK CANYON\MESITA\ME0755\ME0755_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 01-Dec-10 10:36, STARTGIS

ME0756



Legend

ME0756

Results

- 0 - 9106
- 9107 - 10107
- 10108 - 10999

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - ME0756
ASSESSMENT DATE: 6/28/2010
MESITA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\MESITA\ME0756\ME0756_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 01-Dec-10 11:08, STARTGIS

ME0760

Legend

ME0760

Results

- 0 - 9106
- 9107 - 10107
- 10140; 10142

N

0 20 40

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI USA Prime Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - ME0760
ASSESSMENT DATE: 7/9/2010
MESITA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
AUG 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\MESITA\ME0760\ME0760_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 27-Aug-10 08:18, STARTGIS

ME0765

Legend

ME0765

Results

- 0 - 8079

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - ME0765
ASSESSMENT DATE: 6/28/2010
MESITA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\MESITA\ME0765\ME0765_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 01-Dec-10 12:12, STARTGIS

ME0767

Legend

ME0767

Results

- 0 - 8801

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

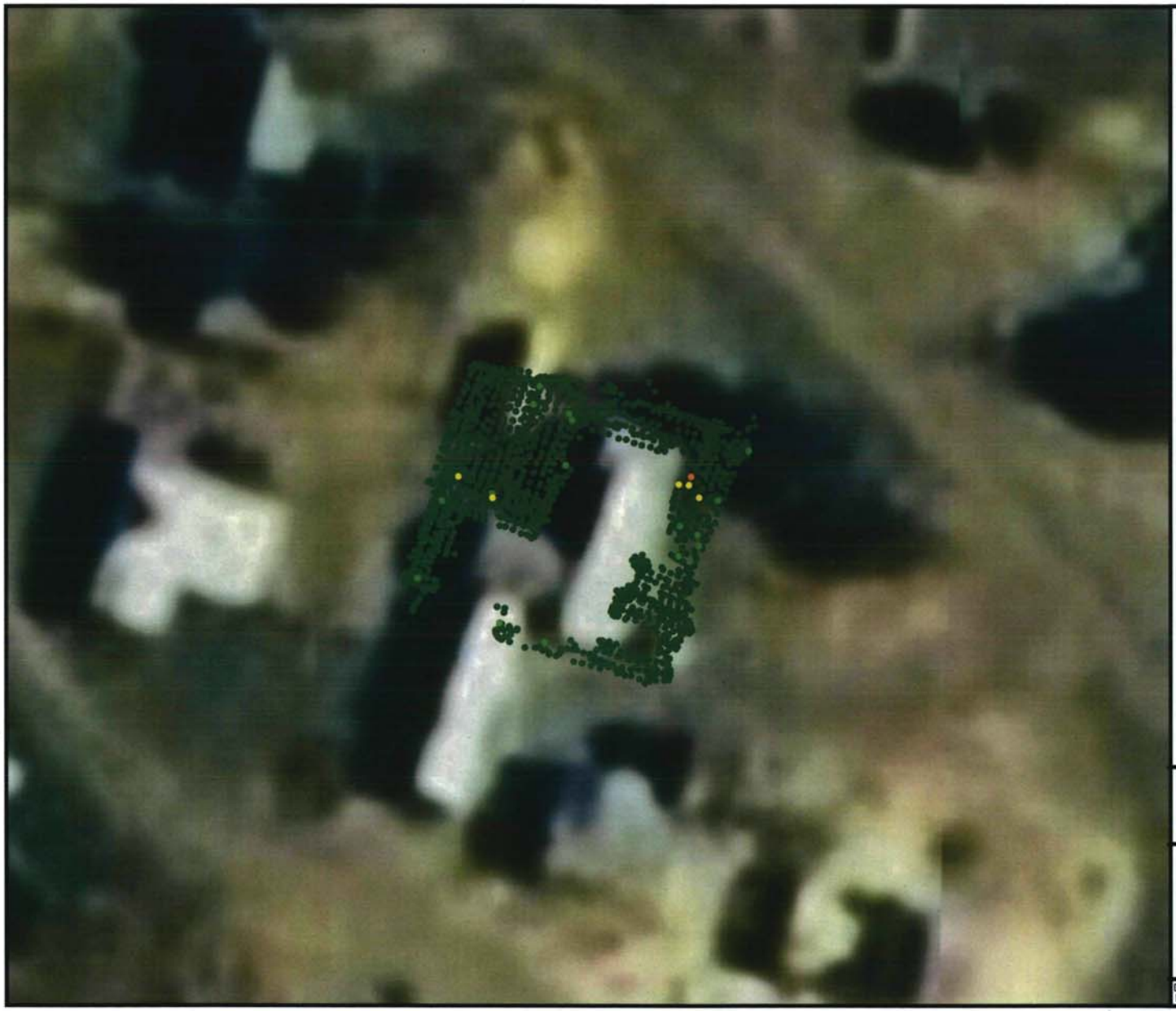
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - ME0767
ASSESSMENT DATE: 6/28/2010
MESITA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\MESITA\ME0767\ME0767_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 01-Dec-10 13:05, STARTGIS

ME0769



Legend

ME0769

Results

- 0 - 9106
- 9107 - 10107
- 10108 - 10999
- 11013

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

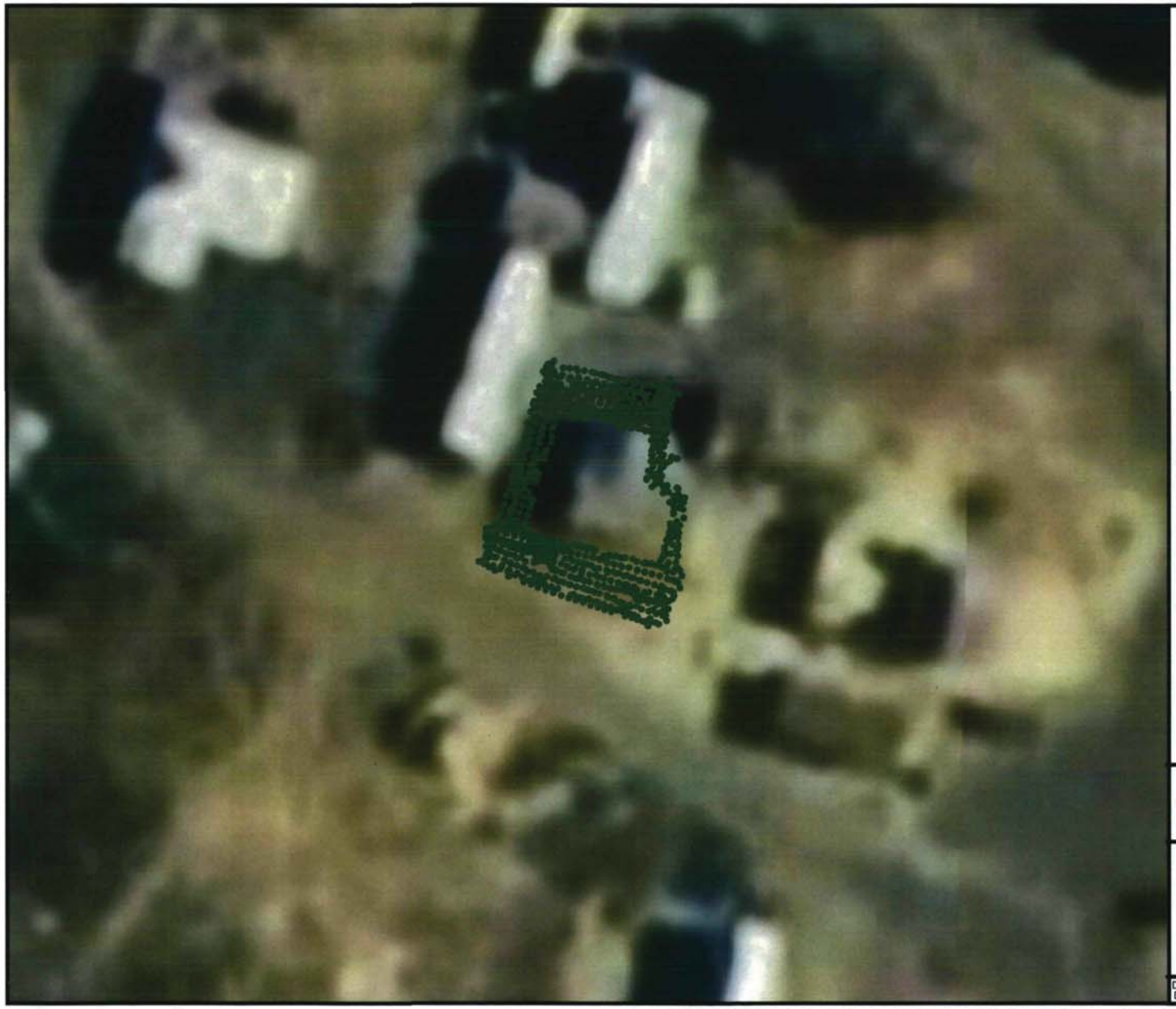
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - ME0769
ASSESSMENT DATE: 7/5/2010
MESITA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\MESITA\ME0769\ME0769_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 01-Dec-10 13:29, STARTGIS

ME0770



Legend

ME0770

Results

- 0 - 6763

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - ME0770
ASSESSMENT DATE: 6/30/2010
MESITA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\MESITA\ME0770\ME0770_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 01-Dec-10 13:56, STARTGIS

ME0774

Legend

ME0774

Results

- 0 - 9106
- 9107 - 10107
- 10108 - 10999
- 11000 - 12999
- 13298

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

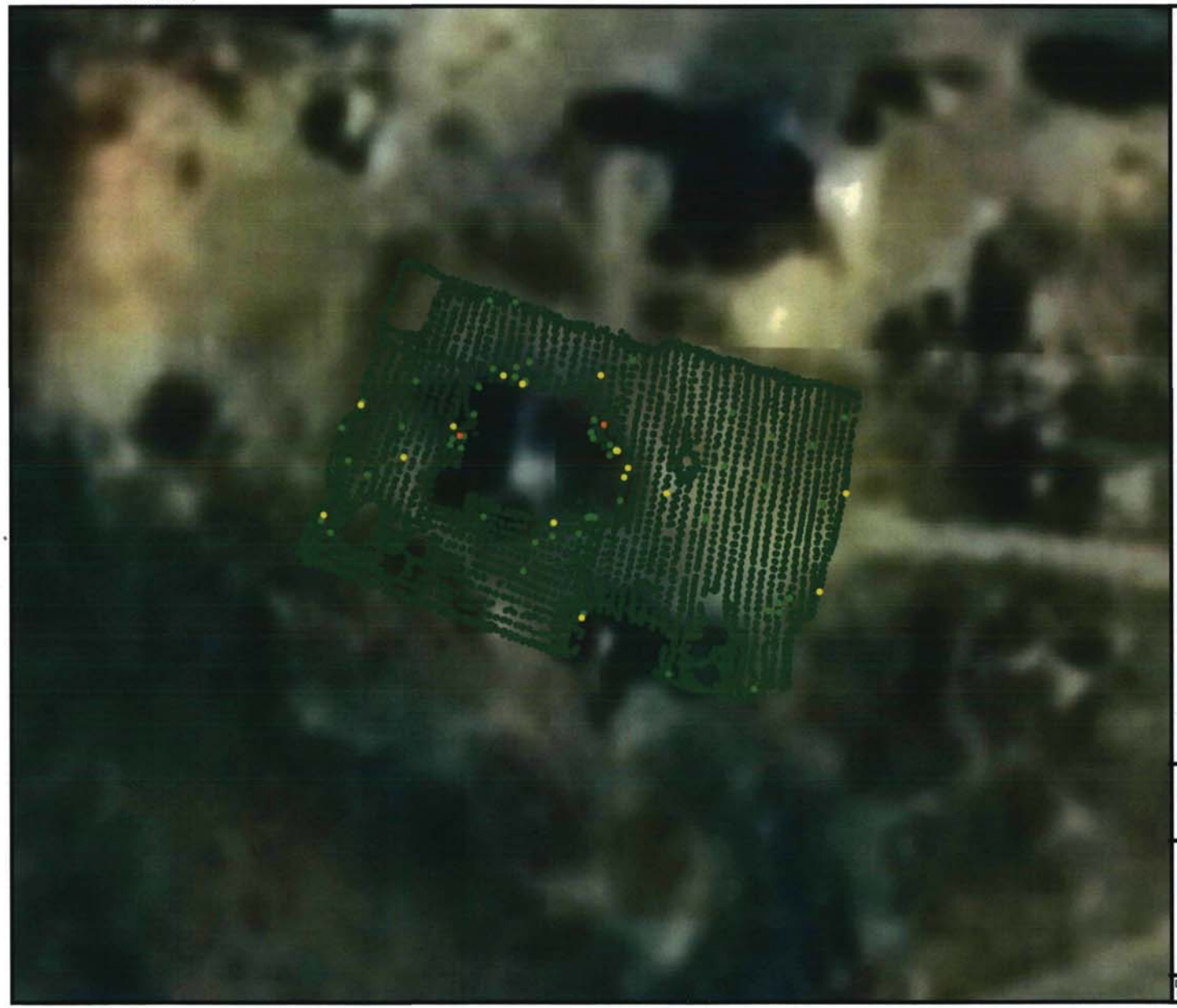
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - ME0774
ASSESSMENT DATE: 6/25/2010
MESITA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

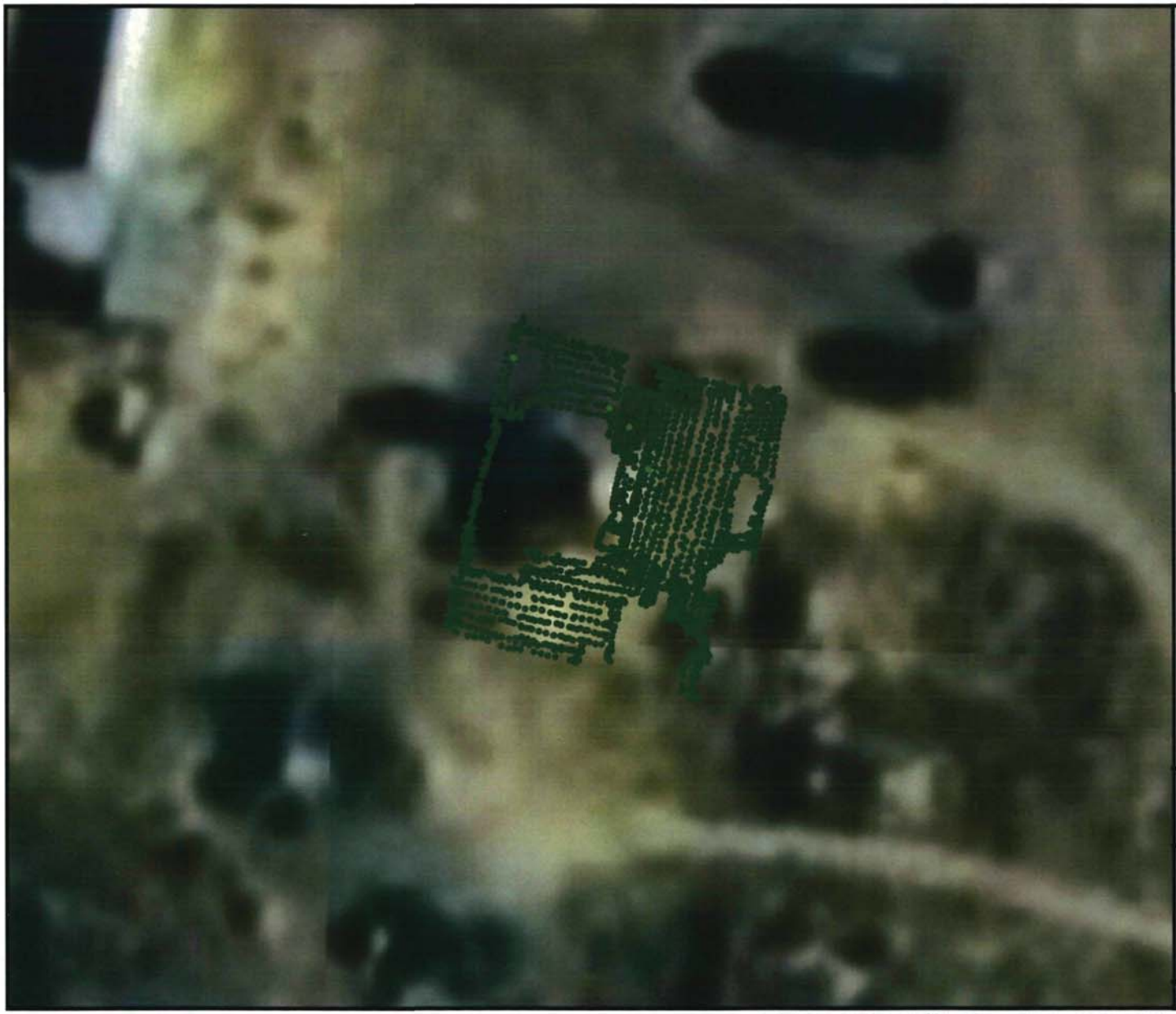
File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\MESITA\ME0774\ME0774_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 01-Dec-10 14:44, STARTGIS

ME0776



File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\MESITA\ME0776\ME0776_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 01-Dec-10 16:00, STARTGIS

ME0777



Legend

ME0777

Results

- 0 - 9106
- 9107 - 10107

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - ME0777
ASSESSMENT DATE: 6/24/2010
MESITA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\MESITA\ME0777\ME0777_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 01-Dec-10 17:42, STARTGIS

ME0778

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\MESITA\ME0778\ME0778_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 02-Dec-10 07:30, STARTGIS

ME0787

Legend

ME0787

Results

- 0 - 8528

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

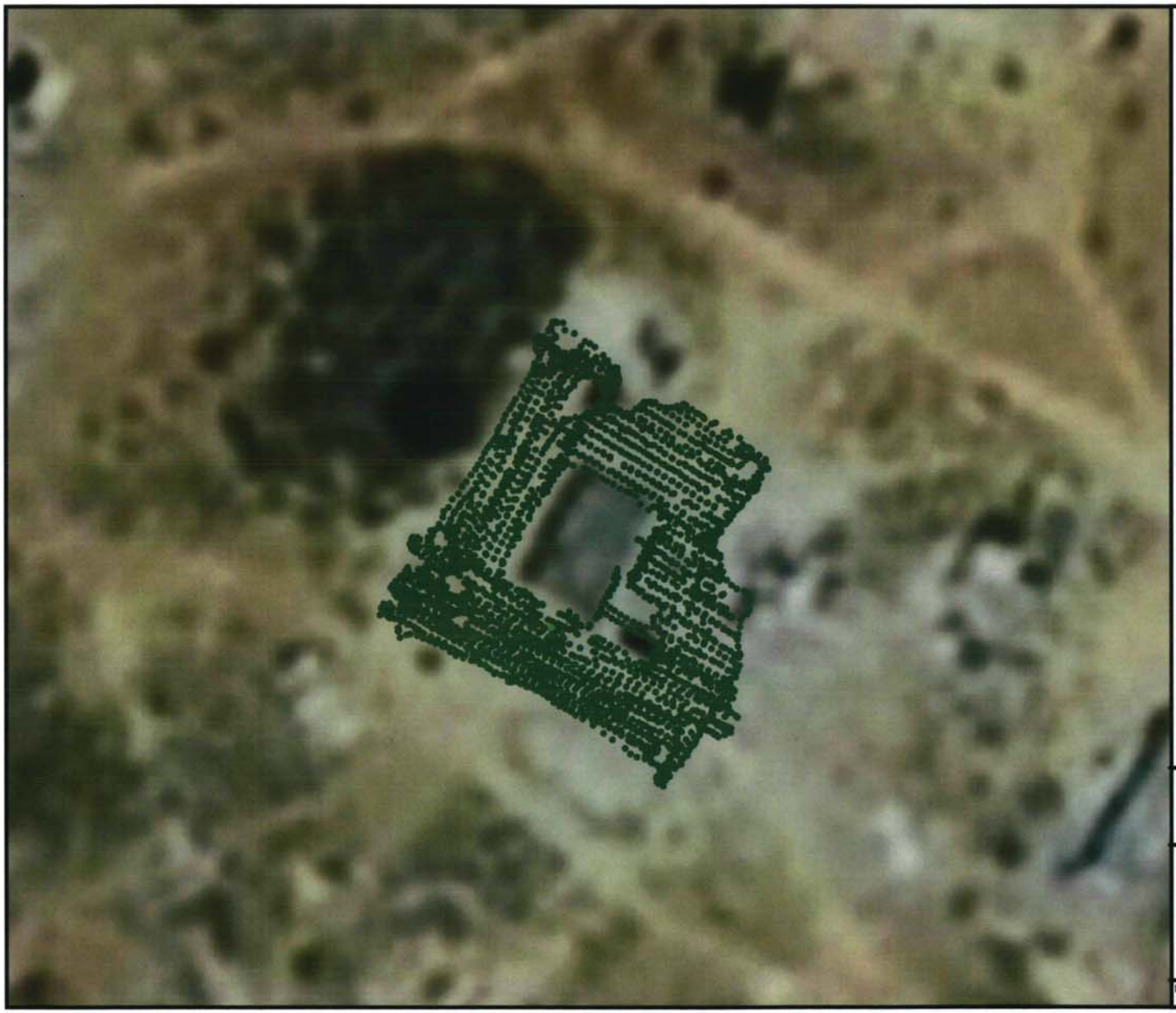
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - ME0787
ASSESSMENT DATE: 7/7/2010
MESITA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\MESITA\ME0787\ME0787_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 02-Dec-10 08:01, STARTGIS

ME0797



Legend

ME0797

Results

- 0 - 9106
- 9107 - 10107

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

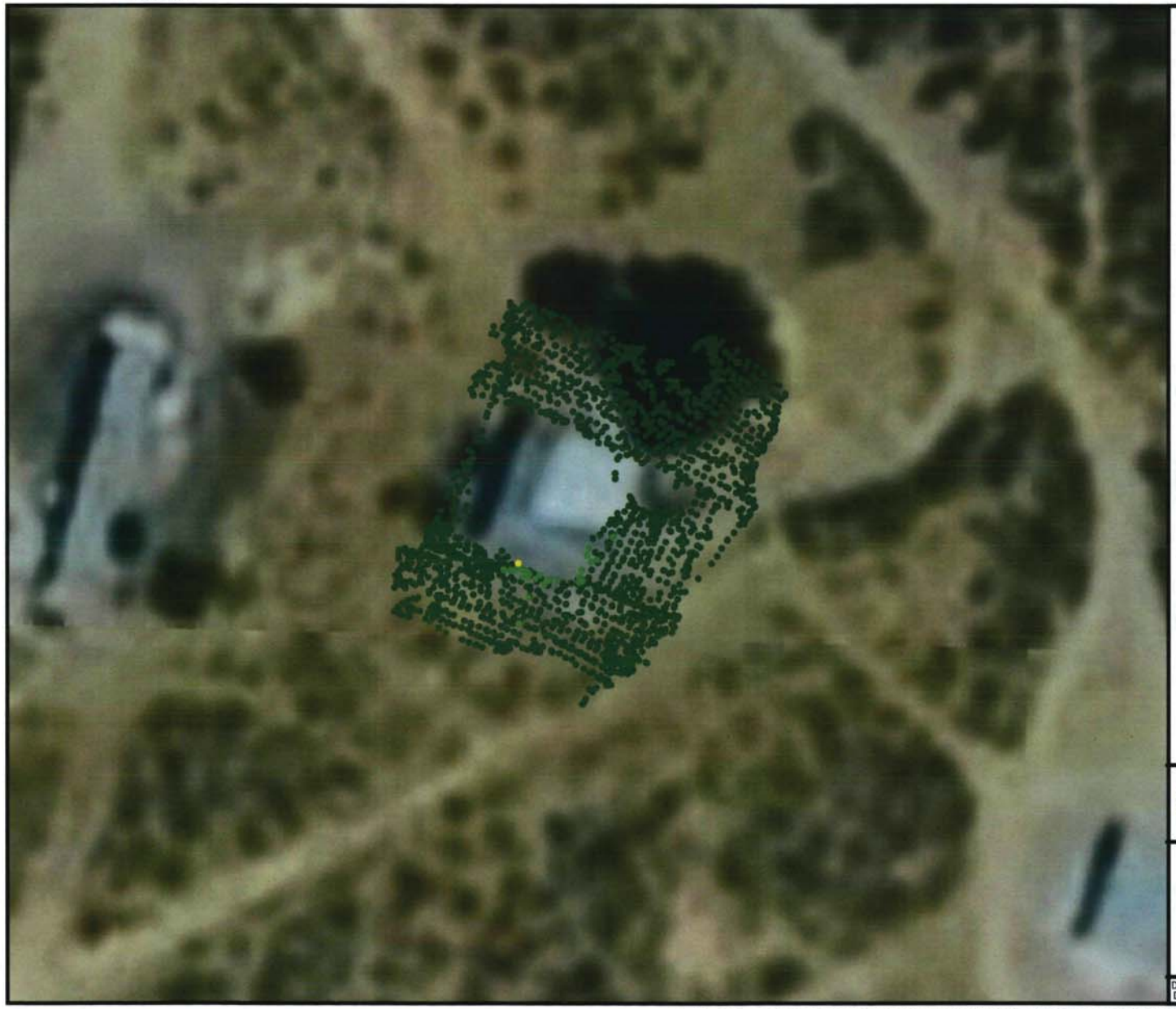
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - ME0797
ASSESSMENT DATE: 7/3/2010
MESITA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\MESITA\ME0797\ME0797_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 02-Dec-10 13:16, STARTGIS

ME0804



Legend

ME0804

Results

- 0 - 9106
- 9107 - 10107
- 10491

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - ME0804
ASSESSMENT DATE: 9/6/2010
MESITA, CIBOLA COUNTY,
NEW MEXICO

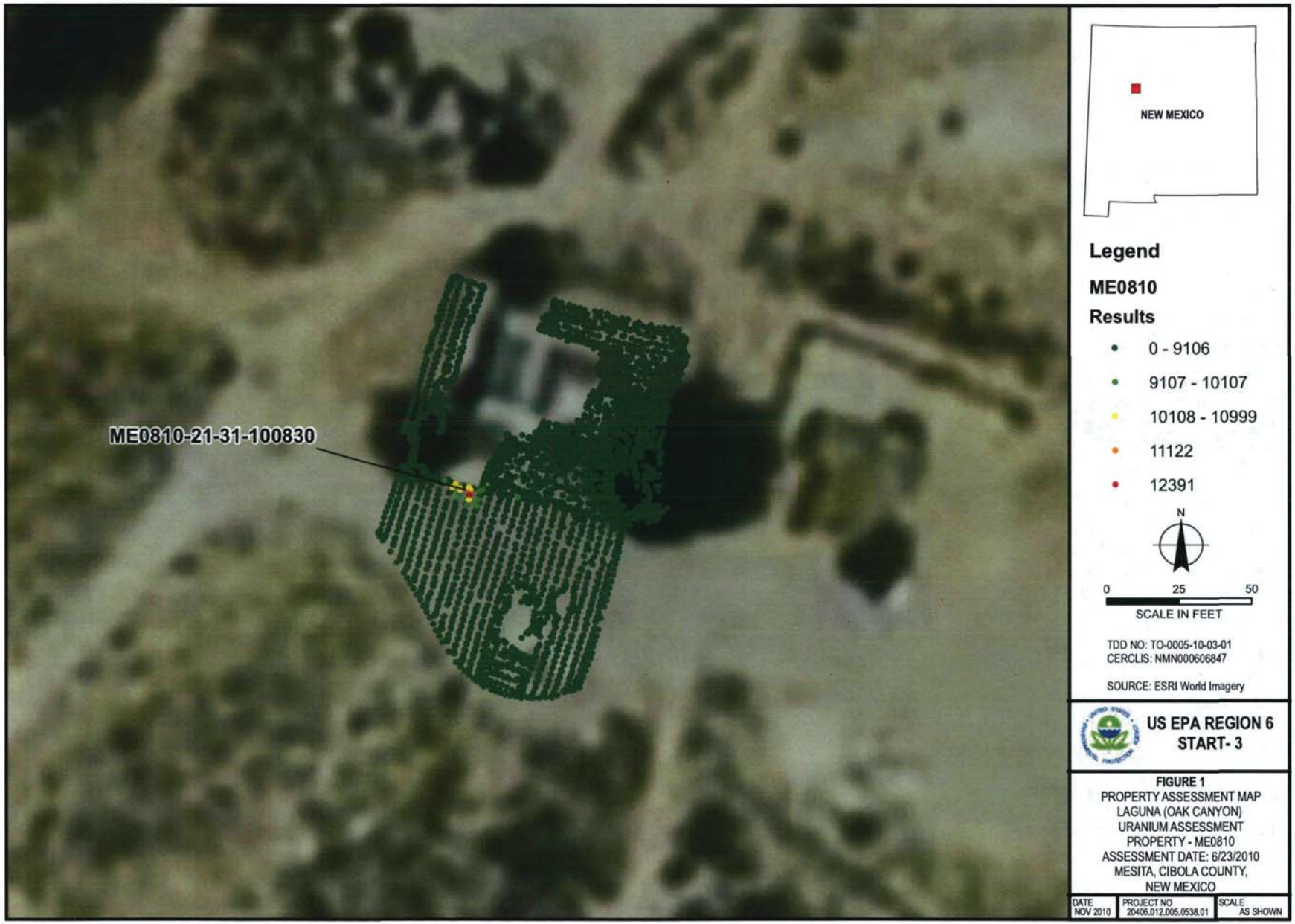
DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\MESITA\ME0804\ME0804_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 02-Dec-10 13:55, STARTGIS

ME0809

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\MESITA\ME0809\ME0809_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 02-Nov-10 10:09, STARTGIS

ME0810



File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\MESITA\ME0810\ME0810_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 02-Nov-10 11:20, STARTGIS

ME0822

Legend

ME0822

Results

- 0 - 9106
- 9107 - 10107
- 10108 - 10999

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

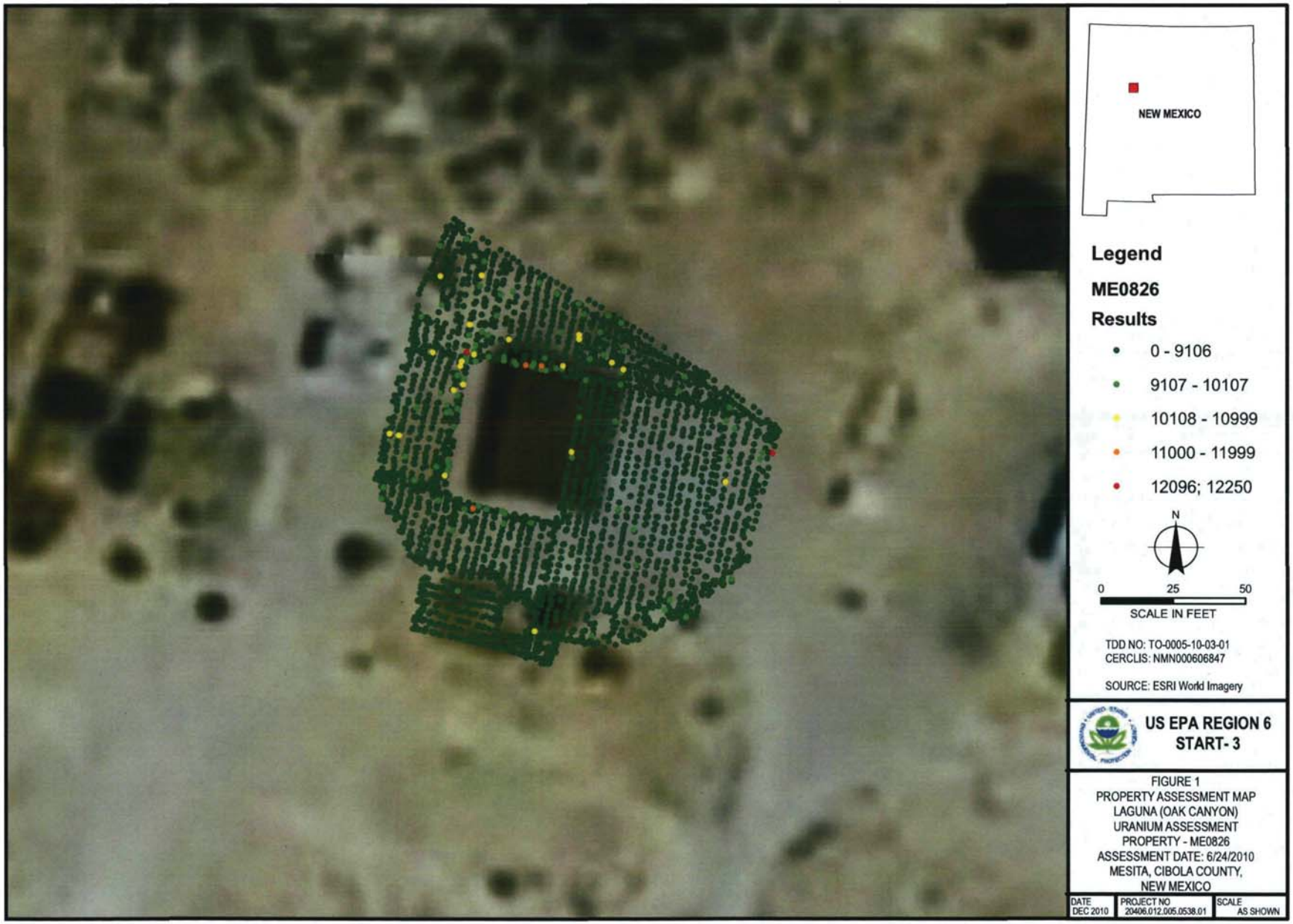
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - ME0822
ASSESSMENT DATE: 7/2/2010
MESITA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

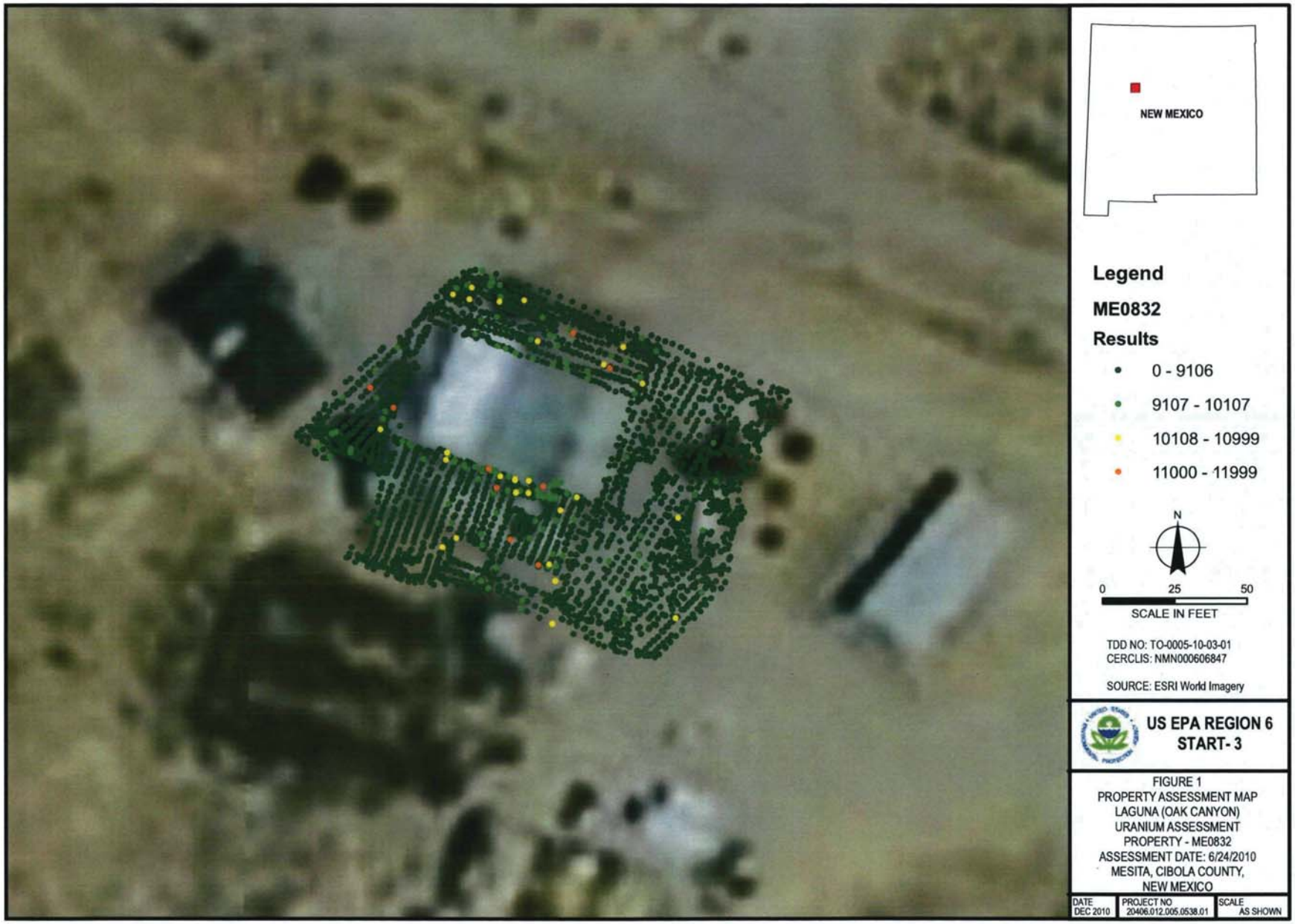
File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\MESITA\ME0822\ME0822_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 02-Dec-10 14:16, STARTGIS

ME0826



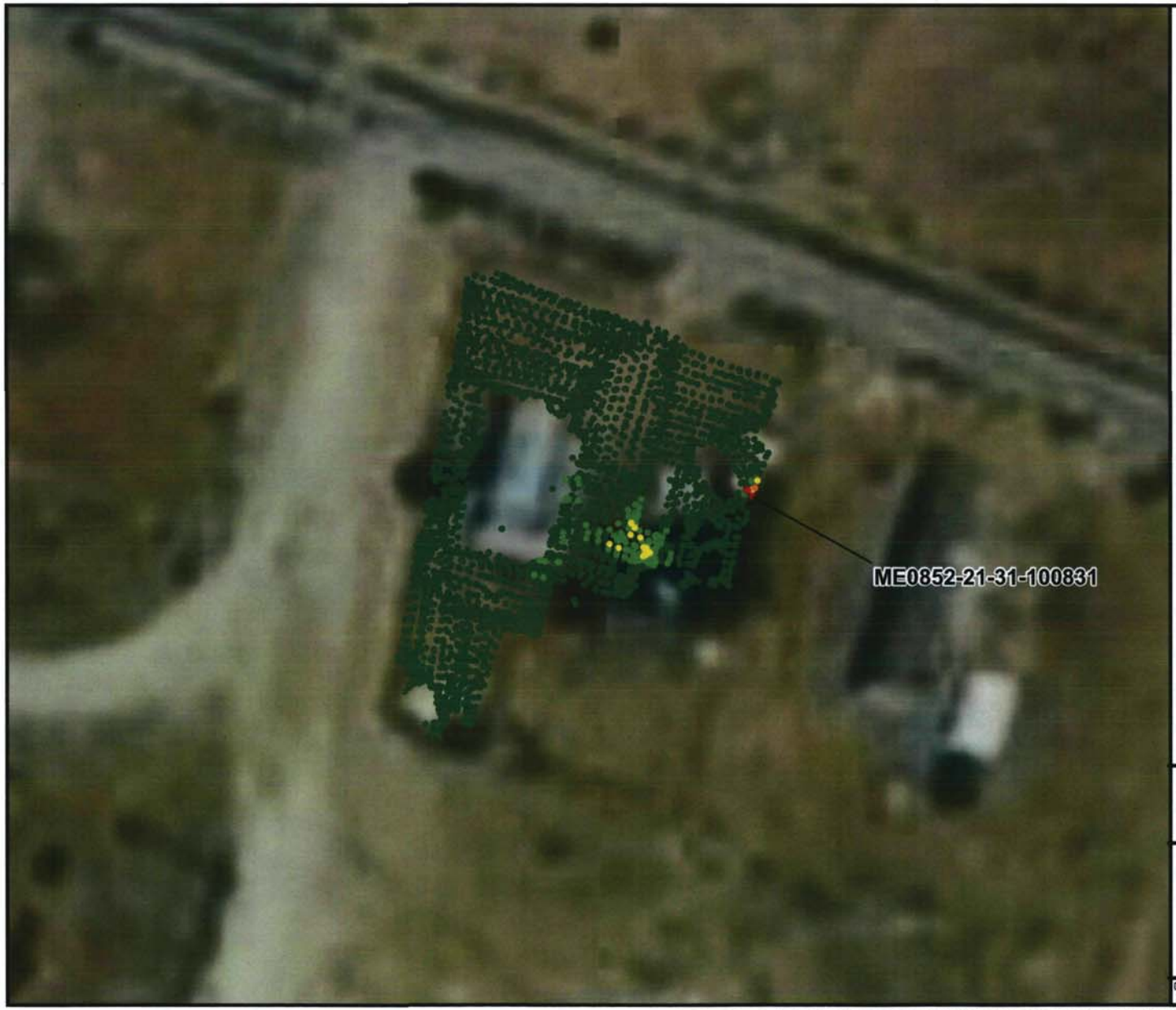
File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\MESITA\ME0826\ME0826_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 02-Dec-10 14:38, STARTGIS

ME0832



File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\MESITA\ME0832\ME0832_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 02-Dec-10 15:15, STARTGIS

ME0852



Legend

ME0852

Results

- 0 - 9106
- 9107 - 10107
- 10108 - 10999
- 11000 - 11999
- 12000 - 12773

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - ME0852
ASSESSMENT DATE: 7/6/2010
MESITA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
NOV 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\MESITA\ME0852\ME0852_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 02-Nov-10 13:48, STARTGIS

ME0893

Legend

ME0893

Results

- 0 - 8293

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - ME0893
ASSESSMENT DATE: 3/02/2011
MESITA, CIBOLA COUNTY,
NEW MEXICO

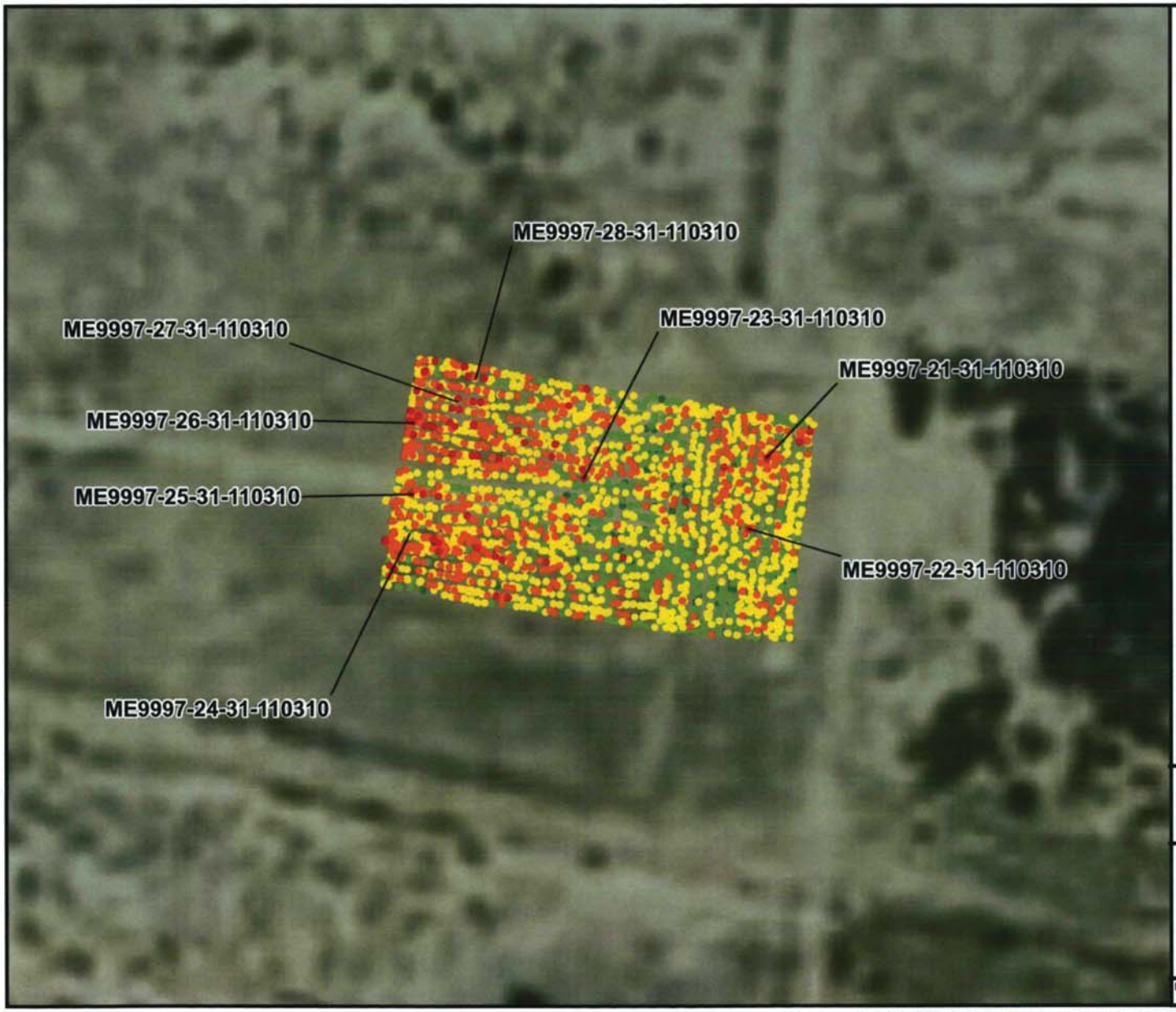
DATE	PROJECT NO	SCALE
APR 2011	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\MESITA\ME0893\ME0893_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 06-Apr-11 16:23, STARTGIS

ME9996

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\MESITA\ME9996\ME9996_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 22-Apr-11 18:08, STARTGIS

ME9997



Legend

ME9997

RESULTS

- 0 - 9106
- 9107 - 10107
- 10108 - 10999
- 11000 - 11999
- 12000 - 13066

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

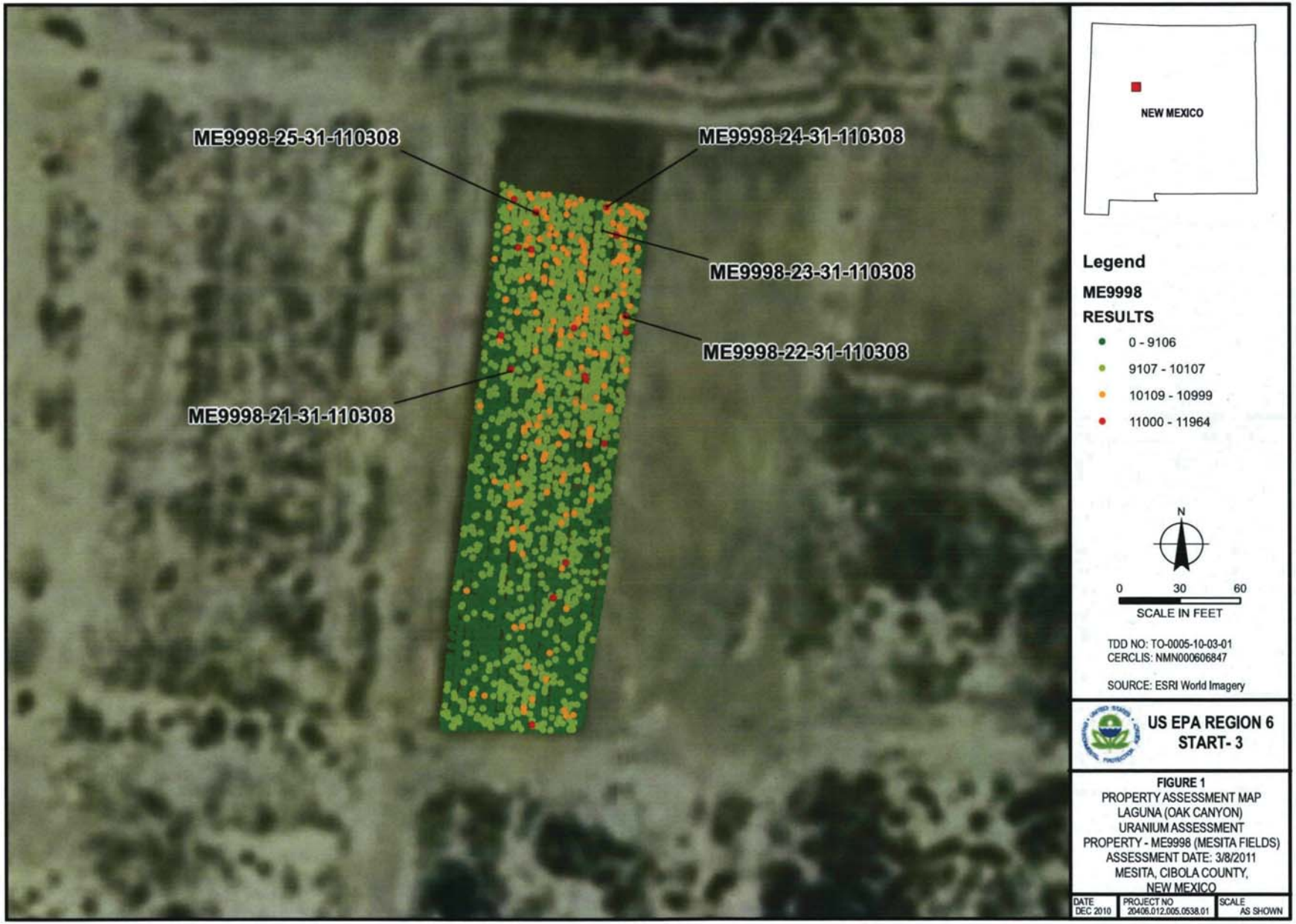
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - ME9997 (MESITA FIELDS)
ASSESSMENT DATE: 3/10/2011
MESITA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
APR 2011	20406.012.005.0538.01	AS SHOWN

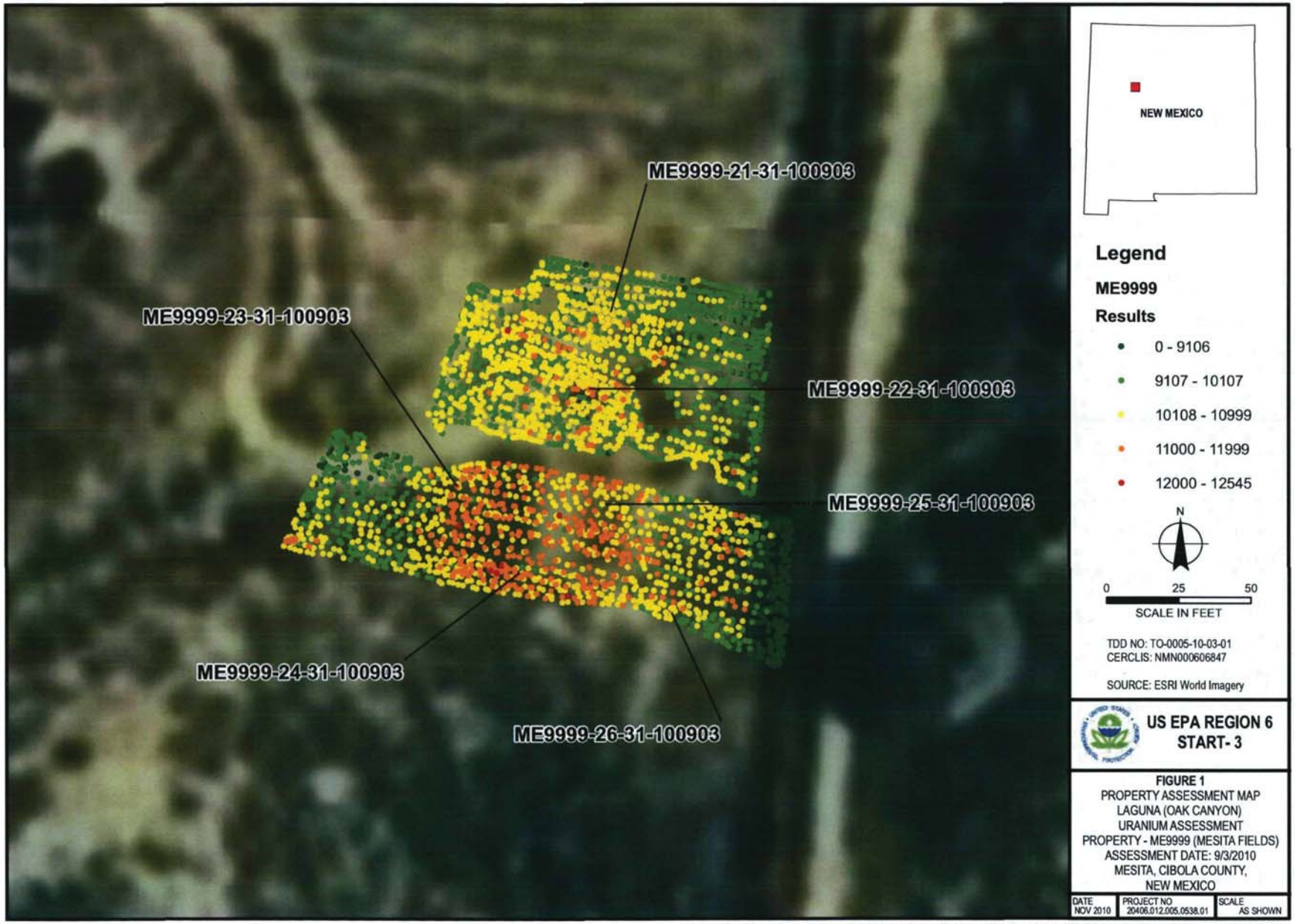
File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\MESITA\ME9997\ME9997_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 22-Apr-11 17:34, STARTGIS

ME9998



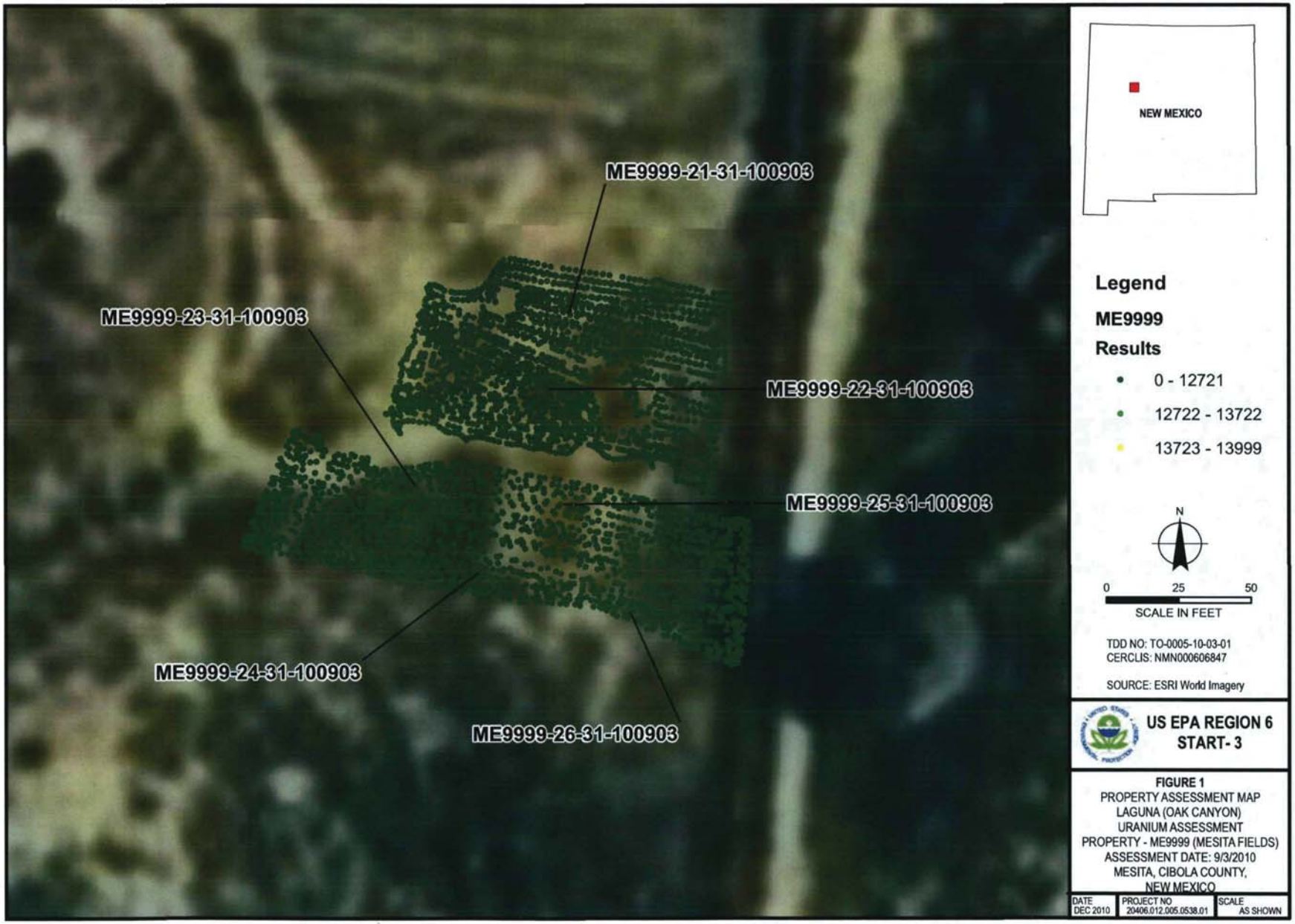
File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\MESITA\ME9998\ME9998_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 14-Apr-11 19:30, STARTGIS

ME9999



File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\MESITA\ME9999 (fields)\ME9999_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 02-Nov-10 14:35, STARTGIS

ME9999



File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\MESITA\ME9999 (fields)\ME9999_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP_02.mxd, 15-Dec-10 09:39, STARTGIS

APPENDIX B

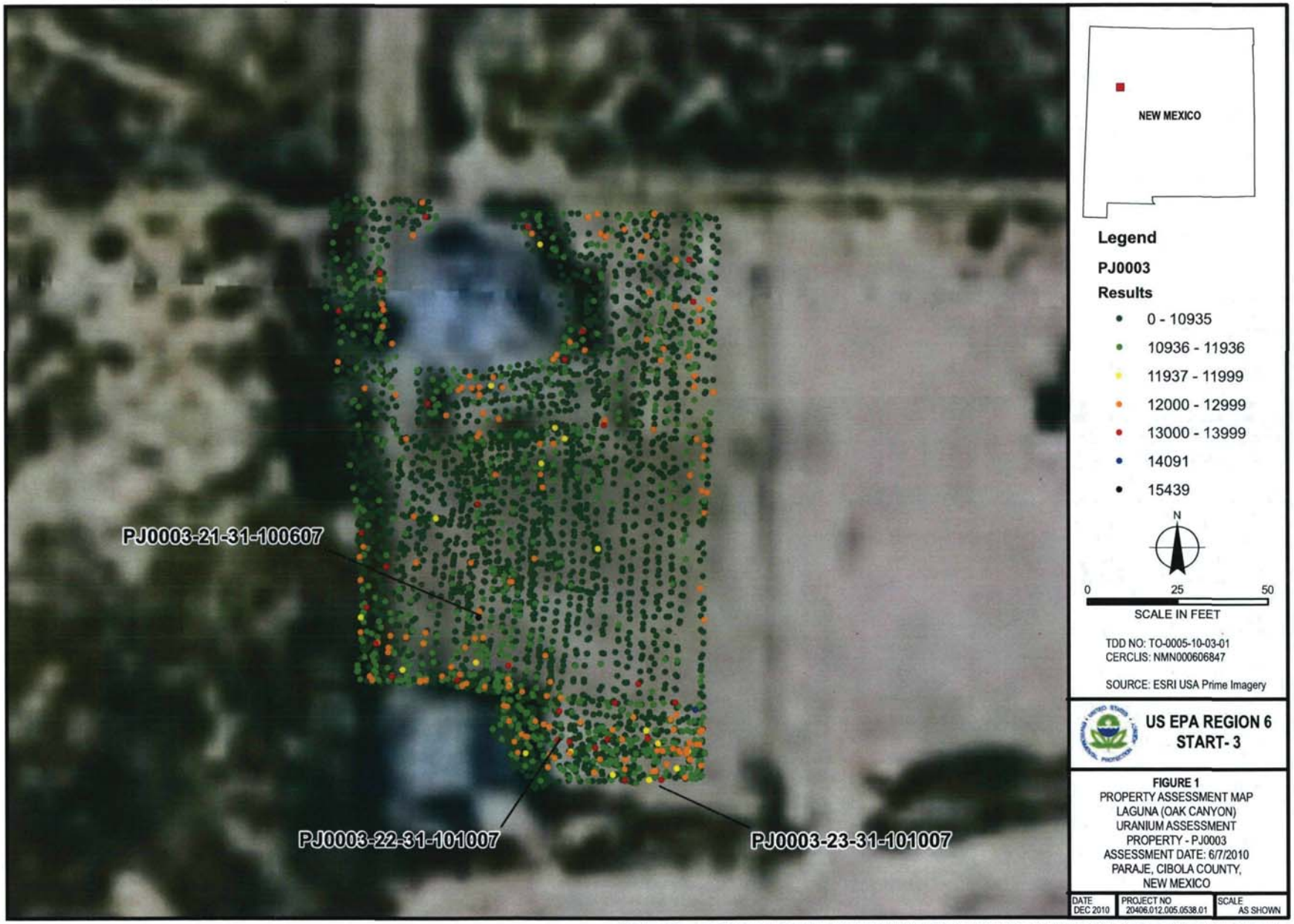
PART 4

Paraje RAT Maps

PJ0001

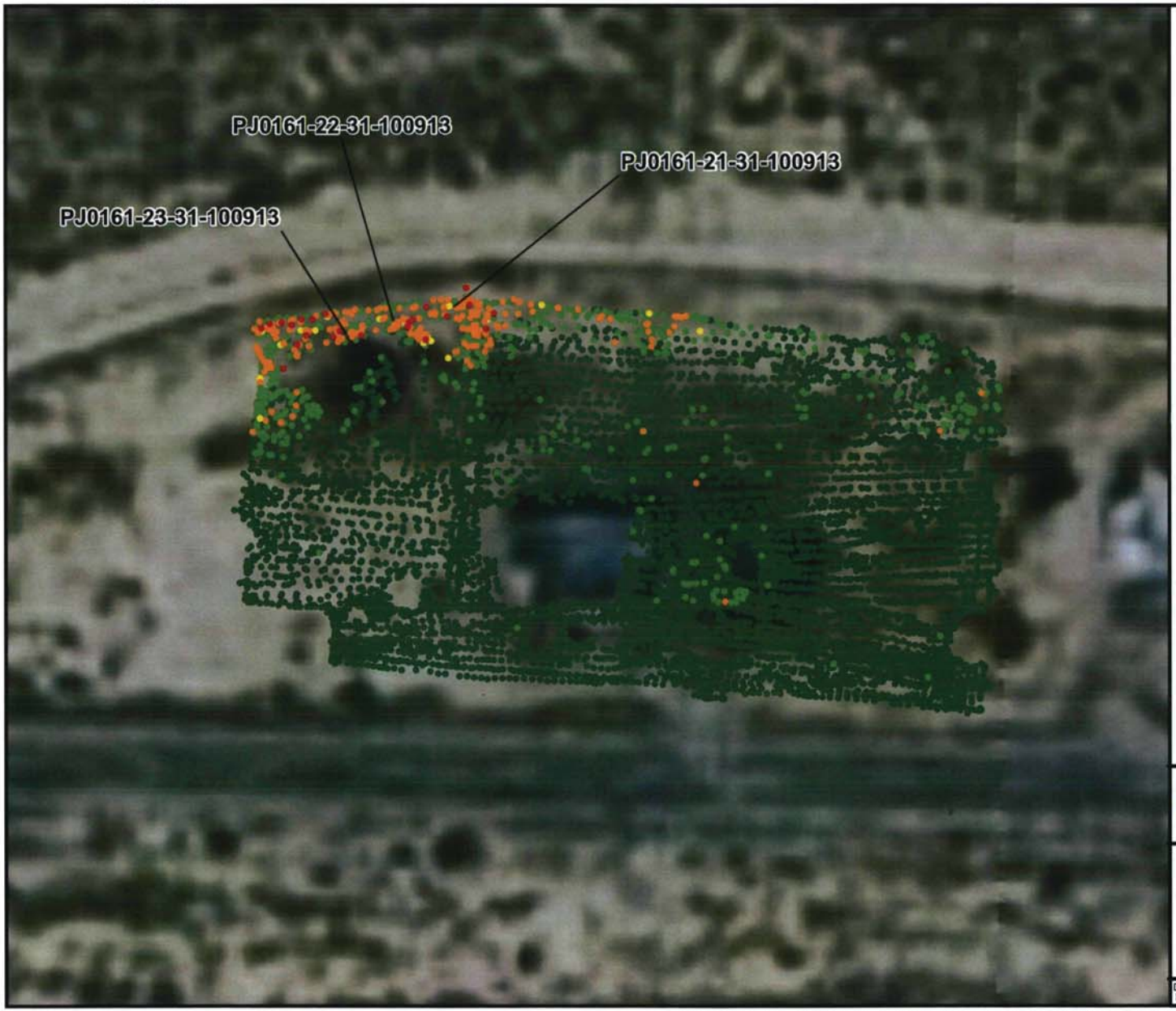
File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\PARAJE\PJ0001\PJ0001_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 03-Nov-10 14:28, STARTGIS

PJ0003



File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\PARAJE\PJ0003\PJ0003_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 01-Dec-10 14:34, STARTGIS

PJ0161



Legend

PJ0161

Results

- 0 - 10935
- 10936 - 11936
- 11937 - 11999
- 12000 - 12999
- 13000 - 13965

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

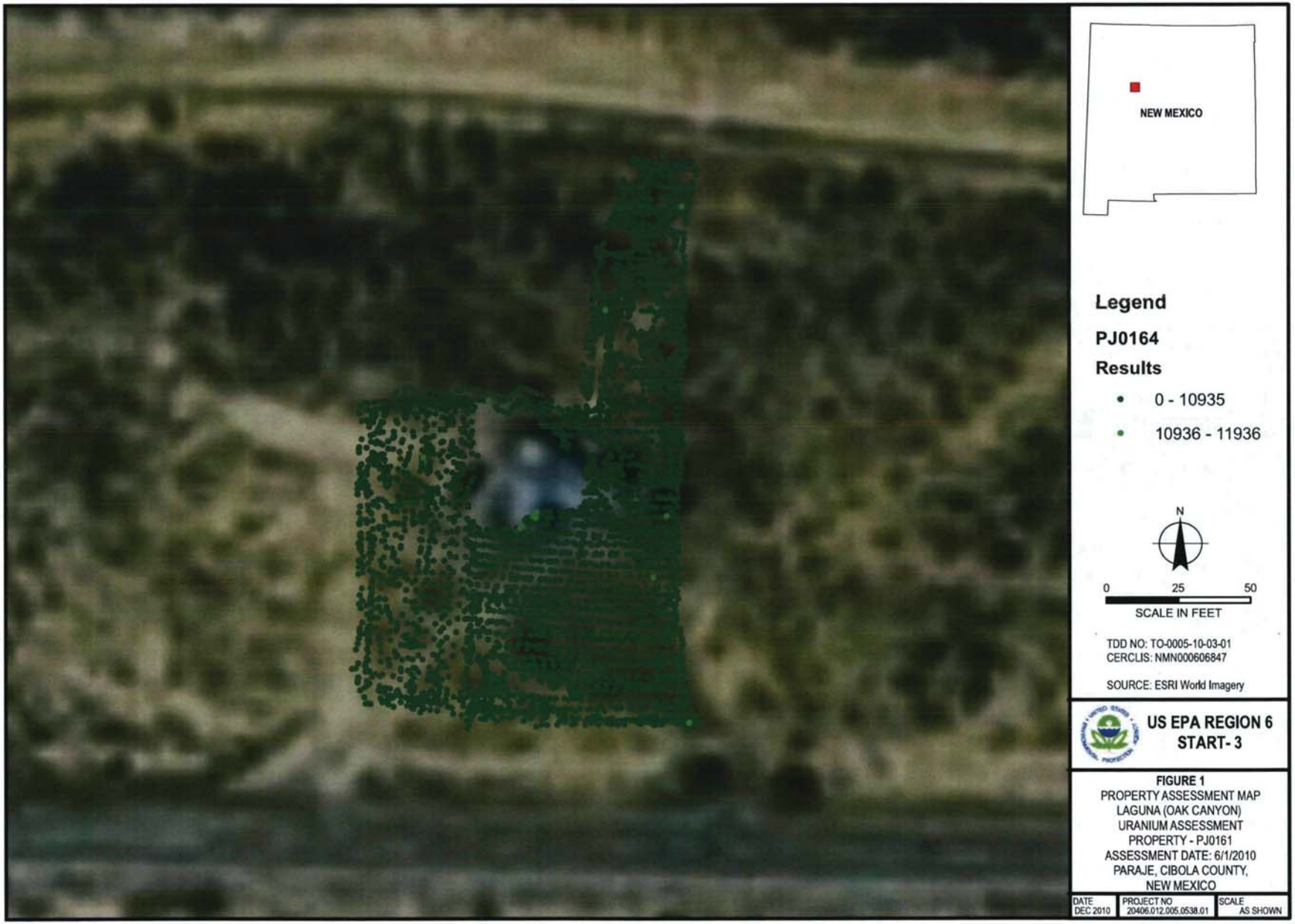
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - PJ0161
ASSESSMENT DATE: 6/1/2010
PARAJE, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
NOV 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\PARAJE\PJ0161\PJ0161_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 02-Nov-10 16:07, STARTGIS

PG0164



File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\PARAJE\PJ0164\PJ0164_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 03-Dec-10 07:26, STARTGIS

PG0260

Legend

PJ0260

Results

- 0 - 10308

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

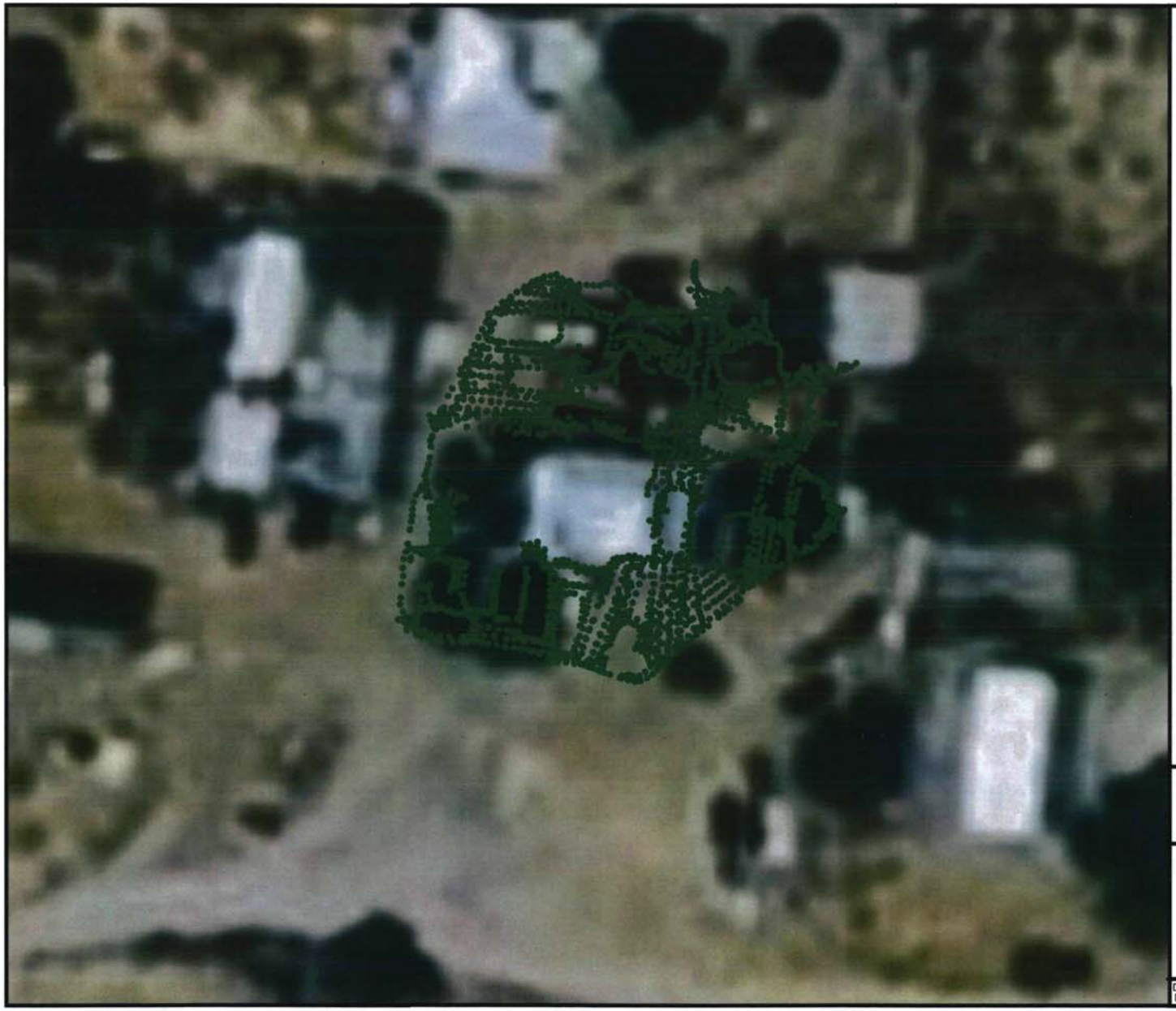
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - PJ0260
ASSESSMENT DATE: 6/2/2010
PARAJE, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\PARAJE\PJ0260\PJ0260_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 03-Dec-10 08:35, STARTGIS

PG0270



Legend

PJ0270

Results

- 0 - 9979

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - PJ0270
ASSESSMENT DATE: 10/27/2010
PARAJE, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\PARAJE\PJ0270\PJ0270_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 03-Dec-10 10:05, STARTGIS

PJ0271

Legend

PJ0271

Results

- 0 - 10935
- 10936 - 11936
- 11937 - 11999
- 12000 - 12449

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - PJ0271
ASSESSMENT DATE: 11/9/2010
PARAJE, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
JAN 2011	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\PARAJE\PJ0271\PJ0271_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 28-Jan-11 14:36, STARTGIS

PG0282

Legend

PJ0282

Results

- 0 - 10935
- 10936 - 11936
- 11937 - 11999
- 12000 - 12470

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - PJ0282
ASSESSMENT DATE: 6/2/2010
PARAJE, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\PARAJE\PJ0282\PJ0282_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 03-Dec-10 10:34, STARTGIS

PG0285

Legend

PJ0285

Results

- 0 - 10095

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

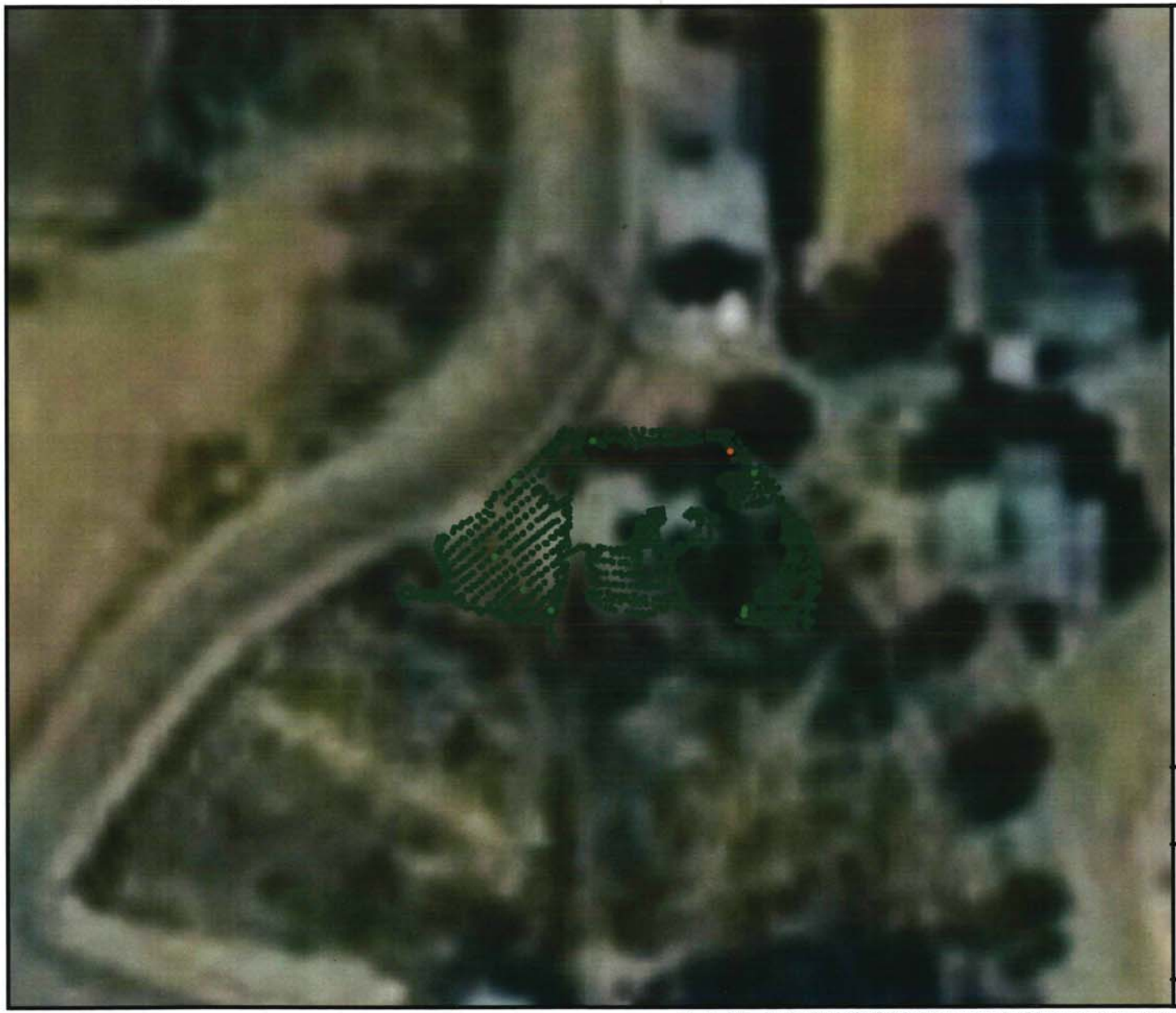
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - PJ0285
ASSESSMENT DATE: 6/9/2010
PARAJE, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\PARAJE\PJ0285\PJ0285_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 03-Dec-10 10:56, STARTGIS

PG0291



Legend

PJ0291

Results

- 0 - 10935
- 10936 - 11936
- 11937 - 11999
- 12000 - 12263

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

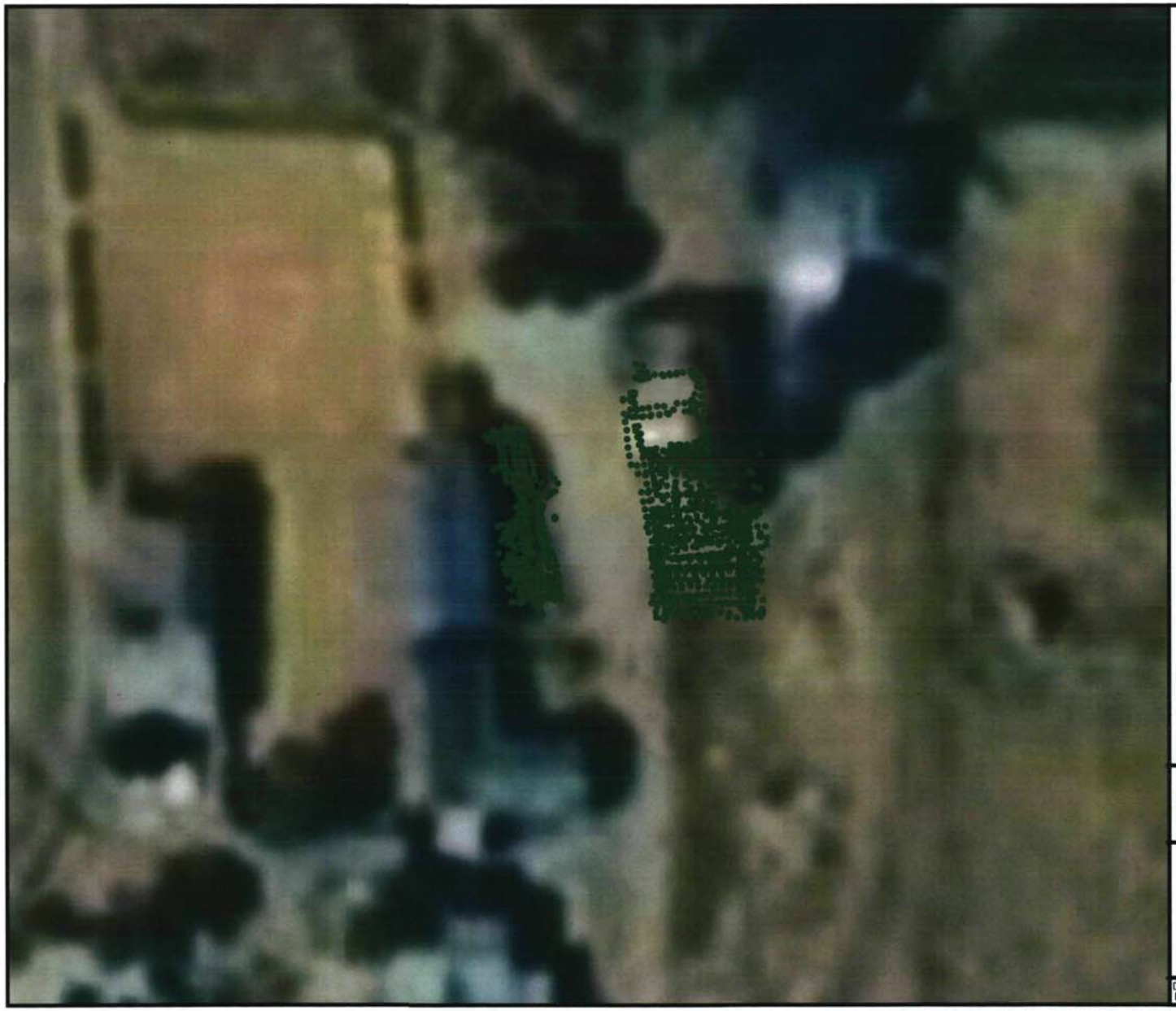
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - PJ0291
ASSESSMENT DATE: 6/19/2010
PARAJE, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\PARAJE\PJ0291\PJ0291_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 03-Dec-10 11:24, STARTGIS

PG0295



Legend

PJ0295

Results

- 0 - 10233

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - PJ0295
ASSESSMENT DATE: 6/5/2010
PARAJE, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\PARAJE\PJ0295\PJ0295_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 03-Dec-10 12:20, STARTGIS

PG0296

Legend

PJ0296

Results

- 0 - 10935
- 10936 - 11936

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - PJ0296
ASSESSMENT DATE: 6/12/2010
PARAJE, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\PARAJE\PJ0296\PJ0296_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 03-Dec-10 12:33, STARTGIS

PG0298

Legend

PJ0298

Results

- 0 - 10571

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

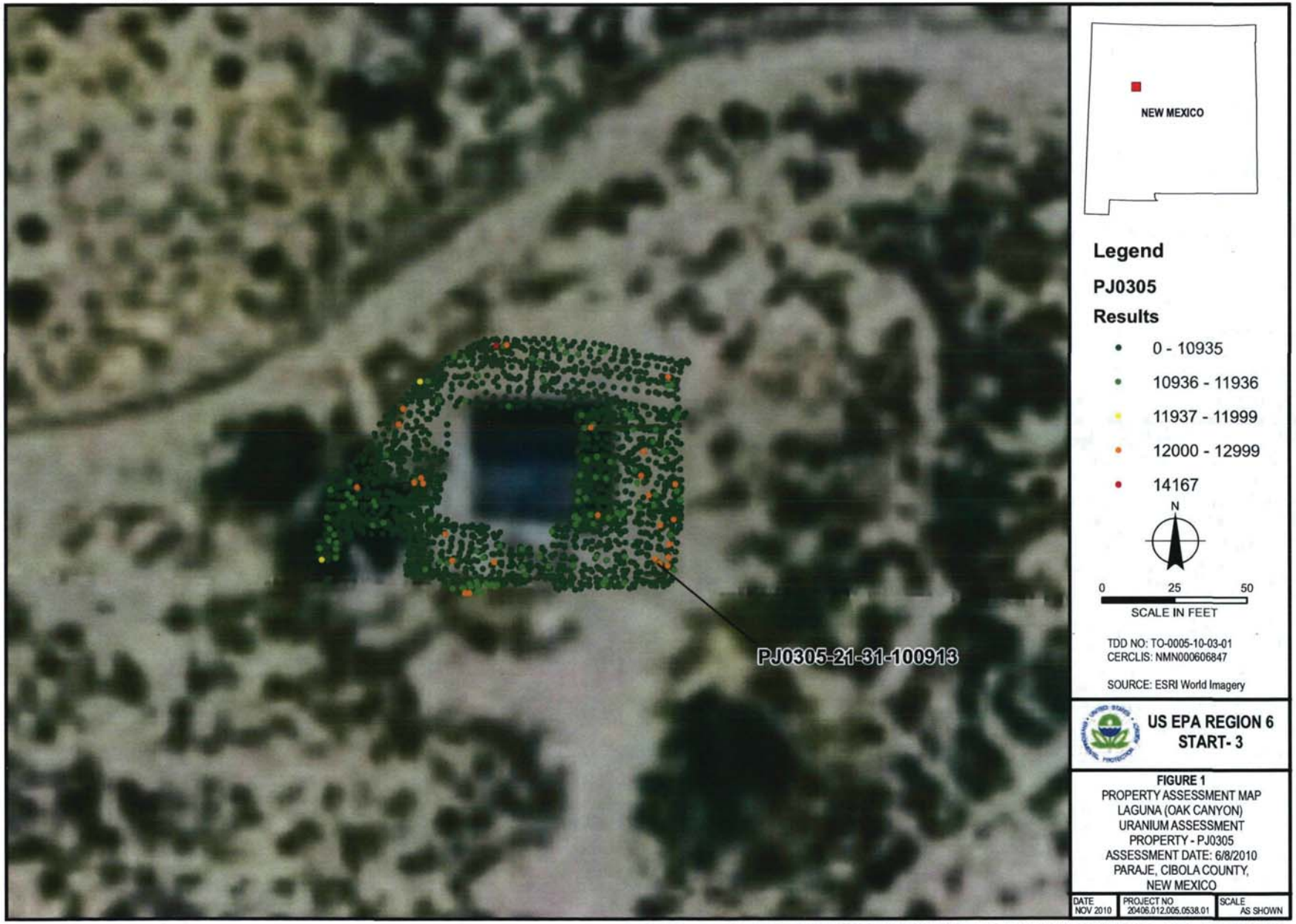
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - PJ0298
ASSESSMENT DATE: 6/21/2010
PARAJE, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\PARAJE\PJ0298\PJ0298_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 03-Dec-10 13:03, STARTGIS

PJ0305



File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\PARAJE\PJ0305\PJ0305_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 06-Nov-10 14:54, STARTGIS

PG0311

Legend

PJ0311

Results

- 0 - 10935
- 10936 - 11936

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - PJ0311
ASSESSMENT DATE: 6/10/2010
PARAJE, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\PARAJE\PJ0311\PJ0311_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 03-Dec-10 13:34, STARTGIS

PG0316

Legend

PJ0316

Results

- 0 - 10935
- 10936 - 11936
- 11937 - 11999
- 12000 - 12978

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - PJ0316
ASSESSMENT DATE: 6/12/2010
PARAJE, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\PARAJE\PJ0316\PJ0316_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 03-Dec-10 14:04, STARTGIS

PG0317

Legend

PJ0317

Results

- 0 - 10935
- 10936 - 11936
- 12000 - 12560

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - PJ0317
ASSESSMENT DATE: 6/12/2010
PARAJE, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\PARAJE\PJ0317\PJ0317_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 03-Dec-10 14:42, STARTGIS

PG0319

Legend

PJ0319

Results

- 0 - 10583

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

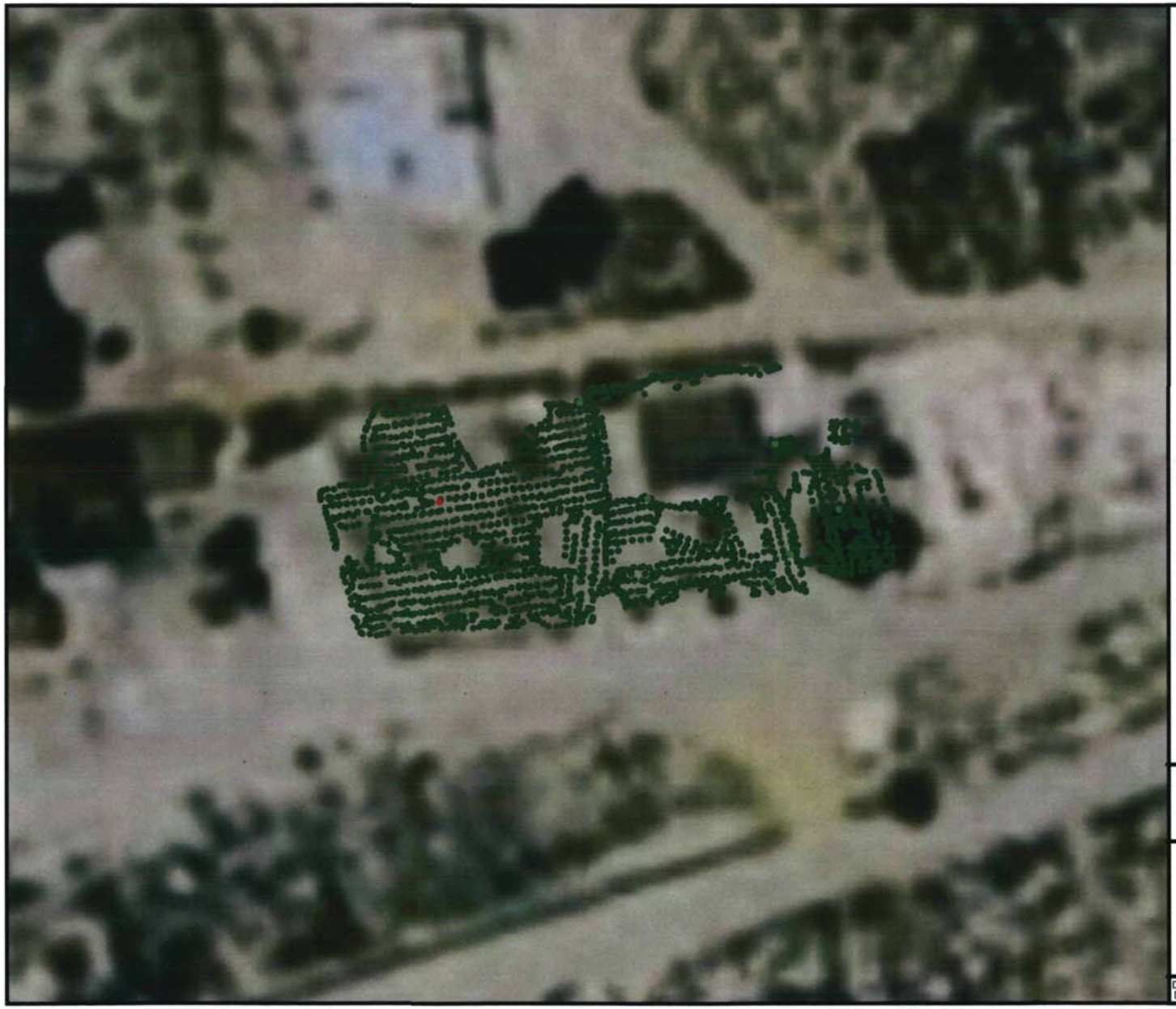
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - PJ0319
ASSESSMENT DATE: 6/21/2010
PARAJE, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\PARAJE\PJ0319\PJ0319_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 03-Dec-10 15:20, STARTGIS

PG0320



Legend

PJ0320

Results

- 0 - 10935
- 10936 - 11936
- 14562

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - PJ0320
ASSESSMENT DATE: 6/19/2010
PARAJE, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\PARAJE\PJ0320\PJ0320_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 03-Dec-10 15:40, STARTGIS

PG0321

Legend

PJ0321

Results

- 0 - 10935
- 10936 - 11936
- 12000 - 12425

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - PJ0321
ASSESSMENT DATE: 6/14/2010
PARAJE, CIBOLA COUNTY,
NEW MEXICO

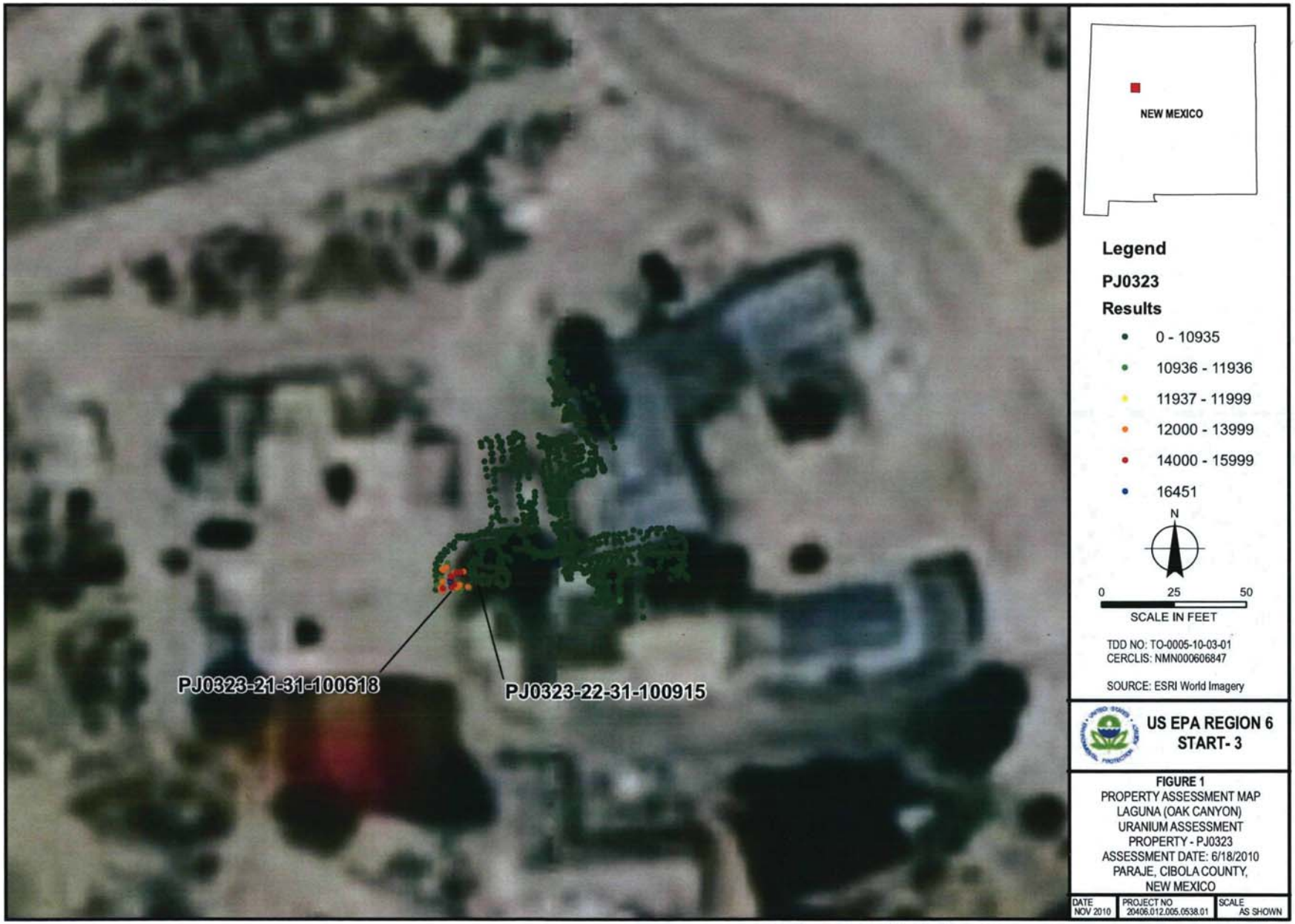
DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\PARAJE\PJ0321\PJ0321_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 03-Dec-10 17:01, STARTGIS

PJ0322

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\PARAJE\PJ0322\PJ0322_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 08-Nov-10 10:05, STARTGIS

PJ0323



File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\PARAJE\PJ0323\PJ0323_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 08-Nov-10 11:53, STARTGIS

PJ0324

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\PARAJE\PJ0324\PJ0324_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 08-Nov-10 13:22, STARTGIS

PG0326

Legend

PJ0326

Results

- 0 - 10935
- 10936 - 11936
- 11937 - 11999
- 12000 - 12999
- 13103; 13552

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - PJ0326
ASSESSMENT DATE: 6/26/2010
PARAJE, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\PARAJE\PJ0326\PJ0326_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 04-Dec-10 07:42, STARTGIS

PG0327

Legend

PJ0327

Results

- 0 - 10498

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

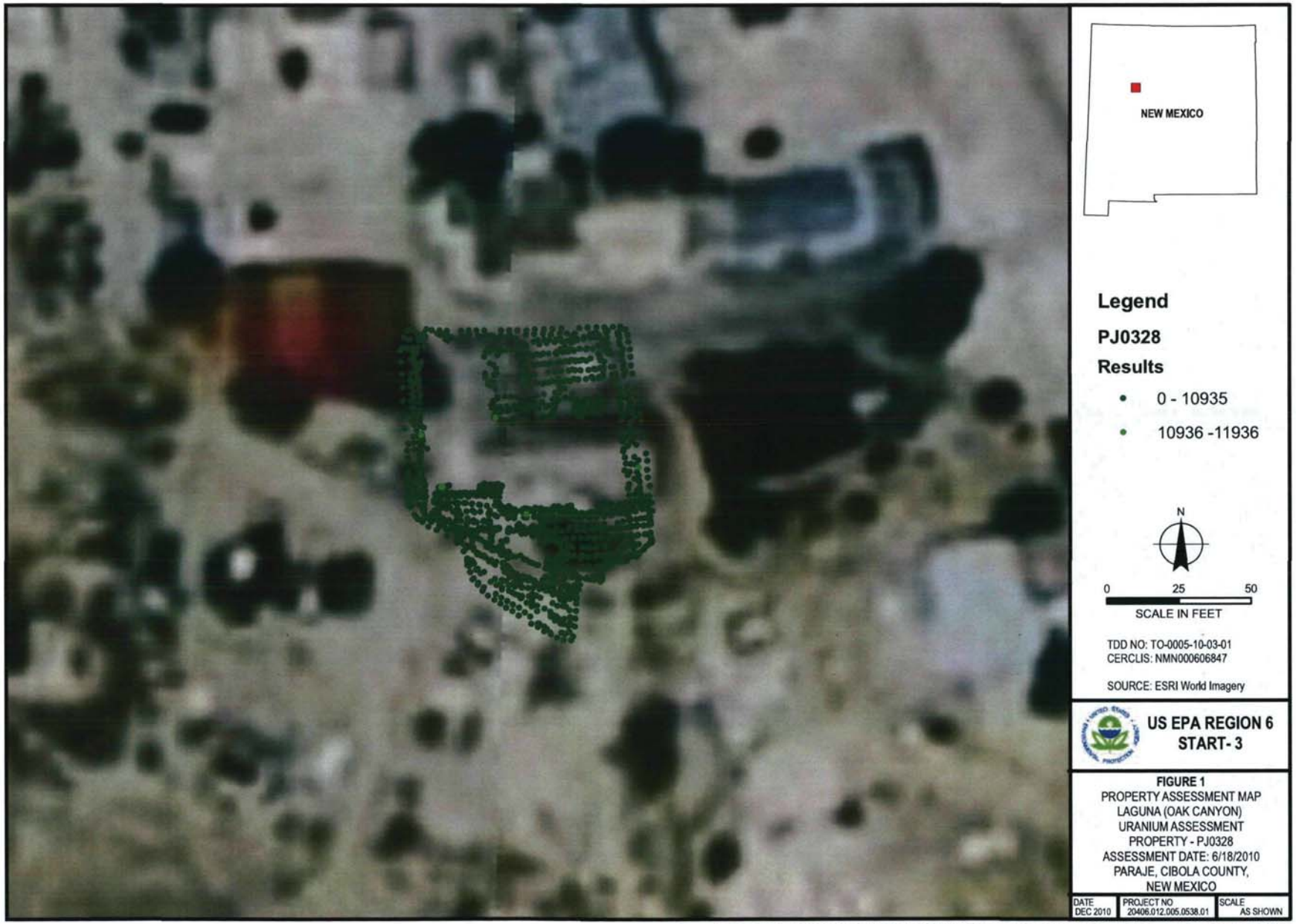
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - PJ0327
ASSESSMENT DATE: 6/9/2010
PARAJE, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\PARAJE\PJ0327\PJ0327_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 04-Dec-10 08:06, STARTGIS

PG0328

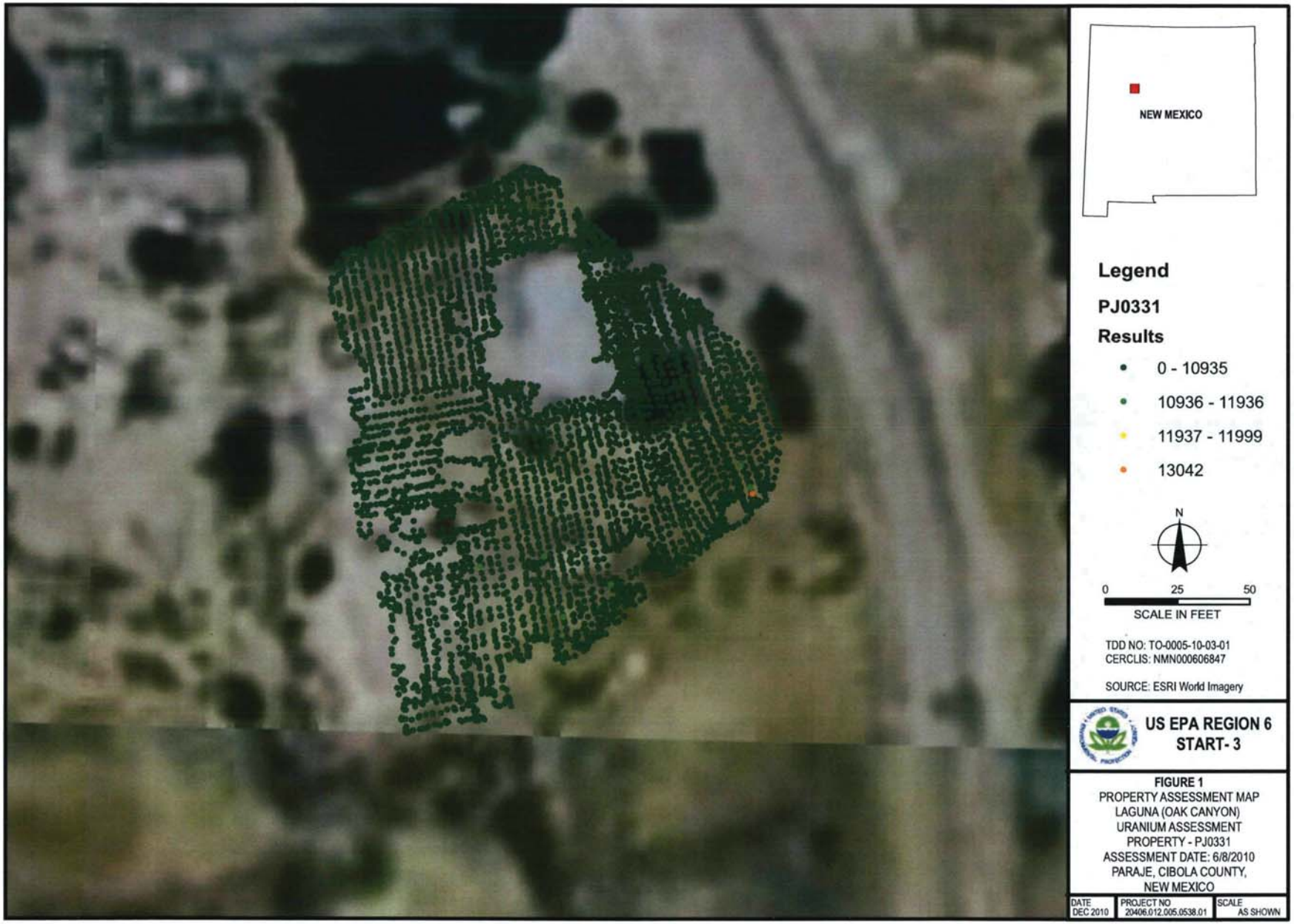


File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\PARAJE\PJ0328\PJ0328_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 04-Dec-10 08:41, STARTGIS

PG0329

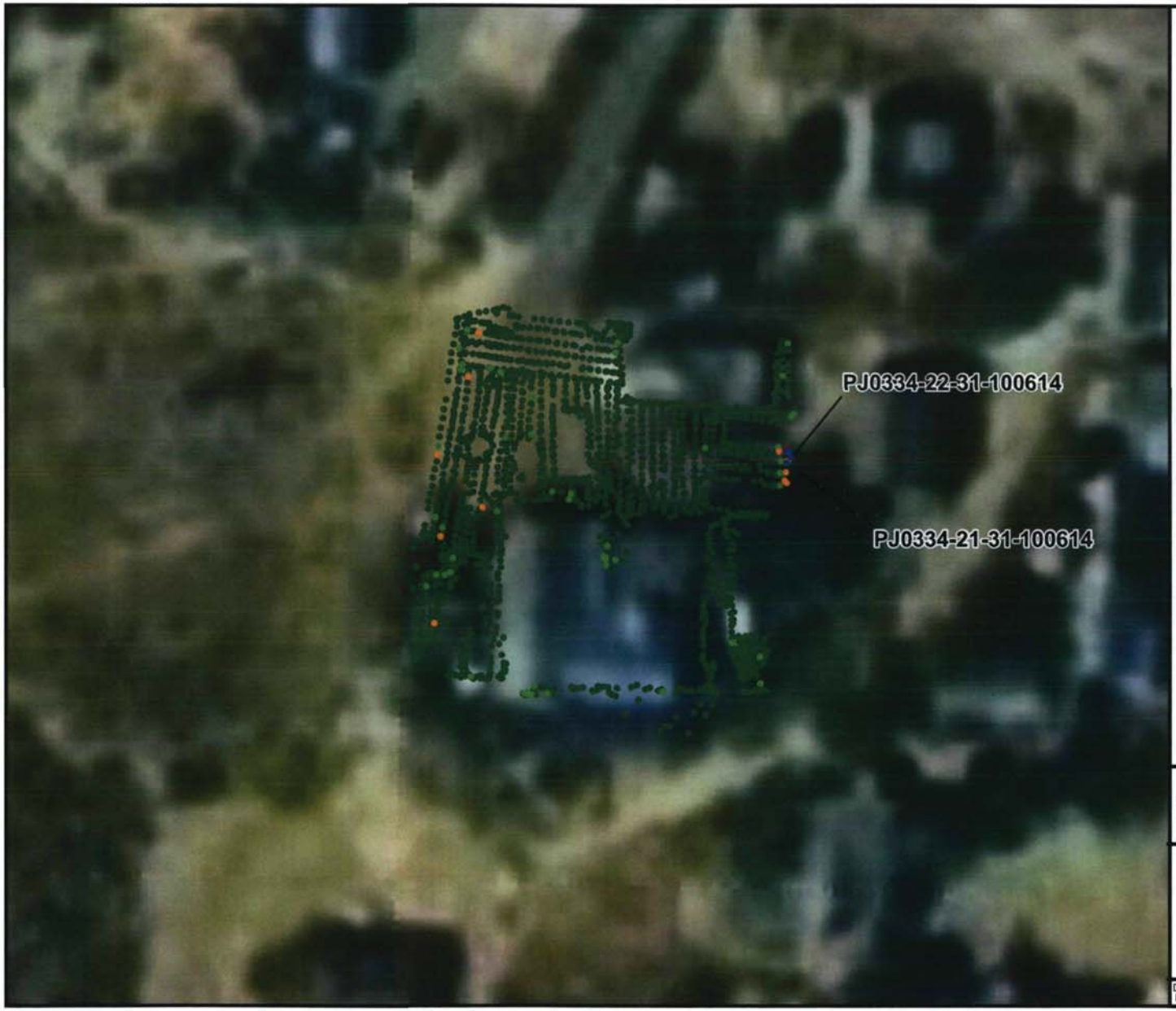
File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\PARAJE\PJ0329\PJ0329_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 04-Dec-10 09:08, STARTGIS

PG0331



File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\PARAJE\PJ0331\PJ0331_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 04-Dec-10 09:56, STARTGIS

PJ0334



Legend

PJ0334

Results

- 0 - 10935
- 10936 - 11936
- 11937 - 11999
- 12000 - 14999
- 15000 - 19999
- 20000 - 40212

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - PJ0334
ASSESSMENT DATE: 6/14/2010
PARAJE, CIBOLA COUNTY,
NEW MEXICO

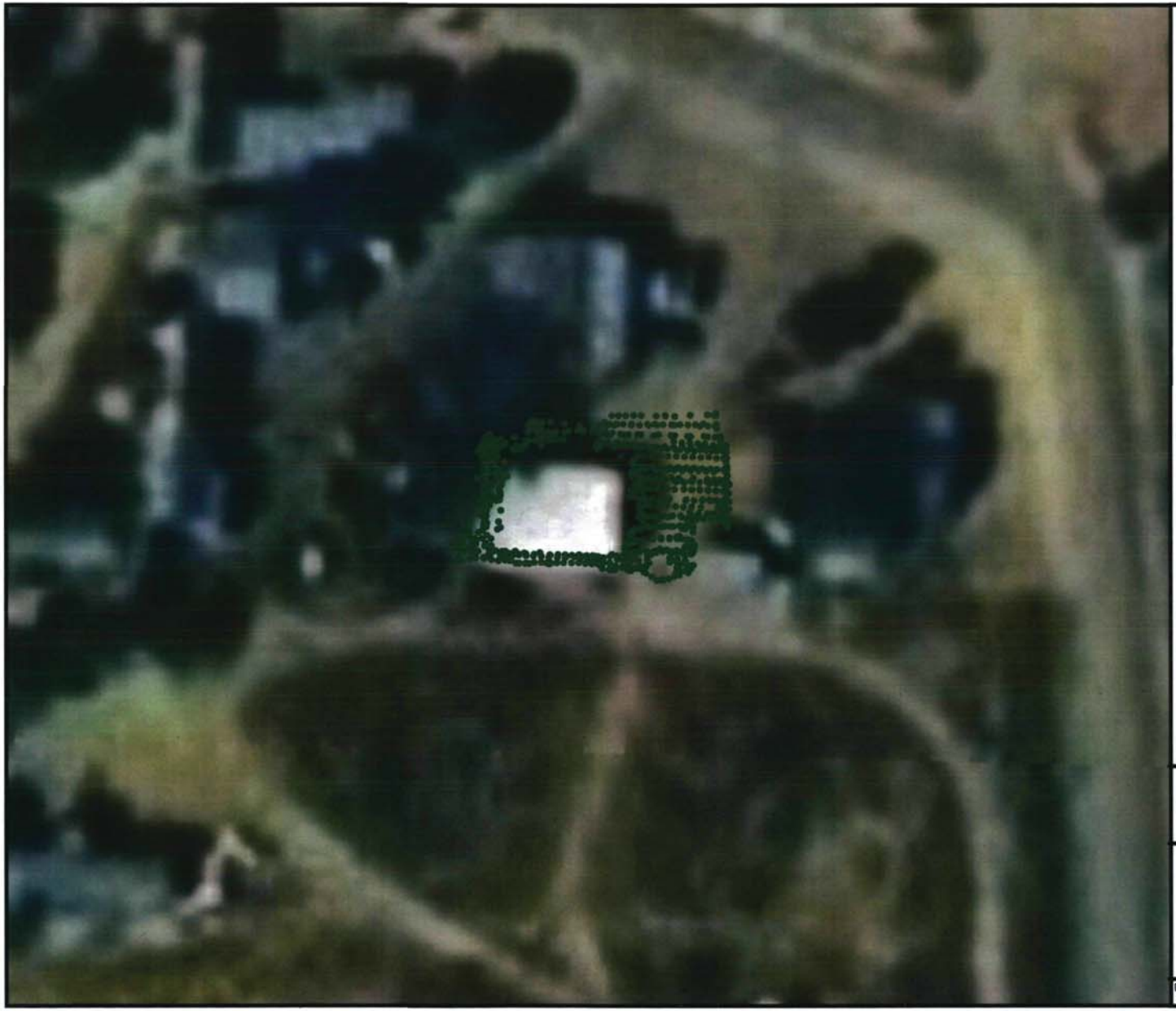
DATE	PROJECT NO	SCALE
NOV 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\PARAJE\PJ0334\PJ0334_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 03-Nov-10 12:23, STARTGIS

PG0337

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\PARAJE\PJ0337\PJ0337_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 04-Dec-10 10:25, STARTGIS

PJ0339



Legend

PJ0339

Results

- 0 - 10696

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - PJ0339
ASSESSMENT DATE: 6/17/2010
PARAJE, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\PARAJE\PJ0339\PJ0339_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 04-Dec-10 10:53, STARTGIS

PJ0340

Legend

PJ0340

Results

- 0 - 10935
- 10936 - 11936
- 11937 - 11999
- 12000 - 12734

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - PJ0340
ASSESSMENT DATE: 6/17/2010
PARAJE, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\PARAJE\PJ0340\PJ0340_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 04-Dec-10 11:13, STARTGIS

PJ0344

Legend

PJ0344

Results

- 0 - 10935
- 10936 - 11936
- 11937 - 11999

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - PJ0344
ASSESSMENT DATE: 6/11/2010
PARAJE, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
NOV 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\PARAJE\PJ0344\PJ0344_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 08-Nov-10 11:11, STARTGIS

PJ0357

Legend

PJ0357

Results

- 0 - 10935
- 10936 - 11936
- 11937 - 11999
- 12000 - 14999
- 15000 - 19999
- 20000 - 27370

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - PJ0357
ASSESSMENT DATE: 6/11/2010
PARAJE, CIBOLA COUNTY,
NEW MEXICO

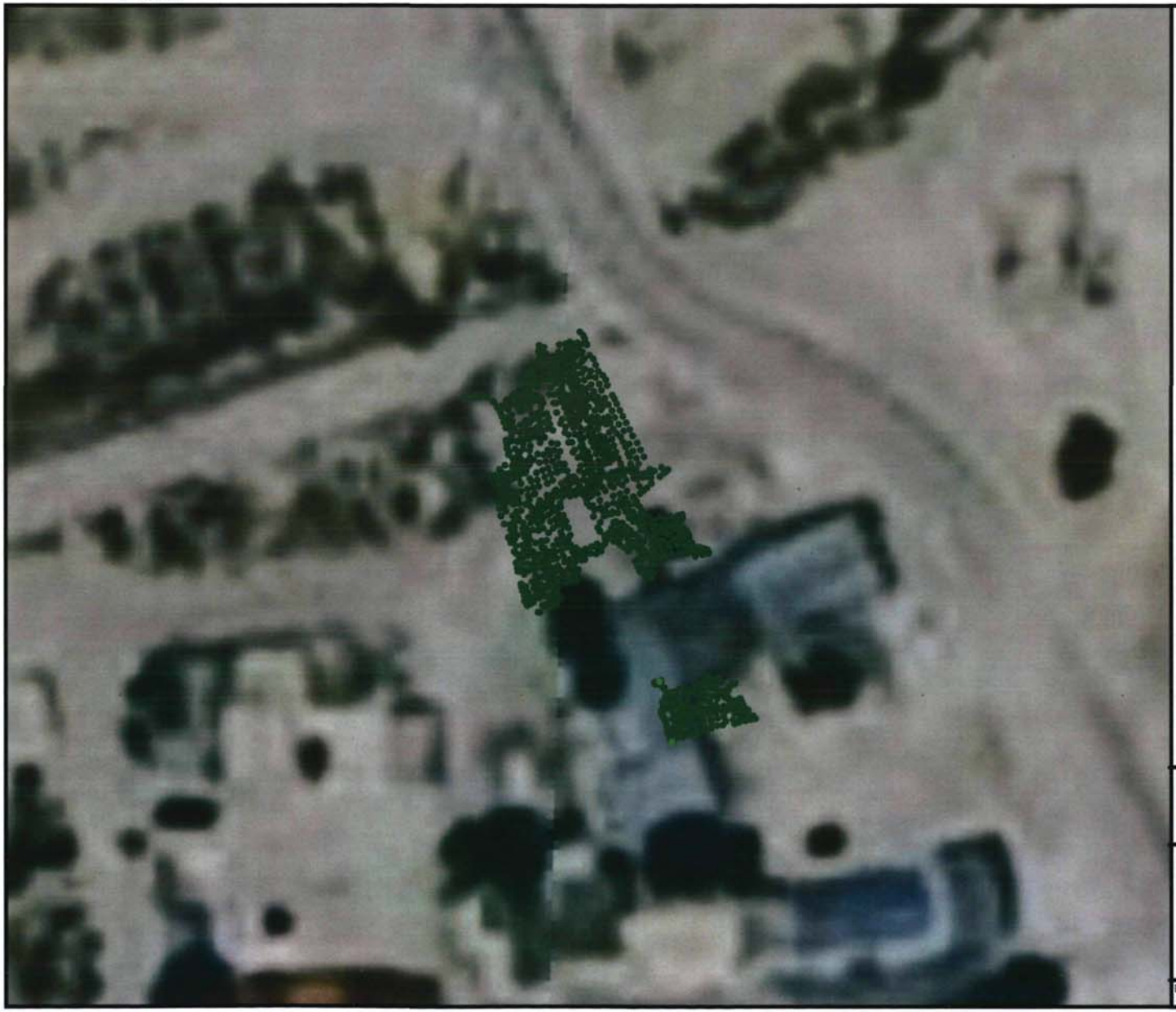
DATE	PROJECT NO	SCALE
NOV 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\PARAJE\PJ0357\PJ0357_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 03-Nov-10 12:51, STARTGIS

PJ0376

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\PARAJE\PJ0376\PJ0376_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 08-Nov-10 13:57, STARTGIS

PJ1309



Legend

PJ1309

Results

- 0 - 10935
- 10936 -11936

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

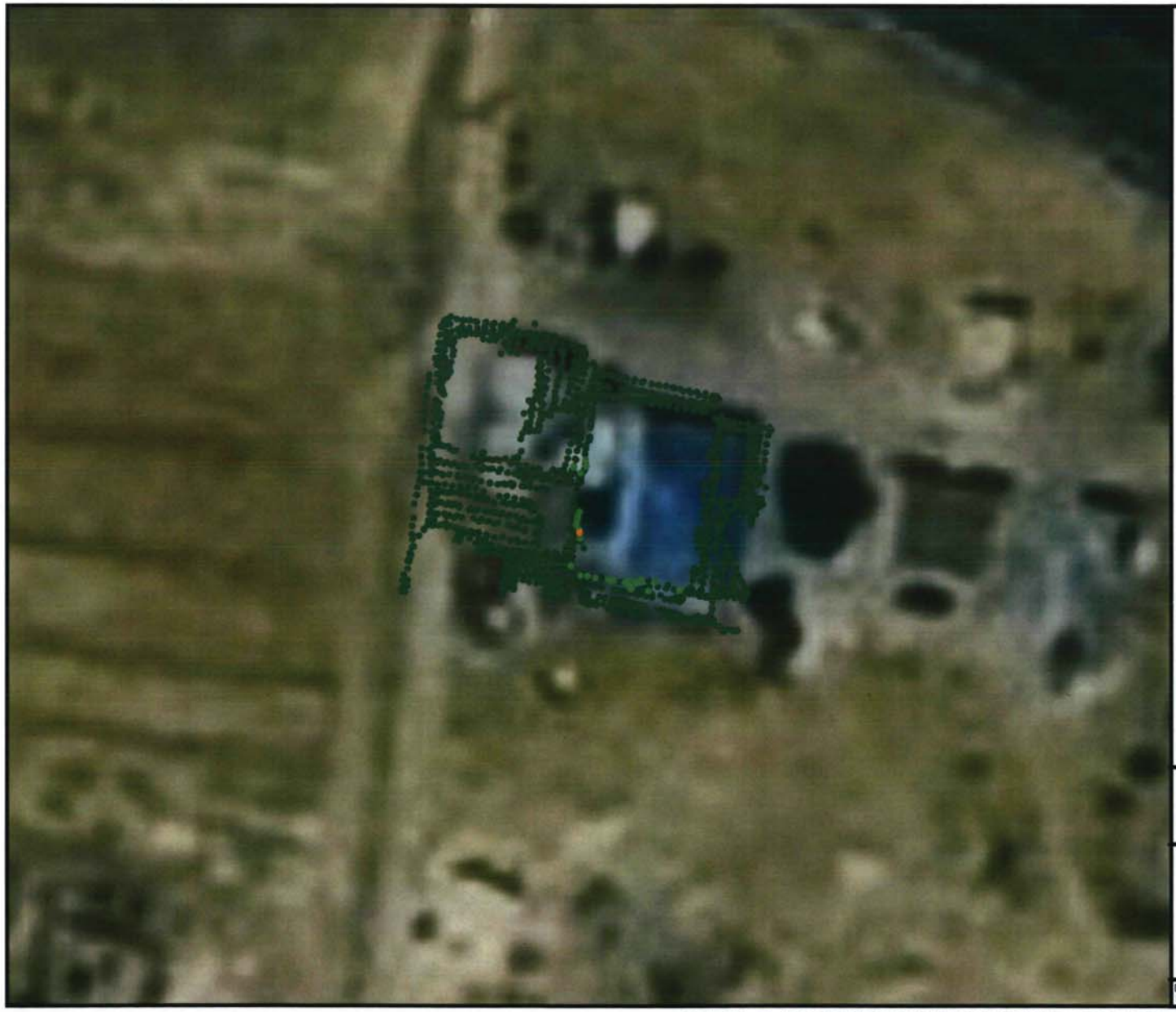
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - PJ1309
ASSESSMENT DATE: 6/14/2010
PARAJE, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\PARAJE\PJ1309\PJ1309_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 04-Dec-10 11:39, STARTGIS

PJ1827



Legend

PJ1827

Results

- 0 - 10935
- 10936 - 11936
- 11937 - 11999
- 12079

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - PJ1827
ASSESSMENT DATE: 6/15/2010
PARAJE, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\PARAJE\PJ1827\PJ1827_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 04-Dec-10 12:35, STARTGIS

APPENDIX B

PART 5

Seama RAT Maps

SE0004

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\SEAMA\SE0004\SE0004_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 28-Aug-10 13:30, STARTGIS

SE0011

Legend

SE0011

Results

- 0 - 13593

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

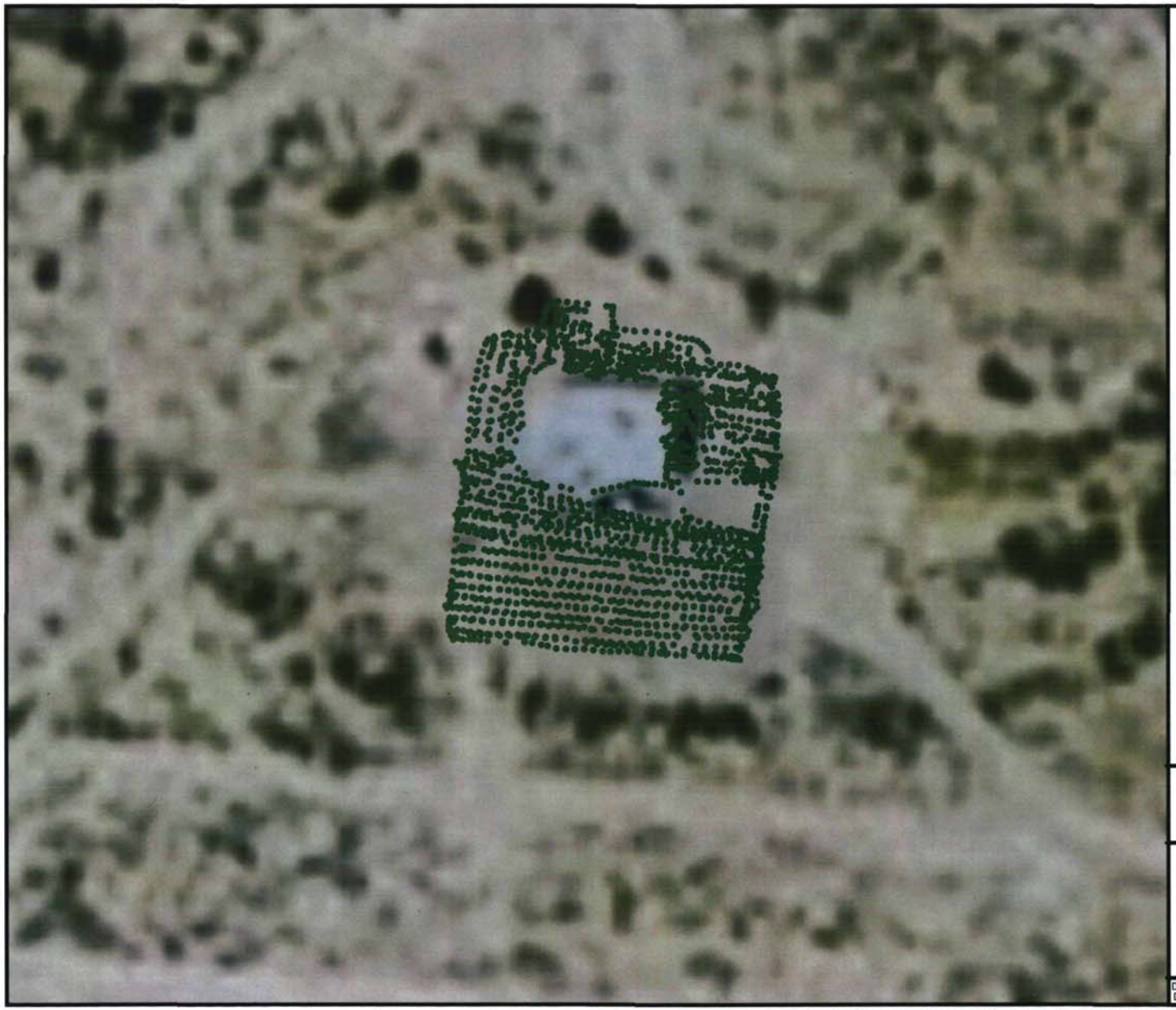
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - SE0011
ASSESSMENT DATE: 6/7/2010
SEAMA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\SEAMA\SE0011\SE0011_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 04-Dec-10 13:29, STARTGIS

SE0017



Legend

SE0017

Results

- 0 - 12728

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

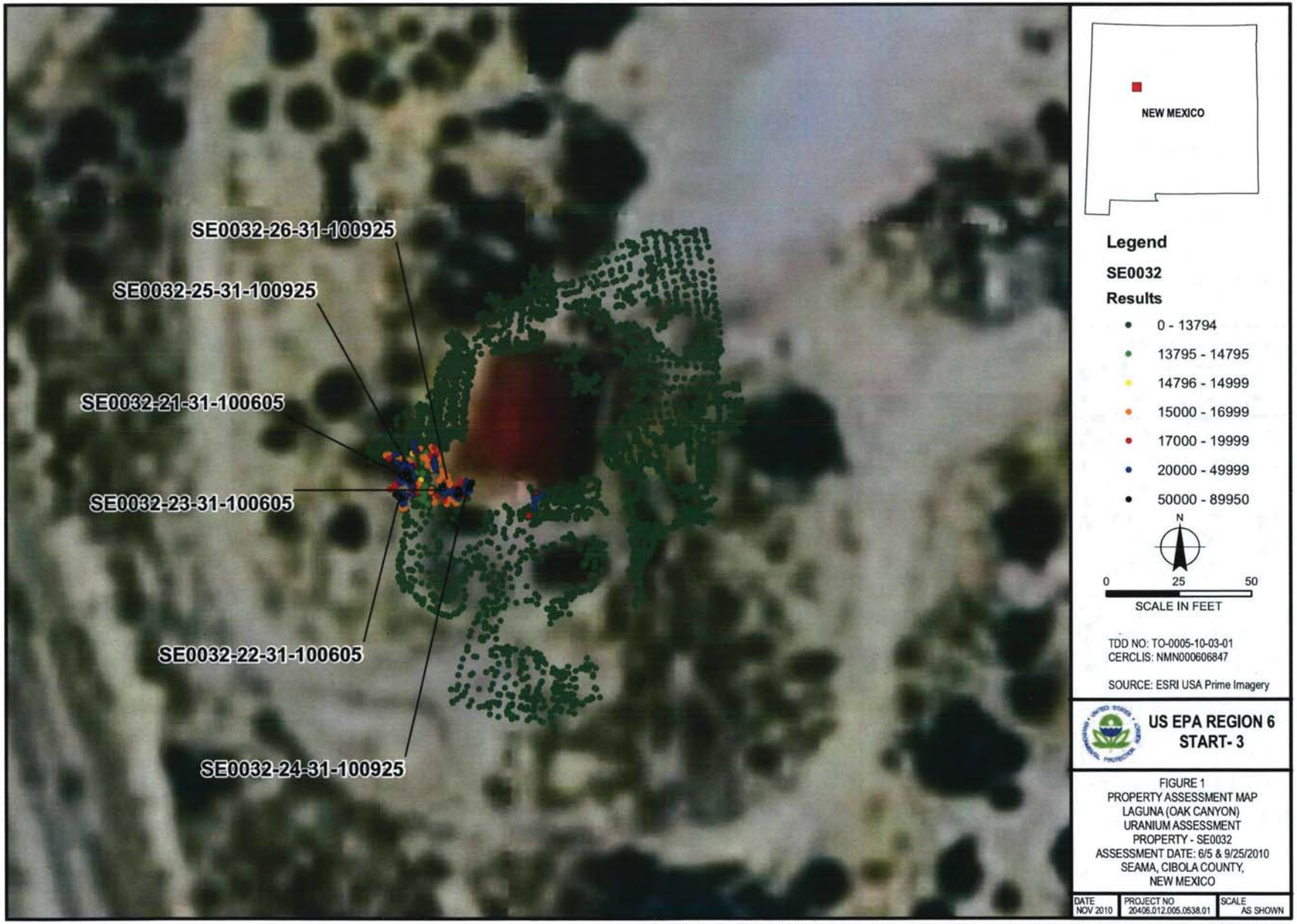
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - SE0017
ASSESSMENT DATE: 6/8/2010
SEAMA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

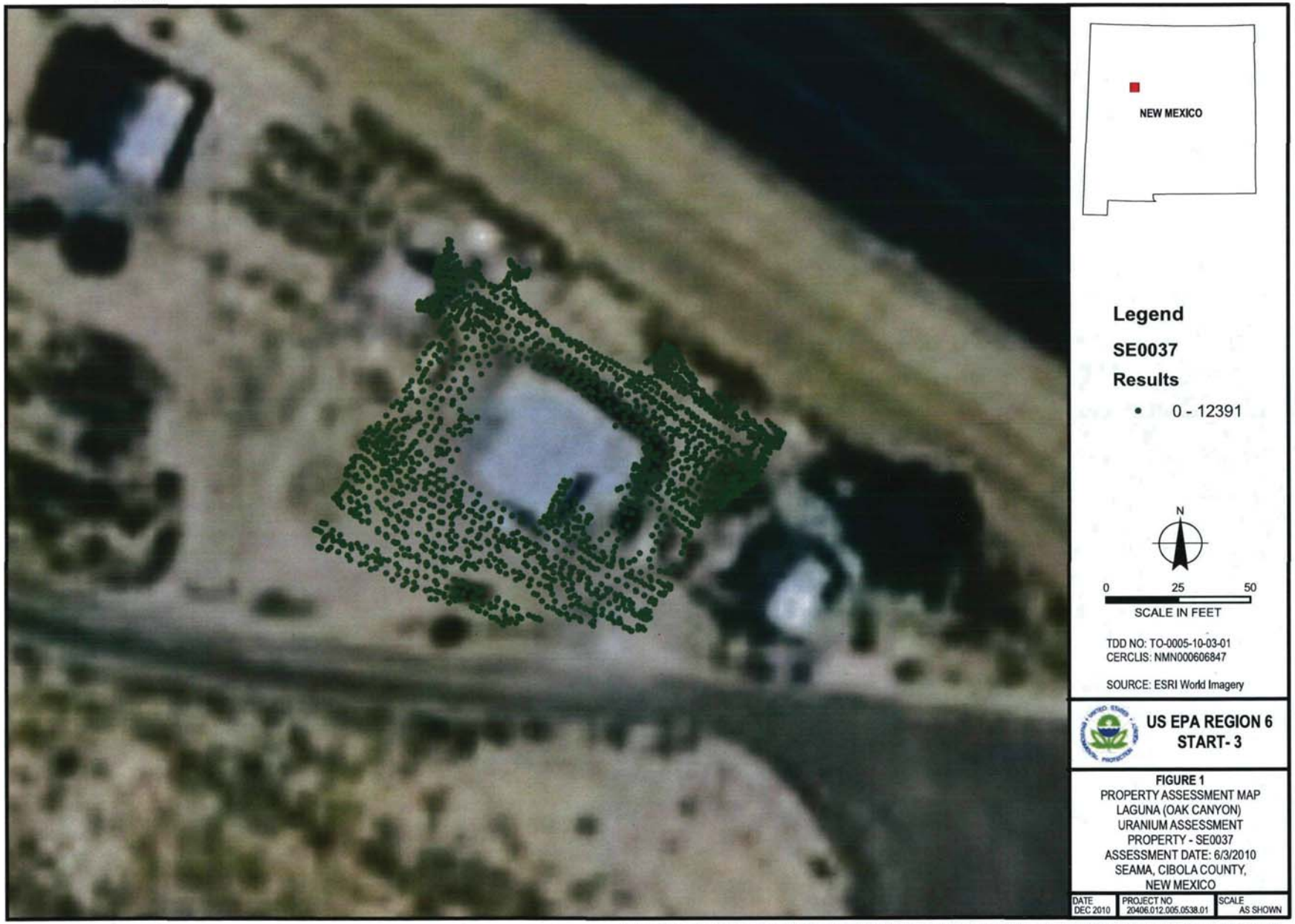
File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\SEAMA\SE0017\SE0017_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 04-Dec-10 14:04, STARTGIS

SE0032



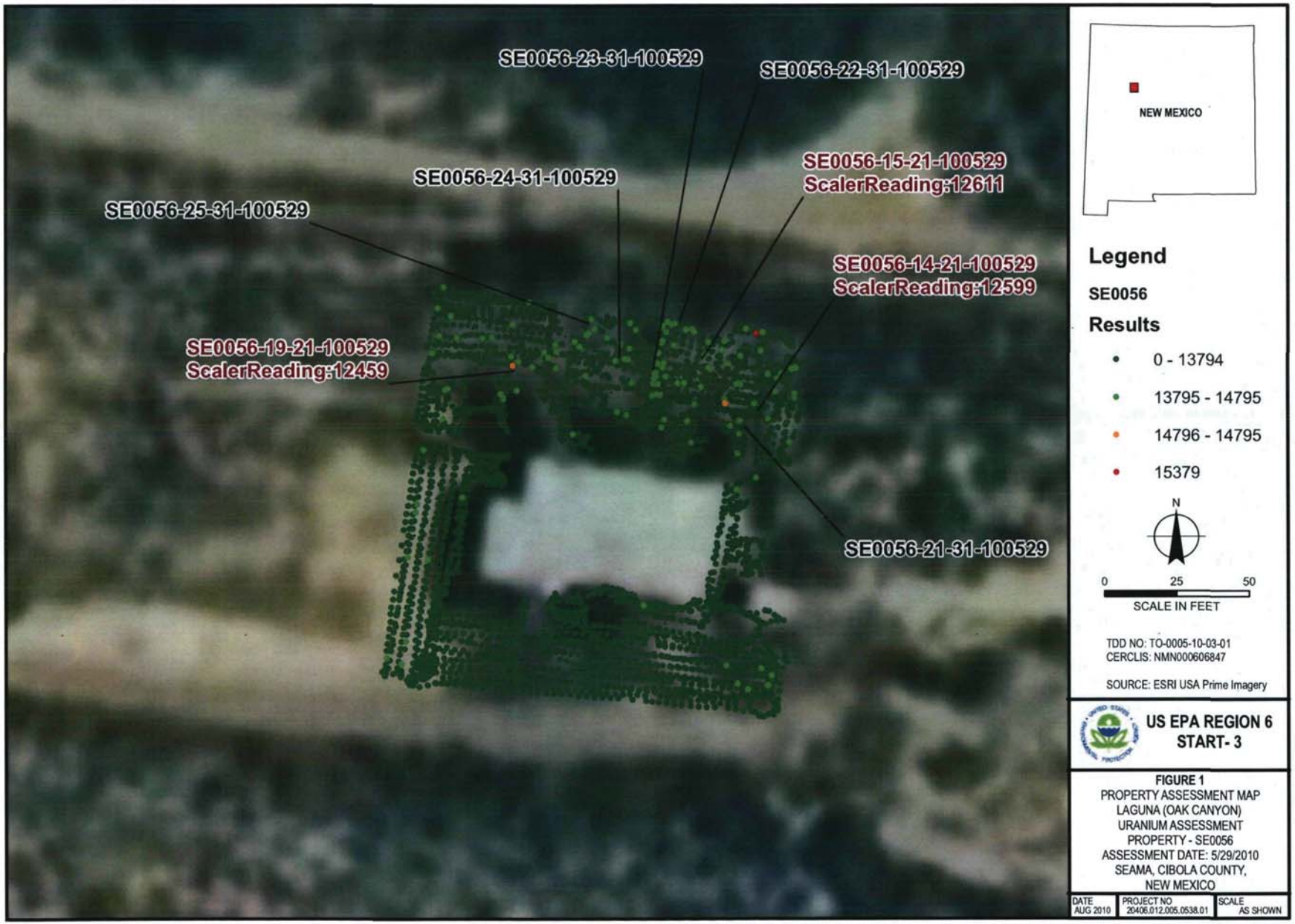
File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\SEAMA\SE0032\SE0032_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 03-Nov-10 15:18, STARTGIS

SE0037



File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\SEAMA\SE0037\SE0037_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 04-Dec-10 14:28, STARTGIS

SE0056



File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\SEAMA\SE0056\SE0056_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 30-Aug-10 09:37, STARTGIS

SE0064

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\SEAMA\SE0064\SE0064_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 30-Aug-10 10:48, STARTGIS

SE0079

Legend

SE0079

Results

- 0 - 11620

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - SE0079
ASSESSMENT DATE: 6/5/2010
SEAMA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\SEAMA\SE0079\SE0079_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 04-Dec-10 14:54, STARTGIS

SE0088

Legend

SE0088

Results

- 0 - 10259

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - SE0088
ASSESSMENT DATE: 6/3/2010
SEAMA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fanm01\Operations\Field Data\TDD-OAK CANYON\SEAMA\SE0088\SE0088_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 04-Dec-10 15:20, STARTGIS

SE0094

Legend

SE0094

Results

- 0 - 11891

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - SE0094
ASSESSMENT DATE: 5/31/2010
SEAMA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\SEAMA\SE0094\SE0094_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 04-Dec-10 16:45, STARTGIS

SE0096

Legend

SE0096

Results

- 0 - 10570

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - SE0096
ASSESSMENT DATE: 6/1/2010
SEAMA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\tsnm01\Operations\Field Data\TDD-OAK CANYON\SEAMA\SE0096\SE0096_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 04-Dec-10 17:20, STARTGIS

SE0126

Legend

SE0126

Results

- 0 - 13794
- 13795 - 14795

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - SE0126
ASSESSMENT DATE: 6/1/2010
SEAMA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\SEAMA\SE0126\SE0126_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 04-Dec-10 17:51, STARTGIS

SE0153

Legend

SE0153

Results

- 0 - 10147

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - SE0153
ASSESSMENT DATE: 6/7/2010
SEAMA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\SEAMA\SE0153\SE0153_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 05-Dec-10 08:39, STARTGIS

SE4089

Legend

SE4089

Results

- 0 - 11981

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - SE4089
ASSESSMENT DATE: 6/30/2010
SEAMA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\tsnm01\Operations\Field Data\TDD-OAK CANYON\SEAMA\SE4089\SE4089_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 05-Dec-10 09:27, STARTGIS

SE5257

Legend

SE5257

Results

- 0 - 11418

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

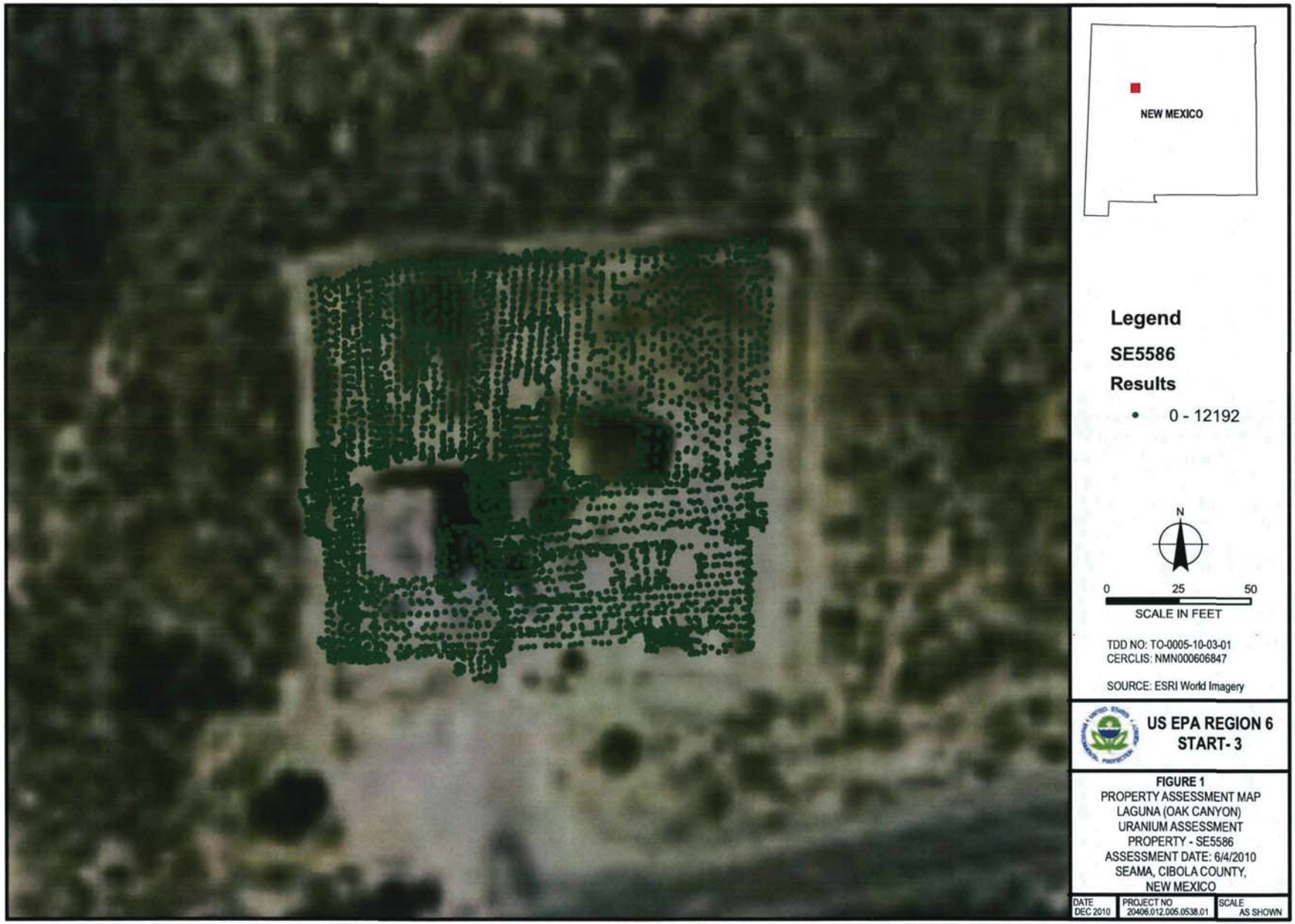
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - SE5257
ASSESSMENT DATE: 6/2/2010
SEAMA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

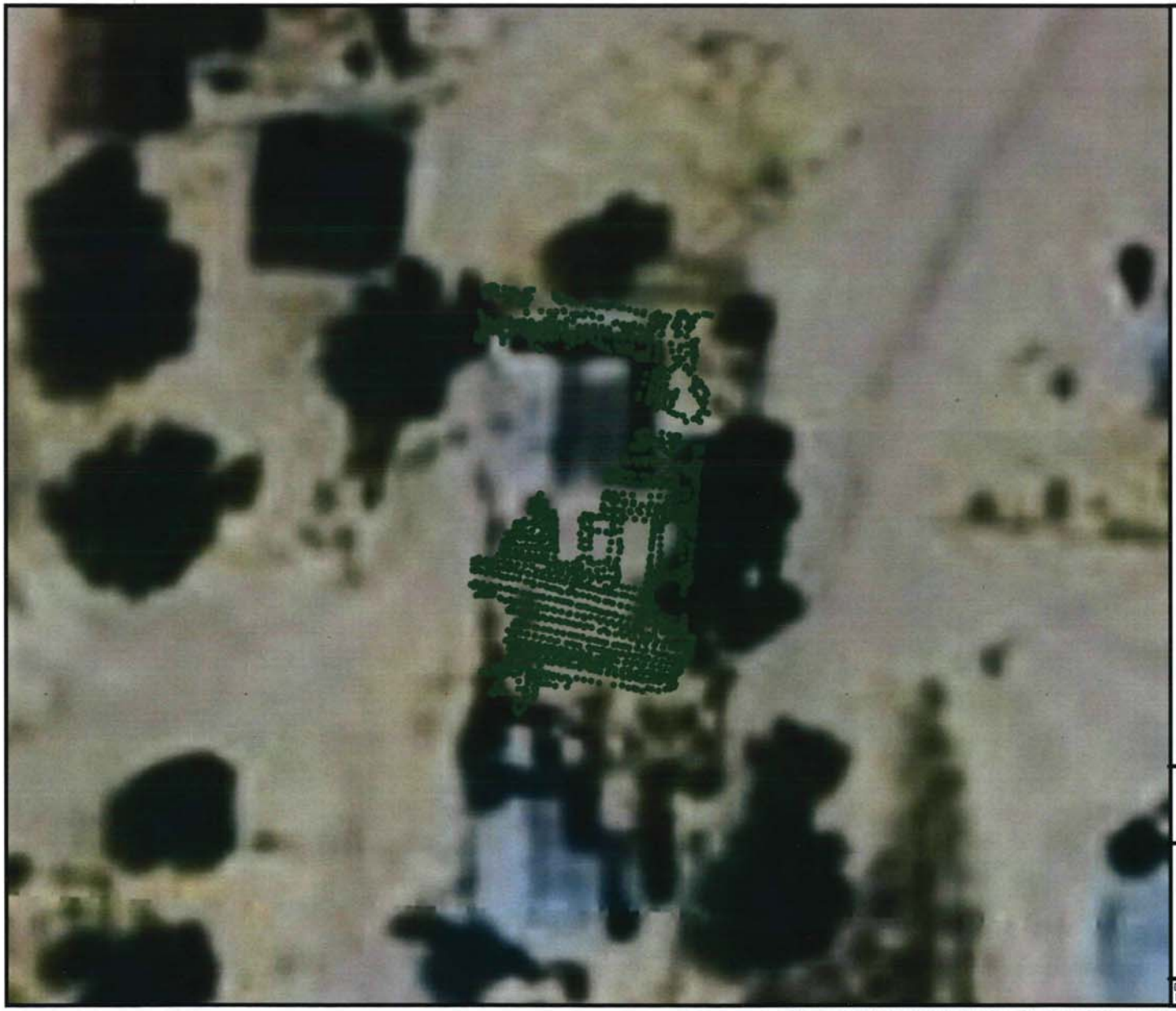
File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\SEAMA\SE5257\SE5257_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 05-Dec-10 09:46, STARTGIS

SE5586



File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\SEAMA\SE5586\SE5586_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 05-Dec-10 10:23, STARTGIS

SE6168



Legend

SE6168

Results

- 0 - 9635

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - SE6168
ASSESSMENT DATE: 6/1/2010
SEAMA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\SEAMA\SE6168\SE6168_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 05-Dec-10 10:51, STARTGIS

SE6245

Legend

SE6245

Results

- 0 - 10105

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

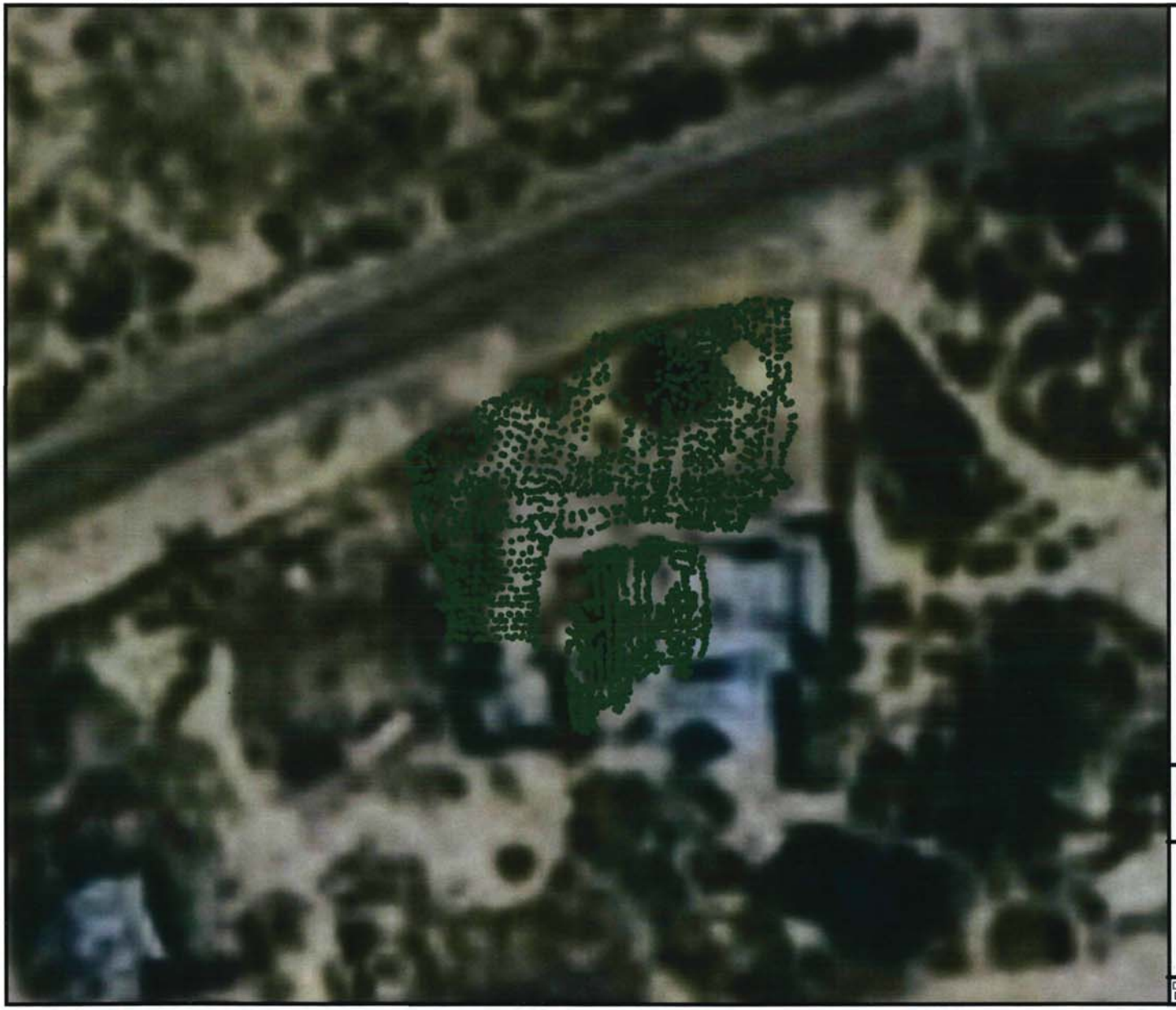
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - SE6245
ASSESSMENT DATE: 6/1/2010
SEAMA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\SEAMA\SE6245\SE6245_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 05-Dec-10 11:04, STARTGIS

SE8344



Legend

SE8344

Results

- 0 - 11036

N

0 25 50

SCALE IN FEET

TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847

SOURCE: ESRI World Imagery

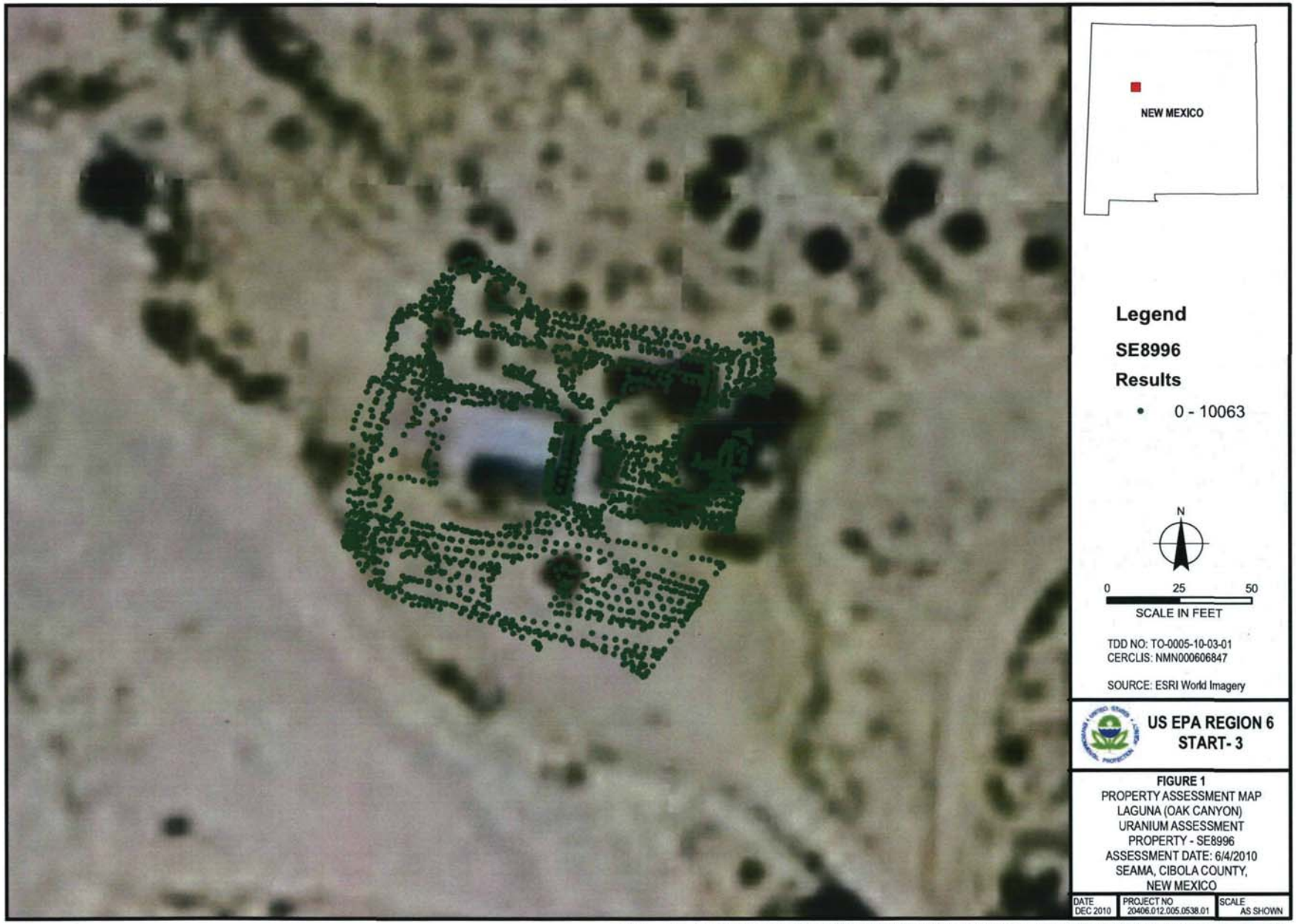
US EPA REGION 6
START- 3

FIGURE 1
PROPERTY ASSESSMENT MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - SE8344
ASSESSMENT DATE: 6/4/2010
SEAMA, CIBOLA COUNTY,
NEW MEXICO

DATE	PROJECT NO	SCALE
DEC 2010	20406.012.005.0538.01	AS SHOWN

File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\SEAMA\SE8344\SE8344_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 05-Dec-10 11:32, STARTGIS

SE8996



File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\SEAMA\SE8996\SE8996_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 05-Dec-10 12:45, STARTGIS

APPENDIX C

MARSSIM TEST 3

WILCOXON RANK SUM TEST

FROM MARSSIM MANUAL, SECTION 8.4.1
TWO-SAMPLE STATISTICAL TEST

The comparison of measurements from the reference area and survey unit is made using the Wilcoxon Rank Sum (WRS) test (also called the Mann-Whitney test). The WRS test should be conducted for each survey unit. In addition, the EMC is performed against each measurement to ensure that it does not exceed a specified investigation level. If any measurement in the remediated survey unit exceeds the specified investigation level, then additional investigation is recommended, at least locally, regardless of the outcome of the WRS test.

The WRS test is most effective when residual radioactivity is uniformly present throughout a survey unit. The test is designed to detect whether or not this activity exceeds the $DCGL_W$. The advantage of the nonparametric WRS test is that it does not assume that the data are normally or log-normally distributed. The WRS test also allows for "less than" measurements to be present in the reference area and the survey units. As a general rule, the WRS test can be used with up to 40 percent "less than" measurements in either the reference area or the survey unit. However, the use of "less than" values in data reporting is not recommended as discussed in MARSSIM Section 2.3.5. When possible, report the actual result of a measurement together with its uncertainty.

The hypothesis tested by the WRS test is

> Null Hypothesis H_0: The median concentration in the survey unit exceeds that in the reference area by more than the $DCGL_W$
>
> versus
>
> Alternative Hypothesis H_a: The median concentration in the survey unit exceeds that in the reference area by less than the $DCGL_W$

The null hypothesis is assumed to be true unless the statistical test indicates that it should be rejected in favor of the alternative. One assumes that any difference between the reference area and survey unit concentration distributions is due to a shift in the survey unit concentrations to higher values (*i.e.*, due to the presence of residual radioactivity in addition to background). Note that some or all of the survey unit measurements may be larger than some reference area measurements, while still meeting the release criterion. Indeed, some survey unit measurements

may exceed some reference area measurements by more than the $DCGL_W$. The result of the hypothesis test determines whether or not the survey unit as a whole is deemed to meet the release criterion. The EMC is used to screen individual measurements.

Two assumptions underlying this test are: 1) samples from the reference area and survey unit are independent, identically distributed random samples, and 2) each measurement is independent of every other measurement, regardless of the set of samples from which it came.

8.4.2 Applying the Wilcoxon Rank Sum Test

The WRS test is applied as outlined in the following six steps:

a. Obtain the adjusted reference area measurements, Z_i, by adding the $DCGL_W$ to each reference area measurement, X_i. $Z_i = X_i + DCGL_W$

b. The m adjusted reference sample measurements, Z_i, from the reference area and the n sample measurements, Y_i, from the survey unit are pooled and ranked in order of increasing size from 1 to N, where $N = m+n$.

c. If several measurements are tied (*i.e.*, have the same value), they are all assigned the average rank of that group of tied measurements.

d. If there are t "less than" values, they are all given the average of the ranks from 1 to t. Therefore, they are all assigned the rank $t(t+1)/(2t) = (t+1)/2$, which is the average of the first t integers. If there is more than one detection limit, all observations below the largest detection limit should be treated as "less than" values[3].

e. Sum the ranks of the adjusted measurements from the reference area, W_r. Note that since the sum of the first N integers is $N(N+1)/2$, one can equivalently sum the ranks of the measurements from the survey unit, W_s, and compute $W_r = N(N+1)/2 - W_s$.

f. Compare W_r with the critical value given in MARSSIM Table I.4 for the appropriate values of n, m, and α. If W_r is greater than the tabulated value, reject the hypothesis that the survey unit exceeds the release criterion.

[3] If more than 40 percent of the data from either the reference area or survey unit are "less than," the WRS test *cannot* be used. Such a large proportion of non-detects suggest that the DQO process be re-visited for this survey to determine if the survey unit was properly classified or the appropriate measurement method was used. As stated previously, the use of "less than" values in data reporting is not recommended. Wherever possible, the actual result of a measurement, together with its uncertainty, should be reported.

APPENDIX D

Output of RESRAD Analysis for Agricultural Areas

Table of Contents
ùùùùùùùùùùùùùùùùù

Part I: Mixture Sums and Single Radionuclide Guidelines
===

Dose Conversion Factor (and Related) Parameter Summary
Dose Library: FGR 12 & FGR 11

0

Menu	Parameter	Current Value#	Base Case*	Parameter Name
A-1	DCF's for external ground radiation, (mrem/yr)/(pCi/g)			
A-1	At-218 (Source: FGR 12)	5.847E-03	5.847E-03	DCF1(1)
A-1	Bi-210 (Source: FGR 12)	3.606E-03	3.606E-03	DCF1(2)
A-1	Bi-214 (Source: FGR 12)	9.808E+00	9.808E+00	DCF1(3)
A-1	Pa-234 (Source: FGR 12)	1.155E+01	1.155E+01	DCF1(4)
A-1	Pa-234m (Source: FGR 12)	8.967E-02	8.967E-02	DCF1(5)
A-1	Pb-210 (Source: FGR 12)	2.447E-03	2.447E-03	DCF1(6)
A-1	Pb-214 (Source: FGR 12)	1.341E+00	1.341E+00	DCF1(7)
A-1	Po-210 (Source: FGR 12)	5.231E-05	5.231E-05	DCF1(8)
A-1	Po-214 (Source: FGR 12)	5.138E-04	5.138E-04	DCF1(9)
A-1	Po-218 (Source: FGR 12)	5.642E-05	5.642E-05	DCF1(10)
A-1	Ra-226 (Source: FGR 12)	3.176E-02	3.176E-02	DCF1(11)
A-1	Rn-222 (Source: FGR 12)	2.354E-03	2.354E-03	DCF1(12)
A-1	Th-230 (Source: FGR 12)	1.209E-03	1.209E-03	DCF1(13)
A-1	Th-234 (Source: FGR 12)	2.410E-02	2.410E-02	DCF1(14)
A-1	Tl-210 (Source: no data)	0.000E+00	-2.000E+00	DCF1(15)
A-1	U-234 (Source: FGR 12)	4.017E-04	4.017E-04	DCF1(16)
A-1	U-238 (Source: FGR 12)	1.031E-04	1.031E-04	DCF1(17)
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Pb-210+D	1.380E-02	1.360E-02	DCF2(1)
B-1	Po-210	9.400E-03	9.400E-03	DCF2(2)
B-1	Ra-226+D	8.594E-03	8.580E-03	DCF2(3)
B-1	Th-230	3.260E-01	3.260E-01	DCF2(4)
B-1	U-234	1.320E-01	1.320E-01	DCF2(5)
B-1	U-238	1.180E-01	1.180E-01	DCF2(6)
B-1	U-238+D	1.180E-01	1.180E-01	DCF2(7)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Pb-210+D	5.376E-03	5.370E-03	DCF3(1)
D-1	Po-210	1.900E-03	1.900E-03	DCF3(2)
D-1	Ra-226+D	1.321E-03	1.320E-03	DCF3(3)

D-1	Th-230	5.480E-04	5.480E-04	DCF3(4)
D-1	U-234	2.830E-04	2.830E-04	DCF3(5)
D-1	U-238	2.550E-04	2.550E-04	DCF3(6)
D-1	U-238+D	2.687E-04	2.550E-04	DCF3(7)
D-34	Food transfer factors:			
D-34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(1,1)
D-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(1,2)
D-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(1,3)
D-34				
D-34	Po-210 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(2,1)
D-34	Po-210 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(2,2)
D-34	Po-210 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.400E-04	3.400E-04	RTF(2,3)
D-34				
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(3,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(3,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(3,3)
D-34				

Dose Conversion Factor (and Related) Parameter Summary (continued)
Dose Library: FGR 12 & FGR 11

Menu	Parameter	Current Value#	Base Case*	Parameter Name
D-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(4,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(4,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(4,3)
D-34				
D-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(5,1)
D-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(5,2)
D-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(5,3)
D-34				
D-34	U-238 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(6,1)
D-34	U-238 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(6,2)
D-34	U-238 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(6,3)
D-34				
D-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(7,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(7,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(7,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC(1,1)
D-5	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(1,2)
D-5				
D-5	Po-210 , fish	1.000E+02	1.000E+02	BIOFAC(2,1)
D-5	Po-210 , crustacea and mollusks	2.000E+04	2.000E+04	BIOFAC(2,2)
D-5				
D-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC(3,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(3,2)
D-5				
D-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC(4,1)
D-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(4,2)
D-5				
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC(5,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(5,2)
D-5				
D-5	U-238 , fish	1.000E+01	1.000E+01	BIOFAC(6,1)
D-5	U-238 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(6,2)
D-5				

Menu	Parameter	Input	Default	(If different from user input)	Name
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(5,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.376E-03	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(6)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(6,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.376E-03	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)
R017	Inhalation rate (m**3/yr)	8.400E+03	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	1.000E-04	1.000E-04	---	MLINH
R017	Exposure duration	3.000E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	4.000E-01	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	7.000E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	0.000E+00	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	1.385E-01	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	>0 shows circular AREA.	FS
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E+00	---	FRACA(3)
R017	Ring 4	not used	0.000E+00	---	FRACA(4)
R017	Ring 5	not used	0.000E+00	---	FRACA(5)
R017	Ring 6	not used	0.000E+00	---	FRACA(6)
R017	Ring 7	not used	0.000E+00	---	FRACA(7)
R017	Ring 8	not used	0.000E+00	---	FRACA(8)
R017	Ring 9	not used	0.000E+00	---	FRACA(9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R018	Fruits, vegetables and grain consumption (kg/yr)	1.600E+02	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	0.000E+00	1.400E+01	---	DIET(2)

R018	Milk consumption (L/yr)	not used	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	not used	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	not used	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	not used	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	3.650E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	not used	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	not used	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	not used	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	0.000E+00	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	not used	5.000E-01	---	FR9
R018	Contamination fraction of plant food	-1	-1	0.500E+00	FPLANT
R018	Contamination fraction of meat	not used	-1	---	FMEAT
R018	Contamination fraction of milk	not used	-1	---	FMILK
R019	Livestock fodder intake for meat (kg/day)	not used	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	not used	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	not used	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	not used	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	1.000E-04	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	9.000E-01	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	not used	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	not used	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	0.000E+00	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	7.000E-01	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	1.500E+00	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	not used	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	1.700E-01	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	2.500E-01	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	not used	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	1.000E-01	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	1.000E+00	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	not used	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	2.000E+01	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4

C14	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG5
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)
TITL	Number of graphical time points	32	---	---	NPTS
TITL	Maximum number of integration points for dose	17	---	---	LYMAX
TITL	Maximum number of integration points for risk	1	---	---	KYMAX

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation (w/o radon)	active
3 -- plant ingestion	active
4 -- meat ingestion	suppressed
5 -- milk ingestion	suppressed
6 -- aquatic foods	suppressed
7 -- drinking water	suppressed
8 -- soil ingestion	active
9 -- radon	suppressed
Find peak pathway doses	suppressed

Contaminated Zone Dimensions

Area:	9000.00 square meters
Thickness:	0.90 meters
Cover Depth:	0.00 meters

Initial Soil Concentrations, pCi/g

Pb-210	1.000E+00
Po-210	1.000E+00
Ra-226	1.000E+00
Th-230	1.000E+00
U-234	1.000E+00
U-238	1.000E+00

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 2.500E+01 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00
TDOSE(t):	1.044E+01	1.041E+01	1.031E+01
M(t):	4.175E-01	4.162E-01	4.124E-01

Maximum TDOSE(t): 1.045E+01 mrem/yr at t = 0.1807 ± 0.0004 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.807E-01 years
Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pb-210	7.882E-04	0.0001	3.821E-04	0.0000	0.000E+00	0.0000	4.392E+00	0.4204	0.000E+00	0.0000	0.000E+00	0.0000	3.281E-02	0.0031
Po-210	2.195E-06	0.0000	5.923E-05	0.0000	0.000E+00	0.0000	4.929E-02	0.0047	0.000E+00	0.0000	0.000E+00	0.0000	3.106E-03	0.0003
Ra-226	1.448E+00	0.1386	1.742E-04	0.0000	0.000E+00	0.0000	4.320E+00	0.4136	0.000E+00	0.0000	0.000E+00	0.0000	7.309E-03	0.0007
Th-230	5.878E-04	0.0001	6.352E-03	0.0006	0.000E+00	0.0000	4.508E-02	0.0043	0.000E+00	0.0000	0.000E+00	0.0000	2.772E-03	0.0003
U-234	5.327E-05	0.0000	2.559E-03	0.0002	0.000E+00	0.0000	5.635E-02	0.0054	0.000E+00	0.0000	0.000E+00	0.0000	1.423E-03	0.0001
U-238	1.967E-02	0.0019	2.288E-03	0.0002	0.000E+00	0.0000	5.351E-02	0.0051	0.000E+00	0.0000	0.000E+00	0.0000	1.352E-03	0.0001
Total	1.469E+00	0.1406	1.181E-02	0.0011	0.000E+00	0.0000	8.916E+00	0.8536	0.000E+00	0.0000	0.000E+00	0.0000	4.878E-02	0.0047

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.807E-01 years
Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.426E+00	0.4237
Po-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.245E-02	0.0050
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.775E+00	0.5529
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.479E-02	0.0052
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.039E-02	0.0058
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.682E-02	0.0074
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.045E+01	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years
Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
Pb-210	7.923E-04	0.0001	3.611E-04	0.0000	0.000E+00	0.0000	4.386E+00	0.4202	0.000E+00	0.0000	0.000E+00	0.0000	3.180E-02	0.0030
Po-210	3.074E-06	0.0000	8.297E-05	0.0000	0.000E+00	0.0000	6.901E-02	0.0066	0.000E+00	0.0000	0.000E+00	0.0000	4.351E-03	0.0004
Ra-226	1.449E+00	0.1389	1.722E-04	0.0000	0.000E+00	0.0000	4.297E+00	0.4117	0.000E+00	0.0000	0.000E+00	0.0000	7.135E-03	0.0007
Th-230	4.744E-04	0.0000	6.352E-03	0.0006	0.000E+00	0.0000	4.475E-02	0.0043	0.000E+00	0.0000	0.000E+00	0.0000	2.772E-03	0.0003
U-234	5.334E-05	0.0000	2.563E-03	0.0002	0.000E+00	0.0000	5.643E-02	0.0054	0.000E+00	0.0000	0.000E+00	0.0000	1.425E-03	0.0001
U-238	1.970E-02	0.0019	2.291E-03	0.0002	0.000E+00	0.0000	5.358E-02	0.0051	0.000E+00	0.0000	0.000E+00	0.0000	1.353E-03	0.0001
Total	1.470E+00	0.1409	1.182E-02	0.0011	0.000E+00	0.0000	8.907E+00	0.8533	0.000E+00	0.0000	0.000E+00	0.0000	4.883E-02	0.0047

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years
Water Dependent Pathways

Radio-Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.419E+00	0.4234
Po-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.345E-02	0.0070
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.754E+00	0.5512
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.435E-02	0.0052
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.047E-02	0.0058
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.692E-02	0.0074
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.044E+01	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years
Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
Pb-210	7.677E-04	0.0001	4.160E-04	0.0000	0.000E+00	0.0000	4.305E+00	0.4138	0.000E+00	0.0000	0.000E+00	0.0000	3.424E-02	0.0033
Po-210	4.759E-07	0.0000	1.284E-05	0.0000	0.000E+00	0.0000	1.069E-02	0.0010	0.000E+00	0.0000	0.000E+00	0.0000	6.736E-04	0.0001
Ra-226	1.441E+00	0.1385	1.836E-04	0.0000	0.000E+00	0.0000	4.410E+00	0.4238	0.000E+00	0.0000	0.000E+00	0.0000	8.135E-03	0.0008
Th-230	1.101E-03	0.0001	6.352E-03	0.0006	0.000E+00	0.0000	4.662E-02	0.0045	0.000E+00	0.0000	0.000E+00	0.0000	2.775E-03	0.0003
U-234	5.296E-05	0.0000	2.544E-03	0.0002	0.000E+00	0.0000	5.601E-02	0.0054	0.000E+00	0.0000	0.000E+00	0.0000	1.415E-03	0.0001
U-238	1.956E-02	0.0019	2.275E-03	0.0002	0.000E+00	0.0000	5.318E-02	0.0051	0.000E+00	0.0000	0.000E+00	0.0000	1.343E-03	0.0001
Total	1.463E+00	0.1406	1.178E-02	0.0011	0.000E+00	0.0000	8.882E+00	0.8536	0.000E+00	0.0000	0.000E+00	0.0000	4.858E-02	0.0047

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years
Water Dependent Pathways

Radio-Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.341E+00	0.4172
Po-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.138E-02	0.0011
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.860E+00	0.5632
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.685E-02	0.0055
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.003E-02	0.0058
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.636E-02	0.0073

Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.041E+01	1.0000

0*Sum of all water independent and dependent pathways.

Summary : U_chain0_9HA_160 kg crop

File : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\NONNUC_UCHAIN+CROPS.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years
Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
Pb-210	7.166E-04	0.0001	3.997E-04	0.0000	0.000E+00	0.0000	4.026E+00	0.3905	0.000E+00	0.0000	0.000E+00	0.0000	3.255E-02	0.0032
Po-210	1.140E-08	0.0000	3.077E-07	0.0000	0.000E+00	0.0000	2.561E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.614E-05	0.0000
Ra-226	1.425E+00	0.1382	2.069E-04	0.0000	0.000E+00	0.0000	4.618E+00	0.4479	0.000E+00	0.0000	0.000E+00	0.0000	1.012E-02	0.0010
Th-230	2.342E-03	0.0002	6.352E-03	0.0006	0.000E+00	0.0000	5.054E-02	0.0049	0.000E+00	0.0000	0.000E+00	0.0000	2.783E-03	0.0003
U-234	5.221E-05	0.0000	2.507E-03	0.0002	0.000E+00	0.0000	5.519E-02	0.0054	0.000E+00	0.0000	0.000E+00	0.0000	1.394E-03	0.0001
U-238	1.927E-02	0.0019	2.241E-03	0.0002	0.000E+00	0.0000	5.241E-02	0.0051	0.000E+00	0.0000	0.000E+00	0.0000	1.324E-03	0.0001
Total	1.447E+00	0.1404	1.171E-02	0.0011	0.000E+00	0.0000	8.802E+00	0.8538	0.000E+00	0.0000	0.000E+00	0.0000	4.818E-02	0.0047

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years
Water Dependent Pathways

Radio-Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.060E+00	0.3938
Po-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.725E-04	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.053E+00	0.5871
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.201E-02	0.0060
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.915E-02	0.0057
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.524E-02	0.0073
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.031E+01	1.0000

0*Sum of all water independent and dependent pathways.

Summary : U_chain0_9HA_160 kg crop

File : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\NONNUC_UCHAIN+CROPS.RAD

Dose/Source Ratios Summed Over All Pathways
Parent and Progeny Principal Radionuclide Contributions Indicated

0 Parent (i)	Product (j)	Thread Fraction	DSR(j,t) At Time in Years 0.000E+00	1.000E+00	3.000E+00
Pb-210+D	Pb-210+D	1.000E+00	4.256E+00	4.110E+00	3.834E+00
Pb-210+D	Po-210	1.000E+00	1.634E-01	2.304E-01	2.253E-01
Pb-210+D	*DSR(j)		4.419E+00	4.341E+00	4.060E+00
0Po-210	Po-210	1.000E+00	7.345E-02	1.138E-02	2.725E-04
0Ra-226+D	Ra-226+D	1.000E+00	5.672E+00	5.640E+00	5.576E+00
Ra-226+D	Pb-210+D	1.000E+00	7.948E-02	2.109E-01	4.539E-01
Ra-226+D	Po-210	1.000E+00	2.515E-03	9.145E-03	2.329E-02
Ra-226+D	*DSR(j)		5.754E+00	5.860E+00	6.053E+00
0Th-230	Th-230	1.000E+00	5.316E-02	5.316E-02	5.316E-02
Th-230	Ra-226+D	1.000E+00	1.171E-03	3.612E-03	8.470E-03
Th-230	Pb-210+D	1.000E+00	1.263E-05	7.623E-05	3.657E-04
Th-230	Po-210	1.000E+00	3.493E-07	2.831E-06	1.693E-05
Th-230	*DSR(j)		5.435E-02	5.685E-02	6.201E-02
0U-234	U-234	1.000E+00	6.047E-02	6.002E-02	5.915E-02

U-234	Th-230	1.000E+00	2.580E-07	7.362E-07	1.675E-06
U-234	Ra-226+D	1.000E+00	3.396E-09	2.479E-08	1.326E-07
U-234	Pb-210+D	1.000E+00	3.038E-11	3.873E-10	4.023E-09
U-234	Po-210	1.000E+00	7.613E-13	1.289E-11	1.713E-10
U-234	ªDSR(j)		6.047E-02	6.003E-02	5.915E-02
0U-238	U-238	5.400E-05	2.939E-06	2.918E-06	2.875E-06
0U-238+D	U-238+D	9.999E-01	7.692E-02	7.636E-02	7.524E-02
U-238+D	U-234	9.999E-01	8.560E-08	2.551E-07	5.867E-07
U-238+D	Th-230	9.999E-01	2.557E-13	1.665E-12	8.440E-12
U-238+D	Ra-226+D	9.999E-01	2.340E-15	3.701E-14	4.398E-13
U-238+D	Pb-210+D	9.999E-01	1.821E-17	4.744E-16	1.048E-14
U-238+D	Po-210	9.999E-01	4.224E-19	1.450E-17	4.156E-16
U-238+D	ªDSR(j)		7.692E-02	7.636E-02	7.524E-02

ª is used to indicate summation; the Greek sigma is not included in this font.
The DSR includes contributions from associated (half-life <= 30 days) daughters.

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 2.500E+01 mrem/yr

0Nuclide

(i)	t= 0.000E+00	1.000E+00	3.000E+00
Pb-210	5.657E+00	5.759E+00	6.158E+00
Po-210	3.404E+02	2.198E+03	9.174E+04
Ra-226	4.345E+00	4.266E+00	4.130E+00
Th-230	4.600E+02	4.397E+02	4.031E+02
U-234	4.134E+02	4.165E+02	4.227E+02
U-238	3.250E+02	3.274E+02	3.323E+02

0

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
at tmin = time of minimum single radionuclide soil guideline
and at tmax = time of maximum total dose = 0.1807 ▒ 0.0004 years

0Nuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin) (pCi/g)	G(i,tmin) (pCi/g)	DSR(i,tmax) (pCi/g)	G(i,tmax) (pCi/g)
Pb-210	1.000E+00	0.1183 ▒ 0.0002	4.427E+00	5.647E+00	4.426E+00	5.649E+00
Po-210	1.000E+00	0.000E+00	7.345E-02	3.404E+02	5.245E-02	4.766E+02
Ra-226	1.000E+00	3.000E+00	6.053E+00	4.130E+00	5.775E+00	4.329E+00
Th-230	1.000E+00	3.000E+00	6.201E-02	4.031E+02	5.479E-02	4.563E+02
U-234	1.000E+00	0.000E+00	6.047E-02	4.134E+02	6.039E-02	4.140E+02
U-238	1.000E+00	0.000E+00	7.692E-02	3.250E+02	7.682E-02	3.254E+02

Individual Nuclide Dose Summed Over All Pathways
Parent Nuclide and Branch Fraction Indicated

0Nuclide (j)	Parent (i)	THF(i)	DOSE(j,t), mrem/yr t= 0.000E+00	1.000E+00	3.000E+00
Pb-210	Pb-210	1.000E+00	4.256E+00	4.110E+00	3.834E+00
Pb-210	Ra-226	1.000E+00	7.948E-02	2.109E-01	4.539E-01
Pb-210	Th-230	1.000E+00	1.263E-05	7.623E-05	3.657E-04
Pb-210	U-234	1.000E+00	3.038E-11	3.873E-10	4.023E-09
Pb-210	U-238	9.999E-01	1.821E-17	4.744E-16	1.048E-14

Pb-210	ºDOSE(j)		4.335E+00	4.321E+00	4.289E+00
0Po-210	Pb-210	1.000E+00	1.634E-01	2.304E-01	2.253E-01
Po-210	Po-210	1.000E+00	7.345E-02	1.138E-02	2.725E-04
Po-210	Ra-226	1.000E+00	2.515E-03	9.145E-03	2.329E-02
Po-210	Th-230	1.000E+00	3.493E-07	2.831E-06	1.693E-05
Po-210	U-234	1.000E+00	7.613E-13	1.289E-11	1.713E-10
Po-210	U-238	9.999E-01	4.224E-19	1.450E-17	4.156E-16
Po-210	ºDOSE(j)		2.394E-01	2.509E-01	2.489E-01
0Ra-226	Ra-226	1.000E+00	5.672E+00	5.640E+00	5.576E+00
Ra-226	Th-230	1.000E+00	1.171E-03	3.612E-03	8.470E-03
Ra-226	U-234	1.000E+00	3.396E-09	2.479E-08	1.326E-07
Ra-226	U-238	9.999E-01	2.340E-15	3.701E-14	4.398E-13
Ra-226	ºDOSE(j)		5.673E+00	5.643E+00	5.584E+00
0Th-230	Th-230	1.000E+00	5.316E-02	5.316E-02	5.316E-02
Th-230	U-234	1.000E+00	2.580E-07	7.362E-07	1.675E-06
Th-230	U-238	9.999E-01	2.557E-13	1.665E-12	8.440E-12
Th-230	ºDOSE(j)		5.316E-02	5.316E-02	5.316E-02
0U-234	U-234	1.000E+00	6.047E-02	6.002E-02	5.915E-02
U-234	U-238	9.999E-01	8.560E-08	2.551E-07	5.867E-07
U-234	ºDOSE(j)		6.047E-02	6.003E-02	5.915E-02
0U-238	U-238	5.400E-05	2.939E-06	2.918E-06	2.875E-06
U-238	U-238	9.999E-01	7.692E-02	7.636E-02	7.524E-02
U-238	ºDOSE(j)		7.692E-02	7.636E-02	7.524E-02

THF(i) is the thread fraction of the parent nuclide.
º is used to indicate summation; the Greek sigma is not included in this font.

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

0Nuclide (j)	Parent (i)	THF(i)	S(j,t), pCi/g t= 0.000E+00	1.000E+00	3.000E+00
Pb-210	Pb-210	1.000E+00	1.000E+00	9.658E-01	9.009E-01
Pb-210	Ra-226	1.000E+00	0.000E+00	3.046E-02	8.778E-02
Pb-210	Th-230	1.000E+00	0.000E+00	6.643E-06	5.821E-05
Pb-210	U-234	1.000E+00	0.000E+00	1.996E-11	5.263E-10
Pb-210	U-238	9.999E-01	0.000E+00	1.416E-17	1.122E-15
Pb-210	ºS(j):		1.000E+00	9.963E-01	9.888E-01
0Po-210	Pb-210	1.000E+00	0.000E+00	8.104E-01	8.965E-01
Po-210	Po-210	1.000E+00	1.000E+00	1.548E-01	3.707E-03
Po-210	Ra-226	1.000E+00	0.000E+00	1.642E-02	7.136E-02
Po-210	Th-230	1.000E+00	0.000E+00	2.701E-06	4.051E-05
Po-210	U-234	1.000E+00	0.000E+00	6.567E-12	3.219E-10
Po-210	U-238	9.999E-01	0.000E+00	3.923E-18	6.135E-16
Po-210	ºS(j):		1.000E+00	9.816E-01	9.716E-01
0Ra-226	Ra-226	1.000E+00	1.000E+00	9.943E-01	9.830E-01
Ra-226	Th-230	1.000E+00	0.000E+00	4.320E-04	1.289E-03
Ra-226	U-234	1.000E+00	0.000E+00	1.941E-09	1.732E-08
Ra-226	U-238	9.999E-01	0.000E+00	1.833E-15	4.899E-14
Ra-226	ºS(j):		1.000E+00	9.947E-01	9.843E-01
0Th-230	Th-230	1.000E+00	1.000E+00	1.000E+00	1.000E+00
Th-230	U-234	1.000E+00	0.000E+00	8.969E-06	2.671E-05
Th-230	U-238	9.999E-01	0.000E+00	1.270E-11	1.132E-10
Th-230	ºS(j):		1.000E+00	1.000E+00	1.000E+00
0U-234	U-234	1.000E+00	1.000E+00	9.926E-01	9.781E-01
U-234	U-238	9.999E-01	0.000E+00	2.814E-06	8.318E-06
U-234	ºS(j):		1.000E+00	9.927E-01	9.781E-01
0U-238	U-238	5.400E-05	5.400E-05	5.360E-05	5.282E-05
U-238	U-238	9.999E-01	9.999E-01	9.926E-01	9.781E-01

```
 U-238    ºS(j):               1.000E+00 9.927E-01 9.781E-01
 ======= ======= =========    ========= ========= =========
 THF(i) is the thread fraction of the parent nuclide.
  º is used to indicate summation; the Greek sigma is not included in this font.
0RESCALC.EXE execution time =     1.48 seconds
=
```

APPENDIX E

Regression Analysis for ME9999

Regression BKGD				Regression-ME9999			
y		x		y		x	
Ra-226	Units	Gamma Scan	Units	Ra-226	Units	Gamma Scan	Units
0.510	pCi/g	6339	cpm	1.008	pCi/g	8902	cpm
0.459	pCi/g	6292	cpm	0.978	pCi/g	9222	cpm
0.426	pCi/g	6190	cpm	1.031	pCi/g	9105	cpm
0.549	pCi/g	6499	cpm	1.007	pCi/g	10069	cpm
0.504	pCi/g	6454	cpm	0.843	pCi/g	8736	cpm
0.515	pCi/g	6407	cpm	1.046	pCi/g	9225	cpm
0.464	pCi/g	6396	cpm	0.956	pCi/g	10404	cpm
0.367	pCi/g	6426	cpm	0.899	pCi/g	8909	cpm
0.418	pCi/g	6547	cpm	0.995	pCi/g	9338	cpm
0.593	pCi/g	6390	cpm	1.043	pCi/g	10365	cpm
0.411	pCi/g	6518	cpm	0.925	pCi/g	8968	cpm
0.455	pCi/g	6508	cpm	0.876	pCi/g	9076	cpm
0.556	pCi/g	6827	cpm	1.321	pCi/g	10290	cpm
0.555	pCi/g	6638	cpm	1.325	pCi/g	9343	cpm
0.449	pCi/g	6408	cpm	0.938	pCi/g	10321	cpm
0.506	pCi/g	6613	cpm	1.006	pCi/g	8685	cpm
0.455	pCi/g	6427	cpm	1.025	pCi/g	8660	cpm
0.651	pCi/g	6656	cpm	0.991	pCi/g	10396	cpm
0.422	pCi/g	6258	cpm	1.420	pCi/g	10875	cpm
0.487	pCi/g	6422	cpm	0.958	pCi/g	8575	cpm

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.929470023
R Square	0.863914523
Adjusted R Square	0.860333326
Standard Error	0.111408367
Observations	40

		CF:		
(y) pCi/g =	-0.61067105	+	0.000171863	(x) cpm

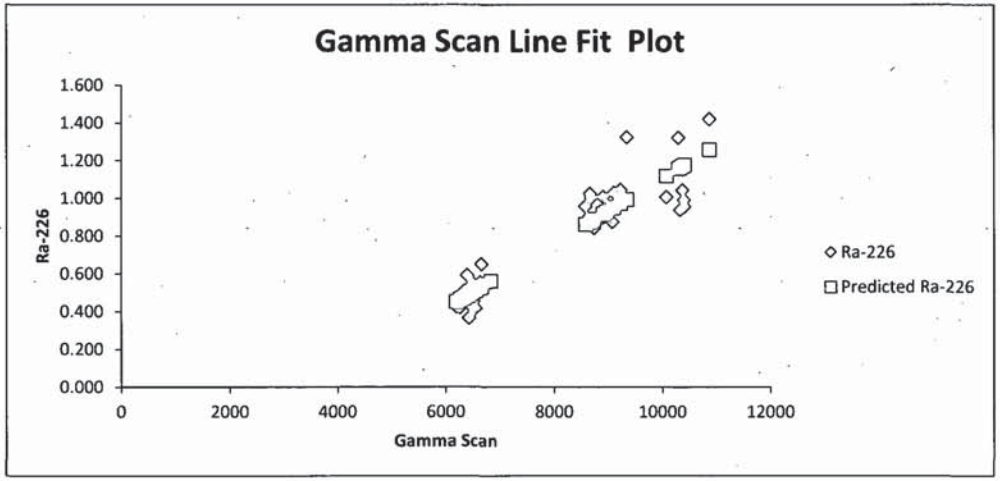
ANOVA

	df	SS	MS	F	Significance F
Regression	1	2.994182089	2.994182089	241.2362623	4.80491E-18
Residual	38	0.471649321	0.012411824		
Total	39	3.46583141			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	-0.610671053	0.08989904	-6.792853981	4.69532E-08	-0.792662144	-0.428679962	-0.792662144	-0.428679962
Gamma Scan	0.000171863	1.10652E-05	15.53178233	4.80491E-18	0.000149462	0.000194263	0.000149462	0.000194263

RESIDUAL OUTPUT

Observation	Predicted Ra-226	Residuals
1	0.478766113	0.031233887
2	0.47068857	-0.01168857
3	0.453158582	-0.027158582
4	0.506264133	0.042735867
5	0.498530315	0.005136352
6	0.490452772	0.024547228
7	0.488562283	-0.024562283
8	0.493718161	-0.126718161
9	0.514513539	-0.096513539
10	0.487531107	0.105468893
11	0.509529523	-0.098529523
12	0.507810896	-0.052810896
13	0.562635073	-0.006635073
14	0.530153037	0.024846963
15	0.490624634	-0.041624634
16	0.525856472	-0.019856472



17	0.493890024	-0.038890024
18	0.533246565	0.117753435
19	0.464845241	-0.042845241
20	0.493030711	-0.006530711
21	0.919250016	0.088749984
22	0.974246055	0.003753945
23	0.954138128	0.076861872
24	1.119813697	-0.112813697
25	0.89072082	-0.04772082
26	0.974761643	0.071238357
27	1.177387675	-0.221387675
28	0.920453054	-0.021453054
29	0.994182119	0.000817881
30	1.170685033	-0.127685033
31	0.930592949	-0.005592949
32	0.949154112	-0.073154112
33	1.157795336	0.163204664
34	0.995041432	0.329958568
35	1.163123077	-0.225123077
36	0.881955826	0.124044174
37	0.877659261	0.147340739
38	1.176012774	-0.185012774
39	1.258334971	0.161665029
40	0.863050938	0.094949062

APPENDIX F

Interim Report for LG9993

Radiological Assessment of LG9993 and LG9989
May 19, 2011

LG9993 is the designation for an area from which clay soil is collected for use in making pottery, and LG9989 designates the residence of one of the potters. These properties were assessed for elevated gamma activity and elevated concentrations of Ra-226 to estimate the potential radiological hazard to the person collecting the clay and to the person who makes the pots. There is considerable human epidemiological data regarding the carcinogenetic hazards of Ra-226. Most of the carcinogenetic hazard data is from the ingestion of Ra-226, and this isotope is a known carcinogen. Both the hazard from ingesting Ra-226 and the hazard from the direct gamma exposure to Ra-226 will be evaluated.

1. Laguna Properties Background Site Data

   The Ra-226 concentration in the twenty soil samples collected across the background site ranged from 0.41 pCi/g to 1.24 pCi/g, and averaged 0.73 pCi/g with a standard deviation of 0.22 pCi/g. One-minute stationary gamma readings were also collected from these sample locations using a 2-inch by 2-inch sodium iodide (2X2 NaI) gamma detector. These gamma data ranged from 7772 to 8871 counts per minute (cpm), and averaged 8244 cpm with a standard deviation of 353 cpm. The Pressurized Ionization Chamber (PIC) reading at the background property was 11.00 µR/h.

2. LG9993

   2.1. Gamma Activity

   Gamma readings were collected in this area using both a 2X2 NaI detector and a pressurized ion chamber (PIC). A gamma scanning survey (RAT Survey) was not conducted on this property in order to not divulge the location coordinates of this religiously sensitive site. In September 2010 EPA visited the site. Twenty one-minute stationary readings were taken with the 2X2 NaI and the results ranged from 9245 to 19,523 cpm, and averaged 12,691 cpm with a standard deviation of 2306 cpm. A soil sample was collected from the location of the highest reading. In January 2011 EPA returned to the site. Several areas were investigated and three soil samples were collected, including one sample from a lignite lens located above the clay pit. Gamma readings were collected from the locations of the three samples. These gamma readings ranged from 11,635 to 15,736 cpm. The analytical results of the soil samples will be discussed in the following paragraph. PIC readings were collected at the three soil sample locations. The PIC readings for these three locations were 13.1 µR/h, 12.6 µR/h, and 13.4 µR/h, and averaged 13.0 µR/h.

   The 2X2 NaI readings and the PIC data collected from property LG9993 indicate the area exhibits slightly elevated gamma activity as compared to the gamma levels detected at the background location.

   2.2. Soil Sample Analyses

   As described above, soil samples were collected from the four localized areas of elevated gamma activity. In addition, six samples of pottery in various stages of manufacturing were collected and analyzed for Ra-226 content. The analytical results for the four samples collected from the property were 1.5, 1.8, 3.3, and 3.5 pCi/g. A duplicate sample was collected from one location, and the results were within the acceptable range for quality assurance. The analytical results for the six samples of pottery were 2.5, 2.6, 3.1, 3.4, 3.5, and 5.4 pCi/g. The average Ra-226

concentration in these ten solid material samples that represent soils from the clay pit was 3.1 pCi/g. These data again indicated that this clay soil is elevated in Ra-226 content as compared to the level measured at the background location.

2.3. Radiological Assessment of Hazard

2.3.1. Gamma Exposure Rate

The 2X2 NaI readings indicate a non-homogenous gamma environment across the property that is probably a result of a varying Ra-226 soil concentration in the clay. Additionally, the lignite lens located above the clay pit may contribute to the elevated gamma readings. Assuming a correlation of 760 cpm per μR/h (MARSSIM Table 6.7), the gamma exposure rates across the property ranged from approximately 12 to 26 μR/h. These data compare favorably with the three PIC readings which averaged 13.0 μR/h. Given the applicable Laguna background is 11.0 μR/h, and assuming the person collecting the clay is working in areas that exhibit the average gamma exposure rate, the incremental (average minus background) exposure the worker receives is 2 μR/h for the time spent in the clay pit. Assuming the allowable annual exposure rate is 15 mR/y (15,000 μR/y), the allowable stay time in this field is 7500 hours. However, if the person is working at the location of the highest gamma count rate as measured by the 2X2 NaI detector, the incremental exposure received would be 15 μR/h. Again assuming the allowable annual exposure rate is 15 mR/y, the allowable stay time at this location would be 1000 hours per year.

2.3.2. Soil Ingestion and Inhalation

EPA was informed that the clay harvesting and pottery making processes can generate dust in localized occupied areas. EPA was unable to conduct a radiological analysis of these processes as they were not taking place at the time of data collection. However, the Certified Health Physicists were able to extrapolate risk based on the results of soil analysis. The ingestion and inhalation pathways are similar in that the material is taken into the body, and the associated dose calculations are similar. The hazard for ingesting and/or inhaling small amounts of soil with an elevated concentration of Ra-226 can be assessed by two methods; dose and risk.

2.3.2.1. Dose Assessment Method

Ra-226 decays through a series of short-lived nuclear transformations to Pb-210 which has a half-life of 21 years. Pb-210 then decays through another short-lived series finally ending in stable Pb-206. Ra-226 when ingested behaves as a chemical analog of calcium and therefore preferentially deposits in the bone and the primary hazard to humans from the intake of Ra-226 via ingestion or inhalation is to the bone surface. The Dose Conversion Factor (DCF) used by RESRAD to calculate the Effective Dose Equivalent from the intake of Ra-226 and daughters, plus Pb/Po-210 and daughters is 0.006697 mrem/pCi. The DCF reported in EPA-520/1-88-020 (Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion) for the same radionuclides is 0.006689 mrem/pCi. Both of these values mathematically round to 0.0067 mrem/ pCi. Assuming the allowable Effective Dose Equivalent is 15 mrem/year, the allowable annual intake of Ra-226 is 2239 pCi [(15 mrem/y) / 0.0067]. Assuming the incremental concentration of the soil is the average soil

concentration detected in the ten soil samples (3.1 pCi/g) minus the background concentration (0.73 pCi/g) or 2.37 pCi/g, then the allowable annual intake of soil is 945 g (2239 pCi/ 2.37 pCi/g), or 2.6 g/day for every day of the year. Alternatively, assuming the incremental soil concentration is the highest detected in the ten soil samples (5.4 pCi/g) minus the background concentration, or 4.67 pCi/g, then the annual allowable intake of soil is 479 g (2239/ 4.67), or 1.3 g/day.

2.3.2.2. Risk Assessment Method

The EPA has published the cancer risk from the ingestion of Ra-226 in EPA-R-08-005, Technologically Enhanced Naturally Occurring Radioactive Materials from Uranium Mining Volume 2; Investigation of Potential Health, Geographic, and Environmental Issues of Abandoned Uranium Mines (2008). Section 3.3.2 of that document provides the formula to calculate the soil concentration of Ra-226 from an assumed cancer risk as follows:

$SSL = TR/(SF \times IR \times 10^{-3} \times EF \times ED)$ where,

SSL, or Site Screening Level, is the soil concentration

TR is the Target Lifetime Cancer risk, generally $1x10^{-4}$ to $1x10^{-6}$

SF is the slope factor, which for Ra-226 and daughters is $3.39x\ 10^{-9}$ pCi^{-1}

IR is the soil ingestion rate in mg/day

$1x10^{-3}$ is a conversion factor (g/mg)

EF is the exposure frequency in days/year, and

ED is the exposure duration in years.

Assuming the soil concentration (the SSL) is again the average incremental soil concentration or 2.37 pCi/g, the TR is $1x10^{-4}$, the EF is 365 days/year, and the exposure duration is 30 years, the allowable IR or ingestion rate is:

$IR = 1x10^{-4}/(3.39x10^{-9} \times 2.37 \times 1x10^{-3} \times 365 \times 30) = 1137$ mg/day or approximately 1.1 g/day.

This value compares favorably with the result calculated by the dose assessment method (assuming the average incremental concentration) of 2.6 g/day. Assuming the soil concentration is the incremental maximum observed (4.67 pCi/g), then the allowable intake rate is 0.56 g/day which compares favorably to that calculated by the dose model of 1.3 g/day. The allowable intake rate can be calculated for any combination of acceptable risk, exposure duration, and soil concentration using this formula.

2.3.2.3. Recommendation to Limit the Effective Dose Equivalent

Based on the above radiological assessments using both the dose method and the risk method, it appears that to limit the lifetime risk to $1x10^{-4}$, the individual should limit the intake of the pottery or clay to about 0.56 to 1.3 g/day. If, however, the individual wishes to limit their risk to $1x10^{-6}$, they should limit their intake to 0.005 to 0.01 g/day.

3. LG9989

3.1. Gamma Activity

PIC measurements were made in two rooms of the residence at site LG9989, with the results being approximately 11.45 μR/h and 11.22 μR/h. Using the highest of these measured values, the incremental exposure rate above background is approximately 0.45 μR/h. Assuming the individual is in this residence for 12 hours/ day, 365 days/year, the incremental exposure is then 1971 μR/y or about 2 mR/year. This amount of incremental exposure is well below the limit of 15 mR/year.

3.2. Soil Ingestion and Inhalation

The Ra-226 concentrations measured in the 10 samples of clay and pottery are applicable to the materials at this residence, so the same recommendations as described in section 2.3.2.3 would apply here as well.

4 Conclusions and Recommendations

As discussed above, EPA has determined that the radioisotope concentrations in the clay pit and in clay materials are above background levels. However, when in a fixed matrix, as in the form of a finished pot, the material appears to be fixed in-place so that the ingestion and inhalation pathways should be adequately minimized and thus the finished pottery is safe to use or sell. Gamma dose rates should be negligible.

The highest radiological exposure risk appears to be during the harvesting and processing of the clay. Recommendations for safely handling this material are listed below.

- People should limit their time at the clay pit to 1000 hours per year, or no more than 20 hours per week.
- Good hygiene practices should be implemented during the harvesting and processing of the clay. These practices include:
  - wearing a dust mask while harvesting or handling the clay,
  - washing ones hands to limit hand-to-mouth transfer of clay material, and
  - practicing good housekeeping (dust control) to prevent the clay material from spreading into living and food-handling areas of the house.
- The clay material should not be eaten. If ingestion is necessary for medical or other reasons, ingestion should be limited to no more than 0.056 to 1.3 grams per day (0.5 to 1 pound per year).

APPENDIX G

Microshield Analysis

Print

MicroShield v6.02 (6.02-00039)
AQ_Safety,_Inc.

	:1
File	:U-238soilSlab.ms6
Date	: May 25, 2011
Time	: 11:26:33 AM
tion	: 00:00:00

File Ref	:
Date	:
By	:
Checked	:

Case Title: U+chainSlab
Description: U-238 + chain slab
Geometry: 16 - Infinite Slab

Source Dimensions:

Thickness	15.0 cm	(5.9 in)

Dose Points

A	X	Y	Z
# 1	115 cm	0 cm	0 cm
	3 ft 9.3 in	0.0 in	0.0 in

Shields

Shield N	Dimension	Material	Density
Source	Infinite	ANS soil 2011	1.5
Air Gap		Air	0.00122

Source Input : Grouping Method - Standard Indices
Number of Groups : 25
Lower Energy Cutoff : 0.015
Photons < 0.015 : Included
Library : Grove

Nuclide	_Ci/cm_	Bq/cm_
Bi-210	1.4990e-006	5.5464e-002
Bi-214	1.4993e-006	5.5476e-002
Pa-234	2.3993e-009	8.8772e-005
Pa-234m	1.4995e-006	5.5483e-002
Pb-210	1.4990e-006	5.5464e-002
Pb-214	1.4993e-006	5.5476e-002
Po-210	1.4990e-006	5.5464e-002
Po-214	1.4990e-006	5.5464e-002
Po-218	1.4996e-006	5.5487e-002
Ra-226	1.4996e-006	5.5487e-002
Rn-222	1.4996e-006	5.5487e-002
Th-230	1.4996e-006	5.5487e-002
Th-234	1.4995e-006	5.5483e-002
U-234	1.4996e-006	5.5486e-002

U-238 1.4995e-006 5.5483e-002

Buildup : The material reference is - Source
Integration Parameters

Energy MeV	Activity Photons/sec	Results: Fluence Rate MeV/cm_/sec No Buildup	Results: Fluence Rate MeV/cm_/sec With Buildup	Results: Exposure Rate mR/hr No Buildup	Results: Exposure Rate mR/hr With Buildup
0.015	4.281e-02	2.034e-05	2.102e-05	1.745e-06	1.803e-06
0.04	1.087e-07	2.822e-09	4.722e-09	1.248e-11	2.088e-11
0.05	2.925e-03	1.432e-04	3.334e-04	3.815e-07	8.882e-07
0.06	2.379e-03	1.794e-04	4.971e-04	3.563e-07	9.873e-07
0.08	1.287e-02	1.689e-03	6.226e-03	2.672e-06	9.853e-06
0.1	3.503e-03	6.578e-04	2.943e-03	1.006e-06	4.503e-06
0.15	6.623e-05	2.220e-05	1.137e-04	3.655e-08	1.872e-07
0.2	5.995e-03	2.976e-03	1.474e-02	5.252e-06	2.602e-05
0.3	1.145e-02	9.877e-03	4.263e-02	1.874e-05	8.087e-05
0.4	2.123e-02	2.721e-02	1.057e-01	5.302e-05	2.059e-04
0.5	9.991e-04	1.746e-03	6.028e-03	3.427e-06	1.183e-05
0.6	2.678e-02	6.037e-02	1.901e-01	1.178e-04	3.710e-04
0.8	5.427e-03	1.834e-02	4.905e-02	3.488e-05	9.329e-05
1.0	1.796e-02	8.322e-02	1.987e-01	1.534e-04	3.662e-04
1.5	1.057e-02	8.715e-02	1.696e-01	1.466e-04	2.853e-04
2.0	1.485e-02	1.833e-01	3.162e-01	2.835e-04	4.889e-04
Totals	**1.798e-01**	**4.769e-01**	**1.103e+00**	**8.228e-04**	**1.948e-03**

MicroShield v6.02 (6.02-00039)
AQ_Safety,_Inc.
Conversion of calculated exposure in air to dose
FILE: C:\Program Files\MicroShield\Examples\casefiles\U-238soilSlab.ms6
Case Title: U+chainSlab
This case was run on Wednesday, May 25, 2011 at 11:26:33 AM
Dose Point # 1 - (115,0,0) cm

Results (Summed over energies)	Units	Without Buildup	With Buildup
Photon Fluence Rate (flux)	Photons/cm2/sec	5.109e-001	1.464e+000
Photon Energy Fluence Rate	MeV/cm2/sec	4.769e-001	1.103e+000
Exposure and Dose Rates:			
Exposure Rate in Air	mR/hr	8.228e-004	1.948e-003
Absorbed Dose Rate in Air	mGy/hr	7.183e-006	1.700e-005
"	mrad/hr	7.183e-004	1.700e-003
Deep Dose Equivalent Rate	(ICRP 51 - 1987)		
o Parallel Geometry	mSv/hr	8.333e-006	2.001e-005
o Opposed	"	7.014e-006	1.647e-005
o Rotational	"	7.013e-006	1.646e-005
o Isotropic	"	6.274e-006	1.471e-005
Shallow Dose Equivalent Rate	(ICRP 51 - 1987)		
o Parallel Geometry	mSv/hr	8.781e-006	2.105e-005
o Opposed	"	8.416e-006	2.008e-005
o Rotational	"	8.415e-006	2.008e-005
o Isotropic	"	6.621e-006	1.556e-005
Effective Dose Equivalent Rate	(ICRP 51 - 1987)		
o Anterior/Posterior Geometry	mSv/hr	7.442e-006	1.779e-005
o Posterior/Anterior	"	6.777e-006	1.601e-005
o Lateral	"	5.335e-006	1.237e-005
o Rotational	"	6.099e-006	1.436e-005
o Isotropic	"	5.363e-006	1.252e-005

Print

MicroShield v6.02 (6.02-00039)
AQ_Safety,_Inc.

	:1
File	:Ra-226SoilSlab.ms6
Date	: May 25, 2011
Time	: 11:20:52 AM
tion	: 00:00:00

File Ref	:
Date	:
By	:
Checked	:

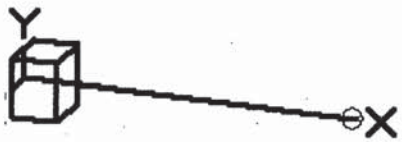
Case Title: Ra-226SoilSlab
Description: Ra226 infinite soil 15 cm slab
Geometry: 16 - Infinite Slab

Source Dimensions:

Thickness	15.0 cm	(5.9 in)

Dose Points

A	X	Y	Z
# 1	115 cm	0 cm	0 cm
	3 ft 9.3 in	0.0 in	0.0 in



Shields

Shield N	Dimension	Material	Density
Source	Infinite	ANS soil 2011	1.5
Air Gap		Air	0.00122

Source Input : Grouping Method - Standard Indices
Number of Groups : 25
Lower Energy Cutoff : 0.015
Photons < 0.015 : Included
Library : Grove

Nuclide	_Ci/cm_	Bq/cm_
Bi-210	1.5206e-006	5.6261e-002
Bi-214	1.4997e-006	5.5489e-002
Pb-210	1.5205e-006	5.6260e-002
Pb-214	1.4997e-006	5.5489e-002
Po-210	1.5209e-006	5.6274e-002
Po-214	1.4994e-006	5.5478e-002
Po-218	1.5000e-006	5.5500e-002
Ra-226	1.5000e-006	5.5500e-002
Rn-222	1.5000e-006	5.5500e-002

Buildup : The material reference is - Source
Integration Parameters

Results

Energy MeV	Activity Photons/sec	Fluence Rate MeV/cm_/sec No Buildup	Fluence Rate MeV/cm_/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.015	2.191e-02	1.041e-05	1.076e-05	8.931e-07	9.230e-07
0.05	2.892e-03	1.416e-04	3.297e-04	3.772e-07	8.782e-07
0.08	1.279e-02	1.679e-03	6.190e-03	2.657e-06	9.795e-06
0.1	7.532e-05	1.414e-05	6.328e-05	2.164e-08	9.682e-08
0.2	5.977e-03	2.967e-03	1.470e-02	5.237e-06	2.594e-05
0.3	1.145e-02	9.874e-03	4.262e-02	1.873e-05	8.084e-05
0.4	2.123e-02	2.721e-02	1.057e-01	5.302e-05	2.059e-04
0.5	9.912e-04	1.732e-03	5.981e-03	3.400e-06	1.174e-05
0.6	2.675e-02	6.031e-02	1.899e-01	1.177e-04	3.706e-04
0.8	5.244e-03	1.772e-02	4.740e-02	3.370e-05	9.015e-05
1.0	1.737e-02	8.051e-02	1.922e-01	1.484e-04	3.543e-04
1.5	1.056e-02	8.707e-02	1.694e-01	1.465e-04	2.851e-04
2.0	1.485e-02	1.833e-01	3.162e-01	2.835e-04	4.890e-04
Totals	**1.521e-01**	**4.726e-01**	**1.091e+00**	**8.141e-04**	**1.925e-03**

MicroShield v6.02 (6.02-00039)
AQ_Safety,_Inc.
Conversion of calculated exposure in air to dose
FILE: Case1
Case Title: Ra-226SoilSlab
This case was run on Wednesday, May 25, 2011 at 11:20:52 AM
Dose Point # 1 - (115,0,0) cm

Results (Summed over energies)	Units	Without Buildup	With Buildup
Photon Fluence Rate (flux)	Photons/cm2/sec	4.968e-001	1.416e+000
Photon Energy Fluence Rate	MeV/cm2/sec	4.726e-001	1.091e+000
Exposure and Dose Rates:			
Exposure Rate in Air	mR/hr	8.141e-004	1.925e-003
Absorbed Dose Rate in Air	mGy/hr	7.107e-006	1.681e-005
"	mrad/hr	7.107e-004	1.681e-003
Deep Dose Equivalent Rate	(ICRP 51 - 1987)		
o Parallel Geometry	mSv/hr	8.246e-006	1.976e-005
o Opposed	"	6.948e-006	1.629e-005
o Rotational	"	6.947e-006	1.628e-005
o Isotropic	"	6.215e-006	1.454e-005
Shallow Dose Equivalent Rate	(ICRP 51 - 1987)		
o Parallel Geometry	mSv/hr	8.684e-006	2.079e-005
o Opposed	"	8.330e-006	1.985e-005
o Rotational	"	8.330e-006	1.985e-005
o Isotropic	"	6.555e-006	1.539e-005
Effective Dose Equivalent Rate	(ICRP 51 - 1987)		
o Anterior/Posterior Geometry	mSv/hr	7.367e-006	1.758e-005
o Posterior/Anterior	"	6.711e-006	1.583e-005
o Lateral	"	5.286e-006	1.224e-005
o Rotational	"	6.041e-006	1.420e-005
o Isotropic	"	5.313e-006	1.238e-005

Print

MicroShield v6.02 (6.02-00039)
AQ_Safety,_Inc.

:1
File :Ra-226SoilConcrete.ms6
Date : May 25, 2011
Time : 2:40:34 PM
tion : 00:00:00

File Ref :
Date :
By :
Checked :

Case Title: Ra-226+found
Description: Ra-226 chain plus 15 cm foundation
Geometry: 16 - Infinite Slab

Source Dimensions:

Thickness	15.0 cm	(5.9 in)

Dose Points

A	X	Y	Z
# 1	130 cm	0 cm	0 cm
	4 ft 3.2 in	0.0 in	0.0 in

Shields

Shield N	Dimension	Material	Density
Source	Infinite	ANS soil 2011	1.5
Shield 1	15.0 cm	Concrete	2.1
Air Gap		Air	0.00122

Source Input : Grouping Method - Standard Indices
Number of Groups : 25
Lower Energy Cutoff : 0.015
Photons < 0.015 : Included
Library : Grove

Nuclide	_Ci/cm_	Bq/cm_
Bi-210	1.5206e-006	5.6261e-002
Bi-214	1.4997e-006	5.5489e-002
Pb-210	1.5205e-006	5.6260e-002
Pb-214	1.4997e-006	5.5489e-002
Po-210	1.5209e-006	5.6274e-002
Po-214	1.4994e-006	5.5478e-002
Po-218	1.5000e-006	5.5500e-002
Ra-226	1.5000e-006	5.5500e-002
Rn-222	1.5000e-006	5.5500e-002

Buildup : The material reference is - Shield 1
Integration Parameters

Results

Energy MeV	Activity Photons/sec	Fluence Rate MeV/cm_/sec No Buildup	Fluence Rate MeV/cm_/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.015	2.191e-02	0.000e+00	0.000e+00	0.000e+00	0.000e+00
0.05	2.892e-03	1.168e-10	6.039e-10	3.112e-13	1.609e-12
0.08	1.279e-02	4.030e-07	5.306e-06	6.377e-10	8.396e-09
0.1	7.532e-05	9.805e-09	1.760e-07	1.500e-11	2.693e-10
0.2	5.977e-03	1.053e-05	2.366e-04	1.859e-08	4.177e-07
0.3	1.145e-02	6.703e-05	1.252e-03	1.272e-07	2.375e-06
0.4	2.123e-02	2.825e-04	4.237e-03	5.505e-07	8.256e-06
0.5	9.912e-04	2.464e-05	3.058e-04	4.836e-08	6.002e-07
0.6	2.675e-02	1.099e-03	1.153e-02	2.144e-06	2.251e-05
0.8	5.244e-03	4.689e-04	3.685e-03	8.919e-07	7.008e-06
1.0	1.737e-02	2.804e-03	1.775e-02	5.170e-06	3.272e-05
1.5	1.056e-02	4.801e-03	2.050e-02	8.078e-06	3.450e-05
2.0	1.485e-02	1.342e-02	4.597e-02	2.075e-05	7.108e-05
Totals	**1.521e-01**	**2.298e-02**	**1.055e-01**	**3.778e-05**	**1.795e-04**

MicroShield v6.02 (6.02-00039)
AQ_Safety,_Inc.
Conversion of calculated exposure in air to dose
FILE: C:\Program Files\MicroShield\Examples\casefiles\Ra-226SoilConcrete.ms6
Case Title: Ra-226+found
This case was run on Wednesday, May 25, 2011 at 2:40:34 PM
Dose Point # 1 - (130,0,0) cm

Results (Summed over energies)	Units	Without Buildup	With Buildup
Photon Fluence Rate (flux)	Photons/cm2/sec	1.617e-002	9.486e-002
Photon Energy Fluence Rate	MeV/cm2/sec	2.298e-002	1.055e-001
Exposure and Dose Rates:			
Exposure Rate in Air	mR/hr	3.778e-005	1.795e-004
Absorbed Dose Rate in Air	mGy/hr	3.299e-007	1.567e-006
"	mrad/hr	3.299e-005	1.567e-004
Deep Dose Equivalent Rate	(ICRP 51 - 1987)		
o Parallel Geometry	mSv/hr	3.761e-007	1.805e-006
o Opposed	"	3.278e-007	1.540e-006
o Rotational	"	3.278e-007	1.540e-006
o Isotropic	"	2.943e-007	1.378e-006
Shallow Dose Equivalent Rate	(ICRP 51 - 1987)		
o Parallel Geometry	mSv/hr	3.955e-007	1.901e-006
o Opposed	"	3.826e-007	1.831e-006
o Rotational	"	3.826e-007	1.831e-006
o Isotropic	"	3.083e-007	1.451e-006
Effective Dose Equivalent Rate	(ICRP 51 - 1987)		
o Anterior/Posterior Geometry	mSv/hr	3.383e-007	1.617e-006
o Posterior/Anterior	"	3.138e-007	1.482e-006
o Lateral	"	2.547e-007	1.179e-006
o Rotational	"	2.840e-007	1.337e-006
o Isotropic	"	2.533e-007	1.181e-006

Date: 5-25-2011

To: Nels Johnson, Weston Solutions

From: Rick Haaker, Weston Solutions

Subject: Microsohield Calculations of Exposure rate and dose equivalent rate

---

On May 10 , 2009 I provided a technical memo entitled *Response Estimates for a 2"x2" NaI Detector to Ra-226 That is Distributed in Soil.* The last paragraph of that memo was a discussion of conversion factors between soil concentration, exposure rate, and effective dose equivalent rate for the U-238 decay chain. This memo elaborates on that final paragraph. In determining the conversion factors, the geometry assumed was an infinite slab of soil having a thickness of 15 cm and a density of 1.5. A simplified soil composition derived from ANSI/ANS 6.6.1-1997[1] was used in the Microshield® 6.02 modelling[2], see Table 1.

Table 1 Simplified Soil Composition from ANSI/ANS 6.6.1.

Element	Weight Percent
Hydrogen	0.954
Oxygen	54.4
Aluminum	12.9
Silicon	31.8

Three cases were considered for the Microshield calculations:

- an infinite slab of soil 15 cm thick containing U-238 plus progeny through Po-210 in decay equilibrium, and
- an infinite slab of soil 15 cm thick containing Ra-226 plus progeny through Po-210 in decay equilibrium.
- an infinite slab of soil 15 cm thick containing Ra-226 plus progeny through Po-210 in decay equilibrium covered by a 15-cm thick concrete foundation.
-

A circular slab of uniformly contaminated soil that is 20 meters in diameter is approximately "infinite" with respect to the Microshield calculations. Microshield also will also model other, non-infinite geometries.

Each time a Microshield calculation was performed, the corresponding "Conversion of Calculated Exposure in Air to Dose" report was generated via the Microshield software package.

---

1 ANSI/ANS-6.6.1-1987, Calculation and Measurement of Direct and Scattered Gamma Radiation from LWR Nuclear Power Plants. American Nuclear Society, La Grange Park, Il, 1987.
2 Microshield 6.02, Grove Engineering, Framatone ANP, Rockville, MD, 2003. !!

Results for a U-238 at 1 pCi/g Plus Progeny

Table 2 provides results for the U-238 decay chain

Table 2. Results for 1 pCi/g U-238 with decay chain in equilibrium

Exposure rate	1.948 μR/h
EDE rate in isotropic field	1.252 μREM/hr
Ratio	1.56 μR/μREM

Results for a Ra-226 at 1 pCi/g Plus Progeny

Table 3 provides results for the Ra-226 decay chain

Table 3. Results for 1 pCi/g Ra-226 with decay chain in equilibrium

Exposure rate	1.925 μR/h
EDE rate in isotropic field	1.238 μREM/hr
Ratio	1.55 μR/μREM

Results for a Ra-226 at 1 pCi/g Plus Progeny and 15 cm Foundation

Table 4 provides results for the Ra-226 decay chain assuming a 15 cm thick concrete foundation covers the entire site.

Table 4. Results for 1 pCi/g Ra-226 with decay chain in equilibrium plus concrete foundation.

Exposure rate	0.1795 μR/h
EDE rate in isotropic field	0.1181 μREM/hr
Ratio	1.52 μR/μREM

Use of estimates indoors

A house is a complicated object, it is constructed of materials that serve to shield the occupant to some degree from the terrestrial gamma radiation field. The degree of shielding that a structure provides an occupant will depend on the materials of construction, their thickness and radiation attenuating properties and other factors.

The RESRAD software package[3] accounts for external radiation attenuation by a structure via an external radiation transmission factor, and the RESRAD default value of 0.7 was used for all RESRAD calculations we have performed; this is probably a reasonable value for frame houses. Another source, NCRP Report 94 suggests an external gamma transmission factor of 0.8.[4]

As a limiting case, a Microshield calculation was performed assuming a 15-cm thick concrete foundation covers the infinite slab of contaminated soil. The μR/μREM ratio decreased insignificantly to 1.52 μR/μREM; see Table 4. Thus it is concluded that any attenuation of external gamma radiation, which is caused by the structure will affect EDE and exposure to a similar degree.

In addition, the materials of construction will contain Ra-226, Ra-228, and K-40, and these will contribute to the external dose of an occupant to some degree. NCRP Report 94 reports that in Europe where masonry houses are prevalent, the structural materials increase indoor gamma radiation exposures by about 20% relative to terrestrial background.

Limitations of estimates

These estimates utilize Microshield 6.02, and so they inherit all of its limitations. Microshield quickly does simple radiation attenuation and build-up calculations, which otherwise would be tedious to do in a spreadsheet. It does not account for:

- surface roughness,
- bremstrahlung arising from beta emitters,
- more than one radiation source at a time,
- complicated radiation behaviors like backscatter or skyshine, or
- dose buildup in more than one model element at a time.

Equilibrium in the decay chain has been assumed, comparison of table 2 and table 3 shows that the amount of U-238 through U-234 in the chain is unimportant. Some radon (Rn-222) is usually lost from near surface soil and this may cause both the external EDE rate and exposure rates to be lower per pCi/g of Ra-226 than have been estimated.

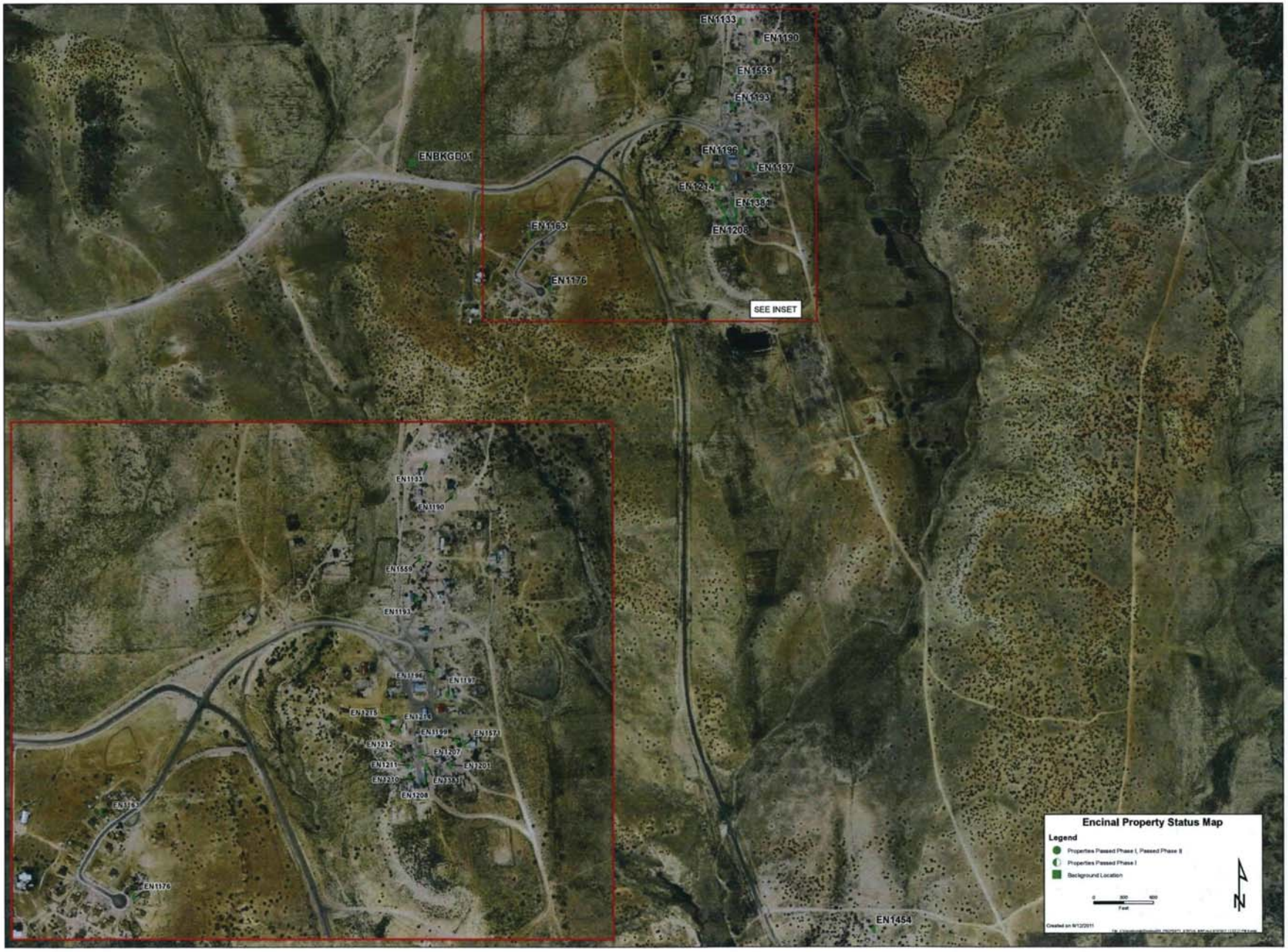
---

3 C. Yu et al. ,User's Manual for RESRAD Version 6, ANL/EAD-4, Argonne National Laboratory, Argonne, IL, 2001.

4 Exposure of the Population of the United States and Canada from Natural Background Radiation, NCRP Report 94, National Council on Radiation Protection and Measurements. Bethesda, MD, 1992. !

APPENDIX H

GRAPHIC, SPATIAL REPRESENTATION OF PHASE 1 AND PHASE 2 RESULTS


EN1133
EN1190
EN1559
EN1193
EN1196
EN1197
EN1214
EN1384
EN1208
EN1183
EN1176
ENBKGD01
SEE INSET
EN1454
Encinal Property Status Map
Legend
Properties Passed Phase I, Passed Phase II
Properties Passed Phase I
Background Location
Feet
N


LG0002
LG0003
LG0627
LG0626
LG1385
LG0628
LG0629
LG1230
LG9998
LG1387
LG1229
LG1228
LG0001
LG9996
LG1248
LG1250
LG1277
LG1313
LG1254
LG1321
LG1233
LG1235
LG1251
LG1275
LG1317
LG1245
LG1238
LG1253
LG0010
LG1243
LG1272
LG1244
LG1265
LG0017
LG1389
LG1267
LG1300
LG0004
LG9993
LG9991
LG0020
LG7777
LG1260
LG0018
LG1257
LG1263
LG0024
LG0011
LG1290
LG1306
LG1254
LG0012
LG9999
LG4922
LG1284
LG9995
LG1510
LG9980
LG1261
LG1335
LG6848
LG0486
LG0489
LG6791
LG0459
LG0026
LG0429
LG0436
LG9990
LG0437
LG0450
LG0451
LG0454
LG0452
LG0438
LG9992
LG8285
LG0694
LG4297
LG0655
LG4868
LG9994
LG0645
LG0644
LG0002
LG1228
LG1313
LG1236
LG1253
LG0011
LG1261
SEE INSET
LG9997
LG9989
LG0619
LGBKGD
LG0612
Laguna Property Status Map
Legend
Properties Failed Phase I, Refused Phase II
Properties Failed Phase I, Passed Phase II
Properties Passed Phase I, Passed Phase II
Properties Passed Phase II, Phase I Not Conducted
Properties Passed Phase I
Background Location
0
500
1,000
Feet
N
Created on 9/12/2011


ME0778
ME0760
ME9995
ME0727
ME0787
ME0769
ME0776
ME0733
ME0735
ME0893
ME0797
ME0738
ME0743
SEE INSET
MEBKGD
ME0352
ME0804
ME0810
ME0809
ME9994
ME9996
ME9997
ME0826
ME0832
ME0822
ME0721
ME0723
ME0718
ME0780
ME0767
ME9993
ME0741
ME0756
ME0753
ME0765
ME0789
ME0727
ME0770
ME0774
ME0777
ME0729
ME0775
ME0731
ME0739
ME0735
ME0734
ME0737
ME0736
ME0738
ME0743
Mesita Property Status Map
Legend
Properties Failed Phase I, Refused Phase II
Properties Passed Phase I, Passed Phase II
Properties Passed Phase I
Background Location
0 275 550
Feet
N
Created on 9/12/2011


PJ0305
PJ0324
PJ0296
PJ0311
PJ0322
PJ0340
PJ0344
SEE INSET
PJ0298
PJBKGD01
PJ0357
PJ0003
PJ0001
PJ0376
PJ0161
PJ0164
PJ0237
PJ0231
PJ0270
PJ0282
PJ0280
Paraje Property Status Map
Legend
Background Location
N
Feet
Created on 9/13/2011


SE5257
SE0032
SE0037
SE8996
SE0017
SE0004
SE0011
SE0063
SE0064
SE0088
SE6168
SE0096
SE0079
SEBKGD01
SE5586
SE0344
SE0126
SE0153
SEE INSET
Seama Property Status Map
Legend
Properties Failed Phase I, Passed Phase II
Properties Passed Phase I
Background Locations
0 400 800
Feet
N
Created on 9/9/2011
SE0088
SE4089
SE6168
SE0096
SE0094
SE4749
SE0079

APPENDIX I

INTERIM REPORT FOR LG0452

INTERIM STATUS REPORT
REMOVAL ASSESSMENT – LG0452 (b) (6) [redacted]
SSID: A6AH

July 26, 2011

Weston Work Order No.: 20406.012/016.005.0538.01

I. General Information

EPA Contract No.	EP-W-06-042
Task Order	0005
TDD No.	TO-0005-10-03-01
Project Location	Cibola County, Laguna, NM
Work Activity	Removal Assessment (RA)
EPA Work Assignment Manager	Warren Zehner/ Jon Rinehart
WESTON Site Manager	David Bordelon

II. Interim Status

The LG0452 property (Latitude: 35.042491; Longitude -107.41861) is located adjacent to Indian Service Road 50, approximately ¾ of a mile west of the intersection with Highway 124 (former Route 66) in the village of New Laguna, New Mexico (see Figure 1). The house is a traditional structure for the area, constructed with a rock foundation and walls made of rock held together with mud mortar. The owner of the property stated that the house was built in 1958, and that rocks from the Jackpile mine were used in the foundation, but not in the walls. The residence is currently unoccupied but renovations are being made in order to create a rental property.

Phase 1

The Phase 1 Outdoor Assessment consisted of a) a walking gamma scan (2-3 feet per second; 15 inches above ground surface) of residential soils utilizing a Model 44-10 2"x2" NaI probe attached to a Model 2210 count- meter , a laptop computer and a global positioning system (together referred to as the RAT system) all mounted in a modified baby buggy, b) the collection of 20 stationary 1-minute gamma measurements uniformly spaced throughout the assessment area utilizing the RAT system, c) the collection of grab 'hot spot' surface soil samples for laboratory analysis of Radium-226 where gamma scan readings exceeded the screening level (the derived concentration guideline level (DCGL)) of 3,648 counts per minute (cpm) above background, d) the collection of stationary 1-minute gamma measurements at 'hot spot' surface soil sample locations utilizing the RAT system, e) the procurement of a residential data information sheet detailing the resident's work relationship with local uranium mines and mills, structural elements of the residence and other buildings and consumption of home-grown produce, and f) the collection of two composite, surface soil samples (from the 20 stationary, 1-minute gamma measurement locations) for laboratory analysis of elemental Uranium (non-radiological/ non-carcinogenic). USEPA assessed approximately 12,000 square feet of the yard, an area that was determined as likely to be used by the resident on a regular basis.

The property was then subjected to four statistical tests, per Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) guidelines, to determine if the property exceeded the DCGL (3,648 cpm or 2.5 pico Curies per gram (pCi/g) above background) and warranted a Phase

2 Indoor Assessment. A background location in Laguna village was chosen for comparison to the property results. The background assessment included the collection of 20 stationary, 1-minute gamma measurements uniformly spaced throughout the assessment area utilizing the RAT system; and the collection of 20 five-minute, stationary gamma measurements utilizing a Pressurized Ionization Chamber (PIC) and 20 grab, surface soil samples for laboratory analysis of Radium-226 at the same 20 locations.

The Phase 1 outdoor assessment was conducted on June 22, 2010. The walking gamma scan revealed elevated readings along the western and northern walls of the house and two grab, surface (0"-6"), soil samples were subsequently collected from these areas. The soil sample results equaled 0.72 and 1.21 pico Curies per gram (pCi/g) [0.00 and 0.48 pCi/g above background, respectively] and were well below the USEPA screening-level (DCGL) of 2.5 pCi/g. Consequently, an extended Phase 1 outdoor assessment was conducted on September 7, 2010 in which two additional surface samples were collected, once more along the north and west walls of the house. The soil sample results were again well below the DCGL; however, subjected to the MARSSIM-defined Elevated Measurement Comparison or "Unity Rule" using the stationary, 1-minute gamma measurement collected at the soil sample location with the highest Ra-226 concentration, the property exceeded the DCGL of 3,648 cpm above background. A third, extended Phase 1 assessment was then conducted on the property on October 28, 2010, during which USEPA determined that the source of the elevated gamma readings discovered during the initial walking gamma scan emanated from the house foundation and not the soil. See Table 1 for a summary of all Phase 1 Assessment and statistical results, including background results. A graphic illustration of gamma scan results and soil sample locations is provided on Figure 2.

Phase 2

The Phase 2 Indoor Assessments consisted of a) the collection of 4 short-term (6-day) samples, utilizing activated charcoal adsorbent canisters, in four separate locations for laboratory analysis of Radon-222, b) the collection of two long-term (90-day) samples, utilizing track etch detectors, in two separate locations for laboratory analysis of Radon-222, c) the collection of 5-minute, stationary gamma measurements utilizing a PIC in the center of each room of the house, d) a walking gamma scan of the floor and walls of each room utilizing a Model 44-10 2"x2" NaI probe attached to a Model 2210 count- meter, and e) the collection of wipe samples for 'alpha tray counter' analysis in locations where gamma scan readings exceeded the house-specific screening level (quick, 'whole-house' scan average plus 1,900 cpm). The short-term radon canisters and long-term detectors were placed in the home from October 28 – November 3, 2010 and from October 28, 2010 – January 27, 2011, respectively; while the PIC measurements, gamma scan readings and wipe samples were collected on August 13, 2010.

An annual *indoor gamma dose above background* was then calculated using the highest room 5-minute average, the highest individual PIC reading, and the highest gamma scan reading assuming default values of 12 hours per day and 365 days per year spent indoors. An annual *outdoor gamma dose above background* was then calculated using the highest gamma scan reading (taken along the house exterior wall) assuming default values of 6 hours per day and 365 days per year spent outdoors. The annual gamma doses were converted from micro-Roentgens per year (μR/yr) to milli-Roentgens equivalent-in-man per year (mrem/yr) [1.5 R = 1 rem, determined by MicroShield Analysis provided as Attachment B] to determine if they exceeded the USEPA action-level Total Effective Dose Equivalent (TEDE) above background of 15 mrem/yr. The same background location in Laguna village that was utilized for Phase 1 assessment results was used for comparison to the Phase 2 results.

Short-term radon results ranged from 3.1 – 3.8 pico Curies per liter (pCi/L) and long-term radon results ranged from 3.1 – 3.3 pCi/L, all below the EPA and Center for Disease Control (CDC) acceptable exposure level of 4 picocuries pCi/L.

The 5-minute measurements taken with the PIC ranged from 10.8- 12.2 micro-Roentgen per hour (μR/hr), with the highest average measured in the kitchen. The annual indoor gamma dose above background using the kitchen average of 12.2 μR/hr calculated to 3.3 mrem/yr. The highest, single PIC reading, also measured in the kitchen, was 13.1 μr/hr, with a corresponding annual indoor gamma dose above background calculating to 6.1 mrem/yr. Both annual doses calculated using PIC measurements are beneath the USEPA action-level of 15 mrem/yr.

Gamma scan readings ranged from a low of 7,400 cpm in the kitchen and southwest bedroom to a high of 37,000 cpm in the kitchen. The annual indoor gamma dose above background using the high kitchen average calculated to 97.4 mrem/yr. An annual *outdoor* gamma dose above background using the same high kitchen average calculated to 48.7 mrem/yr. Added together, a maximum annual dose above background calculated to 146.1 mrem/yr. The annual doses calculated using the highest gamma scan reading are well above the USEPA action-level of 15 mrem/yr.

Wipe samples were collected in each room of the house, with a high of 6 samples collected in the living room. Wipe sample results ranged from a low of 0.0 disintegrations per minute (dpm) in each room to a high of 3.2 dpm in the living room and kitchen. All wipe sample results were well below the 20 dpm per 100 square centimers removable release standard for Ra-226 in NRC Regulatory Guide 1.86.

See Table 2 for a summary of all Phase 2 Assessment and background results. A graphic illustration of the possible range of annual doses to which the property's residents are exposed is presented in Figure 3. Calculations for the range of annual doses were performed by a certified health physicist and are provided as Attachment C.

On January 21, 2011, a qualified, professional engineer (PE) conducted a structural investigation of the house to determine the feasibility of removing and replacing the foundation while leaving the structure intact. The engineer estimated that the removal and replacement of the foundation would cost a minimum of $70,000 (Attachment D).

TABLE 1 Summary of Phase 1 Field Screening, Laboratory Analytical Results and MARSSIM Statistical Tests										
	Walking Gamma Scan Average (cpm)	Standard Deviation: Gamma Scan (cpm)	20 Stationary, One-Minute Measurements Avg. (cpm)	Standard Deviation: 20 One-Minute Stationary Measurements (cpm)	'Hot Spot' Surface Soil Sample Results [Radium 226] (pCi/g)	'Hot Spot" Surface Soil Sample Location One-Minute Stationary Measurements (cpm)	MARSSIM Test 1_1	MARSSIM Test 2_2	MARSSIM Test 3_3	MARSSIM Test 4_4
Background	n/a	n/a	8,244	353	0.73 [avg.] (*non-'hot spot'*)	8,244 [avg.] (*non-'hot spot'*)	n/a	n/a	n/a	n/a
LG0452	8,967	1,475	8,877	635	0.72	12,127	FAIL	PASS	PASS	FAIL
					1.21	**24,095**				
					0.80	12,652				
					0.87	13,877				

$_1$MARSSIM Test 1: Property PASSes if Highest Property Gamma Scan measurement minus Lowest Background 1-minute measurement is < DCGL (3,648 CPM). If property PASSes, no need to conduct further tests. If property FAILs, proceed to MARSSIM Test 2.

$_2$MARSSIM Test 2: Property PASSes if Property Gamma Scan avg. and Property Avg. of 20 one-minute stationary measurements minus Background avg. of 20 one-minute stationary measurements < DCGL (3,648 CPM). If property FAILs, no need to conduct further tests. If property PASSes, proceed to MARSSIM Test 3.

$_3$MARSSIM Test 3 (Wilcoxon Rank Sum Test): **See Appendix A**. If property FAILs, no need to conduct further tests. If property PASSes, proceed to MARSSIM Test 4.

$_4$MARSSIM Test 4 (Elevated Measurement Comparison or Unity Rule Test): Conducted only if concentrated, elevated 'hot spots' are present on a property. The Unity ratio represents the fraction of the DCGL above background that a property's contamination exhibits and provides for an 'adjusted DCGL' based on the area of the hot spot.

TABLE 2

Summary of Phase 2 Laboratory Analytical Results and Field Measurements

	Short-term (6-day) Indoor Radon (pCi/L)	Long-term (90-day) Indoor Radon (pCi/L)	PIC 5-minute Avg. (µR/hr)	PIC: Annual Indoor Dose Above Bkgd. (Using 'Highest Room' Avg.; Assumes 12 hrs/day and 365 days/yr (mrem/yr)	PIC Highest Single Reading (µR/hr)	PIC: Annual Indoor Dose Above Bkgd. (Using Highest Single Reading; Assumes 12 hrs/day and 365 days/yr (mrem/yr)	Room-by-Room Gamma Scan Range (cpm)	*Indoor Gamma Scan:* Annual Indoor Dose Above Bkgd. (Using Highest Gamma Scan Reading; Assumes 12 hrs/ day and 365 days/ yr) (mrem/yr)	Indoor Gamma Scan: Annual *Outdoor* Dose Above Bkgd. (Using Highest Gamma Scan Reading; Assumes 6 hrs/ day and 365 days/ yr) (mrem/yr)	Maximum Annual Dose Above Background (Indoor + Outdoor) (mrem/yr)	Alpha Wipe Sample Results (DPM)
Background	n/a	n/a	11.0 (Avg. of 20 pts.)	48.3	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Living Room	3.8	3.3	10.8		11.4		7,800-22,000				0.0-3.2 6 samples
SW Bedroom	3.3	3.1	11.2		11.7		7,400-19,600				0.0-0.0 2 samples
Kitchen	3.1	n/a	**12.2**	3.3	**13.1**	6.1	7,400-**37,000**	97.4	48.7	146.1	0.0-3.2 3 samples
SE Bedroom	3.6	n/a	11.5		12.3		8,000-18,700				0.0-0.0 3 samples
Bathroom	n/a	n/a	11.2		12.0		7,600-32,000				0.0-0.0 3 samples

FIGURE 1

SITE LOCATION MAP

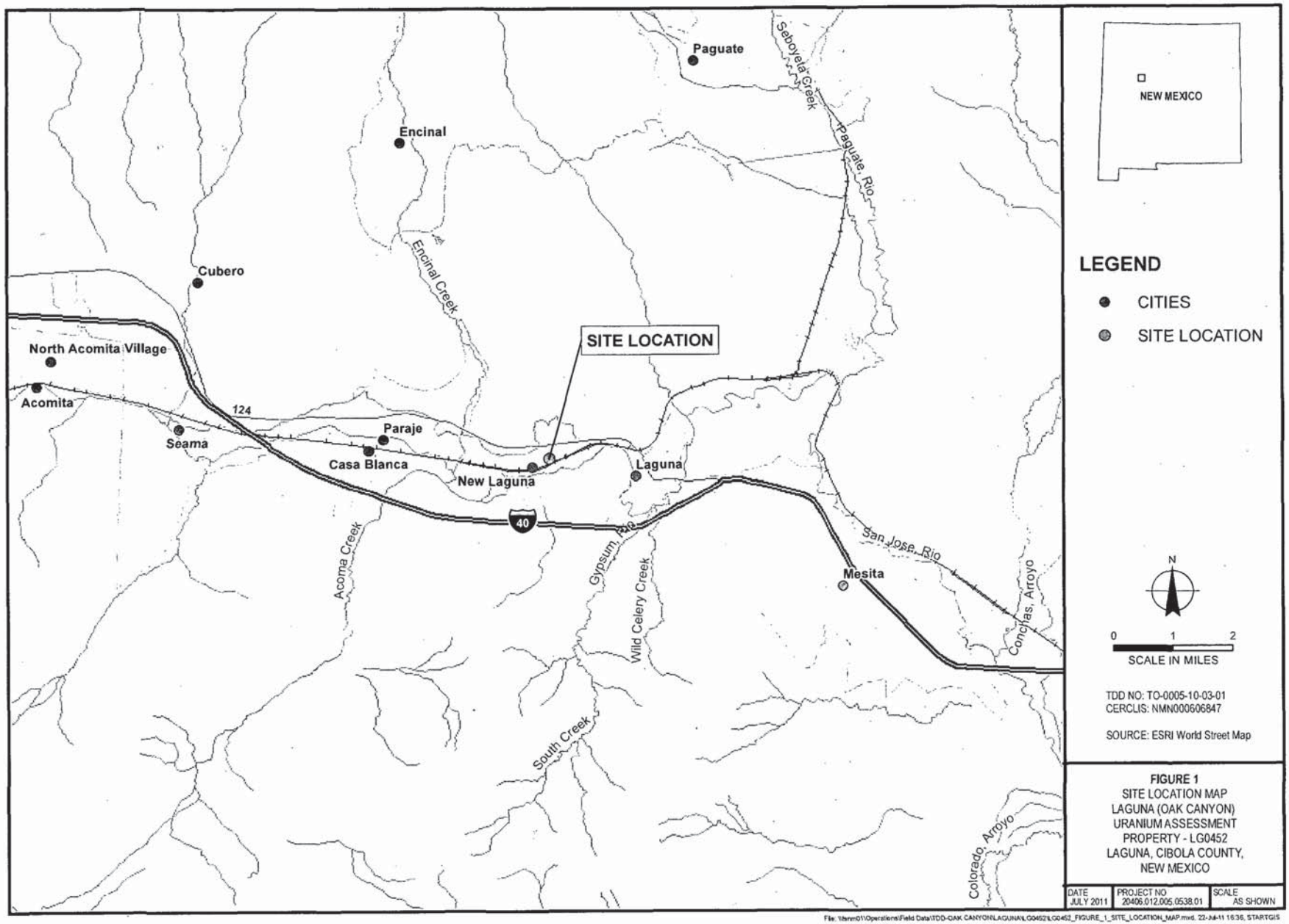
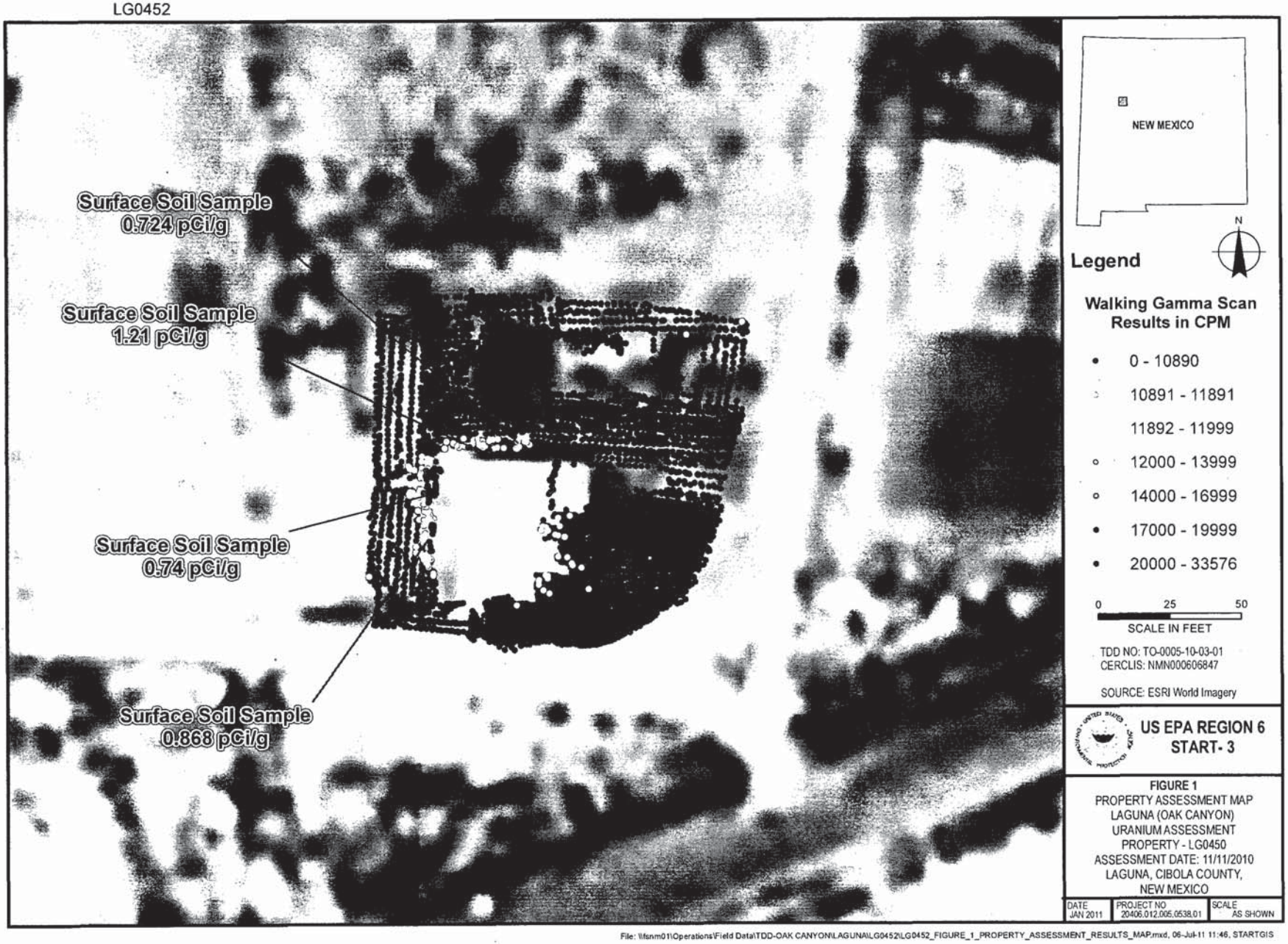

Paguate
Seboyeta Creek
Paguate, Rio
Encinal
Encinal Creek
Cubero
SITE LOCATION
North Acomita Village
Acomita
124
Seama
Paraje
Casa Blanca
New Laguna
Laguna
40
Acoma Creek
Gypsum, Rio
Wild Celery Creek
San Jose, Rio
Mesita
Conchas, Arroyo
South Creek
Colorado, Arroyo
NEW MEXICO
LEGEND
CITIES
SITE LOCATION
N
0 1 2
SCALE IN MILES
TDD NO: TO-0005-10-03-01
CERCLIS: NMN000606847
SOURCE: ESRI World Street Map
FIGURE 1
SITE LOCATION MAP
LAGUNA (OAK CANYON)
URANIUM ASSESSMENT
PROPERTY - LG0452
LAGUNA, CIBOLA COUNTY,
NEW MEXICO
DATE JULY 2011
PROJECT NO 20406.012.005.0538.01
SCALE AS SHOWN
File: \\hnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG0452\LG0452_FIGURE_1_SITE_LOCATION_MAP.mxd, 22-Jul-11 16:36, STARTGIS

FIGURE 2

WALKING GAMMA SCAN RESULTS AND SURFACE SOIL SAMPLE LOCATIONS

LG0452

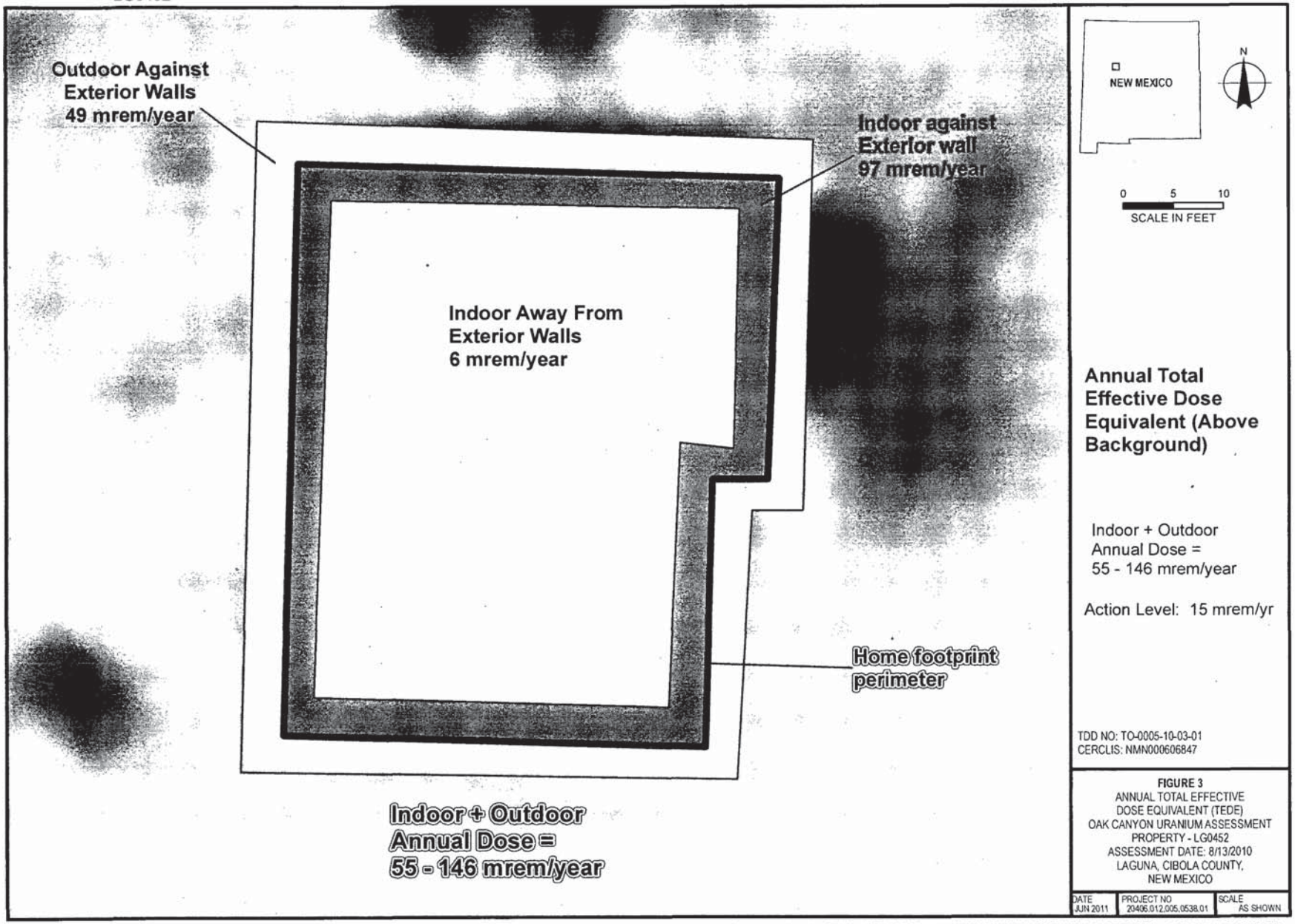


File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG0452\LG0452_FIGURE_1_PROPERTY_ASSESSMENT_RESULTS_MAP.mxd, 06-Jul-11 11:46, STARTGIS

FIGURE 3

ANNUAL INDOOR and OUTDOOR TOTAL EFFECTIVE DOSE EQUIVALENTS

LG0452



File: \\fsnm01\Operations\Field Data\TDD-OAK CANYON\LAGUNA\LG0452\LG0452_FIGURE_3_INDOOR_TEDE.mxd, 26-Jul-11 09:54, STARTGIS

ATTACHMENT A

MARSSIM TEST 3
WILCOXON RANK SUM TEST

From MARSSIM Manual, Section 8.4.1

Two-Sample Statistical Test

The comparison of measurements from the reference area and survey unit is made using the Wilcoxon Rank Sum (WRS) test (also called the Mann-Whitney test). The WRS test should be conducted for each survey unit. In addition, the EMC is performed against each measurement to ensure that it does not exceed a specified investigation level. If any measurement in the remediated survey unit exceeds the specified investigation level, then additional investigation is recommended, at least locally, regardless of the outcome of the WRS test.

The WRS test is most effective when residual radioactivity is uniformly present throughout a survey unit. The test is designed to detect whether or not this activity exceeds the $DCGL_W$. The advantage of the nonparametric WRS test is that it does not assume that the data are normally or log-normally distributed. The WRS test also allows for "less than" measurements to be present in the reference area and the survey units. As a general rule, the WRS test can be used with up to 40 percent "less than" measurements in either the reference area or the survey unit. However, the use of "less than" values in data reporting is not recommended as discussed in MARSSIM Section 2.3.5. When possible, report the actual result of a measurement together with its uncertainty.

The hypothesis tested by the WRS test is

> Null Hypothesis H_0: The median concentration in the survey unit exceeds that in the reference area by more than the $DCGL_W$
>
> versus
>
> Alternative Hypothesis H_a: The median concentration in the survey unit exceeds that in the reference area by less than the $DCGL_W$

The null hypothesis is assumed to be true unless the statistical test indicates that it should be rejected in favor of the alternative. One assumes that any difference between the reference area and survey unit concentration distributions is due to a shift in the survey unit concentrations to higher values (*i.e.*, due to the presence of residual radioactivity in addition to background). Note that some or all of the survey unit measurements may be larger than some reference area measurements, while still meeting the release criterion. Indeed, some survey unit measurements may exceed some reference area measurements by more than the $DCGL_W$. The result of the hypothesis test determines whether or not the survey unit as a whole is deemed to meet the release criterion. The EMC is used to screen individual measurements.

Two assumptions underlying this test are: 1) samples from the reference area and survey unit are independent, identically distributed random samples, and 2) each measurement is independent of every other measurement, regardless of the set of samples from which it came.

8.4.2 Applying the Wilcoxon Rank Sum Test

The WRS test is applied as outlined in the following six steps:

1. Obtain the adjusted reference area measurements, Z_i, by adding the $DCGL_W$ to each reference area measurement, X_i. $Z_i = X_i + DCGL_W$

2. The m adjusted reference sample measurements, Z_i, from the reference area and the n sample measurements, Y_i, from the survey unit are pooled and ranked in order of increasing size from 1 to N, where $N = m+n$.

3. If several measurements are tied (*i.e.*, have the same value), they are all assigned the average rank of that group of tied measurements.

4. If there are t "less than" values, they are all given the average of the ranks from 1 to t. Therefore, they are all assigned the rank t(t+1)/(2t) = (t+1)/2, which is the average of the first t integers. If there is more than one detection limit, all observations below the largest detection limit should be treated as "less than" values.[3]

5. Sum the ranks of the adjusted measurements from the reference area, W_r. Note that since the sum of the first N integers is $N(N+1)/2$, one can equivalently sum the ranks of the measurements from the survey unit, W_s, and compute $W_r = N(N+1)/2 - W_s$.

6. Compare W_r with the critical value given in Table I.4 for the appropriate values of n, m, and α. If W_r is greater than the tabulated value, reject the hypothesis that the survey unit exceeds the release criterion.

[3] If more than 40 percent of the data from either the reference area or survey unit are "less than," the WRS test *cannot* be used. Such a large proportion of non-detects suggest that the DQO process be re-visited for this survey to determine if the survey unit was properly classified or the appropriate measurement method was used. As stated previously, the use of "less than" values in data reporting is not recommended. Wherever possible, the actual result of a measurement, together with its uncertainty, should be reported.

ATTACHMENT B

MICROSHIELD ANALYSIS

(Roentgen (R) to Roentgen-Equivalent-in-Man (rem) Conversion)

Print

MicroShield v6.02 (6.02-00039)
AQ_Safety,_Inc.

:1
File :U-238soilSlab.ms6
Date : May 25, 2011
Time : 11:26:33 AM
tion : 00:00:00

File Ref :
Date :
By :
Checked :

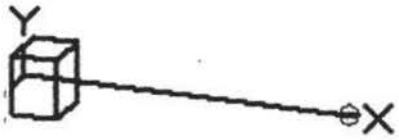
Case Title: U+chainSlab
Description: U-238 + chain slab
Geometry: 16 - Infinite Slab

Source Dimensions:

Thickness	15.0 cm	(5.9 in)

Dose Points

A	X	Y	Z
# 1	115 cm	0 cm	0 cm
	3 ft 9.3 in	0.0 in	0.0 in



Shields

Shield N	Dimension	Material	Density
Source	Infinite	ANS soil 2011	1.5
Air Gap		Air	0.00122

Source Input : Grouping Method - Standard Indices
Number of Groups : 25
Lower Energy Cutoff : 0.015
Photons < 0.015 : Included
Library : Grove

Nuclide	_Ci/cm_	Bq/cm_
Bi-210	1.4990e-006	5.5464e-002
Bi-214	1.4993e-006	5.5476e-002
Pa-234	2.3993e-009	8.8772e-005
Pa-234m	1.4995e-006	5.5483e-002
Pb-210	1.4990e-006	5.5464e-002
Pb-214	1.4993e-006	5.5476e-002
Po-210	1.4990e-006	5.5464e-002
Po-214	1.4990e-006	5.5464e-002
Po-218	1.4996e-006	5.5487e-002
Ra-226	1.4996e-006	5.5487e-002
Rn-222	1.4996e-006	5.5487e-002
Th-230	1.4996e-006	5.5487e-002
Th-234	1.4995e-006	5.5483e-002
U-234	1.4996e-006	5.5486e-002

U-238 1.4995e-006 5.5483e-002

Buildup : The material reference is - Source
Integration Parameters

Energy MeV	Activity Photons/sec	Results Fluence Rate MeV/cm_/sec No Buildup	Fluence Rate MeV/cm_/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.015	4.281e-02	2.034e-05	2.102e-05	1.745e-06	1.803e-06
0.04	1.087e-07	2.822e-09	4.722e-09	1.248e-11	2.088e-11
0.05	2.925e-03	1.432e-04	3.334e-04	3.815e-07	8.882e-07
0.06	2.379e-03	1.794e-04	4.971e-04	3.563e-07	9.873e-07
0.08	1.287e-02	1.689e-03	6.226e-03	2.672e-06	9.853e-06
0.1	3.503e-03	6.578e-04	2.943e-03	1.006e-06	4.503e-06
0.15	6.623e-05	2.220e-05	1.137e-04	3.655e-08	1.872e-07
0.2	5.995e-03	2.976e-03	1.474e-02	5.252e-06	2.602e-05
0.3	1.145e-02	9.877e-03	4.263e-02	1.874e-05	8.087e-05
0.4	2.123e-02	2.721e-02	1.057e-01	5.302e-05	2.059e-04
0.5	9.991e-04	1.746e-03	6.028e-03	3.427e-06	1.183e-05
0.6	2.678e-02	6.037e-02	1.901e-01	1.178e-04	3.710e-04
0.8	5.427e-03	1.834e-02	4.905e-02	3.488e-05	9.329e-05
1.0	1.796e-02	8.322e-02	1.987e-01	1.534e-04	3.662e-04
1.5	1.057e-02	8.715e-02	1.696e-01	1.466e-04	2.853e-04
2.0	1.485e-02	1.833e-01	3.162e-01	2.835e-04	4.889e-04
Totals	**1.798e-01**	**4.769e-01**	**1.103e+00**	**8.228e-04**	**1.948e-03**

MicroShield v6.02 (6.02-00039)
AQ_Safety,_Inc.
Conversion of calculated exposure in air to dose
FILE: C:\Program Files\MicroShield\Examples\casefiles\U-238soilSlab.ms6
Case Title: U+chainSlab
This case was run on Wednesday, May 25, 2011 at 11:26:33 AM
Dose Point # 1 - (115,0,0) cm

Results (Summed over energies)	Units	Without Buildup	With Buildup
Photon Fluence Rate (flux)	Photons/cm2/sec	5.109e-001	1.464e+000
Photon Energy Fluence Rate	MeV/cm2/sec	4.769e-001	1.103e+000
Exposure and Dose Rates:			
Exposure Rate in Air	mR/hr	8.228e-004	1.948e-003
Absorbed Dose Rate in Air	mGy/hr	7.183e-006	1.700e-005
"	mrad/hr	7.183e-004	1.700e-003
Deep Dose Equivalent Rate	(ICRP 51 - 1987)		
o Parallel Geometry	mSv/hr	8.333e-006	2.001e-005
o Opposed	"	7.014e-006	1.647e-005
o Rotational	"	7.013e-006	1.646e-005
o Isotropic	"	6.274e-006	1.471e-005
Shallow Dose Equivalent Rate	(ICRP 51 - 1987)		
o Parallel Geometry	mSv/hr	8.781e-006	2.105e-005
o Opposed	"	8.416e-006	2.008e-005
o Rotational	"	8.415e-006	2.008e-005
o Isotropic	"	6.621e-006	1.556e-005
Effective Dose Equivalent Rate	(ICRP 51 - 1987)		
o Anterior/Posterior Geometry	mSv/hr	7.442e-006	1.779e-005
o Posterior/Anterior	"	6.777e-006	1.601e-005
o Lateral	"	5.335e-006	1.237e-005
o Rotational	"	6.099e-006	1.436e-005
o Isotropic	"	5.363e-006	1.252e-005

Print

MicroShield v6.02 (6.02-00039)
AQ_Safety,_Inc.

:1
File :Ra-226SoilSlab.ms6
Date : May 25, 2011
Time : 11:20:52 AM
tion : 00:00:00

File Ref :
Date :
By :
Checked :

Case Title: Ra-226SoilSlab
Description: Ra226 infinite soil 15 cm slab
Geometry: 16 - Infinite Slab

Source Dimensions:

Thickness	15.0 cm	(5.9 in)

Dose Points

A	X	Y	Z
# 1	115 cm	0 cm	0 cm
	3 ft 9.3 in	0.0 in	0.0 in

Shields

Shield N	Dimension	Material	Density
Source	Infinite	ANS soil 2011	1.5
Air Gap		Air	0.00122

Source Input : Grouping Method - Standard Indices
Number of Groups : 25
Lower Energy Cutoff : 0.015
Photons < 0.015 : Included
Library : Grove

Nuclide	_Ci/cm_	Bq/cm_
Bi-210	1.5206e-006	5.6261e-002
Bi-214	1.4997e-006	5.5489e-002
Pb-210	1.5205e-006	5.6260e-002
Pb-214	1.4997e-006	5.5489e-002
Po-210	1.5209e-006	5.6274e-002
Po-214	1.4994e-006	5.5478e-002
Po-218	1.5000e-006	5.5500e-002
Ra-226	1.5000e-006	5.5500e-002
Rn-222	1.5000e-006	5.5500e-002

Buildup : The material reference is - Source
Integration Parameters

Results

Energy MeV	Activity Photons/sec	Fluence Rate MeV/cm_/sec No Buildup	Fluence Rate MeV/cm_/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.015	2.191e-02	1.041e-05	1.076e-05	8.931e-07	9.230e-07
0.05	2.892e-03	1.416e-04	3.297e-04	3.772e-07	8.782e-07
0.08	1.279e-02	1.679e-03	6.190e-03	2.657e-06	9.795e-06
0.1	7.532e-05	1.414e-05	6.328e-05	2.164e-08	9.682e-08
0.2	5.977e-03	2.967e-03	1.470e-02	5.237e-06	2.594e-05
0.3	1.145e-02	9.874e-03	4.262e-02	1.873e-05	8.084e-05
0.4	2.123e-02	2.721e-02	1.057e-01	5.302e-05	2.059e-04
0.5	9.912e-04	1.732e-03	5.981e-03	3.400e-06	1.174e-05
0.6	2.675e-02	6.031e-02	1.899e-01	1.177e-04	3.706e-04
0.8	5.244e-03	1.772e-02	4.740e-02	3.370e-05	9.015e-05
1.0	1.737e-02	8.051e-02	1.922e-01	1.484e-04	3.543e-04
1.5	1.056e-02	8.707e-02	1.694e-01	1.465e-04	2.851e-04
2.0	1.485e-02	1.833e-01	3.162e-01	2.835e-04	4.890e-04
Totals	**1.521e-01**	**4.726e-01**	**1.091e+00**	**8.141e-04**	**1.925e-03**

MicroShield v6.02 (6.02-00039)
AQ_Safety,_Inc.
Conversion of calculated exposure in air to dose
FILE: Case1
Case Title: Ra-226Soil5lab
This case was run on Wednesday, May 25, 2011 at 11:20:52 AM
Dose Point # 1 - (115,0,0) cm

Results (Summed over energies)	Units	Without Buildup	With Buildup
Photon Fluence Rate (flux)	Photons/cm2/sec	4.968e-001	1.416e+000
Photon Energy Fluence Rate	MeV/cm2/sec	4.726e-001	1.091e+000
Exposure and Dose Rates:			
Exposure Rate in Air	mR/hr	8.141e-004	1.925e-003
Absorbed Dose Rate in Air	mGy/hr	7.107e-006	1.681e-005
"	mrad/hr	7.107e-004	1.681e-003
Deep Dose Equivalent Rate	(ICRP 51 - 1987)		
o Parallel Geometry	mSv/hr	8.246e-006	1.976e-005
o Opposed	"	6.948e-006	1.629e-005
o Rotational	"	6.947e-006	1.628e-005
o Isotropic	"	6.215e-006	1.454e-005
Shallow Dose Equivalent Rate	(ICRP 51 - 1987)		
o Parallel Geometry	mSv/hr	8.684e-006	2.079e-005
o Opposed	"	8.330e-006	1.985e-005
o Rotational	"	8.330e-006	1.985e-005
o Isotropic	"	6.555e-006	1.539e-005
Effective Dose Equivalent Rate	(ICRP 51 - 1987)		
o Anterior/Posterior Geometry	mSv/hr	7.367e-006	1.758e-005
o Posterior/Anterior	"	6.711e-006	1.583e-005
o Lateral	"	5.286e-006	1.224e-005
o Rotational	"	6.041e-006	1.420e-005
o Isotropic	"	5.313e-006	1.238e-005

Print

MicroShield v6.02 (6.02-00039)
AQ_Safety,_Inc.

	:1
File	:Ra-226SoilConcrete.ms6
Date	: May 25, 2011
Time	: 2:40:34 PM
tion	: 00:00:00

File Ref	:
Date	:
By	:
Checked	:

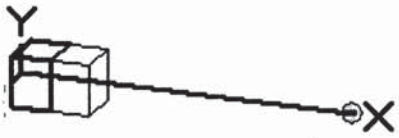
Case Title: Ra-226+found
Description: Ra-226 chain plus 15 cm foundation
Geometry: 16 - Infinite Slab

Source Dimensions:

Thickness	15.0 cm	(5.9 in)

Dose Points

A	X	Y	Z
# 1	130 cm	0 cm	0 cm
	4 ft 3.2 in	0.0 in	0.0 in



Shields

Shield N	Dimension	Material	Density
Source	Infinite	ANS soil 2011	1.5
Shield 1	15.0 cm	Concrete	2.1
Air Gap		Air	0.00122

Source Input : Grouping Method - Standard Indices
Number of Groups : 25
Lower Energy Cutoff : 0.015
Photons < 0.015 : Included
Library : Grove

Nuclide	_Ci/cm_	Bq/cm_
Bi-210	1.5206e-006	5.6261e-002
Bi-214	1.4997e-006	5.5489e-002
Pb-210	1.5205e-006	5.6260e-002
Pb-214	1.4997e-006	5.5489e-002
Po-210	1.5209e-006	5.6274e-002
Po-214	1.4994e-006	5.5478e-002
Po-218	1.5000e-006	5.5500e-002
Ra-226	1.5000e-006	5.5500e-002
Rn-222	1.5000e-006	5.5500e-002

Buildup : The material reference is - Shield 1
Integration Parameters

Results

Energy MeV	Activity Photons/sec	Fluence Rate MeV/cm_/sec No Buildup	Fluence Rate MeV/cm_/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.015	2.191e-02	0.000e+00	0.000e+00	0.000e+00	0.000e+00
0.05	2.892e-03	1.168e-10	6.039e-10	3.112e-13	1.609e-12
0.08	1.279e-02	4.030e-07	5.306e-06	6.377e-10	8.396e-09
0.1	7.532e-05	9.805e-09	1.760e-07	1.500e-11	2.693e-10
0.2	5.977e-03	1.053e-05	2.366e-04	1.859e-08	4.177e-07
0.3	1.145e-02	6.703e-05	1.252e-03	1.272e-07	2.375e-06
0.4	2.123e-02	2.825e-04	4.237e-03	5.505e-07	8.256e-06
0.5	9.912e-04	2.464e-05	3.058e-04	4.836e-08	6.002e-07
0.6	2.675e-02	1.099e-03	1.153e-02	2.144e-06	2.251e-05
0.8	5.244e-03	4.689e-04	3.685e-03	8.919e-07	7.008e-06
1.0	1.737e-02	2.804e-03	1.775e-02	5.170e-06	3.272e-05
1.5	1.056e-02	4.801e-03	2.050e-02	8.078e-06	3.450e-05
2.0	1.485e-02	1.342e-02	4.597e-02	2.075e-05	7.108e-05
Totals	**1.521e-01**	**2.298e-02**	**1.055e-01**	**3.778e-05**	**1.795e-04**

MicroShield v6.02 (6.02-00039)
AQ_Safety,_Inc.
Conversion of calculated exposure in air to dose
FILE: C:\Program Files\MicroShield\Examples\casefiles\Ra-226SoilConcrete.ms6
Case Title: Ra-226+found
This case was run on Wednesday, May 25, 2011 at 2:40:34 PM
Dose Point # 1 - (130,0,0) cm

Results (Summed over energies)	Units	Without Buildup	With Buildup
Photon Fluence Rate (flux)	Photons/cm2/sec	1.617e-002	9.486e-002
Photon Energy Fluence Rate	MeV/cm2/sec	2.298e-002	1.055e-001
Exposure and Dose Rates:			
Exposure Rate in Air	mR/hr	3.778e-005	1.795e-004
Absorbed Dose Rate in Air	mGy/hr	3.299e-007	1.567e-006
"	mrad/hr	3.299e-005	1.567e-004
Deep Dose Equivalent Rate	(ICRP 51 - 1987)		
o Parallel Geometry	mSv/hr	3.761e-007	1.805e-006
o Opposed	"	3.278e-007	1.540e-006
o Rotational	"	3.278e-007	1.540e-006
o Isotropic	"	2.943e-007	1.378e-006
Shallow Dose Equivalent Rate	(ICRP 51 - 1987)		
o Parallel Geometry	mSv/hr	3.955e-007	1.901e-006
o Opposed	"	3.826e-007	1.831e-006
o Rotational	"	3.826e-007	1.831e-006
o Isotropic	"	3.083e-007	1.451e-006
Effective Dose Equivalent Rate	(ICRP 51 - 1987)		
o Anterior/Posterior Geometry	mSv/hr	3.383e-007	1.617e-006
o Posterior/Anterior	"	3.138e-007	1.482e-006
o Lateral	"	2.547e-007	1.179e-006
o Rotational	"	2.840e-007	1.337e-006
o Isotropic	"	2.533e-007	1.181e-006

Date: 5-25-2011

To: Nels Johnson

From: Rick Haaker

SubjectMicrosohield Calculations of Exposure rate and dose equivalent rate

---

On May 10 , 2009 I provided a technical memo entitled *Response Estimates for a 2"x2" NaI Detector to Ra-226 That is Distributed in Soil.* The last paragraph of that memo was a discussion of conversion factors between soil concentration, exposure rate, and effective dose equivalent rate for the U-238 decay chain. This memo elaborates on that final paragraph. In determining the conversion factors, the geometry assumed was an infinite slab of soil having a thickness of 15 cm and a density of 1.5. A simplified soil composition derived from ANSI/ANS 6.6.1-19971 was used in the Microshield® 6.02 modelling2, see Table 1.

Table 1 Simplified Soil Composition from ANSI/ANS 6.6.1.

Element	Weight Percent
Hydrogen	0.954
Oxygen	54.4
Aluminum	12.9
Silicon	31.8

Three cases were considered for the Microshield calculations:

- an infinite slab of soil 15 cm thick containing U-238 plus progeny through Po-210 in decay equilibrium, and
- an infinite slab of soil 15 cm thick containing Ra-226 plus progeny through Po-210 in decay equilibrium.
- an infinite slab of soil 15 cm thick containing Ra-226 plus progeny through Po-210 in decay equilibrium covered by a 15-cm thick concrete foundation.
-

A circular slab of uniformly contaminated soil that is 20 meters in diameter is approximately "infinite" with respect to the Microshield calculations. Microshield also will also model other, non-infinite geometries.

Each time a Microshield calculation was performed, the corresponding "Conversion of Calculated Exposure in Air to Dose" report was generated via the Microshield software package.

Results for a U-238 at 1 pCi/g Plus Progeny

Table 2 provides results for the U-238 decay chain

Table 2. Results for 1 pCi/g U-238 with decay chain in equilibrium

---

Exposure rate	1.948 μR/h

---

1 ANSI/ANS-6.6.1-1987, Calculation and Measurement of Direct and Scattered Gamma Radiation from LWR Nuclear Power Plants. American Nuclear Society, La Grange Park, Il, 1987.
2 Microshield 6.02, Grove Engineering, Framatone ANP, Rockville, MD, 2003. !!

EDE rate in isotropic field	1.252 μREM/hr
Ratio	1.56 μR/μREM

Results for a Ra-226 at 1 pCi/g Plus Progeny

Table 3 provides results for the Ra-226 decay chain

Table 3. Results for 1 pCi/g Ra-226 with decay chain in equilibrium

Exposure rate	1.925 μR/h
EDE rate in isotropic field	1.238 μREM/hr
Ratio	1.55 μR/μREM

Results for a Ra-226 at 1 pCi/g Plus Progeny and 15 cm Foundation

Table 4 provides results for the Ra-226 decay chain assuming a 15 cm thick concrete foundation covers the entire site.

Table 4. Results for 1 pCi/g Ra-226 with decay chain in equilibrium plus concrete foundation.

Exposure rate	0.1795 μR/h
EDE rate in isotropic field	0.1181 μREM/hr
Ratio	1.52 μR/μREM

Use of estimates indoors

A house is a complicated object, it is constructed of materials that serve to shield the occupant to some degree from the terrestrial gamma radiation field. The degree of shielding that a structure provides an occupant will depend on the materials of construction, their thickness and radiation attenuating properties and other factors.

The RESRAD software package3 accounts for external radiation attenuation by a structure via an external radiation transmission factor, and the RESRAD default value of 0.7 was used for all RESRAD calculations we have performed; this is probably a reasonable value for frame houses. Another source, NCRP Report 94 suggests an external gamma transmission factor of 0.8.4

3 C. Yu et al. ,User's Manual for RESRAD Version 6, ANL/EAD-4, Argonne National Laboratory, Argonne, IL, 2001.

4 Exposure of the Population of the United States and Canada from Natural Background Radiation, NCRP Report 94, National Council on Radiation Protection and Measurements. Bethesda, MD, 1992. !

As a limiting case, a Microshield calculation was performed assuming a 15-cm thick concrete foundation covers the infinite slab of contaminated soil. The μR/μREM ratio decreased insignificantly to 1.52 μR/μREM; see Table 4. Thus it is concluded that any attenuation of external gamma radiation, which is caused by the structure will affect EDE and exposure to a similar degree.

In addition, the materials of construction will contain Ra-226, Ra-228, and K-40, and these will contribute to the external dose of an occupant to some degree. NCRP Report 94 reports that in Europe where masonry houses are prevalent, the structural materials increase indoor gamma radiation exposures by about 20% relative to terrestrial background.

Limitations of estimates

These estimates utilize Microshield 6.02, and so they inherit all of its limitations. Microshield quickly does simple radiation attenuation and build-up calculations, which otherwise would be tedious to do in a spreadsheet. It does not account for:

- surface roughness,
- bremstrahlung arising from beta emitters,
- more than one radiation source at a time,
- complicated radiation behaviors like backscatter or skyshine, or
- dose buildup in more than one model element at a time.

Equilibrium in the decay chain has been assumed, comparison of table 2 and table 3 shows that the amount of U-238 through U-234 in the chain is unimportant. Some radon (Rn-222) is usually lost from near surface soil and this may cause both the external EDE rate and exposure rates to be lower per pCi/g of Ra-226 than have been estimated.

ATTACHMENT C

TOTAL EFFECTIVE DOSE EQUIVALENT
(Indoor + Outdoor)

Calculations Performed by Certified Health Physicist

LG0452 Estimate of Dose to Resident

July 26, 2011

Surveys performed using 2" x 2" gamma scintillation detectors during the initial site visits by the Region 6 EPA team indicated areas around or near the LG0452 residence that range up to 35,000 counts per minute (cpm) on contact with some ground-level sections of the residence exterior walls compared to background measurements of about 8,300 cpm. Those readings indicated that contaminated materials were used in the construction of the stem walls of at least some parts of the house. Readings taken at the center of rooms inside the residence (per protocol requirements) with an RSS-111 Pressurized Ion Chamber (PIC) ranged as high as 13 μR/hour compared to background levels that were about 11 μR/hour. Those PIC readings were lower than would be expected if taken along the walls where the highest gamma readings were discovered.

Radon readings in the residence were consistent and ranged between 3.1 and 3.8 pCi/l for four short-term samples collected over a 7-day period, and between 3.1 and 3.3 pCi/l for two long-term (91-day) samples. Those values are less than the EPA limit above which actions should be taken to mitigate radon concentrations, but are sufficient to contribute to the residential dose. Radium concentrations measured in soil samples collected around the exterior of the residence averaged 0.88 pCi/g, which is not significantly elevated above the average background concentration of 0.73 pCi/g when compared to the Protocol limit of 2.5 pCi.g above background.

The protocol developed for this project used RESRAD software to calculate the Total Effective Dose Equivalent (TEDE) from soil radionuclide concentrations. However, the sources of elevated dose rates at this property are not in the soils around or under the house, but rather are in the walls. Additionally, the contribution to total dose equivalent from radon inhalation cannot be determined using RESRAD without an elevated radium concentration in soil as the basis for the RESRAD calculations. Thus, the estimated residential dose for this property is hand calculated and is based only on external gamma dose.

An indoor dose calculation using the PIC data resulted in a value of about 6 mrem/yr, but that does not provide a conservative estimate because the PIC values were taken at the center of the room, away from the walls where the highest gamma readings were found. The positions that a resident may occupy within the home for significant periods of time (such as kitchen tables, chairs, sofas, and beds) are often near walls where the highest gamma readings in the home were detected. It would seem reasonable to accommodate these higher gamma levels for our calculations. Also, the total dose equivalent should include a dose component for time spent outdoors at the property.

An alternate, maximum value was determined for the indoor component of gamma dose using the highest reading along the walls measured with the gamma scintillation detector. To convert the gamma scintillation measurement (in cpm), comparative measurements performed at the indoor PIC measurement locations (PIC vs. scintillator) were used to come up with an empirically determined factor of 0.00116mR/hr per 1000 cpm that was used to convert readings in cpm to mR/hr. Using the highest measured gamma value of 37,000 cpm, subtracting 8,244 cpm for background, and converting to mR/hr and then to mrem/yr, a worst case indoor component of 97 mrem/yr was determined. The difference between the two values is the result of the PIC location in the centers of the rooms. The higher dose equivalent using the near-wall gamma scintillation measurements is overly conservative because occupants are not expected to spend all their time sitting against the wall. A reasonable estimate of the indoor dose equivalent is between 6 and 97 mrem/yr.

Using the same maximum value of 37,000 cpm for the outdoor gamma level, and an occupancy period of 25 of the year resulted in a worst case outdoor component of 49 mrem/yr. Combining the outdoor component with the indoor values of 6 and 97 mrem/yr resulted in a range for the total dose equivalent of 55 to 146 mrem/yr for LG 0452.

This calculation does not follow the basic scenario that was developed for the project protocol, and excludes components associated with inhalation of radon and dust, and ingestion of food items. The exclusion of these components is justified because of the "encapsulated" nature of the contamination that appears to be trapped within the residence walls.

Data used for this evaluation, and the associated calculations, are contained in Response Manager.

ATTACHMENT D

STRUCTURAL INVESTIGATION AND COST ESTIMATE FOR REPLACEMENT OF FOUNDATION

BACCHUS
CONSULTING
ENGINEERING

Charles Bacchus, PE, PhD
David Vasquez, PE, MSCE

INTRODUCTION

This is the report of a study to determine the estimated cost of replacing part or all of the foundation of a single story house located on the Laguna Indian Reservation in west central New Mexico.

DESCRIPTION OF HOUSE

With the exception of the foundation, the house is of conventional construction typical of the 1950s and 1960s. The roof is framed using wood sheathing supported on metal-plate connected wood trusses. The walls are wood studs supporting gypsum board sheathing finished with stucco on the exterior. The floor is framed using plywood decking on wood joists with a shallow "crawl space" (approximately 12 inches from the bottom of the joists to grade).

The foundation consists of individual stones of various sizes laid in adobe mortar. In addition to the foundation around the perimeter of the house, there are also interior foundations which support interior bearing walls.

An attached carport, open on three sides, is connected to the south side of the house.

In its present condition, the house is uninhabitable although there are signs of some recent renovations, reportedly made by the owner with the intent of living in the house at some future time.

POSSIBLE FOUNDATION REPLACEMENT ALTERNATIVES

A limited structural study of various foundation systems has been made to provide a basis for preparing a cost estimate for modifying the foundation. Some of the rocks used to construct the foundation may have traces of radioactivity. The percentage of the rocks which are radioactive and the location in the foundation of the rocks which are radioactive is not presently known. In preparing this report, it has been assumed that all of the foundation must be removed. If it is determined that only a few of the rocks are radioactive, then it may be possible to replace only those few. However, this will be difficult because of the type of foundation construction and it may be more cost effective to remove the entire foundation and the remainder of this report is based on the assumption that the entire foundation will be replaced.

Typical foundation construction for this type of structure consists of cast-in-place concrete in the shape of an inverted tee reinforced both horizontal and vertically. With proper detailing, at least some structural continuity of the foundation could be attained to minimize possible differential settlement of the structure above.

630 Manzano Street NE · Suite D · Albuquerque, New Mexico 87110
Tel: 505 - 262 · Email: cbacchus@swcp.com · Fax: 505 - 262 - 2473
BACCHUS
CONSULTING
ENGINEERING
Charles Bacchus, PE, PhD
David Vasquez, PE, MSCE

Although sequential foundation replacement may be possible, it has its own problems. There is at best only limited structural continuity in the existing foundation. This could be considered to be an advantage because it will be relatively easy to remove portions of the foundation at one time. Replacing the foundation one segment at a time may result in damage to the structure resulting from differential movement. It may be necessary to support the entire structure even though only one portion of a new foundation is under construction at any one time. To completely support the structure above the existing foundation will require the removal of a portion of the flooring and floor decking as well as a portion of the wall sheathing in order to place the shores and jacks necessary to support the house while the new foundation is being placed. This will be necessary at both the exterior walls and at interior bearing walls.

FOUNDATION REPLACEMENT

At the beginning of this investigation, it appeared that replacing the existing foundation with a conventional cast-in-place concrete inverted tee foundation consisting of a strip footing supporting a cast-in-place concrete stem wall. This is the most common type of foundation used in this area for both residential and commercial construction. If this type of system is used, it will be necessary to construct formwork for at least the stem wall. Both the footing and the stem wall could be placed in sections with reinforcing rods and keyways used to achieve continuity between adjacent sections.

It quickly became obvious that there are significant technical and logistical problems with this type of system and that the cost would almost certainly exceed the value of the house.

Among the problems is the location of the house. Ready-mix concrete is not available in the near vicinity of the house although it is available in both Grants and Albuquerque. However, unless the entire footing or the entire stem wall were placed at one time, amount required for any one placement would be relatively small and there would probably be a premium.

As an alternative, it might be possible to mix small batches on site. This might be a viable solution although there still remain other problems with a cast-in-place system.

Other possible alternates which might be considered if it is determined that a concrete system is required include using a grade beam which would act as both the footing and the stem wall. This would probably require a larger quantity of concrete but might be more economical because of the reduction in the amount of formwork required. Unless the grade beam under the entire house was placed at the same time, it would be necessary to provide a method to ensure structural continuity between adjacent pours.

BACCHUS
CONSULTING
ENGINEERING

Charles Bacchus, PE, PhD
David Vasquez, PE, MSCE

It might also be possible to use a system consisting of a series of precast grade beams spanning between and supported on cast-in-place reinforced concrete spot footings placed at intervals. The spacing of the spot footings, their size and their reinforcing would be a matter for design. The precast grade beams could be constructed either on or off site. Placing the grade beams would be problem, particularly under interior bearing walls. Connections between the grade beams and between the grade beams and the footings may also be a problem.

The second basic type of replacement foundation considered is a permanent wood foundation. Many of the same considerations that apply to concrete foundations also apply to wood foundations but there are some advantages.

After evaluating the various possibilities, the conclusion was reached that the best solution would be combination concrete and permanent wood foundation system. The concrete would be used for strip or spot footings and the wood would be used for stem walls.

A first advantage of this system is that the quantity of concrete required would be significantly reduced, making on-site mixing of concrete more practical.

Some references suggest using a gravel bed instead of a concrete strip footing. The gravel would be significantly less expensive than the concrete but I am concerned that there might be some differential settlement of the house as the gravel consolidates under load. At the least, this would result in cracking of the wall sheathing which it would then be necessary the repair or replace.

The wood stem walls could also be built on site, in lengths which would permit them to be placed without requiring the using of mechanized equipment. The design of the wood beams would be dependent on the type of foundation used - continuous strip footings or spot footings at intervals. Connections of the wood beams to each other or the wood beams to the footing would remain a concern as it would if a system using precast concrete beams were used.

The cost estimate which is attached to this report is based on the combination system using concrete footing.

As a final consideration, there is a real possibility that there will be damage to the framing of the house regardless of the system used. It is almost certain that the house will be subject to different loadings than has been the case in the past. As has been illustrated in recent seismic and high wind events, wood framed houses and other wood framed structures can tolerate a significant amount of overload and movement without failure but not without damage.

Foundation Replacement Cost Estimate - House at Laguna Pueblo
All concrete system
Prepared by: Charles Bacchus
Date Prepared: April 4, 2011

					Material		Labor/Equipment			ACTIVITY
Notes	ACTIVITY	Item	Units	Quantity	Unit cost	Total	Unit cost	Total	Total	SUBTOTALS
	Demolition									
Note 1	1	Excavation	BCY	100	$0.00	$0.00	$25.00	$2,500.00	$2,500.00	
Note 2	2	Foundation Removal	CY	20	$0.00	$0.00	$25.00	$500.00	$500.00	
	3	Flooring and Floor Decking	SF	400	$0.00	$0.00	$10.00	$4,000.00	$4,000.00	
	4	Wall Sheathing	SF	400	$0.00	$0.00	$15.00	$6,000.00	$6,000.00	
	5	Contingency (10%)	LS			$0.00		$1,300.00	$1,300.00	$14,300.00
	Shoring and Jacking									
	6	Floor	LS	1	$500.00	$500.00	$1,500.00	$1,500.00	$2,000.00	
	7	Walls	LS	1	$500.00	$500.00	$1,000.00	$1,000.00	$1,500.00	
	8	Contingency (15%)	LS			$150.00		$375.00	$525.00	$4,025.00
	Foundation									
Note 3	9	Concrete-in-Place	CY	15	$200.00	$3,000.00	$250.00	$3,750.00	$6,750.00	
	10	Anchor rods in place	EA	50	$2.50	$125.00	$5.00	$250.00	$375.00	
	11	Contingency (25%)	LS			$781.25		$1,000.00	$1,781.25	$8,906.25
	Wood Stem Walls									
	12	Fabrication	SF	500	$10.00	$5,000.00	$15.00	$7,500.00	$12,500.00	
	13	Installation	SF	500	$0.00	$0.00	$10.00	$5,000.00	$5,000.00	
	14	Contingency (10%)	LS			$500.00		$1,250.00	$1,750.00	$19,250.00

	Backfill / Compaction									
Note 5	**15**	Placement	CY	60	$0.00	$0.00	$15.00	$900.00	$900.00	
	16	Compaction	CY	60	$0.00	$0.00	$20.00	$1,200.00	$1,200.00	
	17	Contingency (10%)	LS			$0.00		$210.00	$210.00	$2,310.00
	Finishes									
	18	Floor / Floor Decking	SF	400	$10.00	$4,000.00	$5.00	$2,000.00	$6,000.00	
	19	Interior Walls	SF	400	$5.00	$2,000.00	$5.00	$2,000.00	$4,000.00	
	20	Contingency (10%)	LS			$600.00		$400.00	$1,000.00	$11,000.00
	Subtotals					$17,156.25		$42,635.00		$59,791.25
	Contractor OH&P					$2,573.44		$8,527.00		$11,100.44
						15.00%		20.00%		
								TOTAL		$70,891.69

NOTES:

1 Some excavation will be required at the interior of the house to deepen the crawl space to permit shores and jacks to be installed. All of the interior excavation and at least some of the exterior excavation will be by hand.
To perform the interior excavation, it will be necessary to remove some of the flooring and floor decking. See Activity #4.

2 The foundation removal will require a large amount of hand labor. The unit prices include an allowance for working with hazardous material. The allowance was mostly a guess and It may be possible/necessary to adjust it.

3 The unit price for concrete material assumes that the concrete will be produced on-site in small batches and that forming will not be required. The price for concrete includes reinforcing and finishing of the top surface. Anchor rods (see Activity 10) will be placed before the concrete has attained its first set.

4 The wood stem walls can be fabricated on or off site at the Contractor's option. The stud walls can be produced in short lengths (8 feet long +/-) which will make tham easier to handle but it will be necessary to include in the design a method to connect them together and to the foundation.

5 It has been assumed that the excavated material (other than the foundation itself) can be used for backfill. Some of the backfill can be placed using backhoes or front end loaders but a signicant percentage of the placement and most of the compaction (Activity 16) will have to be done by hand. It will be difficult to attain good compaction at the interior.

6 Finishing consists of replacing the floor decking and flooring to match the existing adjacent portions of the floor and of replacing the wall sheathing and finishing the wall to match the rest of the wall.